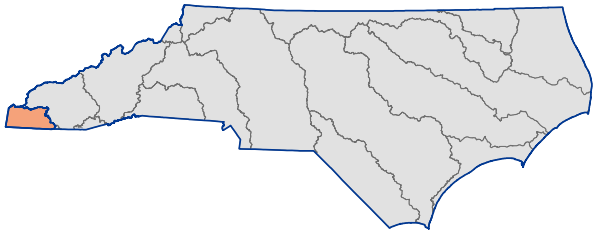
Hiwassee River Basinwide Water Quality Plan



Summary

This 2012 document is the fourth five-year update of the Hiwassee River Basinwide Water Quality Plan. Previous basinwide plans for the Hiwassee River Basin were completed in 1997, 2002, and 2007 and are available from the NC Division of Water Quality Basinwide Planning website. This basin plan was written to provide guidance for watershed stakeholders, municipal planners, natural resource regulators, and other environmental professionals with identifying and addressing water quality stressors, sources, and emerging issues. This document can be used in conjunction with the Supplemental Guide to Basinwide Planning which provides general information about water quality issues and DWQ programs.

National Pollution Discharge Elimination System (NPDES) permits were issued in 2012 for a five year period. Basinwide biological and lake sampling last occurred in the Hiwassee River Basin in 2009 and will be conducted again in 2014.

The Hiwassee River Basin spans over 644 square miles and is divided into two subbasins (Figure 1-3), although 97% of the basin falls within subbasin 06020002. The Division of Water Quality grouped these subbasins to conform to the federal system of river basin management. Previously, DWQ had its own set of subbasins and numbering system (04-05-01 & 04-05-02), but is now using the federal cataloging unit known as hydrologic unit codes (HUCs), Figure 1-2. This report is organized by chapters at the 10-digit hydrologic unit or watershed level.

This plan includes eight chapters covering water quality information for each of the watersheds:

- Chatuge Lake / Shooting Creek Watershed (HUC 0602000201)
- Tusquitee Creek Watershed (HUC 0602000202)
- Brasstown Creek Watershed (HUC 0602000203)
- Valley River Watershed (HUC 0602000204)
- Nottely River Watershed (HUC 0602000206)
- Hiwassee Lake Watershed (HUC 0602000207)
- Apalachia Lake Watershed (HUC 0602000209)
- Ocoee River Watershed (HUC 0602000302)

Basin at a Glance

Area: square miles.....644
acres.....412,375
Stream Miles.....931
Lake/Reservoir acres....10,357

Counties:

Cherokee, Clay

Municipalities:

Andrews, Hayesville, Murphy

Population:

2000.....32,065
2010.....38,237

2006 Land Cover:

Developed.....5%
Forested.....87%
Agriculture.....8%

EPA Level IV Ecoregions:

Broad Basins, High Mtns., Southern Crystalline Ridges & Mtns., & Southern Metasedimentary Mtns.

Permited Facilities:

NPDES
Wastewater Discharge 15
Wastewater Nondischarge . 1
Stormwater 18
Animal Operations 1

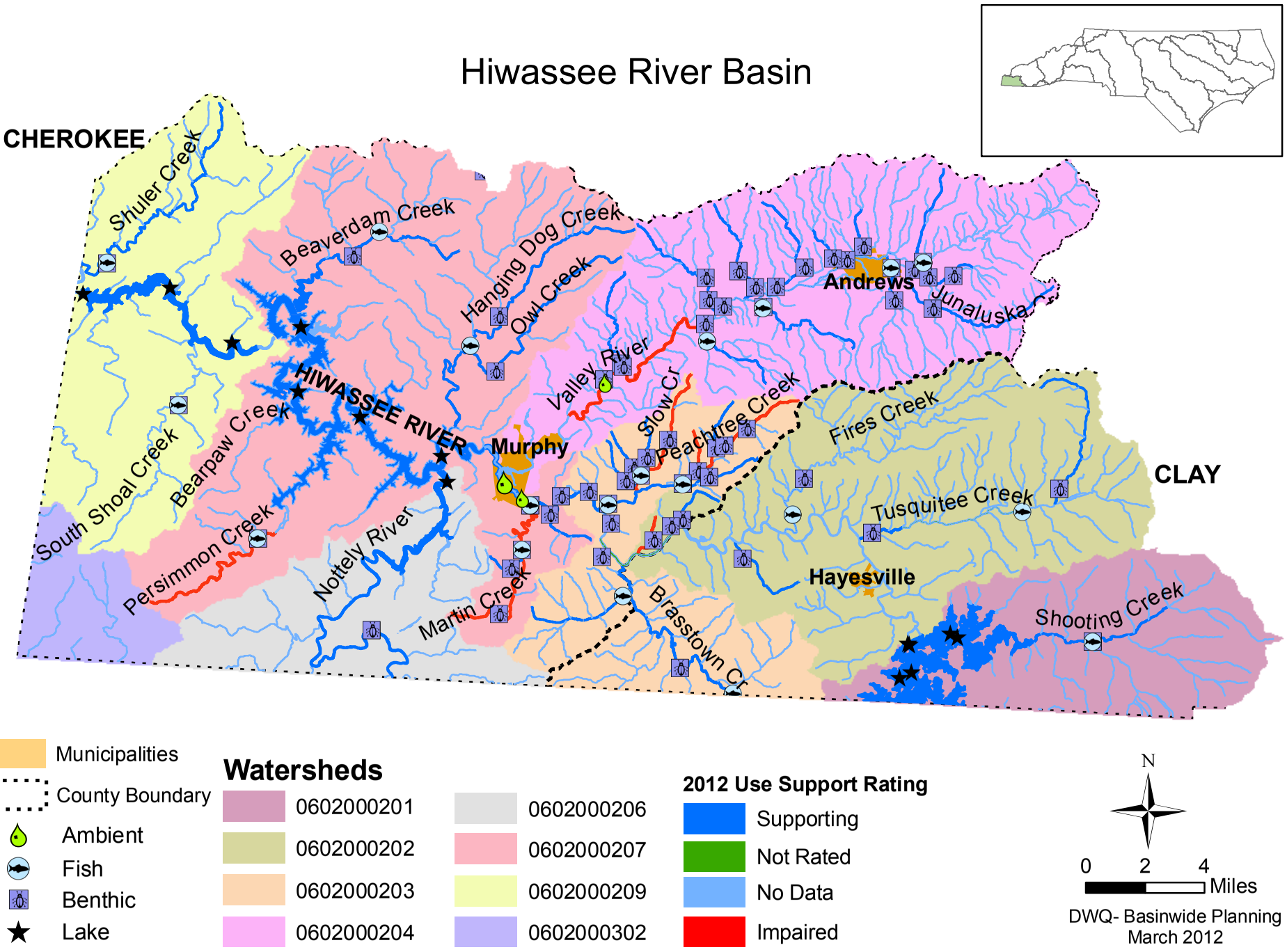


Figure 1-1: Hiwassee River Basin Map

The Hiwassee River is one of three North Carolina river basins that flow westward into the Tennessee Region and eventually drain into the Mississippi River (Figure 1-3). The headwaters of the Hiwassee River originate in North Carolina and north Georgia. The River flows west into Tennessee and eventually merges with the Tennessee River. The North Carolina portion of the Hiwassee River basin is 644 mi^2 and is located in the southwestern corner of North Carolina's Blue Ridge Province of the Appalachian Mountains.

The Hiwassee River and several of its tributaries (Valley River, Brasstown Creek, Hanging Dog Creek, Tusquitee Creek, and Fires Creek) are priority conservation areas for the Wildlife Resource Commission. Brasstown Creek and the Valley River are the largest unimpounded streams in the basin. The Tennessee Valley Authority (TVA) dams the Hiwassee River for production of hydroelectric power, forming Lake Chatuge, Appalachia Lake, and Hiwassee Lake in North Carolina.

Figure 1-2: Old DWQ Subbasin- HUC Subbasin Conversion Map

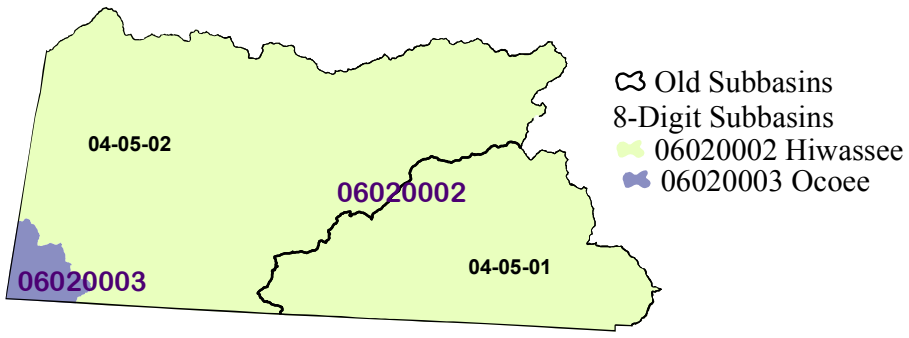
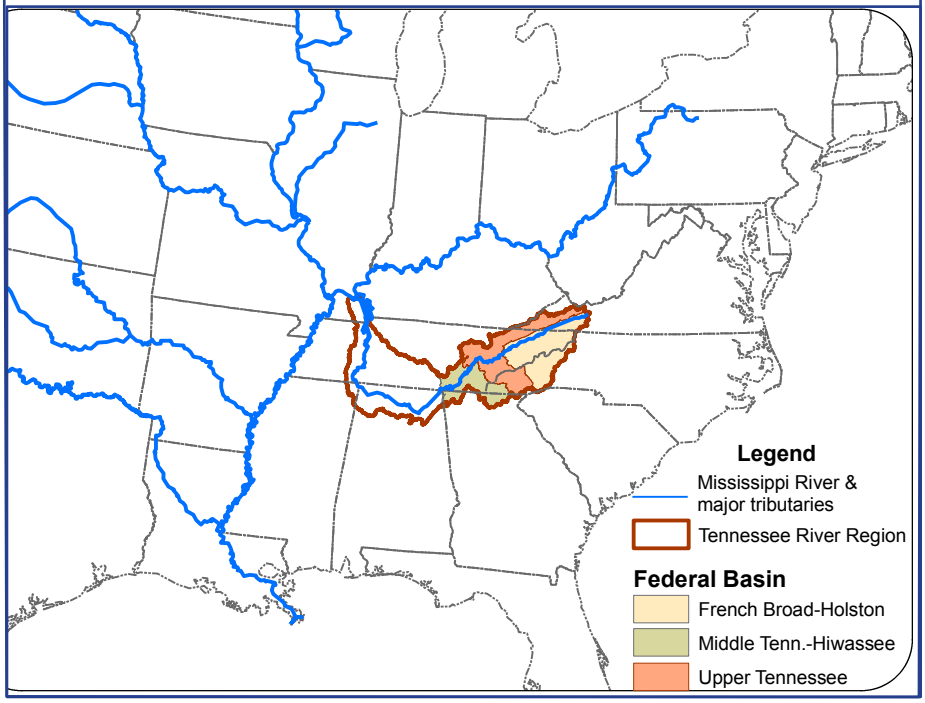


Figure 1-3: Tennessee River Region



Water Quality Summary

There are two ambient water quality monitoring stations within the Basin, of which turbidity, low pH, and fecal coliform bacteria are the only parameters that have had incidences of exceeding surface water standards. Special Studies and data collected by other groups have documented incidences of high turbidity levels, high nutrient levels and high fecal coliform bacteria levels.

Biological samples were taken at 13 macroinvertebrate and 13 fish community basinwide sites with an additional 26 macroinvertebrate and three fish samples taken because of special study requests. Figure 1-4 and Figure 1-5 show the percent change in benthic or fish community rating since their last sample. The most recent biological samples collected since 2000 are color coded according to their latest Bioclassification rating are shown on Figure 1-6.

Figure 1-4: Change in Benthic Macroinvertebrate Site Ratings

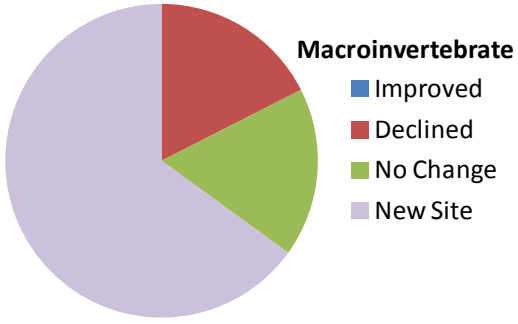


Figure 1-5: Change in Fish Community Site Ratings

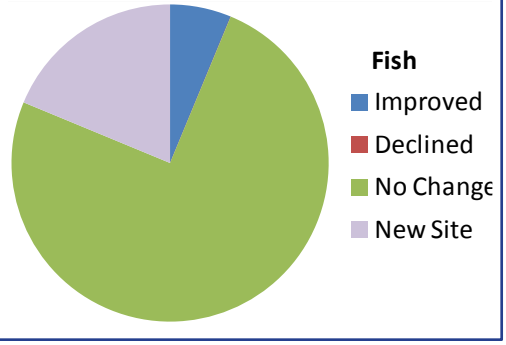
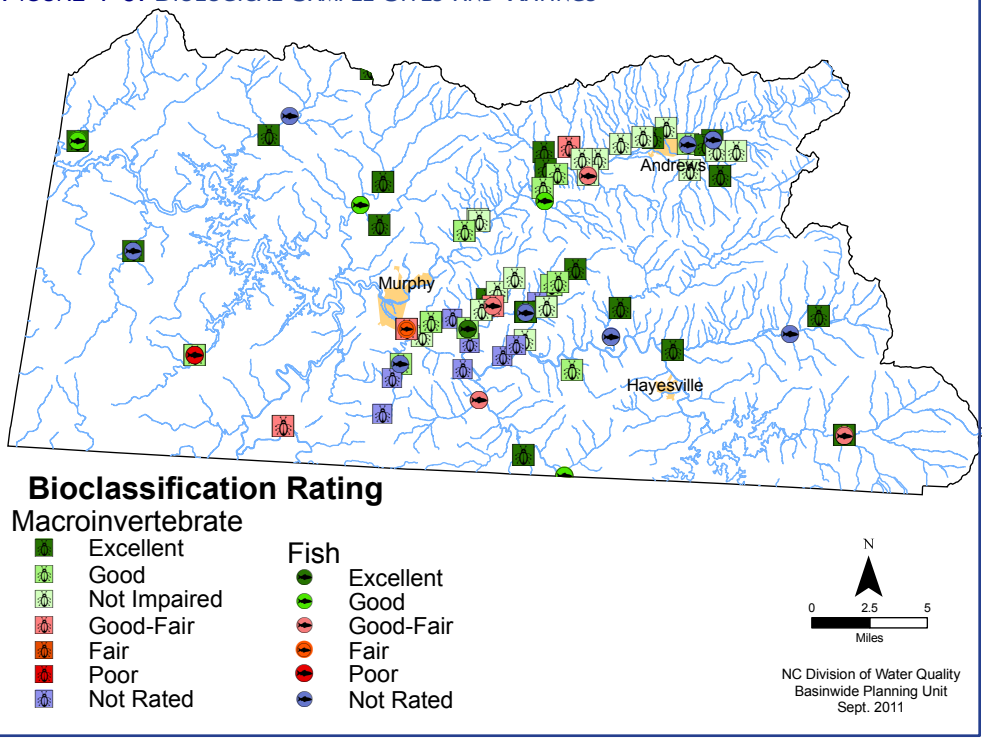


Figure 1-6: Biological Sample Sites and Ratings



Impaired Waters

Water quality data within a five year data sampling period is assessed every two years and reported to EPA to meet requirements under Section 303(d) of the Clean Water Act of 1972. Impaired waterbodies exceed a surface water quality standard for that waterbody's designated use; these waterbodies are listed on the 303(d) list. The following list includes waterbodies in which a parameter exceeded the standard and enough samples were collected to meet criteria assessment.

The draft 2012 303(d) list of Impaired waters includes the waterbodies listed below:

Waterbody	Class	Assessment Unit #	Length	Parameter	Impaired Year
Valley River	C;Tr	1-52c	7.7 mi.	Turbidity	2008
Persimmon Creek (Lake Cherokee)	C	1-63a	5.9 mi.	EBIF	2008
Martin Creek	C	1-49	8.8 mi.	EBIF FCB	2012 2012
Peachtree Creek	C	1-44a	5.3 mi.	FCB	2012
Slow Creek	C	1-44-9	5.2 mi.	FCB	2012
Lamb Branch	C	1-44-5	1.7 mi.	FCB	2012
Mission Branch	WS-IV	1-41	1.8 mi.	FCB	2012
No longer Impaired					
HIWASSEE RIVER (Hiwassee Lake)	C	1-(50)	143.4 ac.	Low pH	2010

EBIF= Ecological Biological Integrity Fish Community
EBIB= Ecological Biological Integrity Benthos (Macroinvertebrates) Community
FCB= Fecal Coliform Bacteria

Improved Waters

The Hiwassee River (near Murphy) AU# 1-(50) is no longer Impaired for aquatic life as ambient samples no longer detected low pH. It is possible the previous low pH readings were a result of Anakeesta (acid rock) disturbance from construction of the new US 64 bypass, otherwise the cause of the low pH conditions remains unknown.

Local Initiatives & Needs

One of the major assets this basin has to protect and preserve water quality are the local groups that are actively participating in stream restoration, protection, monitoring, education, research and land acquisition. Their specific activities are incorporated within the descriptions of water quality issues within the subbasin chapters of this Basin Plan. DWQ supports and encourages these local groups to continue to identify problems and solutions and to implement activities to improve and protect water quality.

Sediment Control

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. Poorly controlled erosion and sediment from steep slope disturbance negatively impacts water quality, hydrology, aquatic habitat, and can threaten human safety. 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.

In November 2009, nine organizations and agencies including the Hiwassee River Watershed Coalition, Land Trust for the Little Tennessee, and Southwestern NC Resource Conservation & Development (RC&D) Council began meeting to discuss the need for a system of erosion and sediment control (E&SC) trainings within the western North Carolina region. E&SC training for the seven western counties were identified as a priority because some counties require contractors to have annual E&SC training while other counties do not. Research about mountainous terrain E&SC best management practices specific to western NC has been identified as a need. This steering committee has been meeting since that time, working on the Regional Erosion and Sediment Control Initiative for Western North Carolina. The steering committee continues to pursue grant funding and promote this effort which could have a significant impact on the sedimentation problem in mountain region stream systems. In addition to the benefit of reduced sedimentation, the initiative will benefit local economies and small businesses by helping contractors create and retain jobs.

Impervious Surfaces

Impervious surfaces alter the natural hydrology by preventing infiltration of water into the soil. Impervious surfaces include roads, rooftops, and parking lots; all are characteristics of conventional growth and development. 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. Bank scour from these frequent high flow events tends to enlarge streams and increase suspended sediment. These effects are compounded when small streams are channelized or piped, and storm sewer systems are installed to increase transport of stormwater downstream.

Progressive planning is needed to protect our water resources to prevent exceeding a watershed's impervious surface threshold. Both counties and the municipal jurisdictions within the basin should implement the voluntary Universal Stormwater Management Program (USMP) to address stormwater runoff concerns. Under the USMP, a local government will be able to meet the different post-construction requirements for many existing stormwater strategies (HQW, Phase 2 NPDES, etc) with just a single set of requirements.

Bacteria

Whether a stream is classified for primary recreation (B) or not, the nature of mountain streams lead to a heavy recreation use. High levels of fecal coliform bacteria have been detected in several streams due to the increase in monitoring during a special study. The bacteria normally would have gone undetected because DWQ's limited monitoring resources primarily focus on Class B waters. The detected instream high bacteria counts reinforce the need to reduce non-point source pollution, focus on limiting livestock access to streams, implement agriculture BMPs, promote domestic pet waste pick-up, control urban stormwater and repair failing septic systems.

WaDE

The discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemical nutrients, disease pathogens and endocrine disrupting chemicals. Special study requests led to an increase in number of streams sampled for bacteria and have led to several new stream impairments. As of 2012, there are 58 stream miles and 171 lake acres Impaired because of high fecal coliform bacteria levels. The economies of the counties in this basin are highly dependent upon river recreation, especially for tourists and seasonal residents. Reducing bacterial contamination is crucial for supporting a tourist economy. In order to protect human health and maintain water quality, straight pipes must be eliminated and failing septic systems should be repaired.

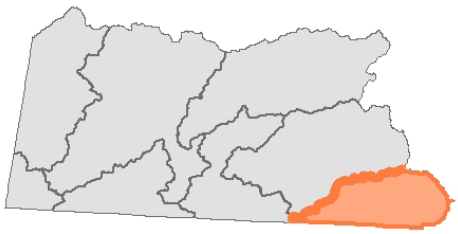
Recent budgetary changes caused the dissolution of an important program that provided significant water quality as well as human health and quality of life benefits. The Wastewater Discharge Elimination (WaDE) Program formed to identify and correct straight-piped wastewater discharges and failing septic systems, lost funding for all activities. The work that had been accomplished by the program assisted in the reduction of fecal coliform levels in several watersheds across the region. At a community, quality-of-life level, the assistance once provided to very-low and low-income households to repair and/or replace failing, or even non-existent septic systems, was lost. The Division of Water Quality in the Asheville region receives regular phone calls from health department personnel, county personnel and other agencies seeking assistance to help families in need of septic system repairs. This on-going need is sometimes met with the aid of church groups and there has been some funding provided by assistance agencies, but the availability of that funding is extremely restricted in comparison to the former WaDE Program's abilities. Funds need to be reallocated to reestablish the WaDE program or allocated to County Health Departments to assist in detecting and eliminating straight pipes and septic failures.

DWQ Asheville Regional Office Outreach

The Asheville Regional Office (ARO) has recently embarked upon a long-term, outreach initiative designed to establish partnership and understanding across the wide variety of industries and organizations within its management area. To accomplish its mission and obtain its goals, the DWQ understands that partnership-building, continuous education efforts and leveraging of resources are required. In that direction, the ARO has launched several efforts with more to come:

- Western North Carolina is home to a large set of active environmental organizations (EOs) involved in numerous initiatives, many involving water quality. Those organizations, located across the nineteen counties of the Asheville Regional Office, house many resources, including experienced staff, community members and local knowledge. The DWQ employs experienced staff as well, with regulatory and technical expertise. Clearly, leveraging the resources of EOs and the DWQ would benefit all parties in the common mission of protecting water quality. In late 2011, DWQ staff launched an effort in pursuit of such partnering. EOs from across the western region along with DWQ personnel will convene several summits during 2012 to develop a better understanding of the work being done across the region and how to mutually benefit from building partnerships.
- In an effort to improve and protect water quality, while supporting the trout farm industry in the region, a collaborative approach has been undertaken which includes trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The outcome of the collaborative work should lead to a better understanding of farm operations, best management practices (BMPs), water resource/quality protection and regulatory needs for all parties.

Shooting Creek Watershed

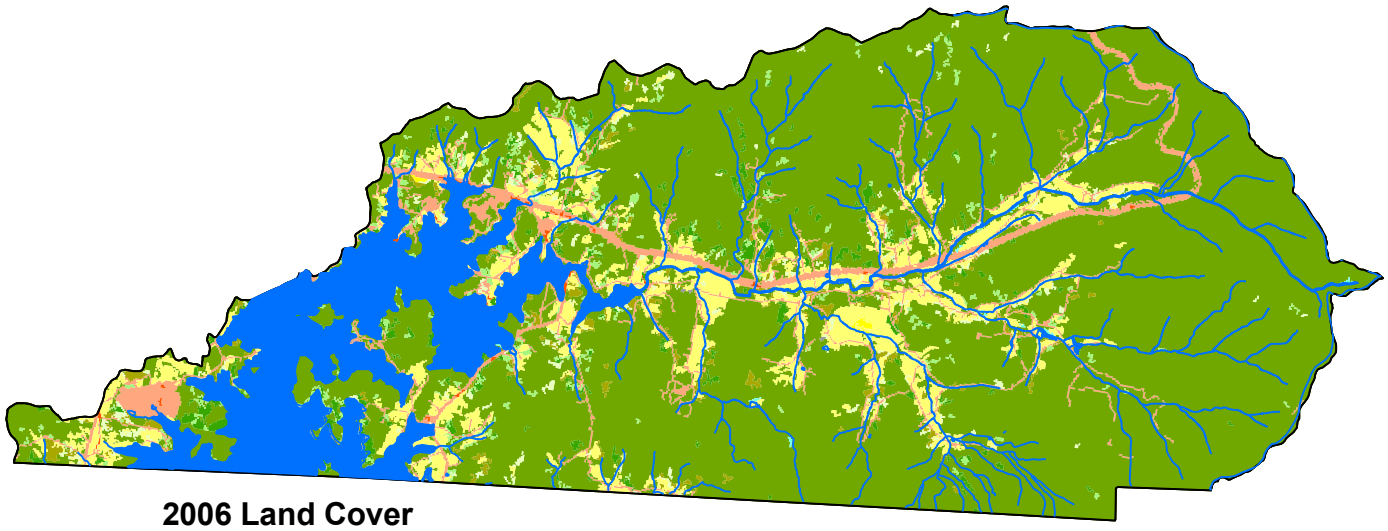


HUC 0602000201

Includes: Major Streams- Shooting Creek, Eagle Fork Creek, Giesky Creek, Pounding Mill Creek, Licklog Creek & Hothouse Branch

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Clay	58 sq mi.	Open Water.....8%	NPDES
Municipalities:	**Population:**	Developed.....6%	Wastewater Discharge.....1
none	2000....2,438	Forested.....75%	Wastewater Nondischarge.....1
EPA Level IV Ecoregions:	2010....2,963	Shrub.....1%	Stormwater.....0
Broad Basins, Southern Crystaline Ridges & Mtns.		Agriculture.....10%	Animal Operations.....0



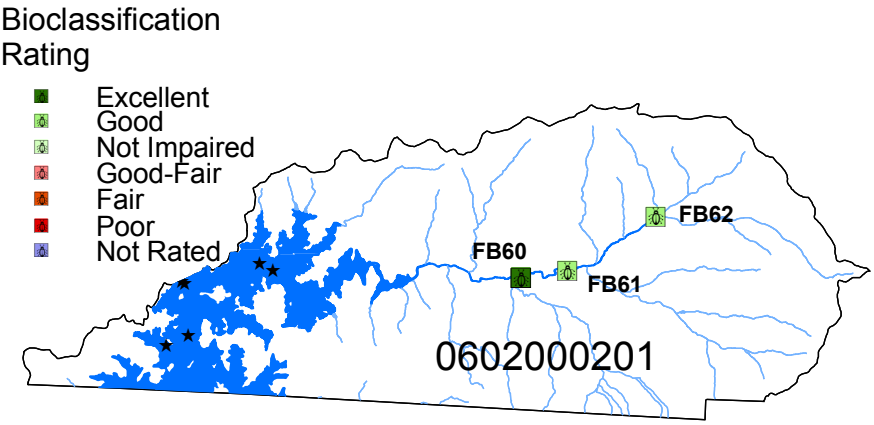
2006 Land Cover

- Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland
- Pasture/Hay
- Cultivated Agriculture
- Woody Wetlands
- Barren Land

Figure 1-1: Shooting Creek Watershed Map

Water Quality Monitoring

Figure 1-2: Biological Sample Sites & Ratings



The only ambient water quality stations in this watershed are in Chatuge Lake. Biological samples have been taken throughout the watershed since the 1980's. Basinwide sites were first sampled in 1994 and the most recent basinwide benthic macroinvertebrate sample was taken in 2009 at site FB60 resulting in an Excellent Bioclassification. Site specific information is available in Appendix and the Biological Assessment Report is available here http://portal.ncdenr.org/web/wq/ess/reports. Figure 1-2 shows the most recent benthic site rating in this watershed at sites sampled since 1994.

Biological Monitoring

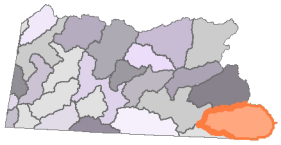
Biocriteria have been developed using the diversity, abundance, and pollution sensitivity of the organisms that inhabit flowing waterbodies in NC. One of five bioclassifications are typically assigned to each water body sampled: Excellent, Good, Good-Fair, Fair and Poor. Not Impaired and Not Rated designations are reserved for samples that were not eligible to be assigned one of the five typical bioclassification categories. Typically, a "Not Impaired" rating is equivalent to a Good-Fair or better bioclassification and a "Not Rated" designation is equivalent to a Fair or worse bioclassification. The reasons for not being able to assign one of these five typical bioclassifications may be a lack of appropriate bio-criteria or atypical sampling conditions (e.g., drought). These bioclassifications are used to assess the various impacts of both point source discharges and nonpoint source runoff. The resulting information is used to document both spatial and temporal changes in water quality, and to complement water chemistry analyses, ambient toxicity data, and habitat evaluations. In addition to assessing the effects of water pollution, biological information is also used to define High Quality or Outstanding Resource Waters, support enforcement of stream standards, and measure improvements associated with management actions. The results of biological investigations have been an integral part in North Carolina's basinwide monitoring program.

Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document, biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Shooting Creek Subwatershed (HUC 060200020105)



This subwatershed drains ~48.5 $mi^{2,}$, with much of the headwaters being within Nantahala National Forest. Shooting Creek [AU# 1-5] is a 5.6 mile tributary to Chatuge Lake. This subwatershed represents nearly a quarter of Lake Chatuge's entire drainage area. The subwatershed is mostly forest with scattered areas of low density housing, row crops and pasture. A road parallels large portions of this waterbody, resulting in impacts to the riparian zone and notable areas of erosion along the stream banks. Shooting Creek is hatchery supported trout waters (Tr) and the DWQ fish community samples taken in Shooting Creek from 2004 & 2009 resulted in a Good-Fair rating. A mixed assemblage of cold, cool, and warm water species were collected and the fish community population appears to be moderately healthy and stable. Macroinvertebrate samples taken at the same location resulted in Excellent bioclassifications. Restoration efforts (installation of rock vanes) have been completed in this reach since 2004 biological samples were taken.

In this subwatershed, there are no discharge permits and one non-discharge permit for a closed laundromat in which the infiltration pond needs to be closed. There are three Significant Natural Heritage Areas: White Oak Stamp, Glade Gap Slopes, and Chunky Gal/Riley Knob are found within the Nantahala National Forest in the headwaters of the Shooting Creek watershed.

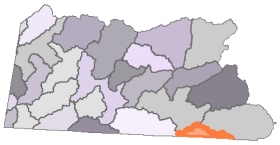
Water Quality Initiatives

In November 2004, Clay County received $184,400 in Emergency Watershed Protection funds from the USDA Natural Resources Conservation Service (NRCS) to repair damage from hurricanes Frances and Ivan. A total of 2,000 linear feet of Eagle Fork Creek, Muskrat Creek, and Shooting Creek were restored using natural channel design techniques. The Projects were administered and supervised by the Clay County Soil and Water Conservation District and Clay County personnel. Additional accomplishments in the Shooting Creek drainage include two restoration projects funded by the North Carolina Agricultural Cost Share Program totaling 500 linear feet of restoration on Geisky and Eagle Fork Creeks.

Recommendations

Within this subwatershed, Shooting Creek Headwaters, Eagle Fork, Giesky Creek, Upper Shooting Cr Embayment, and Licklog Creek are priority catchments for nutrient and sediment erosion reduction BMPs. Local actions are needed to address nonpoint pollution sources in the watershed. DWQ encourages local governments to adopt and enforce local ordinances to protect existing water quality in the watershed. Additionally, new development should avoid building in the floodplain and employ best management practices designed to reduce impacts to water quality. The **Hiwassee River Watershed Coalition** completed a **Watershed Action Plan** in 2007 for Chatuge Lake that includes actions applicable to Shooting Creek. DWQ encourages citizens to volunteer to assist Hiwassee River Watershed Coalition in implementing the plan and also encourages funding organizations to support plan implementation.

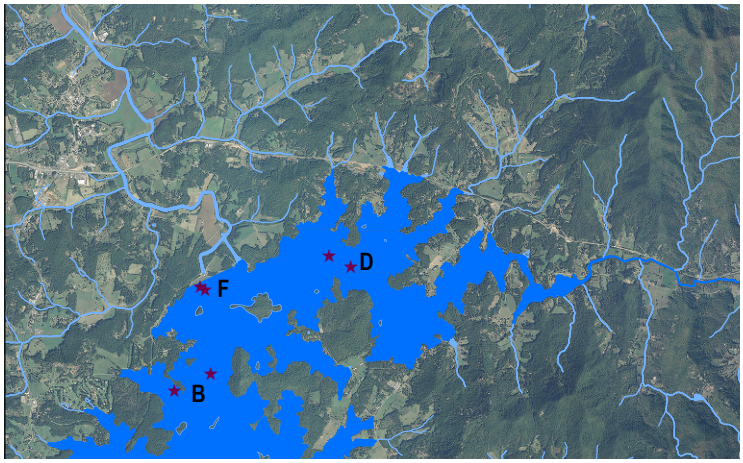
Lake Chatuge (HUC 060200020106)



Lake Chatuge [AU# 1-(1)] is a 7,000 acre reservoir that impounds the Hiwassee River. The lake is situated adjacent to the Nantahala National Forest. Approximately half of the lake lies within the state of Georgia. The lake is owned by the Tennessee Valley Authority (TVA) and was constructed in 1942 for the purpose of storing flood waters for TVA's Hiwassee and Apalachia Reservoirs downstream, as well as mainstream dams on the Tennessee River. Today Lake Chatuge is operated for many purposes, including flood control, augmentation of flows for navigation, hydropower production, protection of aquatic resources, and recreation. Lake Chatuge is classified B (suitable for swimming) and is a popular recreation area. As a result development along the shoreline has occurred contributing to a large increase in impervious surfaces that drain to the lake.

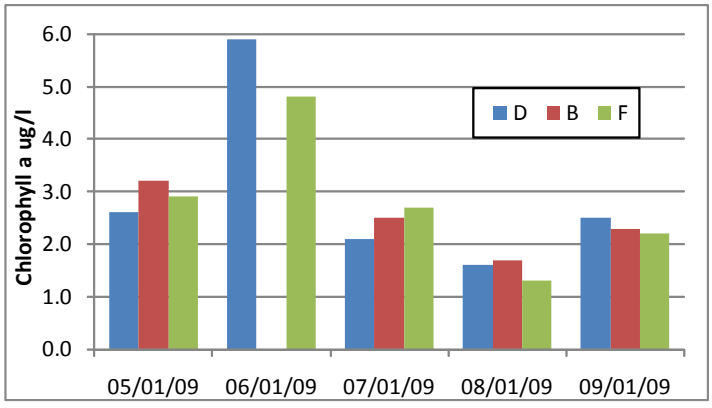
This lake has a maximum depth of 144 feet, and a mean depth of 36 feet. Lake Chatuge is 13 miles long with 130 miles of shoreline. The drainage area of the lake covers 189 mi^2, which is primarily forested. Eller Seep is a Significant Natural Heritage Area near the NC/GA state line near the lake. Major tributaries to the Lake Chatuge include the Hiwassee River and Shooting Creek. There is one discharge permit (USFS Jackrabbit Mountain Recreation Area WWTP, NC0021148) that has had frequent violations for BOD levels. However, this facility is expected to be taken offline in 2012 and the permit will likely be rescinded, when it connects to a regional wastewater sewer system in Towns County, Ga.

Figure 1-3: Chatuge Lake Monitoring Station Locations



DWQ staff monitored Lake Chatuge monthly from May through September 2009, Figure 1-3. Surface dissolved oxygen ranged from 7.0 to 8.9 mg/L with a thermocline generally occurring at a depth of seven meters from the surface. In June, a dissolved oxygen maxima was observed at a depth of approximately six meters from the surface, suggesting the possibility of increased subsurface algal productivity at this depth in the water column. An analysis of a phytoplankton sample collected from Lake Chatuge indicated that the dominant alga was Tabellaria fenestrata, a chain-forming diatom. This diatom is an indicator of cool, clear water, which is present in Lake Chatuge. Chlorophyll a values in June were slightly greater than those observed in May and July (Figure 1-4), but well below the state water quality standard of 40 µg/L (Appendix B). Overall, chlorophyll a values in 2009 did not vary from those previously observed in Lake Chatuge by DWQ staff. Secchi depths were also generally similar to previously observed measurements and ranged from 2.0 to 3.8 meters.

Figure 1-4: Chlorophyll a levels at Lake Stations



Nutrient concentrations in 2009 were consistently low and similar to past observations. The North Carolina Trophic State Score for this lake indicated that productivity is very low (oligotrophic). Lake Chatuge has been consistently oligotrophic since it was first monitored by DWQ in 1981. The 2010 Integrated Report lists Lake Chatuge as Supporting for aquatic life, however bacterial samples were not taken and is therefore the lake is Not Rated for recreation uses.

The Tennessee Valley Authority (TVA) began a monitoring program for its reservoirs in 1990 as a means of collecting data to assess the integrity or

"health" of the aquatic ecosystems of these reservoirs. Based on sampling conducted by the TVA Lake Chatuge was determined to have an Ecological Health Rating of Fair in 2007 and 2008. Chlorophyll a monitored by the TVA rated good at both the forebay and in Shooting Creek, however, trends in chlorophyll a concentrations suggest that levels have been increasing since the TVA first began its monitoring program in this reservoir in the early 1990's (www.tva.com/environment/ecohealth/chatuge.htm).

The TVA data collection has noted a decline in water quality throughout the lake and a steady rise in chlorophyll a levels. The Hiwassee River Watershed Coalition completed a Watershed Action Plan in 2007 for Lake Chatuge to investigate and address the lake's water quality. Specifically, the water quality decline is related to nutrient inputs from pasture lands, developed areas and point sources. The Watershed Action Plan targets reducing both phosphorus and sediment inputs to reduce overall nutrient impacts with the goal of reducing chlorophyll a levels in the lake to <5 ug/l and a 10% reduction in the area of the lake affected by low DO. The modeling completed for the Watershed Action Plan calls for a 30% reduction in phosphorus and nitrogen. The Plan identifies six management strategies to help achieve the 30% reduction:

1. Reduce the Total Phosphorus load from the Hiwassee WWTP by 50%
2. Restrict from streams and/or the lake, and provide appropriate alternative watering for, a minimum of 125 animals (25%) that currently have unrestricted access
3. Improve 40% of pastures considered to be in fair condition to good condition (about 2,500 acres)
4. Improve 50% of the most degraded pasture areas to a minimum of conditions considered fair (about 440 acres)
5. Reduce the Total Phosphorus load by 30% from existing commercial areas (about 1000 acres)
6. Reduce TP load by 5% from existing residential areas (nearly 7,000 acres)

DWQ supports the findings of the Hiwassee River Watershed Coalition study and encourages efforts to implement the actions it identified within the Lake Chatuge Watershed Action Plan to reduce sediment and nutrient loads to the reservoir. Additionally, planning for future wastewater treatment is also needed to protect Lake Chatuge's health.

The Hiwassee River Watershed Coalition (HWRC) is also working to implement activities in the 60% of the Lake Chatuge watershed that falls within the State of Georgia. The HRWC in partnership with Towns County, GA received a NPS 319 grant to hire a watershed coordinator and implement BMPs targeting nutrient reductions.

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The fourth and fifth columns of this table list potential stressors and sources that may be impacting a stream based on in-field observations, monitoring data, historical evidence, permit or other violations, and other staff and public input. In many cases, additional study is needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Eagle Fork Creek	1-5-6	C;Tr	nutrients, sediment	?	Not Rated	BMPs
Giesky Creek	1-5-7	C;Tr	nutrients, sediment	?	Not Rated	BMPs
Licklog Creek	1-10	C	nutrients, sediment	?	Not Rated	BMPs
Shooting Creek	1-5	C;Tr	nutrients, sediment	?	Supporting	BMPs

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source= development, agriculture, WWTP, NPS,

Status = Impaired, Impacted, Supporting, Improving

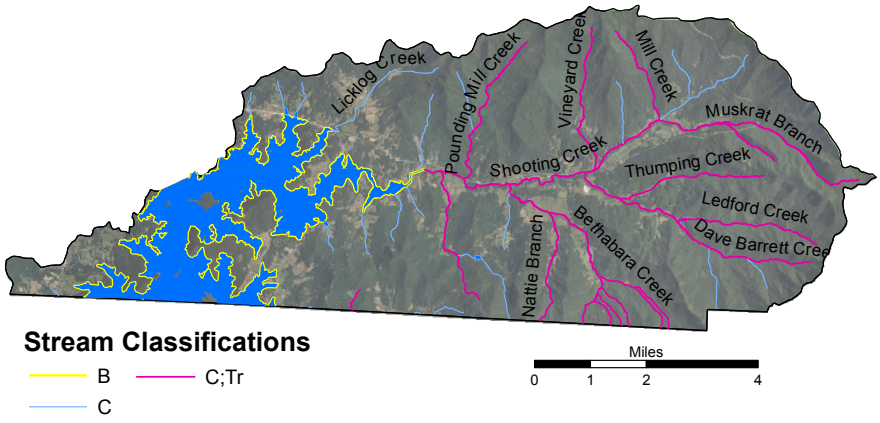
Actions Needed = R= restoration, P= protection, SC= stormwater controls, SS= stressor study, E= education, LO= local ordinance, BMPs, SSP= species protection plan, F= forestry BMPs, Ag= Agriculture BMPs, NMC= nutrient mgnt controls, S&E soil and erosion control, M= monitoring

Waterbody Classifications

All surface waters in the state are assigned at least one primary classification and they may also be assigned one or more supplemental classifications, Figure 1-5 . A list of classifications with a description of their requirements can be found in Chapter 2 of the Supplemental Guide to Basinwide Planning.

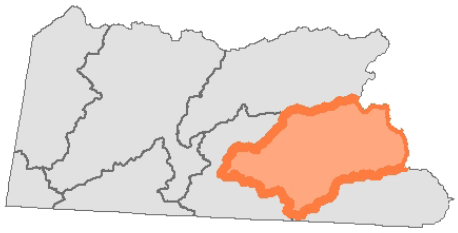
Trout (Tr) Waters

Figure 1-5: Stream Classifications



Shooting Creek and several of its tributaries are classified as Trout (Tr) waters. Tr are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to Tr streams as well as unnamed tributaries flowing to the classified trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1) or the following link: http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364.

Tusquitee Creek Watershed



HUC 0602000202

Includes: Major Streams- Hiwassee River, Tusquitee Creek & Fires Creek

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee, Clay	109 sq mi.	Agriculture.....9%	NPDES
Municipalities:	**Population:**	Developed.....4%	Wastewater Discharge.....5
Hayesville	2000....4,855	Forested.....86%	Wastewater Nondischarge.....0
EPA Level IV Ecoregions:	2010....5,674	Shrub.....1%	Stormwater.....3
Broad Basins, High Mtns., Southern Crystaline Ridges & Mtns, Southern Metasedimentary Mtns			Animal Operations.....0

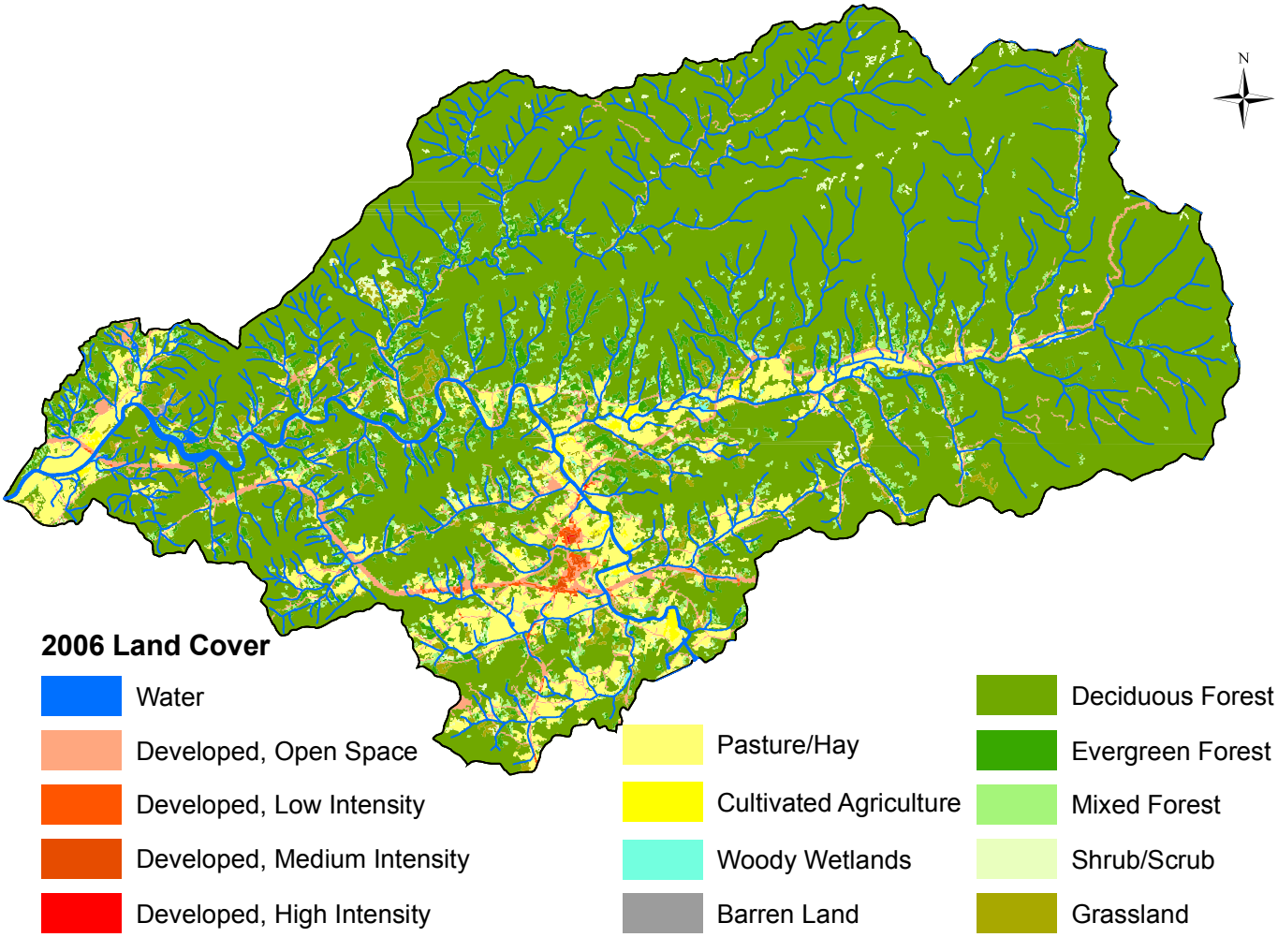
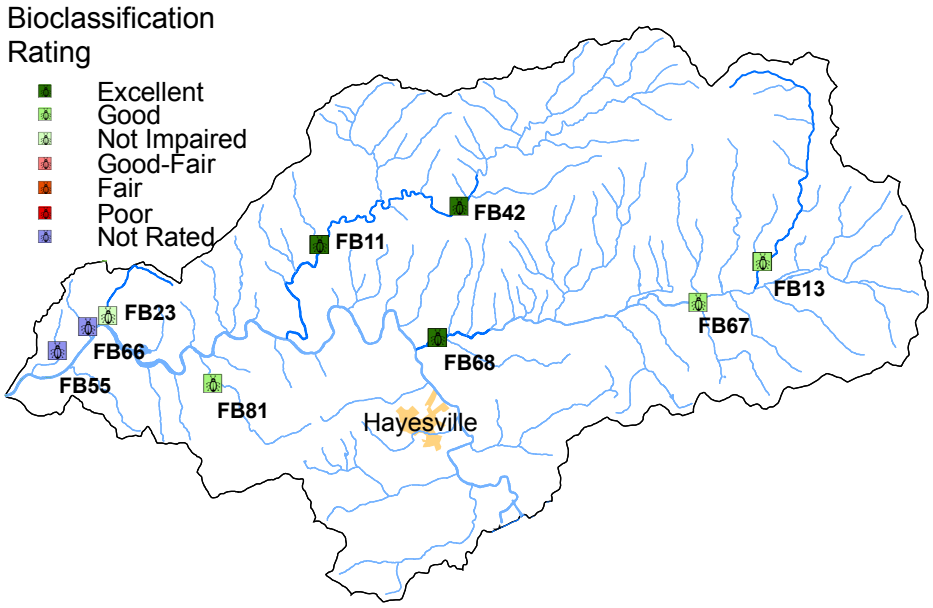


Figure 1-1: Tusquitee Creek Watershed Map

Water Quality Monitoring

There are no ambient stations in this watershed. Although biological samples have been taken throughout the watershed since the 1980's. Basinwide sites were first sampled in 1994 and the three most recent basinwide benthic macroinvertebrate samples were taken in 2009; two resulted in Excellent Bioclassifications and one in a Good rating. Special studies resulted in four additional benthic samples taken in this watershed since 1996. Site specific information is available in Appendix and the Biological Assessment Report is available here: http://portal.ncdenr.org/web/wq/ess/reports. Figure 1-2 shows the most recent benthic site rating in this watershed at sites sampled since 1994.

Figure 1-2: Biological Sample Sites & Ratings



Biological Monitoring

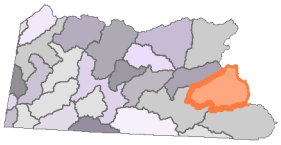
Biocriteria have been developed using the diversity, abundance, and pollution sensitivity of the organisms that inhabit flowing waterbodies in NC. One of five bioclassifications are typically assigned to each water body sampled: Excellent, Good, Good-Fair, Fair and Poor. Not Impaired and Not Rated designations are reserved for samples that were not eligible to be assigned one of the five typical bioclassification categories. Typically, a "Not Impaired" rating is equivalent to a Good-Fair or better bioclassification and a "Not Rated" designation is equivalent to a Fair or worse bioclassification. The reasons for not being able to assign one of these five typical bioclassifications may be a lack of appropriate bio-criteria or atypical sampling conditions (e.g., drought). These bioclassifications are used to assess the various impacts of both point source discharges and nonpoint source runoff. The resulting information is used to document both spatial and temporal changes in water quality, and to complement water chemistry analyses, ambient toxicity data, and habitat evaluations. In addition to assessing the effects of water pollution, biological information is also used to define High Quality or Outstanding Resource Waters, support enforcement of stream standards, and measure improvements associated with management actions. The results of biological investigations have been an integral part in North Carolina's basinwide monitoring program.

Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document, biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Tusquitee Creek (HUC 060200020201)



The downstream reach of Tusquitee Creek [AU 1-21-(16.5)] has consistently had an Excellent rating from the macroinvertebrate samples, 2009 included. This lower 1.7 mile reach is classified as WS-IV;Tr,HQW, while the middle reach of 5.8 miles is C;Tr,HQW and the upper 4.1 miles is C;Tr.

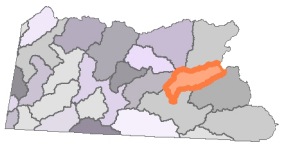
There are two minor WWTP discharge permits: a single family residence (NCG550427) and Tusquitee Trout Ranch Inc.(NCG530130) discharges fish pond, rinsing and packing runoff to Tusquitee Creek.

Steep access roads, impervious surfaces, and lack of sediment controls are causing increased sedimentation in Tusquitee Creek. This formerly pristine watershed now bears unstable abandoned logging roads and large-scale residential developments that are currently for sale. Local Soil and Water Conservation District employees have noted sediment problems after rain events on Tusquitee Creek, suggesting that runoff from prior logging roads and residential construction may be causing sedimentation. Citizens also report a lack of awareness and enforcement of HQW rules in place to protect the watershed. This demonstrates a critical need for an ambient monitoring station and/or sediment monitoring station on Tusquitee Creek. The creek is noted to have a narrow riparian zone and is experiencing some bank erosion.

Big Tuni Creek [AU# 1-21-5] flows through a predominantly forested drainage area. The macroinvertebrate sample taken in 2009 resulted in Good bioclassification which is a decrease from the Excellent status it held from samples taken in 1989 and 2004. This decline is likely related to weather conditions during the previous fall when large storms damaged roads, bridges and blew down trees in the headwaters.

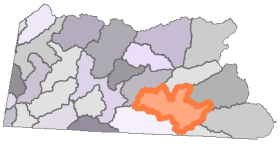
Actions Needed:
Protection of existing water quality in the watershed is the highest priority. The gently sloped valley is attractive for residential development and sediment and erosion control laws must be enforced. A plan to educate local citizens, landowners, and developers about HQW regulations is necessary. Working farm easements on properties in the watershed could be used to protect against the negative water quality impacts associated with increased residential development.

Fires Creek (HUC 060200020202)



Almost this entire subwatershed is part of the Nantahala National Forest. Fires Creek, Laurel Creek, Rockhouse Creek, Coldspring Branch and all other streams in this subwatershed, carry the supplemental classification of Outstanding Resource Waters (ORW). The ORW classification is intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological significance. The Fires Creek watershed is also designated a Significant Natural Heritage Area by the NC Natural Heritage Program. The 2009 macroinvertebrate and fish sample results indicate Excellent water quality conditions in Fires Creek [AU# 1-27-(5.5), WS-IV;Tr, ORW], although the fish sample is considered Not Rated due to limited criteria for rating high gradient mountain trout waters. Fires Creek is protected for maintaining water supply and trout habitat in addition to its ORW designation. Development of private lands has resulted in increased erosion and sedimentation in the lower portion of the Fires Creek watershed. Strict erosion control enforcement and site-specific stormwater control requirements are critical to protecting water quality as future development of private lands occurs in this Outstanding Resource watershed.

Sweetwater Creek (HUC 060200020203)



This subwatershed is named after Sweetwater Creek a 3.5 mi. tributary to the Hiwassee River, which is the main hydrologic feature in this subwatershed. The majority of the watershed falls within a Water Supply IV area. Hayesville, with a population of 311 people is the only municipality within this hydrologic unit. The 2010 census shows a decline in the town's population while growth has occurred throughout the non-incorporated areas of the watershed. The Sweetwater Creek subwatershed is where Chatuge Lake drains into the Hiwassee River.

The Hiwassee River [AU#s, 1-(15), 1-(16.5)a ,1-(16.5)b], between Chatuge and Mission Dams is Not Rated as there are no biological or ambient monitoring stations on it. The Town of Hayesville WWTP (NC0026697) discharges into the Hiwassee River in AU# 1-(16.5)a. This facility does not have a history of violations but they are in need of an upgrade to prevent future violations; upgrades needed include screening, disinfection and sludge handling processes. In September 2011, fecal coliform bacteria samples were collected in AU# 1-(16.5)b and the data indicates bacteria levels that exceed our current water quality standards assessment criteria. The Hiwassee River is heavily used for recreation (tubing, canoeing, kayaking, fly and float fishing) and would benefit from the establishment of instream monitoring stations.

The next 1.5 mile reach of the Hiwassee River [AU# 1-(16.5)c] is also Not Rated; as two small tributaries Mission Branch and Sudderth Branch [AU# 1-39] were sampled in a **2006 special study** resulting in Not Rated Bioclassification. However, Mission Branch [AU# 1-41] was sampled for bacteria contamination; five fecal coliform bacteria samples between May 24- June 12, 2007 detected bacteria levels that exceed state standards with a maximum coliform count of 2400 and a geometric mean of 631. Tributaries including: Sweetwater, Blair, South Fork Blair, Town and Hyatt Mill Creeks have been identified as contributing to water quality degradation. Enforcement of soil and erosion control plans, BMPs to reduce sedimentation in streams and additional monitoring are needed.

Calhoun Branch [AU# 1-38] also sampled as part of the **EEP special study** was rated as Not Impaired, with noted stream channelization, lack of riparian vegetation and minimal macroinvertebrate habitat. Just upstream of the confluence of Calhoun Branch and Tusquitee Creek, Duke Energy holds a discharge permit for cooling and condensation water and there are two stormwater discharge permits.

Sweetwater Creek [AU # 1-32] received a Good bioclassification from a macroinvertebrate sample taken in 2009. The 2007 Basin Plan notes the need for a special study to investigate sedimentation within this subwatershed.

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The fourth and fifth columns of this table list potential stressors and sources that may be impacting a stream based on in-field observations, monitoring data, historical evidence, permit or other violations, and other staff and public input. In many cases, additional study is needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Blair Creek	1-17	WS-IV	habitat degradation	agriculture, stormwater	Not Rated	S&E, R, BMPs
Calhoun Branch	1-38	WS-IV	habitat degradation	agriculture	Not Impaired	BMPs
Fires Creek	1-27-(5.5)	WS-IV;Tr,ORW	sediment	development	Supporting	P, S&E, M
Hiwassee River	1-(15) 1-(16.5)a 1-(16.5)b	C WS-IV WS-IV	habitat degradation, fecal coliform bacteria	agriculture, development, highway impacts, stormwater, WWTP	Not Rated	P, R, S&E, M, BMPs
Hyatt Mill Creek	1-16	C	habitat degradation	stormwater, development livestock access	Not Rated	S&E, R, BMPs
Mission Branch	1-41	WS-IV	fecal coliform bacteria	stormwater, failing septic systems	Impaired	BMPs
S Fk Blair Creek	1-17-2	WS-IV	sediment	livestock access, stormwater	Not Rated	S&E, M,
Sweetwater Creek	1-32	WS-IV	sediment	roads, development, livestock access, stormwater	Not Rated	S&E, M, BMPs, R
Town Creek	1-19	WS-IV	habitat degradation	stormwater, development, livestock access, septic systems, roads	Not Rated	S&E, M, BMPs, R
Tusquitee Creek	1-21-(4.5)	C;Tr,HQW	sediment	development, forestry	Supporting	P, S&E, M, F

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source = development, agriculture, WWTP, NPS,

Status = Impaired, Impacted, Supporting, Improving

Actions Needed = R= restoration, P= protection, SC= stormwater controls, SS= stressor study, E= education, LO= local ordinance, BMPs, SSP= species protection plan, F= forestry BMPs, Ag= Agriculture BMPs, NMC= nutrient mgnt controls, S&E soil and erosion control, M= monitoring

Management Strategies for Water Quality Protection

Fires Creek and Tusquitee Creek watersheds are classified as Outstanding Resource Waters and High Quality Waters, respectively. Trout (Tr), High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the freshwater classification(s) placed on a waterbody. Figure 1-3 shows stream classifications in this watershed. Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect water quality. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina(NCDENR-DWQ, 2004). This document is available on-line at **http://portal.ncdenr.org/web/wq/ps/csu/rules**.

HQW & ORWs

HQW classification is intended to protect waters with water quality higher than the state's water quality standards. In the Hiwassee River basin, waters classified as Water Supply I and II (WS-I and WS-II), ORW, and waters designated by the NC Wildlife Resources Commission (WRC) as native (wild) trout waters are subject to HQW rules. Streams petitioned for WS-I or WS-II or which are considered Excellent based on biological and physical/chemical water quality parameters may qualify for the HQW supplemental designation.

New discharges and expansions of existing discharges may, in general, be permitted in waters classified as HQW provided that the effluent limits are met for dissolved oxygen (DO), ammonia/nitrogen levels (NH_3-N), and the biochemical oxygen demand (BOD5). More stringent limitations may be necessary to ensure that the cumulative effects from more than one discharge of oxygen-consuming wastes will not cause the dissolved oxygen concentration in the receiving water to drop more than 0.5 milligrams per liter (mg/l) below background levels. Discharges from single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (Administrative Code 15A NCAC 2B .0224).

In addition to the above, development activities which require an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). Under these rules, stormwater management strategies must be implemented if development activities are within one mile of and draining to waters designated as HQW. There are two development options outlined in the rule:

- The low-density option requires a 30-foot wide vegetative buffer between development activities and the stream. This option can be used when the built upon area is less than 12 percent of the total land area or the proposed development is for a single-family residential home on one acre or greater. Vegetated areas may be used to transport stormwater in the low-density option, but it must not lead to a discrete stormwater collection system (e.g., constructed).
- The high-density option is for all land disturbing activities on greater than one acre. For high-density projects, structural stormwater controls must be constructed (e.g., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch or more of rainfall. More stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water (Administrative Code 15A NCAC 2H .1006).

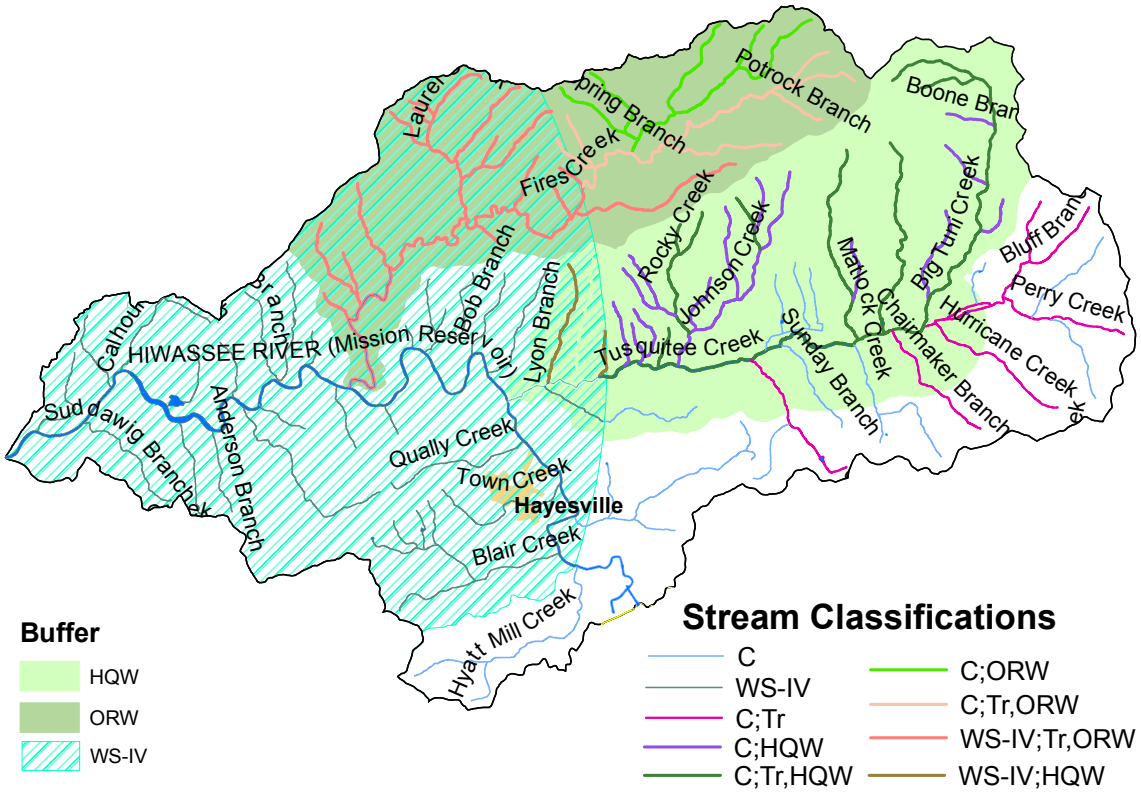
ORWs are unique and special surface waters that have some outstanding resource value (e.g., outstanding fish habitat and fisheries, unusually high levels of water-based recreation, special ecological or scientific significance). No new discharge or expansions on existing discharges are permitted. Rules related to the development activities are similar to those for HQW, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow

stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). In addition, site specific stormwater management strategies may be developed if needed to protect the resource values of these waters.

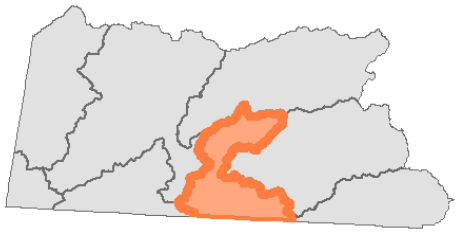
Trout (Tr) Waters

Trout (Tr) waters are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to Tr streams as well as unnamed tributaries flowing to the classified trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1) or the following link: http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364

Figure 1-3: Stream Classifications & Special Management Areas



Brasstown Creek Watershed



HUC 0602000203

Includes: Major Streams- Brasstown Creek, Hiwassee River, Little Brasstown Creek & Peachtree Creek

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee, Clay	58 sq mi.	Agriculture.....15%	NPDES
Municipalities:	**Population:**	Developed.....6%	Wastewater Discharge.....0
none	2000.....4,456	Forested.....77%	Wastewater Nondischarge.....0
EPA Level IV Ecoregions:	2010.....5,422	Shrub.....1%	Stormwater.....0
Broad Basins, Southern Metasedimentary Mtns			Animal Operations.....0

2006 Land Cover

- Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland
- Pasture/Hay
- Cultivated Agriculture
- Woody Wetlands
- Barren Land

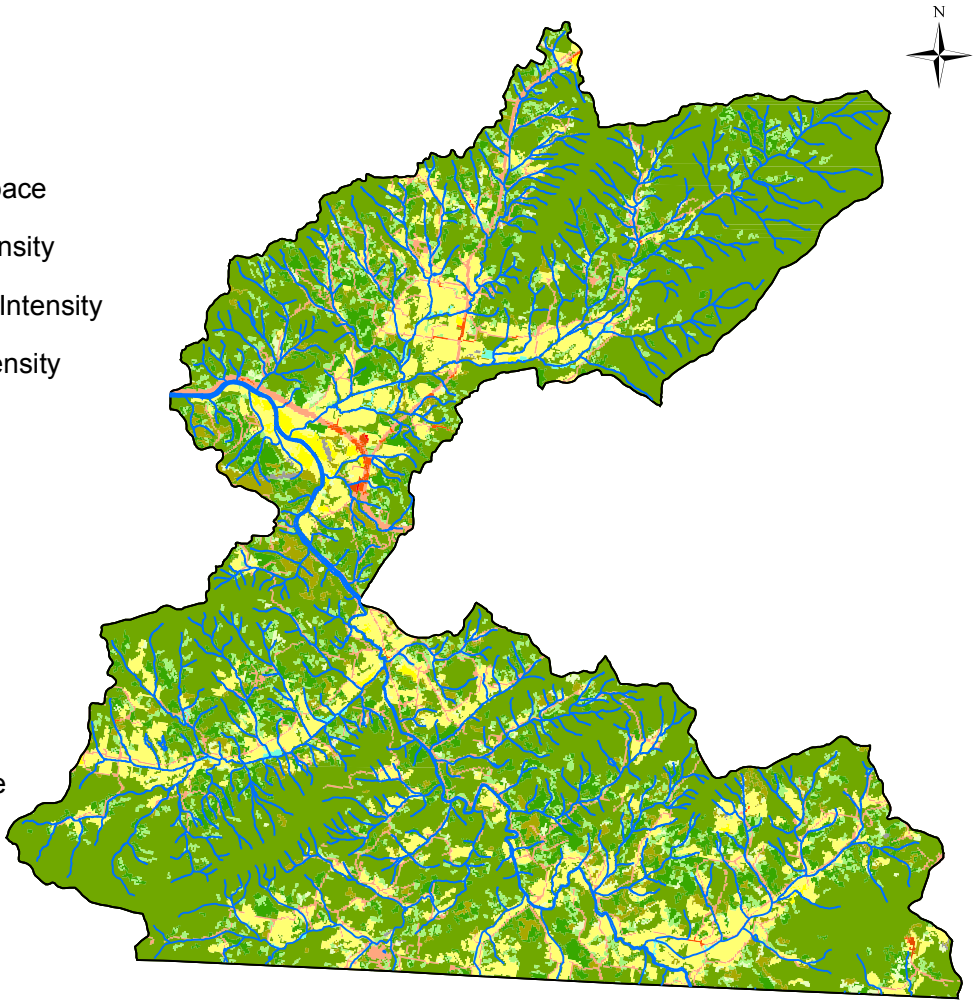


Figure 1-1: Brasstown Creek Watershed Map

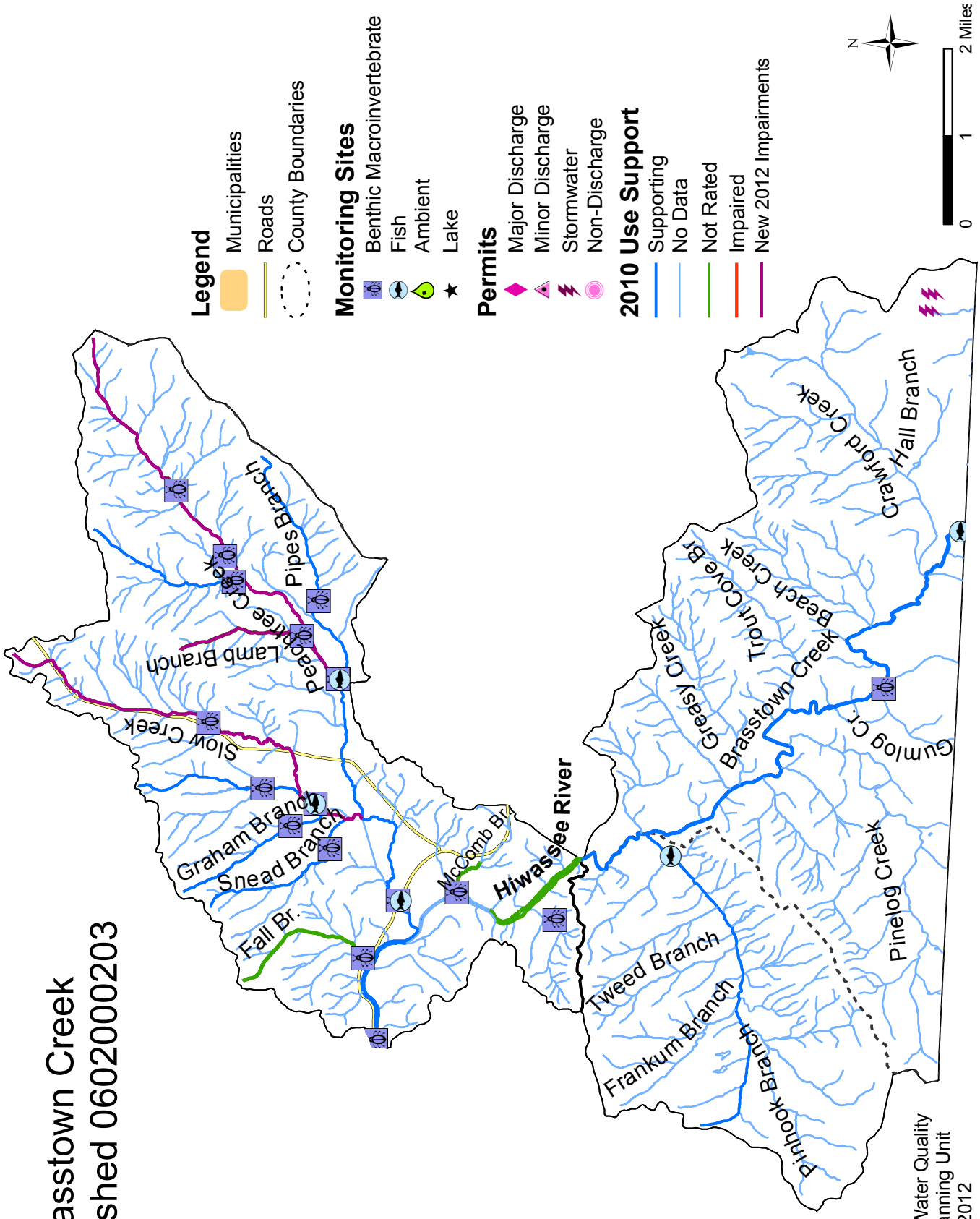


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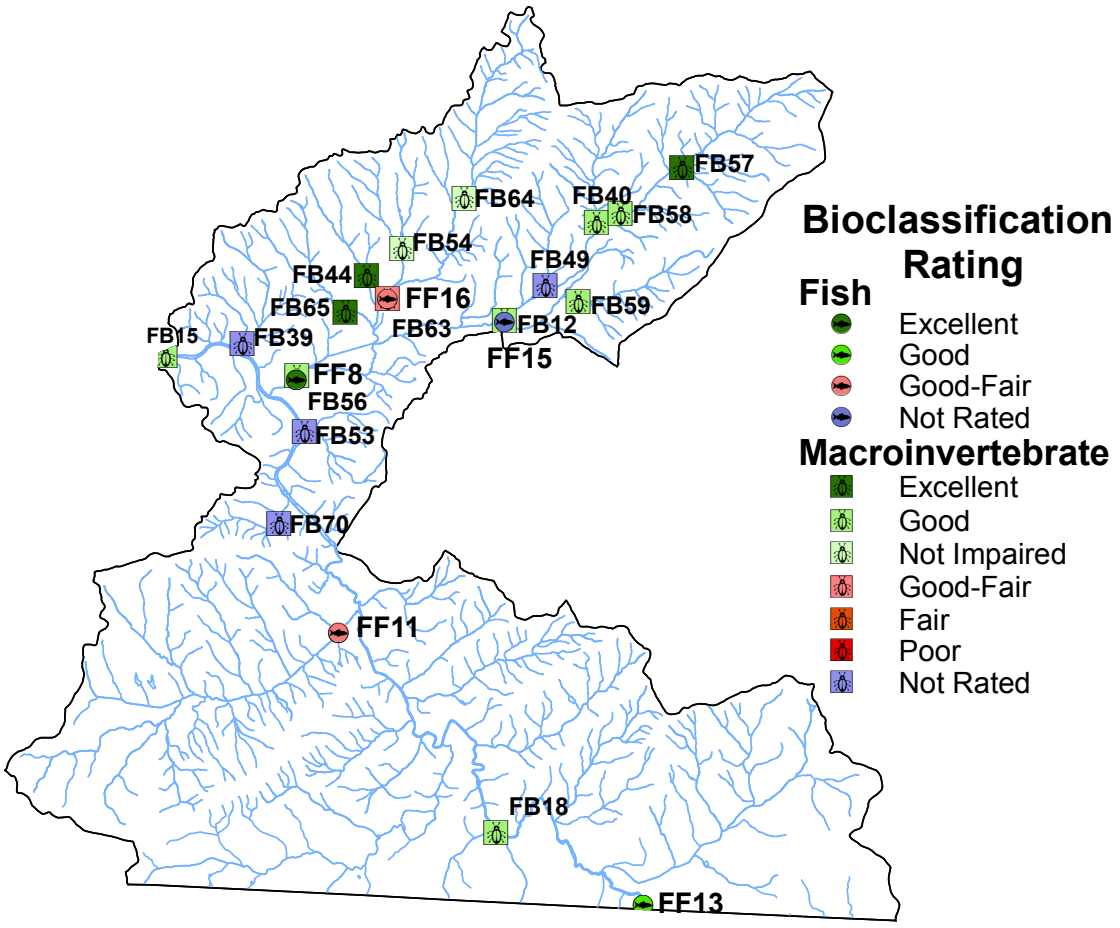
Figure 1-2: Biological Sample Sites & Ratings



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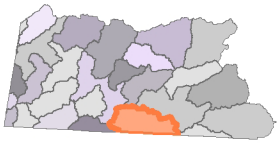
Lower Brasstown Creek (HUC 060200020302)



Brasstown Creek [AU# 1-42] originates in northern Georgia where it drains a portion of Towns County and the Town of Young Harris before flowing through southwestern Clay County, NC to join the Hiwassee River. Brasstown Bald is the highest point in GA and is in the headwaters of Brasstown Creek. DWQ took a fish sample (FF13) near the state line which improved from the Good-Fair sample in 2004 to Good in 2009. Although the water quality shows a slight improvement specific conductivity readings suggest agricultural and municipal wastewater inputs from GA. Further downstream, macroinvertebrate sample site (FB18) rated Good. This site rated Excellent in 2004 and the decline is likely associated with drought conditions. This reach drains small portions of the Chattahoochee National Forest in Georgia but its watershed also contains areas of low density housing, pasture and row crops in North Carolina that lie outside of the national forest boundary.

Little Brasstown Creek [AU# 1-42-11] is a large tributary to Brasstown Creek, draining a small portion of southeastern Cherokee County. The watershed contains low density, rural residential development, pasture, hay, and row crops in addition to substantial forest cover. Some of the headwaters are in a permanent conservation easement through the Land Trust for the Little Tennessee and significant restoration and monitoring efforts were conducted by the Hiwassee River Watershed Coalition and its partners. The fish sample (FF11) taken in 2009 resulted in the same rating as the 2004 sample, Good-Fair. The lower reach of this creek has sandy runs with boulder/cobble pools and very few riffles. The riparian vegetation consists of overgrown exotic species bordered by agricultural fields.

The Hiwassee River Watershed Coalition (HRWC) hired a professional consultant to conduct benthic monitoring along Little Brasstown Creek in association with a watershed restoration project. Three sites on Little Brasstown Creek, along with one reference site on Winchester Creek, were evaluated before and one year after stream restoration work was conducted. These sites were rated using methods established by NC DWQ. Winchester Creek and the sites upstream and downstream of the restoration project on Little Brasstown Creek showed no between-year differences. Winchester Creek received a Good bioclassification in both 2004 & 2005; the upstream and downstream sites rated Good-Fair. Although the site on Little Brasstown Creek within the project reach still received a Good-Fair bioclassification, there was a large improvement in habitat quality. The habitat score improved from 37 in 2004 to 70 in 2005 following restoration work. Improvements in the benthic macroinvertebrate community typically require more than one year following restoration. The study also noted that the benthic macroinvertebrate community structure at all sites, including the reference reach, are warmer than expected for mountain streams, probably due to a lack of shading from the limited riparian cover. Habitat scores in unrestored sections of Little Brasstown Creek that were monitored immediately upstream and downstream of the Carringer/Mitchell restoration project were poor, averaging 35/100 in both years. (Lenat Consulting Services, March 2005).

The HRWC also used a grant from the CWMTF to hire NCSU's Water Quality group to do an extensive 3-year monitoring effort at 10 of their Brasstown Creek restoration sites. All samples were collected using protocols developed by DWQ. Qualitative 4 surveys were used at all collection locations, in 2005, 2006, and 2007. In addition, an epifaunal sample was collected from all three of the Brasstown Creek locations. All

specimens were preserved in the field using standard protocols and identified to the lowest practical level in the laboratory. The results are listed below.

Project	No. EPT Taxa			EPT Abundance			Bioclassification		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Greasy Creek	24	26	25	115	96	90	--	--	--
Long Branch	4	16	16	24	62	42	--	--	--
Little Brasstown Cr (Mason/Stalcup)	29	28	25	85	170	81	Good	Good	G/F
Little Brasstown Cr (Sheppard)	30	30	28	120	137	93	Good	Good	Good
Little Brasstown Cr (Carringer/Mitchell)	28	27	19	136	97	76	Good	G/F	G/F
Little Brasstown Cr (Campbell)	19	13	5	73	34	7	G/F	Fair	Poor
Brasstown Creek (Warne)	26	28	28	106	118	114	G/F	Good	Good
Brasstown Creek (Bell)	25	32	27	109	143	96	G/F	Good	G/F
Brasstown Creek (Hyatt & Oland)	43	37	31	140	178	88	Excel.	Good	Good

Water Quality Initiatives

Between 1999 and 2005, the Hiwassee River Watershed Coalition (HRWC) was awarded more than $2.5 million by the NC Clean Water Management Trust Fund for restoration work in the Brasstown Creek watershed. Using these funds, HRWC, in partnership with the Natural Resources Conservation Service, the Clay and Cherokee County Soil & Water Conservation Districts, and 46 local landowners, conducted restoration activities along 30,000 linear feet (approximately 5.7 miles) of stream. In addition, more than 50 acres of wooded riparian buffer were created and placed under a protective easement; 160 acres of critically eroding bare areas were re-vegetated; and 2,000 acres of pastureland were improved. Additional accomplishments of the Brasstown Creek Watershed Restoration Project include $1.8 million dollars spent locally (materials and grading/clearing contractors); the purchase of a no-till grain drill that continues to be available to local farmers at low cost rental rates; and a community educated about the value of riparian buffers for controlling erosion. Specific information, including before and after pictures, about the projects can be found at the HRWC website: **http://www.hrwc.net/brasstown.htm**

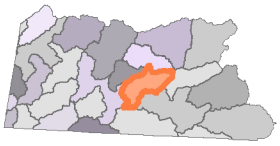
In 2004 HRWC was granted additional funds to monitor channel stability, vegetation survival, temperature, benthic communities, and suspended sediment at 10 restoration sites in the Brasstown Creek watershed over a 3-year period (2005-2007). Staff and students of NCSU's Department of Biological and Agricultural Engineering conducted the monitoring work. The study found that restoration efforts at nine of the monitored locations have been highly successful in terms of improving habitat, re-vegetating riparian areas, and improving the physical condition of the stream channel. Most banks are now stabilized and erosion has been greatly reduced. The January 2008 summary, Monitoring Report, Evaluation, & Action Plan is available on the HRWC website: **http://www.hrwc.net/bc_evaluation.htm**

The US Fish & Wildlife Service awarded HRWC $20,000 in 2010 to help implement the Brasstown Creek Action Plan. Specifically, eradication of nonnative invasive plants and supplemental plantings of native trees and shrubs within the riparian buffers at six of the individual projects sites is being conducted. At one project site, new landowners have allowed HRWC to extend the 50-foot buffer for an additional 500 linear feet and have signed a new contract that can be recorded, replacing the old 2-page "handshake" agreement HRWC previously held.

Recommendations

Additional efforts to prevent sedimentation and to re-establish instream habitats and riparian vegetation are needed in the Brasstown Creek watershed. HRWC has demonstrated its ability to coordinate such projects. HRWC's restoration effort in the Brasstown Creek watershed is a model program. It uses sound scientific methods and has created effective partnerships at the federal, state, and local level. DWQ strongly supports their ongoing restoration goals.

Peachtree Creek-Hiwassee River (HUC 060200020303)



Peachtree subwatershed drains 24 mi^2 including headwaters within Nantahala National Forest and a small portion of the subwatershed along the Hiwassee River is a Water Supply IV watershed area. Peachtree Creek flows through a broad flat valley called Ammon Bottom. Land use in the subwatershed consists of rural residences, residential lawns, and active pasture (hay fields) with forested hillsides. There are no DWQ ambient stations; however, water chemistry data was also collected for a special study that captured baseflow and stormwater conditions. Samples detected elevated nutrient levels and elevated fecal coliform counts. Five fecal coliform bacteria samples between May 24- June 12, 2007 at Mission Road detected bacteria levels that exceed state standards with a maximum coliform count of 1200 and a geometric mean of 520, leading to a portion of Peachtree Creek [AU# 1-44a] listed as Impaired on the 2012 303(d) list. In September 2011, fecal coliform bacteria samples collected from another site further downstream (US 64 alt.) did not exceed our current water quality standards assessment criteria. There are two macroinvertebrate sample sites and one fish sample site that are resampled every five years in this subwatershed. Site FB12 on Peachtree Creek [AU# 1-44a] rated Good. Previous samples at this location were Excellent bioclassifications; the decline is likely associated with drought conditions. Downstream from the benthic site is the fish site (FF8) which rated Excellent, with noted improvements in bank stabilization on Peachtree Creek (AU# 1-44b). The creek is noted as having a naturalized, wild reproducing population of rainbow trout and a moderately diverse and very abundant fish community.

The Peachtree-Martins Creek Watershed Management Plan (described below) is the best available strategy for restoration needs in the subwatershed. DWQ supports these identified restoration needs and will work with federal, state, and local parties to implement its recommendations. The **Hiwassee River Watershed Coalition** continues to take the lead role in facilitating restoration activities.

Flow conditions on the Hiwassee River [AU# 1-(43.7)] are influenced by a hydroelectric power station at Mission Dam. The macroinvertebrate sample (FB15) site on this reach of the river has consistently rated Good, but the benthic community is becoming slightly more pollution tolerant.

Special Study Summary

In July 2005, the Ecosystem Enhancement Program (EEP), Hiwassee River Watershed Coalition (HRWC), Equinox Environmental Consultation & Design and DWQ started a local watershed planning process in the Peachtree-Martins Creek watershed: **http://www.hrwc.net/peachtreemartinslwp.htm**. The goals were to: (1) assess stream quality in the watershed, identifying key sources of degradation and pollution, and (2) develop a comprehensive strategy to address watershed needs. The resulting **Local Watershed Plan** addressed both ecological and community priorities for the 39 mi^2 Peachtree-Martins Creek watershed.

Intensive field assessments and landowner outreach activities were performed, carrying out recommendations named by a local advisory committee. The Tennessee Valley Authority developed new land use and riparian buffer datasets from low altitude aerial photography and produced an Integrated Pollutant Source Identification database in March 2006.

Stressors identified that limit stream integrity throughout the watershed are lack of riparian vegetation, channel modification, excess nutrients and sediments, and fecal bacterial contamination. Localized stressors include stormwater impacts in the Peachtree area, groundwater contamination in the vicinity of Tri-County Community College and the Clifton Precision Products/Moog Components facility, and impacts from Mission Quarry. Ongoing commercial and residential development is expected to continue in the area and is the biggest future threat to water quality and other elements of ecological function.

Specific management strategies to address both present and future stressors were identified. Strategies to address current problems include stream restoration, riparian buffer restoration, agricultural, road, residential, and forestry best management practices (BMPs). Strategies to address future threats and protect current resources include preservation of existing large forested tracts, sustainable forest management, public education, and a number of planning programs to soften development impacts.

Biological Data

DWQ sampled macroinvertebrate communities at seven locations in this subwatershed as part of the development of EEP Local Watershed Plan. The location and sample results are listed below. Pictures and descriptions of these sites, including taxa collected are available in BAU Memorandum 20060731, "Results of Biological Sampling for the Ecosystem Enhancement Program in Hiwassee Subbasin 02, March 2006" by request. Additional details are available from EEP's website: http://portal.ncdenr.org/web/eep/rbrps/hiwassee.

Waterbody	AU #	Site ID #	Biological Sample	Specific Conductance	Additional Notes
Pipes Branch	1-44-7	FB59	Good	10 µmhos/cm	Least impacted benthos community of all small stream sites. High fecal coliform bacteria levels, low pH and phosphorus are parameters of interest.
Peachtree Creek	1-44a	FB12 FF15	Excellent Not Rated	18 µmhos/cm 16 µmhos/cm	Sparse bank vegetation, a narrow riparian zone on the left side of the stream, and a reduced canopy
Peachtree Creek	1-44b	FB56	Good	37 µmhos/cm	Areas of erosion were present on both banks; bank vegetation was a diverse mix of trees, shrubs and grasses; incised channel
Slow Creek	1-44-9	FB64 FF16	Not Impaired Good-Fair	36 µmhos/cm 44 µmhos/cm	Upper reach is within a horse pasture with sparse habitat. Slightly turbid water and incised channel. The macroinvertebrate community is probably more reflective of broad watershed conditions than local habitat conditions. Elevated nutrients levels are also of concern.
Messer Branch	1-44-9-2	FB54	Not Impaired	34 µmhos/cm	Upper reach had no riparian vegetation; lower reach had moderate riparian zones with grass banks vegetation.
Snead Branch	1-44-9-4	FB65	Excellent	30 µmhos/cm	Riparian zones were wide and intact on both sides of the stream and no serious habitat or water quality problems were noted.
McComb Branch	1-43-(2)	FB5	Not Rated	61 µmhos/cm	Channel was incised and areas of severe bank erosion were evident with limited riparian vegetation. Turbid water with abundant periphyton. Nutrients, toxicity, fecal coliform bacteria, aluminum, manganese, zinc are additional potential water quality problems.

Additional water quality data, including biological, chemical and toxicity was also collected by DWQ's Watershed Assessment Team (WAT) for the EEP Local Watershed Plan. The results of the biological samples are listed in Table X along with identified stressors. The full reports is available online at: http://www.nceep.net/services/lwps/Hiwassee/PMC_DWQwaterquality_study.pdf.

Waterbody	AU #	Site ID #	Biological Sample	Additional parameters of interest
Fall Branch	1-45	FB39	Not Rated	aluminum, phosphorus, turbidity, fecal coliform bacteria
UT Hiwassee	1-(16.5)c	FB70	Not Rated	
Graham Branch	1-44-9-3	FB44	Excellent	no water quality concerns
Fate Puet Cove Cr.	1-44-4	FB40	Good	nutrients, turbidity, aluminum & zinc
Lamb Branch	1-44-5	FB49	Not Rated	fecal coliform bacteria
Peachtree Creek	1-44a	FB58 FB57	Good Excellent	fecal coliform bacteria, nutrients

Bacteria Data

The NC Division of Water Quality (DWQ) conducted fecal coliform bacteria sampling in the Peachtree-Martins Creek watersheds near Murphy between May 24, 2007 to June 19, 2007 to support the development of a Local Watershed Plan (LWP) by the NC Ecosystem Enhancement Program. The sampling during this period was conducted during baseflow conditions. Streams sampled and results are listed below.

Waterbody	Total number samples	Results >400	Min Value	Max Value	Geometric Mean	Proportion (% > 400)
Lamb Branch	5	5	800	2200	1540	100
Peachtree Creek (at Mission Rd)	5	3	180	1200	520	60
Slow Creek	5	5	460	2400	1043	100
McComb Branch	4	2	170	2200	518	50
George Creek (Hiwasee Lake HUC)	5	0	88	230	140	0
Martins Creek (Hiwasee Lake HUC)	5	2	220	1400	550	40
Mission Branch (Tusquitee Creek HUC)	5	3	390	2400	631	60
Sudderth Branch (Tusquitee Creek HUC)	4	0	96	190	122	0

EEP projects in the Brasstown Creek Watershed

EEP has two restoration and/or preservation projects in the Peachtree-Martins Creek watershed which will be constructed in 2012 and one project that has already been constructed on Trout Cove Branch, a tributary to Brasstown Creek.

The Martins Creek project is on a large tract of largely wooded property that drains to Martins Creek that was identified as the top priority for preservation in EEP's project atlas. This project will protect almost four miles of highly functioning stream and riparian area and restore another mile of degraded stream along Martins Creek itself and tributaries that flow to it that have been impacted by livestock grazing. In addition, almost seven acres of riparian wetland will be restored in the Martins Creek floodplain.

Another project is on an unnamed tributary to Martins Creek near its headwaters. This project is on a stream that has been highly impacted by cattle. It will restore the stream and riparian area of more than a mile of stream, installing fencing and other livestock BMPs.

The Trout Cove Branch project restored the stream and riparian area of almost 4,000 linear feet of the creek. Procedures included reestablishing channel sinuosity, installation of rock vanes and root wads for erosion control and improved aquatic habitat, and enhancement of existing wetland areas. The project is now in long-term stewardship.

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The fourth and fifth columns of this table list potential stressors and sources that may be impacting a stream based on in-field observations, monitoring data, historical evidence, permit or other violations, and other staff and public input. In many cases, additional study is needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Crawford Creek	1-42-1	WS-IV	habitat degradation, sedimentation	agriculture	Not Rated	R,M, BMPs
Lamb Branch	1-44-5	C	fecal coliform bacteria	agriculture, failing septic systems	Impaired	BMPs
Little Brasstown Creek	1-42-11	WS-IV	habitat degradation, sedimentation	agriculture, forestry, residential development	Supporting	R, BMPs, F
McComb Branch	1-43-(2)	WS-IV	sedimentation, nutrients, toxicity, fecal coliform bacteria, metals	stormwater, agriculture, historical groundwater contamination	Impacted	SC, R
Peachtree Creek	1-44a	C	fecal coliform bacteria	agriculture, failing septic systems	Impaired	BMPs,R
Pinelog Creek	1-42-6	WS-IV	habitat degradation, sedimentation	agriculture	Not Rated	R, M, BMPs
Slow Creek	1-44-9	C	nutrients, fecal coliform bacteria	historical groundwater contamination, agriculture, failing septic systems	Impaired	R, M, NMC, BMPs

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source = development, agriculture, WWTP, NPS,

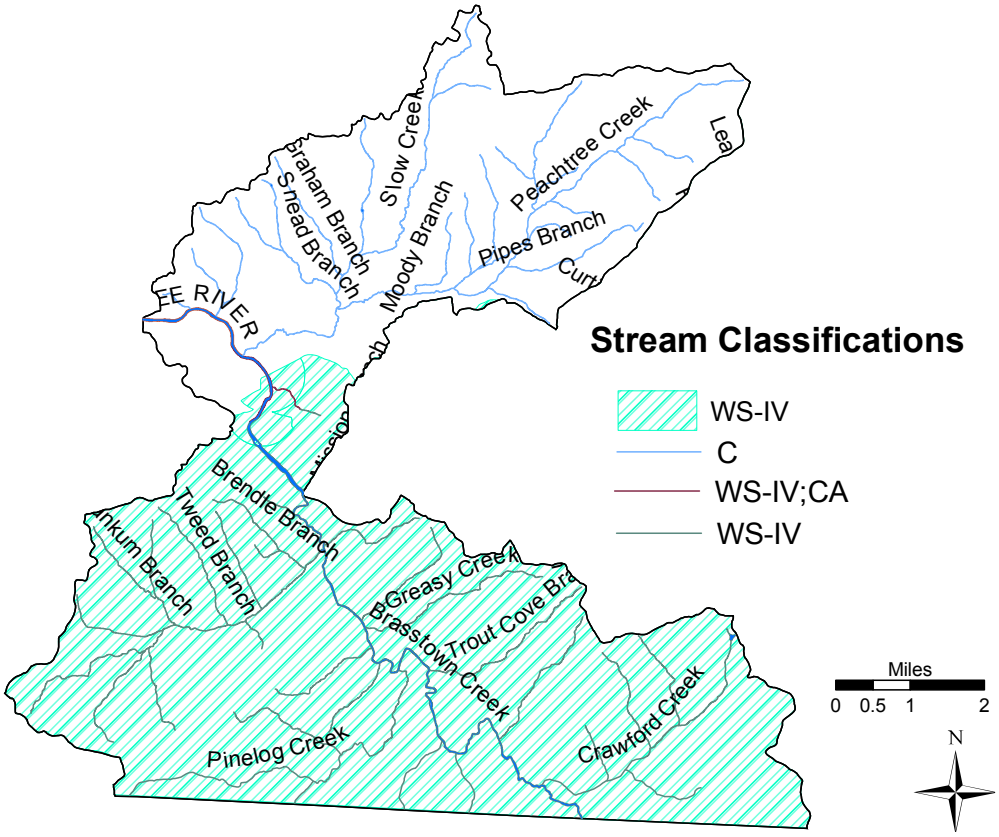
Status = Impaired, Impacted, Supporting, Improving

Actions Needed = R= restoration, P= protection, SC= stormwater controls, SS= stressor study, E= education, LO= local ordinance, BMPs, SSP= species protection plan, F= forestry BMPs, Ag= Agriculture BMPs, NMC= nutrient mgnt controls, S&E soil and erosion control, M= monitoring

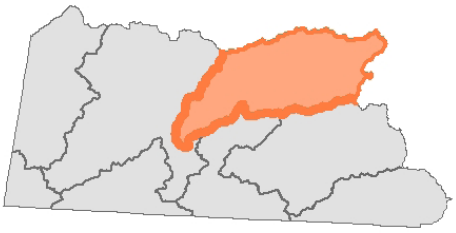
Waterbody Classifications

All surface waters in the state are assigned at least one primary classification and they may also be assigned one or more supplemental classifications, Figure 1-3 . A list of classifications with a description of their requirements can be found in Chapter 2 of the **Supplemental Guide to Basinwide Planning**.

Figure 1-3: Stream Classifications



Valley River Watershed



HUC 0602000204

Includes: Major Streams Junaluska Creek, Tatham Creek, Gipp Creek, Morris Creek, Welch Mill Creek, Hyatt Creek, Vengeance Creek, Colvard Creek & Valley River

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee	117 sq mi.	Agriculture.....6%	NPDES
Municipalities:	**Population:**	Developed.....8%	Wastewater Discharge.....4
Andrews, Murphy	2000.....9,210	Forested.....86%	Wastewater Nondischarge.....0
EPA Level IV Ecoregions:	2010.....9,713		Stormwater.....10
Broad Basins, Southern Metasedimentary Mtns.			Animal Operations.....0

The Valley River originates in the Snowbird Mountains near the Cherokee/Graham County line and flows generally southwest into the Hiwassee River near Murphy. The entire 117 square miles watershed lies within Cherokee County and the county boundaries follow the watershed boundary for much of its length. The Valley River is one of the largest tributaries of the Hiwassee River.

The Valley River watershed is predominantly forested, but the valley contains significant pastureland and row crops, see Figure 1-1. A major highway, US 74/19/129, crosses the river several times as it follows the valley from Andrews to Murphy. Residential development is currently low density and generally not located directly on the banks of the river. Development is increasing, but the pace is relatively slow when compared to other parts of Cherokee and Clay counties.

Major impacts to water quality and instream habitat include a lack of riparian vegetation, stream bank erosion, livestock access, stream channel alterations, and runoff from the highway, airport and urbanized areas. As a result, turbidity, sedimentation, high temperatures and fecal coliform bacteria continue to stress the river.

Figure 1-1: 2006 Land Cover

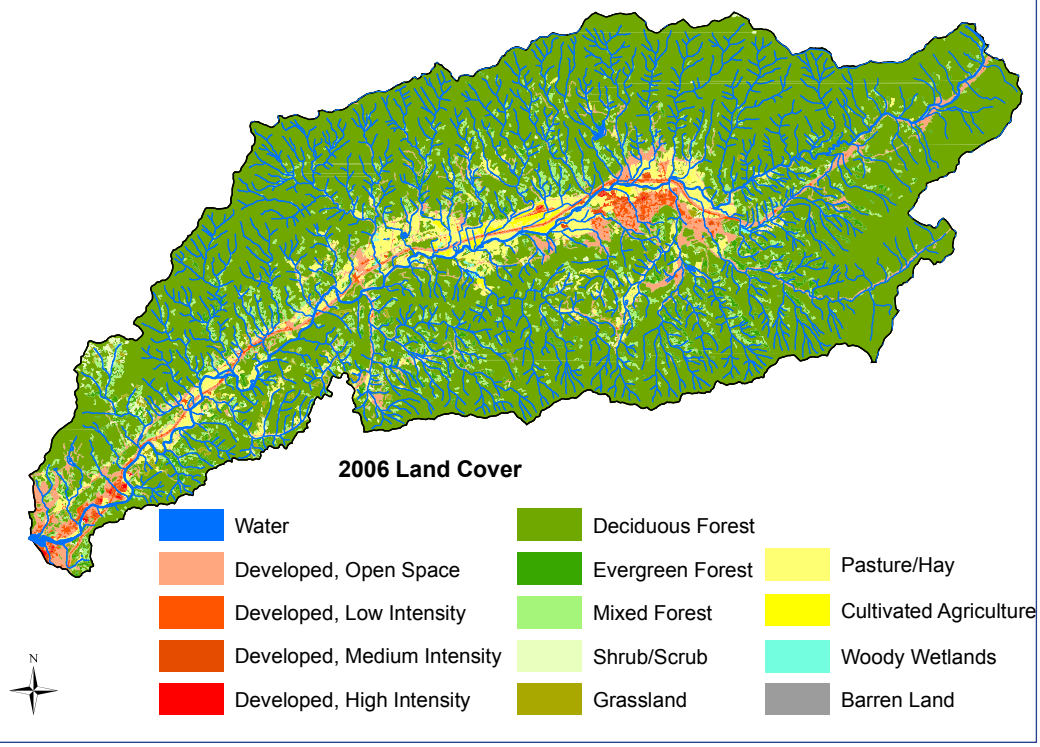
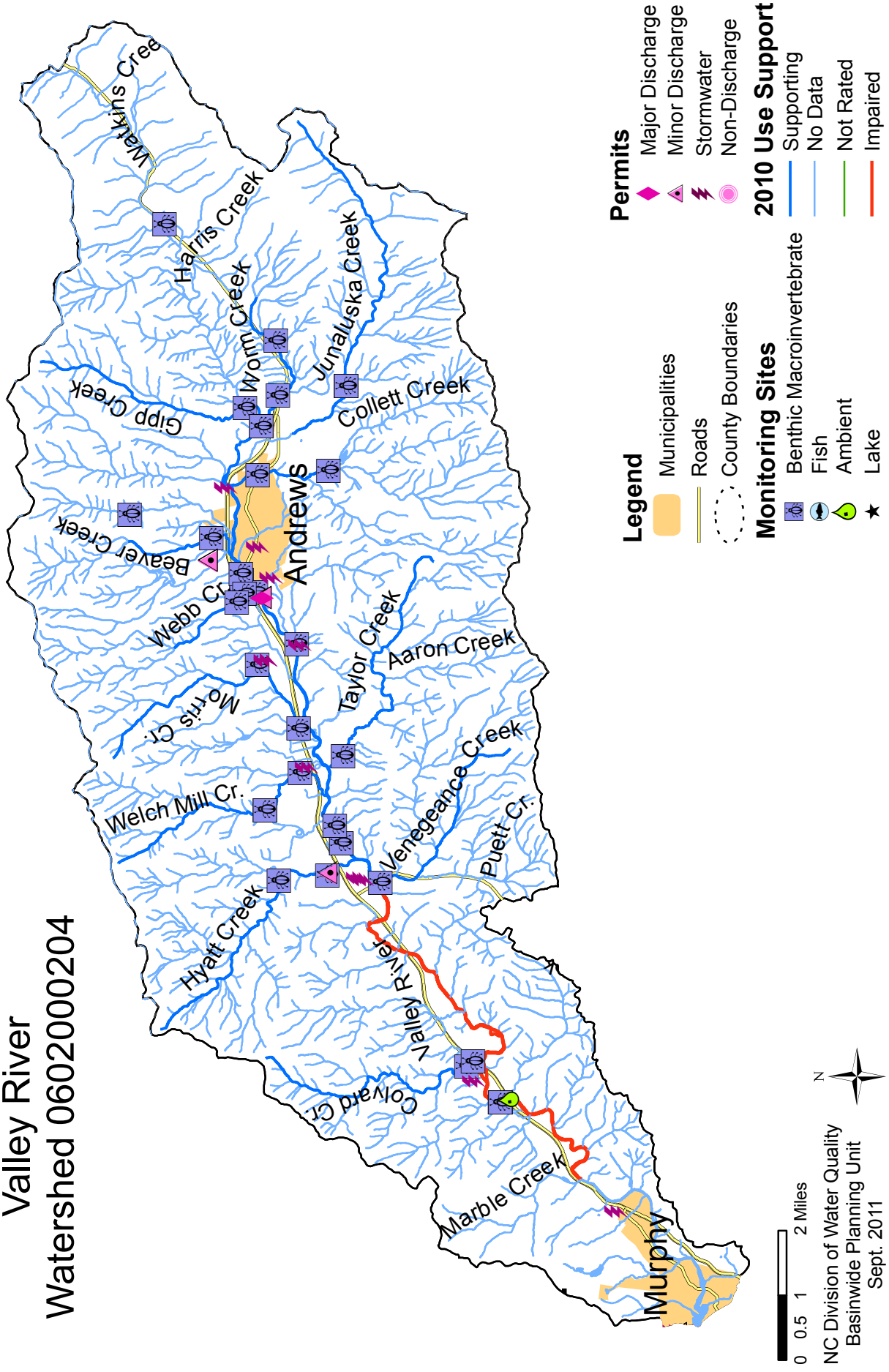


Figure 1-2: Valley River Watershed Map

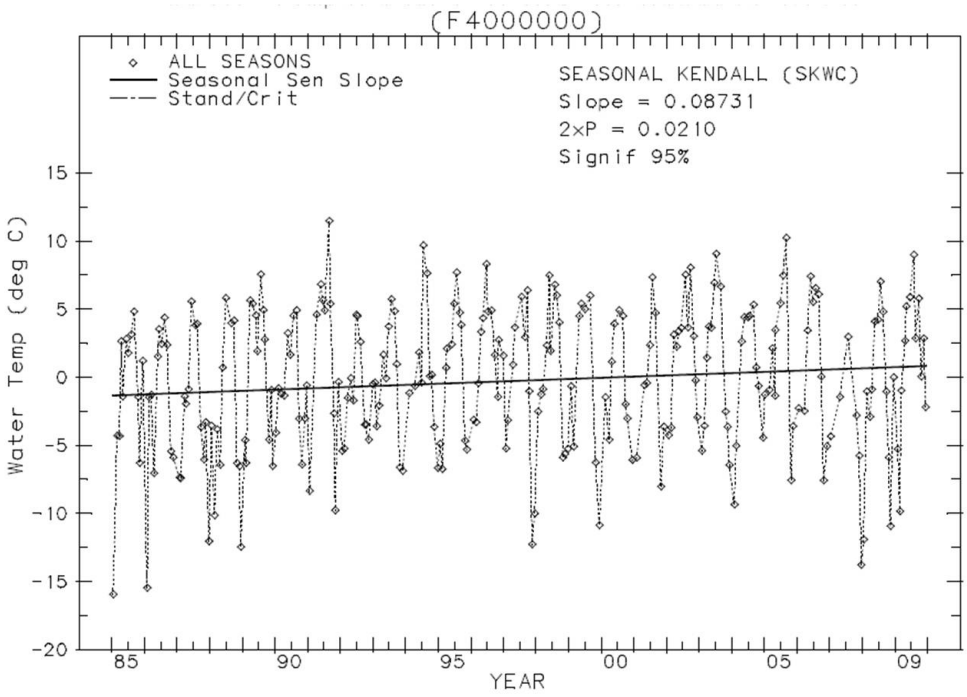


Water Quality Monitoring

There is one ambient station in this watershed (F4000000). Water quality data from this station does show high levels of turbidity and fecal coliform. Data from this site were evaluated for the presence of trends for parameters including: water temperature, specific conductance, pH, dissolved oxygen, turbidity, fecal coliform bacteria, ammonia, nitrates/nitrites, kjeldahl nitrogen, and phosphorus. Trends were explored for this station from station inception (1973) through 2009 and there were no strong linear trends found, except for temperature.

The Flow and Seasonally Adjusted Temperature Trend in the Valley River reported in the 2007 Basin Plan was updated using the 1985-2009 time period (Figure 1-3). The trend through 2009 is statistically significant at the 95% confidence level with a slope of 0.09 degrees Celsius/year. The slope for the 1985-2003 analysis was 0.16 degrees Celsius/ year. The results indicate there has been some improvement in that the temperature is not increasing as much as previously indicated, but it is still increasing.

Figure 1-3: Valley River Flow & Seasonally Adjusted Temperature Trend

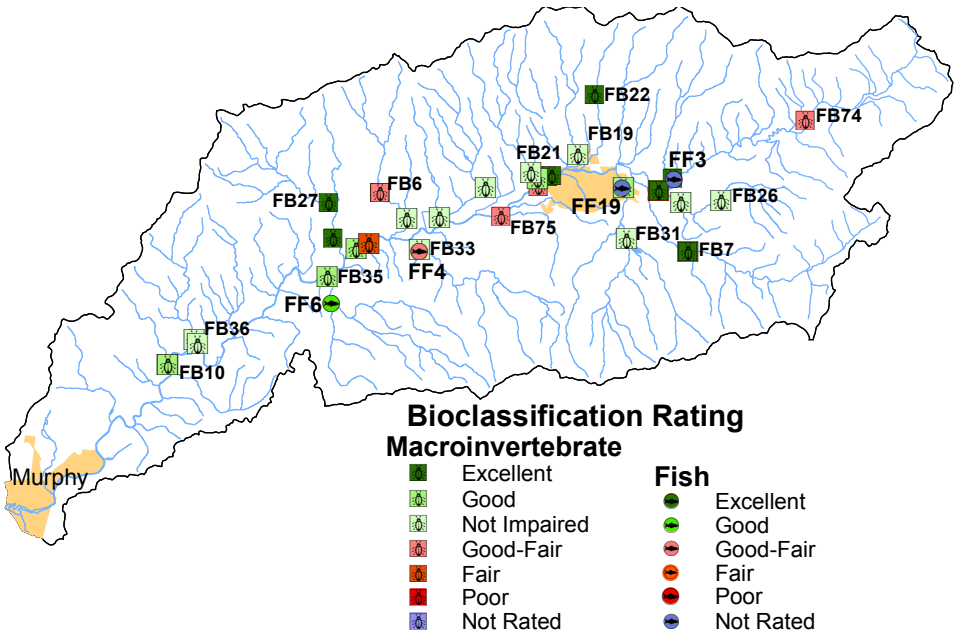


Biological Monitoring

Biocriteria have been developed using the diversity, abundance, and pollution sensitivity of the organisms that inhabit flowing waterbodies in NC. One of five bioclassifications are typically assigned to each water body sampled: Excellent, Good, Good-Fair, Fair and Poor. Not Impaired and Not Rated designations are reserved for samples that were not eligible to be assigned one of the five typical bioclassification categories. Typically, a “Not Impaired” rating is equivalent to a Good-Fair or better bioclassification and a “Not Rated” designation is equivalent to a Fair or worse bioclassification. The reasons for not being able to assign one of these five typical bioclassifications may be a lack of appropriate bio-criteria or atypical sampling conditions (e.g., drought). These bioclassifications are used to assess the various impacts of both point source discharges and nonpoint source runoff. The resulting information is used to document both spatial and temporal changes in water quality, and to complement water chemistry analyses, ambient toxicity data, and habitat evaluations. In addition to assessing the effects of water pollution, biological information is also used to define High Quality or Outstanding Resource Waters, support enforcement of stream standards, and measure improvements associated with management actions. The results of biological investigations have been an integral part in North Carolina’s basinwide monitoring program.

Biological samples have been taken throughout the watershed since the 1980’s. Basinwide sites were first sampled in 1994 and the three most recent basinwide benthic macroinvertebrate samples were taken in 2009. Site specific information is available in Appendix and the Biological Assessment Report is available here: http://portal.ncdenr.org/web/wq/ess/reports. Figure 1-4 shows the most recent benthic site rating in this watershed at sites sampled since 1994.

Figure 1-4: Biological Sample Sites & Ratings

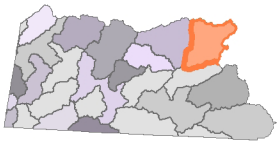


Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Headwaters Valley River (HUC 060200020401)



The headwaters of the Valley River drain 42 square miles, with a majority of the tributaries starting in the mountains of Nantahala National Forest. The Valley River and most of the tributaries are classified as Trout (Tr) waters. Gipp Creek and its tributaries, Brokeleg Branch and Ash Cove Creek are classified as ORWs. This drainage is a National Heritage Significant Area.

Gipp Creek [AU# 1-52-23] was last sampled for macroinvertebrates in 2002 and rated Excellent (FB20).

Junaluska Creek [AU# 1-52-25a] maintains its Excellent Bioclassification rating at site FB7 in 2009 and water quality conditions are noted as stable.

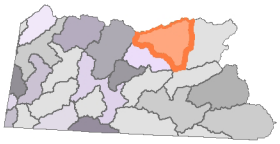
Valley River [AU# 1-52b] is hatchery supported trout waters, was sampled in 2009 (FF3) noting a moderately rich and abundant assemblage of primarily cool water fish and the presence of Hellbender salamanders indicating high water quality despite the Not Rated status.

Tatham Creek [AU# 1-52-28] site FF19, was sampled in 2009 resulting in a Not Rated status due to absence of criteria for rating high gradient mountain trout streams. Two benthic sites (FB24 and FB31) were

sampled on Tatham Creek during the 2002 Valley River Watershed Assessment. Much of the watershed is in residential land use. Instream habitat was generally good at both sites, but the riparian vegetation had been cleared for residential purposes. Periphyton growth was prolific and the creek bed was slightly embedded with silt and sand. These problems are likely due to a combination of leaky/failing septic systems, straight pipes, and runoff from lawns through the poor riparian habitat.

Worm Creek [AU# 1-52-24] was sampled at benthic sites FB26 and FB38 as part of the Valley River Watershed Assessment in 2002. The habitat at the upstream site (FB26) was good, but the conductivity was elevated. This suggests runoff from residential or agricultural land use. The downstream site (FB38) was plagued by several habitat and water quality problems. The stream was full of silt and muck due to severe erosion. Heavy equipment had been used to push trees and other woody debris into the creek, disrupting flow. The site was very productive with long filamentous algae, suggesting nutrient enrichment. Conductivity was also very high for a mountain stream. Field staff determined the source of this high conductivity was Rail Cove Creek, a very small tributary to Worm Creek. Rail Cove Creek runs along SR 1503 through a number of residences.

Upper Valley River (HUC 060200020402)



The Upper Valley River subwatershed drains 41 square miles, with the tributaries beginning in the mountains of Nantahala National Forest. The upstream reach of this subwatershed begins in the Town of Andrews. North of Andrews, the headwaters of Beaver Creek and Dan Holland Creek are WSW-II/ HQW areas. Along Dan Holland Creek, the Town of Andrews WTP holds a discharge permit (NC0069892) for release of its backwash water. Downstream on the Valley River the town has a major WWTP discharge (NC0020800), which needs to improve its operation and maintenance regime to avoid future violations. There are also two active stormwater permits within the vicinity of Andrews; one for transportation and vehicle maintenance (NCG080754) and other for concrete mixing operation (NCG140154).

Britton Creek [AU# 1-52-29-(2)] was evaluated by Tennessee Valley Authority in 1993 and 2002. The stream was rated Good based on fish community data, but habitat was degraded. Habitat problems included: lack of well-developed riffle/run complexes, embedded substrate, heavy deposits of sediment, unstable banks, bank erosion, and a narrow riparian zone. Much of the bank damage, erosion, and sediment deposition are likely due to livestock access. The impacts from cattle access should be corrected through use of agricultural best management practices.

Beaver Creek [AU# 1-52-30-(3)] was sampled at Site FB19 as part of the 2002 Valley River Watershed Assessment, resulting in a Not Impaired status. Riparian vegetation is absent from many of the banks and much of the stream has been channelized and hardened with riprap. Channel restoration is advised where feasible, but identifying restoration sites may be difficult due to the proximity of the road that parallels the creek for its entire length. Residential landowners along the creek are encouraged to contact the Hiwassee River Watershed Coalition to help in reducing pollution caused by runoff from their property.

Morris Creek [AU# 1-52-36] was sampled above (site FB25) and below (site FB29) the Andrews Airport during the 2002 Valley River Watershed Assessment. Both sites were rated Not Impaired based on the stream's small size. There were several pollution intolerant species collected at the upstream site, but green algae and abundant aquatic worms indicated nutrient enrichment. The stream is channelized through the airport property and the downstream benthic community was more pollution tolerant. The stream banks are unstable due to the lack of riparian vegetation and channelization. Stream restoration and bank stabilization options should be evaluated. The Andrews Airport contributes significant runoff to several Valley River tributaries.

Taylor Creek [AU# 1-52-39] maintained it Good-Fair Bioclassification from a fish sample (FF4) taken in 2009. The creeks headwaters are primarily forested although downstream the creeks is impacted by animal agriculture with evidence of breaks in riparian vegetation, bank instability and sedimentation.

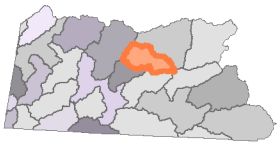
Welch Mill Creek [AU# 1-52-40] declined in Bioclassification from Excellent in 2004 to Good-Fair in 2009.

Biologists noted excellent habitat conditions but a decrease in flow conditions. In 2006, a trout farm began diverting an estimated 70-80% of the creeks water resulting in the absence of taxa that require heavier stream flows. The extremely sharp reduction in taxa here greatly exceeds anything observed elsewhere in the Hiwassee basin and warrants further investigation. Resampling this site, as well as sampling below the trout farm is recommended.

Hyatt Creek [AU# 1-52-43] was last sampled in 2002 (FB34 & FB27) which resulted in an Excellent macroinvertebrate rating. Hyatt Creek is one of the larger tributary streams to the Valley River. The lower end passes through residential areas and follows SR 1379. Livestock and land disturbing activities along the stream have likely contributed to sedimentation within the stream.

Hiwassee River Watershed Coalition helped facilitate the development of an outdoor environmental education area on property adjacent to the Marble Elementary School in Cherokee County. The property, which was donated by NC Rep. Roger West, contains the original Marble Springs, Hyatt Creek (which is a designated trout stream), a wetland area, and an area of native pine forest.

Middle Valley River (HUC 060200020403)

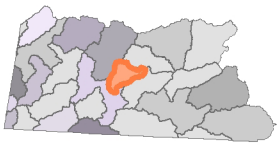


The impairment on Valley River starts just below the mouth of Vengeance Creek. The Valley River [AU# 1-52c] is Impaired because of turbidity standard violations from ambient data collected at site F4000000. The Valley River also has a history of high fecal coliform bacteria levels with several occurrences happening within the last several years. This rise may indicate a change in land use, land cover, intensity of use, or possibly a deterioration of vegetative buffers in the drainage area. Addressing the causes of the turbidity impairment in this reach may also help reduce fecal coliform bacteria levels. A 5-in-30 day sample study is needed to assess whether this portion of the river could be Impaired for fecal coliform bacteria.

The fish community in Vengeance Creek [AU# 1-52-45] was sampled at site FF6 and resulted in a Good Bioclassification in 2009. Nutrients were indicated as a possible concern in this drainage but overall water quality remains good.

Colvard Creek [AU# 1-52-58] was sampled at sites FB36 and FB37 as part of the 2002 Valley River Watershed Assessment. Habitat was severely degraded primarily due to poor cattle management practices. At the time the stream was sampled, livestock had direct access to the stream. During periods of high water, parts of a feedlot could be submerged. The impacts from cattle access should be corrected through use of agricultural best management practices.

Lower Valley River (HUC 060200020404)



The basinwide macroinvertebrate site FB10 on the Valley River received a Good rating in 2009 as it did in 2004, although water quality improvements were noted. However, this reach [AU# 1-52c] of the river is Impaired because of high turbidity levels. The reach designated as Impaired by DWQ extends to the mouth of Marble Creek just above Murphy. Fecal coliform bacteria samples were collected in the Valley River near the KOA Campground and near Konehete Park in September 2011 and the data indicates bacteria levels that exceed our current water quality standards assessment criteria. The remaining 3.2mi. reach of Valley River [AU# 1-52d] that flows through Murphy before it empties into the Hiwassee River is Not Rated because of there is no data collected to represent this portion, although it may be Impaired on the 2014 303(d) list based on the 2011 fecal coliform bacteria data. North of Murphy there are two drainages that are protected for water supplies, Marble Creek and Brittian Branch/Fain Mtn. Reservoir are WSW-I areas. There is also one stormwater discharge permit for a concrete business with an outfall into Valley River.

Marble Creek [AU# 1-52-66-(3)] was evaluated by Tennessee Valley Authority as part of the 2002 Valley River Watershed Assessment. Severe habitat degradation affects the biological communities in this stream. The substrate was partially embedded, with cobble and boulders (25-50 percent) surrounded by fine sediment. The banks were moderately stable, but there were small areas of erosion. The channel of this stream was altered (channelized) in the past. Stream restoration and bank stabilization options should be evaluated.

Water Quality Initiatives

Hiwassee River Watershed Coalition

Between 2003 and 2008, the Hiwassee River Watershed Coalition (HRWC) was awarded approximately $1.5 million by the NC Clean Water Management Trust Fund for restoration work in the Valley River watershed. Using these funds, HRWC, in partnership with the Natural Resources Conservation Service, the Cherokee County Soil & Water Conservation District, and 22 local landowners, conducted restoration activities along nearly 15,000 linear feet (2.8 miles) of the river and its tributaries. In addition, more than 25 acres of wooded riparian buffer were created and placed under a protective easement and 150 acres of pastureland were improved. Additional accomplishments of the Valley River Watershed Restoration Project include $600,000 dollars spent locally (materials and grading/clearing contractors); updated biological data for 24 sites in the watershed; a detailed nonpoint source pollution inventory to help guide restoration efforts; and a community educated about the value of riparian buffers for controlling erosion. Specific information, including before and after pictures, about the projects can be found at the HRWC website: http://www.hrwc.net/valley.htm

In 2008 HRWC received a grant from the NC Section 319 program to draft a watershed action plan for the Valley River watershed. The action plan establishes the reduction in Total Suspended Solids needed for the river to meet the turbidity standard, violations of which cause it to be Impaired. The grant also allowed for a bank stabilization project at Murphy High School which was conducted in partnership with Cherokee County Schools. HRWC is currently conducting restoration work in the upper third of the watershed under a second 319 grant, in partnership with Cherokee County, the Town of Andrews, and a number of private landowners.

HRWC has also been working to reduce sedimentation and improve aquatic habitat at several locations in the Valley River watershed using a $45,000 grant from the Southeast Aquatic Resources Partnership (SARP) administered by the US Fish & Wildlife Service. This work involves eradication of nonnative invasive plants and supplemental plantings of native trees and shrubs within the riparian buffer areas, as well as instream habitat improvements.

Land Trust for the Little Tennessee

Over the past five years, the Land Trust for the Little Tennessee's Hiwassee-Valley Land Trust project assisted in the conservation, or pending conservation, of 1,773 acres of open land, 4,462 feet of river frontage, and tens of thousands of feet of tributaries in the Valley River watershed.

In 2008, the land trust facilitated conservation of the 713-acre Marble Creek water supply watershed owned by the Town of Murphy. The land trust acted as a liaison between the Town and the State to help bring Clean Water Management Trust Fund dollars to the table, resulting in a permanent conservation easement for the land. Land trust staff have continued to monitor the easement annually and worked with the Town to improve drainage and vegetative cover on old logging roads and skid trails on the watershed property. In 2011, the Town was proactive in investing considerable resources in road and trail improvements, with all investments going to local contractors and materials suppliers. As a result, erosion has been sharply reduced on over two miles of steep roads and trails in the Marble Creek watershed.

In 2009, the land trust "bridged" a funding gap to allow the addition of 28 acres in the Vengeance Creek watershed to the Nantahala National Forest. The land trust purchased the vulnerable privately-owned tract, which includes over a half-mile of trout streams and a waterfall, and held it until the US Forest Service was able to purchase the land approximately one year later.

The land trust conserved its first major riverfront property in 2011, with the purchase of a conservation easement on a 101-acre historic farm on Valley River immediately upstream of the mouth of Welch Mill Creek. The rare property includes 4,462 feet of frontage on the river, as well as the most extensive and intact oxbow wetlands in the watershed. Farming will continue on most of the property, with stream buffers and many wetland areas protected and eventually enhanced or restored with the assistance of Hiwassee River Watershed Coalition and other partners.

The land trust is also working with the Town of Andrews and the NC Clean Water Management Trust Fund to facilitate the conservation of the Town's 930-acre Beaver Creek water supply watershed. Similar to the work of the Murphy project in 2008, this project would conserve nearly ten additional miles of streams, and would connect two disjunct tracts of Nantahala National Forest. With a written corridor conservation strategy in hand, the land trust will continue to work with interested landowners in the Valley River watershed to move forward with conserving waters, farms, forests, and heritage in this amazing valley.

Recommendations

This watershed was intensively monitored in 1992 and 2002 and would benefit from being monitored again in 2012 to keep the 10-year cycle going. This would allow for a more thorough assessment of the local restoration efforts and adapting future restoration projects.

While HRWC has made significant progress towards reducing erosion and sediment inputs to the Valley River, much work remains to be done. HRWC has identified thirteen restoration projects that will address erosion and sedimentation problems in the Valley River watershed. These include approximately 18,050 feet of restoration on the Valley River mainstem and 19,000 feet on its tributaries. Projects to protect and restore riparian vegetation along the Valley River and its tributaries can slow the rate of water temperature increase and greatly reduce turbidity. The high gradient/high flow of headwater streams, coupled with the rocky nature of mountain streams have likely kept the tributaries from becoming impaired despite poor land use practices; but their biological integrity will decline if land disturbing activities continue without appropriate best management practices and riparian buffer protection. HRWC has demonstrated its ability to coordinate restoration efforts in the Valley River watershed to significantly reduce sedimentation. It uses sound scientific methods and has created effective partnerships at the federal, state, and local level. DWQ strongly supports their ongoing restoration goals.

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The fourth and fifth columns of this table list potential stressors and sources that may be impacting a stream based on in-field observations, monitoring data, historical evidence, permit or other violations, and other staff and public input. In many cases, additional study is needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Britton Creek	1-52-29-(2)	C;Tr	habitat degradation, sedimentation	agriculture, limited riparian cover, development, stormwater	Impacted	R, BMPs
Brown Creek	1-52-34	C	habitat degradation, sedimentation	agriculture, livestock access	Impacted	R, Ag
Colvard Creek	1-52-39-1-1	C	habitat degradation, sedimentation	agriculture, livestock access	Impacted	R, Ag, BMPs
Marble Creek	1-52-66-(3)	C	sedimentation	unpaved roads (ATVs), stormwater	Impacted	R, BMPs
McColl Branch	1-51	C	habitat degradation, sedimentation, nutrients	urban stormwater, failing septic systems	Impacted	M, SC, LO, R
Rodgers Creek	1-52-60	C; Tr	habitat degradations, sedimentation	agriculture, residential stormwater	Impacted	R, M, Ag, BMPs
Taylor Creek	1-52-39	C;Tr	habitat degradation, nutrients	agriculture	Supporting	R, Ag, BMPs
Valley River	1-52c	C;Tr	turbidity, nutrients, fecal coliform bacteria, increasing temperature	agriculture, livestock access, development, failing septic systems, stormwater	Impaired	S&E, R, LO, M, Ag, BMPs
Welch Mill Creek	1-52-40	C;Tr	flow	trout farm	Supporting	M, Ag, R
Whitaker Creek	1-52-33	C	habitat degradation, sedimentation	agriculture, livestock access, residential runoff	Impacted	R, Ag, BMPs
Worm Creek	1-52-24	C;Tr	habitat degradation, sedimentation, nutrients	agriculture, residential stowmater	Supporting	R, Ag, BMPs

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source = development, agriculture, WWTP, NPS,

Status = Impaired, Impacted, Supporting, Improving

Actions Needed = BMPs, R= restoration, P= conservation protection, SC= stormwater controls, SS= stressor study, E= education, LO= local ordinance, SSP= species protection plan, F= forestry BMPs, Ag= Agriculture BMPs, NMC= nutrient mgnt controls, S&E soil and erosion control, M= monitoring

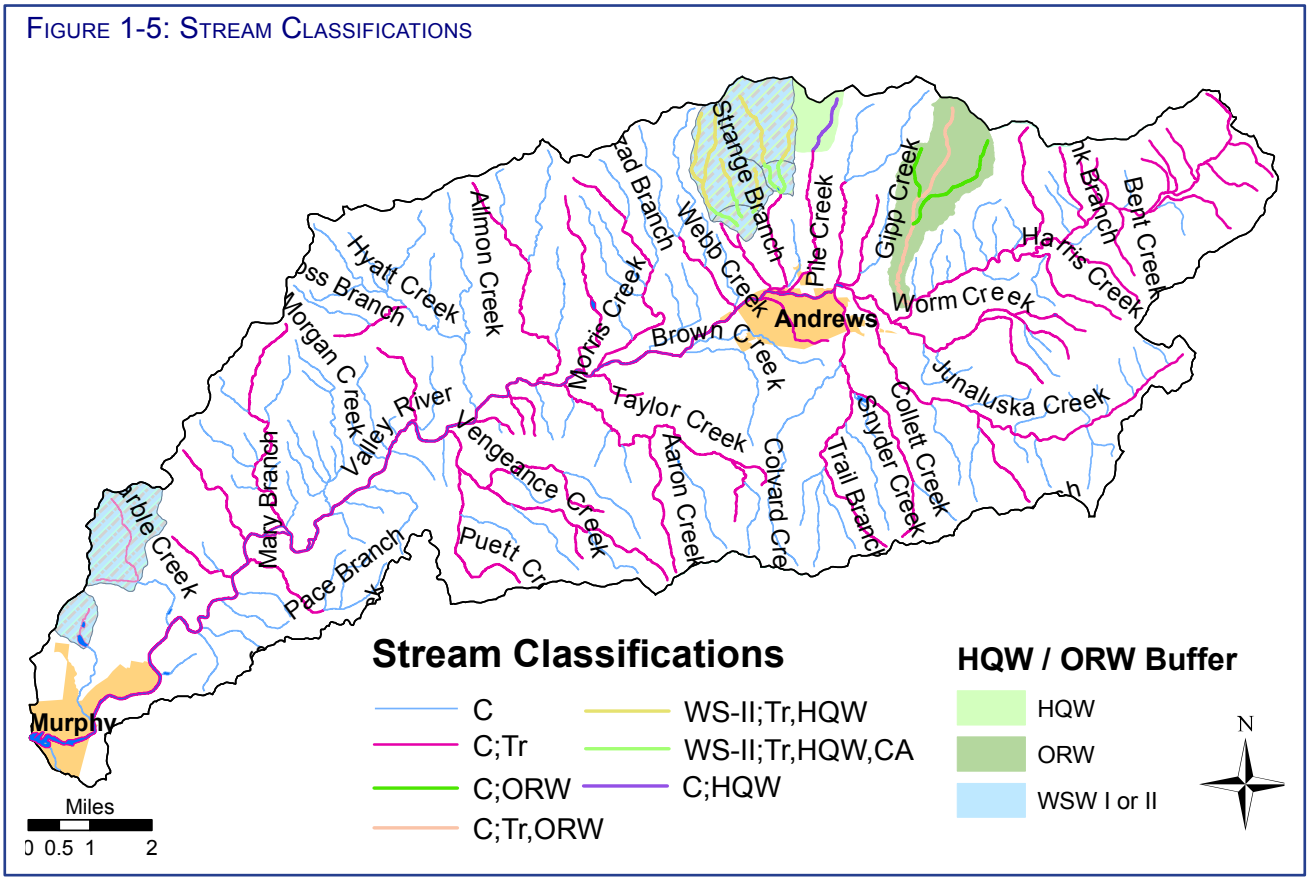
Management Strategies for Water Quality Protection

Trout (Tr), High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the primary freshwater classification(s) placed on a waterbody. As show in Figure 1-5, Gipp Creek is classified as an ORW Trout stream. Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect water quality. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina(NCDENR-DWQ, 2004). This document is available on-line at http://portal.ncdenr.org/web/wq/ps/csu/rules.

Trout (Tr) Waters

Trout (Tr) waters are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1) or the following link: http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364.

Figure 1-5: Stream Classifications



HQW & ORWs

HQW classification is intended to protect waters with water quality higher than the state's water quality standards. In the Hiwassee River basin, waters classified as Water Supply I and II (WS-I and WS-II), ORW, and waters designated by the NC Wildlife Resources Commission (WRC) as native (wild) trout waters are subject to HQW rules. Streams petitioned for WS-I or WS-II or which are considered Excellent based on biological and physical/chemical water quality parameters may qualify for the HQW supplemental designation.

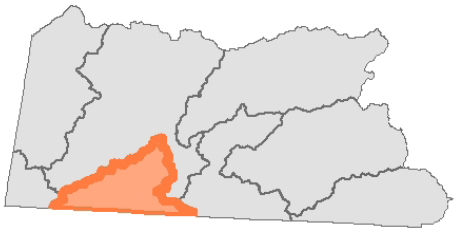
New discharges and expansions of existing discharges may, in general, be permitted in waters classified as HQW provided that the effluent limits are met for dissolved oxygen (DO), ammonia/nitrogen levels (NH_3-N), and the biochemical oxygen demand (BOD5). More stringent limitations may be necessary to ensure that the cumulative effects from more than one discharge of oxygen-consuming wastes will not cause the dissolved oxygen concentration in the receiving water to drop more than 0.5 milligrams per liter (mg/l) below background levels. Discharges from single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (Administrative Code 15A NCAC 2B .0224).

In addition to the above, development activities which require an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). Under these rules, stormwater management strategies must be implemented if development activities are within one mile of and draining to waters designated as HQW. There are two development options outlined in the rule:

- The low-density option requires a 30-foot wide vegetative buffer between development activities and the stream. This option can be used when the built upon area is less than 12 percent of the total land area or the proposed development is for a single-family residential home on one acre or greater. Vegetated areas may be used to transport stormwater in the low-density option, but it must not lead to a discrete stormwater collection system (e.g., constructed).
- The high-density option is for all land disturbing activities on greater than one acre. For high-density projects, structural stormwater controls must be constructed (e.g., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch or more of rainfall. More stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water (Administrative Code 15A NCAC 2H .1006).

ORWs are unique and special surface waters that have some outstanding resource value (e.g., outstanding fish habitat and fisheries, unusually high levels of water-based recreation, special ecological or scientific significance). No new discharge or expansions on existing discharges are permitted. Rules related to the development activities are similar to those for HQW, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). In addition, site specific stormwater management strategies may be developed to protect the resource values of these waters.

Nottely River Watershed



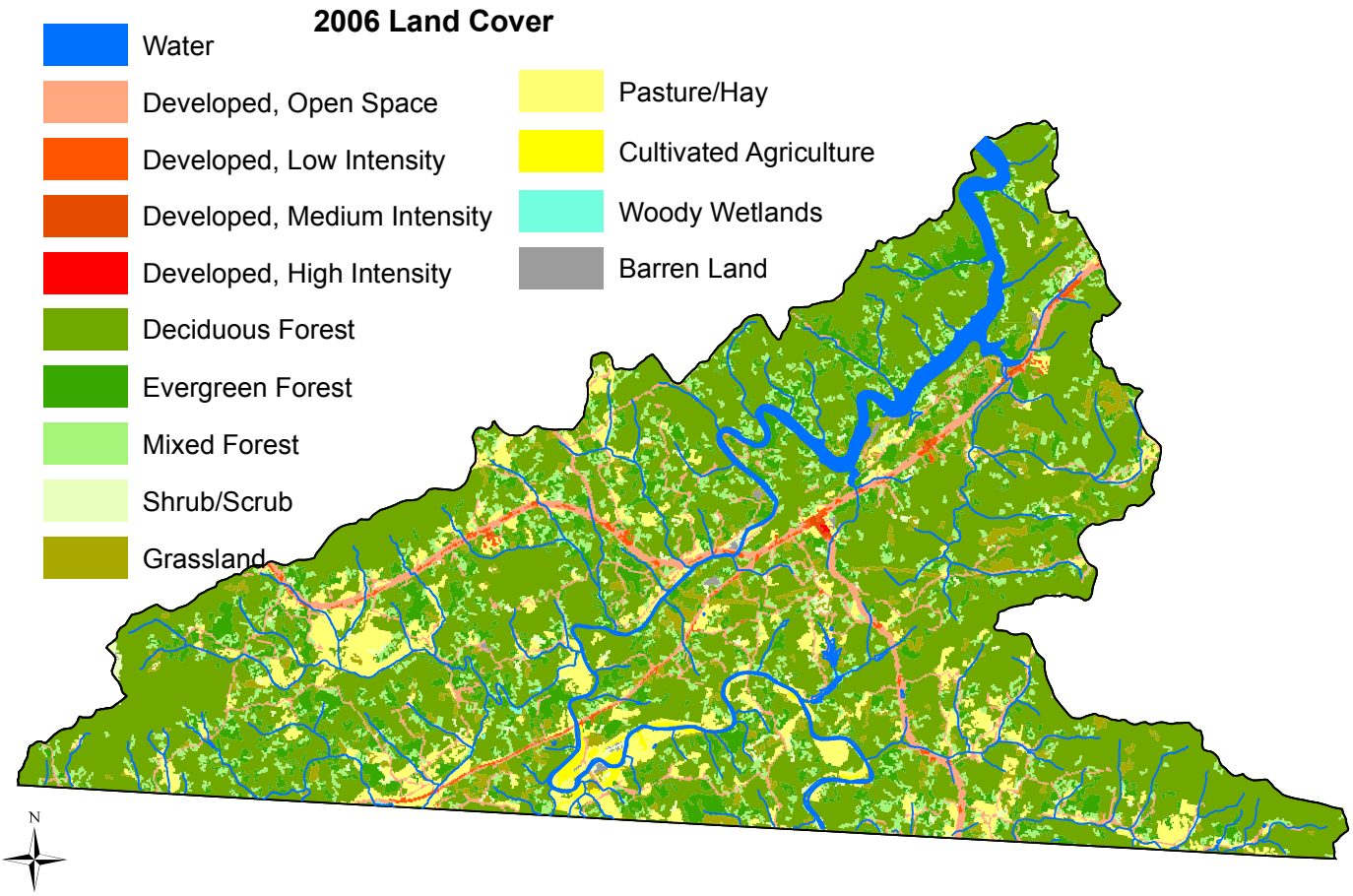
HUC 0602000206

Includes: Major Streams- Rapier Mill Creek, Cane Creek & Nottely River

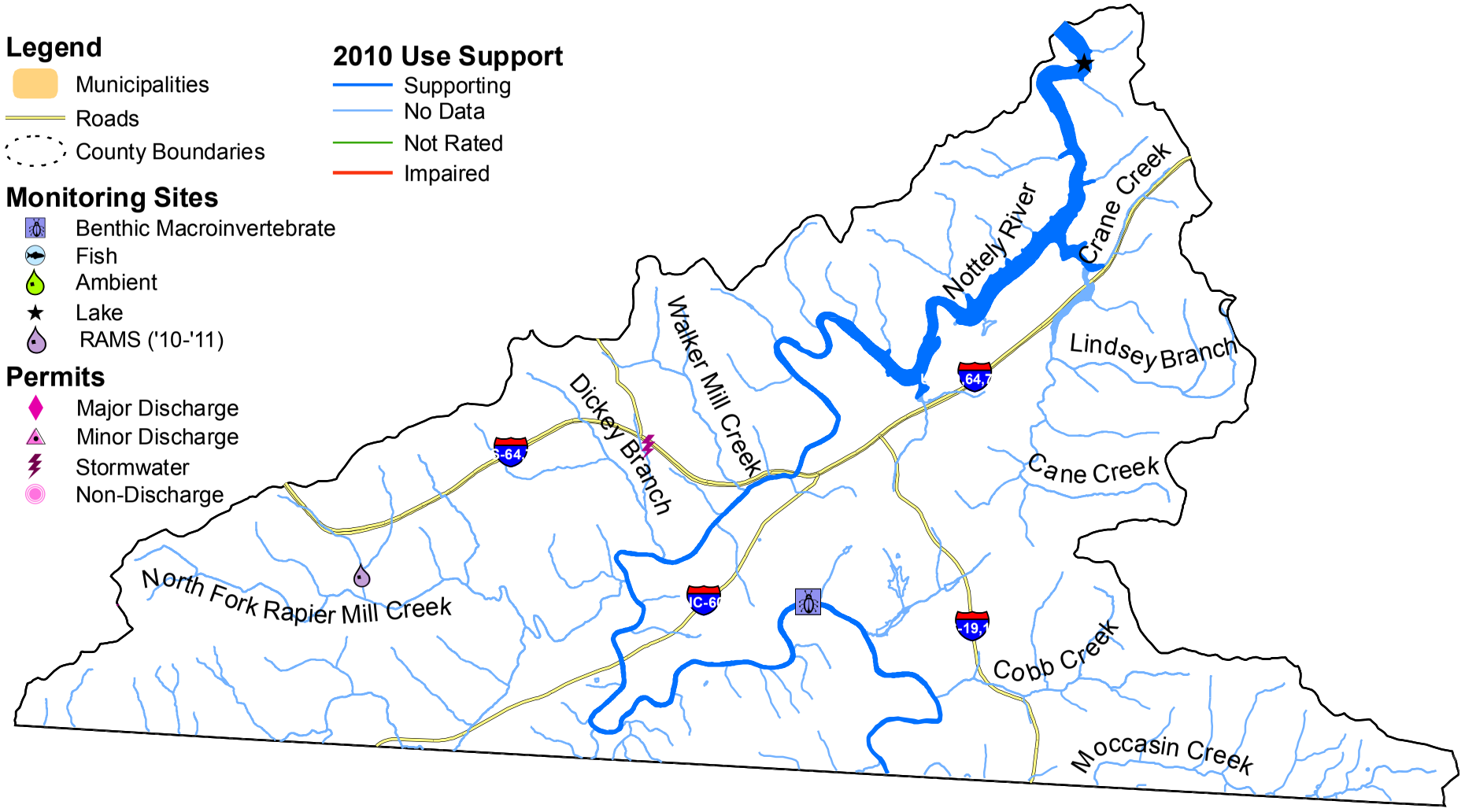
Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee	46 sq mi.	Open Water.....1%	NPDES
Municipalities:	**Population:**	Developed.....7%	Wastewater Discharge.....0
none	2000.....3,842	Forested.....80%	Wastewater Nondischarge....0
EPA Level IV Ecoregions:	2010.....4,937	Shrub.....1%	Stormwater.....1
Broad Basins, Southern Metasedimentary Mtns.		Agriculture.....11%	Animal Operations.....1

The Nottely River, a large tributary to the Hiwassee River, is impounded upstream in Georgia to form the Nottely Reservoir. Tailwaters from the Nottely Dam are managed to maintain dissolved oxygen levels and minimal flows by the Tennessee Valley Authority.



Nottely River Watershed 0602000206



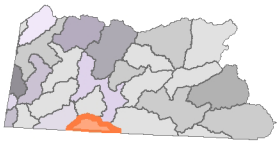
NC Division of Water Quality
Basinwide Planning Unit
Sept. 2011

Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

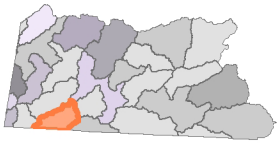
To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Dooley Creek-Nottely River (HUC 060200020601)



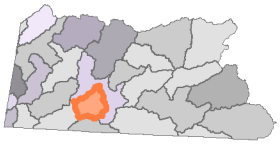
The only DWQ monitoring site in this watershed is in this subwatershed. This site (FB3) is located on the Nottely River [AU# 1-58a] downstream of Nottely Lake and receives cold water from the bottom of the lake associated with discharge from a dam upstream. Based on decreased EPT taxa richness, water quality appears to be declining. The macroinvertebrate site rated Excellent in 1994, dropped to Good in 1999 and 2004, and continued to drop in 2009 to Good-Fair. Daily dam releases change the River stage approximately 4ft. or more resulting in dramatic flow velocity changes and habitat deficiencies. These hydrological fluctuations limit the diversity and abundance of benthic macroinvertebrates and promote stream bank erosion and substrate embeddedness and prevent the establishment of well-developed pools and riffles. DWQ supports efforts led by Hiwassee River Watershed Coalition in Georgia to reduce nutrient loads to Lake Nottely. Nutrient reductions in the lake may lead to improved water quality in the regulated river reach. Options for bank stabilization should be evaluated and implemented in the North Carolina portion of the watershed. Doing so will likely reduce erosion and improve instream habitat.

Rapier Mill Creek-Nottely River (HUC 060200020602)



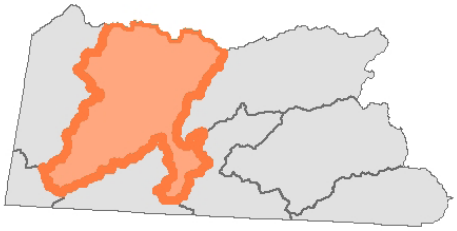
The major tributaries to the Nottely River in this subbasin include: Rapier Mill Creek [AU# 1-58-6], Dickey Branch [AU# 1-58-7], Walker Mill Creek [AU# 1-58-8]; none of them are monitored. There is one Random Ambient Monitoring System (RAMS) site (F6514200) along North Fork Rapier Mill Creek [AU# 1-58-6-1] that collected data in 2011 and 2012; data results from this site is currently not available. There is one DWQ permitted animal operation in the Rapier Mill Creek drainage, a 200 cow dairy with a lagoon for waste management and one stormwater permit for a concrete business with an outfall along Dickey Branch. Monitoring of Rapier Mill Creek is needed in this watershed. The NC portion of the Nottely River is very popular for fishing and is an important resource for Cherokee County.

Nottely River (HUC 060200020603)



This subwatershed is where Nottely River [AU# 1-58b] widens out and becomes part of Hiwassee Lake. There is one lake monitoring site (HIW009B) on the Nottely and no water quality problems were noted as a result of sampling. A Significant Natural Heritage Area (Die Bend/Crowder Bluff) runs along a small portion of the Nottely River that is also a part of Nantahala National Forest.

Hiwassee Lake Watershed



HUC 0602000207

Includes: Major Streams- Martins Creek, Hanging Dog Creek, Grape Creek, Beaverdam Creek, Persimmon Creek & Bearpaw Creek

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee	157 sq mi.	Open Water.....4%	NPDES
Municipalities:	**Population:**	Developed.....4%	Wastewater Discharge.....2
Murphy	2000.....5,929	Forested.....85%	Wastewater Nondischarge....0
EPA Level IV Ecoregions:	2010.....6,822	Shrub.....1%	Stormwater.....4
Broad Basins, Southern Metasedimentary Mtns.		Agriculture.....5%	Animal Operations.....0

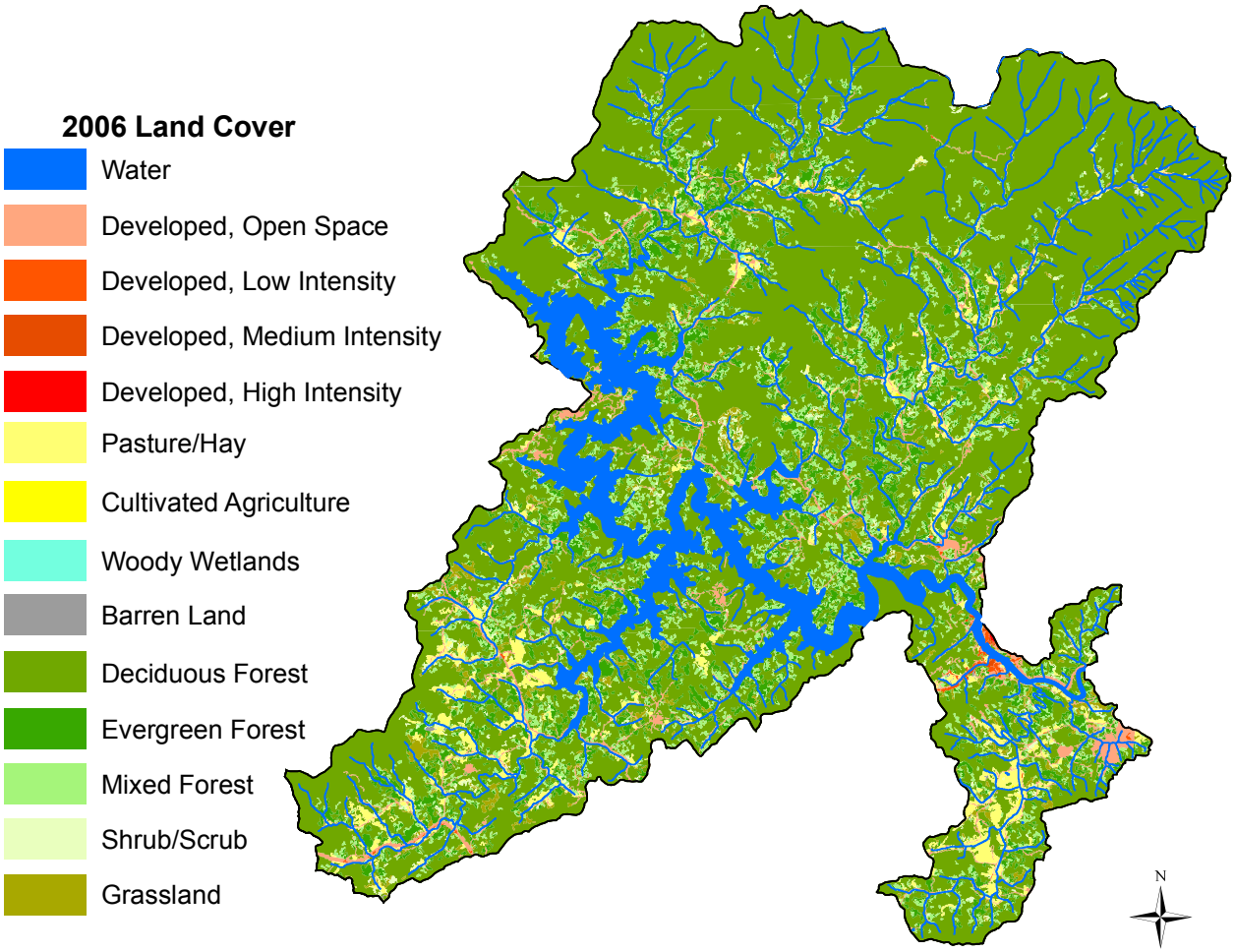
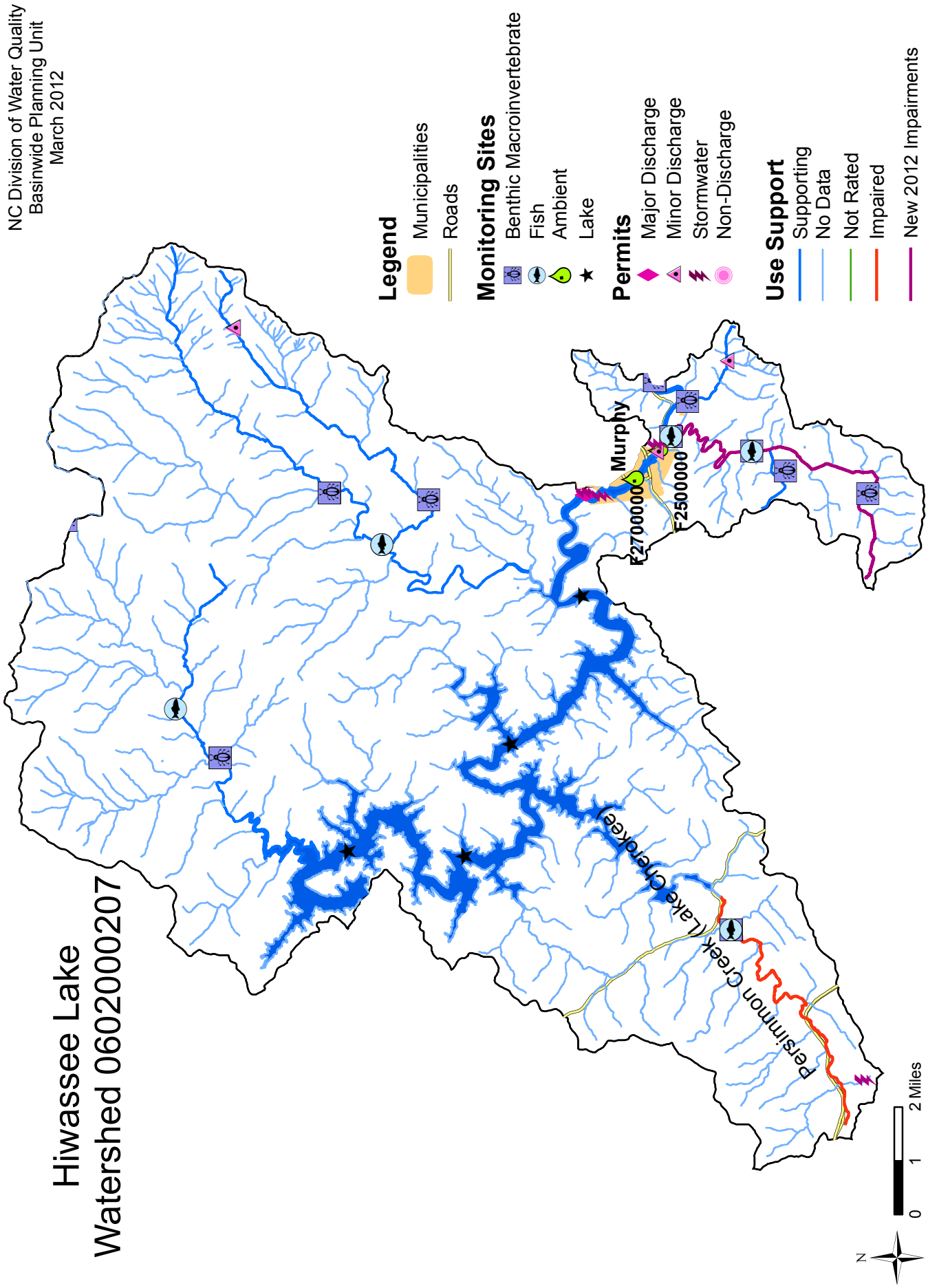


Figure 1-1: Hiwassee Lake Watershed Map

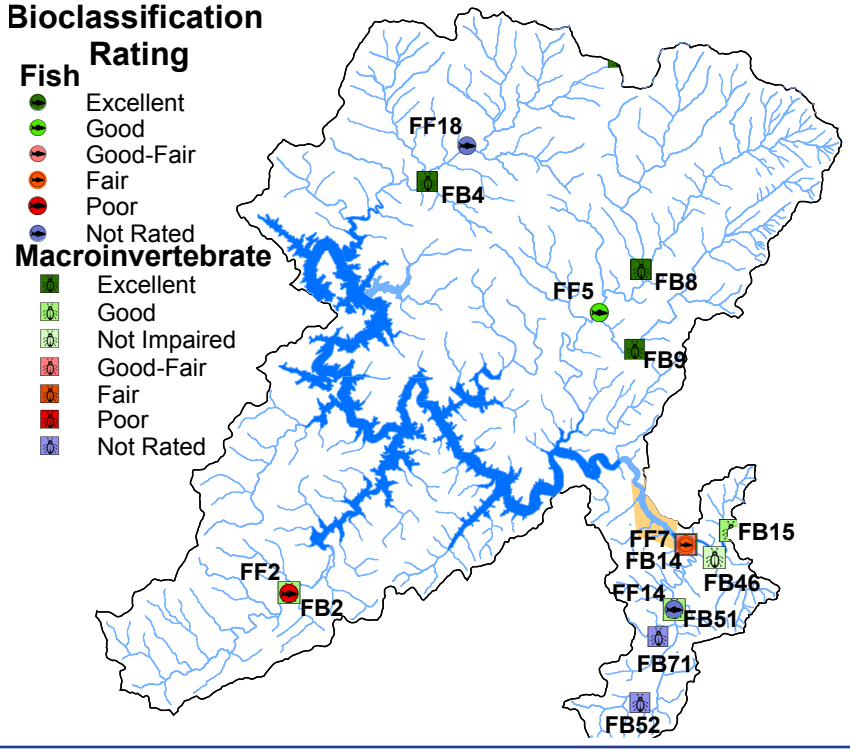


Water Quality Monitoring

There is one ambient station in this watershed. Ambient station F2500000 at US 64 was discontinued and a new station F2700000 was established further downstream at Business 19 in 2007. Data from these stations indicate low pH levels.

Biological samples have been taken throughout the watershed since the 1980's. Basinwide sites were first sampled in 1994 and the two most recent basinwide benthic macroinvertebrate samples were taken in 2009 resulting in an Excellent and Good-Fair Bioclassifications. An additional six samples were taken in 2006 as part of a special study. Site specific information is available in Appendix and the Biological Assessment Report is available here: http://portal.ncdenr.org/web/wq/ess/reports. Figure 1-2 shows the most recent benthic site rating in this watershed at sites sampled since 1994.

Figure 1-2: Biological Sample Sites & Ratings



Biological Monitoring

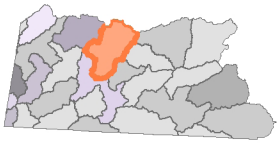
Biocriteria have been developed using the diversity, abundance, and pollution sensitivity of the organisms that inhabit flowing waterbodies in NC. One of five bioclassifications are typically assigned to each water body sampled: Excellent, Good, Good-Fair, Fair and Poor. Not Impaired and Not Rated designations are reserved for samples that were not eligible to be assigned one of the five typical bioclassification categories. Typically, a "Not Impaired" rating is equivalent to a Good-Fair or better bioclassification and a "Not Rated" designation is equivalent to a Fair or worse bioclassification. The reasons for not being able to assign one of these five typical bioclassifications may be a lack of appropriate bio-criteria or atypical sampling conditions (e.g., drought). These bioclassifications are used to assess the various impacts of both point source discharges and nonpoint source runoff. The resulting information is used to document both spatial and temporal changes in water quality, and to complement water chemistry analyses, ambient toxicity data, and habitat evaluations. In addition to assessing the effects of water pollution, biological information is also used to define High Quality or Outstanding Resource Waters, support enforcement of stream standards, and measure improvements associated with management actions. The results of biological investigations have been an integral part in North Carolina's basinwide monitoring program.

Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Hanging Dog Creek (HUC 060200020701)

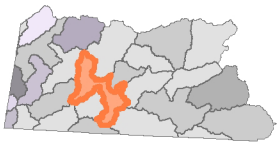


Hanging Dog Creek drains ~41 square miles to Hiwassee Lake, some of which is in Nantahala National Forest. Davis Creek and all its tributaries, and Dockery Creek are tributaries to Hanging Dog Creek that carry the supplemental Trout classification (Tr).

Hanging Dog Creek [AU# 1-57] was sampled in 2009 resulting in Excellent macroinvertebrate (FB8) and Good fish (FF5) community rating; although there was a noted increase in sedimentation and riparian vegetation loss. Downstream, the riparian zone was narrow and provided insufficient shading. Reestablishing the riparian zone will provide more shading to keep water temperature low and protect against bank erosion.

Owl Creek [AU# 1-57-6] was last sampled for macroinvertebrates in 2004 resulting in an Excellent rating. There is one discharge permit (NCG530068) in Owl Creek for a trout farm. Dinkin Branch and Little Owl Creek are tributaries to Owl Creek and are classified for the protection of trout.

Grape Creek-Hiwassee Lake (HUC 060200020702)



This subwatershed drains ~36 square miles, including: Hampton Creek, Martin Creek, Grape Creek, and Beech Creek drainages. Hiwassee Lake is surrounded by Nantahala National Forest and there are two significant natural heritage areas within the subbasin: Hiwassee Church Bluffs and Will Scott Mountain. There is also a significant amount of Tribal land in this subwatershed, held by the Eastern Band of Cherokee Indians.

Special Study Summary

In July 2005, the Ecosystem Enhancement Program (EEP), Hiwassee River Watershed Coalition (HRWC), and Equinox Environmental Consultation and Design started a local watershed planning process in the Peachtree-Martin Creek watershed: http://www.hrwc.net/peachtreemartinslwp.htm. The goals were to: (1) assess stream quality in the watershed, identifying key sources of degradation and pollution, and (2) develop a comprehensive strategy to address watershed needs.
The resulting Local Watershed Plan addressed both ecological and community priorities. Hampton Creek and Martin Creek in this subwatershed were sampled as part of this assessment.

Hampton Creek [AU# 1-48] was sampled (FB46) in 2006 as part of the EEP watershed assessment special study resulting in a Not Impaired status. However, when compared to other similarly rated small streams, Hampton Creek ranks the worst biologically. The creeks drainage area at the sample site is 1.9 square miles were there was minimal canopy cover noted. Average stream width was 4 meters; average depth was 0.3 meter. The upper section of the reach had been channelized. To the right of the stream was a horticultural nursery. Habitat at the site suffered primarily from a very narrow riparian zone that provided minimal shade to the stream. (BAU Memorandum B-20060731).

Hampton Creek, Site FB46

Martin Creek [AU# 1-49] drains north ~9 to the Hiwassee River and is a broad, flat, agricultural valley, but is also one of the most developed subwatersheds in the Hiwassee River basin, with many new single-family homes under construction in addition to older, established residential neighborhoods associated with the Town of Murphy. The mountain creekshell (Villosa vanuxemensis), a

state-threatened mussel is found in Martin Creek. This creek was sampled by DWQ biologists in 2006 as part of an EEP study (BAU Memorandum B-20060731); the details of this study are available on the EEP website: http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html.

The basinwide benthic sample in Martin Creek at SR 1558, (FB14) near the confluence with the Hiwassee River received a Good-Fair bioclassification in 2009, which is a decrease from the Good rating it received in 2004. The basinwide site FB14 was sampled in 2006 as part of the special study and resulted in a Good-Fair rating, with noted sedimentation as being an issue, but also noting a healthy and diverse riparian vegetation. The fish community sample (FF7) taken at the same location resulted in a Fair rating with a noted shift in trophic community, which is a decline from the special study sample taken in 2006, which received a Good-Fair rating. Benthic site FB51 at SR 1576 is about halfway upstream from the mouth resulted in a Good rating, while the fish sample (FF14) at the same location was Not Rated because of the stream is a low elevation trout-type stream and criteria have not been developed for those streams. Biologists noted areas of habitat degradation, sedimentation and abundant periphyton growth. Most of the stream reach has been channelized with limited riparian vegetation and evidence of cattle access. Two additional sites were sampled as part of the special study in the winter of 2006, one site is near the headwaters (FB52) and another (FB71) on a unnamed tributary to Martin Creek; both were Not Rated because of their small stream status. The unnamed tributary was noted as having nutrients and habitat degradation as stressors. The declining stream conditions are likely a result of steep slope and ridgetop residential development that occurred in this area between 2005-2008.

Martin Creek at SR 1576, Sites FB51 & FF14

Martin Creek at SR 1558, Sites FF7 & FB14

In 2004, Martin Creek at SR 1558 (sites FF7 & FB14) was considered a regional reference site because of its instream, riparian, and watershed characteristics. At that time, based upon an examination of topographic maps, it was estimated that approximately 60 percent of the watershed upstream from the site was forested. GIS analyses, based upon 1993-1995 landuse coverage, showed that approximately 75 percent of the watershed was forested and approximately 20 percent in pasture. Thus, despite the prevalence of pasture alongside the creek throughout the middle of the watershed and that which was observed in 2006 at sites FB51 and FB14 technically continued to qualify as a regional reference site. However, the fish community has not been rated Good or Excellent even though this site has moderately high quality instream and riparian habitats. There are no known upstream dischargers and nonpoint source runoff should not be affecting this moderate gradient stream. But clearly, some factor(s) is impacting the fish community. Effects from historical land use practices within the watershed and illegal discharges (e.g., “straight pipes”) may be impacting the stream. The uniform depth, the relatively homogenous flat cobble substrate covered with fine silts, the lack of productive riffles, and the lack of deep pools with submerged structures undoubtedly all contribute to the low total abundance of fish, the low diversities and abundance of cyprinids, darters, and Rock Bass, Smallmouth Bass, and Trout, and ultimately the continued lower than expected NCIBI ratings. Although the watershed is predominantly forested, land use practices closest to the stream throughout the watershed and upstream from the SR 1558 monitoring site may be having a negative impact on the downstream fish community that far exceeds the moderately high quality habitat benefits at the monitoring site. (BAU Memorandum B-20060731).

Water chemistry data was also collected in Martin Creek capturing baseflow and stormwater conditions, detecting moderate nitrite-nitrate concentrations in the baseflow and elevated fecal coliform counts. Five fecal coliform bacteria samples between May 24- June 12, 2007 detected bacteria levels that exceed state standards with a maximum coliform count of 1400 and a geometric mean of 550.

The Hiwassee River, [AU# 1-(50)], below Martin Creek had low pH and was Impaired on the 2010 303(d) list, however no low pH conditions were detected in 2009 or 2010 and therefore the stream will no longer be impaired on the 2012 303(d) list. Ambient station F2500000 at US 64 was discontinued and a new station F2700000 was established further downstream at Bus 19 in 2007. This reach of the river flows through the Town of Murphy. Fecal coliform bacteria samples were collected in September 2011 at this site and the data indicates bacteria levels that do not exceed our current water quality standards assessment criteria. The Town of Murphy's WWTP (NC0020940) discharges into this reach of the river. The facility has had several permit violations(TSS, fecal coliform bacteria and monitoring frequency) in recent years, however the instream low pH does not appear to be a result of the WWTP violations. The plant has issues with solids management because of slug loading and weather conditions. The facility is to consider entering into SOC in order to allow the facility time to get solids management and process control strategy in place.

Hiwassee Lake [AU# 1-(53)] was built by the Tennessee Valley Authority (TVA) between 1936 and 1940 to provide hydroelectric power and is the second largest TVA-owned lake in North Carolina. Hiwassee Reservoir's classifications include C and B, for the protection of primary recreation and aquatic life. DWQ took water quality samples in the lake from May through September 2009 and did not detect any water quality parameters of concern. For more details regarding the data collected see the **ESS Lake & Reservoir Assessment report**.

Recommendation

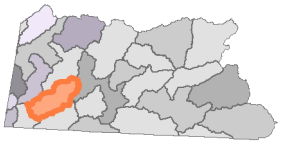
The final Peachtree-Martin Creek Watershed Management Plan is the best available strategy for restoration needs in this subwatershed. DWQ supports these identified restoration needs and will work with federal, state, and local parties to implement its recommendations.

Ecosystem Enhancement Program Projects

The Martins Creek project is on a large tract of largely wooded property that drains to Martins Creek that was identified as the top priority for preservation in EEP's project atlas. This project will protect almost four miles of highly functioning stream and riparian area and restore another mile of degraded stream along Martins Creek itself and tributaries that flow to it that have been impacted by livestock grazing. In addition, almost seven acres of riparian wetland will be restored in the Martins Creek floodplain.

Another project is on an unnamed tributary to Martins Creek near its headwaters. This project is on a stream that has been highly impacted by cattle. It will restore the stream and riparian area of more than a mile of stream, installing fencing and other livestock BMPs.

Lake Cherokee-Persimmon Creek (HUC 060200020703)

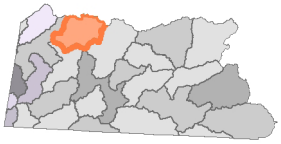


This subwatershed drains 25 square miles northeast into Hiwassee Lake. Persimmon Creek is impounded to form Lake Cherokee, a 30 acre reservoir, before entering Hiwassee Lake. The monitoring sites at SR 1127 are approximately one mile upstream from the backwaters of Lake Cherokee. Persimmon Creek [AU# 1-63a] received a Poor bioclassification in 2006 at fish sampling site FF2 and therefore the Creek is Impaired and listed on the 2010 303(d) list. However, the benthic site FB2 which is downstream from the fish site, has rated Excellent from 1994-2006, when it declined to a Good bioclassification. These extreme differences in ratings prompted a special study done in 2006, (BAU Memorandum -20060720). The upstream site is noted as having poor habitat characteristics, while downstream habitat conditions improve. The main differences in the two reaches were in bottom substrate, pool variety, riffles, bank stabilities, and canopy cover. Such a difference in ratings suggested that habitat alone may have been the influencing factor for the fish rating, because the water quality would not have changed within this short stretch of stream.

Recommendations

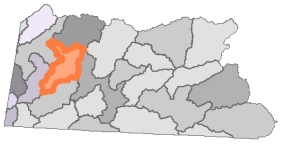
Habitat improvements are anticipated in future sites assessments of the creek but stream restoration and bank stabilization are still needed in Persimmon Creek. DWQ supports the restoration efforts led by the Cherokee County Soil and Water Conservation District who completed a restoration project on 1,700 ft. of the upstream reach. Creating sloped banks re-vegetated with dogwood, willow, and river birch; rock veins and root wad structures were also placed within the stream to deflect the current. Additionally, DWQ encourages the District to develop a watershed plan for moving forward in order to insure that both water quality and watershed function are restored. DWQ will sample this stream again to evaluate the improvements to water quality as a result of these efforts.

Beaverdam Creek (HUC 060200020704)



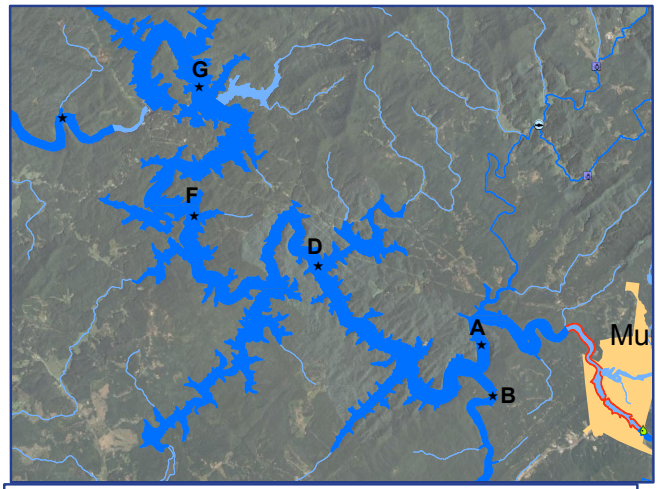
Beaverdam Creek [AU# 1-72] drains ~30 square miles and the majority of streams, including the creek itself, carry the supplemental Trout waters classification (Tr). The last macroinvertebrate sample was collected (FB4) in 2004 resulting in a Excellent rating, however the 2009 fish sample (FF18) was Not Rated and noted some water quality concerns. Despite being a trout stream no top predator species were found, there were also noted breaks in riparian vegetation from cattle access.

Hiwassee Lake-Hiwassee River (HUC 060200020705)



This subwatershed includes the downstream portion of Hiwassee Lake. Bearpaw Creek [AU# 1-66] flows north to Hiwassee Lake is the one major drainage solely within this subwatershed and is not monitored by DWQ.

Hiwassee Lake [AU# 1-(53)] was built by the Tennessee Valley Authority (TVA) between 1936 and 1940 to provide hydroelectric power and is the second largest TVA-owned lake in North Carolina. Hiwassee Reservoir's classifications include C and B, for the protection of primary recreation and aquatic life. DWQ took water quality samples in the lake from May through September 2009 and did not detect any water quality parameters of concern. The locations of samples sites are located on the figure to the right. For more details regarding the data collected see the ESS Lake & Reservoir Assessment report.



Hiwassee Lake Station Locations

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The fourth and fifth columns of this table list potential stressors and sources that may be impacting a stream based on in-field observations, monitoring data, historical evidence, permit or other violations, and other staff and public input. In many cases, additional study is needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Beaverdam Creek	1-72	C;Tr	habitat degradation	agriculture	Supporting	Ag BMPs
Hampton Creek	1-48	C	habitat degradation, sedimentation	urban stormwater	Supporting	R,SC
Martin Creek	1-49	C	sedimentation, nutrients, fecal coliform bacteria	agriculture, failing septic systems, residential development	Impaired	SC, LO, SSP, Ag, NMC
Persimmon Creek	1-63a	C	habitat degradation, sedimentation	agricultural, loss of riparian vegetation	Impaired	R, Ag

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source = development, agriculture, WWTP, NPS,

Status = Impaired, Impacted, Supporting, Improving

Actions Needed: R=restoration, P=conservation protection, SC=stormwater controls, SS=stressor study, E=education, LO=local ordinance, BMPs, SSP=species protection plan, F=forestry BMPs, Ag=agriculture BMPs, NMC=nutrient mgnt controls, S&E=soil and erosion control, M=monitoring,

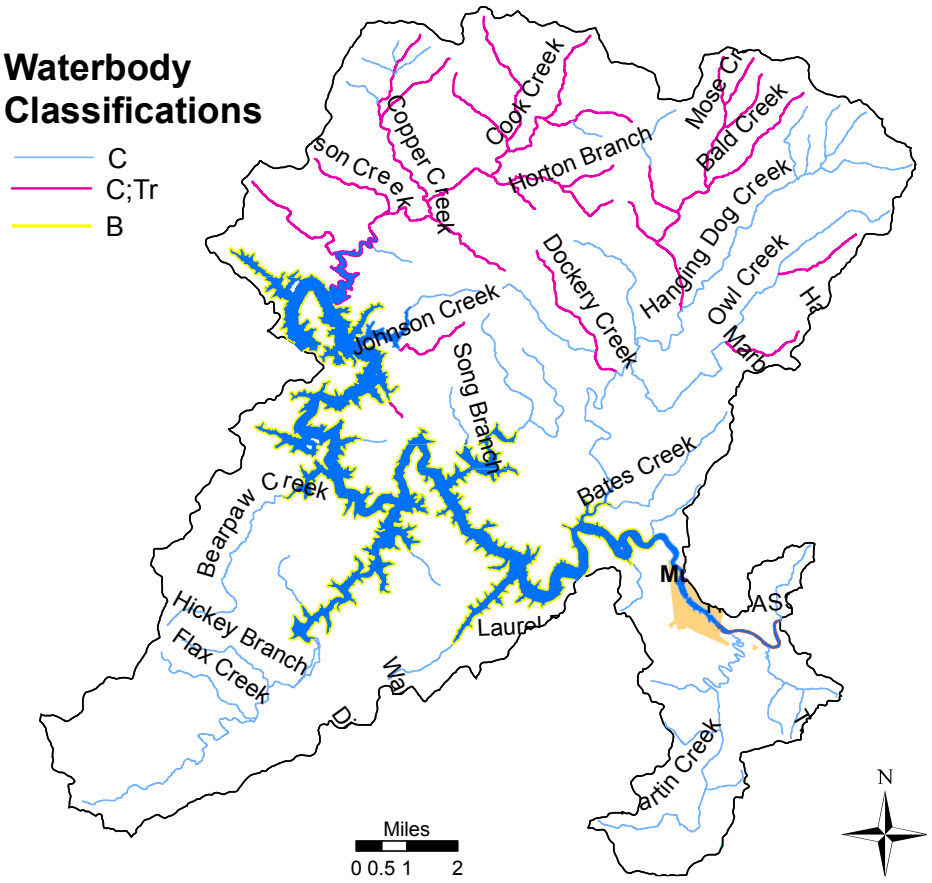
Waterbody Classifications

All surface waters in the state are assigned at least one primary classification and they may also be assigned one or more supplemental classifications, Figure 1-3 . A list of classifications with a description of their requirements can be found in Chapter 2 of the Supplemental Guide to Basinwide Planning.

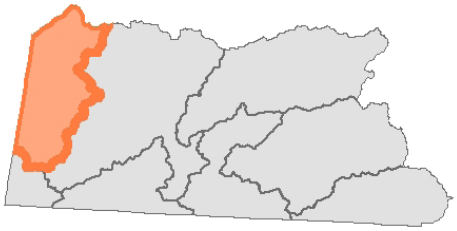
Trout (Tr) Waters

Beaverdam Creek and several of its tributaries are classified as Trout (Tr) waters. Tr are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1) or the following link: http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364.

Figure 1-3: Waterbody Classifications

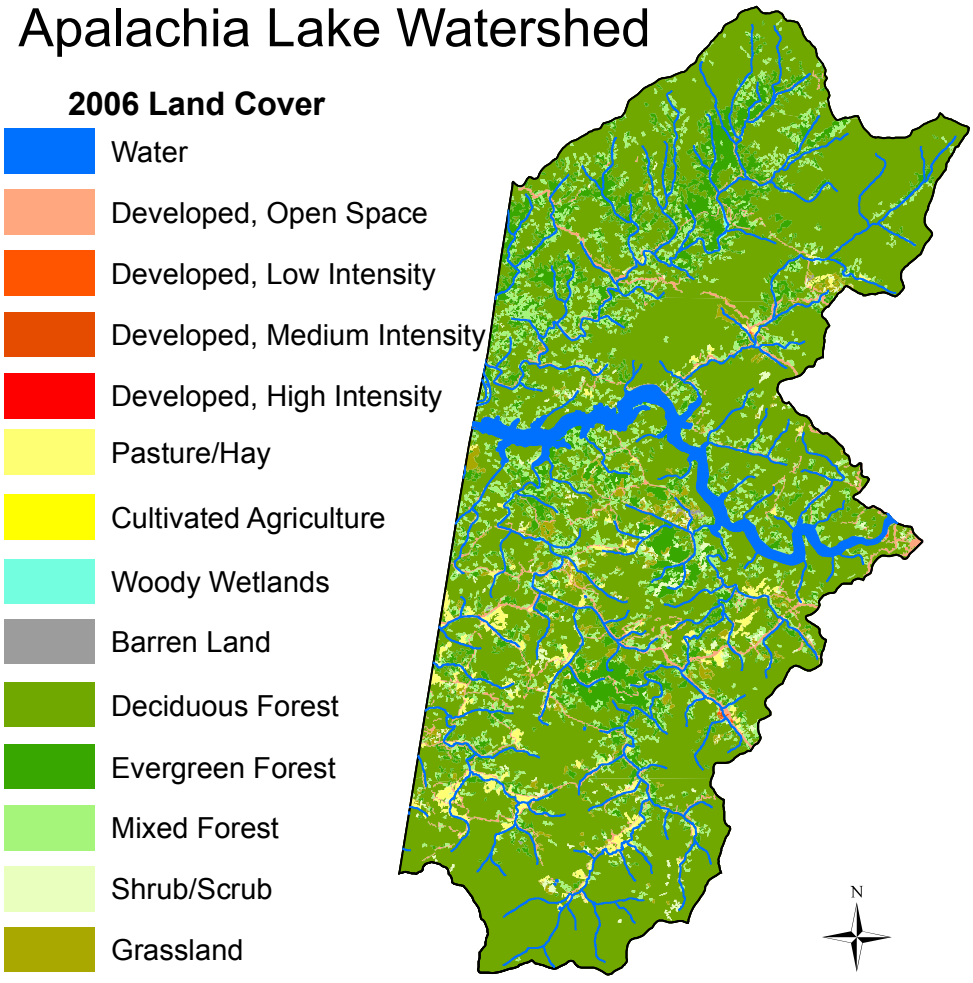


Apalachia Lake Watershed



HUC 0602000209

Includes: Major Streams- Shuler Creek, Shoal Creeks, Camp Creek & Apalachia Lake/Hiwassee River



Watershed at a Glance

County:
Cherokee

Municipalities:
none

Population:
2000:..... 1335
2010:..... 1781

Area Estimates
Square miles.....80.5

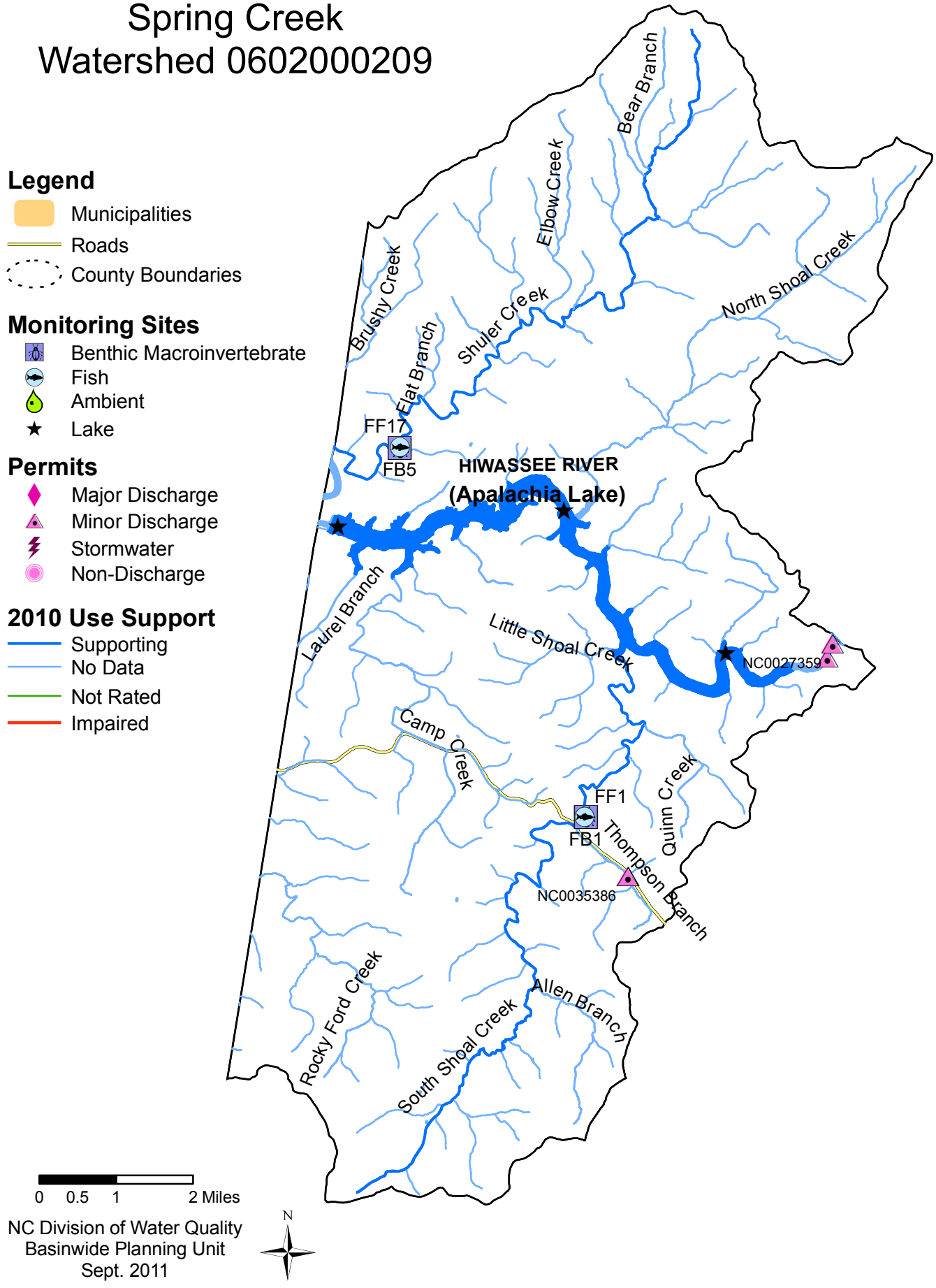
Land Cover:
Open Water.....2%
Developed.....3%
Forested.....91%
Scrub 1%
Agriculture.....3%

Ecoregions:
Broad Basins, Southern Metasedimentary Mtns.

Permitted Facilities:
NPDES
Wastewater Discharge 3
Wastewater Nondischarge 0
Stormwater 0

Animal Operations 0

Figure 1-1: Apalachia Lake / Spring Creek Watershed Map



Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Within this document biological sample site IDs ending in an "F" denote fish community and a "B" denote macroinvertebrate community. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

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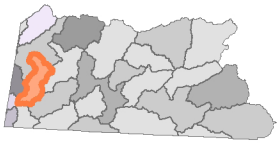
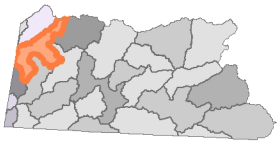
South Shoal Creek (HUC 060200020901)



South Shoal Creek [AU# 1-77] drains a primarily forested watershed of approximately 19 square miles. The creek, which is classified for trout protection was last sampled by DWQ in 2004 (FF1 & FB1), Those samples indicated excellent water quality. The fish site is a regional reference site and downstream NC Wildlife Resources Commission classifies the creek as Wild Trout Waters. Cherokee County Hiwassee Dam School (NC0035386) is located along Thompson Branch, which is a tributary to South Shoal Creek. The school's discharge effluent has had low pH resulting several violations for not meeting effluent limits.

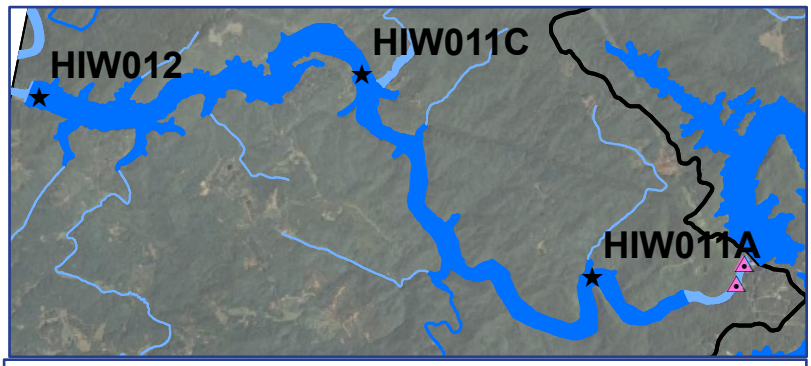
Apalachia Lake-Hiwassee River (HUC 060200020902)



This subwatershed drains from Hiwassee Lake to form Apalachia Lake. The main tributaries to Apalachia Lake besides the Hiwassee River include: South Shoal Creek, North Shoal Creek and Camp Creek. North Shoal [AU# 1-80] and Camp Creeks are not monitored by DWQ. On the Hiwassee River [AU# 1-(74)] below the dam there are two minor dischargers (NC0023001 Bear Paw WWTP, NC0027359 TVA) and one non-dicharge permit for Bear Paw WWTP (WQCSD0439).

Camp Creek [AU# 1-82] is not sampled by DWQ, but the Cherokee County Soil and Water Conservation District conducted a stream survey to evaluate water quality impacts. Cherokee SWCD noted a sediment and erosion problem in the creek and identified pasture, road construction, and residential construction activities as possible sources. Water quality stressors originating from these sources include stream channelization, livestock access, and development. Less than twenty percent of the agricultural land is operating with a conservation plan. Agricultural landowners are encouraged to work with Cherokee SWCD to develop and implement conservation plans for the remaining agricultural land in the watershed. The following are also needed to reduce the sediment and erosion problem: streambank stabilization/repair, establishing vegetated riparian buffers, livestock exclusion, off-stream livestock watering locations, and better erosion and sediment control enforcement for new construction.

Apalachia Lake [AU#1-(75)] is a run-of-the-river reservoir located within the Nantahala National Forest in the mountains of western North Carolina. It is situated immediately downstream of Hiwassee Lake on the Hiwassee River. The lake is owned by the Tennessee Valley Authority and was constructed int the 1940's to generate hydroelectric power. Apalachia Lake has a maximum depth of 118 feet, a length of 10 miles and 31 miles of shoreline at full pool level.



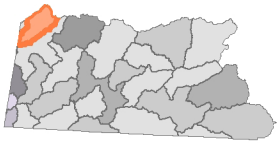
Apalachia Lake Station Locations

The drainage area covers 651,300 acres of mountainous terrain, almost all forested. Apalachia Lake is classified B (suitable for swimming).

DWQ staff sampled Apalachia Lake in 3 locations monthly from May through September 2009. Secchi depths ranged from 2.4 meters to 5.5 meters, indicating very good water clarity. Dissolved oxygen concentrations and pH values were similar to those previously observed in this lake. The thermocline generally occurred at a depth of four to five meters at the sampling site near the dam (HIW012). Nutrient concentrations were low with the exception of nitrite plus nitrate, which was elevated. Chlorophyll a concentrations were also low, with the mean lake values ranging from <1.0 to 3.7 µg/L. Based on the calculated NCTSI scores, Apalachia Lake was determined to have low biological productivity (oligotrophic).

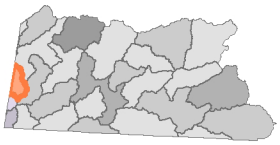
Apalachia Lake was monitored by Tennessee Valley Authority in 2006 and 2008 and was determined to have an Ecological Health Rating of Good. The chlorophyll a rating in both years was Good and this rating has fluctuated between Poor, Fair and Good (www.tva.com/environment/ecohealth/apalachia2.htm).

Shuler Creek (HUC 060200020903)



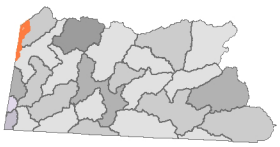
Shuler Creek [AU# 1-86] drains ~19 square miles of which almost all of it is part of Nantahala National Forest and is hatchery supported trout waters. The creek was sampled for macroinvertebrates in 2004 resulting in an Excellent rating and the fish community was sampled (FF17) in 2009 resulting in a Good rating. Two hellbender salamanders were also found indicating high water quality.

Turtletown Creek (HUC 060200020904)



Rocky Ford Creek [AU# 1-89] is the only creek in this subwatershed that is in North Carolina. The creek flows north out of Pack Mountain Significant Natural Heritage Area and then west into Tennessee. This subwatershed contains a 9.4-acre rare shrub-emergent wetland. The wetland is heavily beaver influenced with abundant open water, shrub islands, and emergent marsh areas. NC Natural Heritage Program and Wildlife Resources Commission personnel have identified some amphibians of interest including peepers, a wood frog, a spotted salamander egg mass, and possibly a red-spotted newt adult. Mountain chorus frogs have been identified on two different occasions. The Land Trust for the Little Tennessee is working with the landowner to conserve this unique wetland. There are no DWQ monitoring stations in this subwatershed.

Towee Creek-Hiwassee River (HUC 060200020907)



In the North Carolina portion of this subwatershed is small including 0.6 miles of the Hiwassee River [AU# 1-(85)] from Apalachia Dam to North Carolina-Tennessee State Line and 1.9 mi. of Brushy Creek [AU# 1-88]. There are no DWQ water quality monitoring stations in this subwatershed.

Table 1-1: Notable Waterbodies

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Allen Branch	1-77-2	C	habitat degradation, sedimentation	development, forestry	Impacted	M, R, F, S&E
Camp Creek	1-82	C	habitat degradation, sedimentation	agriculture, livestock access,residential	Impacted	P, Ag, BMPs
Thompson Branch	1-77-2	C	pH, habitat degradation, sedimentation	WWTP, development, stormwater	Impacted	M,R,SC, BMPs

AU # = Assessment Unit # or stream segment/reach

Class. = Classification (e.g., C, S, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor = chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use.(e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.)

Source = development, agriculture, WWTP, NPS,

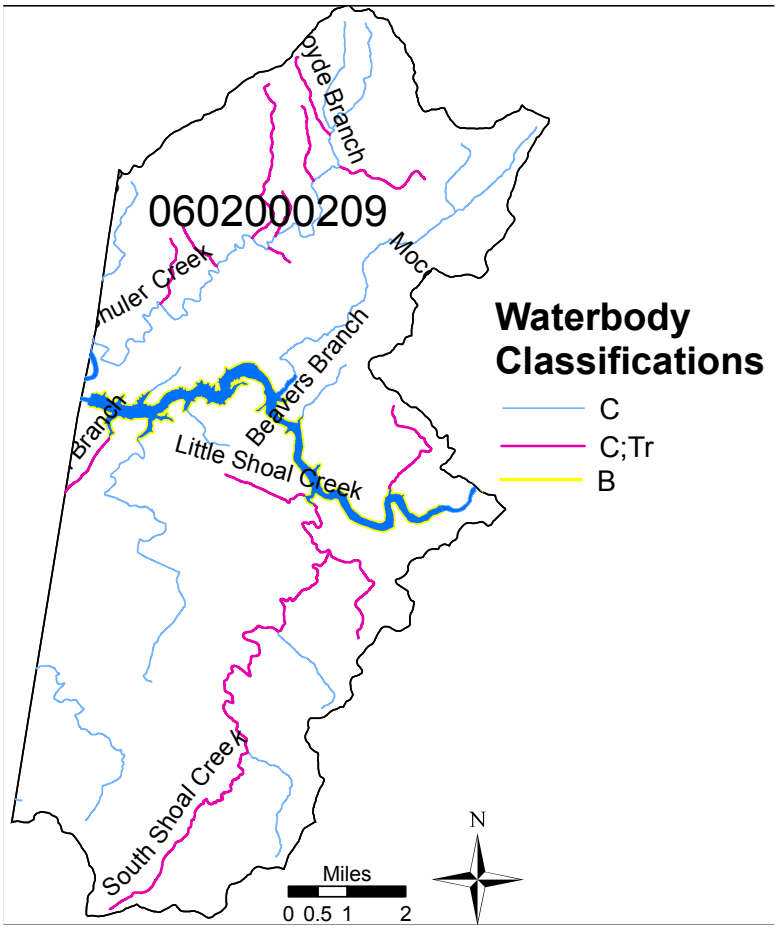
Status = Impaired, Impacted, Supporting, Improving

Actions Needed: R=restoration, P=conservation protection, SC=stormwater controls, BMPs, F=forestry BMPs, Ag=agriculture BMPs, S&E=soil and erosion control, M=monitoring,

Waterbody Classifications

All surface waters in the state are assigned at least one primary classification and they may also be assigned one or more supplemental classifications, Figure 1-2 . A list of classifications with a description of their requirements can be found in Chapter 2 of the **Supplemental Guide to Basinwide Planning**.

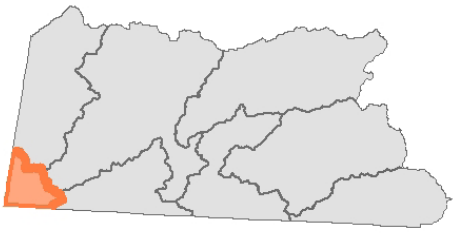
Figure 1-2: Stream Classifications



Trout (Tr) Waters

Trout (Tr) waters are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1) or the following link: **http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364.**

Ocoee River Watershed



HUC 06020000302

Includes: Major Streams- Hothouse Creek & Wolf Creek

Watershed at a Glance

County:	Area	2006 Land Cover:	Permitted Facilities:
Cherokee	18 sq mi.	Open Water.....4%	NPDES
Municipalities:	**Population:**	Developed.....4.5%	Wastewater Discharge.....0
none	2000.....0	Forested.....88%	Wastewater Nondischarge....0
EPA Level IV Ecoregions:	2010.....925	Shrub.....1%	Stormwater.....0
Broad Basins, Southern Metasedimentary Mtns.		Agriculture.....6%	Animal Operations.....0.

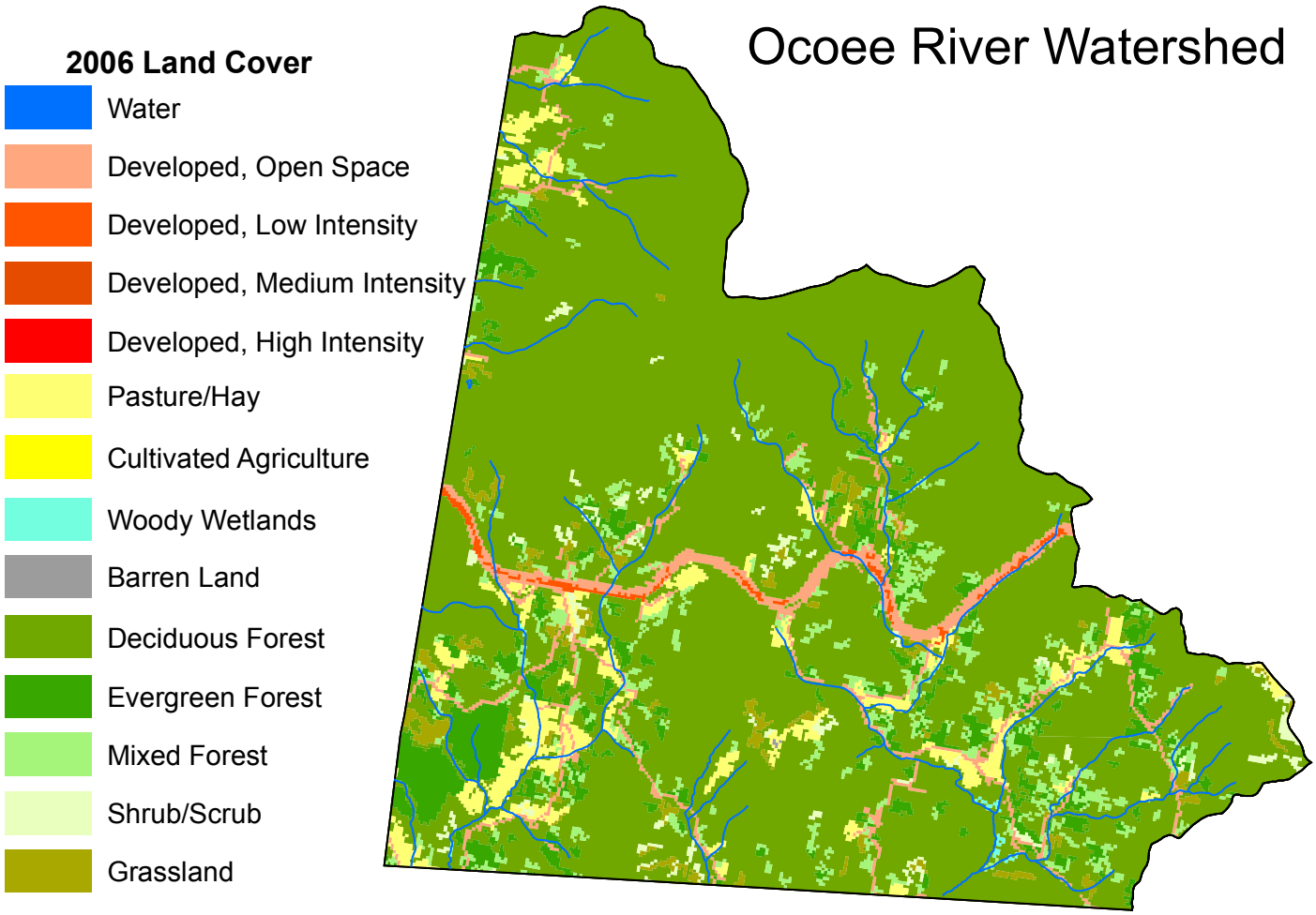
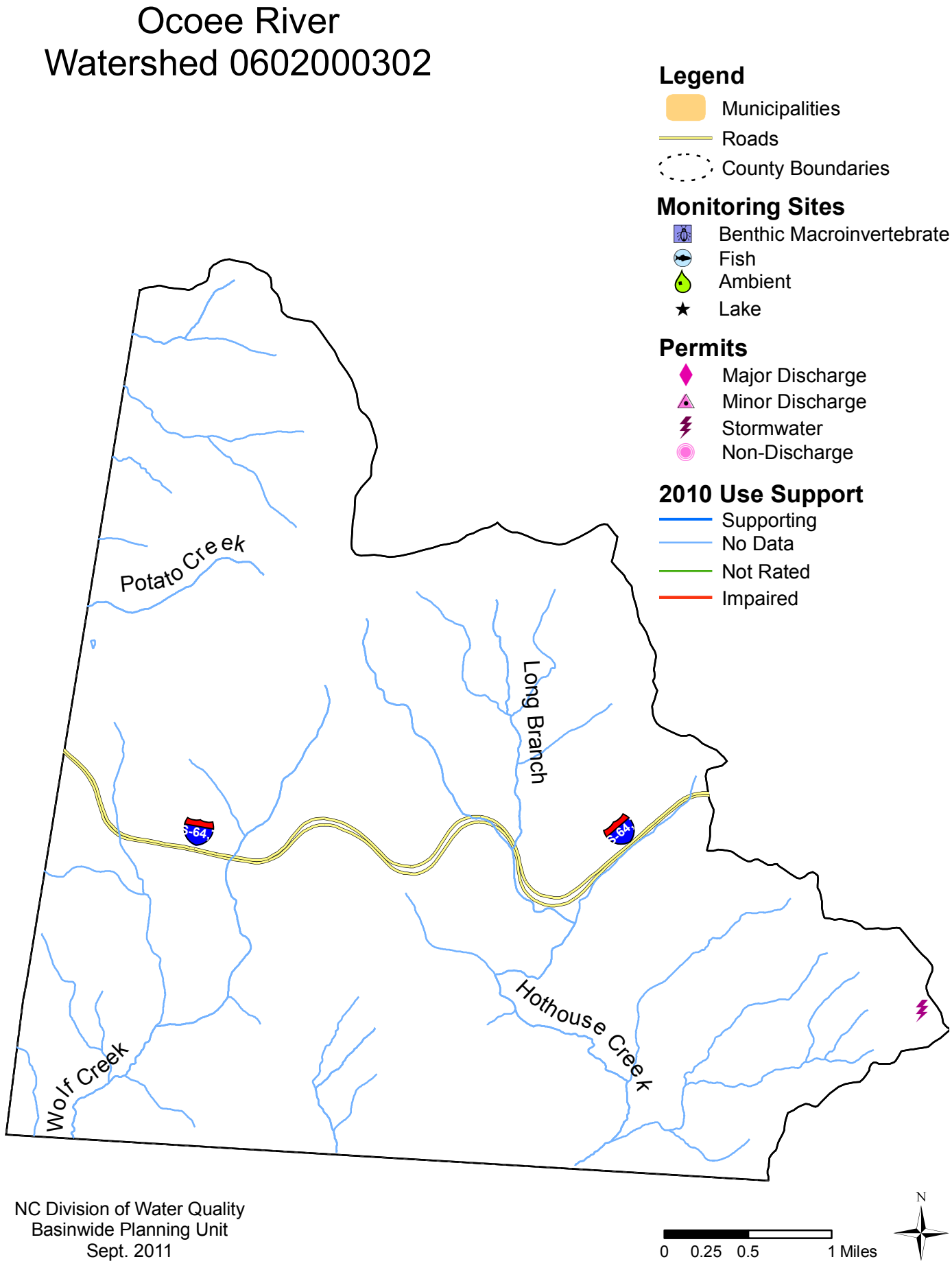


Figure 1-1: Ocoee River Watershed Map

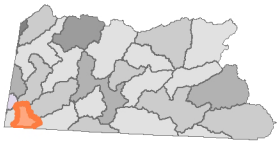


Protection and Restoration Opportunities

The following section provides more detail about specific streams where special studies have occurred or stressor sources information is available. Specific stream information regarding basinwide biological samples sites are available in Appendix 1B. Use support information on all monitored streams can be found in Appendix 1A. Detailed maps of each of the watersheds are found in Appendix 1C or by clicking on the following small maps.

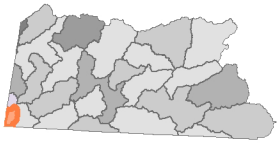
To assist in identifying potential water quality issues citizens, watershed groups and resource agencies can gather and report information through our Impaired and Impacted Stream/ Watershed survey found here: http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey.

Hothouse Creek (HUC 060200030204)



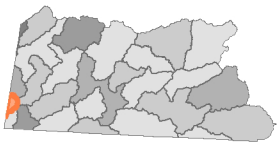
There are three named streams in this subwatershed that all drain south into Georgia, including: Synacia Creek [AU#1-91-2] and Long Branch [AU# 1-91-1] which are tributaries to Hothouse Creek [AU# 1-91]. There are no DWQ monitoring stations in this subwatershed. Additional information is needed about water quality conditions, restoration, and protection opportunities in this subwatershed.

Wolf Creek-Toccoa River (HUC 060200030201)



Wolf Creek [AU# 1-92] is the only waterbody in the North Carolina portion of this subwatershed which drains to Georgia. There are no DWQ monitoring stations in this subwatershed. Additional information is needed about water quality conditions, restoration, and protection opportunities in this subwatershed.

North Potato Creek (HUC 060200030209)



The headwaters of North Potato Creek [AU# 1-93-1] and Potato Creek [AU# 1-93] are found on the North Carolina portion of this subwatershed. There are no DWQ monitoring stations in this subwatershed. Additional information is needed about water quality conditions, restoration, and protection opportunities in this subwatershed.

Local Conservation Initiatives

Chapter Topics

- SWCD
- EEP
- 319 Grants
- WaDE

Soil and Water Conservation District Operations

The soil and water conservation districts in North Carolina are comprised of a five-member Board of Supervisors for each county in the state staffed by resource professionals in the district, usually with federal, state, and local funds. This group establishes local resource priorities. This structure allows the local district to call upon federal, state, local, non-profit, non-government, and other natural resource groups for technical, financial, planning, and implementation support to restore, enhance, and/or maintain the natural resource base at the local level.

The North Carolina Agricultural Cost Share Program

The NC Agricultural Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into the state's waters. The program, administered by the NC Division of Soil and Water Conservation (now within the NC Department of Agriculture and Consumer Services) and managed by the local districts, helps owners and renters of established agricultural operations improve their on-farm management by using best management practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater pollution. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divide the approved BMPs into five main purposes or categories:

• Sediment/Nutrient Delivery Reduction from Fields - Sediment/nutrient management measures include planned systems that prevent sediment and nutrient runoff from fields into streams. Practices include: field borders, filter strips, grassed waterways, nutrient management strategies, riparian buffers, water control structures, streambank stabilization, and road repair/stabilization.

• Erosion Reduction/Nutrient Loss Reduction in Fields - Erosion/nutrient management measures include planned systems for reducing soil erosion and nutrient runoff from cropland into streams. Practices include: critical area planting, cropland conversion, water diversion, long-term no-till, pastureland conversion, sod-based rotation, stripcropping, terraces, and Christmas tree conservation cover.

• Stream Protection from Animals - Stream protection management measures are planned systems for protecting streams and streambanks. Such measures eliminate livestock access to streams by providing an alternate watering source away from the stream itself. Other benefits include reduced soil erosion, sedimentation, pathogen contamination and pollution from dissolved, particulate, and sediment-attached substances. Practices include: heavy use area protection, livestock exclusion (i.e., fencing), spring development, stream crossings, trough or watering tanks, wells, and livestock feeding areas.

• Proper Animal Waste Management - A waste management system is a planned system in which all necessary components are installed for managed liquid and solid waste to prevent or minimize degradation of soil and water resources. Practices include: animal waste lagoon closures, constructed wetlands, controlled livestock lounging area, dry manure stacks, heavy use area protection, insect and odor control, stormwater management, waste storage ponds/lagoons, compost, and waste application system.

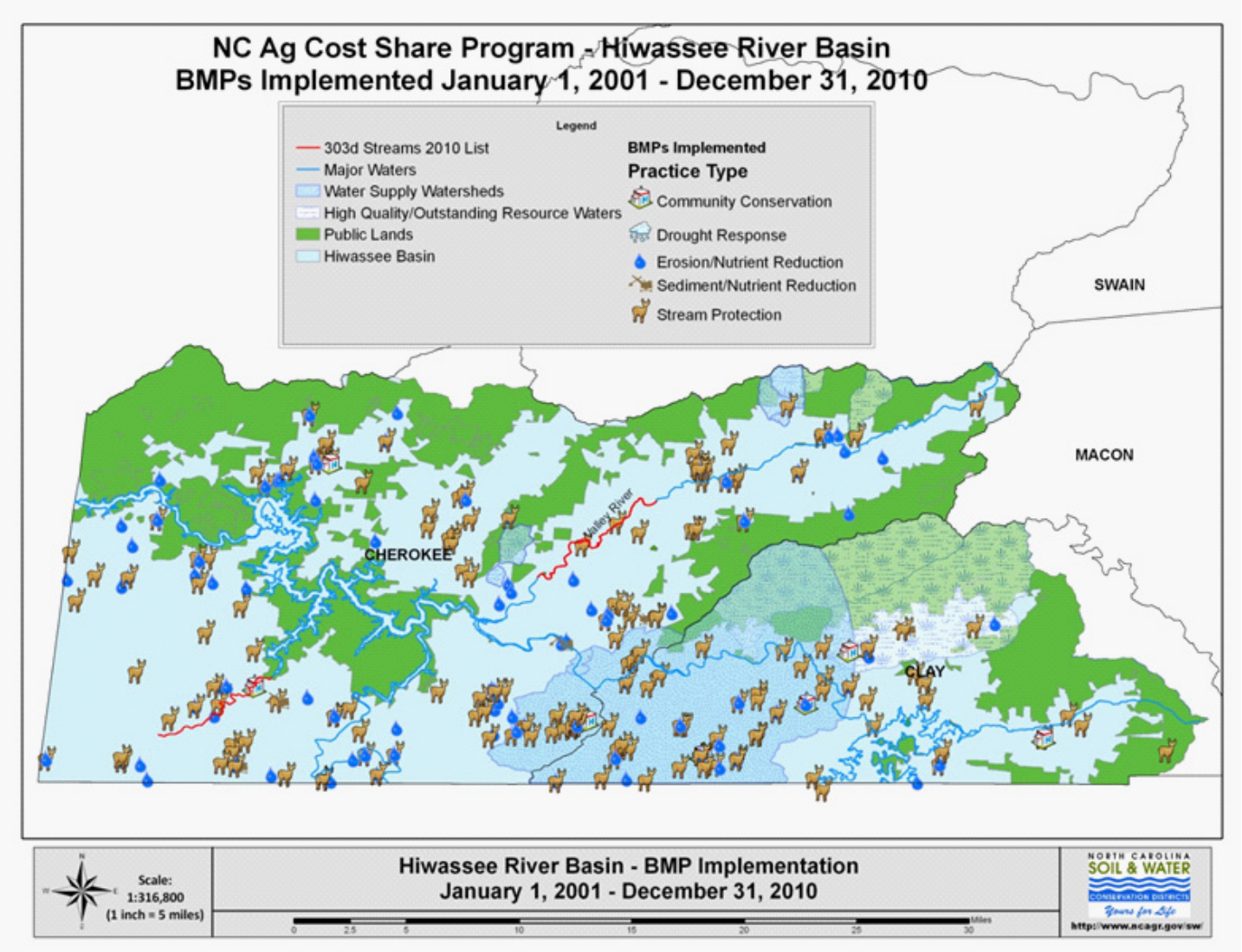
• Agricultural Chemical (agrichemical) Pollution Prevention - Agrichemical pollution prevention measures involve a planned system to prevent chemical runoff to streams for water quality improvement. Practices include: agrichemical handling facilities and fertigation/chemigation back flow prevention systems.

A full listing of all the BMPs and the categories they are grouped in is available at the following link (under Section V: Best Management Practice Guidelines): http://www.ncagr.gov/sw/acspprogrammanual.html

The practices mentioned above (please note, this is a partial list) have calculated water quality benefits associated with the implementation of the BMP. The benefits calculated include: affected acres, nitrogen reductions, phosphorus reductions, tons of soil saved, and the proper management of nitrogen and phosphorus resulting from animal waste. Within the Hiwassee Basin from 2001, 1512 individual BMPs were installed that affected over 33,000 acres. The majority of these practices are categorized as "Stream Protection" measures. Stream Protection practices accounted for nearly 73% of the affected area. Nitrogen and phosphorus reductions were achieved primarily by Erosion/Nutrient Reduction practices however. Over 85% of the soil savings was achieved through Streamside Protection practices.

Figure 1-1 is a map installed by the NC Agricultural Cost Share Program for the period January 1, 2001 through December 31, 2010:

Figure 1-1: Agriculture BMPs



NC Ecosystem Enhancement Program (EEP)

EEP uses watershed planning at two scales (basinwide and local) to identify the best locations to implement stream, wetland and riparian buffer restoration/enhancement and preservation projects. The EEP planning process considers where compensatory mitigation (under provisions of the Clean Water Act) is needed, and how mitigation efforts might contribute to the improvement of water quality, habitat and other vital watershed functions in the state. Watershed planning requires GIS data analysis, stakeholder involvement, water quality monitoring, habitat assessment and consideration of local land uses and ordinances. It is a multi-dimensional process which considers science, policy and partnership. For more information on EEP's mission, processes and products, please visit http://portal.ncdenr.org/web/eep/home.

River Basin Restoration Priorities

EEP River Basin Restoration Priorities (RBRPs) are focused on the identification of Targeted Local Watersheds (TLWs) within the 8-digit Cataloging Units (subbasins) that comprise individual river basins. TLWs represent priority areas (14-digit Hydrologic Units or HUs) for the implementation of stream and wetland mitigation projects. GIS screening factors considered in the selection of TLWs include: documented water quality impairment and habitat degradation, the presence of critical habitat or significant natural heritage areas, the presence of water supply watersheds or other high-quality waters, the condition of riparian buffers, estimates of impervious cover, existing or planned transportation projects, and the opportunity for local partnerships. Recommendations from local resource agency professionals and the presence of existing watershed projects are given significant weight in the selection of TLWs. RBRP documents (and TLW selections) for each of the 17 river basins in North Carolina are updated periodically to account for changing watershed conditions, increasing development pressures and local stakeholder priorities.

The most recent update to the Hiwassee River Basin TLWs occurred in 2008. Eleven 14-digit HUs (of 22 total in the basin) have been selected as TLWs by EEP in the Hiwassee River basin:

- Hiwassee River/Sweetwater Creek (06020002060010)
- Brasstown Creek (06020002090010)
- Unnamed Tributaries to Hiwassee River (06020002090020)
- Upper Valley River (06020002100010)
- Middle Valley River (06020002100020)
- Lower Valley River (06020002100030)
- Peachtree Creek (06020002100040)
- Mission Creek (06020002100050)
- Martins Creek (06020002170010)
- Persimmon Creek (06020002180010)
- South Shoal/North Shoal/Camp Creek (06020002180020)

The 2008 Hiwassee RBRP, including maps and a summary table of Targeted Local Watersheds, can be found at http://portal.ncdenr.org/web/eep/rbrps/hiwassee.

Local Watershed Planning

EEP Local Watershed Planning (LWP) initiatives are conducted in specific priority areas (typically a cluster of two or three Targeted Local Watersheds) where EEP and the local community have identified a need to address critical watershed issues. The LWP process typically takes place over a two-year period, covers a planning area around 50 to 150 square miles, and includes three distinct phases: I - existing data review and preliminary watershed characterization (largely GIS-based); II – detailed watershed assessment (including water quality & biological monitoring and field assessment of potential mitigation sites); and III – development of a final Project Atlas and Watershed Management Plan. EEP collaborates with local stakeholders and resource professionals throughout the process to identify projects and management strategies to restore enhance and protect local watershed resources. There is one LWP in the basin, Peachtree-Martins Creek. This plan is summarized in the Brasstown Creek Watershed chapter.

Section 319 Grant Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration and restoration projects. In 2009/2010, approximately $450,000 was available annually through base funding for demonstration and education projects across the state. An additional $2 million was available annually through incremental funding for restoration projects on impaired waters statewide. All projects must provide non-federal matching funds of at least 40 percent of the project's total costs. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina Section 319 Grant Program application process is available online as well as descriptions of projects and general Section 319 Program information.

The Valley River is Impaired for turbidity violations. The Hiwassee River Watershed Coalition received two 319 grants to reduce excess sedimentation to the River. Grant funds were used to complete the Valley River Watershed Restoration Plan in 2010, which links excess sedimentation in the watershed to erosion of stream banks, uncontrolled stormwater runoff, and a lack of adequate riparian buffers, among other sources. The plan calls for a 22% reduction (3,915 tons/yr) in Total Suspended Solids in order to decrease turbidity to levels that meet the state's water quality standards. The second 319 grant is to implement the Valley River Watershed Restoration Plan by working in partnership with the Cherokee Co. SWCD and others to (a) correct erosion and instability problems along another mile of stream resulting an additional TSS reduction of 650 tons/yr (17% of the needed reduction), (b) installing a variety of stormwater best management practices on the Andrews High School campus, and (c) educating people in the watershed about the causes and sources of the Valley River's impairment, controlling stormwater runoff and the value of riparian buffers.

WaDE

In the Hiwassee River basin, wastewater from many households is not treated at wastewater treatment plants associated with NPDES discharge permits. Instead, it is treated onsite through the use of permitted septic systems. Wastewater from some of these homes illegally discharges directly to streams through what is known as a "straight pipe". In other cases, wastewater from failing septic systems makes its way to streams or contaminates groundwater. Straight piping and failing septic systems are illegal discharges of wastewater into waters of the State.

The discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemical nutrients, disease pathogens and endocrine disrupting chemicals. Special study requests in the Hiwassee River Basin led to an increase in number of streams sampled for bacteria and have led to several new stream impairments. As of 2012, there are five streams (23 stream miles) Impaired because of high fecal coliform bacteria levels. The economies of the counties in this basin are highly dependent upon river recreation, especially for tourists and seasonal residents. Reducing bacterial contamination is crucial for supporting a tourist economy. In order to protect human health and maintain water quality, straight pipes must be eliminated and failing septic systems should be repaired.

The NC Wastewater Discharge Elimination (WaDE) Program was actively helping to identify and remove straight pipes (and failing septic systems) in the western portion of North Carolina. This program used door-to-door surveys to locate straight pipes and failing septic systems, and offered deferred loans or grants to homeowners who had to eliminate the straight pipes by installing a septic system. This program was cut from the State budget and is no longer in operation.

Forestry

Forestry in the Hiwassee River Basin: 2012 Update

Forestland Ownership*

Approximately 55% of the forestland in the basin is privately-owned, with the remainder being publically-owned land, primarily the Nantahala National Forest.

* 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 Water Quality Regulations

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (Article 4-GS113A, referred to as "SPCA"). However, forestry operations may be exempted from specific requirements of the SPCA if the operations meet the compliance performance 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 FPG performance standard rule-codes and topics include:
.0201 Streamside Management Zone (SMZ)
.0202 Prohibition of Debris Entering Streams and Waterbodies
.0203 Access Road and Skid Trail Stream Crossings
.0204 Access Road Entrances
.0205 Prohibition of Waste Entering Streams, Waterbodies, and Groundwater
.0206 Pesticide Application
.0207 Fertilizer Application
.0208 Stream Temperature
.0209 Rehabilitation of Project Site

The NC Forest Service (NCFS) monitors forestry operations for compliance with these aforementioned laws and/or rules. In addition, the NCFS 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 NCFS are referred to the appropriate State agency for enforcement action. During the period September 1, 2005 through August 31, 2010 there were 137 sites in the basin inspected for FPG compliance with 85% of the sites in compliance upon the initial site inspection.

Other Water Quality Regulations

In addition to the multiple State regulations noted above, NCFS 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 for activities in wetlands;
- The federally-mandated 15 best management practices (BMPs) related to road construction in wetlands;
- The federally-mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S.

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 BMP manual was completed. This comprehensive update to the forestry BMP manual is the

result of nearly four years of effort by the NCFS and a forestry Technical Advisory Committee consisting of multiple sector stakeholders, supported by two technical peer-reviews. The forestry BMP manual describes measures that may be implemented to help comply with the forestry regulations while protecting water quality. Copies of the forestry BMP manual can be obtained at a County or District office, or online: http://www.ncforestservice.gov/water_quality/bmp_manual.htm.

From 2006 to 2008, the NCFS conducted its second cycle of BMP implementation site assessment surveys to evaluate the use of forestry BMPs, and qualitatively assess the strengths and weaknesses of BMPs in regards to protecting water quality. Statewide, the BMP surveys were completed on 212 active logging sites and the average BMP implementation rate observed during this survey was 85 percent.

- In the Hiwassee basin we surveyed 3 sites, evaluated 142 individual BMPs, and observed a BMP implementation rate of 51 percent.

A copy of the survey report (PDF, 5MB) is available from the website http://www.ncforestservice.gov/publications/WQ0210.pdf. These periodic, recurring BMP surveys serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP development, implementation and training.

Protecting Stream Crossings with Bridgemats

The NCFS 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. Bridgemats are available for use in this river basin, and have been for several years. Periodic status reports, a list of bridgemat suppliers, and additional information are available at http://www.ncforestservice.gov/water_quality/bridgemats.htm.

Forest Harvesting, Regeneration & Planning

During this last planning period, more than 880 acres of land were established or regenerated with forest trees across the basin. During this same time period, an estimated 930 acres had a final harvest conducted and a little more than 1,100 acres had an intermediate harvest conducted. In addition, 307 individual forestry-related management plans were produced for landowners, encompassing more than 19,300 acres of forestland.

Christmas Tree Production

The Christmas tree industry is predominant across many counties in the North Carolina mountains. It should be noted that the N.C. Forest Service does not oversee regulations or land-clearing activities associated with Christmas tree production. These activities are not considered forestry (“silviculture”) activities, but are instead deemed to be an agricultural or horticultural activity. Personnel with the County Soil & Water Conservation District or USDA-Natural Resources Conservation Service (NRCS) can provide BMP assistance. Additional information about Christmas trees is available from the N.C. Cooperative Extension Service: http://www.ces.ncsu.edu/fletcher/programs/xmas/ctnotes/index.html.

North Carolina Forest Service (NCFS) Contacts for the Hiwassee River Basin:		
Office Location	**Contact Person**	**Phone**
Cherokee County	County Ranger	(828) 837-5426
Clay County	County Ranger	(828) 837-5426
Sylva District (District-9)	Assistant District Forester	(828) 586-4007
Western region (Region-3)	Asst. Regional Forester	(828) 665-8688
State Central Office, Raleigh	Nonpoint Source Branch - Forest Hydrologist	(919) 857-4856
Griffiths Forestry Center, Clayton	Water Quality & Wetlands Staff Forester	(919) 553-6178 Ext. 230

References & Websites

NC Division of Water Quality

Biological Assessment- http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=722215&name=DLFE-28224.pdf

Ambient Report- http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=722215&name=DLFE-28602.pdf

Lakes & Reservoir Assessment- http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=722215&name=DLFE-29890.pdf

303(d) List- http://portal.ncdenr.org/web/wq/ps/mtu/assessment

Impaired & Impacted Survey- http://portal.ncdenr.org/web/wq/ps/bpu/about/impactedstreamssurvey

Classification Rules- http://portal.ncdenr.org/web/wq/ps/csu/rules

Trout Water- http://portal.ncdenr.org/c/document_library/get_file?uuid=f4f0b765-7892-4681-885b-95f4ef26f806&groupId=38364

Supplemental Guide- http://portal.ncdenr.org/web/wq/ps/bpu/about/supplementalguide

NC Ecosystem Enhancement Program

http://portal.ncdenr.org/web/eep/rbrps/hiwassee

Phase II- http://www.nceep.net/services/lwps/Hiwassee/PMC_WAR_Final_May07-Final_Text.pdf

DWQ Report- http://www.nceep.net/services/lwps/Hiwassee/PMC_DWQwaterquality_study.pdf

Peachtree- Martin Fact Sheet- http://www.nceep.net/services/lwps/Hiwassee/Hiwassee.pdf

Watershed Planning- http://www.nceep.net/services/lwps/pull_down/by_basin/Hiwassee_RB.html

Hiwassee River Watershed Coalition, Inc.

http://www.hrwc.net

Brasstown Creek Restoration Project - http://www.hrwc.net/brasstown.htm

Lake Chatuge Watershed Action Plan - http://www.hrwc.net/lakechatugeplan.htm

Nonpoint Source Pollution Fact Sheets - http://www.hrwc.net/publications.htm

Peachtree-Martins Creek Project - http://www.hrwc.net/peachtreemartinslwp.htm

Valley River Restoration Project - http://www.hrwc.net/valley.htm

Land Trust for the Little Tennessee

http://www.ltlt.org/

Tennessee Valley Authority

http://www.tva.gov/environment/ecohealth/hiwassee.htm

Lake Chatuge- http://www.tva.com/environment/ecohealth/chatuge.htm

Apalachia Lake- http://www.tva.com/environment/ecohealth/apalachia2.htm

NC Department Health and Human Services

Fish Advisory- http://epi.publichealth.nc.gov/fish/current.html

NC Division of Water Resources

Flow- http://www.ncwater.org/Permits_and_Registration/Instream_Flow/

NC Forest Service

BMP Manual - http://www.ncforestservice.gov/water_quality/bmp_manual.htm

BMP Survey Report - http://www.ncforestservice.gov/publications/WQ0210.pdf

Bridgemats - http://www.ncforestservice.gov/water_quality/bridgemats.htm

NC Division of Land Resources

Erosion & Sediment Control Resources- http://portal.ncdenr.org/web/lr/publications

Appendix 1A

Use Support Ratings for All Monitored Waterbodies

IR & 303(d) list Category Codes

IR Category	Integrated Reporting Categories for individual Assessment Unit/Use Support Category/ Parameter Assessments. A single Assessement Unit (AU) can have multiple assessments depending on data available and classified uses.
1	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1nc	DWQ have made field determination that parameter in exceedance is due to natural conditions.
1b	Parameter is supporting uses in the AU and there is a management strategy in place to address exceedances of the parameter.
1r	Parameter is supporting uses in the AU and there was restoration activity to address past standards violations of this parameter.
1t	Parameter is supporting uses in the AU and there is an approved TMDL for the parameter.
2	All monitored uses are supporting or not rated and there are no impaired assessments in the AU
3a	Parameter assessment is Not Rated due to insufficient or inconclusive data.
3b	Parameter assessment is Not Rated due to insufficient or inconclusive data and there is a management strategy in place to address exceedances of the parameter.
3n2	Not Rated for Chlorophyll a. Exceeds the evaluation level but there are less than 10 samples.
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4b	Parameter assessment is impaired and there is a management strategy in place to address exceedances of the parameter.
4c	Parameter assessment is impaired and there is a dam upstream or downstream that is causing exceedances of the parameter.
4cr	Impaired for loss of Recreation use and there is no data for TMDL (swimming advisories posted)
4cs	Impaired loss of Shellfish Harvesting us, no data for TMDL (non-approved area)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4t	Parameter assessment is impaired and there is an approved TMDL for theparameter.
4s	Ecological/biological integrity is Impaired and there is separate category 5assessment for another aquatic life parameter.
5	Parameter assessment is impaired and a TMDL development is required for the parameter.
5r	Assessed as impaired watershed is in restoration effort status

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Hiwassee River Basin — **Chatuge Lake-Hiwassee River Watershed 0602000201**

Hiwassee River Basin — Hiwassee River Subbasin 06020002

Hiwassee River Basin — **Chatuge Lake-Hiwassee River Watershed 0602000201**

1-(1)	**HIWASSEE RIVER (Chatuge Lake below elevation 1928)**	From North Carolina-Georgia State line to Chatuge Dam	**3,533.1 FW Acres**		B
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
1-5	**Shooting Creek**	From source to Chatuge Lake	**5.6 FW Miles**		C;Tr
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

Hiwassee River Basin — **Tusquitee Creek-Hiwassee River Watershed 0602000202**

1-21-5	**Big Tuni Creek**	From source to Tusquitee Creek	**6.1 FW Miles**		C;Tr,HQW
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1-38	**Calhoun Branch**	From source to Hiwassee River	**2.3 FW Miles**		WS-IV
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2006	
1-27-(5.5)	**Fires Creek**	From Rocky Cove Branch to Hiwassee River	**8.6 FW Miles**		WS-IV;Tr,OR
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
3a	**Ecological/biological Integrity FishCom**	Not Rated Bioclassification	Aquatic Life	2004	
1-41	**Mission Branch**	From source to Hiwassee River	**1.8 FW Miles**		WS-IV
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	
1-39	**Sudderth Branch**	From source to Hiwassee River	**1.4 FW Miles**		WS-IV
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	
1-21-(16.5)	**Tusquitee Creek**	From Buckner Branch to Hiwassee River	**1.7 FW Miles**		WS-IV;Tr,HQ
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1-21-(4.5)	**Tusquitee Creek**	From Big Tuni Creek to Buckner Branch	**5.8 FW Miles**		C;Tr,HQW
3a	**Ecological/biological Integrity FishCom**	Not Rated Bioclassification	Aquatic Life	2004	

Hiwassee River Basin — **Brasstown Creek-Hiwassee River Watershed 0602000203**

1-42	**Brasstown Creek**	From North Carolina-Georgia State Line to Hiwassee River	**8.7 FW Miles**		WS-IV
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1	**Ecological/biological Integrity FishCom**	Good-Fair Bioclassification	Aquatic Life	2004	
1-45	**Fall Branch**	From source to Hiwassee River	**1.9 FW Miles**		C
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Hiwassee River Basin — **Brasstown Creek-Hiwassee River Watershed 0602000203**

1-44-4	**Fate Puett Cove Creek**	From source to Peachtree Creek	**2.1**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2006	
1-44-9-3	**Graham Branch**	From source to Slow Creek	**1.9**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2006	
1-(16.5)c	**HIWASSEE RIVER**	From Calhoun Creek below Mission Reservoir to a point 0.6 mile upstream of McComb Branch	**1.5**	**FW Miles**	WS-IV
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	
1-44-5	**Lamb Branch**	From source to Peachtree Creek	**1.7**	**FW Miles**	C
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	
1-42-11	**Little Brasstown Creek**	From source to Brasstown Creek	**4.2**	**FW Miles**	WS-IV
1	**Ecological/biological Integrity FishCom**	Good-Fair Bioclassification	Aquatic Life	2004	
1-43-(2)	**McComb Branch**	From a point 0.1 mile upstream of NC Hwy. 141 to Hiwassee River	**0.6**	**FW Miles**	WS-IV;CA
3a	**Ecological/biological Integrity Benthos**	Not Rated Bioclassification	Aquatic Life	2006	
1-44-9-2	**Messer Branch**	From source to Slow Creek	**2.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2006	
1-44a	**Peachtree Creek**	From source to Pipes Branch	**5.3**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2006	
1-44b	**Peachtree Creek**	From Pipes Branch to Hiwassee River	**3.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2006	
3a	**Ecological/biological Integrity FishCom**	Not Rated Bioclassification	Aquatic Life	2006	
1-44-7	**Pipes Branch**	From source to Peachtree Creek	**3.0**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2006	
1-44-9	**Slow Creek**	From source to Peachtree Creek	**5.2**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Good-Fair Bioclassification	Aquatic Life	2006	
1-44-9-4	**Snead Branch**	From source to Slow Creek	**2.1**	**FW Miles**	C
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2006	

Hiwassee River Basin — **Valley River Watershed 0602000204**

1-52-30-(3)	**Beaver Creek**	From Andrews Water Supply Intake to Valley River	**2.0**	**FW Miles**	C;Tr
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Hiwassee River Basin — **Valley River Watershed 0602000204**

1-52-58	**Colvard Creek**	From source to Valley River	**4.3 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	
1-52-23	**Gipp Creek**	From source to Valley River	**3.6 FW Miles**	C;Tr,ORW	
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2002	
1-52-43	**Hyatt Creek**	From source to Valley River	**4.9 FW Miles**	C	
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2002	
1-52-25a	**Junaluska Creek**	From source to Junaluska Road	**6.5 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1-52-36	**Morris Creek**	From source to Valley River	**4.7 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	
1-52-28	**Tatham Creek**	From source to Valley River	**1.8 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2002	
1-52-39	**Taylor Creek**	From source to Valley River	**4.8 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	
1	**Ecological/biological Integrity FishCom**	Good-Fair Bioclassification	Aquatic Life	2004	
1-52b	**Valley River**	From Gipp Creek above Andrews to Venegeance Creek near Marble	**9.8 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2002	
3a	**Ecological/biological Integrity FishCom**	Not Rated Bioclassification	Aquatic Life	2004	
1-52c	**Valley River**	From Venegeance Creek near Marble to Marble Creek above Murphy	**7.7 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	
3a	**Fecal Coliform (recreation)**	Potential Standards Violation	Recreation	2008	
3a	**High Water Temperature**	Potential Standards Violation	Aquatic Life	2008	
5	**Turbidity**	Standard Violation	Aquatic Life	2008	2008
1-52-45	**Venegeance Creek**	From source to Valley River	**3.6 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2002	
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	
1-52-32	**Webb Creek**	From source to Valley River	**1.6 FW Miles**	C;Tr	
1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Hiwassee River Basin — **Valley River Watershed** — **0602000204**

1-52-40	**Welch Mill Creek**	From source to Valley River	**4.5**	**FW Miles**	C;Tr

1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	

1-52-24	**Worm Creek**	From source to Valley River	**2.6**	**FW Miles**	C;Tr

1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2002	

Hiwassee River Basin — **Nottely River Watershed** — **0602000206**

1-58a	**Nottely River**	From North Carolina-Georgia State Line to Hiwassee Lake Arm	**12.2**	**FW Miles**	C

1	**Ecological/biological Integrity Benthos**	Good Bioclassification	Aquatic Life	2004	

1-58b	**Nottely River**	Hiwassee Lake Arm	**587.4**	**FW Acres**	C

1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	

Hiwassee River Basin — **Hiwassee Lake-Hiwassee River Watershed** — **0602000207**

1-72	**Beaverdam Creek**	From source to Hiwassee Lake	**6.7**	**FW Miles**	C;Tr

1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	

1-48	**Hampton Creek**	From source to Hiwassee River	**2.2**	**FW Miles**	C

1	**Ecological/biological Integrity Benthos**	Not Impaired Bioclassification	Aquatic Life	2006	

1-57	**Hanging Dog Creek**	From source to Hiwassee Lake	**13.2**	**FW Miles**	C

1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1	**Ecological/biological Integrity FishCom**	Good Bioclassification	Aquatic Life	2004	

1-(43.7)	**HIWASSEE RIVER**	From Town of Murphy water supply intake to a point 0.3 mile downstream of Martin Creek	**4.2**	**FW Miles**	WS-V

1	**Ecological/biological Integrity Benthos**	Excellent Bioclassification	Aquatic Life	2004	
1	**Fecal Coliform (recreation)**	No Criteria Exceeded	Recreation	2008	
1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	
1	**Water Quality Standards Water Supply**	No Criteria Exceeded	Water Supply	2008	

1-(50)	**HIWASSEE RIVER (Hiwassee Lake below elevation 1525)**	From a point 0.3 mile downstream of Martin Creek to Laurel Creek	**143.4**	**FW Acres**	C

1	**Fecal Coliform (recreation)**	No Criteria Exceeded	Recreation	2008	
5	**Low pH**	Standard Violation	Aquatic Life	2008	2010

1-(53)	**HIWASSEE RIVER (Hiwassee Lake below elevation 1525)**	From Laurel Creek to Hiwassee Dam	**5,029.5**	**FW Acres**	B

1	**Water Quality Standards Aquatic Life**	No Criteria Exceeded	Aquatic Life	2008	

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year

Hiwassee River Basin — **Hiwassee Lake-Hiwassee River Watershed 0602000207**

1-49 Martin Creek — From source to Hiwassee River — **8.8 FW Miles** C

1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2006	
1	Ecological/biological Integrity FishCom	Good-Fair Bioclassification	Aquatic Life	2006	

1-57-6 Owl Creek — From source to Hanging Dog Creek — **8.5 FW Miles** C

1	Ecological/biological Integrity Benthos	Excellent Bioclassification	Aquatic Life	2004	

1-63a Persimmon Creek (Lake Cherokee) — From source to Lake Cherokee — **5.9 FW Miles** C

1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2006	
5	Ecological/biological Integrity FishCom	Poor Bioclassification	Aquatic Life	2006	2008

Hiwassee River Basin — **Spring Creek-Hiwassee River Watershed 0602000209**

1-(75) HIWASSEE RIVER (Apalachia Lake below elevation 1281) — From River Mile 75 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary to Apalachia Dam — **1,021.5 FW Acres** B

1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	

1-86 Shuler Creek — From source to Hiwassee River — **11.9 FW Miles** C

1	Ecological/biological Integrity Benthos	Excellent Bioclassification	Aquatic Life	2004	

1-77 South Shoal Creek — From source to Apalachia Lake — **12.1 FW Miles** C;Tr

1	Ecological/biological Integrity Benthos	Excellent Bioclassification	Aquatic Life	2004	
3a	Ecological/biological Integrity FishCom	Not Rated Bioclassification	Aquatic Life	2004	

Appendix 1B

Biological Assessment
Macroinvertebrate and Fish Site Sample Results

The full report is available on the DWQ Environmental Sciences Section website:
http://portal.ncdenr.org/web/wq/ess/reports

Appendix S-1

Benthic Macroinvertebrate and Fish Community

Site Summaries for the Hiwassee Basin

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SHOOTING CR	SR 1340	FB60	08/20/09	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.022222	-83.682222	1-5	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	22.2	2100	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	20	30	10 (Road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	36
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	88

Site Photograph

Substrate Mostly cobble and gravel with small amounts of boulder and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/06/09	10691	---	37	---	1.86	Excellent
08/16/04	9487	---	39	---	2.66	Excellent
08/11/99	7943	---	30	---	2.42	Good
08/29/94	6700	68	37	2.89	2.11	Good

Taxonomic Analysis

EPT taxa richness has remained essentially unchanged between the 1994 and 2004 sampling events. The 2009 sample contained a slightly more intolerant benthic community than the 2004 sample resulting in a lower EPT biotic index in 2009. Species collected for the first time at this location include: the pollution sensitive mayflies, *Drunella lata* , *Rhithrogena spp* , *Stenacron pallidum* , and *Habrophlebiodes spp,* the stonefly *Isoperla holochlora* and the moderately tolerant caddisfly *Nectopsyche exquisita* .

Data Analysis

Shooting Creek, a tributary to Chatuge Lake, is located in eastern Clay County. The watershed is mostly forest with scattered areas of low density housing, row crops and pasture. A road parallels large portions of this waterbody and resulted in impacts to the riparian zone and produced notable areas of erosion along the stream banks. Despite these habitat issues, the 2009 assessment resulted in the lowest biotic index ever recorded for this stream.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BIG TUNI CR	**SR 1311**	**FB13**	**07/06/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.096111	-83.706389	1-21-5	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr, HQW	5.3	2240	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.6
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	16
pH (s.u.)	6.0
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	15
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph

Substrate Good mix of boulder, cobble, gravel with small amounts of sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/06/09	10692	---	35	---	1.83	Good
08/16/04	9488	---	48	---	1.59	Excellent
08/11/99	7941	---	45	---	1.61	Excellent
07/13/94	6574	62	37	2.09	1.55	Excellent
03/31/89	4895	83	45	2.89	2.11	Excellent

Taxonomic Analysis

A dramatic drop in EPT richness occurred since 2004 driven mostly by a decrease in mayfly and caddisfly taxa. Mayfly taxa not collected in 2009 but collected previously include *Baetis flavistriga* , *B. pluto* , *Ephemerella spp* , *Eurylophella spp* , *Serratella spiculosa* and *Leucrocuta spp* . Caddisfly taxa include *Nyctiophylax* , *Lype diversa* , *Rhyacophila atrata* and *R. carolina* . Five of the aforementioned taxa are very sensitive to pollution with tolerance values of 2.0 or less. The remaining five are moderately tolerant with tolerance values ranging from 2.4 to 6.9.

Data Analysis

Big Tuni Creek is located in northern Clay County and drains a portion of the Nantahala National Forest. The watershed is predominantly forested. Big Tuni Creek rated Excellent from 1989 to 2004 but dropped to Good in 2009. However, only two more taxa were needed for an Excellent rating. At the time of sampling, water levels were low which may have contributed to a lower taxa richness. Given the protected nature of this watershed, the borderline Good bioclassification is likely the result of less habitat being available for invertebrate colonization as a result of drought effects and in all likelihood is not attributable directly to anthropogenic influence.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
TUSQUITEE CR	**SR 1300**	**FB68**	**08/16/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.070278	-83.816667	1-21-(16.5)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	42.8	1825	12	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	60	20	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.2
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	20
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	9
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Site Photograph

Substrate A mix of bedrock, boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10714	105	45	3.73	2.44	Excellent
08/16/04	9489	119	51	4.07	2.75	Excellent
08/11/99	7942	84	39	3.49	2.70	Excellent
03/30/89	4890	90	47	3.10	2.35	Excellent

Taxonomic Analysis

The 2009 benthic community composition was diverse, containing many pollution sensitive taxa, and as similar to previous collections. However, many taxa were new records for this site and included the mayflies *Plauditus punctiventris* , *Baetisca berneri* , *Ephemera spp* ; the caddisflies *Ceratopsyche morosa* , *Molanna tryphena* , *Polycentropus spp* and the Chironomids *Diamesa spp* , *Paracladopelma spp* , *Paratendipes spp* , *Procladius spp* and *Rheocricotopus robacki* .

Data Analysis

This site on Tusquitee Creek is approximately 0.5 miles above the confluence with the Hiwassee River. Despite very narrow riparian vegetation and some bank erosion along both banks, Tusquitee Creek has never rated lower than Excellent. It maintained an Excellent rating in 2009 indicating the water quality remains stable.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
FIRES CR	**SR 1344**	**FB11**	**08/17/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.095000	-83.858611	1-27-(5.5)	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WSIV; Tr, ORW	20.6	1900	9	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (Picnic area)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	12
pH (s.u.)	6.3
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph

Substrate Mix of boulder, cobble, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10715	71	43	3.12	2.75	Excellent
08/17/04	9493	118	53	3.72	2.57	Excellent
08/11/99	7940	77	44	2.91	2.39	Excellent
08/29/94	6702	81	36	3.51	2.25	Good

Taxonomic Analysis

The benthic community composition was relatively similar to previous collections. However, midge diversity decreased from 37 taxa in 2004 to seven taxa in 2009, the lowest ever recorded at this location. This reduction contributed to a lower BI in 2009 compared to the BI recorded in 2004. Taxa collected at this location for the first time include the mayfly, *Habrophlebioides spp* and the dragonfly, *Hagenius brevistylus* .

Data Analysis

The entire Fires Creek watershed is undisturbed forest and drains a portion of the Nantahala National Forest in northwestern Clay County. Thirteen samples have been collected from this location since 1985. Of those, only 2 samples have rated lower than Excellent. Both samples, which were taken in 1994 (July and August) immediately after severe flooding, rated Good. The lower bioclassifications were most likely due to scour effects.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BRASSTOWN CR	**SR 1104**	**FB18**	**08/14/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	34.999444	-83.926944	1-42	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	3.1 (NC Portion)	1625	9	0.6

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	0	30	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.6
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	39
pH (s.u.)	7.3

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	7
Pool Variety (10)	10
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	70

Site Photograph

Substrate A mix of bedrock, boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/09	10693	84	40	4.96	4.34	Good
08/14/04	9498	109	53	4.83	3.68	Excellent
08/11/99	7944	77	44	4.55	3.74	Good
07/28/94	6625	---	18	---	4.75	Fair

Taxonomic Analysis

The biotic index here has gradually increased since 1999 suggesting a slight shift to a more tolerant invertebrate community. This is mostly seen by an increase in abundance of moderately tolerant or tolerant taxa and a decrease in abundance of intolerant taxa compared with previous samples. For example, tolerant taxa that increased in abundance include the mayflies *Baetis flavistriga* , *Pseudocloeon propinquum* , *Caenis spp* and the caddisfly *Hydroptila spp* . Intolerant taxa that decreased in abundance include the mayflies *Serratella deficiens* , *Heptagenia marginalis* , *Stenacron pallidum* , the long-lived stonefly *Acroneuria abnormis* , and the caddisflies *Micrasema watauga* and *Ceratopsyche morosa* .

Data Analysis

Brasstown Creek is located in the southwest corner of Clay County near the Georgia state line. This reach drains small portions of the Chattahoochee National Forest in Georgia but its watershed also contains areas of low density housing, pasture and row crops in North Carolina that lie outside of the national forest boundary. Overall, water quality is better than that of 1994 and has remained fairly stable since 1999 but the increasing biotic index suggests a shift to a more pollution tolerant benthic community.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HIWASSEE R	**US 64**	**FB15**	**08/27/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.080556	-84.002778	1-(43.7)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V (upstream); C (downstream)	210.2	1600	50	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	40	10	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	27
pH (s.u.)	7.8

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	20
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	12
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	3
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	75

Site Photograph

Substrate Mostly boulder and cobble with small amounts of gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/27/09	10724	82	37	4.73	3.82	Good
08/18/04	9497	100	46	4.47	3.53	Excellent
08/10/99	7936	73	36	4.36	3.43	Good
08/08/90	5364	79	38	4.36	3.28	Good

Taxonomic Analysis

Other than minor shifts in abundance or presence of taxa, no major changes in the benthic community have occurred. Species collected for the first time at this site include the mayflies, *Heterocloeon anoka* , *Heterocloeon david* , *Maccaffertium mediopunctatum* and the caddisfly *Neophylax consimilis.*

Data Analysis

Due to safety and access issues, the 2009 assessment at this site was moved two river miles downstream of the previous location and is approximately 200 meters upstream of the new highway US 64 bridge. The stream classification changes from WS-V upstream of the bridge to C downstream of the bridge. A hydroelectric power station, located approximately seven miles upstream near Mission, regulates this portion of the river. This segment of the Hiwassee River has been sampled on eight occasions since 1983 and has been rated Good since 1987. With the exception of the 2004 sample, EPT richness has been fairly stable (36-38); however, the gradually increasing biotic index since 1999 suggests the benthic community is becoming slightly more tolerant.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PEACHTREE CR	**SR 1537**	**FB12**	**08/25/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.089722	-83.930556	1-44b	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.2	1675	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.5
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	26
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph

Substrate Mostly cobble with small amounts of boulder and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10717	---	35	---	2.77	Good
08/17/04	9494	---	49	---	2.87	Excellent
08/10/99	7939	---	38	---	2.78	Excellent
07/12/94	6573	---	37	---	2.47	Excellent

Taxonomic Analysis

Small changes in rare and in some cases common taxa were the main differences between the 2009 collection and past collections although the stonefly composition of the 2009 sample is identical to the 1999 and 2004 collections. *Ceratopsyche alhedra* , a caddisfly, was the only taxa collected in 2009 that had not been collected previously.

Data Analysis

Peachtree Creek is located in eastern Cherokee County. The watershed is predominantly forested but has some low density residential areas and agriculture present. Although this site rated Good in 2009 and represents a decrease from previous Excellent bioclassifications, the EPT biotic index was similar to values recorded in 1999 and 2004. Although EPT taxa richness was lower in 2009 compared to previous collections, this assessment was was short of receiving an Excellent rating by only one EPT taxon. This slight decrease in EPT diversity may have been related to drought induced reductions in colonizable habitat and is likely not a result of direct anthropogenic inputs.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MARTIN CR	**SR 1558**	**FB14**	**08/26/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.075278	-84.020833	1-49	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.9	1560	7	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	0	20 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	65
pH (s.u.)	7.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph

Substrate Some boulder, cobble and sand that is heavily coated iwith silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10721	---	25	---	3.51	Good-Fair
08/18/04	9499	---	30	---	3.15	Good

Taxonomic Analysis

The EPT taxa richness has declined from 30 taxa collected in 2004 to 25 taxa in 2009. Many sensitive taxa that were collected as abundant or common in 2004 were absent in 2009 and included the mayflies *Serratella deficiens* , *Epeorus vitreus* , *Heptagenia marginalis* and the caddisflies *Triaenodes ignitus* and *Rhyacophila carolina* . Other sensitive species (the stoneflies *Leuctra spp* , *Acroneuria abnormis* and the caddisfly *Pycnopsyche spp*) were abundant in 2004 but decreased to common or rare in 2009.

Data Analysis

Martin Creek at SR 1558 is approximately 400 meters upstream of its confluence with the Hiwassee River. The watershed is forested but still contains many residential areas associated with the town of Murphy. This water body missed receiving a Good bioclassification by three taxa and the slight decrease in bioclassification in 2009 is likely the result of a drought induced reduction in instream habitat.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
VALLEY R	SR 1554	FB10	08/17/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.138889	-83.980556	1-52c	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	102.3	1590	18	1.0

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	30	40	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Andrews WWTP	NC0020800	1.5

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	52
pH (s.u.)	6.9

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	10
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	64

Site Photograph

Substrate: A mix of bedrock, boulder, cobble, gravel, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10718	78	38	4.50	3.91	Good
08/17/04	9492	100	36	5.03	3.97	Good
08/10/99	7928	80	33	5.08	4.12	Good-Fair
07/11/94	6588	77	29	5.02	4.31	Good-Fair

Taxonomic Analysis

There were several pollution intolerant taxa collected at this location; including the mayflies *Serratella serratoides* , *Epeorus dispar* , *E. vitreus* and *Heptagenia marginalis* ; the stonefly *Paragnetina immarginata* ; and the caddisflies *Ceratopsyche sparna* and *C. morosa* . The number of EPT taxa has increased slightly during the 15 years of sampling, but midges continue to be the dominant group. The mayflies *Heterocloeon davidi* , *Pseudocloeon frondale* , *Stenacron interpunctatum* ; the stonefly *Paragnetina immarginata* ; and the caddisfly *Nectopsyche exquisita* and *Dolophiloides spp* were added to this site's taxa list in 2009.

Data Analysis

The Valley River is a large tributary to the Hiwasse river. It flows from the Cherokee/Graham County line through the towns of Andrews and Murphy to the Hiwassee River. Land use in the watershed includes extensive commercial and residential areas associated with the town of Andrews., row crops throughout the valley and some scattered tracts of forest. The sampling site at SR 1554 is approximately 8 miles downstream of Andrew's WWTP, which has a permitted discharge of 1.5 MGD. Despite some nonpoint source runoff from urban areas and a point source discharger higher in the watershed, EPT richness has gradually increased and the biotic index has decreased, suggesting that water quality is improving at this location.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
JUNALUSKA CR	**SR 1505**	**FB7**	**08/26/09**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.181389	-83.786944	1-52-25a	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	6.7	1950	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	30	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.2
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	31
pH (s.u.)	6.5

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph

Substrate Good mix of boulder, cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10719	---	37	---	2.87	Excellent
08/17/04	9490	---	40	---	2.26	Excellent
08/12/99	7946	---	31	---	3.09	Good
08/31/94	6678	---	22	---	2.51	Good-Fair

Taxonomic Analysis

EPT taxa richness has remained essentially unchanged between the 2004 and 2009 sampling events. Intolerant taxa common or abundant from both the 2004 and 2009 collections include the mayflies *Baetis tricaudatus* , *Leucrocuta spp* , the stoneflies *Acroneuria abnormis* , *Paragnetina immarginata* , *Leuctra spp* , *Tallaperla spp* , and the caddisflies *Ceratopsyche sparna* , *Dolophilodes spp* , *Pycnopsyche spp* and *Neophylax consimilis* .

Data Analysis

Junaluska Creek is a small tributary to the Valley River. It drains some low density residential areas on the outskirts of Andrews but still most of the watershed remains forested. Since the initial 1994 Good-Fair bioclassification, this site has improved to Excellent. In general, the improvement seen in 2004 from the 1994 and 1999 samples has been maintained through 2009 and indicates that water quality in this catchment remains stable.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WELCH MILL CR	**SR 1381**	**FB6**	**08/26/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.195000	-83.903889	1-52-40	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	2.8	1660	4	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (fish farm)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	13
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph

Substrate Mostly bedrock with some boulder, cobble, gravel and sand.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10720	---	27	---	1.46	Good-Fair
08/30/04	9505	---	44	---	1.94	Excellent
06/26/02	8822	---	43	---	1.88	Excellent

Taxonomic Analysis

EPT richness decreased by more than 60% from that measured in 2004. Mayflies which generally require habitats with sufficient flow decreased by 50%. Taxa not collected in 2009 but were collected previously include the mayflies *Baetis pluto* , *Plauditus dubius* group, *Heptagenia spp* , *Leucrocuta spp* , *Maccaffertium modestum* , *Rhithrogena spp* and the caddisflies *Cheumatopsyche spp* and *Neophylax consimilis* . Although still present in the sample, many other taxa declined in abundance from that collected in 2004.

Data Analysis

Upstream from SR 1381, the Welch Mill Creek watershed is entirely within the Nantahala Gamelands and completely forested. Habitat was excellent but flows appeared far below normal. Approximately 150 meters upstream of the bridge, much of the stream water (estimated at 70-80%) was being diverted to a fish farm that was constructed in 2006 and located just downstream of the bridge. In addition, substrate had been arranged to encourage water flow to the water intake. The 2009 sample was collected upstream of the water intake. EPT taxa richness drastically decreased from 44 taxa in 2004 to 27 taxa in 2009. It is likely that the dramatic decrease in EPT taxa collected in 2009 was the result of a drought induced reduction in available habitat and a reduction in flow. This is supported by the absence of the taxa noted above, many of which require robust flow. Nevertheless, the extremely sharp reduction in taxa here greatly exceeds anything observed elsewhere in the Hiwassee basin and warrants further investigation. Resampling this site, as well as sampling below the fish farm is recommended.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HANGING DOG CR	**SR 1331**	**FB8**	**08/17/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.166944	-84.045000	1-57	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.4	1750	8	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	50	0	20 (Road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	17
pH (s.u.)	6.5

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	6
Bank Vegetation (7)	4
Light Penetration (10)	4
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	70

Site Photograph

Substrate Mix of boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10722	---	40	---	3.05	Excellent
08/17/04	9495	---	41	---	2.47	Excellent
08/10/99	7937	---	40	---	2.50	Excellent
07/12/94	6570	---	46	---	2.70	Excellent

Taxonomic Analysis

Small differences exist (mainly among the caddisflies) with the taxa collected at this site between 2004 and 2009 and overall the benthic community here remains diverse, pollution-sensitive, and quite stable. However, several EPT taxa were reported for the first time at the site in 2009 including the mayfly *Maccaffertium ithaca and the caddisflies Apatania spp* , *Hydroptila spp* , and *Hydatophylax spp* .

Data Analysis

Hanging Dog Creek is a tributary to Hiwassee Lake and drains a portion of the Nantahala National Forest north of Murphy, NC. Although much of the watershed is forested, a road follows almost the entire main stem of this water body and has resulted in residential development along much of the stream channel. This along with a few erosional areas and narrow riparian vegetation along both banks resulted in a moderate habitat score. Bottom substrate was diverse but it appears the amount of sand has increased from that noted in previous habitat assessments.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NOTTELY R	**SR 1596**	**FB3**	**08/27/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.010278	-84.111667	1-58	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	238.0	1600	19	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.1
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	31
pH (s.u.)	6.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Site Photograph

Substrate Mostly gravel and cobble with small amounts of boulder and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/27/09	10723	---	26	---	2.98	Good-Fair
08/19/04	9500	---	32	---	2.60	Good
08/12/99	7947	---	33	---	3.36	Good
07/12/94	6571	---	36	---	2.86	Excellent

Taxonomic Analysis

The EPT taxa richness at this location has declined steadily since 1994. Taxa not collected in 2009 that were previously common or abundant include the stoneflies *Tallaperla spp, Perlesta spp* , and the caddisflies *Glossosoma spp* and *Neophylax oligius* .

Data Analysis

The Nottely River, a large tributary to the Hiwassee River, is impounded upstream in Georgia to form the Nottely Reservoir. This site is located downstream of Nottely Lake and receives hypolimnetic discharge from a dam upstream. Based on decreased EPT taxa richness, water quality appears to be declining. The site rated Excellent in 1994, dropped to Good in 1999 and 2004, and continued to drop in 2009 to Good-Fair.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LITTLE BRASSTOWN CR	SR 1565	06/23/09	FF11	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	1	06020002	35.03333333	-83.96277778	1-42-11	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	9.1	1595	5.5	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	47
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	3
Bank Erosion (7)	4
Bank Vegetation (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**55**

Site Photograph

Substrate sand, silt, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-70	19	40	Good-Fair
06/17/04	2004-91	20	44	Good-Fair

Most Abundant Species Creek Chub

Exotic Species Redbreast Sunfish, Green Sunfish

Species Change Since Last Cycle

Gains: Largemouth Bass, Black Redhorse. **Losses:** Banded Darter, Golden Redhorse, Telescope Shiner (pollution intolerant).

Data Analysis

Watershed - drains the southeast corner of Cherokee County. Site is located less than a half mile above the confluence with Brasstown Creek. **Habitats** - Atypical mountain stream with embedded instream habitats due to historical sedimentation of alluvial soils. Primarily sandy runs with boulder and cobble pools; very few riffles. The riparian corridor is intact but consists mostly of overgrown exotic vegetation and is bordered by agricultural fields. More than half of this stream's total length has undergone habitat restoration efforts that began 10 years ago under the direction of the Hiwassee River Watershed Coalition. **2009** - a diverse, yet relatively sparse (total n = 138) assemblage of primarily intermediately tolerant cool and warm water fish was collected, including 1 intolerant species (Rock Bass). **2004-2009 -** all changes (i.e. species gains and losses) in the fish community were among fish species represented by one or two individuals. The NCIBI metrics have remained stable between sampling cycles and indicate little change in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
VENGEANCE CR	**NC 141/SR 1520**	**06/25/09**	**FF6**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.16	-83.92027778	1-52-45	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	7.2	1650	5	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	45	35	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	29
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**83**

Site Photograph

Substrate cobble, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-76	14	48	Good
06/17/04	2004-93	18	56	Good

Most Abundant Species Mottled Sculpin

Exotic Species Rainbow Trout

Species Change Since Last Cycle **No Gains. Losses:** Bigeye Chub, Bluegill, Mirror Shiner, Telescope Shiner (pollution intolerant).

Watershed - located in east-central Cherokee County, and flows north to its confluence with the Valley River less than a mile downstream. **Habitats** -the high gradient instream habitats include short riffles, and runs with a few deeper boulder pools. The riparian corridor is thin but relatively dense, and continues to provide good shade to the stream. **2009** - a moderately rich assemblage of fish was collected, including 2 intolerant species (Rock Bass and Rainbow Trout). **2004 - 2009** - Fewer total fish were collected in 2009 (639 vs 1013 in 2004), but the proportions of species were similar between sample years. Mottled Sculpin remain as the most frequently collected species in this stream (56% of 2009 sample, 47% in 2004); this is likely a response to an abundance of benthic macroivertabrates as a food source and little predation from larger piscivorous species. Altough 4 fewer species were collected in 2009, 3 of these changes were only represented by one individual. The NCIBI score has dropped 8 points since 2004, but the fish community has not changed since the last basin cycle. Nutrient enrichment may be having an effect on the fish community of Vengeance Creek, but overall, water quality remains Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
TAYLOR CR	**SR 1515**	**06/25/09**	**FF4**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.1775	-83.88805556	1-52-39	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	5.7	1685	5	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	40	30	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	27
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	12
Bank Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	**67**

Site Photograph

Substrate cobble, bedrock, gravel, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-77	15	44	Good-Fair
06/18/04	2004-94	15	44	Good-Fair

Most Abundant Species Mottled Sculpin

Exotic Species None

Species Change Since Last Cycle **Gains:** Bigeye Chub, Black Redhorse. **Lossses:** Banded Darter, Rainbow Trout (intolerant exotic).

Data Analysis

Watershed - located in the northeast corner of Cherokee County; the site is located about one-third of a mile upstream of the Valley River, just west of Andrews. The headwaters of this watershed are primarily forested; however, this part of the catchment is largely in agricultural land use. **Habitats** - instream habitats include riffle runs, with side snags and a few bedrock shelves. This stream is a good candidate for cattle exclusion fencing; cattle access throughout this reach has resulted in numerous breaks in the riparian, instability of the banks, and sedimentation. **2009** - a moderately rich and abundant assemblage of fish (n=646) was collected, including one intolerant species (Rock Bass), but no trout (stream is classified as Tr). **2004 - 2009** - the fish community of Taylor Creek has not changed much between sampling cycles; species changes are represented by only 1 to 4 individuals. Livestock sedimentation and nutrient enrichment continues to occur in this watershed. However, the fish community does not seem to be indicating any obvious changes in water quality since the last basin cycle.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HANGING DOG CR	**off SR 1342**	**06/24/09**	**FF5**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.15194444	-84.06111111	1-57	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.7	1665	12	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	50	30	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	17
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	**79**

Site Photograph

Substrate cobble, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-75	15	50	Good
06/16/04	2004-88	15	56	Good

Most Abundant Species Tennessee Shiner

Exotic Species None

Species Change Since Last Cycle **Gains:** Smallmouth Bass, Black Redhorse. **Losses:** Bluegill, Rainbow Trout (exotic).

Data Analysis

Watershed - drains a portion of north central Cherokee County; landuse is primarily forest with agriculture in the lower valleys. **Habitats** - moderate quality instream habitats including good riffles, runs with bedrock veins, a few big pools, and side snags. Vegetation on the right bank in the lower half of the reach has been completely removed with herbicides, leaving the bank prone to erosion during high flow events. The upper part of the right riparian corridor is in much better shape with good quality Rododendron coverage. The riparian corridor on the left is thin but intact and bordered by agriculture. **2009** - a moderately abundant (n=521) fish community with good species richness was collected, including 3 intolerants (Rock Bass, Smallmouth Bass, and Gilt Darter). **2004 - 2009** - All species changes between collections were represented by only 1 individual. NCIBI metrics have remained stable here, with only a slight increase in the percentage of insectivores collected in 2009. Overall, the fish community in this watershed shows healthy characteristics and reflects good water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
VALLEY R	**SR 1409**	**06/25/09**	**FF3**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20361111	-83.79361111	1-52b	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	16.8	1845	8	0.4	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	65	35	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

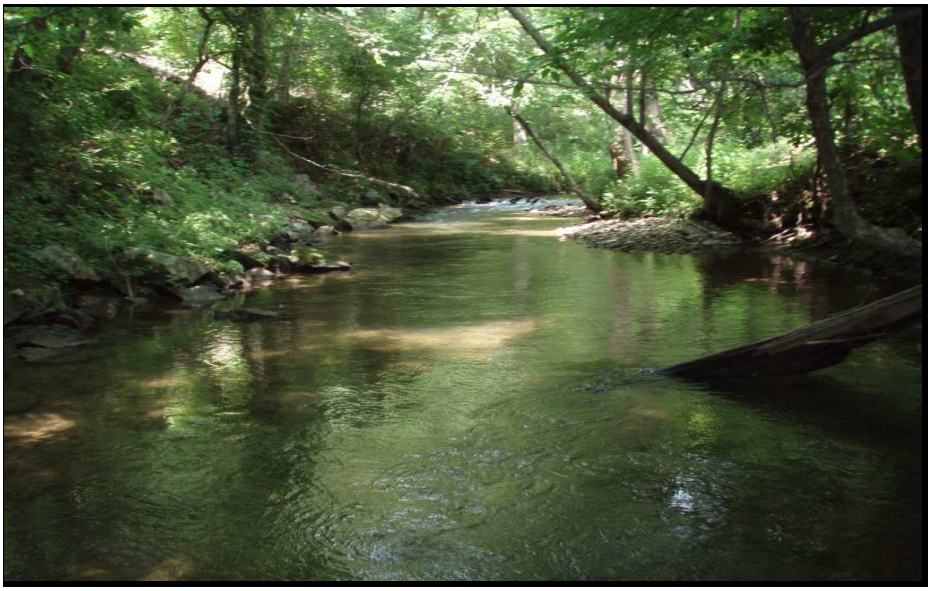
Temperature (°C)	20.3
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	34
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**93**

Site Photograph



Substrate cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-79	13	---	Not Rated
06/18/04	2004-95	11	---	Not Rated

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle **Gains:** Redbreast Sunfish (exotic), Warpaint Shiner, River Chub. **Losses:** Greenside Darter.

Data Analysis

Watershed - Hatchery Supported Trout Waters; drains the easternmost part of Cherokee County; the site is located just east of Andrews. **Habitats** - high quality instream habitats consisting of great riffles, runs with chutes, and pools. The riparian coverage is good throughout most of the sample segment, and provides adequate shading to the stream. **2009** - a moderately rich and abundant (n=652) assemblage of primarily cool water fish was collected. This included 2 intolerant species (Rock Bass, and Rainbow Trout - multiple cohorts). Five Hellbenders of various sizes were also collected and released at this site. **2004 - 2009** - Other than the few species changes (represented by a maximum of 3 individuals per species), the fish community in 2004 and 2009 are very similar. Although Not Rated with the NCIBI, the fish community, and the perserverance of Hellbenders in this catchment are indicatave of high quality water.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
FIRES CR	**SR 1300**	**06/23/09**	**FF10**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.07722222	-83.86444444	1-27-(5.5)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV;Tr, ORW	23	1775	12	0.3	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	80	20	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	13
pH (s.u.)	5.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	8
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**97**

Site Photograph

Substrate cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-69	11	---	Not Rated
06/15/04	2004-86	11	---	Not Rated

Most Abundant Species	Mottled Sculpin	Exotic Species	Rainbow Trout

Species Change Since Last Cycle	None, same exact species collected in 2004 and 2009.

Data Analysis

Waterbody - located in west-central Clay County, draining the counties' western-most edge. The site is about 1 mile upstream of the Hiwassee River confluence. Managed by NCWRC as Wild Trout Waters and Hatchery Supported Trout Waters. **Habitats** - high quality instream habitats including fast riffles and chutes, runs, and bedrock pools. The riparian corridors are very high quality and wide, consisting of Rhododendron and Hemlock stands. The left riparian score dropped 1 point because of a new house along the left bank. **2009** - identical to the fish fauna present here in 2004, an assemblage of cool and cold water species was collected, including three intolerant species (Rock Bass, Telescope Shiner, and Rainbow Trout); Mottled Sculpin represented 70% of the sample; 1 Hellbender and several young-of-year Rainbow Trout were also collected. **2004 - 2009** - Although not yet ratable with the NCIBI, this trout stream continues to exhibit a very stable fish community that is indicative of high quality water and habitats.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PEACHTREE CR	**old US 64**	**06/23/09**	**FF8**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.0775	-83.97444444	1-44b	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.4	1560	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	30	20 (Fill Dirt Operation)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	44
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	10
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	**74**

Site Photograph

Substrate cobble, gravel, boulder, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-71	24	58	Excellent
06/15/04	2004-85	22	58	Excellent

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Green Sunfish, Yellow Perch

Species Change Since Last Cycle **Gains:** Silver Shiner, Yellow Perch (exotic), Longnose Dace. **Losses:** Rainbow Trout (exotic).

Data Analysis

Watershed - located east of Murphy about 1/2 mile above the Hiwassee River confluence; drains the mid-eastern edge of Cherokee County. **Habitats** - Instream habitats include runs, riffles, and side snag pools. The riparian widths remain thin but intact, except where soil was being pushed over the right bank from the adjacent field. The total habitat score has improved by 16 points since 2004, mostly due to higher bank stability and vegetation scores; scoured banks from high flows just prior to the 2004 sample have since healed. **2009 -** an extremely rich and trophically balanced assemblage of cold, cool, and warm water species was collected, including three intolerants (Rock Bass, Silver Shiner, Gilt Darter). Almost twice the total abundance as collected in 2004 (n= 982 vs 535), mostly due to increases in Tennessee Shiner (n=284 vs 77) and Mottled Sculpin (n=327 vs 197). Two hellbenders (pollution intolerant) were also collected in 2009. **2004 - 2009** - the NCIBI metrics have remained stable; despite the elevated specific conductance, the fish community here continues to suggest excellent water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MARTIN CR	**SR 1558**	**06/23/09**	**FF7**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.07527778	-84.02083333	1-49	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9	1560	6	0.25	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	0	0	40 (powerline)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	53
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	5
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate flat cobble, sand, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-72	22	38	Fair
03/23/06	2006-03	20	46	Good-Fair
06/17/04	2004-92	19	38	Fair

Most Abundant Species Highlands Shiner (pollution intolerant)

Exotic Species Redbreast Sunfish, Green Sunfish, Yellow Perch

Species Change Since Last Sample **Gains:** Spotted Bass, Largemouth Bass, Golden Redhorse, Yellow Perch (exotic - present in '04). **Losses:** Black Redhorse, Bluntnose Minnow.

Data Analysis

Watershed - drains part of the southeast corner of Cherokee County; the site is located just below Murphy, about 400 meters above the Hiwassee River confluence. The urban and agricultural land uses of this catchment is reflected in the relatively high conductivity at this site. **Habitat -** instream habitats consist of moderately embedded shallow runs, bedrock shelves, and some side root snags and short riffles. A slight increase in fine silts upon substrates was observed in 2009. Although crossed by the newly constructed US 64 just upstream, the riparian corridor is densely vegetated here, primarily with Rhododendron. **2009** - a moderately abundant (n = 449) and rich assemblage of cool and warm water fish was collected at this regional reference site, including three top predator species (Largemouth Bass, Spotted Bass and young of year Walleye). However, no Rock Bass, Smallmouth Bass or trout were collected. These additions, and the 10 fold increase in the intolerant Highland Shiner in 2009 (n=233 vs 22 in 2006, and 26 in 2004) are likely due to the recruitment opportunities provided by the nearby river. 2004 - 2009 - The fluctuations in ratings here seem to be the result of trophic shifts within the fish community between insectivores and omnivores + herbivores, which may be due to the forementioned recruitment potential. Overall, the cause of impairment is unclear.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SHULER CR	**SR 1323**	**06/24/09**	**FF17**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.18321	-84.28017	1-86	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.6	1239	8	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	20
pH (s.u.)	5.6

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**88**

Site Photograph

Substrate cobble, bedrock, gravel, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-73	17	50	Good

Most Abundant Species	Tennessee Shiner	**Exotic Species**	Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle N/A

Data Analysis

New Site. **Watershed -** almost the entire catchment is managed as Hatchery Supported Trout Waters. Drains the primarily forested, northwestern tip of Cherokee County. **Habitats** - high quality instream habitats consist of cobble and boulder runs, riffles, and a few deep rock vein pools holding trout. The upper portion of the reach consists of one long run-pool. The riparian corridor in this section of the stream is intact and wide. **2009** - a rich and moderately abundant (n=453) community of fish were collected, including three intolerant species (Rock Bass, Rainbow Trout, and Brook Trout). Three darter species and 6 minnow species were also collected. Two hellbenders measuring 201 and 240 mm were also collected and released, indicating high quality water in this catchment. Overall, the NCIBI metrics indicate no apparent issues with water quality in this watershed, and the fish community appears healthy.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRASSTOWN CR	**SR 1111**	**06/22/09**	**FF13**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	34.98805556	-83.89472222	1-42	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	37.3	1710	8.5	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	50	5	45	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None in North Carolina	---	---

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	42
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**84**

Site Photograph

Substrate cobble, gravel, boulder, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/09	2009-68	17	50	Good
06/14/04	2004-84	18	46	Good-Fair

Most Abundant Species Mottled Sculpin

Exotic Species Green Sunfish

Species Change Since Last Cycle **Gains:** Black Redhorse, Creek Chub. **Losses:** Bigeye Chub, Warpaint Shiner, Largemouth Bass.

Data Analysis

Watershed - located in the southwest corner of Clay County, just above the Georgia state line. Drainage is primarily from Towns County and Union County GA. **Habitats** - instream habitats are primarily shallow riffles and runs with side snag pools, and some undercuts. The riparian corridor is thin but functional, and bordered by agricultural fields. **2009** - the fish community continues to be dominated by intermediately tolerant cool and cold water species, including Mottled Sculpin and Tennessee Shiner, which comprise 34% and 25% of the sample, respectively; 2 intolerant species (Rock Bass and Gilt Darter) were also collected here for the second time; Green Sunfish are still the only exotic fish collected here. **2004 - 2009** - 20 fish species are known from this watershed. The conductivity of Brasstown Creek (40 µS/cm in 2004) continues to imply agricultural and municipal inputs from GA. However, with a few exceptions related to species richness, the NCIBI metric scores between sampling years are very similar, with ratings that may suggest a slight improvement to water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SHOOTING CR	SR 1340	06/22/09	FF12	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.02194444	-83.68222222	1-5	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	22.5	2000	9	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	30
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**84**

Site Photograph

Substrate cobble, boulder, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/09	2009-67	11	40	Good-Fair
06/14/04	2004-83	16	40	Good-Fair

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle

Gains: Creek Chub. **Losses:** Yellow Bullhead (exotic), Brown Bullhead, Largemouth Bass, Black Redhorse, Yellow Perch (exotic), Gilt Darter.

Data Analysis

Watershed - Hatchery Supported Trout Waters located in the southeast corner of Clay County; drains to Chatuge Lake. Restoration efforts (installation of rock veins) have been completed in this reach since last cycle. **Habitats** - good quality instream habitas consisting of riffles, runs, and side snag pools. The riparian corridor of this stream is thin, but intact. **2009** - a mixed assemblage of cold, cool, and warm water species was collected with Mottled Sculpin and Central Stonerollers comprising 64% and 21% of the sample, respectively. Two cohorts of intolerant Rainbow Trout were also observed. **2004 - 2009** - species richness dropped from 16 to 11 species, but 5 of 6 losses were represented by only 1 or 2 fish in 2004. A slightly more balanced trophic function was observed in 2009 with an increase in percentage of omnivores + herbivores from 7 to 21%. Reproductive function also increased from 56 to 82% of the fish assemblage with multiple age classes. Overall the fish community in this stream appears to be moderately healthy and stable as indicated by its' repeated bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
TATHAM CR	**US Bus 19**	**06/25/09**	**FF19**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20023	-83.81293	1-52-28	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	8.24	1800	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	35	25	25	5 (power sub-station), 10 (commercial)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.9
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	42
pH (s.u.)	6.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	14
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	**86**

Site Photograph

Substrate flat cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-78	8	---	Not Rated

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle N/A

Data Analysis

New Site. **Watershed** - located in the northeast corner of Cherokee County, just south of Andrews. Landuse in the lower portions of the catchment is a mix of urban and agriculture (reflected in the elevated conductivity); the headwater tributaries are largely forested. **Habitats** - high quality instream habitats consisting of riffles and runs with side snag pools; substrate embeddedness is low. Riparian coverage is good and provides adequate shading for most of the sample reach; the upper part of the reach is in full sun as the stream runs behind a trailer park off of US 19 Business. **2009** - this high gradient trout stream is supporting a highly abundant fish community (n=1072) with relatively low species richness. Mottled Sculpin (representing 77% of the collected sample) may be indirectly influenced by nutrient enrichment through food source abundance. However, this stream is supporting multible age classes of Rainbow Trout, considered pollution intolerant. The existing NCIBI is not applicable to this trout stream because of naturally occuring, low species richness; therefore, the site is Not Rated.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BEAVERDAM CR	**off SR 1331**	**06/24/09**	**FF18**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20549	-84.11877	1-72	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	12.4	1801	6	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	0	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	19.0
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	17
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	**76**

Site Photograph

Substrate cobble, gravel, boulder, silt, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-74	11	---	Not Rated

Most Abundant Species	Mirror Shiner	**Exotic Species**	None

Species Change Since Last Cycle	N/A

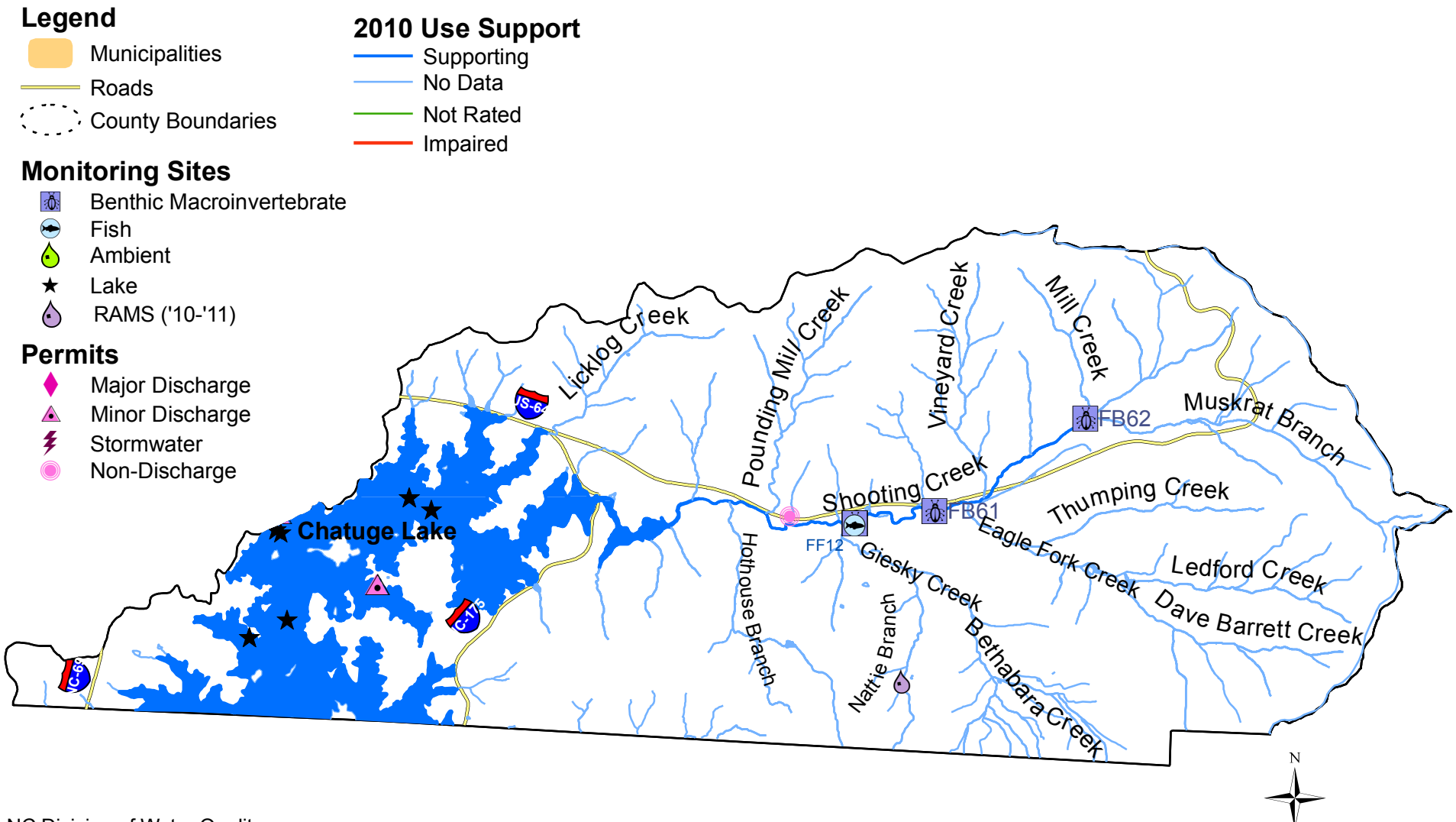
Data Analysis

New Site. **Watershed** - a good portion of the catchment above this site is managed as Hatchery Supported Trout Waters. Drains part of the primarily forested northern edge of Cherokee County just south of the Tennassee line. **Habitats** - instream habitats consist primarily of cobble and boulder runs, riffles, and silty side pools. This section of Beaverdam Creek would be a good candidate for watershed restoration efforts with the installation of cattle exclusion fencing. Breaks in the riparian corridor were abundant on both sides of the stream due to cattle access. **2009** - a moderately rich and abundant mix of intermediately tolerant cool and cold water species was collected. The fish community was skewed towards a high percentage of insectivores, with no intolerant species collected. Also, no top predator species were observed, including Rock Bass, Smallmouth Bass and trout (yet the stream is classified as Tr). Contrary to the sedimentation issues observed in this creek, one intolerant hellbender at 340 mm was collected and released. Application of the current NCIBI is not appropriate for this particular medium diversity mountain stream, so the site is Not Rated. However, there are no obvious water quality issues other than the forementioned agricultural influences.

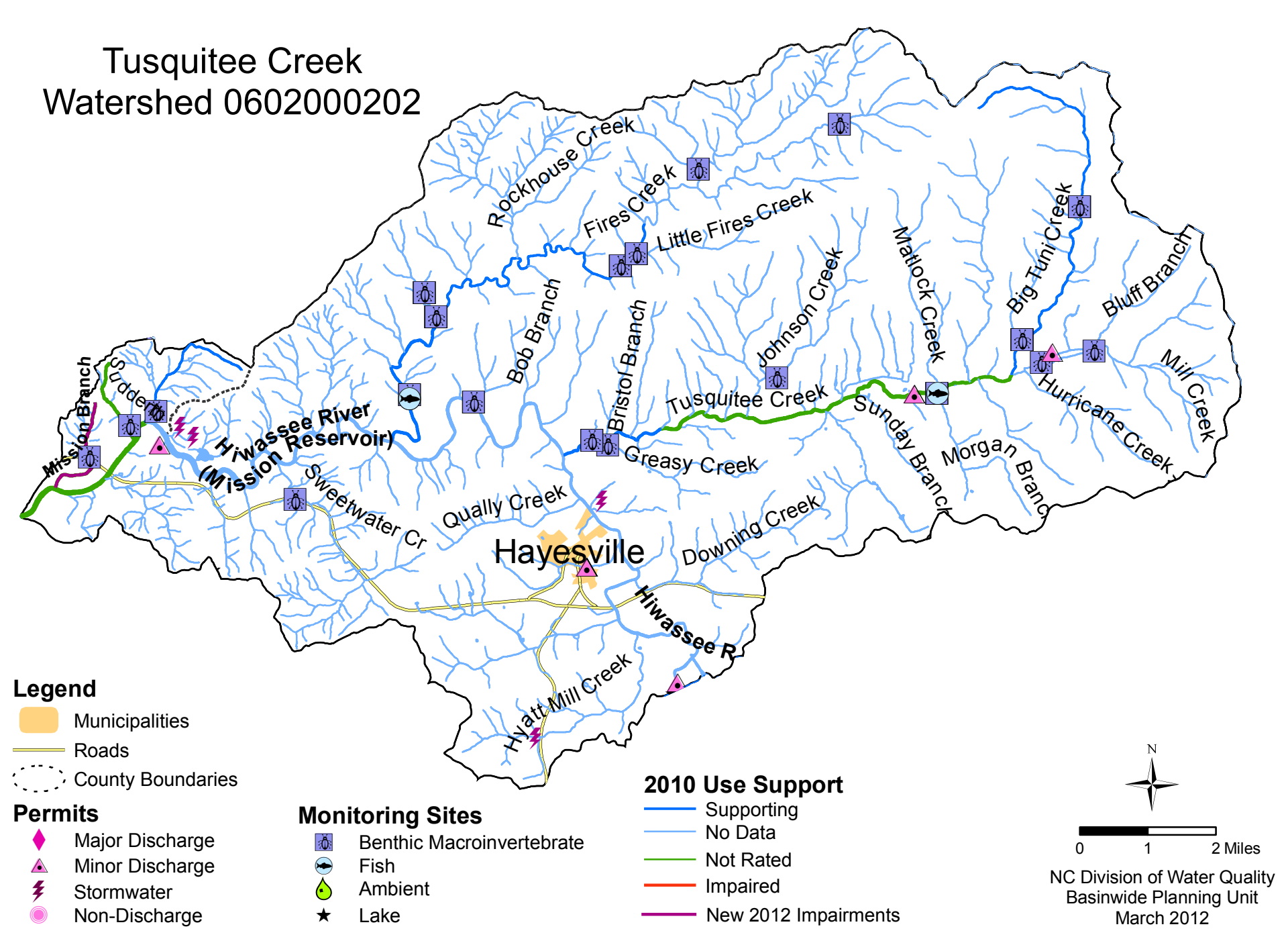
Appendix 1C

Maps

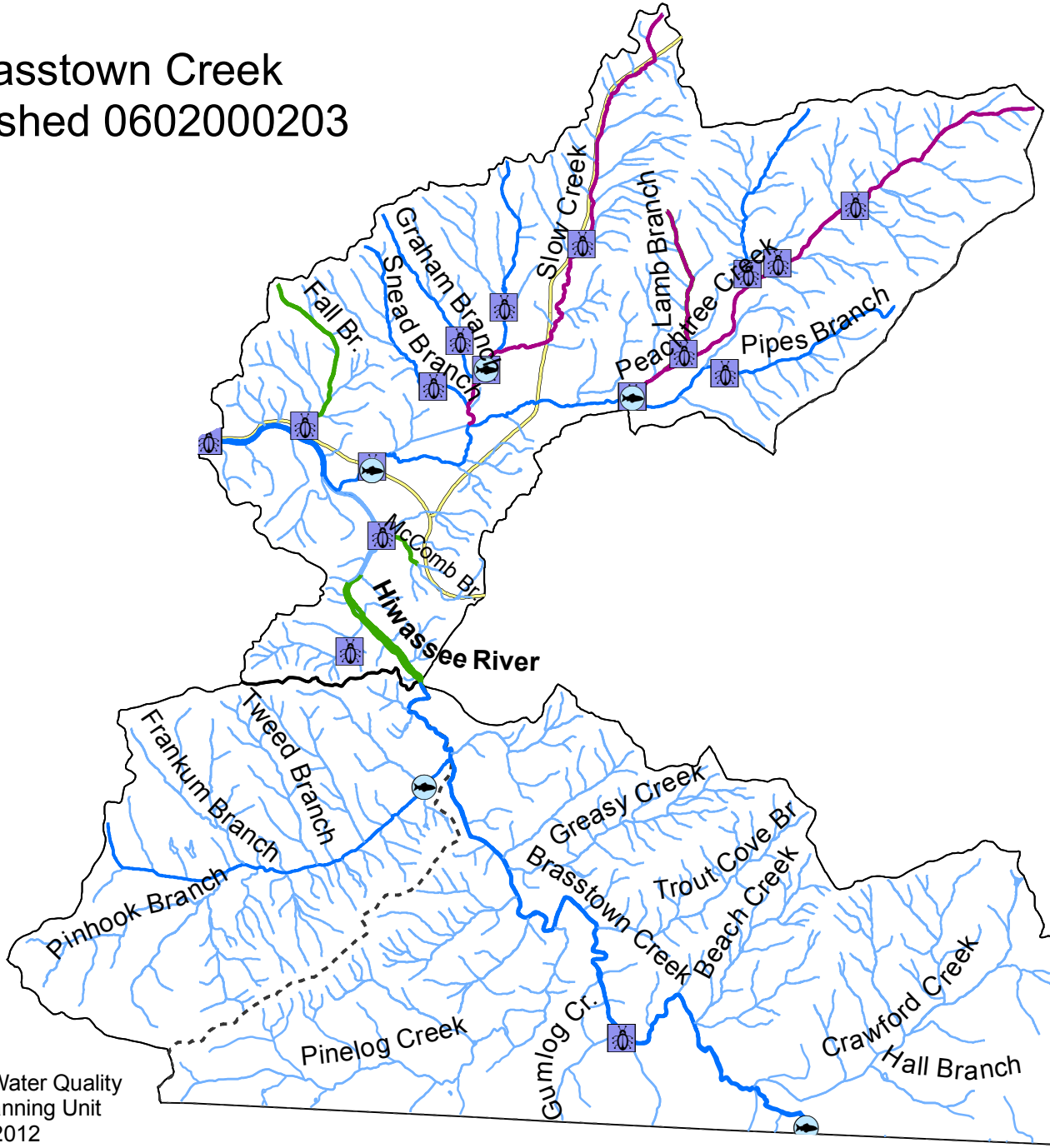
Shooting Creek Watershed 0602000201



NC Division of Water Quality
Basinwide Planning Unit
January 2012


Tusquitee Creek
Watershed 0602000202
Rockhouse Creek
Fires Creek
Little Fires Creek
Bob Branch
Bristol Branch
Johnson Creek
Matlock Creek
Big Tuni Creek
Bluff Branch
Mill Creek
Hurricane Creek
Morgan Branch
Sunday Branch
Tusquitee Creek
Greasy Creek
Mission Branch
Hiwassee River
(Mission Reservoir)
Sweetwater Cr
Qually Creek
Hayesville
Downing Creek
Hiwassee R
Hyatt Mill Creek
Legend
Municipalities
Roads
County Boundaries
Permits
Major Discharge
Minor Discharge
Stormwater
Non-Discharge
Monitoring Sites
Benthic Macroinvertebrate
Fish
Ambient
Lake
2010 Use Support
Supporting
No Data
Not Rated
Impaired
New 2012 Impairments
N
0
1
2 Miles
NC Division of Water Quality
Basinwide Planning Unit
March 2012

Brasstown Creek Watershed 0602000203



Legend

- Municipalities
- Roads
- County Boundaries

Monitoring Sites

- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake

Permits

- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

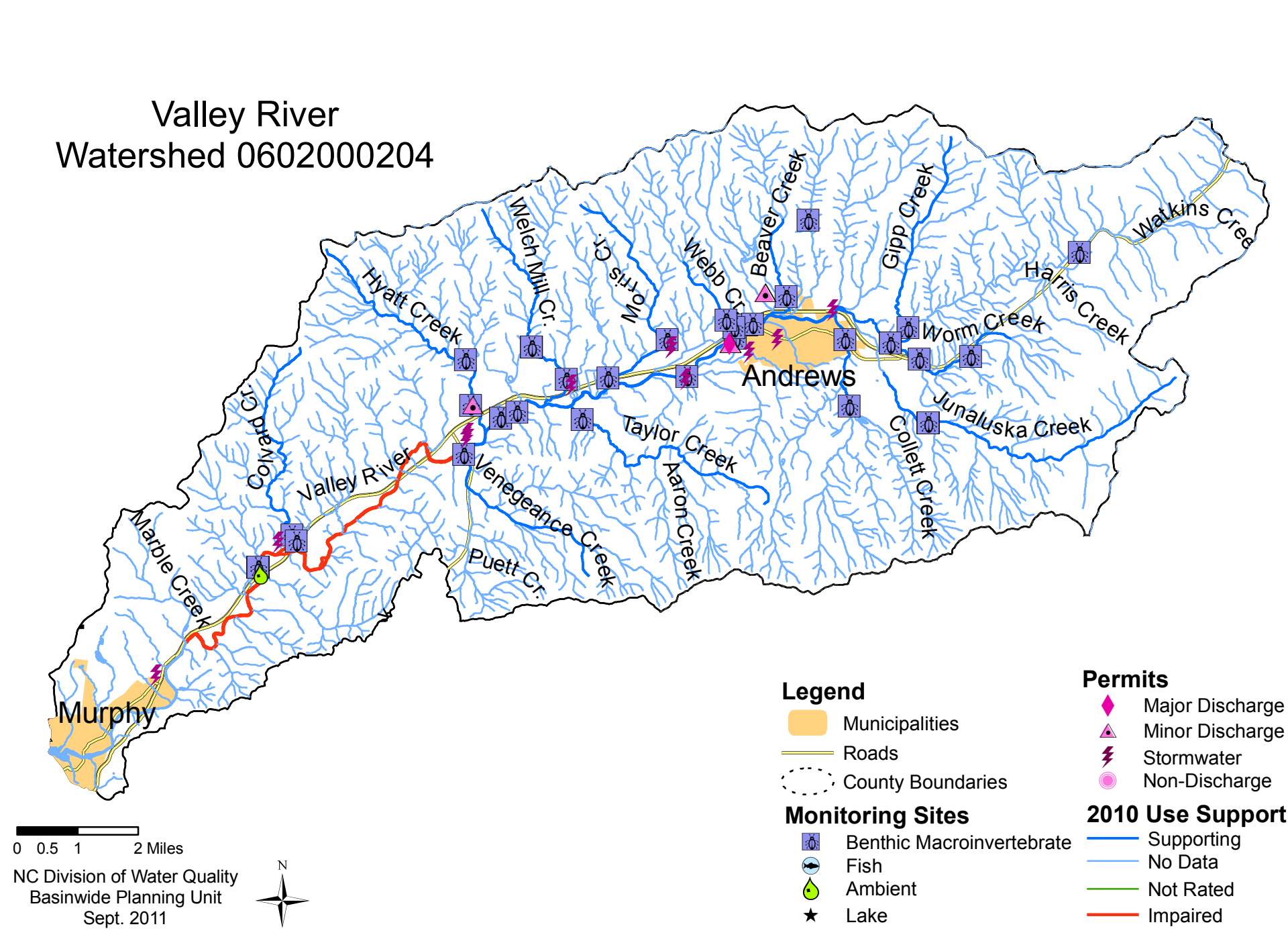
2010 Use Support

- Supporting
- No Data
- Not Rated
- Impaired
- New 2012 Impairments

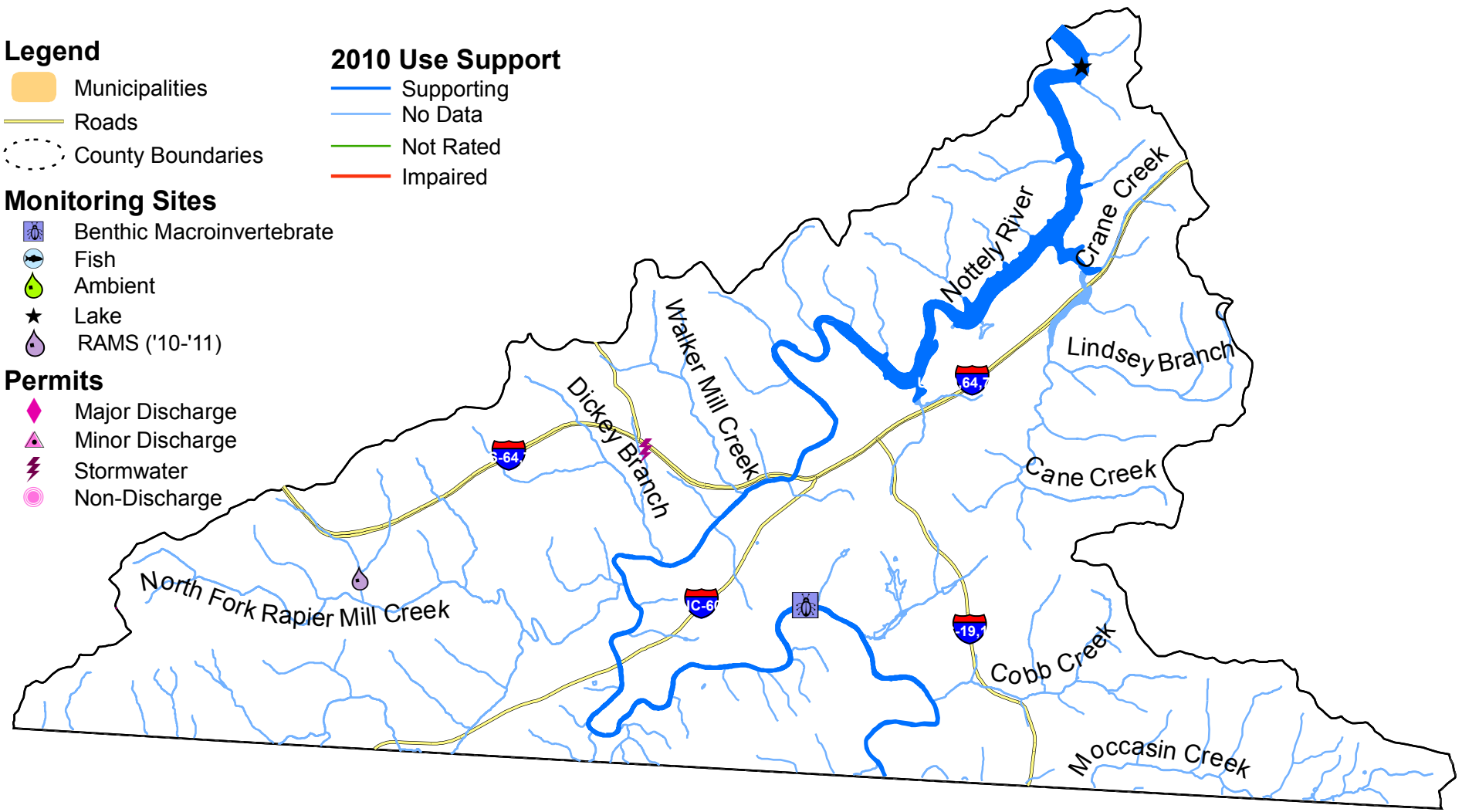
N

0 1 2 Miles

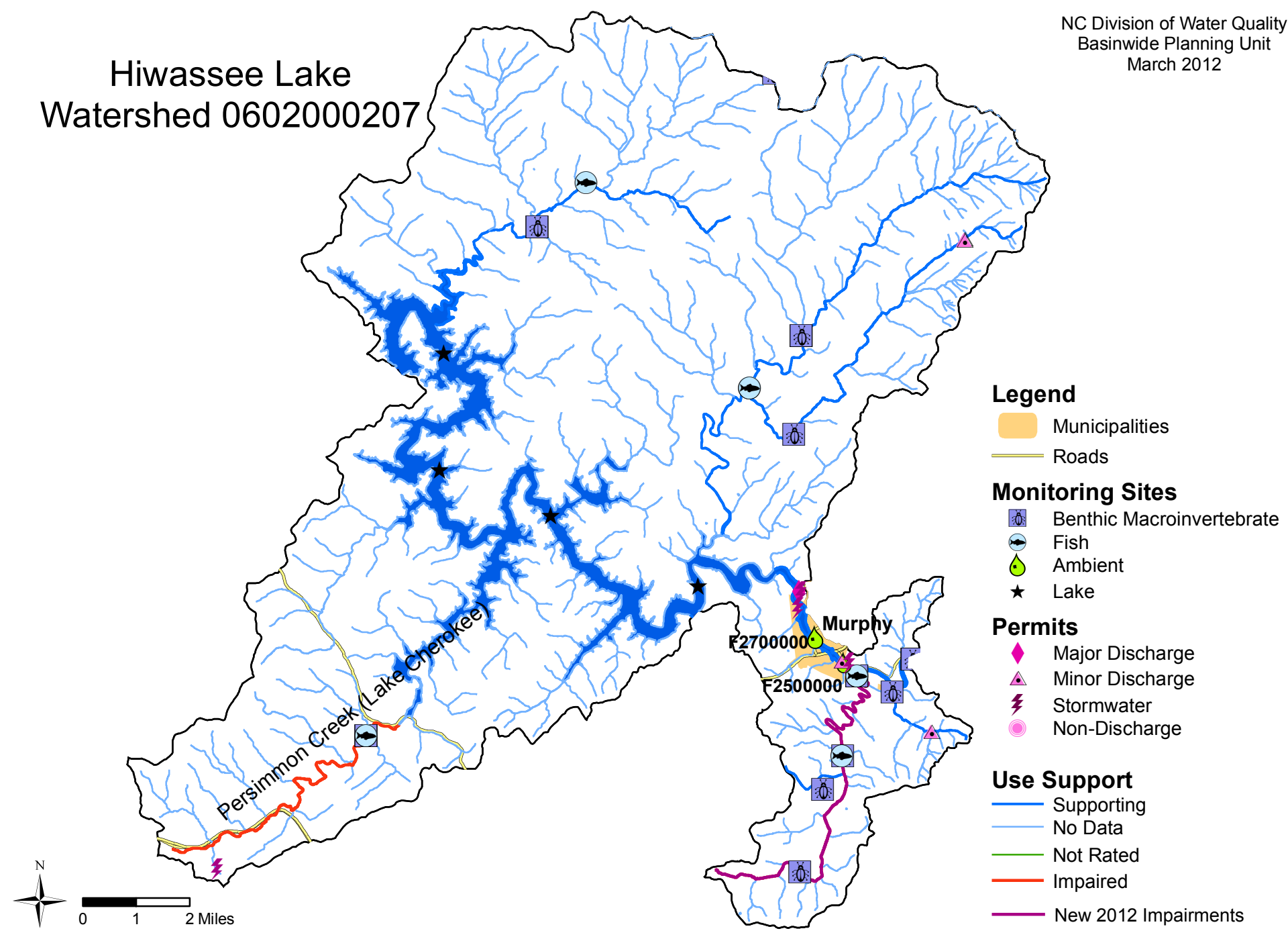
NC Division of Water Quality
Basinwide Planning Unit
March 2012


Valley River
Watershed 0602000204
Andrews
Murphy
Hyatt Creek
Welch Mill Cr.
Morris Cr.
Webb Cr.
Beaver Creek
Gipp Creek
Watkins Cree
Harris Creek
Worm Creek
Junaluska Creek
Collett Creek
Taylor Creek
Aaron Creek
Venegeance Creek
Puett Cr.
Colvard Cr.
Valley River
Marble Creek
Legend
Municipalities
Roads
County Boundaries
Monitoring Sites
Benthic Macroinvertebrate
Fish
Ambient
Lake
Permits
Major Discharge
Minor Discharge
Stormwater
Non-Discharge
2010 Use Support
Supporting
No Data
Not Rated
Impaired
0 0.5 1 2 Miles
N
NC Division of Water Quality
Basinwide Planning Unit
Sept. 2011

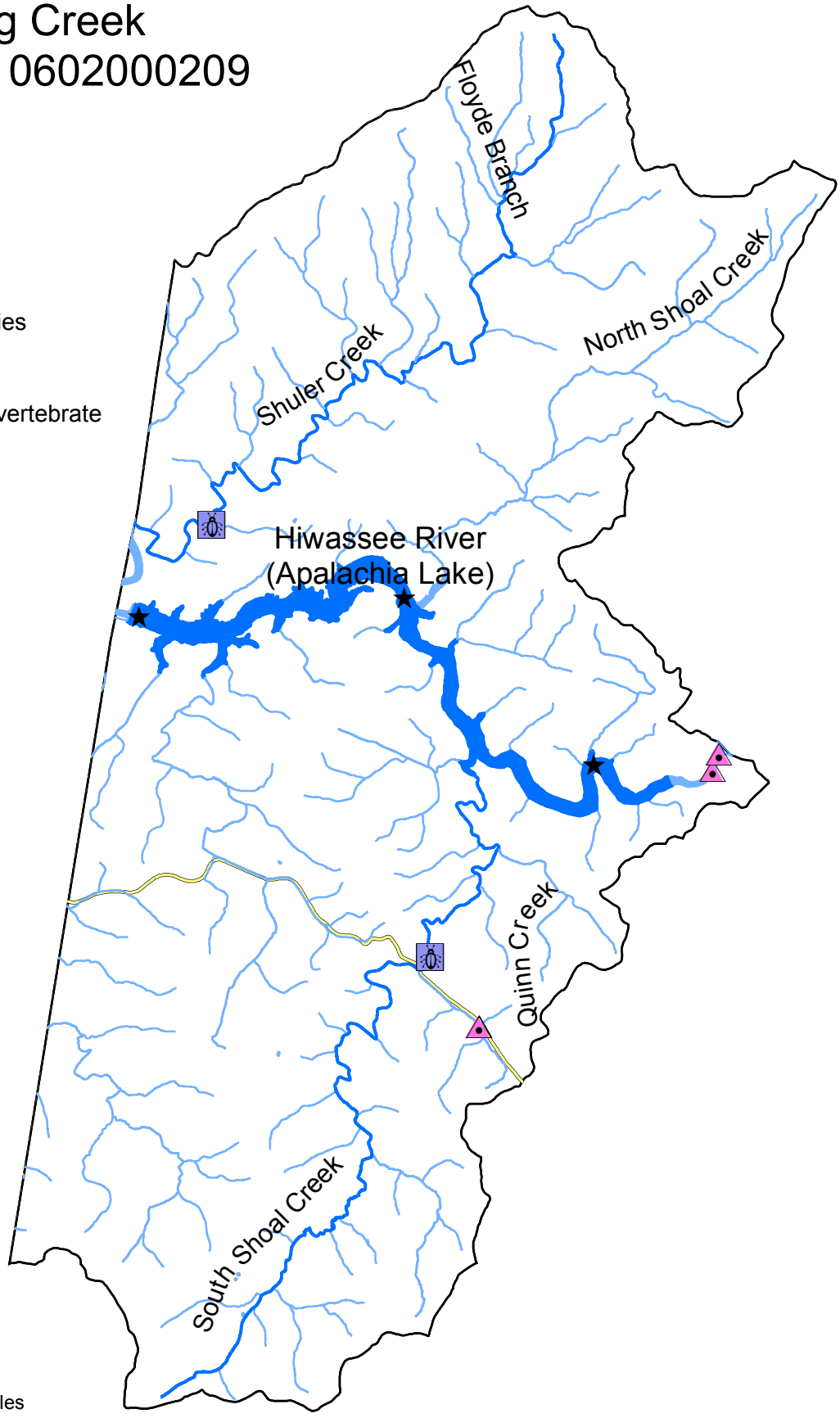
Nottely River Watershed 0602000206



NC Division of Water Quality
Basinwide Planning Unit
Sept. 2011


Hiwassee Lake
Watershed 0602000207
NC Division of Water Quality
Basinwide Planning Unit
March 2012
Persimmon Creek (Lake Cherokee)
Murphy
F2700000
F2500000
Legend
Municipalities
Roads
Monitoring Sites
Benthic Macroinvertebrate
Fish
Ambient
Lake
Permits
Major Discharge
Minor Discharge
Stormwater
Non-Discharge
Use Support
Supporting
No Data
Not Rated
Impaired
New 2012 Impairments
N
0
1
2 Miles

Spring Creek Watershed 0602000209



Legend

- Municipalities
- Roads
- County Boundaries

Monitoring Sites

- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake

Permits

- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

2010 Use Support

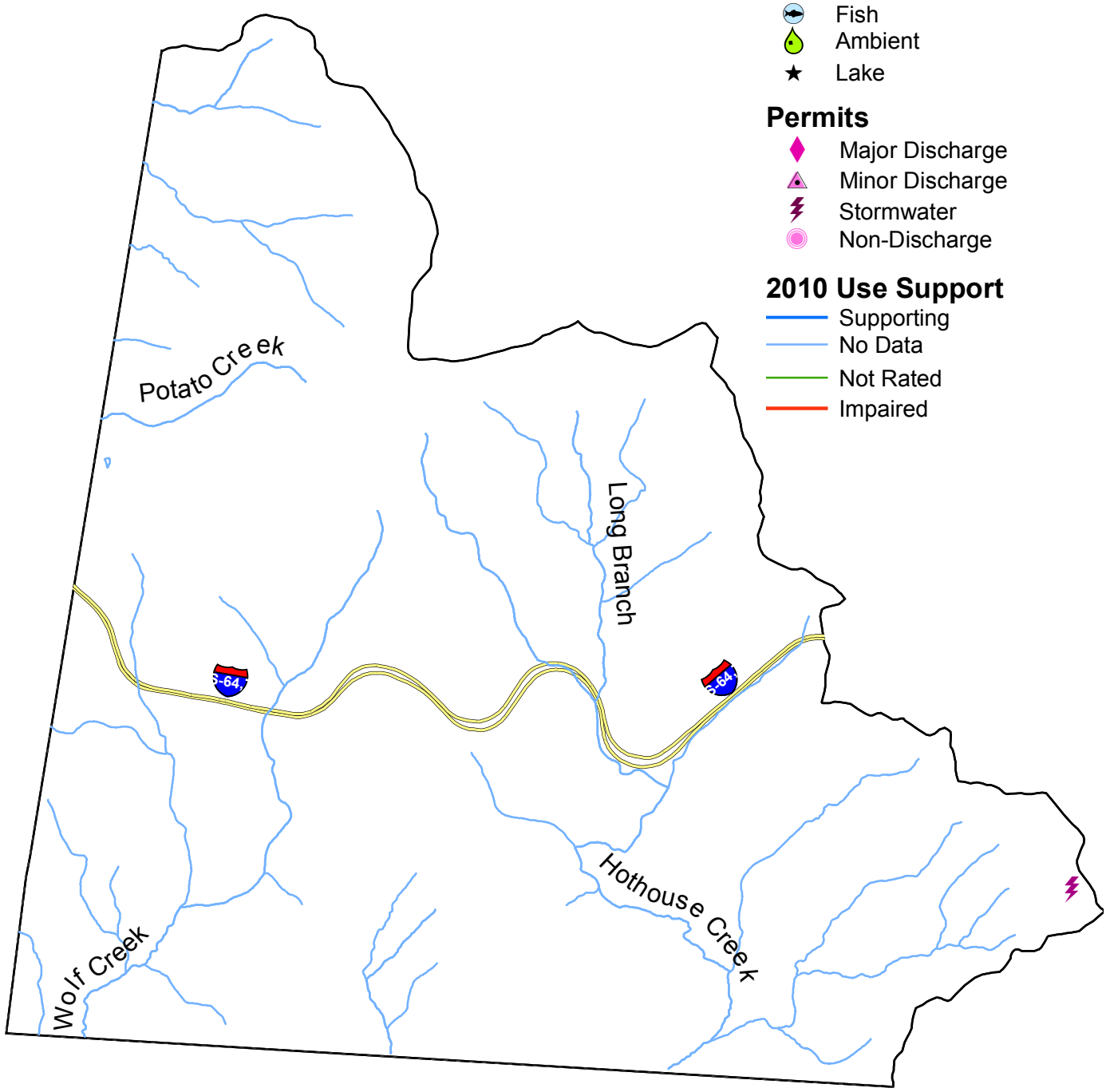
- Supporting
- No Data
- Not Rated
- Impaired

0 0.5 1 2 Miles

N

NC Division of Water Quality
Basinwide Planning Unit
Sept. 2011

Ocoee River Watershed 0602000302



Legend

- Municipalities
- Roads
- County Boundaries

Monitoring Sites

- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake

Permits

- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

2010 Use Support

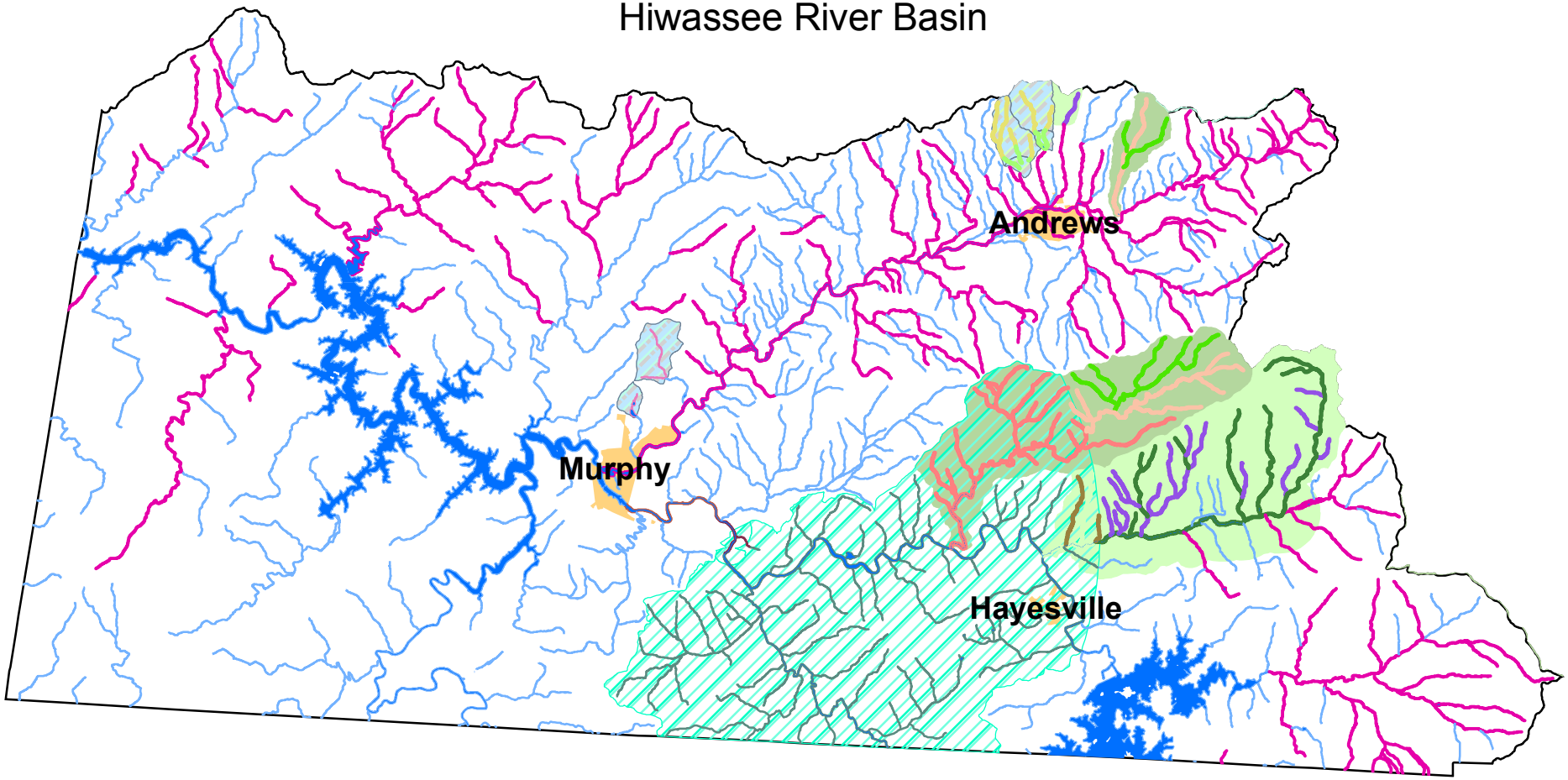
- Supporting
- No Data
- Not Rated
- Impaired

NC Division of Water Quality
Basinwide Planning Unit
Sept. 2011

0 0.25 0.5 1 Miles

N

Hiwassee River Basin



Stream Classifications

- B
- C
- C;HQW
- C;ORW
- C;Tr
- C;Tr,HQW
- C;Tr,ORW
- WS-V
- WS-I;HQW
- WS-II;Tr,HQW
- WS-II;Tr,HQW,CA
- WS-IV
- WS-IV;CA
- WS-IV;HQW
- WS-IV;Tr,HQW
- WS-IV;Tr,ORW

Water Supply Watersheds

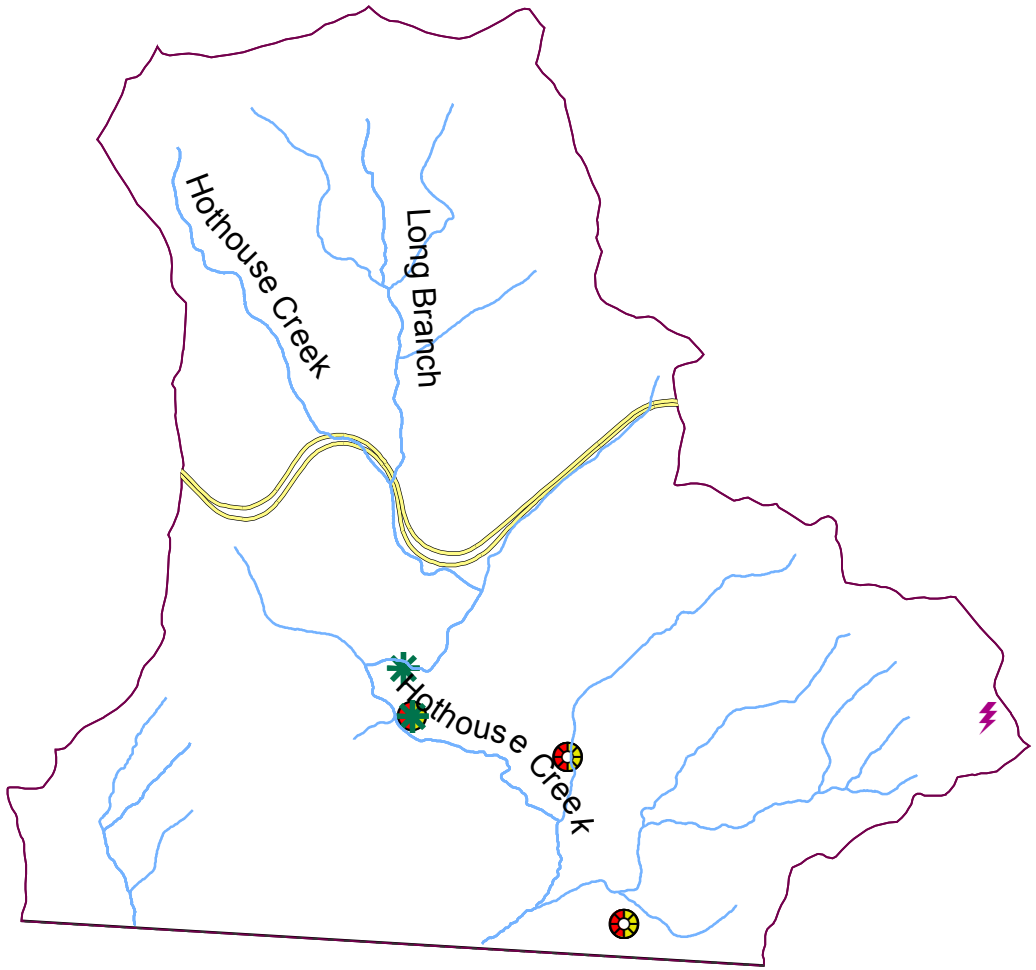
- WS-I
- WS-II
- WS-III
- WS-IV

HQW / ORW Buffer

- HQW
- ORW
- WSW I or II

- Municipalities

060200030204 Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning

HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200030201 Subwatershed

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

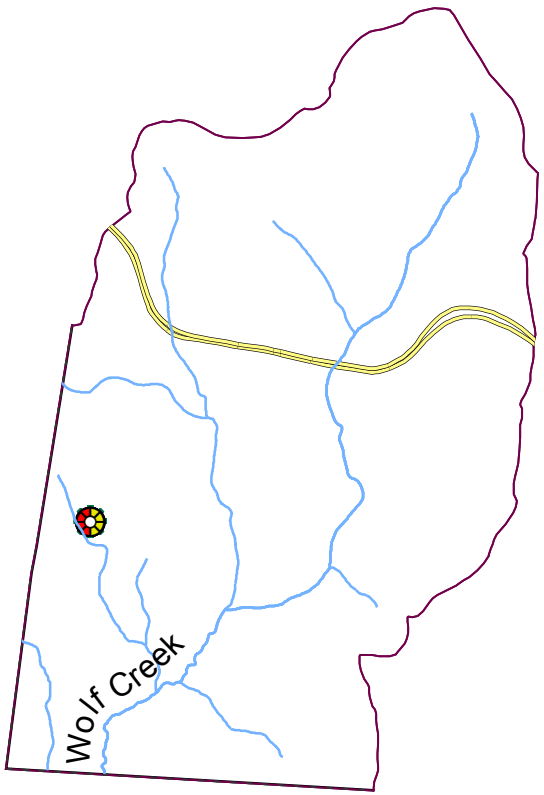
Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning



HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020907 Subwatershed

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

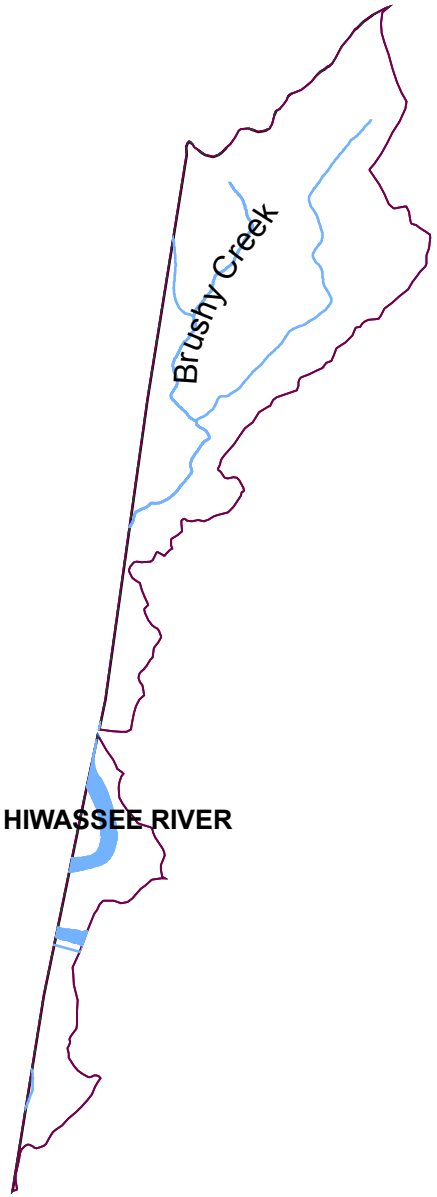
- USGS Gage
- Municipality
- Roads
- County Boundaries

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning



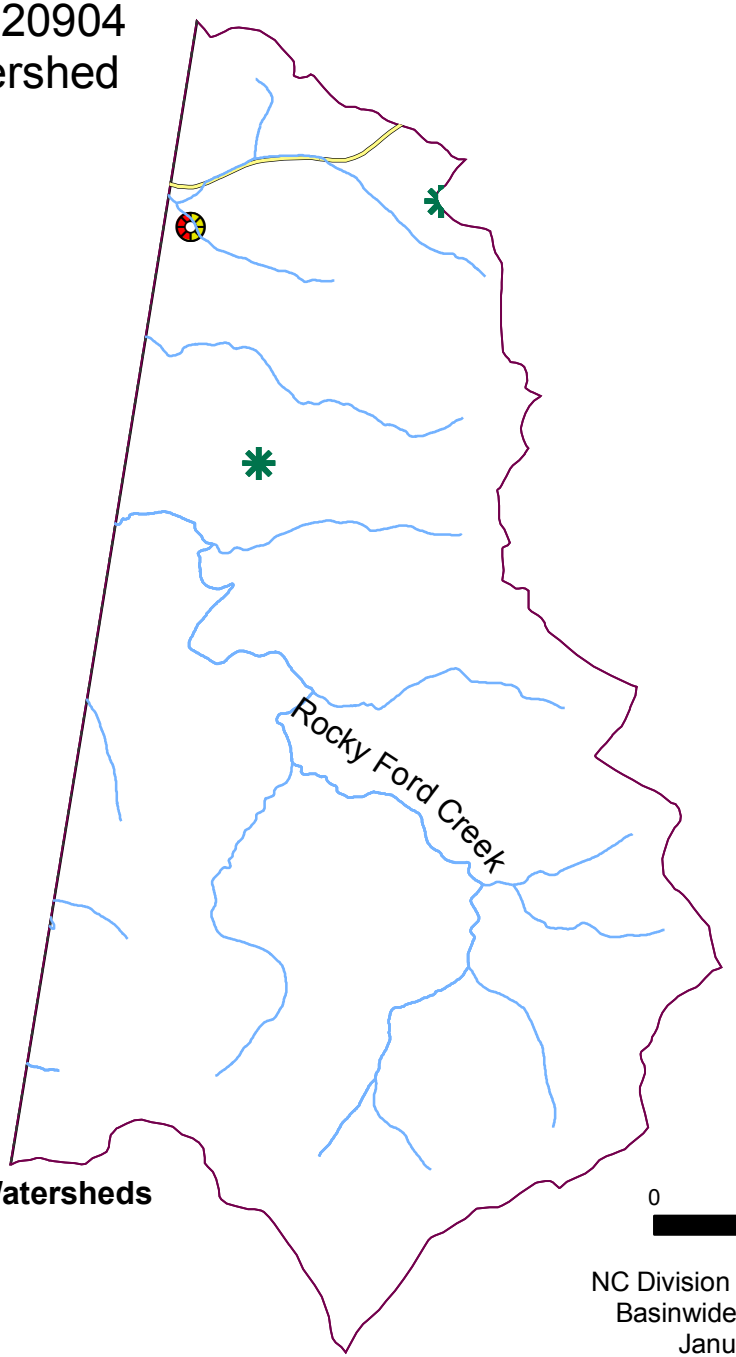
N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020904
Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning

HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

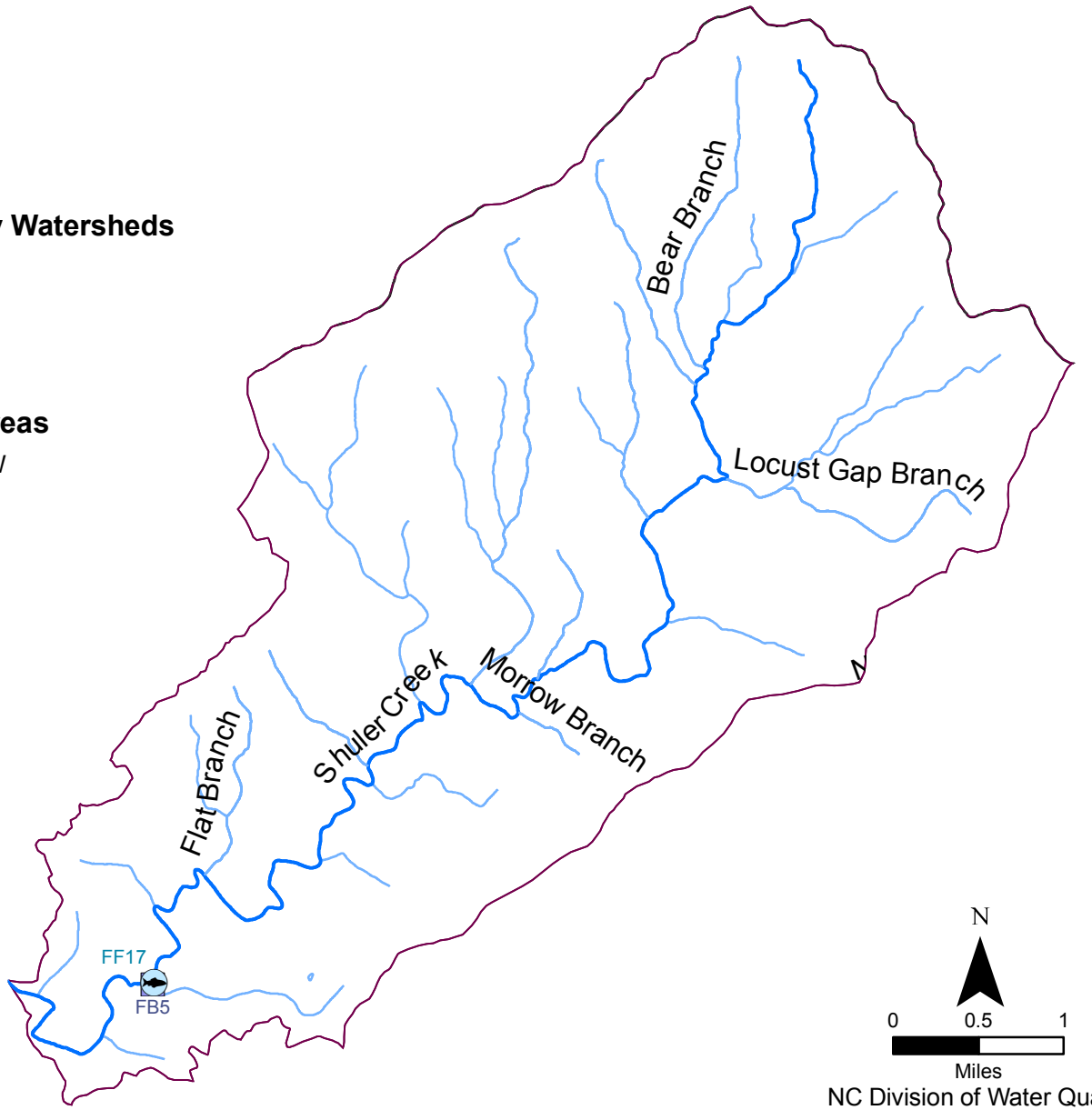
N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020903 Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

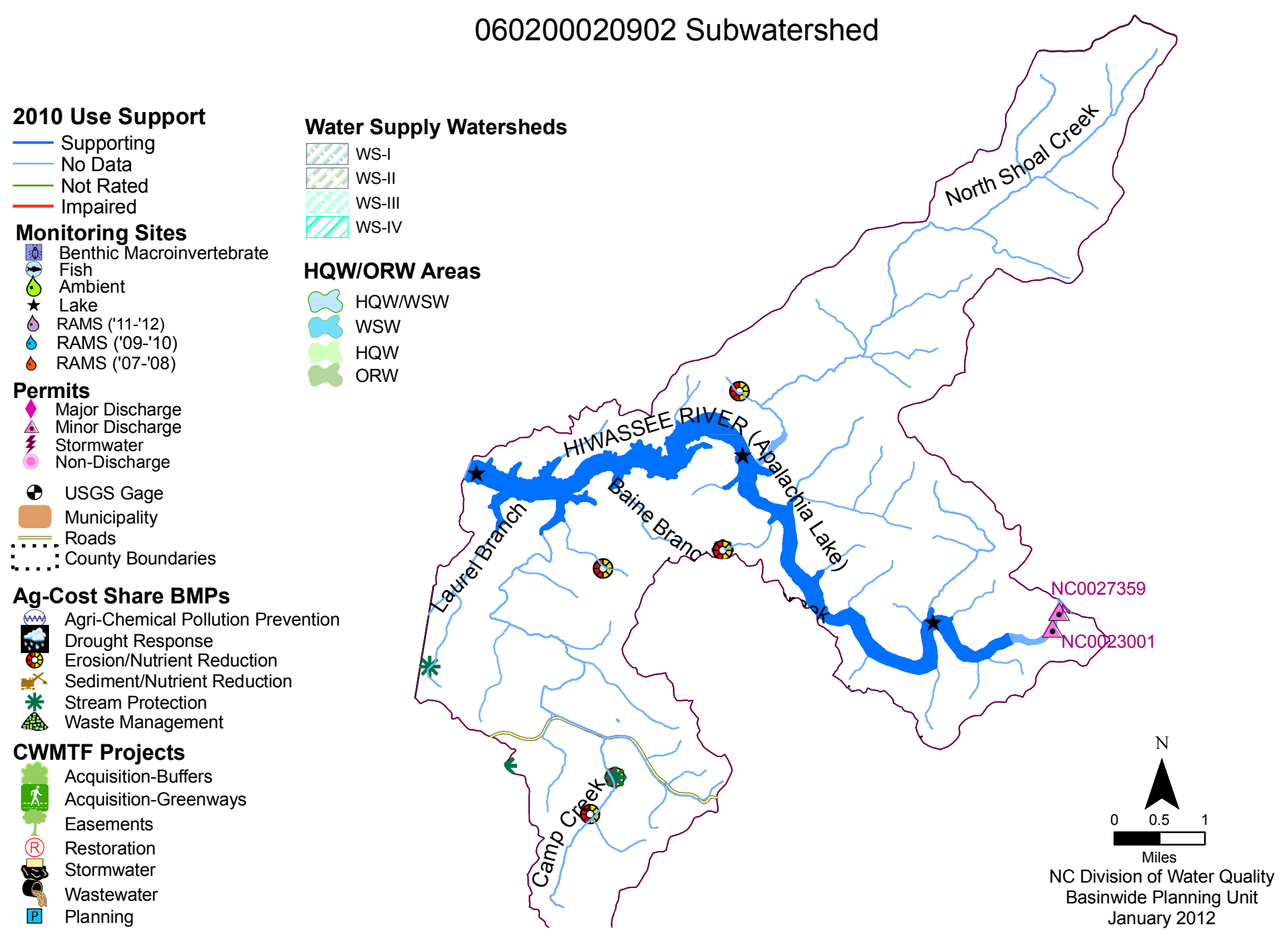
HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

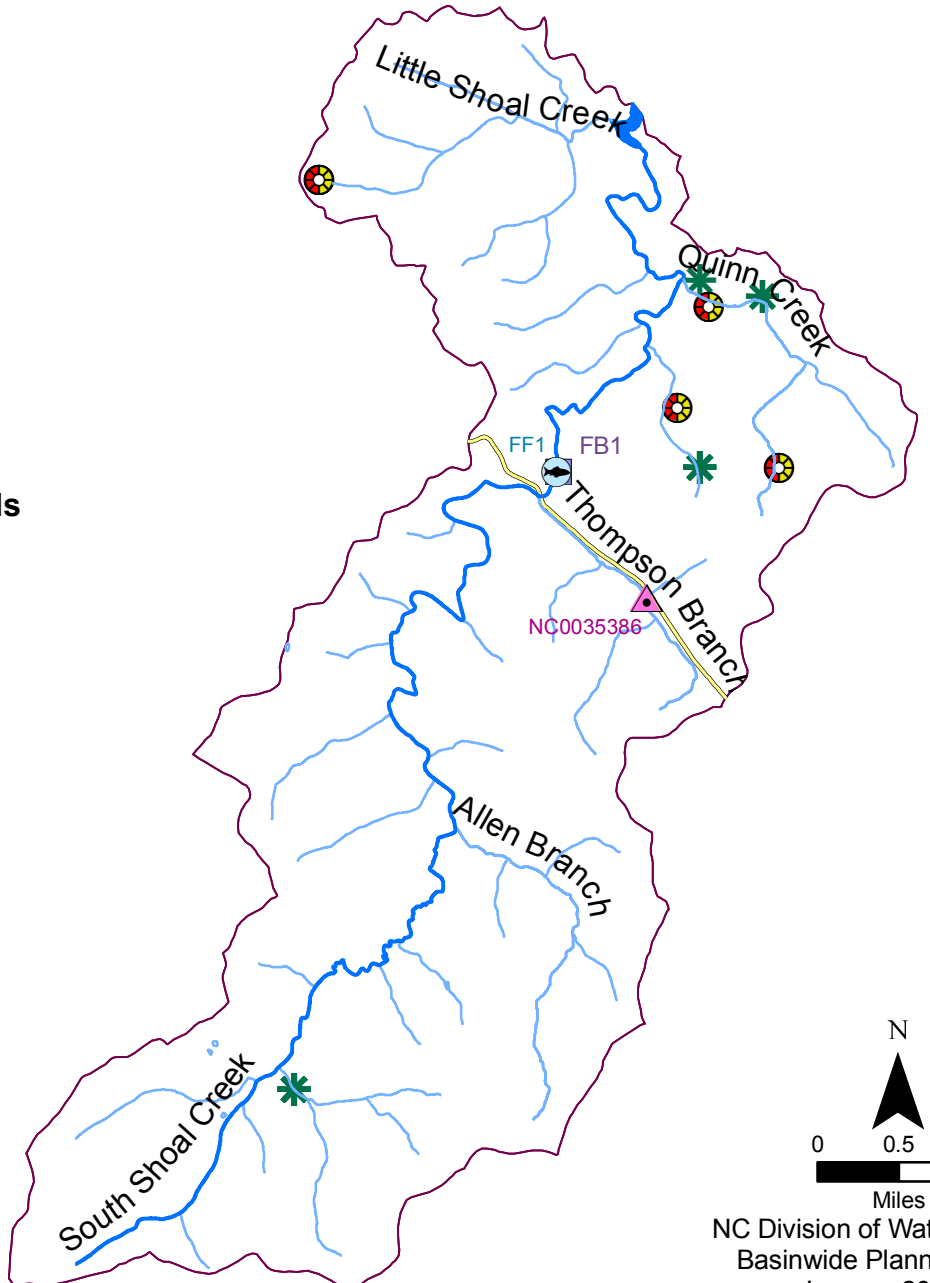
CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020902 Subwatershed



060200020901 Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

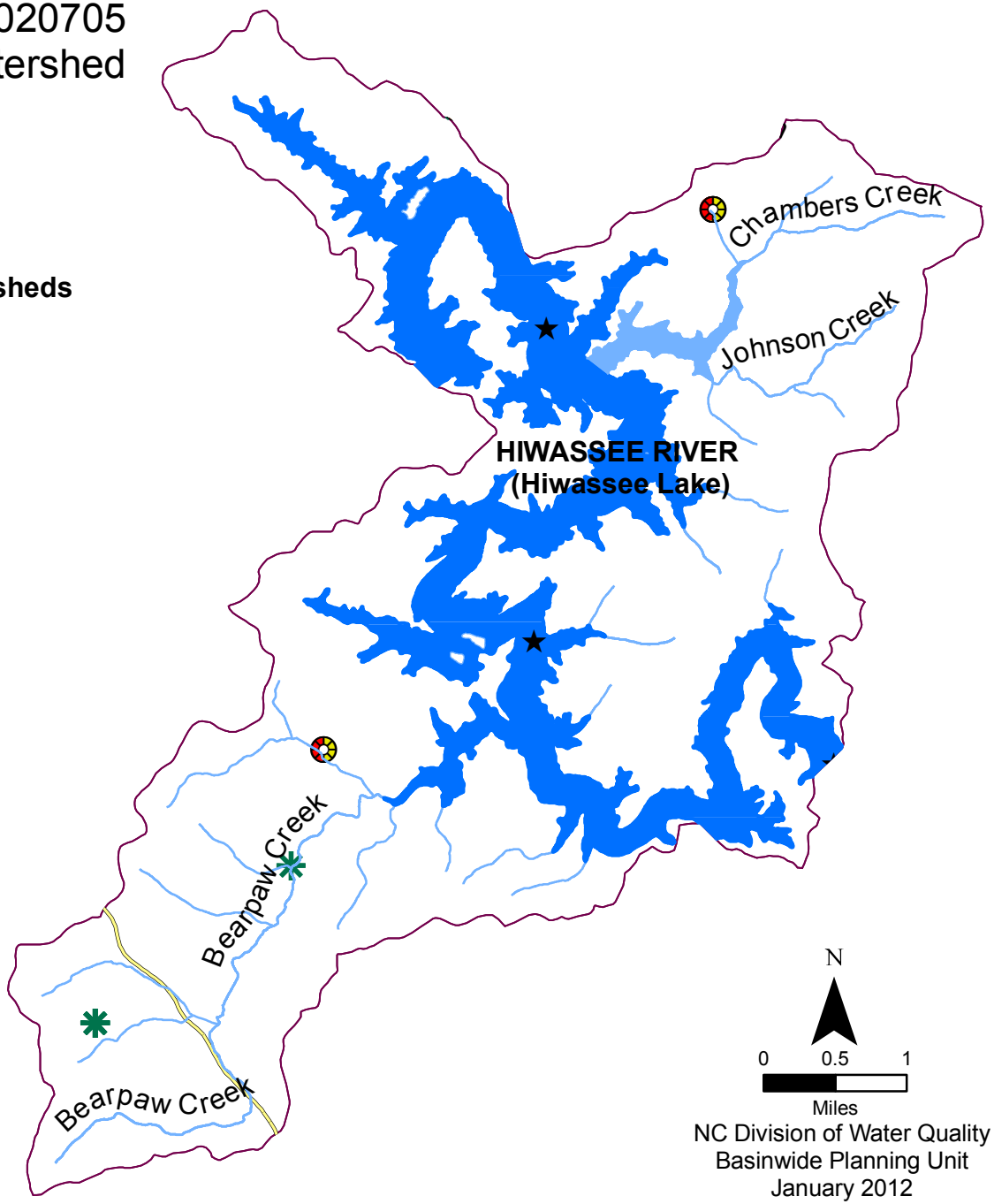
CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning

HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020705 Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
- Major Discharge
- Minor Discharge
- Stormwater
- Non-Discharge

- USGS Gage
- Municipality
- Roads
- County Boundaries

Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
- Drought Response
- Erosion/Nutrient Reduction
- Sediment/Nutrient Reduction
- Stream Protection
- Waste Management

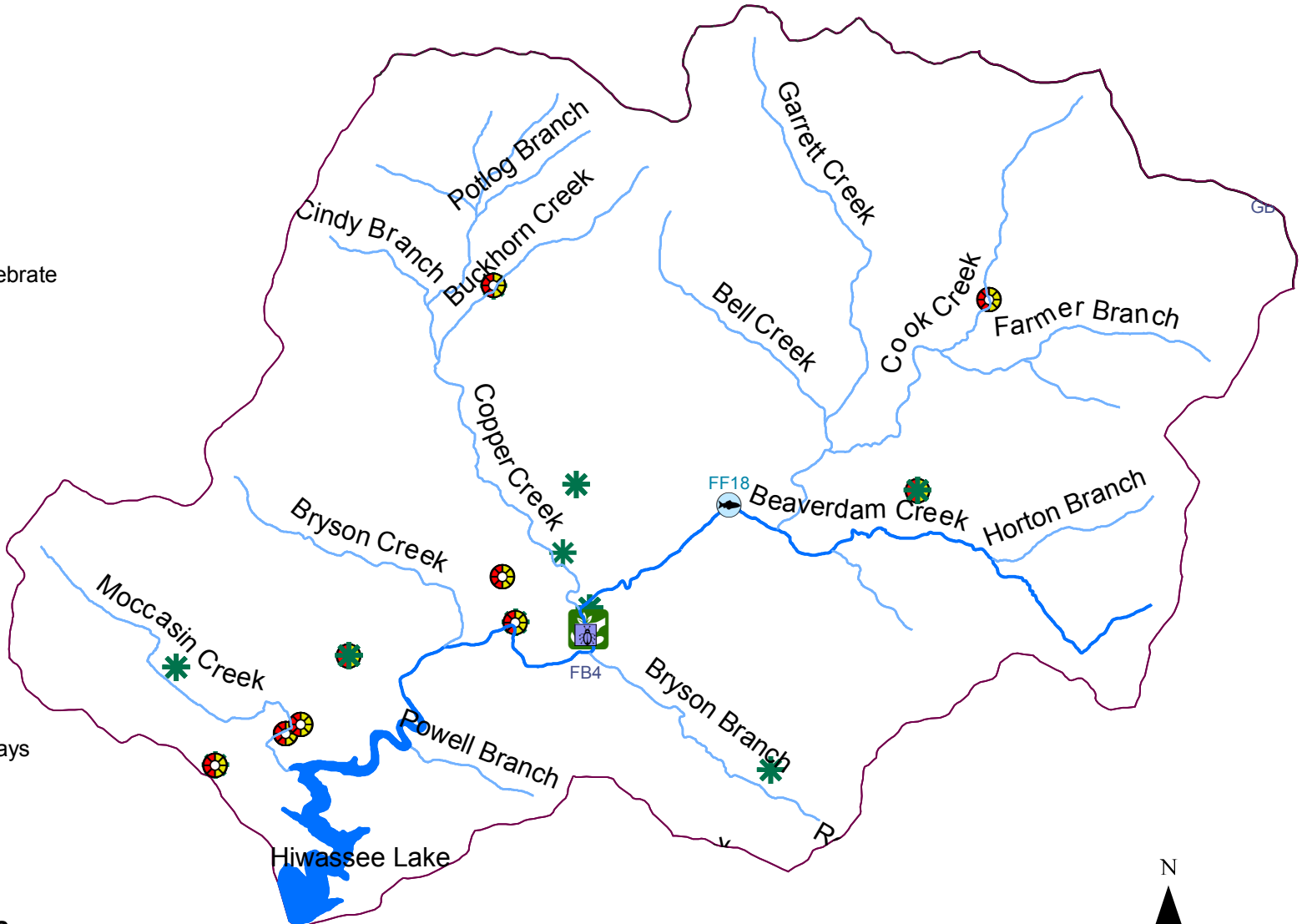
CWMTF Projects
- Acquisition-Buffers
- Acquisition-Greenways
- Easements
- Restoration
- Stormwater
- Wastewater
- Planning

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020704 Subwatershed



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
- Ambient
- Lake
- RAMS ('11-'12)
- RAMS ('09-'10)
- RAMS ('07-'08)

Permits
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- USGS Gage
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CWMTF Projects
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- Acquisition-Greenways
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- Restoration
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- Wastewater
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Ag-Cost Share BMPs
- Agri-Chemical Pollution Prevention
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HQW/ORW Areas
- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds
- WS-I
- WS-II
- WS-III
- WS-IV

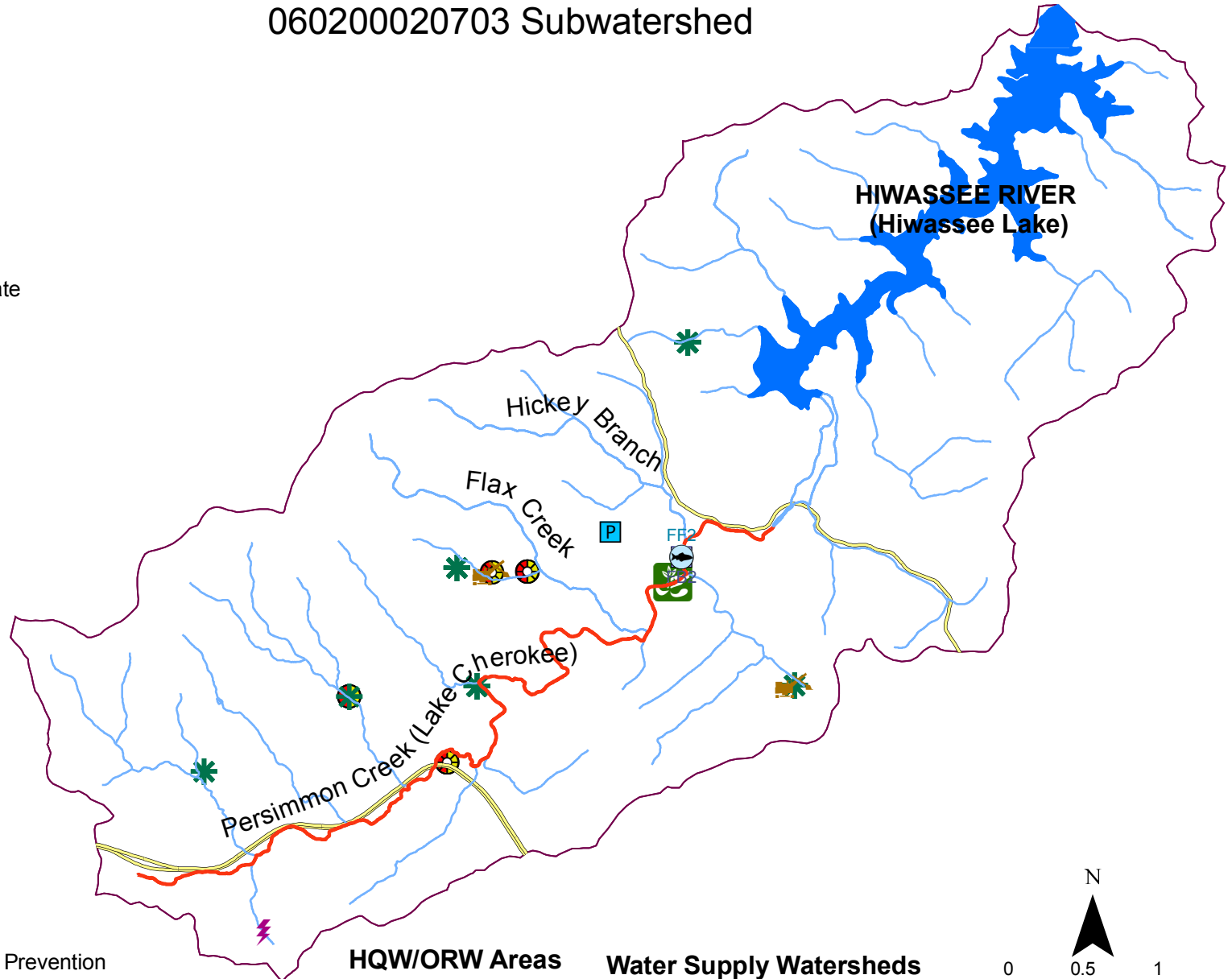
N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020703 Subwatershed



2010 Use Support
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- No Data
- Not Rated
- Impaired

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Water Supply Watersheds
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- WS-II
- WS-III
- WS-IV

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Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

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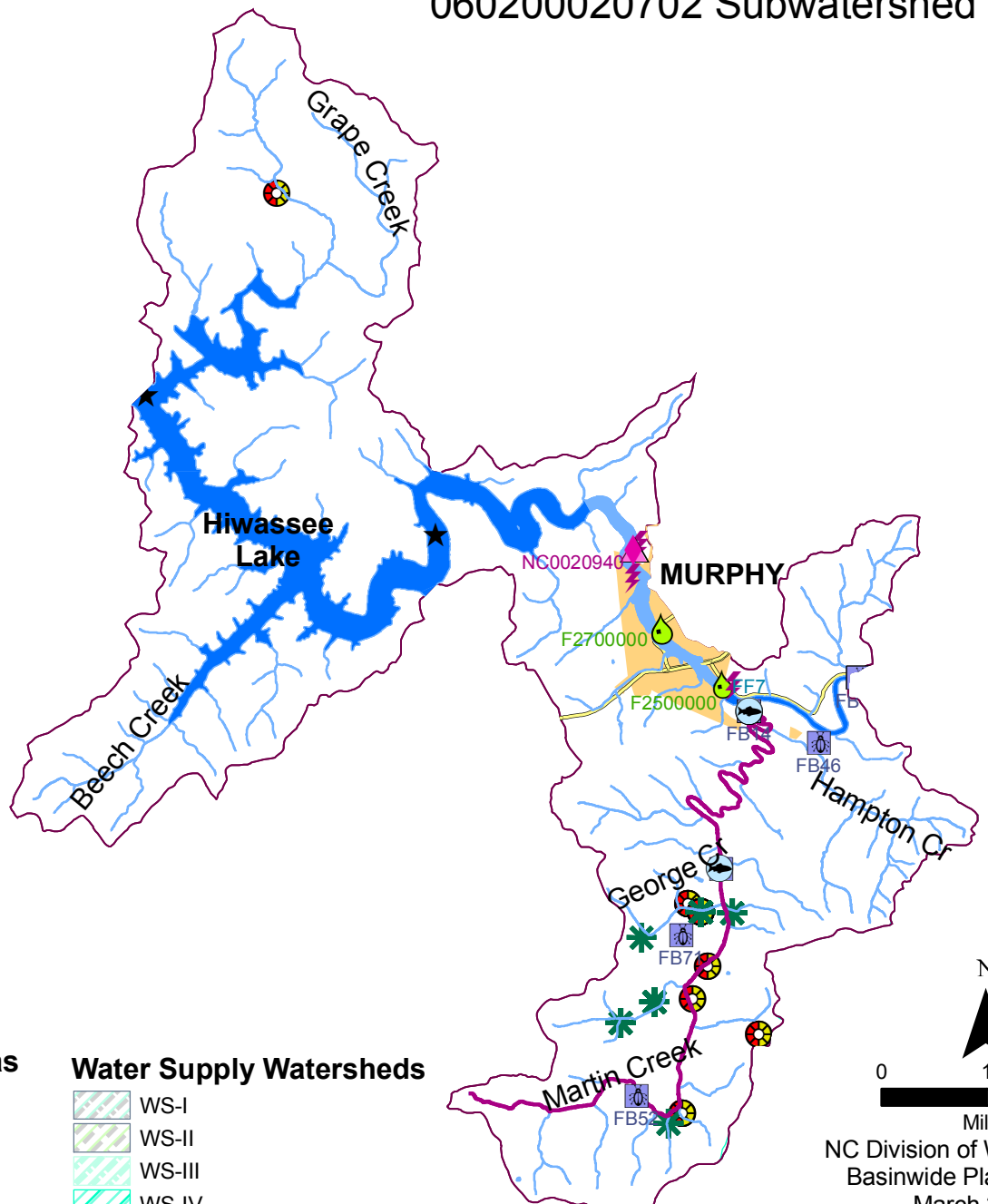

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired
- New 2012 Impairments

Monitoring Sites
- Benthic Macroinvertebrate
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- Ambient
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Water Supply Watersheds
- WS-I
- WS-II
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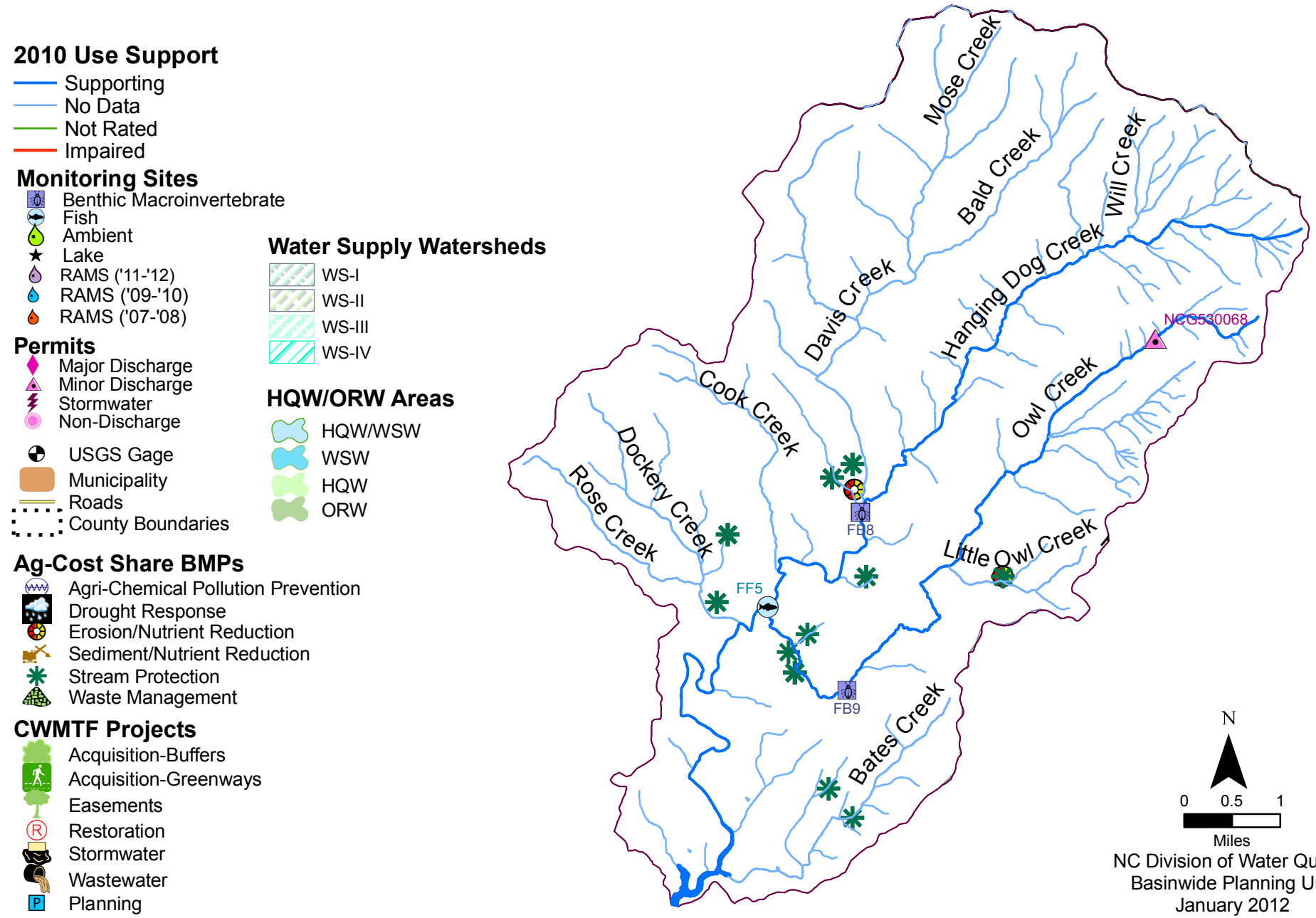
NC Division of Water Quality
Basinwide Planning Unit
March 2012

060200020701 Subwatershed



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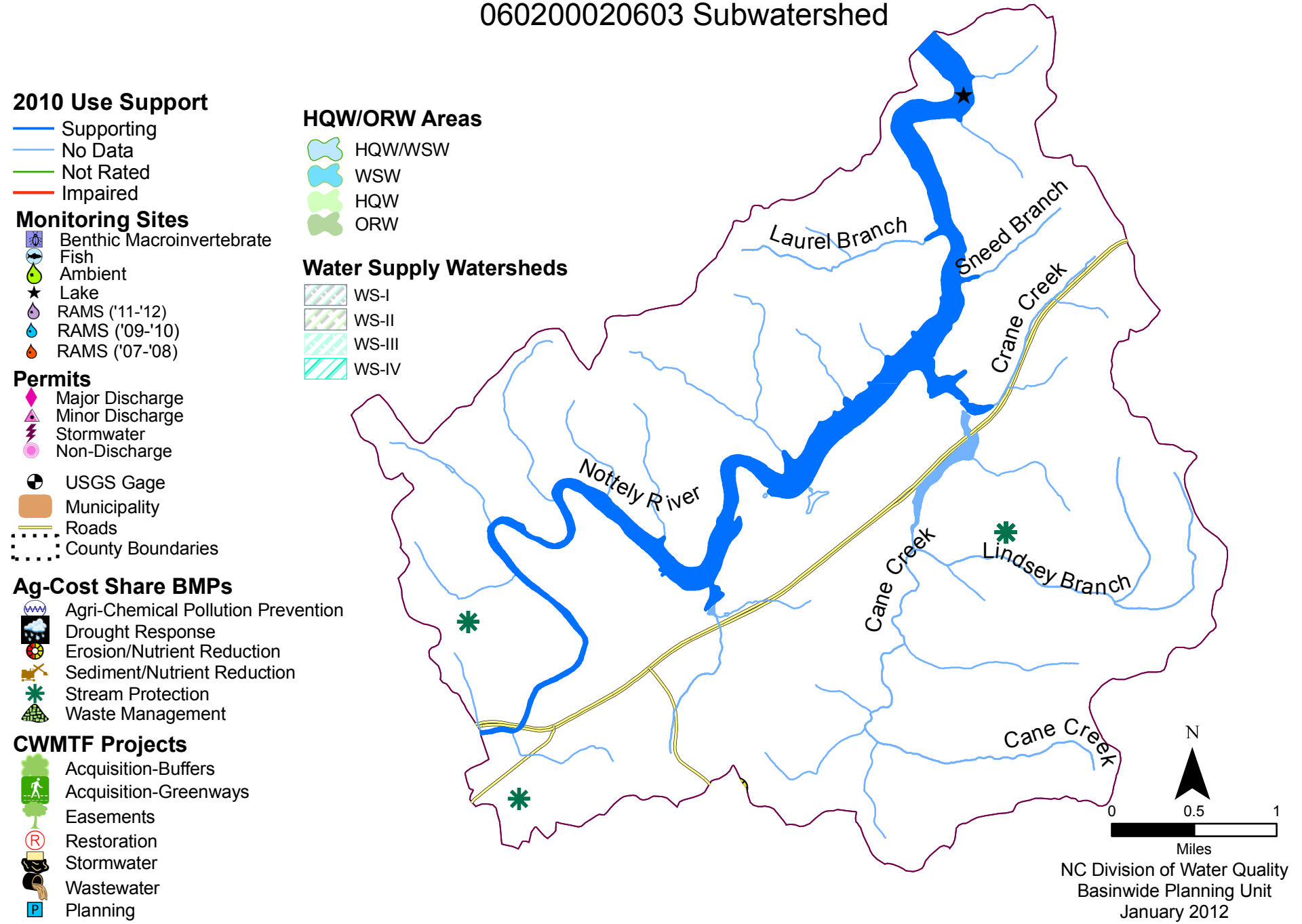

NC Division of Water Quality
Basinwide Planning Unit
January 2012

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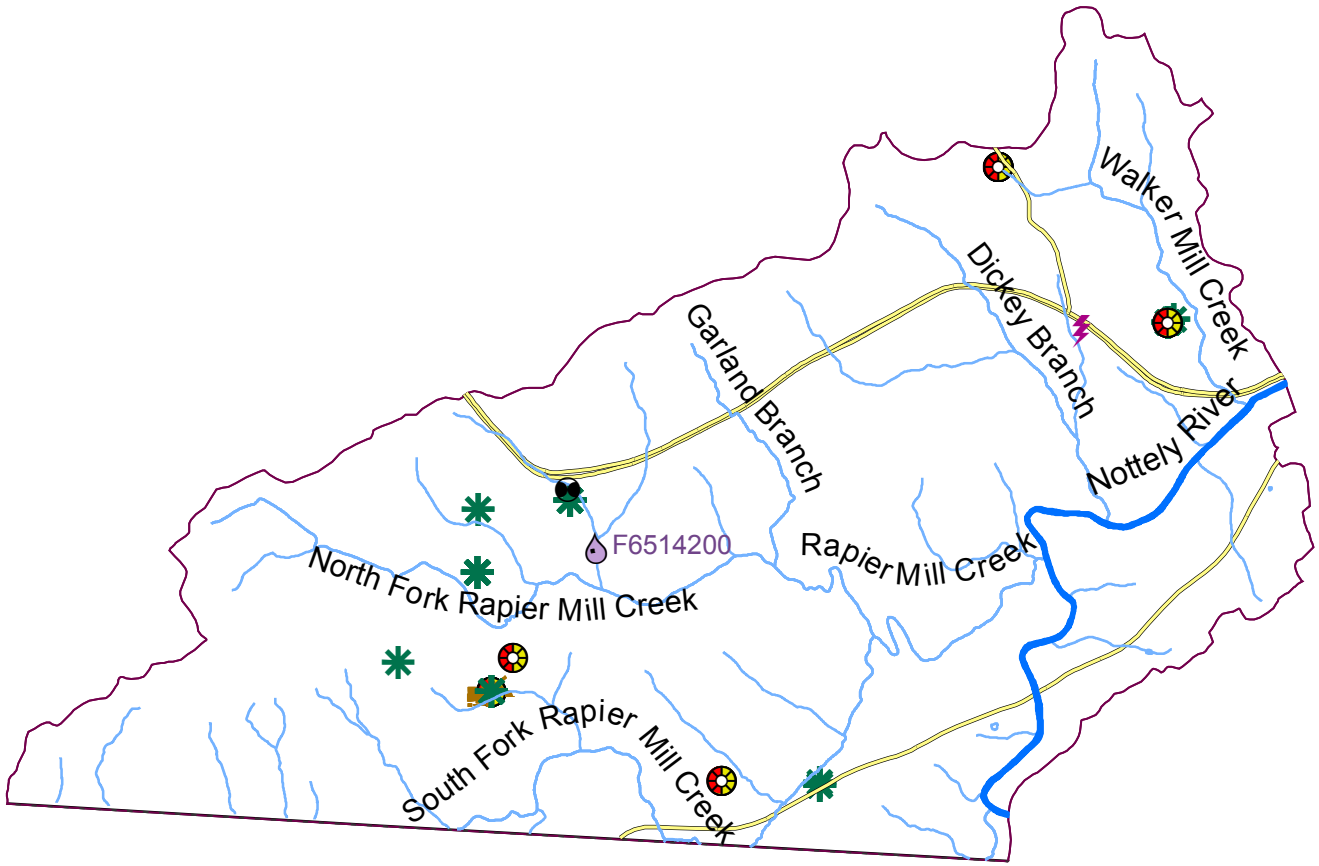

2010 Use Support
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- Not Rated
- Impaired

Monitoring Sites
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Water Supply Watersheds
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Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

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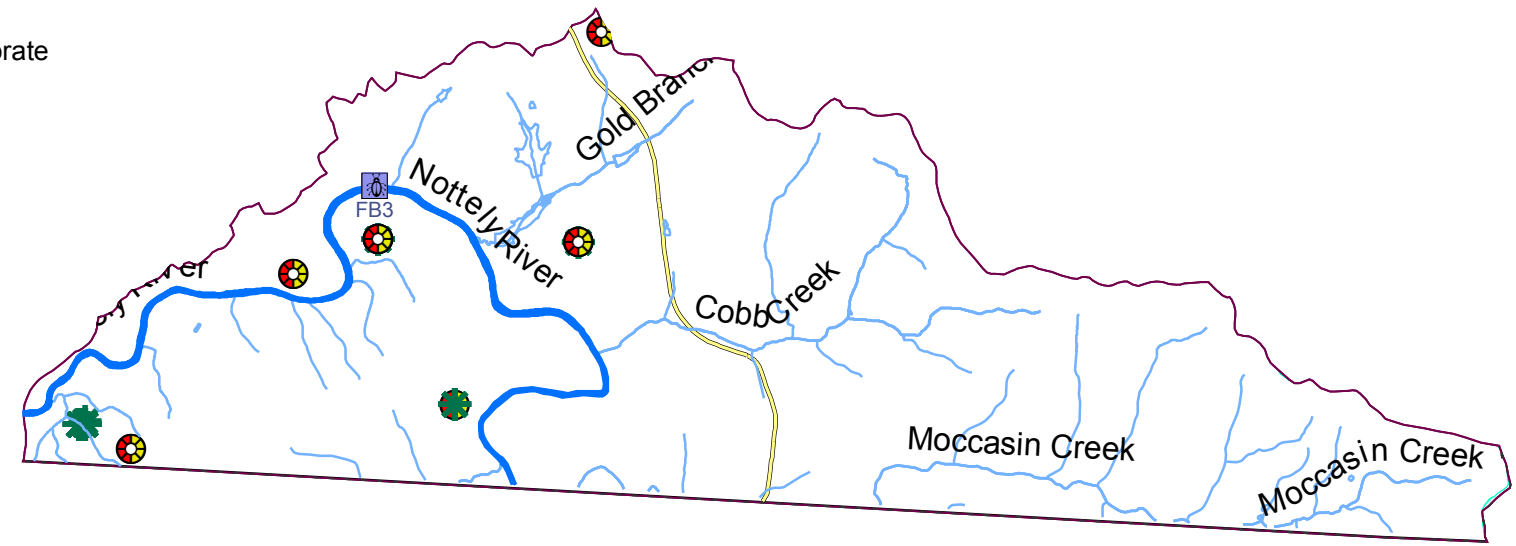

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
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Water Supply Watersheds
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- WS-IV

N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

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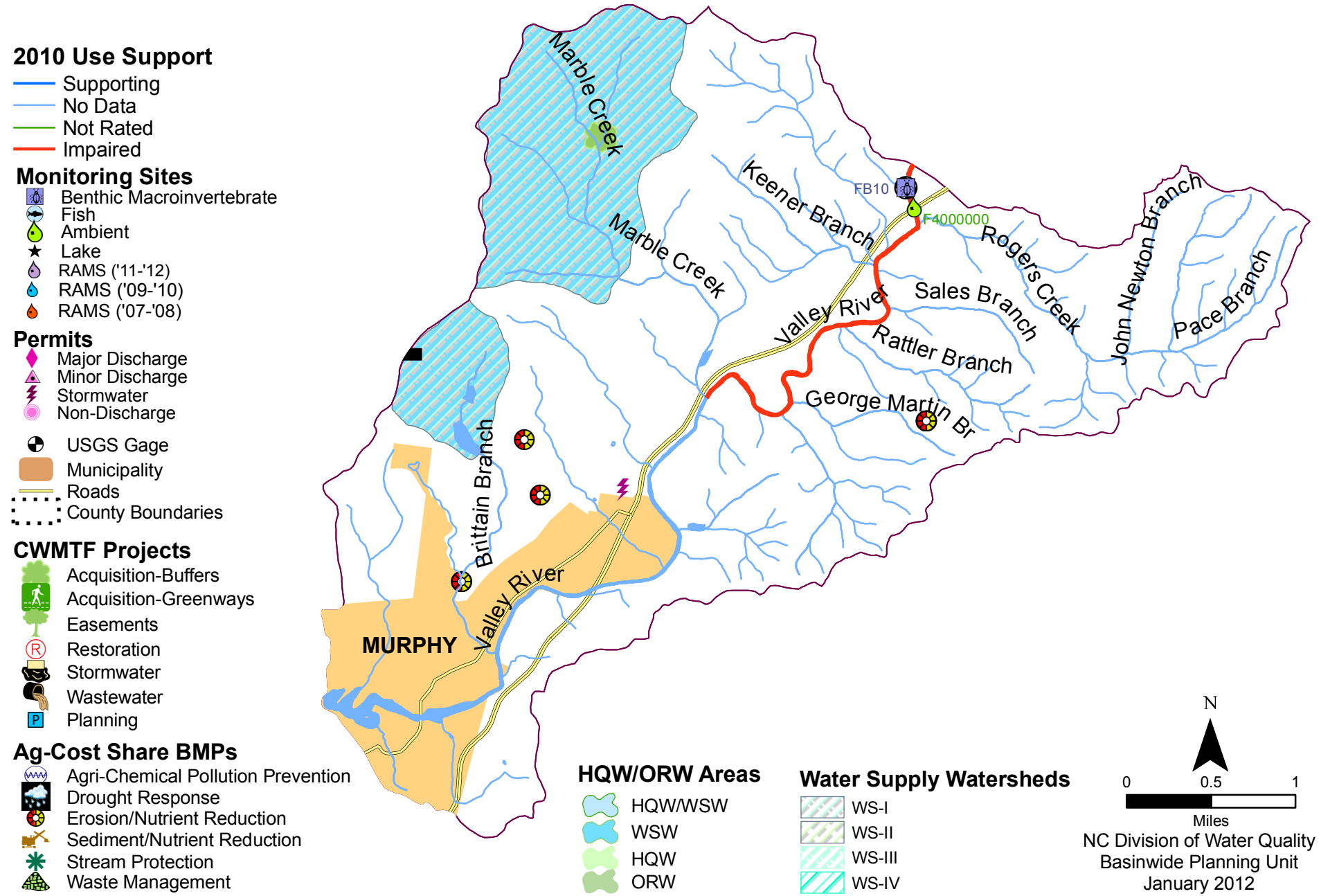

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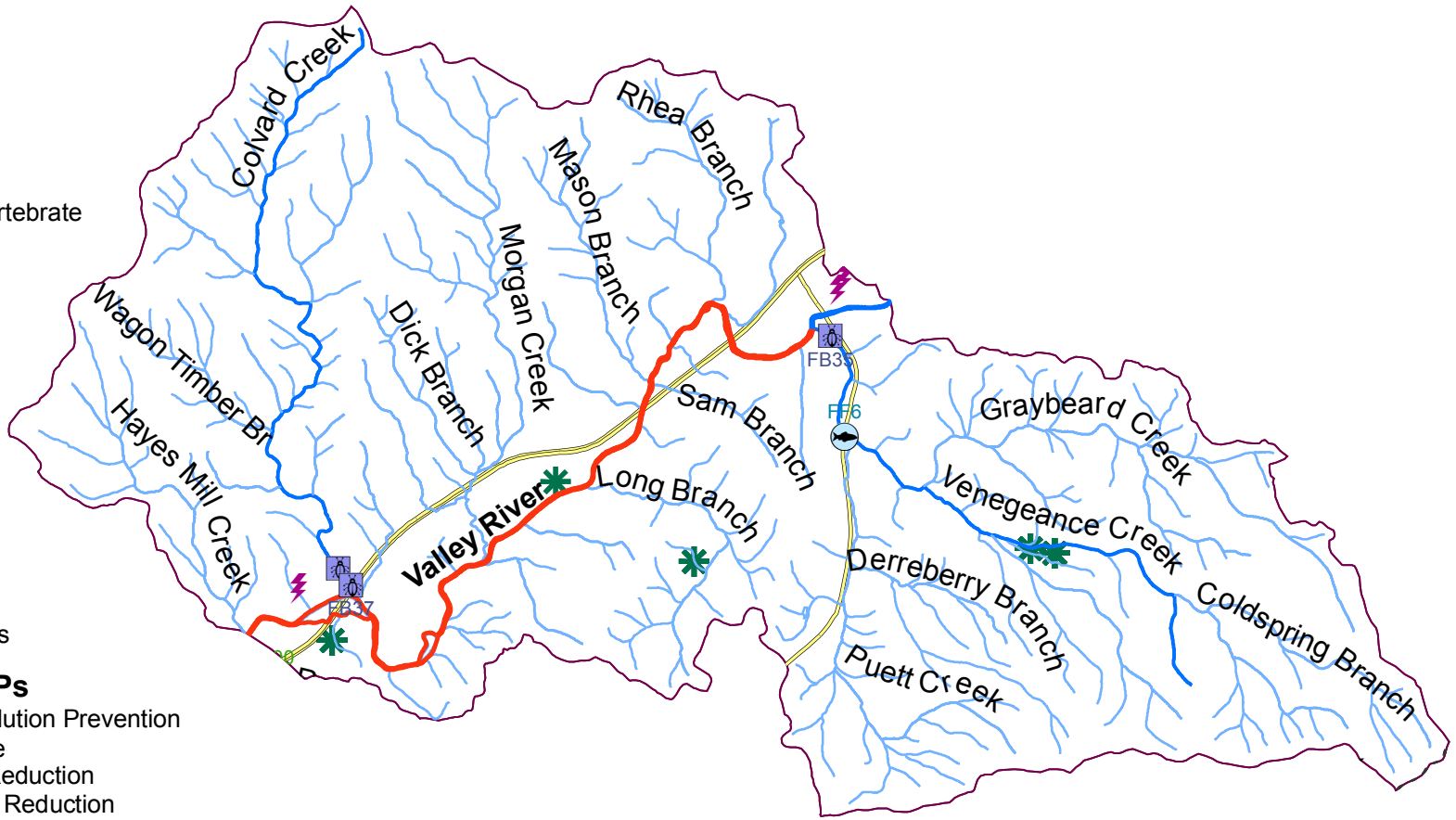

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
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Water Supply Watersheds
- WS-I
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- WS-III
- WS-IV

N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

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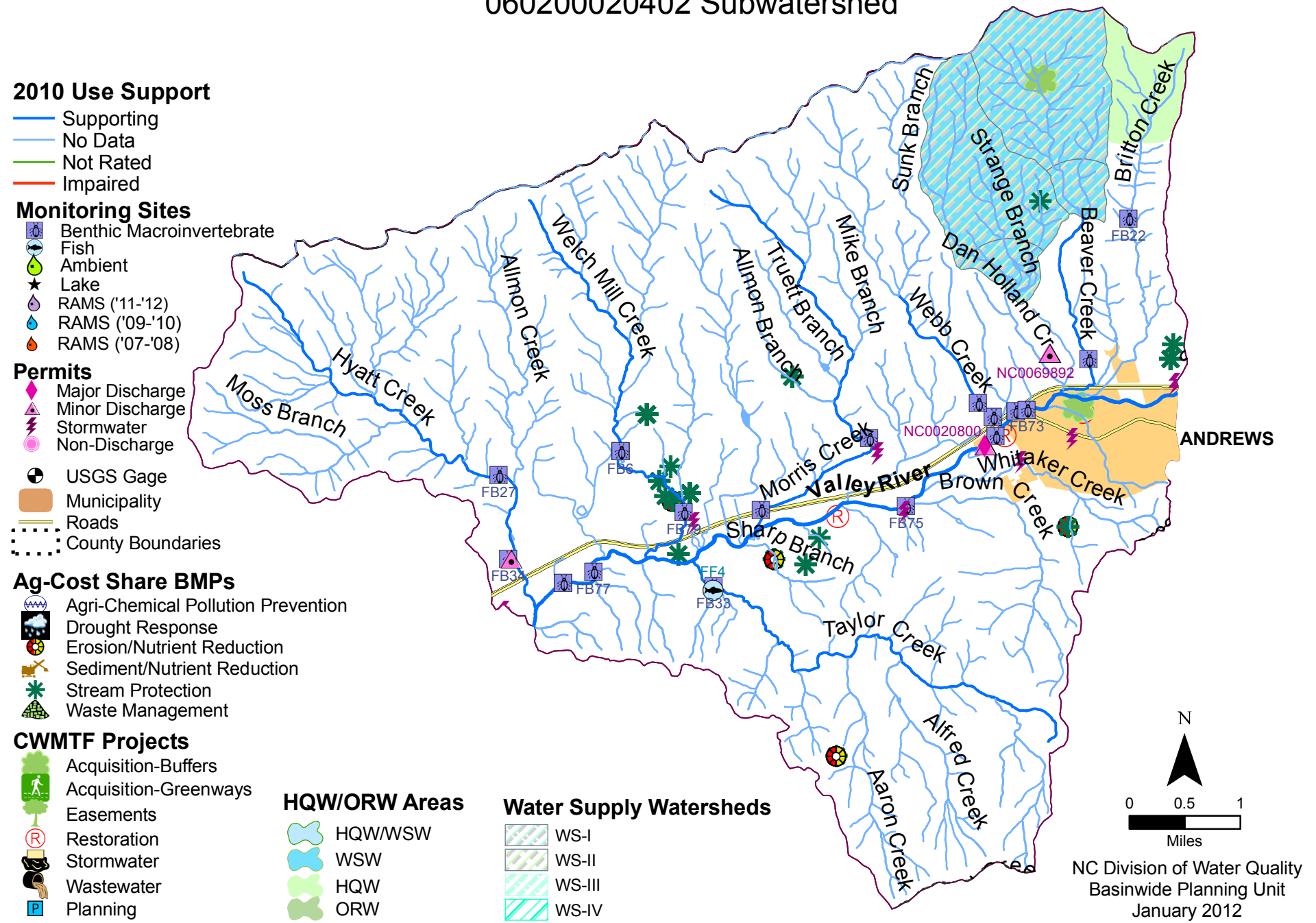

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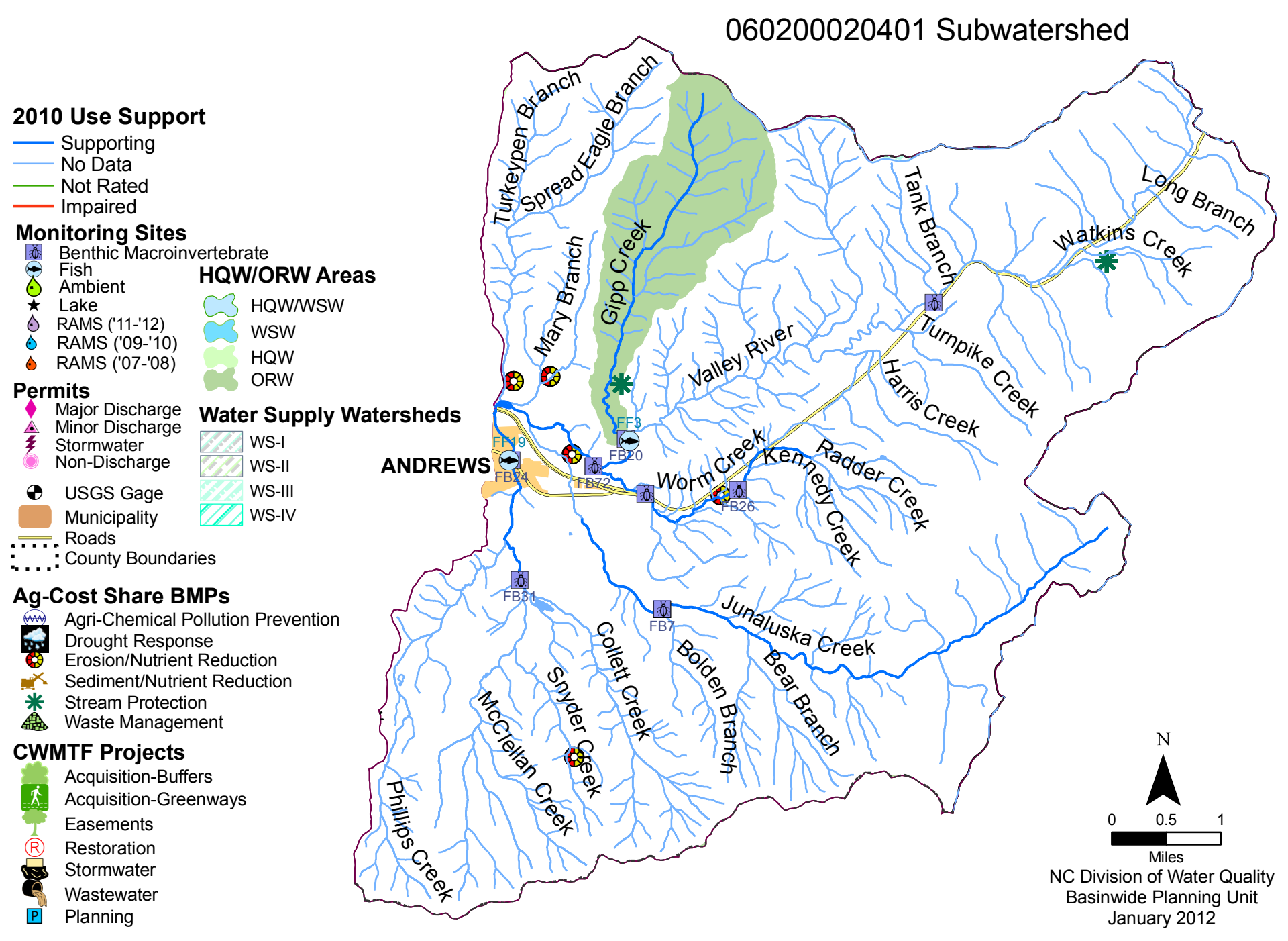
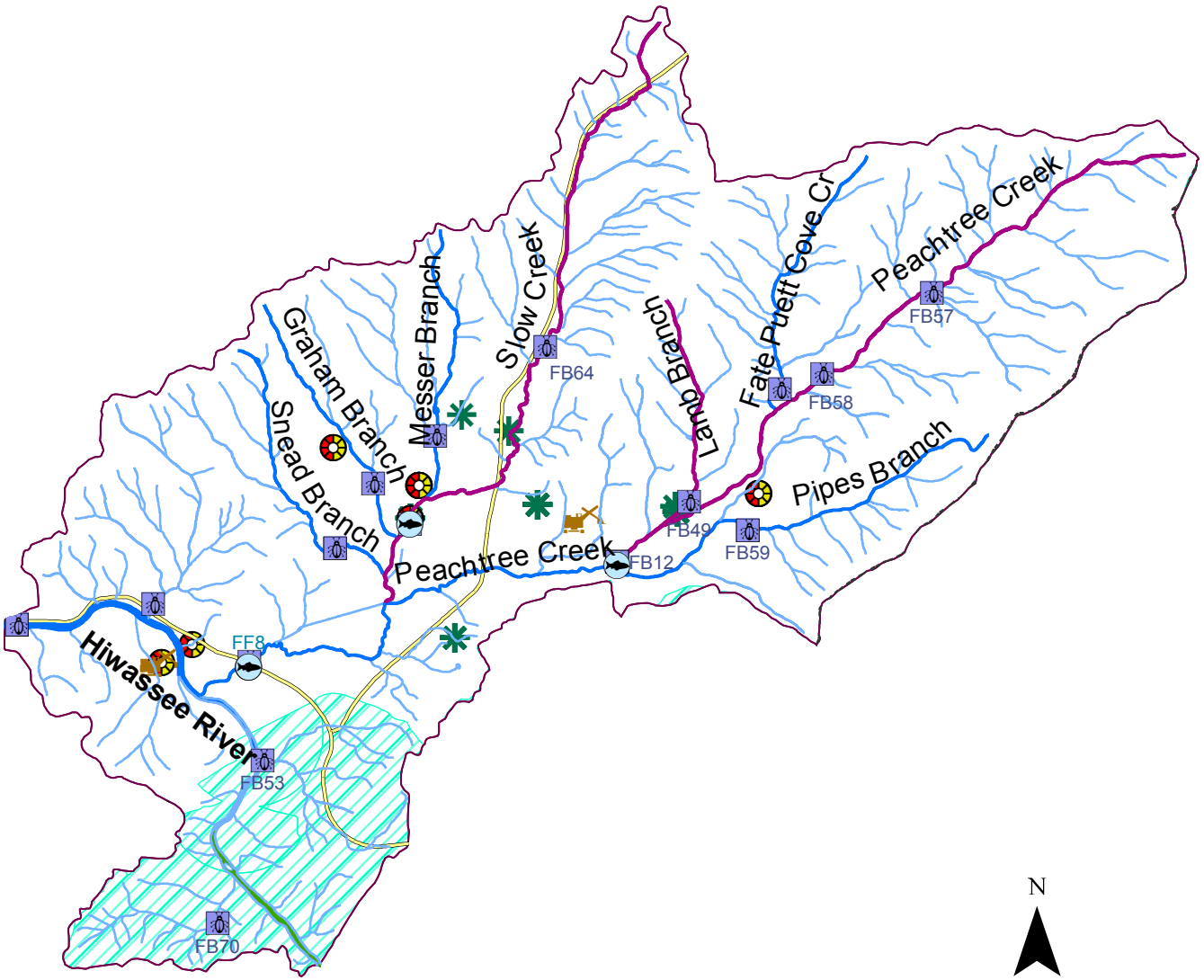


060200020303 Subwatershed



2010 Use Support

- Supporting
- No Data
- Not Rated
- Impaired
- New 2012 Impairments

Monitoring Sites

- Benthic Macroinvertebrate
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HQW/ORW Areas

- HQW/WSW
- WSW
- HQW
- ORW

Water Supply Watersheds

- WS-I
- WS-II
- WS-III
- WS-IV

N

0 0.5 1

Miles

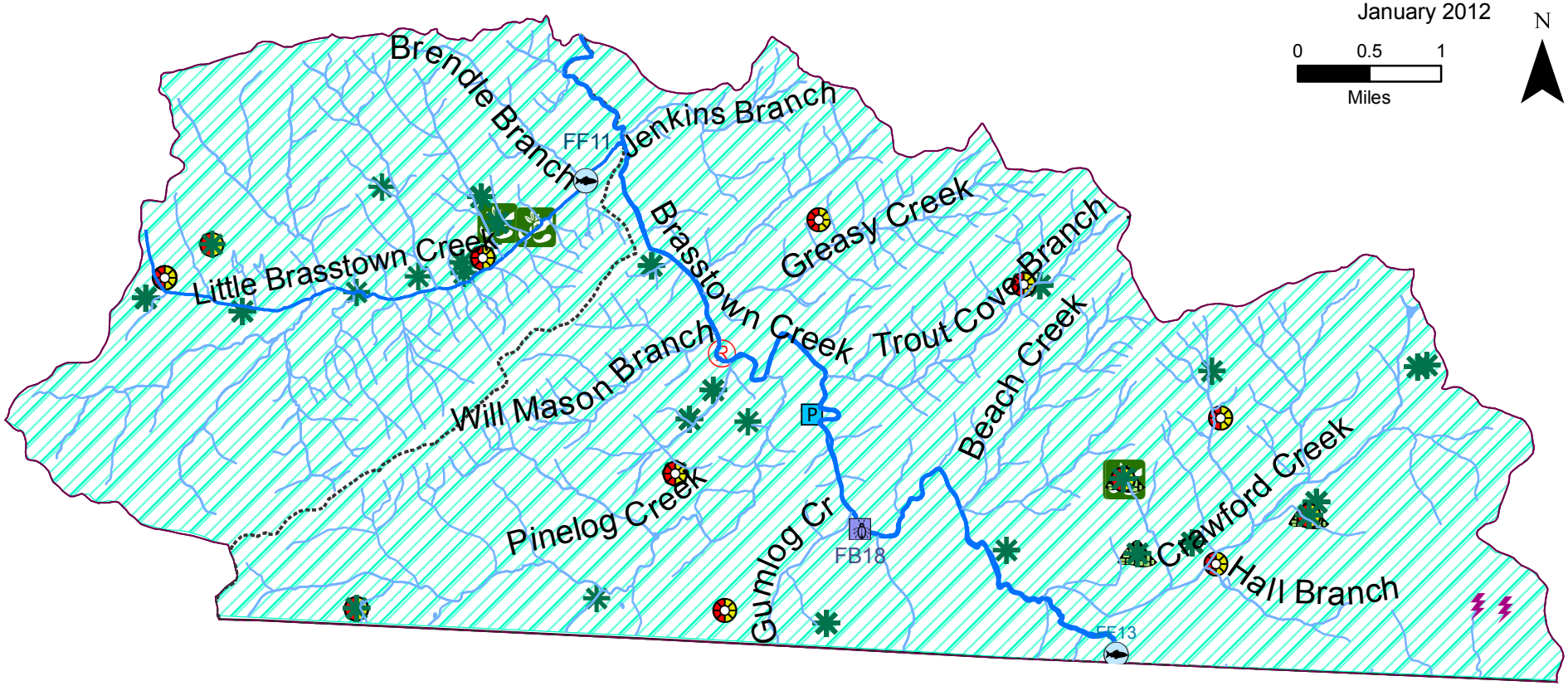
NC Division of Water Quality
Basinwide Planning Unit
March 2012

060200020302 Subwatershed

NC Division of Water Quality
Basinwide Planning Unit
January 2012

N

0 0.5 1
Miles



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

Monitoring Sites
- Benthic Macroinvertebrate
- Fish
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Water Supply Watersheds
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HQW/ORW Areas
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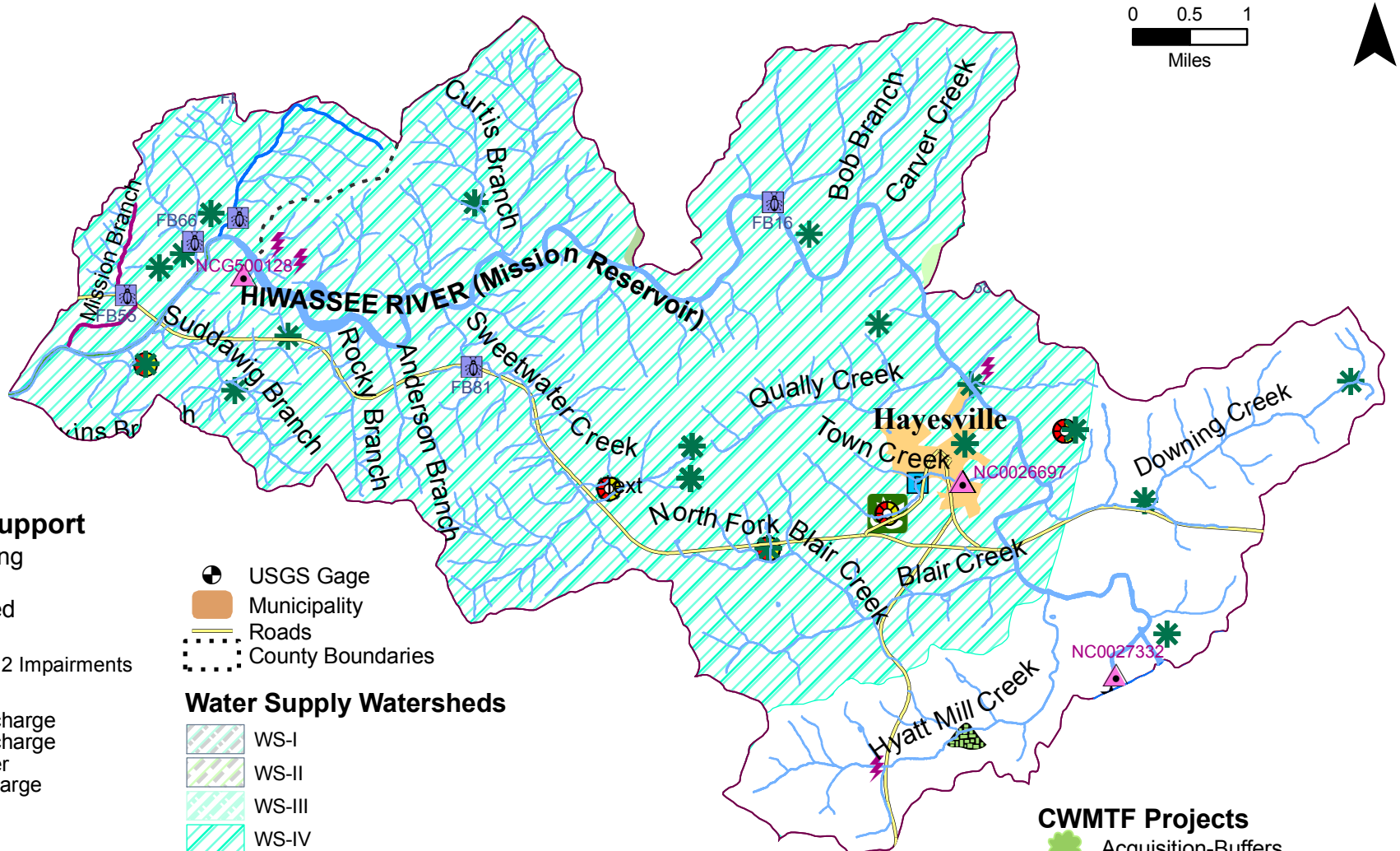
- Stormwater
- Wastewater
- Planning

060200020203 Subwatershed

NC Division of Water Quality
Basinwide Planning Unit
March 2012

N

0 0.5 1
Miles



2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired
- New 2012 Impairments

Permits
- Major Discharge
- Minor Discharge
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Water Supply Watersheds
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- WS-IV

Monitoring Sites
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HQW/ORW Areas
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CWMTF Projects
- Acquisition-Buffers
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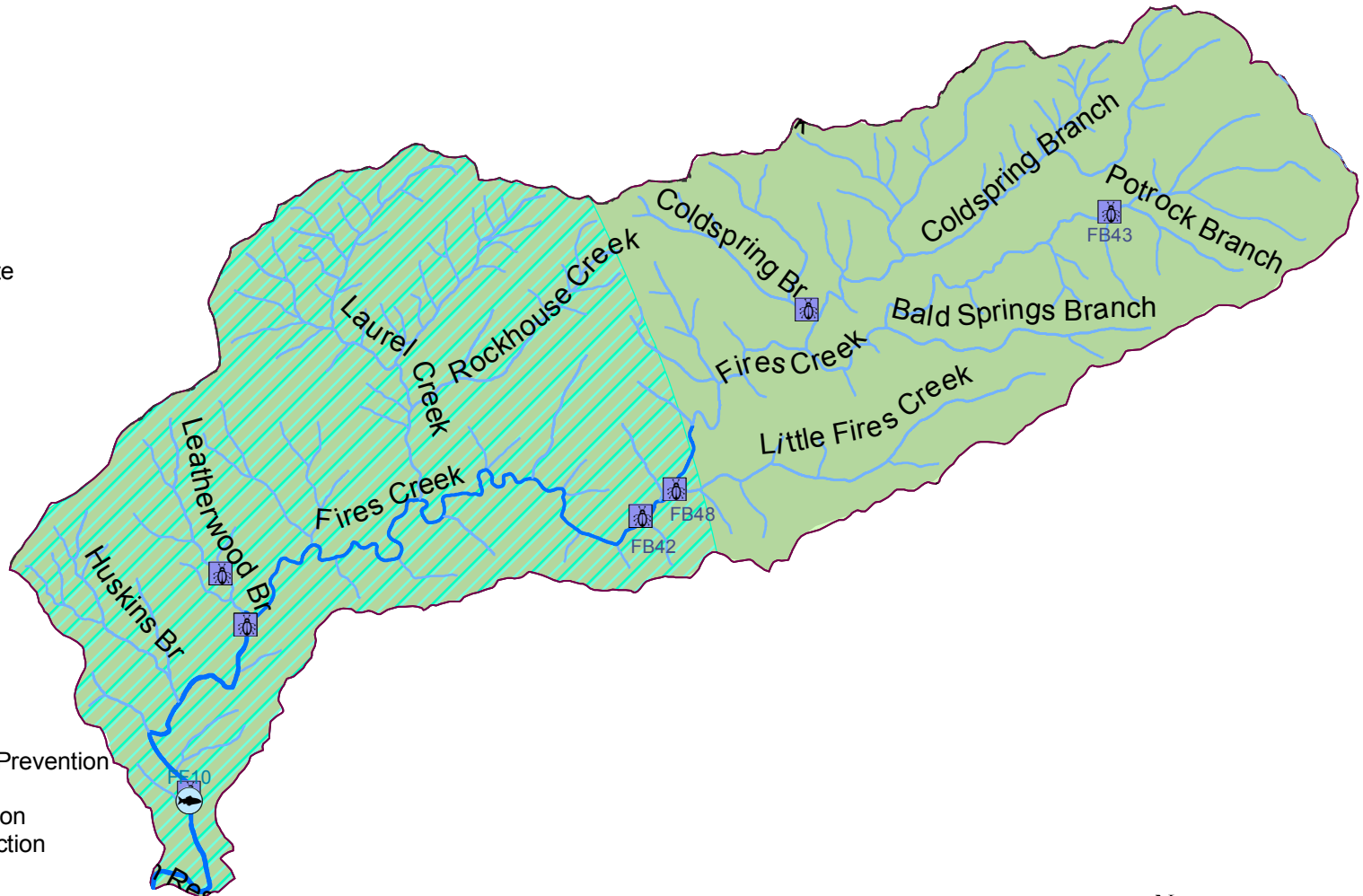
060200020202 Subwatershed



2010 Use Support
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Water Supply Watersheds
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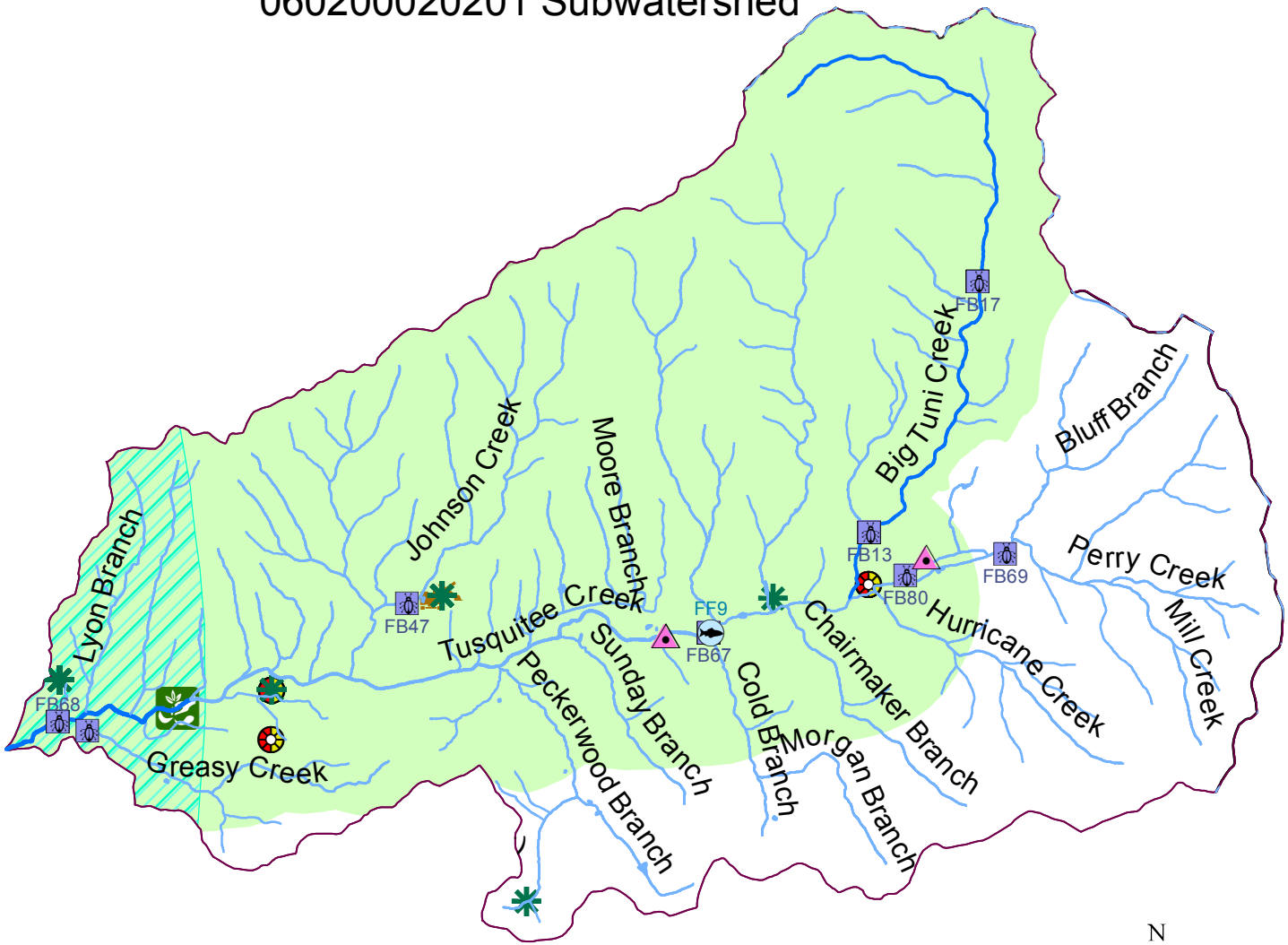
Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020201 Subwatershed



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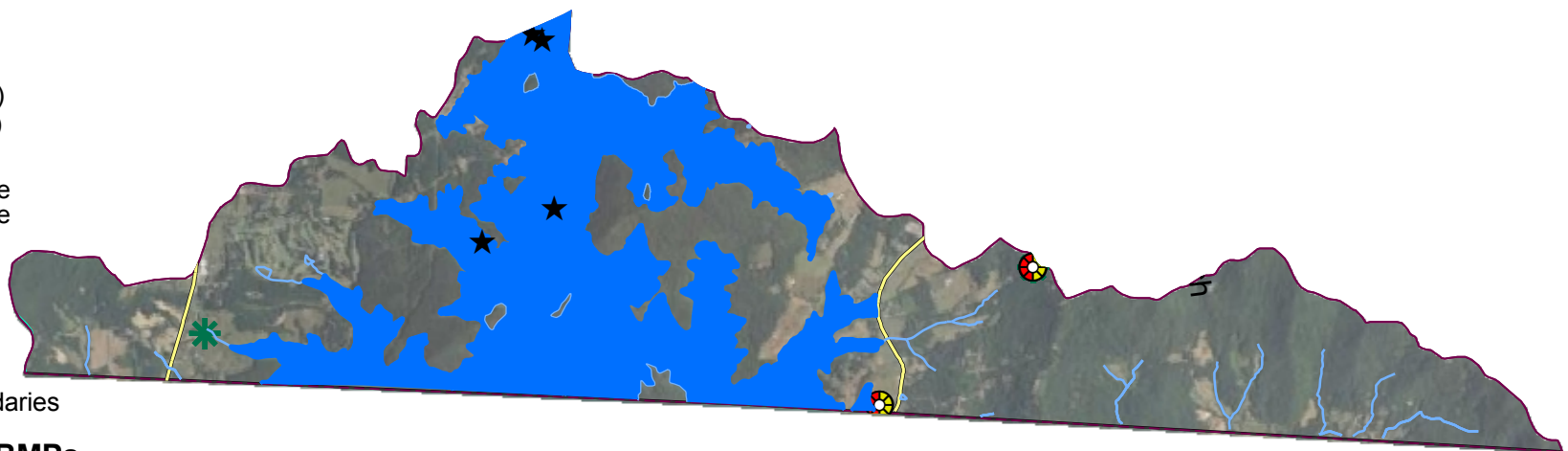
Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200020106 Subwatershed



2010 Use Support
- Supporting
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Monitoring Sites
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N

0 0.5 1

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

Subwatershed 060200020105

2010 Use Support
- Supporting
- No Data
- Not Rated
- Impaired

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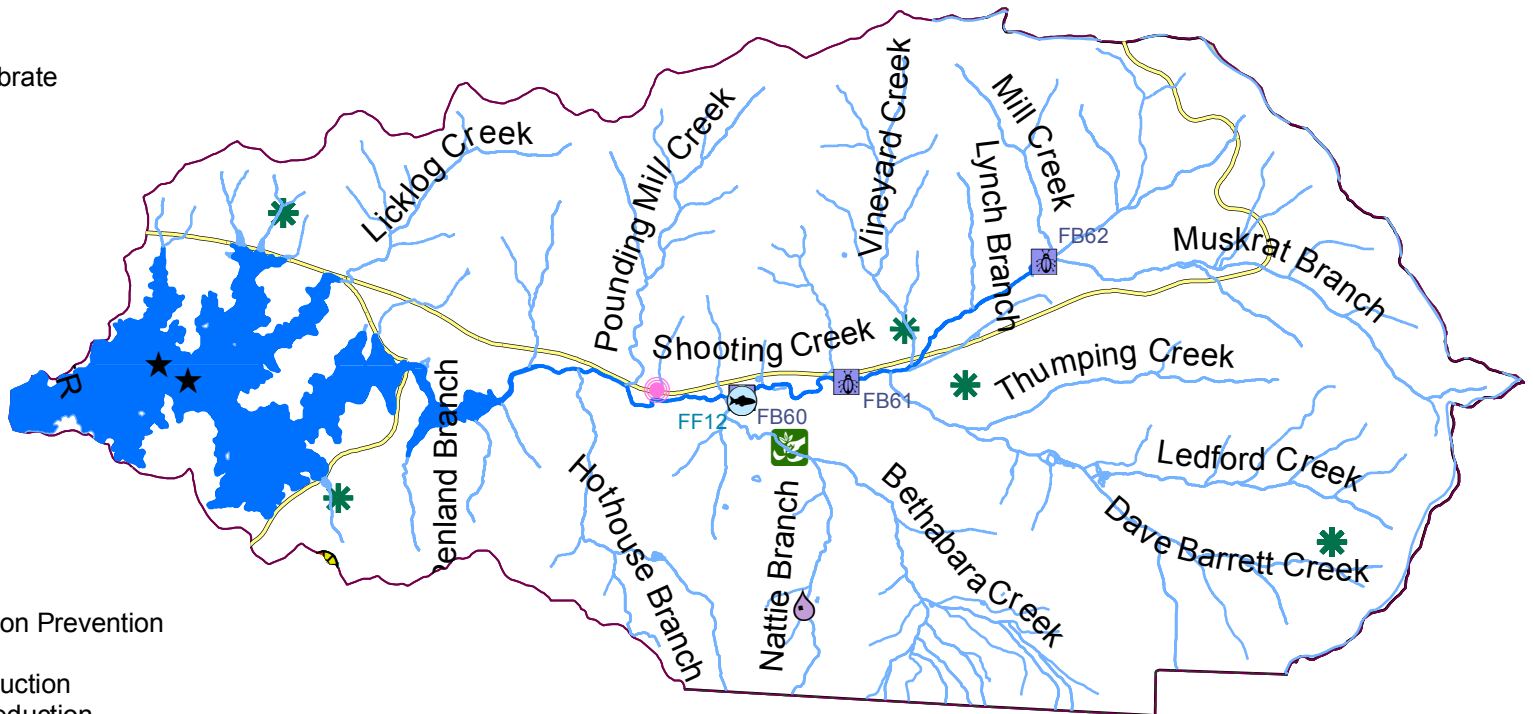

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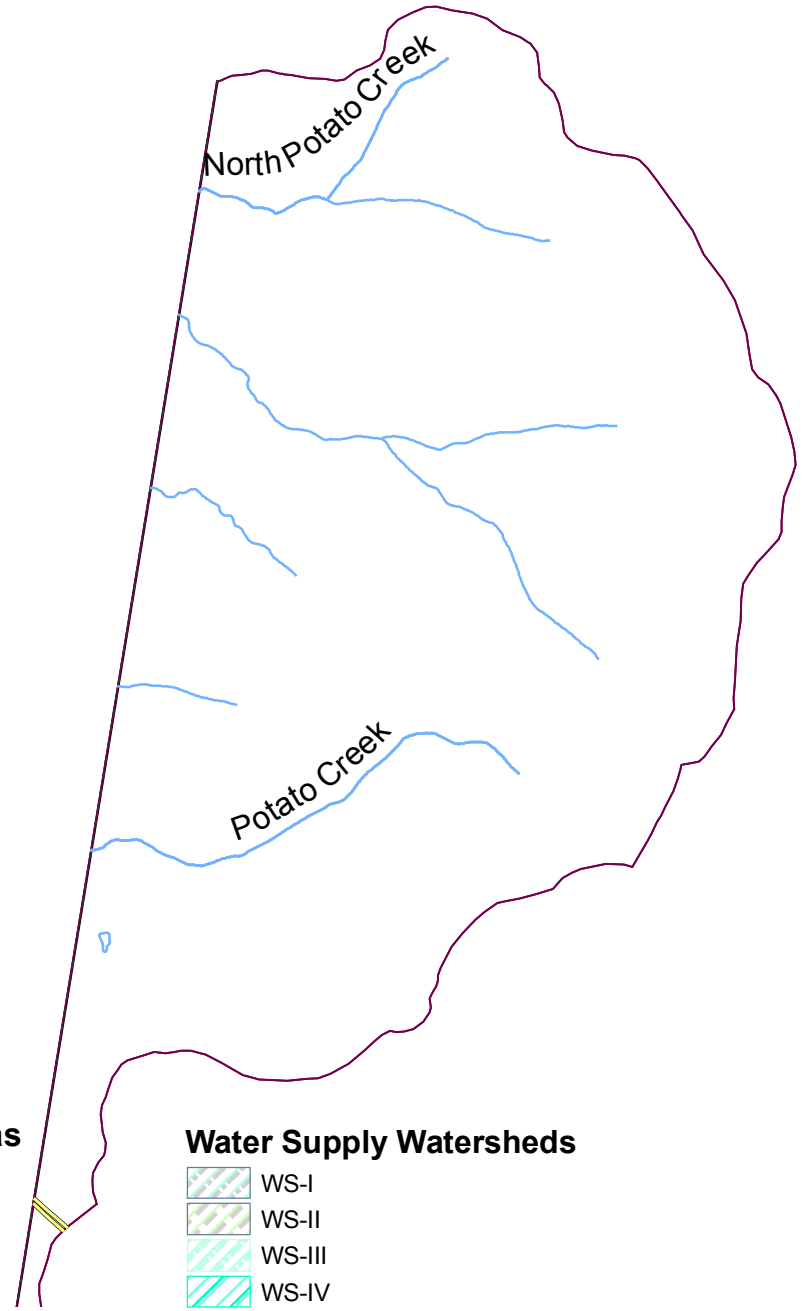
Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

060200030209 Subwatershed



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N

0 0.25 0.5

Miles

NC Division of Water Quality
Basinwide Planning Unit
January 2012

Appendix 1D

Ambient Monitoring Station Data Summary Sheets

The full report is available on the DWQ Environmental Sciences Section website:
http://portal.ncdenr.org/web/wq/ess/reports

Ambient Monitoring System Station
NCDENR, Division of Water Quality
Basinwide Assessment

Location: HIWASSEE RIV AT US 64 AT MURPHY
Station #: F2500000 **Hydrologic Unit Code:** 06020002
Latitude: 35.07840 **Longitude:** -84.02600 **Stream class:** WS-V
Agency: NCAMBNT **NC stream index:** 1-(43.7)

Time period: 01/17/2006 to 01/25/2010

	#	#		Results not meeting EL			Percentiles						
	results	**ND**	**EL**	**#**	**%**	**%Conf**	**Min**	**10th**	**25th**	**50th**	**75th**	**90th**	**Max**
Field													
D.O. (mg/L)	13	0	<4	0	0		8.5	8.5	9	10.2	11.1	11.5	11.6
	13	0	<5	0	0		8.5	8.5	9	10.2	11.1	11.5	11.6
pH (SU)	15	0	<6	1	6.7		5.6	5.9	6.3	6.7	7	7.7	8.2
	15	0	>9	0	0		5.6	5.9	6.3	6.7	7	7.7	8.2
Spec. conductance (umhos/cm at 25°C)	13	0	N/A				16	19	25	30	34	36	36
Water Temperature (°C)	15	0	>29	0	0		7.5	8.3	11.4	15.2	21.7	24.2	25.2
Other													
Hardness (mg/L)	1	0	>100	0	0		8	8	8	8	8	8	8
TSS (mg/L)	9	2	N/A				2.5	2.5	3.5	6.2	8.1	58	58
Turbidity (NTU)	16	0	>50	0	0		2.9	3	4.7	5.8	8	28.5	32
Nutrients (mg/L)													
NH3 as N	16	15	N/A				0.02	0.02	0.02	0.02	0.02	0.02	0.03
NO2 + NO3 as N	16	0	>10	0	0		0.05	0.06	0.08	0.13	0.22	0.38	0.53
TKN as N	16	10	N/A				0.2	0.2	0.2	0.2	0.22	0.33	0.39
Total Phosphorus	16	2	N/A				0.02	0.02	0.02	0.03	0.07	0.08	0.11
Metals (ug/L)													
Aluminum, total (Al)	6	0	N/A				130	130	175	230	275	380	380
Arsenic, total (As)	6	6	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	6	6	>2	0	0		1	1	1	2	2	2	2
Chromium, total (Cr)	6	6	>50	0	0		10	10	10	25	25	25	25
Copper, total (Cu)	6	6	>7	0	0		2	2	2	2	2	2	2
Iron, total (Fe)	6	0	>1000	1	16.7		270	270	292	350	792	1100	1100
Lead, total (Pb)	6	6	>25	0	0		10	10	10	10	10	10	10
Manganese, total (Mn)	5	0	>200	0	0		21	21	24	31	87	130	130
Mercury, total (Hg)	4	4	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	6	6	>25	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	6	5	>50	0	0		10	10	10	10	11	15	15

Fecal Coliform Screening(#/100mL)

# results:	Geomean	# > 400:	% > 400:	%Conf:
16	105.9	2	12.5	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station
NCDENR, Division of Water Quality
Basinwide Assessment

Location: HIWASSEE RIV AT US 19 BUS AT MURPHY
Station #: F2700000 **Hydrologic Unit Code:** 06020002
Latitude: 35.08530 **Longitude:** -84.03690 **Stream class:** C
Agency: NCAMBNT **NC stream index:** 1-(50)

Time period: 11/27/2007 to 11/17/2010

	#	#		Results not meeting EL			Percentiles						
	results	ND	EL	#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	29	0	<4	0	0		7.8	8.5	9.2	10.1	11.4	12.7	13.1
	29	0	<5	0	0		7.8	8.5	9.2	10.1	11.4	12.7	13.1
pH (SU)	31	0	<6	2	6.5		5.6	6	6.4	6.7	7.6	8.2	8.7
	31	0	>9	0	0		5.6	6	6.4	6.7	7.6	8.2	8.7
Spec. conductance (umhos/cm at 25°C)	32	0	N/A				23	24	26	28	31	32	35
Water Temperature (°C)	33	0	>29	0	0		4.3	6.6	10	14.6	20.8	25.1	28.5
Other													
Hardness (mg/L)	4	0	N/A				8	8	8	9	10	11	11
TSS (mg/L)	12	9	N/A				6.2	6.2	6.2	6.2	6.4	9.1	9.8
Turbidity (NTU)	33	1	>50	0	0		1	2	2.5	4.1	7.6	17.2	50
Nutrients (mg/L)													
NH3 as N	33	30	N/A				0.02	0.02	0.02	0.02	0.02	0.02	0.04
NO2 + NO3 as N	33	0	N/A				0.02	0.04	0.07	0.1	0.13	0.17	0.48
TKN as N	32	25	N/A				0.2	0.2	0.2	0.2	0.2	0.28	0.44
Total Phosphorus	33	13	N/A				0.02	0.02	0.02	0.02	0.03	0.04	0.1

Fecal Coliform Screening(#/100mL)

# results:	Geomean	# > 400:	% > 400:	%Conf:
33	28.9	3	9.1	

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station
NCDENR, Division of Water Quality
Basinwide Assessment

Location: VALLEY RIV AT US 74 AND 19 AND 129 AT TOMOTLA
Station #: F4000000 **Hydrologic Unit Code:** 06020002
Latitude: 35.13728 **Longitude:** -83.97960 **Stream class:** C Tr
Agency: NCAMBNT **NC stream index:** 1-52

Time period: 01/17/2006 to 11/17/2010

	# results	# ND	EL	Results not meeting EL #	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	42	0	<6	0	0		7.6	8.1	8.6	9.8	11.3	12.5	13.7
pH (SU)	44	0	<6	0	0		6	6.3	6.6	7	7.2	7.4	8
	44	0	>9	0	0		6	6.3	6.6	7	7.2	7.4	8
Spec. conductance (umhos/cm at 25°C)	45	0	N/A				25	33	40	48	66	73	81
Water Temperature (°C)	48	0	>29	0	0		4.2	6.2	9.6	13.6	20.3	24.3	25.6
Other													
Hardness (mg/L)	4	0	N/A				11	11	12	18	29	31	31
TSS (mg/L)	20	12	N/A				2.5	4.8	6.2	6.2	12	38.1	68
Turbidity (NTU)	49	0	>10	10	20.4	> 99.9	1.1	1.4	2.2	3.9	9.8	16	34
Nutrients (mg/L)													
NH3 as N	48	40	N/A				0.02	0.02	0.02	0.02	0.02	0.02	0.04
NO2 + NO3 as N	48	0	N/A				0.11	0.22	0.25	0.3	0.33	0.36	0.4
TKN as N	47	26	N/A				0.2	0.2	0.2	0.2	0.25	0.32	0.36
Total Phosphorus	48	4	N/A				0.02	0.02	0.03	0.04	0.07	0.08	0.1
Metals (ug/L)													
Aluminum, total (Al)	6	0	N/A				58	58	127	220	448	590	590
Arsenic, total (As)	6	6	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	6	6	>0.4	0	0		1	1	1	2	2	2	2
Chromium, total (Cr)	6	6	>50	0	0		10	10	10	25	25	25	25
Copper, total (Cu)	6	6	>7	0	0		2	2	2	2	2	2	2
Iron, total (Fe)	6	0	>1000	0	0		190	190	212	400	588	640	640
Lead, total (Pb)	6	6	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	4	4	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	6	6	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	6	4	>50	0	0		10	10	10	10	10	11	11

Fecal Coliform Screening(#/100mL)

# results:	Geomean	# > 400:	% > 400:	%Conf:
49	206.3	16	32.7	98.8

Key:
result: number of observations
ND: number of observations reported to be below detection level (non-detect)
EL: Evaluation Level; applicable numeric or narrative water quality standard or action level
Results not meeting EL: number and percentages of observations not meeting evaluation level
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)
Stations with less than 10 results for a given parameter were not evaluated for statistical confidence