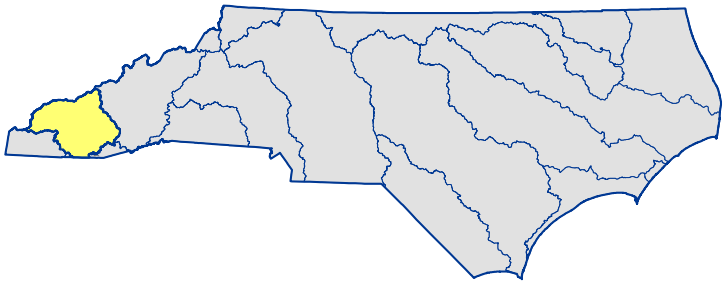
Little Tennessee River Basinwide Water Quality Plan



Summary

Introduction

This 2012 document is the fourth five-year update of the Little Tennessee River Basinwide Water Quality Plan. Previous basinwide plans for the Little Tennessee River Basin were completed in 1997, 2002, and 2007 and are available from the DWQ 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 Little Tennessee River Basin in 2009 and will be conducted again in 2014.

The Little Tennessee River Basin spans over 1,797 square miles and is divided into three subbasins, Figure 1-1. 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 (formerly 040401, 040402, 040403, 040404), 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 8-digit hydrologic unit or subbasin level.

The Little Tennessee 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.

This plan includes three chapters covering water quality information for each of the subbasins:

- Chapter 1: Upper Little Tennessee River Subbasin HUC 06010202
- Chapter 2: Tuckasegee River Subbasin HUC 06010203
- Chapter 3: Lower Little Tennessee River Subbasin HUC 06010204

Basin at a Glance

Land Area square miles....1,797
Stream Miles.....2,501
Lake/Reservoir acres.....14,171

Counties:

Cherokee, Clay, Graham, Jackson, Macon, Swain,

Municipalities:

Bryson City, Dillsboro, Forest Hills, Franklin, Highlands, Robbinsville, Sylva, Santeetlah, Webster

Population:

2000.....81,917
2010.....94,566

2006 Land Cover:

Developed.....5%
Forested.....91%
Agriculture.....4%

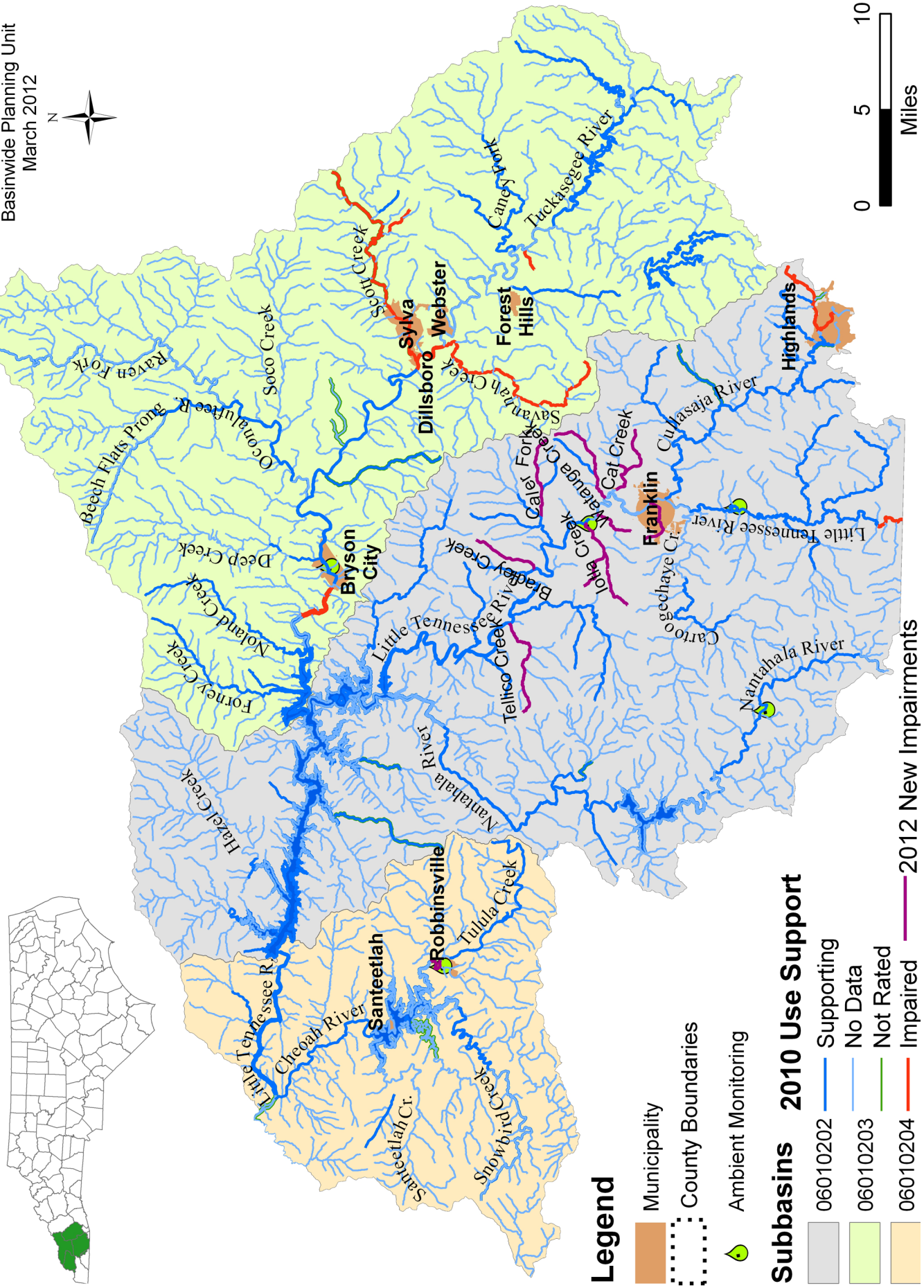
EPA Level IV Ecoregions:

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

Permited Facilities:

NPDES
Wastewater Discharge.....58
Wastewater Nondischarge...13
Stormwater.....38
Aquaculture Operations.....4

FIGURE 1-1: LITTLE TENNESSEE RIVER BASIN MAP

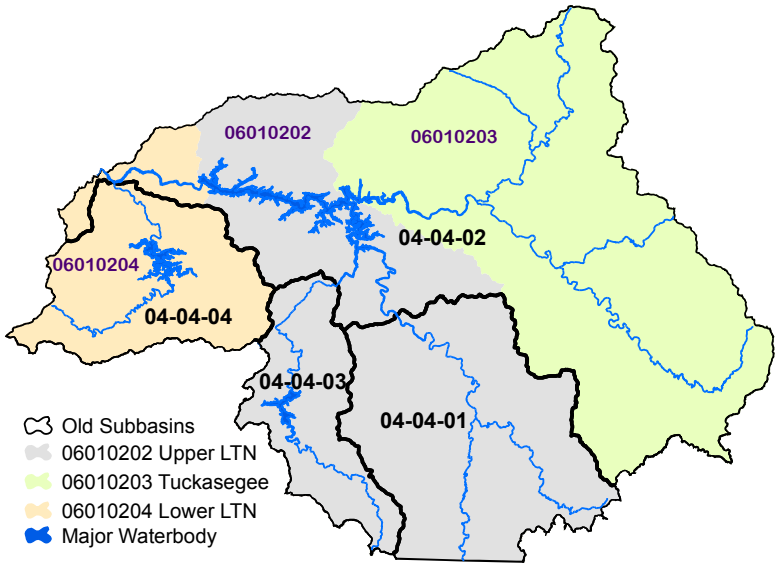


Overview

The Little Tennessee River basin is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina. It encompasses ~1,800 mi^2 in Swain, Macon, Clay, Graham, Cherokee, and Jackson counties. Much of the land within the basin is federally owned (49%) and in the U.S. Forest Service's Nantahala National Forest (Joyce Kilmer/Slick Rock Wilderness Area) or the Great Smoky Mountains National Park. The basin also includes the Cherokee Indian Reservation.

The Little Tennessee River is one of three major tributaries of Fontana Lake. The other two are the Nantahala River and the Tuckasegee River. The Cheoah River, the fourth major tributary of the Little Tennessee River in North Carolina, has its confluence with the river below Fontana Lake.

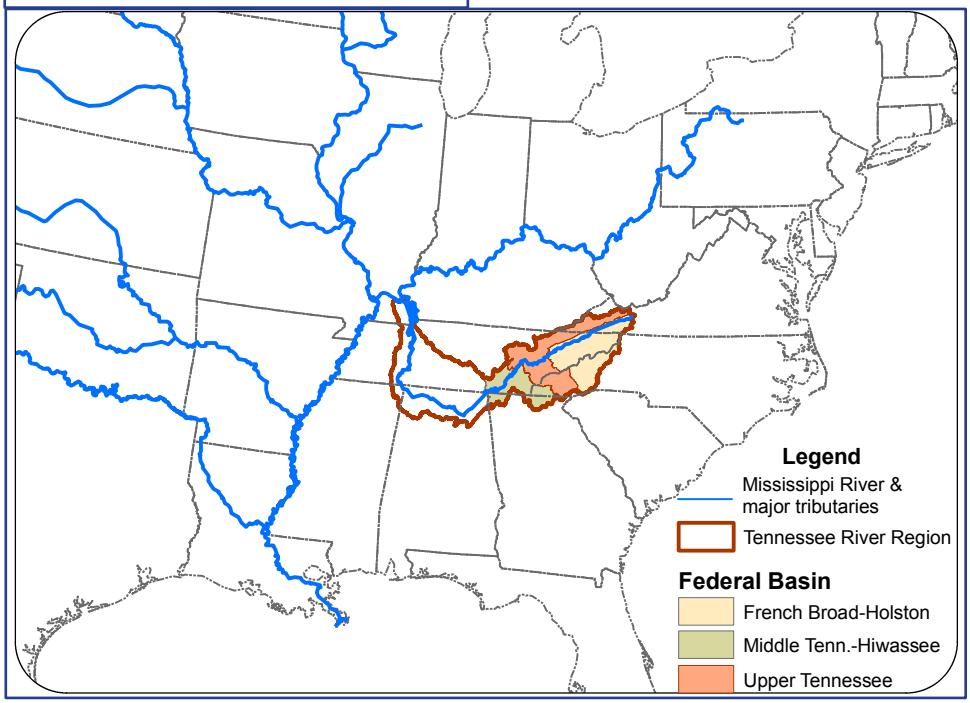
Figure 1-2: Old DWQ Subbasin- HUC Subbasin Conversion Map



The North Carolina section of the Little Tennessee River is typical of many other mountain rivers. The gradient is relatively steep in most reaches of the river and the substrate is dominated by riffle habitats. Most tributaries are high gradient streams capable of supporting trout populations in the upper reaches. The Basin has one of the most outstanding and diverse aquatic communities within the entire state. It is home to a variety of rare species, including crayfish, mussels, fish, aquatic insects, and amphibians. The stretch of Little Tennessee River between Franklin and Fontana Lake (25 miles) has a faunal diversity that rivals any in the state and perhaps in the nation. Forested land continues to comprise a large majority of this basin, owing to its relatively pristine condition.

Although habitat fragmentation due to dam construction has occurred throughout this system in North Carolina and Tennessee, it continues to support an incredibly rich and diverse ecosystem. Mountain home development on steep slopes is an increasing environmental concern and the lower reaches of many tributary catchments are farmed or developed resulting in the increased potential for nonpoint source problems.

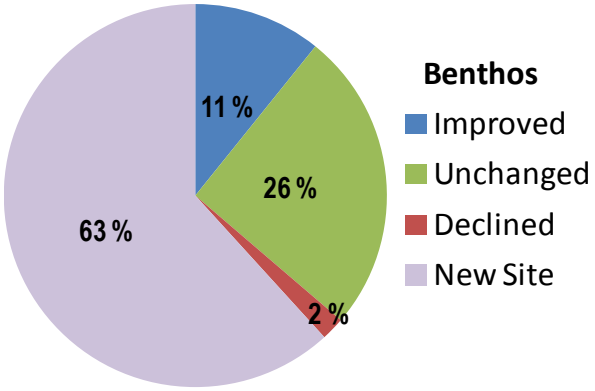
Figure 1-3: Tennessee River Region



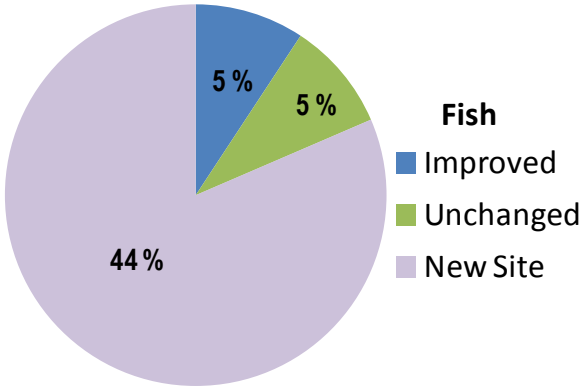
Water Quality Summary

There are five ambient water quality monitoring stations within the Basin, of which turbidity and low pH 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 39 macroinvertebrate and 12 fish community basinwide sites with an additional 63 macroinvertebrate and 42 fish samples taken because of special study requests. A majority of the macroinvertebrate sites have Excellent Bioclassification ratings and most of the fish community sites resulted in a Not Rated status due to absence of criteria for rating high gradient mountain trout waters.

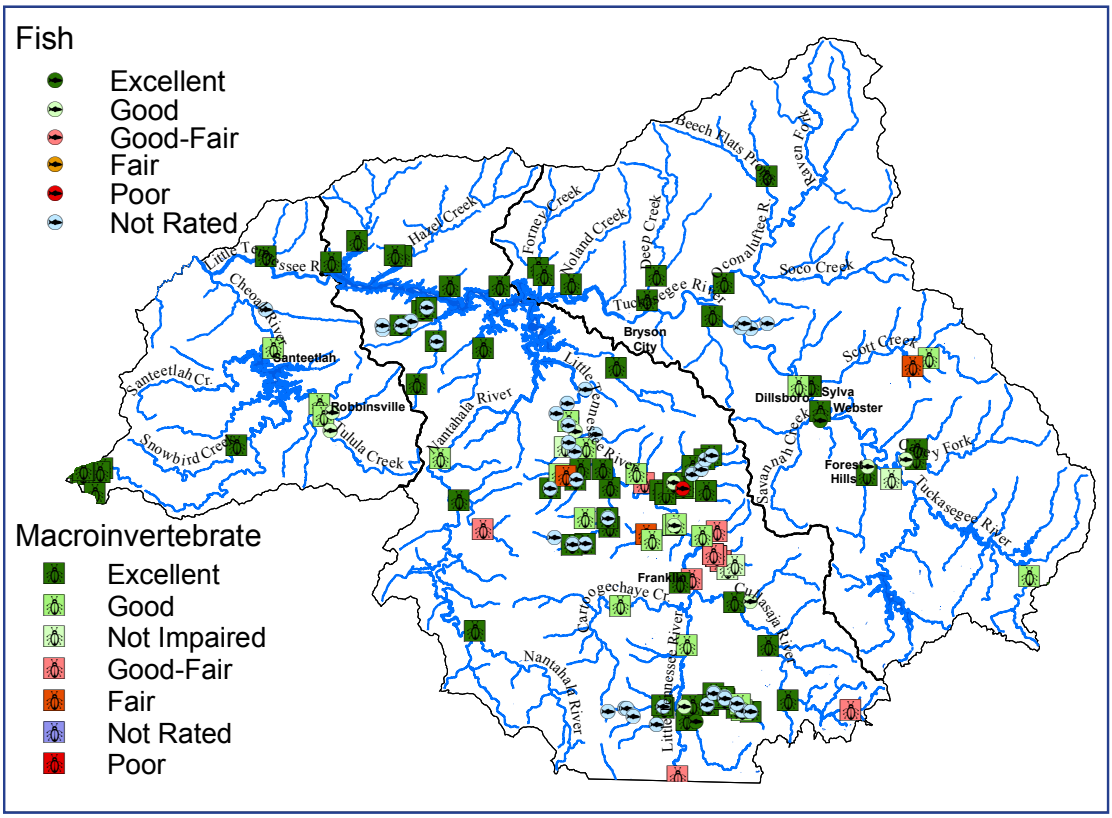
Change in Benthic Macroinvertebrate Site Ratings



Change in Fish Community Site Ratings



Biological Sample Sites and Ratings between 2005-2011



Improved Waters

The Cullasaja River (Ravenel Lake) AU# 2-21-(0.5)a is no longer Impaired for biological integrity as the benthic macroinvertebrate sample resulted in a Good-Fair Bioclassification rating in 2010. This is an improvement over the Fair rating it received in the previous four samples.

Impaired Waters

Water quality data within a 5- 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 in Table 1-1 includes waterbodies in which a parameter exceeded the standard and enough samples were collected to meet criteria assessment.

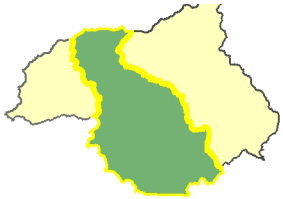
Table 1-1: Impaired Waters

Waterbody	Classification	Assessment Unit #	Length	Parameter	Impaired Year
Caler Fork Creek	C	2-29-4	4.6 mi.	EBIF	2012
Cat Creek	C	2-23-4a 2-23-4b 2-23-4b	2.5 mi 0.5 mi. 0.5 mi.	FCB EBIB FCB	2012 2010 2012
Cheoah River	C;Tr	2-190-(3.5)	1.4 mi.	Turbidity	2012
Crawford Branch	C	2-22	2.7 mi.	FCB EBIB	2012
Cullasaja River (Ravenel Lake)	WS-III;Tr	2-21-(0.5)b	0.7 mi.	EBIB	1998
Bradley Creek	C;Tr	2-33	3.7 mi.	FCB	2012
Iotla Branch	C	2-27-1	2.4 mi.	FCB	2012
Iotla Creek	C	2-27	5.5 mi.	FCB	2012
Little Tennessee R.	C	2-(1)a	2.1 mi.	EBIF	2002
Mill Creek	WS-III;Tr	2-21-3	1.3 mi.	EBIB	1998
Rabbitt Creek	C;Tr	2-23b	2.1 mi.	EBIB FCB	2010 2012
Rocky Branch	C	2-26	2.3 mi.	FCB	2012
Savannah Creek	C;Tr	2-79-36	13.4 mi.	FCB	2008
Scott Creek	C;Tr	2-79-39	15.3 mi.	FCB	2008
Sugarloaf Creek	C	2-79-39-5-1	1.8 mi.	EBIB	2010
Tellico Creek	C;Tr	2-40b	1.0 mi.	EBIB	2012
Tuckasegee River Arm of Fontana Lake	C	2-(78)a	170.6 ac.	FCB	2008
Tuckasegee River	C	2-79-(38)	0.7 mi.	FCB	2008
Tuckasegee River	C;Tr	2-79-(35.5)a 2-79-(35.5)b	1.4 mi. 0.5 mi.	FCB	2008
UT Tuckasegee	C	2-79-(24)ut4	1.3 mi.	Low pH	2010
Watauga Creek	C;Tr	2-24	5.4 mi.	FCB	2012

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

Subbasin Water Quality Summaries

Upper Little Tennessee River Subbasin HUC 06010202

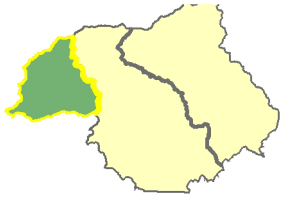


Water quality issues of concern in this subbasin include impacts from developments on steep slopes, agricultural runoff, trout farm waste, stream bank erosion, limited riparian buffers, failing culverts and individual onsite wastewater failures. Waterbodies currently on the 2010 303(d) list of Impaired waters include: a two mile reach of the Little Tennessee River, Cullasaja River, Mill Creek, Cat Creek, Rabbit Creek and Iotla Branch. Also a new fish advisory was issued in 2008 for Lake Fontana due to the potential mercury content in walleye. In 2011, The **Little Tennessee Watershed Association** completed their State of the Streams report. This document is an excellent resource, covering land use changes, natural history, local biomonitoring program results and restoration initiatives.

Chapter 2: Tuckasegee River Subbasin HUC 06010203

This subbasin contains some of the most pristine high quality waters in the state and supports numerous trout streams. Water quality issues of concern in this subbasin include impacts from developments on steep slopes, agricultural runoff, stream bank erosion, limited riparian buffers and individual onsite wastewater failures. Waterbodies currently on the 2010 303(d) list of Impaired waters include: a 1.3 mile unnamed tributary to the Tuckasegee River, Scott Creek, Sugarloaf Creek, Savannah Creek and 170 acres of the Tuckasegee River Arm of Fontana Lake.

Chapter 3: Lower Little Tennessee River Subbasin HUC 06010204



This subbasin contains high quality waters and supports numerous trout streams. Water quality issues of concern in this subbasin include agricultural runoff, stream bank erosion, and individual onsite wastewater failures. There are currently no waterbodies on the 2010 303(d) list of Impaired waters, however a new fish advisory was issued in 2008 for Lake Santeetlah due to the potential mercury content in walleye. Water quality improvements were made in West Buffalo Creek with the removal of four trout farms that were contributing nutrients to Santeetlah Lake, in the Cheoah River with the improved management of water releases from Santeetlah Dam to support aquatic habitat, and in the Tellico River watershed by the restoration of forest and stream conditions impacted from off-highway vehicle recreation.

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

In 1995, a group of Little Tennessee River Basin stakeholders, particularly non-profit organizations and public agencies, was convened as the Little Tennessee Non-Point Source Team (LTNPST) by the NC Division of Water Quality. The participants in the LTNPST continue to meet on a regular basis to exchange information and ideas and, at times, pursue collaborative opportunities. Various participants facilitated the meetings and in 2007, NC Natural Heritage Program assumed a leadership role in convening meetings. In 2008, a Conservation Action Plan for the Upper Little Tennessee River Basin was assembled with assistance

from World Wildlife Fund, and with direction provided by LTNPST. In 2009, the stakeholders changed the name of this informal group to “Partners for the Little Tennessee”.

The PLT has identified the need for a system of erosion and sediment control (E&SC) trainings within the western North Carolina region as a priority, as 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. In November 2009, key PLT participants (Land Trust for the Little Tennessee, Watershed Association of the Tuckasegee River, Little Tennessee Watershed Association, Jackson-Macon Conservation Alliance, Southwestern Resource Conservation and Development Service, NC Natural Heritage Program) invited the Hiwassee River Watershed Coalition and Haywood Waterways Association to a discussion about E&SC training for the seven westernmost counties [Haywood, Jackson, Macon, Swain, Graham, Clay, Cherokee]. 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.

Franklin to Fontana Local Watershed Plan

Between 2008 and 2011, the North Carolina Ecosystem Enhancement Program led a watershed study and planning effort in the Little Tennessee River watershed between Lake Emory and Lake Fontana. This effort included an assessment of the health of the Little Tennessee River and its tributaries, identification of the major stressors that impact stream quality, development of a plan that names specific recommendations to restore and protect watershed resources, and the production of an atlas of on-the-ground projects that can provide the greatest benefit to the watershed. The data collected during this assessment greatly enhanced DWQ’s existing dataset and provides valuable knowledge on site specific restoration needs. Implementation of identified restoration and protection projects is encouraged.

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.

Trout Farms

Macroinvertebrate and chemical sampling data collected in streams used by and adjacent to trout farms indicated negative impacts to water quality standards. 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. The NCG530000 permit is anticipated to be renewed in July 2012. Any necessary permit modifications to fully protect surface waters used by trout farm operations will be considered and discussed by DWQ and stakeholders during the renewal period. Possibilities may include individual permits for certain farms, farm-specific BMP plan requirements and system modifications.

The economic impact of trout farms in the rural counties within which they are located is considered important. The past six years have seen a decrease of ten percent of the total number of trout farms in the state. Various reasons account for the changes, including an aging farmer population, land valuation increases and, considered most significant, an increase in water temperatures. Options are being considered to maintain current production levels in light of the water temperature change.

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.

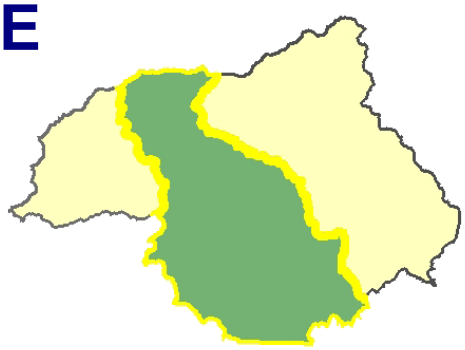
Recent budgetary changes caused the dissolution of an important program that provided significant water quality as well as human health and quality of life benefits. The Wastewater Discharge Elimination (WaDE) Program formed to identify and correct straight-piped wastewater discharges and failing septic 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. 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. 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.

Upper Little Tennessee River Subbasin



HUC 06010202

Includes: Nantahala River, Cullasaja River, Little Tennessee River & Fontana Lake

Watershed at a Glance

Counties:
Clay, Graham, Macon, & Swain

Municipalities:
Franklin, Highlands

EPA Level IV Ecoregions:
Broad Basins, High Mtns., Southern Metasedimentary Mtns, Southern Crystalline Ridges & Mtns.

Population:
2000: 33,168
2010: 37,924

Area 789 mi²

2006 Land Cover:
Open Water.....2%
Developed.....5%
Forested.....87%
Scrub.....1%
Agriculture.....5%

Permitted Facilities:
NPDES
Wastewater Discharge.....27
Wastewater Nondischarge.....4
Stormwater.....19
Trout Farms.....3

Figure 1-1: NLCD 2006 Land Cover

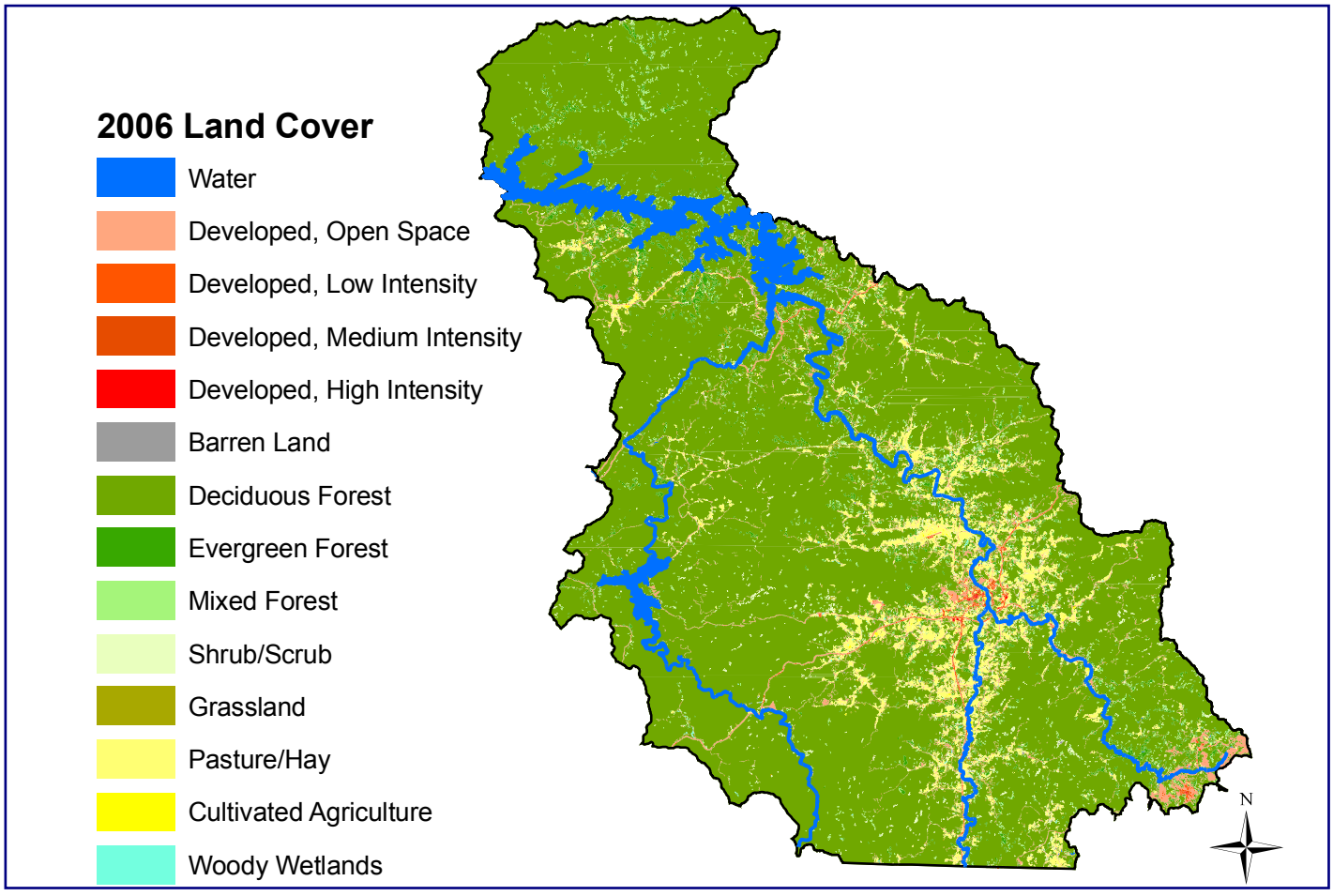
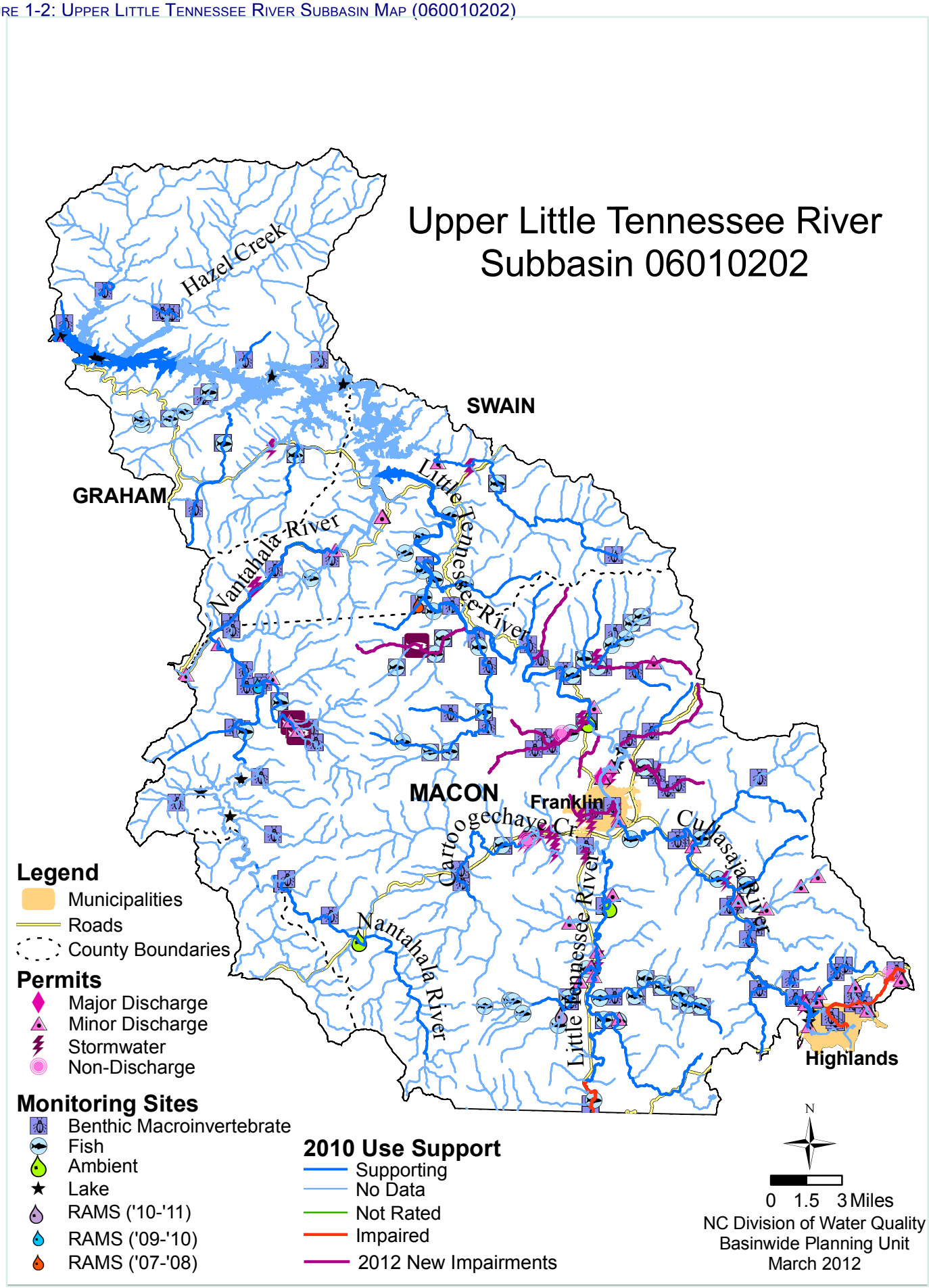


Figure 1-2: Upper Little Tennessee River Subbasin Map (060010202)

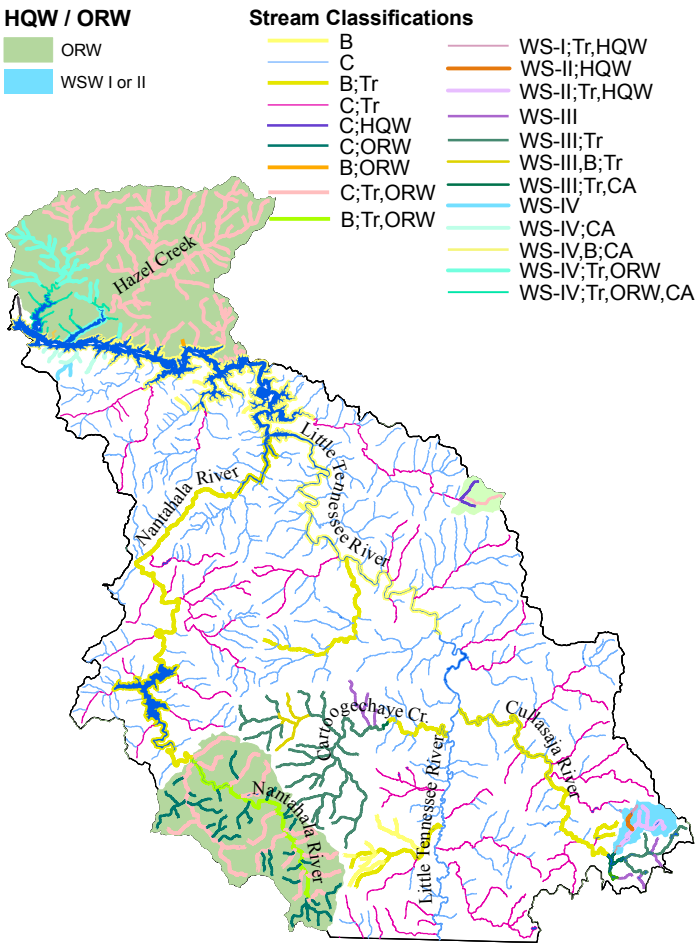


Water Quality Overview

The Upper Little Tennessee River Subbasin, hydrologic unit 06010202, was represented in previous Basin Plans as Subbasins 04-04-01, 04-04-02, 04-04-03, and 04-04-04. This subbasin covers 789 sq. miles and is 87% forested; containing portions of Nantahala National Forest and Great Smoky Mountains National Park (Figure 1-1). There are approximately 9,761 reservoir acres and ~1,083 classified stream miles, not including the numerous unnamed tributaries. The Nantahala River is a major tributary to the Little Tennessee River and drains into Fontana Lake. A map of the subbasin showing Impaired streams, monitoring and permit locations is shown in Figure 1-2.

This subbasin contains some of the most pristine high quality waters in the state and supports numerous trout streams (Figure 1-3). Water quality issues of concern in this subbasin include impacts from developments on steep slopes, agricultural runoff, trout farm waste, stream bank erosion, limited riparian cover, failing culverts and individual onsite wastewater failures. Waterbodies currently on the 2010 303(d) list of Impaired waters include: a 2 mile reach of the Little Tennessee River, Cullasaja River, Mill Creek, Cat Creek, Rabbit Creek and Iotla Branch. A new fish advisory was issued in 2008 for Lake Fontana due to the potential mercury content in walleye.

Figure 1-3: Stream Classifications

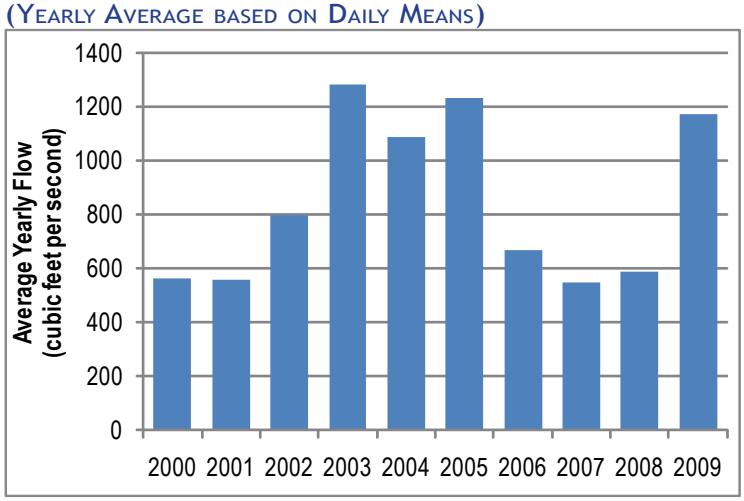


In 2011, The Little Tennessee Watershed Association completed their State of the Streams report. This document is an excellent resource, covering land use changes, natural history, local biomonitoring program results and restoration initiatives.

Stream Flow

Stream flow is monitored at US Geological Survey gaging stations. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). There are six gaging stations in this subbasin. Figure 1-4 provides an example of average stream flow over a 10 year period and gives an idea of which years received heavier precipitation. The flow rate in a stream can impact the measurement of physical and chemical parameters. In particular, droughts can have major effects on parameters such as dissolved oxygen, turbidity, pH, and others by reducing stream flow. For more information about instream flow see Division of Water Resources website: http://www.ncwater.org/Permits_and_Registration/Instream_Flow/ or for USGS daily discharge data: http://coweeta.uga.edu/dbpublic/hydrologic_data.asp.

Figure 1-4: Stream flow at USGS 03503000 Little Tennessee River at Needmore (Yearly Average based on Daily Means)

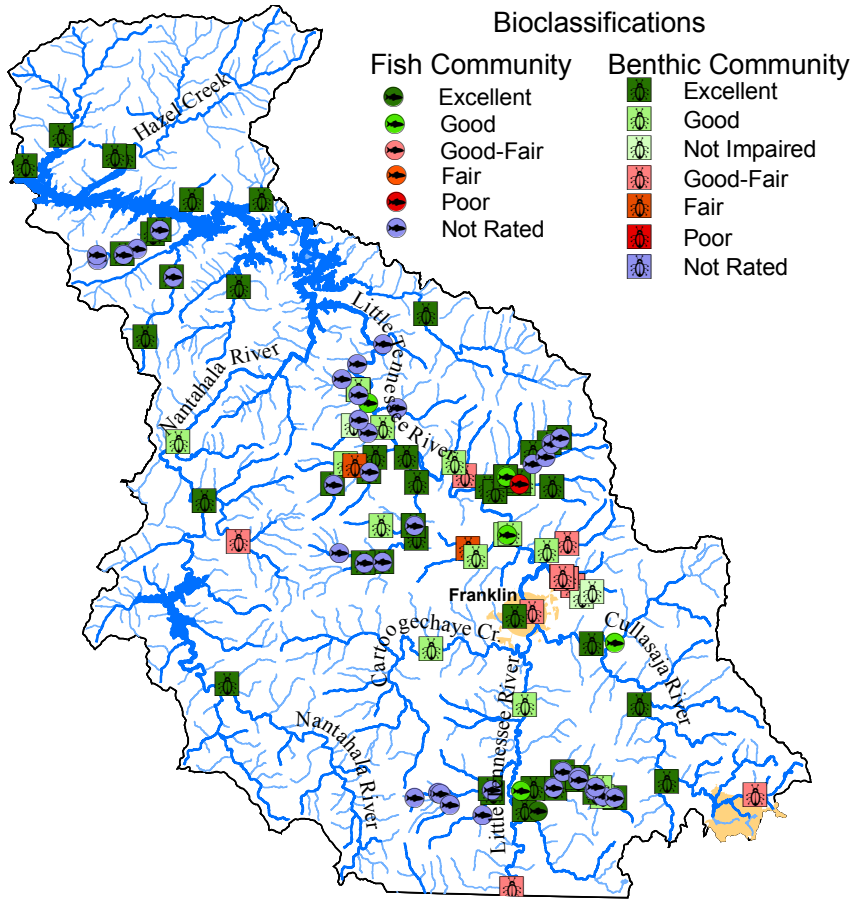


Biological Monitoring

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.

Biological samples were collected during the spring and summer months of 2004 and 2009-10 by the DWQ-Environmental Sciences Section as part of the five-year basinwide sampling cycle. Twenty-one benthic macroinvertebrate sites and six fish community sites were evaluated in 2009-10, representing 24 distinct localities. Each basinwide biological station monitored during the current cycle is shown in Figure 1-5 and color coded based on its current rating. The majority of benthic macroinvertebrate samples taken in this watershed received an Excellent rating, while most fish community sites resulted in a Not Rated status, due to the absence of criteria for rating high gradient mountain trout waters. For more information about biological data in this watershed, see the 2010 Little Tennessee River Basinwide Assessment Report. Detailed data sheets for each sampling site can be found in Appendix 1-B.

Figure 1-5: Biological Sites Current Ratings



Benthos

Among the benthic macroinvertebrate sample sites, six sites improved, while the remainder retained the same bioclassification in 2009-2010 as observed in 2004 (Figure 1-6). There were an additional 51 benthic samples taken to support special studies.

Fish

Among the six fish community sites, two improved from 2004 while the remaining sites maintained the same bioclassification in 2009 from that observed in 2004 (Figure 1-7). There were an additional 38 fish community samples taken to support special studies.

Figure 1-6: Benthic Macroinvertebrate Sample Status

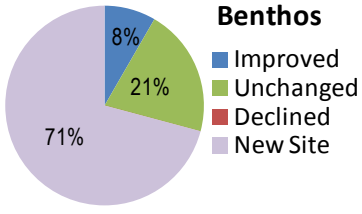
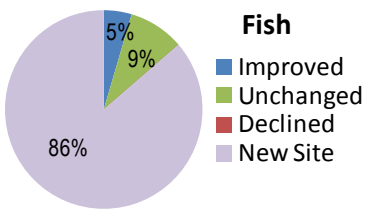


Figure 1-7: Fish Community Sample Status



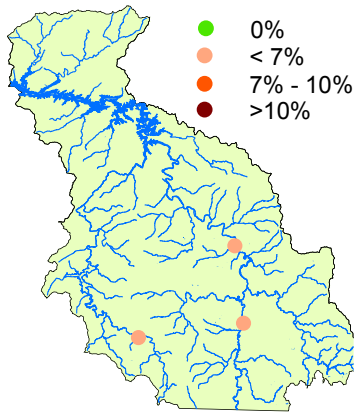
In addition, over 20 years of fish community data collected by Dr. Bill McLarney of the Little Tennessee Watershed Association (LTWA) was assessed for Brush, Cowee, Crawford Branch, Cullasaja, Ellijay, Skeenah and Watauga Creeks. A discussion of IBI scores, fish abundance, diversity, and land cover comparisons are detailed in the report **Fishing for Answers: An Analysis of Biomonitoring Trends in Seven Different Watersheds within the Little Tennessee River Basin**. The LTWA biomonitoring data is available on Coweeta Long Term Ecological Research website: **http://coweeta.uga.edu/ltwa/**.

Long Term Ambient Monitoring

The DWQ's Ambient Monitoring System (AMS) is a network of stream stations strategically located for the collection of physical and chemical water quality data. There are three AMS stations: G2000000, G0035000, and G3500000 in this subbasin; data has been collected from these sites since 1968, 1981 and 1973 respectively.

To assist with an EEP Special Study, DWQ assessed the relationships between the concentrations of pollutants detected at AMS station G2000000 with mean daily flow measurements obtained by the USGS's gaging station near Needmore, NC. Water quality data, representing 106 parameters, were available for the period between July 1968 and December 2007, but only 25 parameters were analyzed. Pair-wise comparisons providing correlation coefficients of concentrations for all 25 parameters with mean daily discharge were calculated. Alkalinity (field), conductivity (field), pH (laboratory) manganese, pH (field), total alkalinity, and water temperatures had significant negative correlations ($p<0.05$) with flow. Dissolved oxygen, nitrite/nitrate, total aluminum, total iron, total nonfilterable residue, total residue and turbidity (laboratory) had significant positive correlations ($p<0.05$) with flow; the remaining 11 parameters had no significant correlations with flow. Details of this assessment are available on pages 96-114 of **EEP's Phase II WAT report.**

Figure 1-8: Percentage of Samples Below the pH 6 Standard between 2004-2008

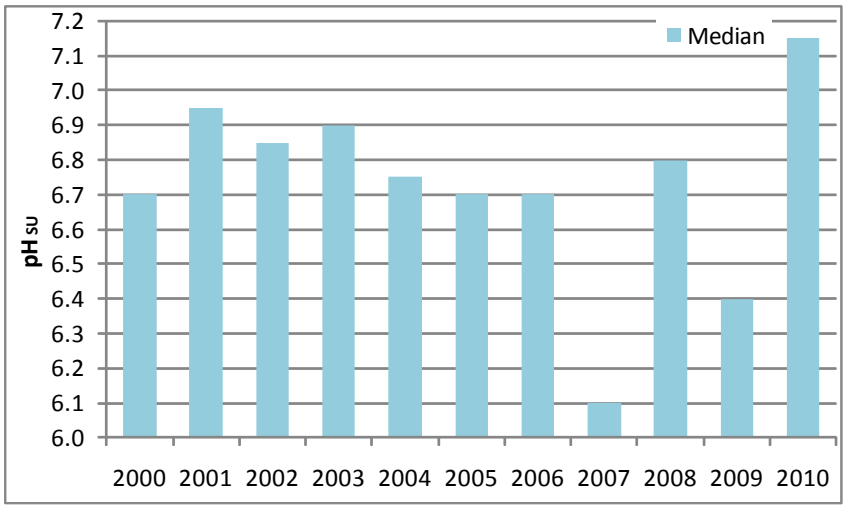


The following discussion of ambient monitoring parameters includes concentration value graphs for AMS station G2000000 over a 11 year period (2000-2010). Each major parameter is discussed, even if no current impairment exists. The graphs are not intended to provide statistically significant trend information, but rather an idea of how changes in land use or climate conditions can affect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the data set. Box and whisker plots of individual ambient stations were completed by parameter for data between 2005 and 2009 by DWQ's Environmental Sciences Section (ESS) and can be found in the **Little Tennessee River Basin Ambient Monitoring Report**.

pH

As seen in Figure 1-8, which represents the data window for the 2010 **303(d)** list, each ambient site had at least one sample that fell below the pH standard of 6su, but no stations exceeded the standard in 10% or more of the samples. Over 11 years there were four incidences of pH dropping below the minimal standard of 6su at ambient station G2000000 (Figure 1-9). Two of which occurred during the fall of 2007; 2007 also had the fewest samples (6) taken.

Figure 1-9: Summarized pH data at AMS G2000000 site between 2000-2010.



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Dissolved Oxygen

As seen in Figure 1-10, which represents the data window for the 2010 303(d) list, each ambient station did not have any exceedances of their DO standards. Over the past 11 years, (Figure 1-11) no samples were collected with dissolved oxygen levels below the 4mg/l instantaneous standard for Class C waters or below 6mg/l standard for trout waters at ambient station G2000000.

Figure 1-10: Percentage of Samples Exceeding the DO Standard between 2004-2008

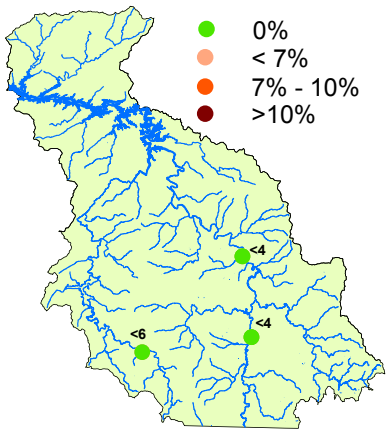
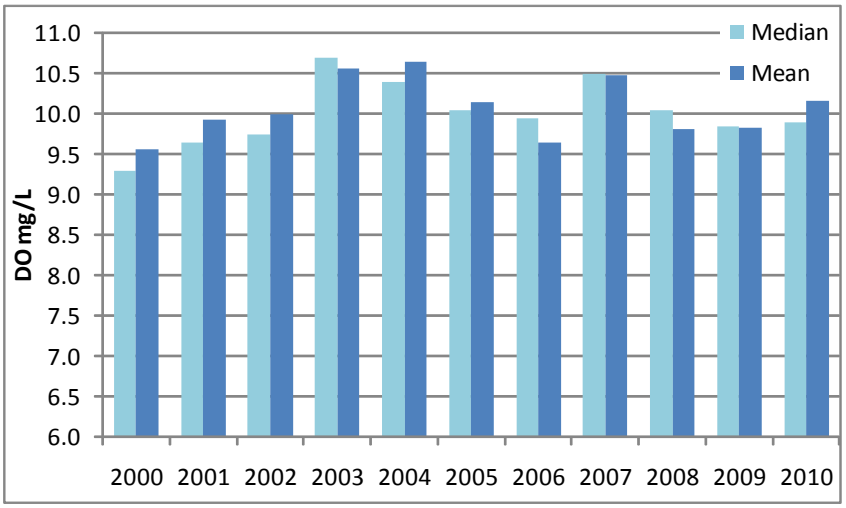


Figure 1-11: Summarized DO data at AMS G2000000 site between 2000-2010.



Fecal Coliform Bacteria

Fecal coliform bacteria occurs in water as a result of the overflow of domestic sewage and from other nonpoint sources of human and animal waste, including pets, wildlife and farm animals. The fecal coliform bacteria standard for freshwater streams is not to exceed the geometric mean of 200 colonies/100 ml or 400 colonies/100 ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are used to indicate whether a stream is Impaired or Supporting. Waters with a use classification of B (primary recreational waters) receive priority for 5-in-30 studies. Other waters are studied as resources permit.

As seen in Figure 1-12, which represents the data window for the 2010 303(d) list, two ambient stations exceeded the 400 colonies/100ml in greater than 10% of the samples. There were eleven incidences of high bacteria counts as indicated by several peaks in mean values over the eleven compared years, shown in Figure 1-13. In 2008, a 5-in-30 was collected at AMS G2000000; data results did not exceed the standard. However, an additional eight streams were sampled as part of a special study all indicating fecal coliform bacteria levels that exceed state standards.

Figure 1-12: Percentage of Samples Exceeding the Fecal Coliform Bacteria >400 colonies/100ml between 2004-2008

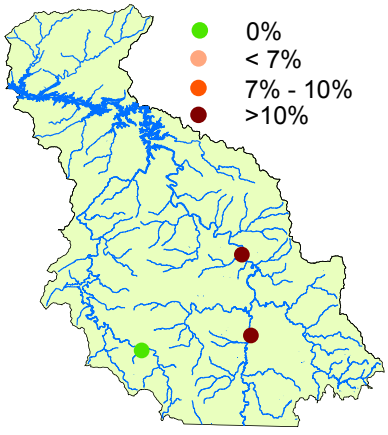
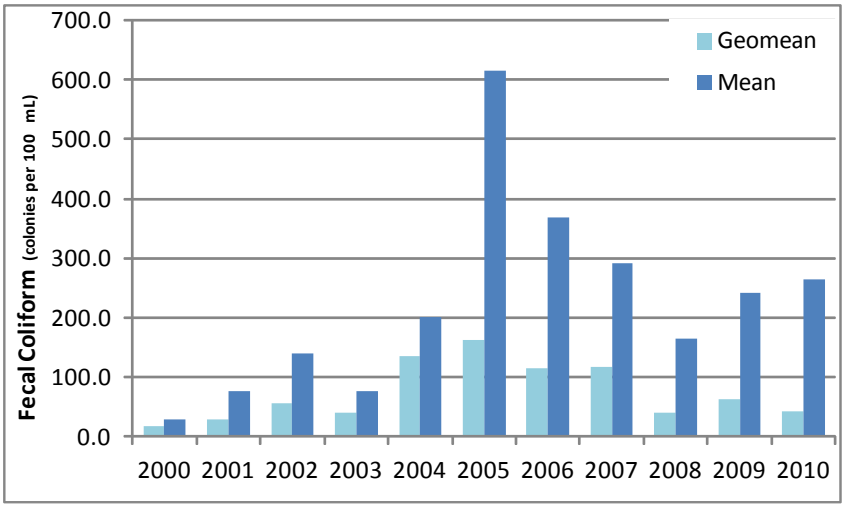


Figure 1-13: Summarized Fecal Coliform Bacteria data at AMS G2000000 site between 2000-2010.



Turbidity

As seen in Figure 1-14, which represents the data window for the 2010 303(d) list, two ambient sites had at least one sample that was >50NTUs, but no stations exceeded the standard in 10% or more of the samples. Over the past 11 years (Figure 1-15), six samples at AMS G2000000 exceeded the standard of >50 NTUs for Class C waters.

Figure 1-14: Percentage of Samples Exceeding Turbidity Standard between 2004-2008

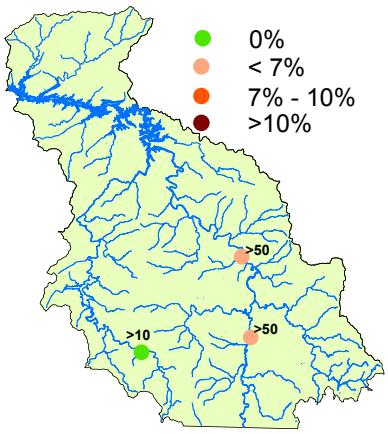
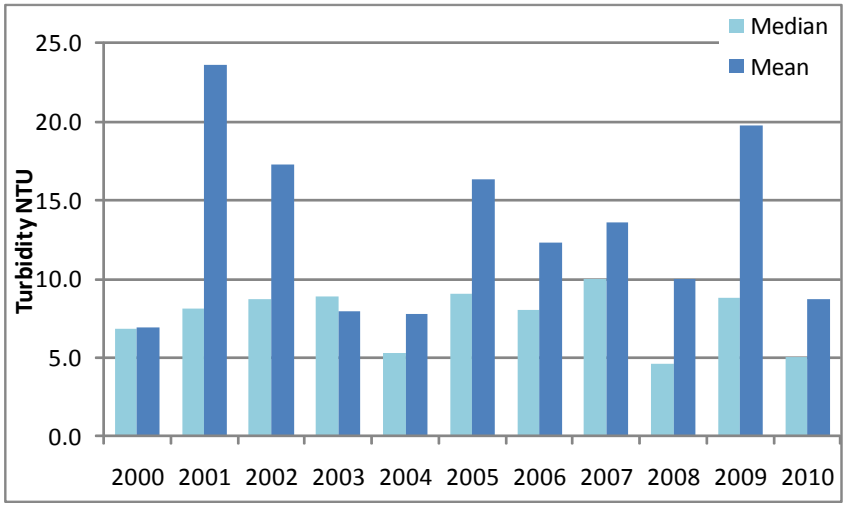


Figure 1-15: Summarized Turbidity data at AMS G2000000 site between 2000-2010.



Supplemental Ambient Monitoring

Coweeta Hydrologic Laboratory collected water quality data at 12 locations within the Upper Little Tennessee subbasin. Data collected includes:

1) Weekly stream grabs analyzed for DOC, TN, NH4-N, Cl, NO3-N, O-PO4, SO4, K, Na, Ca, Mg, and TP from ~January 2010 to September 2011, plus six storm events,

2) Hourly conductivity, dissolved oxygen, temperature, and turbidity measurements from ~January 2010 to September 2011 from Hach Hydrolabs, and

3) Stream TSS and TOS from 6 storm events from January 2010 to September 2011; samples were collected by ISCO water samplers and includes stage data from pressure transducer which were later converted to discharge data.

Original Sample Sites		Smaller Stream sites
1) Little Tenn. at Needmore USGS gage	7) Ball Creek	Falls Branch
2) Little Tenn. at Prentiss USGS gage	8) Watauga Creek	Mica City Creek
3) Cartoogechaye Creek at USGS gage	9) Jones Creek	Hugh White Creek
4) South Skeenah Creek	10) Crawford Branch	Willis Cove Creek
5) Caler Fork	11) Ray Branch	Ammons Branch
6) Cowee Creek	12) Bates Branch	

Coweeta staff plan to continue monitoring the 3 large stream sites (Little T at Needmore, Little T and Prentiss, and Little T and Cartoogechaye) until mid 2013 for all the above metrics. In addition, monitoring has begun in smaller streams to attempt to link land use directly to water quality with a focus on three land use types: forested, traditional valley development, and mountain development.

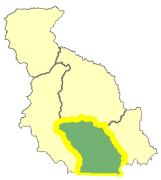
Other measurements include physical measurements of the stream bed, including coarse woody debris, width, depth, etc. and biological measurements such as salamander, fish, and macroinvertebrate surveys. These data will be made available when published.

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 Little Tennessee River Watershed (HUC 0601020201)



This watershed encompasses 127,057 acres and has an estimated 2010 population of 13,377 people.

The Little Tennessee River [AU# 2-(1)a] (C) from North Carolina-Georgia State line to the confluence of Mulberry Creek has been Impaired since 2002, because of a Fair bioclassification at site GF17, which was last sampled in 2004 and rated again as Fair. However, the benthic population improved from Fair in 2000 to Good-Fair in 2010 at site GB50. The Little Tennessee River watershed above sites GF17 and GB50 is approximately 56 square miles, mostly in Georgia. Water quality may have improved and is reflected in the improvement of macroinvertebrate communities at site GB50 when the Fruit of the Loom plant in Rabun Gap, GA, which accounted for over 95% of the total permitted industrial discharges to the entire watershed, stopped discharging in 2006. There are four NPDES permitted facilities within the river's watershed in Georgia. WWTPs' effluent, agriculture, road construction, small industries, urbanization, residential development, and failing septic systems remain a concern. Beginning downstream of the NC/ GA state line, Little Tennessee River is Designated Critical Habitat for the Appalachia Elktoe mussel, further raising the importance of clean water in the river.

Improving water quality in this reach will require corrective action by both nonpoint and point sources of pollution. Local action is needed to address nonpoint source pollution through installation of BMPs and riparian zone protection/restoration. Protective measures should be written into the NPDES permit for any new operation at the old Rabun Mills (Fruit of the Loom) plant. The fish community site needs to be sampled to assess biological changes due to the recent changes in industrial effluent contributions.

The Little Tennessee River [AU# 2-(1)b] (C) gains volume rapidly as it flows into North Carolina, becoming a major river. Land use in the watershed south of Franklin is a mix of light commercial, agriculture, scattered residences and broken tracts of forest. DWQ sampled the benthic community at GB10 resulting in a Good bioclassification and found that water quality has improved at this location since the 1985, 1987, and 1999 samples. Past habitat problems include very poor riparian vegetation, lack of pools, and infrequent riffles. Data collected at ambient monitoring station G0035000 showed incidences of low pH and high turbidity levels but not enough to cause Impairment. Laurel Hills Homeowners Association WWTP discharges into the Little Tennessee River and has incidences where their effluent exceeded limits with high BOD levels and low pH levels.

Middle Creek [AU# 2-8] (C;Tr) drains southern Macon County and a small portion of northern Rabun County, GA. The creek's benthic (GB49) and fish (GF19) communities were sampled in 2009 resulting in Excellent ratings. There is one single family residence domestic wastewater discharge (NCG550392) into the Creek.

Tessentee Creek [AU# 2-9] (C;Tr) is an 8 mile trout creek draining southern Macon County. Land use in the Tessentee Creek catchment is mostly forested, but includes lesser areas of cropland, pasture, Fraser Fir Christmas farms and second homes. There are no NPDES permitted discharges in the catchment. DWQ sampled the basinwide benthic site, GB46 in 2009 resulting in an Excellent rating and fish community site, GF28 resulting in a Good rating.

Tributaries to Tessentee Creek (listed in the table below) were also sampled in 2009 as part of a Use Attainability Study to determine suitability for supplemental classification as trout waters (Tr). The request was expanded to have Tessentee Creek and its tributaries sampled for benthic macroinvertebrates to determine whether they were suitable as High Quality Waters and Outstanding Resource Waters as well. Later in 2009, DWQ collected trout from seven of the eight tributaries, with multiple age classes of rainbow trout collected from six of the sites sampled. The presence of multiple age classes of trout provides evidence of natural trout reproduction and survival within the Tessentee Creek watershed. Based on 2009 and 2011 benthic macroinvertebrates samples collected from the Tessentee Creek watershed, seven sites received an Excellent bioclassification and therefore qualify for consideration for the High Quality Waters classification. Moreover, two Federal and State Species of Special Concern were found in Tessentee Creek (Hellbender, *Cryptobranchus alleganiensis* and Smoky Dace, *Clinostomus sp. cf. funduloides*) as well as in four tributaries. The combination of Excellent bioclassifications within this catchment plus the presence of resource values (Hellbender and Smoky Dace) further qualifies the catchment for classification to Outstanding Resource Waters.

Name	Assessment Unit #	Sample Site ID	Bioclassification Rating
Cadon Branch	2-9-1	GB193	Excellent
Nichols Branch	2-9-2	GB192	Good
Whiterock Branch	2-9-3	GB191	Good
Possum Branch	2-9-4	GB190	Excellent
Stillhouse Branch	2-9-5	GB189	Excellent
Wheatfield Branch	2-9-6	GB188	Excellent
Buckeye Creek	2-9-7	GB187	Excellent
Evans Branch	2-9-8	GB186	Excellent

On the contrary, Tessentee Creek received a Poor rating as part of LTWA's **Stream Visual Assessment Protocol** (SVAP) biomonitoring efforts.

Coweeta Creek [AU# 2-10] (B;Tr) was sampled again in 2009 at site GB45. This site has rated Excellent since sampling commenced in 1994. The majority of the watershed is undisturbed forest, in part, associated with Coweeta Creek Hydrological Laboratory. A protected, forested watershed combined with a minimally disturbed riparian zone and instream habitat have resulted in a temporally stable, diverse, and pollution intolerant macroinvertebrate benthic community. There is one single family residence domestic wastewater discharge (NCG550364) and one minor WWTP from Willowbrook Park (NC0070394) discharging into the creek.

Skeenah Creek [AU# 2-13] (C,Tr) is not monitored by DWQ, but it is monitored by the LTWA. Skeenah Creek's **Water Health Report Card** notes its fish community IBI score as being Fair and using LTWA's **Stream Visual Assessment Protocol** the stream also rated Fair. The LTWA notes the stream is impacted from limited riparian cover, past agricultural activities and more recently road building and developments. They have also noted the disappearance of the endemic Smoky Dace with the decline in the biotic integrity of the stream. The Smoky Dace is classified as both a Federal and State Species of Special Concern.

Cartoogechaye Creek [AU# 2-19-(1), AU# 2-19-(10.3) & AU# 2-19-(10.5)] (WS-III;Tr, WS-III;Tr,CA, & B;Tr) is an 11 mile tributary to the Little Tennessee River that enters the river near the backwaters of Lake Emory. The creek's watershed drains west-central Macon County and is characterized by steep mountainous terrain in its headwaters reaching an elevation of 5324' at Wayah Bald. The headwaters are mostly within the Nantahala National Forest and habitat and stream conditions remain mostly unimpacted. The stream and tributaries in the lower elevations are surrounded by alluvial valleys and land use consists of cattle pasture

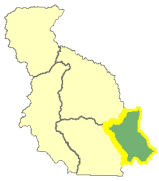
and some large-lot residential areas. Before Cartoogechaye Creek enters the Little Tennessee River, it goes through an area within the town limits of Franklin with more dense residential and some light industrial/ commercial property. The creek provides drinking water to the Town of Franklin.

DWQ sampled Cartoogechaye Creek for possible bacterial contamination in September 2011, completing five samples within 30 days resulting in a geometric mean of 273 colonies/100 ml which exceeds the standard. This creek qualifies to be listed on the 303(d) list in 2014. The sampling site is located at the Town of Franklin WTP, which is just upstream of the town limits and the more commercial zone. Surveys in the watershed indicate that livestock farming without the use of BMPs (e.g.,cattle exclusion fencing), may be the main cause of elevated fecal coliform levels. There may be some contribution from failing septic systems, but surveys by the WaDE program indicated this was not a major problem. Action to address this issue should include working with the local Soil and Water Conservation District to provide cost-share funding for the implementation of BMP's where livestock have access to the creek.

Biological data collected by DWQ indicated the benthic community at site GB40 rated Good in 2009 and 2004, but was Excellent in 1999. The habitat was good, indicating the decline is likely due to a change in water quality. Site GB41, in the headwaters, rated Excellent in 2004 and the fish community at site GF6 rated Good.

The Little Tennessee Watershed Association (LTWA) completed the Cartoogechaye Creek Municipal Watershed Assessment in 2008. They monitored fish communities in the Cartoogechaye watershed at 14 locations. Their monitoring results indicate a high incidence of the parasitic infection called blackspot. Blackspot is often associated with organic enrichment, but can be found in healthy streams. LTWA reports blackspot was in decline in 2006, but a resurgence was seen in 2009. Further monitoring will determine if the trend will continue. LTWA also evaluated several tributaries to Cartoogechaye Creek. Blaine Branch and Mill Creek (not to be confused with Mill Creek in Highlands) suffer from channelization, bank erosion, development, and riparian zone disturbance. Allison and Jones Creek continues to suffer from cattle access and Allison Creek is under increased pressure from development.

Cullasaja River Watershed (HUC 0601020202)



The upper Cullasaja River Watershed is located in southeastern Macon County and contains most of the Town of Highlands and surrounding lands with an estimated 2010 population of 5,604. The 59,263 acre watershed lies on the Highlands Plateau, a high elevation area noted for exceptionally high rainfall (80 - over 100 inches per year). The watershed was historically logged and many of the streams dammed and/ or channelized. Estimates provided by the Upper Cullasaja Watershed Association (UCWA) indicate land use in the watershed was approximately 50 percent residential-commercial-industrial (high level of impervious cover), and 50 percent forested as of 2004.

Within this watershed, the Cullasaja River [AU# 2-21-(0.5)a & 2-21-(0.5)b] (WS-III;Tr) from its source to Macon Co. SR-1545 (4.4 miles) and Mill Creek [AU# 2-21-3] (WS-III;Tr) from its source to Mirror Lake (1.3 miles) are listed as Impaired on North Carolina's 303(d) list. The watershed is developed in golf courses, residences, and an urban center. The upper Cullasaja River and its tributaries are impounded numerous times in three golf course communities, while Mill Creek drains half of the town of Highlands. The 2010 benthic sample collected at site GB48 rated Good-Fair which is an improvement over the Fair rating it received in the previous four samples and therefore the upper segment [AU# 2-21-(0.5)a] of the River is now Supporting. A lower pH (5.4) level was measured in 2010; the 2010 observations were substantially lower than the 2000 (6.7), 2001 (6.7) and 2004 (6.8) measurements and suggests a reduction in non-point pollution inputs which tend to have neutral to high pH characteristics. Many sites in this basin with minimal non-point pollution have very low pH values.

The Wildcats Cliffs County Club WWTP (NC0075612) facility which discharges into the Cullasaja River has had several permit violations since 2007. As this facility ages an evaluation should be conducted to determine if rehabilitation or replacement of the facility would be the better course of action.

In 2002, DWQ completed an assessment of the biological impairment for the Upper Cullasaja River Watershed. A wide range of data was collected to evaluate potential causes and sources of impairment. Data collection activities included: benthic macroinvertebrate sampling; assessment of stream habitat, morphology, and riparian zone condition; water quality sampling to evaluate stream chemistry and toxicity; analysis of stream bed sediment for chemistry and toxicity; and characterization of watershed land use, conditions and pollution sources. A total of 17 benthic samples were collected, ranging from Fair on the Cullasaja River (site GB48) to Excellent in Big Creek (site GB51). The study determined that sedimentation is a significant problem in many of the impoundments, but the primary causes of biological impairment in the Cullasaja River are dam related issues including the prevention of fish and benthic macroinvertebrate colonization and migration, lower water levels, increased temperature, and shifts in food availability. The lack of organic microhabitat (sticks and leaf packs), pesticides, elevated cadmium, and low dissolved oxygen levels also contribute to impairment. Several other streams were also evaluated during the study. Big Creek [AU# 2-21-5-1-(0.5)], Houston Branch [AU# 2-21-5-1-3-(2)], and Ammons Branch [AU# 2-21-2] watersheds are mostly forested with minimal disturbance and considered Supporting for aquatic life. Saltrock Branch [AU# 2-21-1] (WS-III), however, is heavily impacted by a golf community and would benefit greatly from habitat restoration efforts. Because of its small size, it is Not Rated for aquatic life. Skyline Lodge & Village WWTP which discharges into Big Creek had exceeded its effluent BOD limit in 2010.

DWQ's Lakes Assessment Unit evaluated Lake Sequoyah [AU# 2-21-(3.5)b] in summer 2009. The lake, is classified as WS-III and Trout Waters (Tr). Out of 15 samples taken at three locations within the lake in 2009, five samples exceeded the 10 NTU turbidity standard. Lake Sequoyah is Not Rated because of an insufficient number of samples (10 samples in one location over a 5 year period is needed to assess for Use Support). The lake was also considered to be eutrophic during May conditions and algal growth is limited by phosphorous. More information is available from DWQ's Lake & Reservoir Assessment Report.

The Upper Cullasaja Watershed Association (UCWA) has noted Lake Sequoyah, along with most impoundments in the watershed, has shown significant impacts from sediment deposition. Much of this sedimentation occurred prior to the enacting of local sediment and erosion control measures but continues as development on steep slopes progresses. Reducing current sediment loads and removing existing sediment deposits are high priorities for many local watershed residents. In 2004, Hurricane Ivan aggravated flooding and erosion problems in the watershed leaving large sediment deposits near critical drinking water intakes. The Town of Highlands, Upper Cullasaja Watershed Association, and the Mirror Lake Improvement Association are working together to secure funds to remove built-up sediment in the lakes and pave eroding gravel roads.

Water Quality Initiatives

The Upper Cullasaja Watershed Association (UCWA) and the Town of Highlands have taken significant steps towards addressing water quality issues. Since its inception, UCWA's primary focus has evolved from rainfall measurement and erosion control to understanding and implementing effective stormwater management in the watershed. UCWA received a Regional Geographic Initiative grant from the U.S. Environmental Protection Agency to determine stakeholder concerns and issues within the watershed and define possible solutions. In 2004, UCWA compiled their findings in the Upper Cullasaja River Watershed Strategy and Action Plan. The action plan divides the watershed into four subbasins including: Upper Cullasaja River, Mill Creek, Monger Creek, and Big Creek. General recommendations are given for the entire watershed and specific tasks are outlined for each watershed. With help from UNC's Highlands Biological Station, an addendum was published "Water Quality Monitoring of the Upper Cullasaja Watershed, Highland, NC" to the 2004 Action Plan that included a detailed assessment of the Cullasaja River, Mill Creek, Monger Creek, and Big Creek and an assessment of stream restoration opportunities in those watersheds.

The following needs were identified by DWQ and UCWA after completing watershed assessments:
• Evaluate and implement the following at each of the impoundments in the upper Cullasaja River watershed; minimum and/or bypass flows, sediment transport devices, and fish passages. Doing so will allow passage of aquatic organisms and help address sediment build up, elevated temperatures, and low dissolved oxygen levels. If the problems associated with dams are not addressed, then the recovery potential for the Cullasaja River is limited and other strategies listed below will have limited effect.
• Complete restoration projects at all sites identified in the Upper Cullasaja Watershed Strategy and Action Plan. Successful completion will improve habitat conditions and stormwater management in the watershed.
• Pesticide and nutrient management programs should be evaluated and improved to further decrease the use of these materials and their potential to enter lakes and streams. Homeowners and landscapers should also be educated about the responsible use of pesticides, fertilizers, and hydroseed mix.
• Woody vegetation should be planted along cleared streams, and large woody debris and rock clusters should be placed in the stream channel where wooded buffers are not planted. This action will stabilize eroding streambanks, provide shade, and produce leaf packs and other organic instream habitat.

In addition, the LTWA with the assistance of students at the UNC's Highlands Biological Station and UCWA are completing a nine element watershed restoration plan for the Upper Cullasaja River. This process is funded through DWQ's NPS 319 grant program and will outline additional restoration implementation activities.

The Cullasaja River [AU# 2-21-(5.5)] (B;Tr) from dam at Lake Sequoyah to Little Tennessee River (10.6 mi) is noted as having improved water quality conditions with 2010 Excellent ratings at benthic sites GB79 and GB39. The Cullasaja School's WWTP facility has had several permit violations since 2007, including exceeding BOD and flow levels.

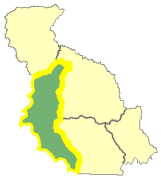
Turtle Pond Creek [AU# 2-21-8] (C;Tr) is a 4 mile creek that has consistently rated Excellent for its benthic community since sampling commenced in 1999 at site GB47.

Peeks Creek [AU# 2-21-16] (C,Tr) is not monitored by DWQ, but is monitored annually by LTWA since 2004. In the fall of 2004, a **landslide** moved debris down this drainage over 2 miles to the Cullasaja River. Since then, natural stream restoration has occurred and fish populations have returned giving it a Good IBI fish score in 2010. Monitoring details are discussed in Peeks Creek **Health Report Card**.

Walnut Creek [AU# 2-21-17] (C;Tr) a 4.5 mile tributary to the middle reaches of the Cullasaja River and is adjacent to the Ellijay Creek watershed. It is a high gradient Southern Appalachian-type trout stream with plunge pools and riffles. DWQ sampled the fish and benthic communities in 2004 (sites GF30 and GB43). The benthic site was sampled in response to complaints of dead fish, soapy water, and development. There are no NPDES discharges in the watershed, but conductivity was elevated for a mountain stream. The results from the benthic sample suggest instream habitat appears to be declining. Increased residential development along the stream banks and agricultural activities in the watershed are affecting the riparian and in-stream habitats by increasing the sediment load. The stream is significantly embedded with sand at site GB43. The fish site technically qualified as a regional reference site based on land use calculations and despite noted sediment problems. The fish community was typical of many un-impacted trout streams (low species diversity, a reproducing population of naturalized rainbow trout, and mottled sculpin being the numerically dominant species). This stream was not resampled in 2009.

Ellijay Creek's [AU# 2-21-23] (C;Tr) 7.2 miles drains the east-northeast region of Macon County. The creek was sampled at site GF14, in 2004 and 2009 resulting in Good bioclassifications and it is currently supporting its supplemental classification as a trout waters (Tr). Although in 2009, fish species present indicate upstream nonpoint nutrient runoff. Riparian zones were noted as narrow with a fairly open canopy, pasture or roads are adjacent to the creek. As part of LTWA's **Stream Visual Assessment Protocol** (SVAP) biomonitoring efforts Ellijah Creek was assessed and received Fair rating.

Nantahala River Watershed (HUC 0601020203)



This watershed encompasses 112,202 acres and has an estimated 2010 population of 2,070 people. The majority of the watershed falls within the Nantahala National Forest.

Moore Creek [AU# 2-57-17] (C;Tr,ORW) was sampled in 2008 by DWQ. The purpose was to evaluate the possible effects on Moore Creek and downstream reaches of the Nantahala River as the result of a sediment release from two in-line ponds located on Moore Creek. Four sites were sampled, upstream of the Moore Creek ponds, downstream of the ponds and on the Nantahala upstream of Moore Creek confluence and downstream of the confluence. Moore Creek-upstream benthic macroinvertebrate collection resulted in a Not Impaired bioclassification and would have received an Excellent rating using mountain EPT criteria had this stream's watershed exceeded three-square miles. Moore Creek-downstream is located approximately 0.25 miles downstream of the two in-line ponds from which the sediment was released and is about 0.5 miles below the upstream sample reach. This sample resulted in a Not Rated bioclassification and would have received a Fair rating using mountain EPT criteria had this stream's watershed exceeded three-square miles. Habitat quality between these two locations were essentially the same and further supports the conclusion that the large discrepancy between the downstream and upstream benthic macroinvertebrate communities is related to the sediment release and not a result of habitat differences. The invertebrate sample collected on the Nantahala River upstream and downstream of the Moore Creek confluence resulted in an Excellent ratings, although the downstream location had noted sediment accumulation.

Nantahala River [AU# 2-57-(0.5)] (B;Tr,ORW) straddles the Macon County-Clay County line and is upstream of Nantahala Lake. It's waters are derived from small mountain streams that reside within Nantahala National Forest, and thus has colder water than many other rivers of similar size. The river has consistently rated Excellent for its benthic community since sampling commenced in 1984 at site GB42. At ambient site G3500000 several incidences of low pH were recorded.

Nantahala Lake [AU# 2-57-(22.5)a] (B;Tr) is an impoundment of the Nantahala River. Duke Power Company owns this reservoir, which was impounded in 1942 for hydroelectric power. The lake is 76 meters deep at the dam at maximum pool. Nantahala Lake was monitored five times from May through September 2009 by DWQ field staff. No water quality issues were detected. Nantahala Lake demonstrates it is oligotrophic and has exhibited these trophic conditions since DWQ began monitoring in 1981. Nantahala Mountain Village WWTP discharges into Nantahala Lake and has had several permit violations for exceeding ammonia permit limits.

Below Nantahala Lake the Nantahala River [AU# 2-57-(22.5)b] (B;Tr) is highly regulated with daily releases that greatly influence water chemistry, water depth and velocities. The benthic site at GB8 rated Good in 2009. A Random Ambient Monitoring System site (G3700000) also collected data along this reach of the river between Jan. 2009 - Dec. 2010. Station G3700000 was located on Nantahala R. off of SR 1310 near Beechertown. Data collected included normal field parameters along with metals, volatile organics, semi-volatiles, and pesticides. No water quality problems were detected, although there was one sample with low pH and one sample with high dissolved copper content. The Nantahala Outdoor Center wastewater facility has had permit violations for exceeding fecal coliform bacteria and TSS levels.

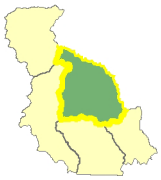
Whiteoak Creek [AU# 2-57-45a, 2-57-45b, & 2-57-45c] (C;Tr) is a 3.6 mile creek with its headwaters in Nantahala National Forest. The creek rated Good-Fair in 2009 at site GB36, the same rating it received in 2004. Since first being sampled in 1988, this waterbody has rated Fair twice and Good-Fair four times. This segment is located downstream of a trout farm, which appears to be adversely affecting the benthic community. Previous DWQ investigations (B-881209, B-900220, B-900720, B-050218) clearly documented the effects of untreated wastewater in this creek. Abnormally large and thick mats of aquatic plants have

been a historic issue in Whiteoak Creek from 1998 to present.

Otter Creek [AU# 2-57-45-10] (C;Tr) is a 3.8 mile tributary to Whiteoak Creek. In October 2011, a special study request was made to assess macroinvertebrate communities upstream and downstream of trout farms. Data results on Otter Creek showed similar EPT richness values between the upstream and downstream sites. However, the increase in EPTBI value is significant and indicative of degradation downstream. (BAU Memorandum 120201).

Water in Dicks Creek [AU# 2-57-42] (C;Tr) was historically impounded at Dicks Creek Pond and diverted into Duke Energy's Nantahala Hydroelectric Project. As part of the 1999 agreement between Duke Energy, NCDENR, USDA, and USFWS, this diversion ceased and flows in Dicks Creek were allowed to pass through Dicks Creek dam, into the Nantahala River. In 2003, Duke Energy agreed to restore additional flow in Dicks Creek as part of its mitigation for impacts caused by the Nantahala Hydroelectric Project. DWQ sampled the benthic community in Dicks Creek at site GB9 to determine the condition of the stream prior to the introduction of new, stable flows. This site received a Good-Fair bioclassification in 2004. Additional sampling is needed to evaluate the stream response to restored flows.

Alarka Creek-Little Tennessee River Watershed (HUC 0601020204)



This watershed encompasses 130,309 acres and has an estimated 2010 population of 15,445 people. The Town of Franklin's WWTP is the only NPDES permit with limit violations since 2007; the facility was in violation for exceeding its BOD and TSS limits. The facility is in the process of upgrading portions of its treatment works and has been compliant with its whole effluent toxicity testing.

Crawford Branch [AU# 2-22] (C) was sampled for macroinvertebrates in two locations in May 2010, in support of the EEP's local watershed planning (LWP) effort. The upstream site received a Good bioclassification based on small stream criteria and the downstream site received a Fair rating. Both Crawford Branch sites have poor habitat and riparian zones are narrow and the substrate is filled with sand and silt. The stream is straight from channelization and lacks adequate pool habitat. The benthic macroinvertebrate community clearly declines in Crawford Branch as it flows through the town of Franklin. Five fecal coliform bacteria samples were also taken as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 2600 and a geometric mean of 1308 cfu/100ml. The source of fecal coliform bacteria was not detected during stream walks of Crawford Branch as described in the special study report, but elevated fecal values typically occurred at the same locations as elevated NOx, possibly indicating a common source of both. Water samples were also collected to test for the presence of urban pollutants (aluminum, silver, arsenic, cadmium, chromium, copper, iron, mercury, nickel, lead, selenium, and zinc). Only aluminum, iron and zinc were detected at low levels and the results indicate further sampling is not warranted.

The Lake Emory [AU# 2-(1)c] (C) segment of the Little Tennessee River is a run-of-river impoundment created in the 1920's by construction of Porter Bend Dam at Franklin. DWQ considered it shallow and eutrophic based on samples collected in 1988. In 1994, DWQ Lake Assessment Unit ceased sampling this reservoir because sediment accumulation prevented boat access. Sediment deposition had become so pronounced that vegetation had become established on sediment bars and the upstream areas resembled a braided stream rather than a lake. DWQ determined Lake Emory was no longer functioning as a reservoir and Tennessee Valley Authority gave it an ecological health rating of Very Poor. The USGS conducted an analysis of sediment loads to Lake Emory from 2000-2001. The study compared sediment loads from the Cullasaja River, Cartoogechaye Creek, and the mainstem Little Tennessee River. This study noted that riparian agricultural activities and increasing urbanization in the upper portion of the watershed in the towns of Highlands and Franklin have increased the river's sediment load. The study also notes the dam has trapped many of those sediments, protecting the downstream habitat in the Needmore area. However, during the FERC dam relicensing process Duke Energy reported that Lake Emory has limited sediment retention capacity and the incoming sediment is being passed through the impoundment and

flowing downstream into the reach of the Little Tennessee River known for its ecological significance (Duke Energy 2003). In 2010, DWQ issued a Section 401 Water Quality Certification for the FERC relicensing of the Franklin Hydroelectric Project (# 2603). A condition of the permit includes a Long-Term Sediment Management Plan that will protect existing aquatic life uses in downstream waters.

Downstream of Lake Emory, water quality and habitat improves significantly. This downstream section of river is noted as one of the healthiest major rivers in the Blue Ridge region and supports a nearly complete biological community, including sensitive and protected species such as the spotfin chub, sicklefin redhorse, olive darter, slippershell mussel and Appalachian Elktoe mussels. The limited capacity of Lake Emory to trap sediment and the possible organic and metal contaminants attached to sediments both trapped within the Lake's sediment and those sediments moving through the impoundment is a concern to protecting downstream conditions. Investigations by USGS and Western Carolina University (as reported in EEP's Watershed Plan) indicate metals (Cd, Cu, Ni, Zn, Pb) and organic pollutants are present in legacy sediments in Lake Emory and the Little Tennessee River. These contaminants may negatively impact aquatic biota, especially those associated with bottom substrates, such as mussels.

The heavy sediment in Lake Emory and increasing loads in the downstream reach demonstrates the need for strong sediment and erosion control, wetland restoration, and streambank stabilization throughout the entire watershed. Macon County has adopted a Soil Erosion & Sedimentation Control Ordinance that should help reduce erosion problems originating from certain new land disturbing activities.

Additional research indicates that since 2005, there has been a >90% decline in the abundance of Appalachian elktoe and slippershell (Alasmidonta viridis) mussels in the Little Tennessee River between Franklin Dam and the backwaters of Fontana Reservoir. This reach of the Little Tennessee River formerly supported the strongest populations of both species, but slippershell has now dropped below detection at multiple monitoring sites and Appalachian elktoe has become rare. Research into causes of this decline are on-going by NC State University and US Geological Survey. No single, definitie casual factor has been identified to date, but increased sedimentation, as well as elevated levels of manganese, and an explosion of a recently established population of the exotic Asian clam (Corbicula flumminea), have been observed and may be contributing factors. (Personal communication, S. Fraley, NCWRC).

Rabbitt Creek [AU# 2-23b] (C;Tr) watershed lies northeast of Franklin and drains the Holly Springs community. DWQ evaluated the fish community at site GF22 in 2004, when it received a Good-Fair bioclassification. The creek's benthic community was sampled by DWQ in 2008 and 2009 as part of an EEP special study. Samples collected resulted in Poor, Good-Fair and Good ratings. During these sampling efforts, the Biologists noted sedimentation especially in pools, beaver activity, and channelization. Five fecal coliform bacteria samples were also taken in Rabbitt Creek as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 1300 and a geometric mean of 510 cfu/100ml. The Creek is Impaired.

Cat Creek [AU# 2-23-4a & 2-23-4b] (C) suffers from severe habitat degradation due to land clearing activities, channelization, livestock access, unpaved roads and several small impoundments. In 2000, a half-mile reach of Cat Creek was re-channelized and the riparian zone was cleared. This action resulted in a significant increase in streambank erosion and sediment delivery to Rabbitt Creek. Cat Creek was sampled four times by DWQ, in 2008, as part of an EEP special study resulting in an Impaired status for the lower 0.5 miles [AU# 2-23-4b]. Five fecal coliform bacteria samples were also taken as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 1000 and a geometric mean of 443 cfu/100ml.

Both Rabbitt and Cat creeks show instream habitat degradation caused by toxic and sediment impacts. Identified sediment sources include, livestock access to streams, stream bank erosion, unpaved roads. Toxicity impacts to the benthic community were attributed to the large tomato farm at the confluence of Cat and Rabbit Creeks. The tomato farm went into production in 2008 and a sample comparison from pre & post growing season noted a decline in macroinvertebrate taxa collected (Special Study see page 60 for Memorandum addendum 20090429). The samples in the upper reaches of Cat Creek resulted in Not Impaired ratings, a sample taken just above the tomato farm resulted in a Good-Fair rating and the sample below the tomato farm received a Poor rating. The tomato farm has since converted to growing blackberries and thus sampling the macroinvertebrate communities in both Rabbitt and Cat creeks is suggested, preferably in the fall after the growing season.

The Ecosystem Enhancement Program's restoration project on Cat Creek included the restoration of ~9,000 ft of stream channel and riparian area and 8 acres of riparian wetland through old and current cattle pasture and an old golf course.

The LTWA has been sampling the fish community in Rabbit Creek for many years and the IBI score has fluctuated from Very Poor in the 1990's to Fair & Poor in recent years. Recovery from disturbance during golf course construction and removal of cattle access may be responsible for some improvement, but subsequent declines could also be associated with the large tomato farm and pesticide use and a bridge replacement project. The negative changes also appear to be related to increasing sedimentation originating from poor land use practices. As part of LTWA's Stream Visual Assessment Protocol (SVAP) biomonitoring efforts Rabbit Creek was assessed and received Fair rating and received a Poor IBI score reported on LTWA's Health Report Card. DWQ supports LTWA's efforts to include Franklin High School students in restoration and protection activities in this subwatershed.

Coon Creek [AU# 2-24-3] (C) was sampled in 2008, at site GB160, and received a Good rating as part of an EEP special study. The creek was noted as having severe bank erosion and sediment within the channel.

Watauga Creek [AU# 2-24] (C;Tr) was sampled for macroinvertebrates in 2008, at site GB161, and received a Good rating as part of an EEP special study. Five fecal coliform bacteria samples were also taken as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 1100 and a geometric mean of 417 cfu/100ml. The creek was noted as being impacted from animal agriculture. As part of LTWA's Stream Visual Assessment Protocol (SVAP) biomonitoring efforts Watauga Creek was assessed in two locations and both received Fair ratings. In 2009, the LTWA completed a restoration project to help improve fish passage on Watauga Creek; activities included removal of an abandoned dam and a damaged culvert which was replaced with a free-spanning bridge and streambank restoration.

Rocky Branch [2-26] (C) was sampled as part of the EEP special study to assess fecal coliform bacteria contamination. Five samples taken between July 20- August 18, 2009 detected bacteria levels that exceed state standards with a maximum coliform count of 780 and a geometric mean of 370 cfu/100ml.

Iotla Creek [AU# 2-27] (C) watershed contains large amounts of agriculture and the Macon County Regional Airport. Impacts from these land use practices are evident in both DWQ and LTWA sample results. DWQ sampled this stream in two locations in 2004 and 2009. The fish and benthic communities were evaluated downstream of the airport at sites GB33 and GF15 and both rated Good. The stream was also sampled at as part of an EEP special study with the upper site receiving a Good-Fair rating and the lower site a Good rating. Biologists noted sediment problems and nutrient enrichment. Samples collected by LTWA confirm the instream habitat in Iotla Creek is some of the poorest in the basin and much of the lower reach has been channelized. Five fecal coliform bacteria samples were also taken as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 1600 and a geometric mean of 917 cfu/100ml. Three small tributaries were found to have high fecal levels and need to be investigated further to try and determine the source of the elevated fecal coliform bacteria

Iotla Branch [AU# 2-27-1] (C) was sampled at site GB152 as part of an EEP special study, in 2008, and received a Good-Fair rating. The creek was noted as having poor overall habitat with channels and pools filled in with sediment. In 2007, water samples showed elevated levels of fecal coliform bacteria. A 5-in-30 days study was completed in 2008 to assess if the stream was meeting water quality standards; the samples did not indicate standard violations. However, in 2009 the stream was resampled as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 2300 and a geometric mean of 1306 cfu/100ml. The tributaries with primarily agricultural land uses should be further investigated as sources of fecal coliform bacteria.

Cowee Creek [AU# 2-29] (C;Tr) drains the northeast corner of Macon County, an area with historical ruby mining operations and scattered residential and pasture areas. DWQ sampled the fish community at site GF8 in 2004 and the benthic community at site GB31 in 2007 and 2009. The fish community was rated Good and the benthic community rated Excellent both years, improving steadily from Good-Fair in 1994. The benthic community was also sampled upstream at site GB156 and rated Excellent in 2008 as part of the EEP special study. Biologists noted turbid water and slight sedimentation.

> LTWA collected fish samples on Cowee Creek and three of its larger tributaries: Caler Fork, Matlock Creek, and Beasley Creek. Their results compare well with the DWQ samples and indicate the fish community in the downstream reach is in good health, but also note an increase in stream temperature and disappearance of trout. Significant sedimentation impacts are noted in and above Caler Fork from failing roads in the Wildflower development. LTWA measured the single largest drop in stream health at their site on Caler Fork. They report turbidity problems on this stream even during dry spells. Caler Fork received a Fair IBI fish rating; details of their monitoring results are described on their Health Report Card. LTWA noted Matlock Creek is also deteriorating, perhaps due to an increase in organic loading from development. Beasley is in good condition and supports a healthy population of rainbow trout.
>
> DWQ sampled Caler Fork [AU# 2-29-4] (C) in Sept. 2010 and it received at Poor fish community rating at site GF62 leading to its Impaired status on the 2012 303(d) list. The Creek was also sampled as part of the EEP special study, in 2008, at site GB154 resulting in a Good rating. Samples were also take in Matlock Creek [AU# 2-29-5] (C) at GB155 resulting in a Good-Fair rating and Dalton Creek [AU# 2-29-4-2] (C) at site GB172 resulting in a Not Impaired rating, Dalton Creek was sampled again in May 2010, using the small stream criteria received an Excellent bioclassification.

Bradley Creek [AU# 2-33] (C;Tr) was sampled in 2008 at site GB148 and received a Good rating as part of an EEP special study. The creek was noted as having rocks coated with an abundance of aufwuchs and poor riparian and edge habitat. Five fecal coliform bacteria samples were also taken as part of the EEP special study between July 20- August 18, 2009 which detected bacteria levels that exceed state standards with a maximum coliform count of 770 and a geometric mean of 314 cfu/100ml. Bradley Creek was also monitored by the LTWA's biomonitoring program and received a Fair IBI fish rating; details of their monitoring results are described on their Health Report Card. In early 2011, the LTWA completed a restoration project to improve fish passage and reduce sedimentation caused by streambank scour; activities included removal of two damaged culverts which were replaced with a free-spanning bridge and streambank restoration.

Lakey Creek [AU# 2-34] (C;Tr) was sampled for macroinvertebrates in 2008 at site GB149 and received a Good rating as part of an EEP special study. The stream was noted as having poor riparian cover.

Burningtown Creek [AU# 2-38] (B;Tr) is the largest tributary to the Little Tennessee River downstream of Franklin. Compared with much of the county, its watershed is largely undeveloped excepting light residential and agricultural activities. The stream provides habitat for several sensitive species including the spotfin chub, hellbender salamander, smoky dace, and the sicklefin redhorse. DWQ sampled the fish community at GF3 in 2004 and benthic communities at sites GB30 in 2009, GB34 in 2007 and GB147 in 2008 as part of an EEP special study, all resulted in Excellent Ratings.

> LTWA monitors Burningtown Creek and two of its tributaries, Younce Creek and Left Prong Burningtown Creek. Their data shows a healthy fish population in Burningtown Creek and the Left Prong. They report impacts from cattle near the mouth of Burningtown Creek. LTWA notes Younce Creek is degraded, but

by unknown causes. However, Younce Creek [AU# 2-38-8] (C) was also sampled by DWQ with the latest samples resulting in Excellent ratings at both sites, GB150 and GB151.

Tellico Creek's [AU# 2-40a, 2-40b & 2-40c] (C;Tr) fish community was sampled in 2004 resulting in a Good rating and the benthic community, at site GB28, in 2009 resulting in an Excellent rating. The creek was sampled several miles upstream from GB28 in 2010, in response to concerns regarding the Tellico Trout Farm located along the creek. The upstream sample location rated Good and downstream of the farm rated Fair. Based on the Fair rating a one mile segment [AU# 2-40b] of the Creek is now Impaired. **Tellico Trout Farm** claims to be the largest commercial hatchery in the eastern United States. At the trout farm, Tellico Creek drains 6.6 square miles of largely forested land, much of it in Nantahala National Forest. In 2008, ambient data was collected downstream of the trout farm showing, increased nutrient levels, a decrease in dissolved oxygen and pH, and specific conductance, water temperature, turbidity, and total suspended solids increased compared to the upstream sample. Also, in August 2008, DWQ staff observed that the trout farm was diverting the entire flow of Tellico Creek through the trout runs; similar stream conditions were observed recently in August 2010 (details of the ambient water quality data collected in 2008 & 2009 are found on page 57 of **EEP's Phase II report**). It also appears that the trout farm is influencing the stream's substrate and growth of aquatic moss in Tellico Creek. The substrate below the trout farm discharge is noticeably filled in with silt and fine sediments and there is abundant growth of aquatic moss on the rocks and in the leafpacks. These conditions were not seen upstream of the farm. Based on the benthic macroinvertebrate sampling results, the Tellico Trout farm is a significant contributor of pollution to Tellico Creek. DWQ's Asheville Regional Office is monitoring water quality conditions and may require permit changes or enhancements.

In July 2010, fish community sample collected by the LTWA in Tellico Creek downstream of the trout farm reported a very low catch rate and small fish of all species scarce or lacking. The community was characterized by extremely low numbers of sculpins, a high number of fish associated with sediment, a high proportion of omnivores and herbivores, a relatively high proportion of specialized insectivores, and a high darter/sculpin ratio. The LTWA concluded that the biotic integrity is declining in Tellico Creek (although no species have been eliminated) and that the decline is probably related to nutrient enrichment (McLarney, 2010).As part of LTWA's **Stream Visual Assessment Protocol** (SVAP) biomonitoring efforts Tellico Creek was assessed and received a Good rating, but received a Fair IBI score reported on LTWA's **Health Report Card**.

Rattlesnake Creek [AU# 2-44] (C) was sampled in 2007 as part of the **EEP special study** and rated as Not Impaired. The creek flows along a forested corridor and is one of the healthiest tributaries to the Little Tennessee River and it was noted as having some of the best habitat amongst all those sampled for the special study (although habitat conditions are limited due to bedrock substrate). Ambient data was also collected as part of the Random Ambient Monitoring System (RAMS) sample between Jan. 2007 - Dec. 2008. Station G3080000 was located on Rattlesnake Creek at Big Dog Road near Lauada. Data collected included normal field parameters along with metals, volatile organics, semi-volatiles, and pesticides; no water quality problems were detected.

Brush Creek's [AU# 2-46] (C) fish community was sampled in 2009 at site GF2, resulting in a Good rating. Good habitat and riparian conditions were present, but upstream nonpoint sediment runoff sources should be investigated.

Alarka Creek [AU#s 2-69-(0.4), 2-69-(0.5), & 2-69-(2.5)] (C;Tr; HQW) a medium-size tributary to the Little Tennessee River Arm of Fontana Reservoir. The creek's watershed (25 mi^2) drains southern Swain County. The headwaters are classified as High Quality Waters, but land uses in the lower portion of the catchment are residential and pasture. The benthic community sample at site GB17 indicates the water quality is Excellent. However, the fish community at site GF1 reflects significant habitat problems, receiving only a Good-Fair bioclassification. Also, an exceptionally large number of fish were collected, indicating the stream may be nutrient enriched. Likely sources for excess nutrients include nonpoint source runoff from lawns and/or failing septic systems. In many locations, the riparian zone was narrow or nonexistent and manicured lawns reached to the stream bank. The Swain County Soil and Water Conservation District identified concentrated livestock, row cropping, Christmas tree farming, and new development projects as possible pollution sources in the watershed. Swain SWCD is focusing efforts on this watershed.

Little Tennessee River [AU# 2-(26.5)a & 2-(26.5)b] (B) was sampled near Iotla Creek (GB35) in 2009 with noted water quality improvements resulting in a Good benthic rating. Downstream the river runs along 13 miles of Needmore Game Lands (4,525 acres) in which the river has seen an increase in recreational use and fishing. The river was sampled at site GB24, in 2007, resulting in an Excellent rating.

Fontana Lake Watershed (HUC 0601020205)

This watershed encompasses 107,019 acres and has an estimated 2010 population of 1,425 people.

Panther Creek [AU# 2-115] (C;Tr) in northeastern Graham County, is a high gradient tributary to the Panther Creek Arm of Fontana Reservoir. Habitat and water quality are good, the benthic community has rated from Excellent at site GB16 in 2009.

Stecoah Creek [AU# 2-130] (C;Tr) in northeastern Graham County, is a small tributary to Fontana Reservoir. The recent NC 28 widening project occurred in the middle part of its watershed. This stream is located in a more densely developed residential drainage than other streams in the subbasin. Some channelization has occurred, and a significant amount of substrate (large rocks) has been removed from the streambed for retaining walls around adjacent livestock areas or stream bank protection. Areas along the bank near the residential and agricultural areas are actively eroding. Riparian vegetation consists of mostly grasses and a few trees. The benthic community sampled in 2009 at site GB14 rated Excellent and the fish community at site GF26 was Not Rated but noted higher conductivity levels and siltation.

Hazel Creek [AU# 2-146-(0.5)] (C;Tr,ORW) was sampled in 2009 resulting in an Excellent benthic bioclassification.

Tuskeegee Creek [2-136] (C) is a tributary to the Little Tennessee River (Fontana Lake) and drains northern Graham county. The catchment is primarily forested with rural residential development and pastures and fallow fields along the state secondary roads. There are no NPDES permitted dischargers to the creek or to any of its tributaries. In 2007 a request to evaluate the Tuskeegee Creek watershed for the supplemental Tr waters classification was made. DWQ sampled two sites on the mainstem reach of Tuskeegee Creek in 2007 to determine if a wild, reproducing population of trout exists. The creek's tributaries were not sampled for trout because of their small size, lack of sufficient flow, or inaccessibility via public roads. A reproducing population of rainbow trout was found at one of the two sampling sites, but the habitat conditions during the sampling of this site were found to be less than optimal. Therefore, the Tuskeegee Creek watershed was re-sampled for trout and sampled for benthic macroinvertebrates in 2011 to provide additional data for consideration of the Tr, HQW, or ORW classifications for the watershed.

Trout Reclassification Request	
Tuckeegee Tributaries	Assessment Unit #
S.Fork Tuckeegee Creek	2-136-1
N.Fork Tuckeegee Creek	2-136-2
Cindy (Sandy) Branch	2-136-3
Apple Tree Branch	2-136-4
Chestnut Log Branch	2-136-5
Maple Branch	2-136-6
Garland (Flat) Branch	2-136-7
Bailey Branch	2-136-8

Fontana Lake is located along the southern boundary of the Great Smoky Mountain National Park. It provides power and flood control on the Little Tennessee River. Fontana Lake is owned by the federal government and operated by the Tennessee Valley Authority. Construction on the dam was begun in 1942 and was completed in 1944. At a height of over 480 feet, the Fontana dam is the highest dam east of the Mississippi River. The upstream 5,568 acres [AU# 2-(66)] of the lake is classified for primary swimming (B) and the downstream 1,697 acres [AU# 2-(140.5)] is classified WS-IV B CA.

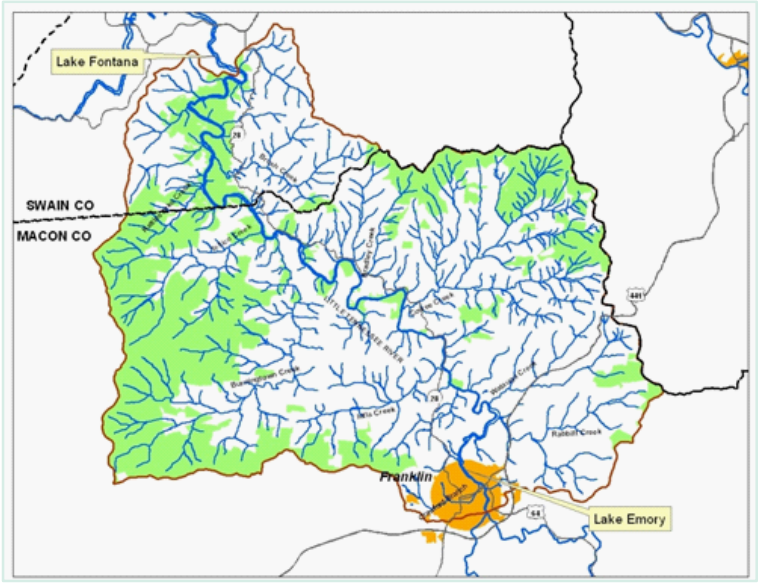
Fontana Lake was sampled monthly from May through September 2009 by DWQ. Dissolved oxygen and water temperature readings in 2009 were similar to readings measured by DWQ staff on previous sampling trips. The thermocline near the dam generally occurred at a depth of 15 meters from the lake surface. Since 1981, the trophic state of this lake has been consistently oligotrophic.

In September 2008, a lake fish consumption advisory was announced for Fontana Lake based on high levels of mercury found in walleye fish. Fontana Lake is also under a statewide consumption advisory for largemouth bass due to mercury contamination.

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. The TVA monitored Fontana Reservoir in 2010. Data results from this monitoring determined that the Ecological Health Rating was Fair. This reservoir has received this rating since 1995. The bottom life, one of the parameters used in the TVA's monitoring program, has consistently rated Poor and this may be the reason for the overall Fair rating. (www.tva.com/environment/ecohealth/fontana.htm)

Franklin to Fontana Local Watershed Plan

A Summary of a Comprehensive Watershed Planning Effort



Between 2008 and 2011, the North Carolina Ecosystem Enhancement Program led a watershed study and planning effort in the Franklin to Fontana watershed. The Franklin to Fontana watershed is a 154 square mile area that encompasses the Little Tennessee River watershed between Lake Emory and Lake Fontana. It lies within north Macon County and a small portion of south Swain County, and it includes much of the Town of Franklin.

The Franklin to Fontana watershed was chosen for study due to the interest of both local and regional stakeholders in its natural resources and cultural landscape. This area is of great ecological significance, and it includes a 23-mile free-flowing stretch of the Little Tennessee River that hosts a highly diverse aquatic community, including a number of rare, threatened or endangered fish and mussels. The area includes many tributaries to the Little Tennessee River, including Cowee, Burningtown, Iotla, Watauga, Cat, Rabbit, Brush, and Tellico Creeks. This primarily rural watershed is a mix of pasture, forest, and residential land, but there is notable development pressure on existing agricultural and forested land.

The objectives of this effort were to assess the health of the Little Tennessee River and its tributaries, identify the major stressors that impact stream quality, develop a plan that names specific recommendations to restore and protect watershed resources, and produce an atlas of on-the-ground projects that can provide the greatest benefit to the watershed.

A Team Effort

A Local Advisory Committee (LAC) comprised of representatives of local governments, conservation organizations, and resource agencies, was formed to oversee the project. The LAC established watershed study and planning objectives, carried out field studies, provided data, and developed management recommendations for the watershed plan.

Findings

An assessment of stream and upland conditions revealed that a large portion of the watershed is highly functioning, or healthy, including much of the Cowee subwatershed and the Burningtown, Tellico, Brush, Sawmill, and Needmore subwatersheds. These subwatersheds have a high amount of public and privately-owned forest and are generally associated with healthy fish and aquatic macroinvertebrate communities.

Franklin to Fontana Planning Timeline

June 2008: Plan started, Local Advisory Committee established
January 2009: Preliminary Findings & Recommendations Report completed, intensive watershed assessment tasks begin
January 2010: Watershed plan recommendation development begins
October 2010: Watershed Assessment Report completed
January 2011: Project Atlas completed
July 2011: Watershed Management Plan completed

The most highly impacted subwatersheds are those of Iotla Creek, Watauga Creek, Cat and Rabbit Creeks, and the Franklin area, including Crawford Branch. Aquatic macroinvertebrate communities were severely impacted by toxic impacts associated with a large tomato farm along Cat and Rabbit Creeks. Stream habitat is severely degraded in the Cat and Rabbit Creek and Iotla Creek subwatersheds; poor habitat was linked to a lack of woody riparian buffers, extensive stream straightening, livestock access to streams, and unpaved roads. In Franklin, Crawford Branch fish and aquatic macroinvertebrate communities are highly degraded, impacted by urban stormwater, water quality problems, and poor habitat. Tellico Creek biological communities were found to be impacted by waste inputs from a trout farm in its upper reaches.

Fecal coliform bacteria and nutrient levels were high in numerous subwatersheds; high fecal bacteria levels were often associated with livestock access to streams in rural subwatersheds, and high fecal bacteria levels in urban Crawford Branch are still under investigation. Assessment of mussel populations in the Little Tennessee River demonstrated continued decline in the federally endangered Appalachian Elktoe and other mussel species populations. High levels of metals were found in Lake Emory sediments, but copper levels in downstream Little Tennessee sediments were low.

The primary stressors to streams in the Franklin to Fontana watershed include the following:

1. Lack of woody streamside vegetation
2. Channel modification/straightening
3. Excess sediment inputs
4. Excess nutrient inputs
5. Bacterial contamination
6. Stormwater runoff
7. Tomato pesticides
8. Barriers to fish passage

Recommendations Developed:

The recommendations developed for the Franklin to Fontana Watershed Management Plan represent what were identified to be the most effective solutions to address the primary watershed stressors and to protect healthy streams across the Franklin to Fontana area. These thirty-six recommendations are summarized and grouped into four categories: Conservation Projects, Policy and Institutional Measures, Educational Activities, and Research and Assessment Activities.

Good fish habitat in Matlock Creek

Conservation projects include specific on-the-ground projects and general recommendations for landowners who would like to improve water quality and habitat of streams on their land. One key general recommendation for landowners is to maintain and plant a streamside buffer of native trees and shrubs, which can greatly improve stream habitat and stream bank stability, filter pollutants, and provide cooler water needed by mountain fishes like trout. Specific stream and wetland restoration projects and agricultural best management practices (BMPs) were proposed for the most highly impacted

rural subwatersheds. Stream-side reforestation projects were proposed along the Little Tennessee River. Forty retrofit stormwater BMPs were suggested for specific sites in Franklin. In order to conserve the natural and cultural heritage of the Franklin to Fontana watershed, both forestland and farmland preservation projects were proposed across the study area.

A number of policy and institutional measures related to state and local government programs are needed to address both existing and future threats to stream health. Two new ordinances would be particularly effective at protecting resources, including a county steep slope ordinance and a stormwater management ordinance. Existing sedimentation and erosion control programs and ordinances can be modified to increase their efficacy in streamside vegetation protection and provide consistent training and rules across Western North Carolina.

Education is a key element in achieving many of the strategies named above and is fundamental to increasing public awareness of the value of streams and rivers. A local environmental education program is essential to encourage environmental stewardship, and a number of specific elements of that program are spelled out in the Plan.

Continued research and assessment are needed to better understand watershed stressors, protect and restore aquatic resources, and to target conservation activities. In particular, continued investment into understanding the ecology of mussels in general and the cause of the Appalachian Elktoe decline in the Little Tennessee River in particular are important to mussel and aquatic habitat conservation both in the Little Tennessee River and in Western North Carolina at large. The Little Tennessee Watershed Association's highly successful stream biomonitoring program not only provides an on-going picture of stream and river health, but it also serves to educate area citizens through volunteer opportunities; this program is essential to community-based conservation of watershed resources.

The Franklin to Fontana watershed is an ecologically and culturally rich area. Everything that we do can impact stream and river health both in the Franklin to Fontana watershed and in downstream waters; the Franklin to Fontana Watershed Management Plan identifies a number of ways to live and work and play in the watershed that will conserve and improve the health of the Little Tennessee River and its tributaries.

For more information on the Franklin to Fontana watershed planning effort, including the full Watershed Management Plan, see: **http://portal.ncdenr.org/web/eep/rbrps/little-tennessee.**

Notable Waters

Table 1-1 lists waterbodies identified as needing additional protection and potential restoration actions. The third and fourth 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.

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Cartoogechaye Creek	2-19-(1) 2-19-(10.3) 2-19-(10.5)	WS-III;Tr WS-III;Tr,CAB;Tr	nutrients, fecal coliform bacteria	development, agriculture	S	P, BMPs
Little Tennessee R.	2-(1)b	C	low pH, habitat degradation	WWTP, Non-point sources	S, IP	P
Blaine Branch	2-19-13	C	habitat degradation	channelization, bank erosion, development, riparian zone disturbance	NR	R
Mill Creek	2-19-9	WS-III	habitat degradation	channelization, bank erosion, development, riparian zone disturbance	NR	R
Mill Creek	2-21-3	WS-III;Tr	habitat degradation	impoundments, low water levels, temperature, sediment, pesticides, flow modification, stormflow scour, development	I	R
Cullasaja River	2-21-(0.5)b	WS-III;Tr	habitat degradation	impoundments, low water levels, temperature, sediment, pesticides	I	R
Saltrock Branch	2-21-1	WS-III	habitat degradation	golf course	NR	R
Walnut Creek	2-21-17	C;Tr	habitat degradation, sediment, elevated conductivity	development, agriculture	S, IM	SS, BMPs
Alarka Creek	2-69-(2.5)	C;Tr	habitat degradation, nutrients	non-point source runoff, failing septic systems, limited riparian cover, agriculture	S	R, BMPs
Bradley Creek	2-33	C; Tr	fecal coliform bacteria, nutrients, habitat degradation	limited riparian cover, unfenced livestock	I	R, BMPS
Caler Fork	2-29-4	C	sediment	development on steep slopes	I	BMPs
Cat Creek	2-23-4a 2-23-4b	C	sediment, toxicity, habitat degradation, fecal coliform bacteria	channelization, land clearing, livestock, impoundments, lack of riparian cover, pesticides	I	R, BMPs
Crawford Branch	2-22	C	sediment, habitat degradation, channelization, fecal coliform bacteria	development, agriculture	I	R, BMPs
Iotla Creek Iotla Branch	2-27 2-27-1	C	sediment, nutrients, fecal coliform bacteria	channelization, agriculture	I I	R, BMPs
Moore Creek	2-57-17	C;Tr,ORW	sedimentation	impoundments	NR	P, R

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Rabbitt Creek	2-23	C; Tr	sediment, toxicity, habitat degradation, fecal coliform bacteria	development, agriculture, beavers, channelization, pesticides	I	R, BMPs
Rocky Branch	2-26	C	fecal coliform bacteria		I	
Tellico Creek	2-40	C;Tr	sediment, nutrients,	trout farm, flow alterations	I	Ag BMPs, NMC
Whiteoak Creek	2-57-45a	C;Tr	nutrients	trout farm	NR	BMPs, NMC
Watauga Creek	2-24	C, Tr	fecal coliform bacteria	agriculture	I	R, BMPS
Younce Creek	2-38-8	C	habitat degradation		S	SS
Tuskeegee Cr + 8 tributaries	2-136	C	-	-	S	P, SS
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.)						
Status = I=Impaired, IM= Impacted, S=Supporting, IP= 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 mgmt controls.						

NPDES Permits

NPDES Permits Discharging to Upper Little Tennessee River Subbasin			
Permit #	**Permit Type**	**Outfall location**	**Facility Name**
NPDES Permits Discharging to Little Tennessee River			
NCG551116	Wastewater	Little Tennessee R.	single family residence
NCG550866	Wastewater	Little Tennessee R	single family residence
NC0060844	WWTP	Little Tennessee R	Laurel Hills HOA
NCG070136	Stormwater	Little Tennessee R	Cemex Construction
NCG520024	Stormwater	Little Tennessee R	Mountain Sand
NPDES Permits within Cullasaja Subwatershed			
NC0051381	WWTP	Saltrock Br	Highlands Falls Country Club
NC0021407	WTTP	Cullasaja R	Town of Highlands
NC0075612	WWTP	Cullasaja R	Wildcat Cliffs Country Club
NC0067326	WWTP	Cullasaja R	Macon County Schools
NC0059552	WWTP	Cullasaja R	Highlands Falls Community
NCG550658	Wastewater	Cullasaja R	Highlands-Cashiers Animal Clinic
NC0036692	WWTP	Big Cr	Skyline Lodge & Village
NC0032778	WTP	Big Cr	Town of Highlands
NCG110104	Stormwater	ditch to Cullasaja. R	Highlands WWTP
NCG550389	Wastewater	Little Buck Cr	single family residence

NPDES Permits Discharging to Upper Little Tennessee River Subbasin			
Permit #	**Permit Type**	**Outfall location**	**Facility Name**
NCG550170	Wastewater	Buck Cr	single family residence
NCG550162	Wastewater	Buck Cr	single family residence
NCG550444	Wastewater	Buck Cr	single family residence
NPDES Permits within Nantahala watershed			
NCG530062	Wastewater	Whiteoak Cr.	Whiteoak Trout Farm
NCG530072	Wastewater	Whiteoak Cr.	Coldspring Trout Farm
NC0067318	WWTP	Partridge Cr.	Macon County Schools
NCG500136	Wastewater	Nantahala R./Lake	Duke Nantahala Hydroelectric
NCG530121	Wastewater	Rowlin Cr.	Nantahala Trout Farm
NCG160030	Stormwater	Nantahala R./Lake	Nantahala Asphalt Plant
NCG020065	Stormwater	Nantahala R./Lake	Nantahala Talc & Limestone
NC0057193	WWTP	Nantahala R./Lake	Nantahala Outdoor Center
NC0037737	WWTP	Nantahala R./Lake	Nantahala Village
WQ0003441 WQ0003442	Wastewater recycling	Non-discharge	Nantahala River Gem Mine
NPDES Permits within the alarka Creek- Little Tenn. Watershed			
NCG080728	Stormwater	Crawford Br.	Rolling Frito-Lay
NCG210393	Stormwater	Ditch to Little Tenn. R	Zickgraf Hardwood Flooring
NCG120083	Stormwater	Ditch to Little Tenn. R	Macon County Landfill
NC0021547	WWTP	Little Tenn. R.	Town of Franklin
NCG550300 NCG550299	Wastewater	Little Tenn. R.	single family residence
WQ0022711	Irrigation	Non-discharge	Macon County
WQ0034616	Irrigation	Non-discharge	North Macon K-4 School
NCG150005	Stormwater	Iotla Cr.	Macon County Airport
NCG020262	Stormwater	UT to Iotla Cr.	Rose Creek Mine
NCG520016	Wastewater	Mason Br.	Old Cardinal Gem Mine- sand dredging
WQ0006560	Recycling	Non-discharge	Mason Mountain Mine
NCG520017	Wastewater	Caler Fork Cr.	Maceffie Gems & Land- sand dredging
NCG020146	Stormwater	Cowee Cr.	Sheffield Mine
NCG140400	Stormwater	Alarka Cr.	Smoky Mtn. Ready Mix
NCG551010	Wastewater	Alarka Cr.	single family residence
NPDES Permits within the Panther Creek Subwatershed			
NCG210055	Stormwater	Wolf Cr.	Dehart Lumber Co.

References & Useful Websites

Coweeta Long Term Ecological Research
http://coweeta.uga.edu/
USGS Hydrologic Data- http://coweeta.uga.edu/dbpublic/hydrologic_data.asp

Duke Energy
Franklin Hydroelectric Project- http://www.duke-energy.com/pdfs/Franklin_Vol_IIId.pdf

Land Trust for the Little Tennessee /Little Tennessee Water Association
http://www.ltlt.org/ or http://www.ltwa.org/
State of the Streams- http://www.ltwa.org/sites/all/files/images/2011SOSsmall.pdf
Cartoogehcaye Report- http://www.ltwa.org/sites/all/files/images/Cartoogechaye_report_final_web_version.pdf
LTWA Biomonitoring Trends- http://coweeta.uga.edu/publications/10415.pdf
LTWA Biomonitoring Program- http://coweeta.uga.edu/ltwa/
SVAP- http://coweeta.uga.edu/publications/10519.pdf
Skeenah Health Report- http://www.ltwa.org/sites/all/files/images/Skeenah_ck_mini.pdf
Peeks Cr.Health Report- http://www.ltwa.org/sites/all/files/images/Peeks_ck_mini.pdf
Rabbitt Cr. Health Report- http://www.ltwa.org/sites/all/files/images/Rabbit_ck_mini.pdf
Caler Fk. Health Report- http://www.ltwa.org/sites/all/files/images/Caler_Fork_mini.pdf
Bradley Cr. Health Report- http://www.ltwa.org/sites/all/files/images/Bradley_ck_mini.pdf
Tellico Cr. Health Report- http://www.ltwa.org/sites/all/files/images/Tellico_ck_mini.pdf

NC Ecosystem Enhancement Program
http://portal.ncdenr.org/web/eep/rbrps/little-tennessee
Phase I- http://www.nceep.net/services/lwps/Little_Tennessee/New/5_Supporting%20Documents%20I-II_F2F_Jan09.pdf
Phase II- http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=2806346&name=DLFE-41508.pdf
Phase III-http://www.nceep.net/services/lwps/Little_Tennessee/New/F2F_WMP_Final_21July2011.pdf

NC Division of Water Quality
Biological Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=de0dbb2d-3417-44c4-9736-1710d2e18d43&groupId=38364
Ambient Report- http://portal.ncdenr.org/c/document_library/get_file?uuid=ac3b7afe-e2f1-4d1e-93df-c2ba9d897888&groupId=38364
Lakes & Reservoir Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=0b586b2a-6851-4783-a4e1-a7f58b2549f4&groupId=38364
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
Cullasaja River- http://portal.ncdenr.org/c/document_library/get_file?uuid=c75eb8e2-0354-4490-88ab-771d9b7871d0&groupId=38364

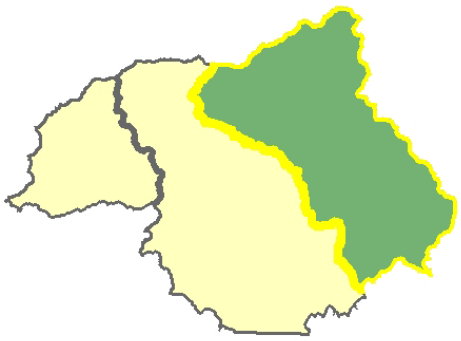
NC Department Health and Human Services
Fish Advisory- http://epi.publichealth.nc.gov/fish/current.html

NC Division of Water Resources
Flow- http://www.ncwater.org/Permits_and_Registration/Instream_Flow/

Upper Cullasaja Watershed Association
http://portal.ncdenr.org/c/document_library/get_file?uuid=bda0b403-848d-4951-b7fe-d8f365505a71&groupId=38364
http://coweeta.uga.edu/publications/10518.pdf

Tennessee Valley Authority
Monitoring- http://www.tva.com/environment/ecohealth/fontana.htm

Tuckasegee River Subbasin



HUC 06010203

Includes: Tuckasegee River, Caney Fork, Scott Creek, Savannah Creek & Oconaluftee River

Watershed at a Glance

Counties:
Jackson, Swain

Municipalities:
Bryson City, Dillsboro, Forest Hills, Sylva, Webster

EPA Level IV Ecoregions:
High Mtns., Southern Metasedimentary Mtns, Southern Crystalline Ridges & Mtns

Population:
2000: 41,737
2010: 49,162

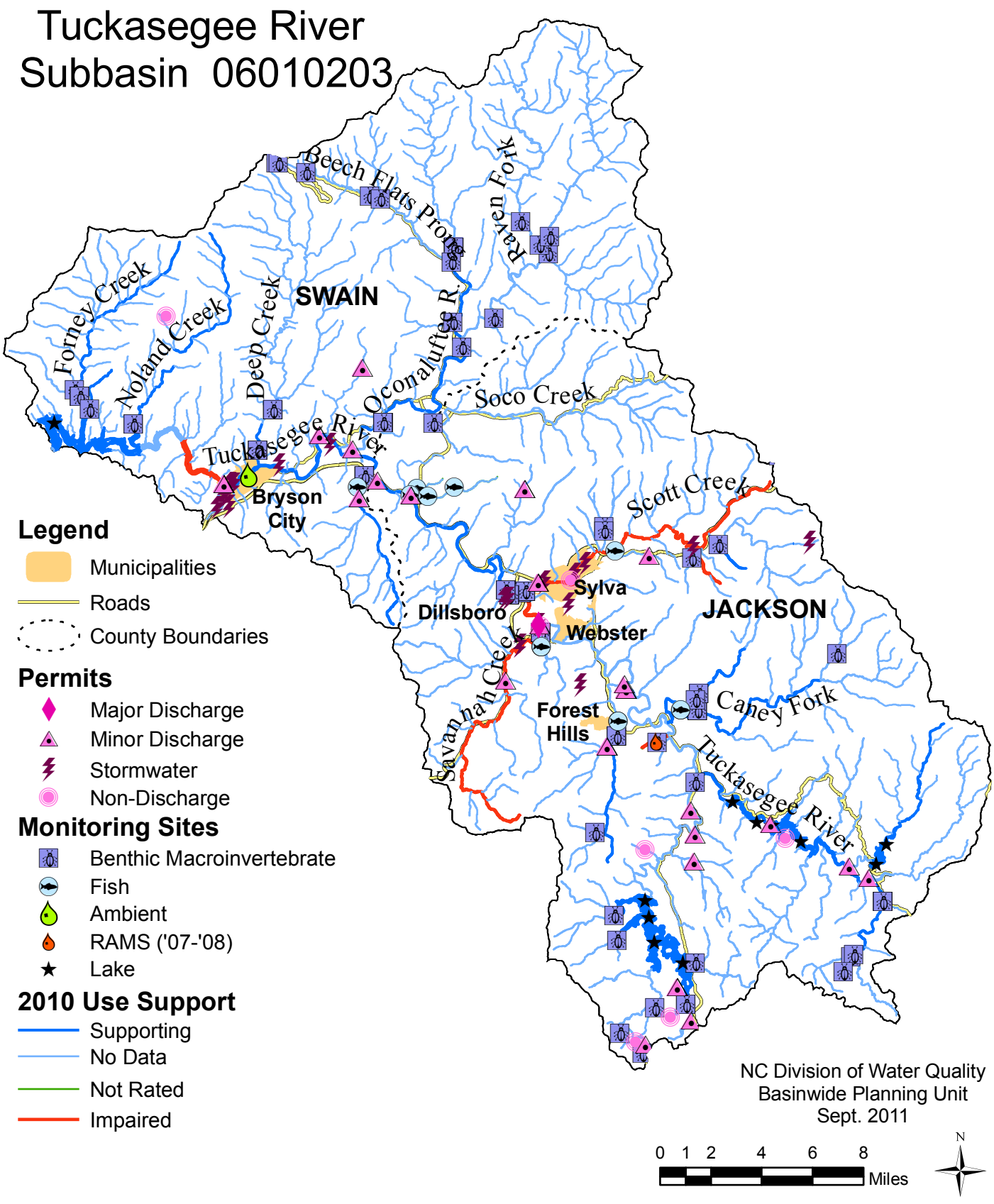
Area 734 mi²

2006 Land Cover:
Open Water.....1%
Developed.....5%
Forested.....89%
Scrub.....1%
Agriculture..... .....4%

Permitted Facilities:
NPDES
Wastewater Discharge.....22
Wastewater Nondischarge....8
Stormwater.....16
Animal Operations.....0

Figure 1-1: NLCD 2006 Land Cover

Figure 1-2: Tuckasegee River Subbasin Map (06010203)



Water Quality Overview

The Tuckasegee River Subbasin, hydrologic unit 06010203, was represented in previous Basin Plans as Subbasin 04-04-02. This subbasin covers 734 sq. miles and is 89% forested; containing portions of Nantahala National Forest and Great Smoky Mountains National Park (Figure 1-1). There are approximately 3,429 reservoir acres and ~998 classified stream miles, not including the numerous unnamed tributaries. The Tuckasegee River drains into Fontana Lake just downstream of Bryson City.

This subbasin contains some of the most pristine high quality waters in the state and supports numerous trout streams (Figure 1-3). Water quality issues of concern in this subbasin include impacts from developments on steep slopes, agricultural runoff, stream bank erosion, limited riparian cover and individual onsite wastewater failures. Waterbodies currently on the 2010 303(d) list of Impaired waters include: a 1.3 mile unnamed tributary to the Tuckasegee River, Scott Creek, Sugarloaf Creek, Savannah Creek and 170 acres of the Tuckasegee River Arm of Fontana Lake. A map of the subbasin showing Impaired streams, monitoring and permit locations is shown in Figure 1-2.

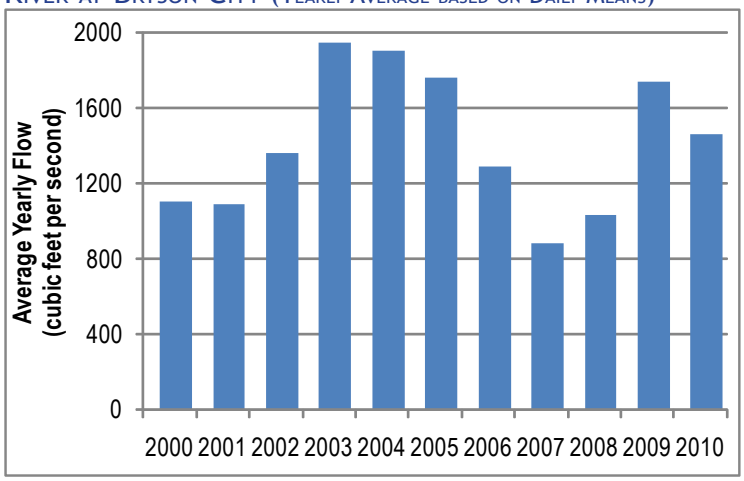
Figure 1-3: Stream Classifications

For more information regarding stream classifications see: http://portal.ncdenr.org/web/wq/ps/csu/

Stream Flow

Stream flow is monitored at US Geological Survey gaging stations. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). There are four gaging stations in this subbasin. Figure 1-4 provides an example of average stream flow over a 11 year period and gives an idea of which years received heavier precipitation. For more information about instream flow see DWR website: http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html.

Figure 1-4: Stream flow at USGS 03513000 Tuckasegee River at Bryson City (Yearly Average based on Daily Means)



The flow rate in a stream can impact the measurement of physical and chemical parameters. In particular, droughts can have major affects on parameters such as dissolved oxygen, turbidity, pH, and others by reducing stream flow. Most recently this subbasin was in drought conditions in 2007 and 2008 (see page 17 AMS Report). Drought effect on discharge in the Tuckasegee River was somewhat reduced by the almost daily releases of water

from the Duke Energy hydroelectric facility at the lower end of the West Fork of the Tuckasegee River. The Oconaluftee River, with no dam control, the drought effect was more pronounced. Annual average streamflow for 2007 was the lowest in since data collection in ~1946. Low precipitation over the 2007-08 winter accentuated the drought with recovery not starting until the storms in November 2008.

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 were collected during the spring and summer months of 2004 and 2009-10 by the DWQ-Environmental Sciences Section as part of the five-year basinwide sampling cycle. Fourteen benthic macroinvertebrate sites and three fish community sites were evaluated in 2009-10, representing seventeen distinct localities. Each basinwide biological station monitored during the current cycle is shown in Figure 1-5 and color coded based on its current rating. The majority of benthic macroinvertebrate samples taken in this watershed received an Excellent rating. Several fish community sites resulted in a Not Rated status, due to the absence of criteria for rating high gradient mountain trout waters, while others rated Good. There were an additional 8 samples taken at new locations.

Figure 1-5: Biological Sites Current Ratings

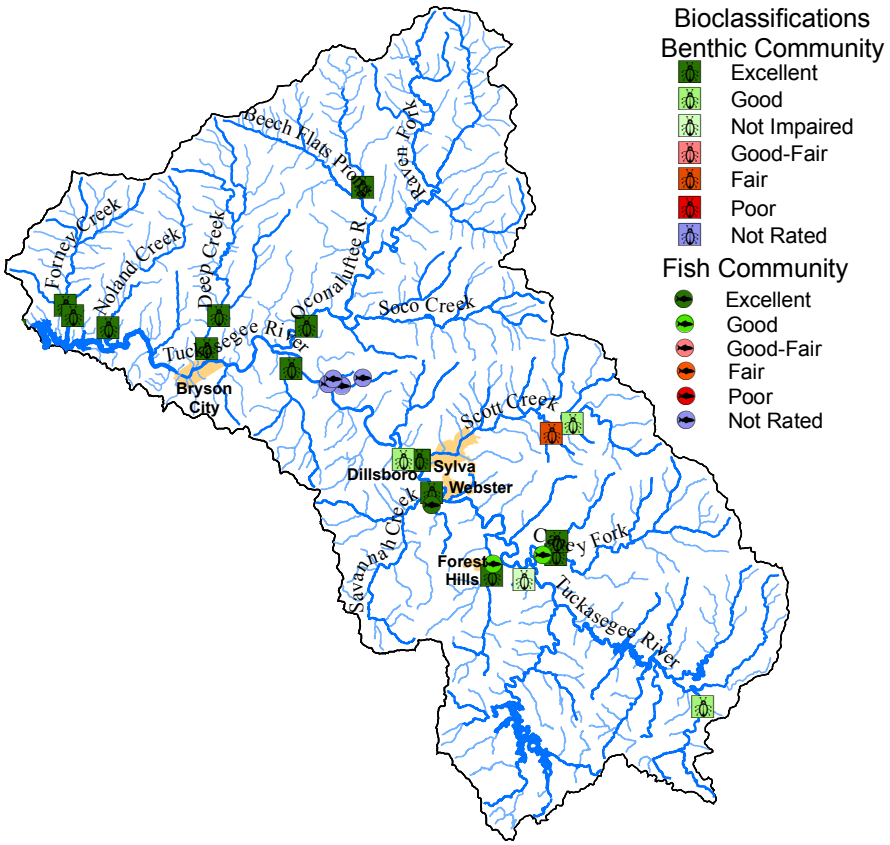
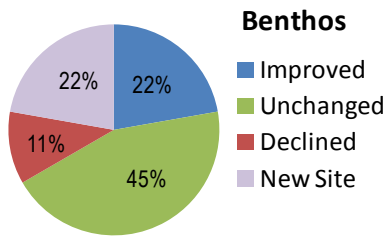


Figure 1-6: Benthic Macroinvertebrate Sample Status



Benthos

Among the benthic macroinvertebrate sample sites, four sites improved, two declined and eight retained the same bioclassification in 2009-2010 as observed in 2004. There were an additional four benthic samples taken to support special studies. Figure 1-6 shows the distribution of these samples.

Fish

Among the three fish community sites, two improved from 2004 while the one remaining site maintained the same bioclassification in 2009 from that observed in 2004. There were an additional four fish community samples taken to support special studies. Figure 1-7 shows the distribution of these samples.

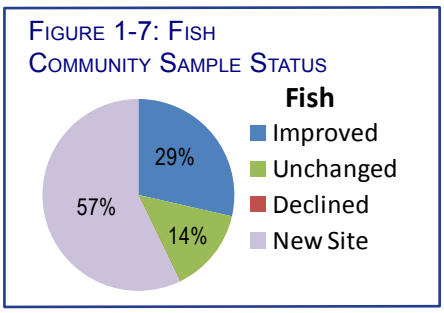


Figure 1-7: Fish Community Sample Status

For more information about biological data in this watershed, see the 2010 Little Tennessee River Basinwide Assessment Report. Detailed data sheets for each sampling site can be found in Appendix 1-B.

Long Term Ambient Monitoring

The DWQ's Ambient Monitoring System (AMS) is a network of stream stations strategically located for the collection of physical and chemical water quality data. There is one AMS station (G8600000) in this subbasin; data has been collected from this site since 1973. The following discussion of ambient monitoring parameters includes concentration value graphs for AMS station G8600000 over a 11 year period (2000-2010). Each major parameter is discussed, even if no current impairment exists. The graphs are not intended to provide statistically significant trend information, but rather an idea of how changes in land use or climate conditions can affect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the data set. Box and whisker plots of individual ambient stations were completed by parameter for data between 2005 and 2009 by DWQ's Environmental Sciences Section (ESS) and can be found in the Little Tennessee River Basin Ambient Monitoring System Report.

pH

As seen in Figure 1-8, which represents the data window for the 2010 303(d) list, ambient site G8600000 had at least one sample that fell below the pH standard of 6su, but it did not exceed the standard in 10% or more of the samples. Over 11 years (Figure 1-9), there were four incidences of pH dropping below the minimal standard of 6 su at AMS G8600000.

At a Random Ambient Monitoring System site (G4210000) on an unnamed tributary to Tuckasegee River at State Road 1172 near East Laport, samples taken recorded low pH levels resulting in Impairment.

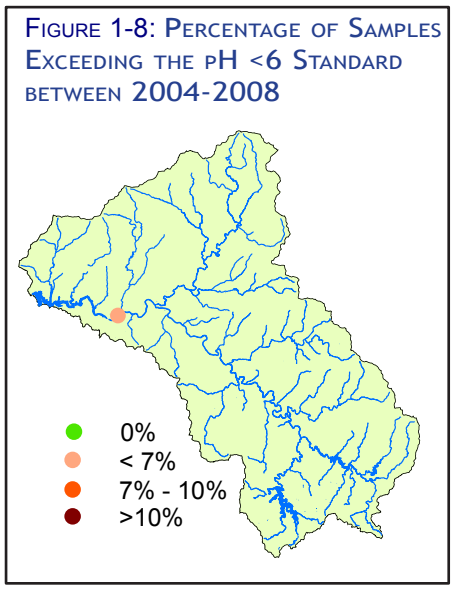


Figure 1-8: Percentage of Samples Exceeding the pH <6 Standard between 2004-2008

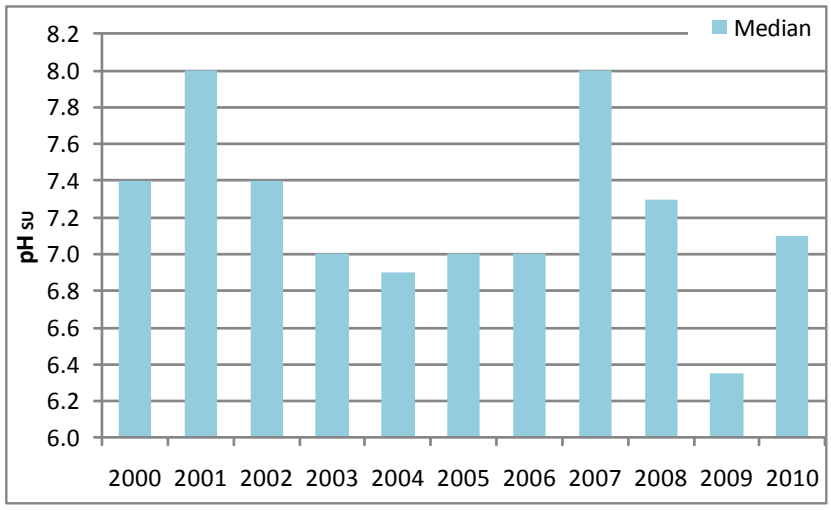


Figure 1-9: Summarized pH data at AMS G8600000 site between 2000-2010

Dissolved Oxygen

As seen in Figure 1-10, which represents the data window for the 2010 303(d) list, ambient station G8600000 did not have any exceedances of DO standards. Over the past 11 years (Figure 1-11), no samples were collected with dissolved oxygen levels below the 4mg/l instantaneous standard for Class C waters.

Figure 1-10: Percentage of Samples Exceeding the DO <4 Standard between 2004-2008

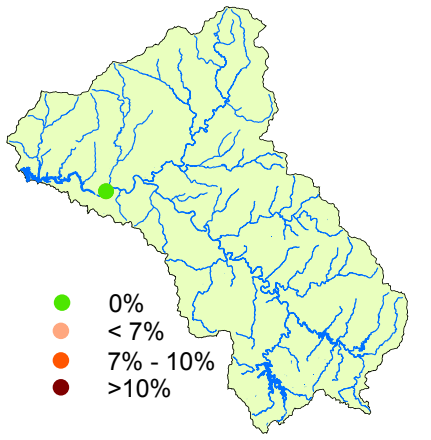
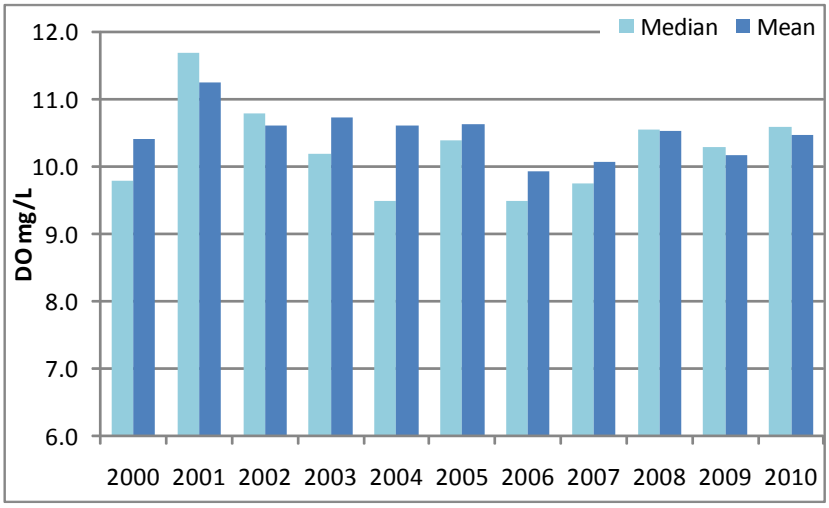


Figure 1-11: Summarized DO data at AMS G8600000 site between 2000-2010.



Fecal Coliform Bacteria

Fecal coliform bacteria occurs in water as a result of the overflow of domestic sewage and from other nonpoint sources of human and animal waste, including pets, wildlife and farm animals. The fecal coliform bacteria standard for freshwater streams is not to exceed the geometric mean of 200 colonies/100 ml or 400 colonies/100 ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are used to indicate whether a stream is Impaired or Supporting. Waters with a use classification of B (primary recreational waters) are prioritized for 5-in-30 studies.

As seen in Figure 1-12, which represents the data window for the 2010 303(d) list, ambient station G8600000 exceeded the 400 colonies/100ml in at least one sample. There were eight incidences of high bacteria counts as indicated by several peaks in mean values over the eleven compared years, shown in Figure 1-13 . There are three waterbodies Impaired because of elevated fecal coliform bacteria detected in 5-in-30 data collected in August 2005: Savannah Creek, Scott Creek and Tuckasegee River.

Figure 1-12: Percentage of Samples Exceeding the Fecal Coliform Bacteria >400 Standard between 2004-2008

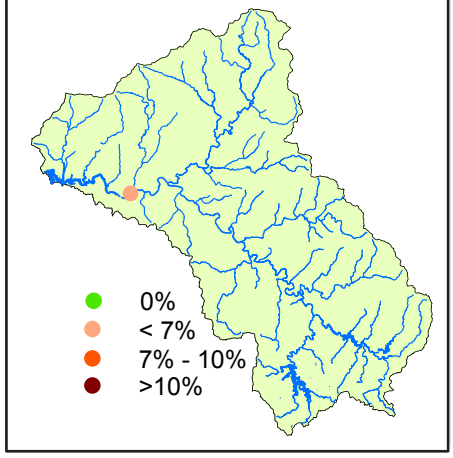
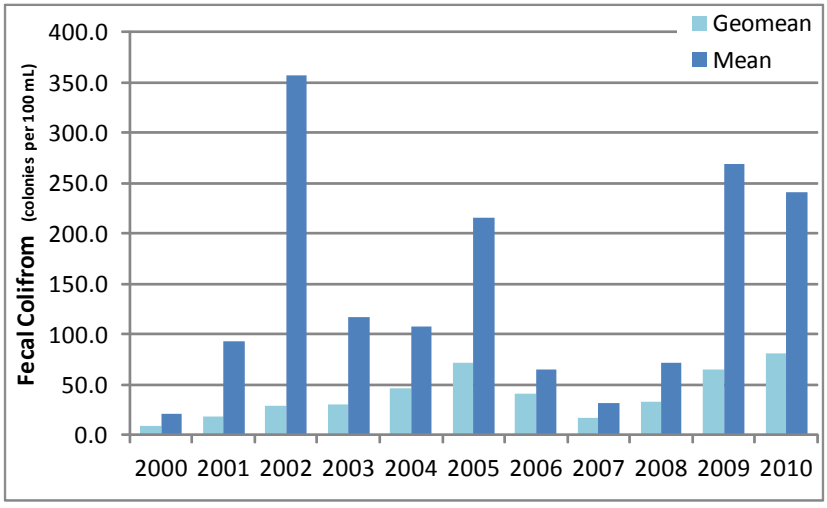


Figure 1-13: Summarized Fecal Coliform Bacteria data at AMS G8600000 site between 2000-2010.



Turbidity

As seen in Figure 1-14, which represents the data window for the 2010 303(d) list, ambient site G8600000 did not have any samples that exceeded 50NTUs. Over the past 11 years (Figure 1-15), only one sample at exceeded the standard of >50 NTUs for Class C waters.

Figure 1-14: Percentage of Samples Exceeding the >50 Turbidity Standard between 2004-2008

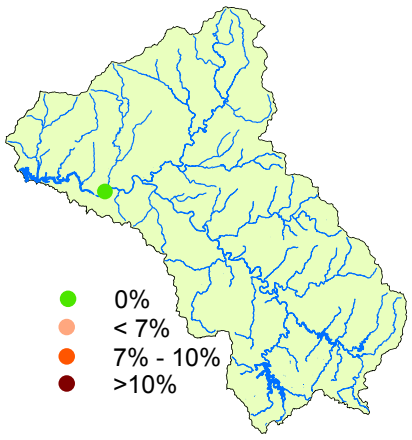
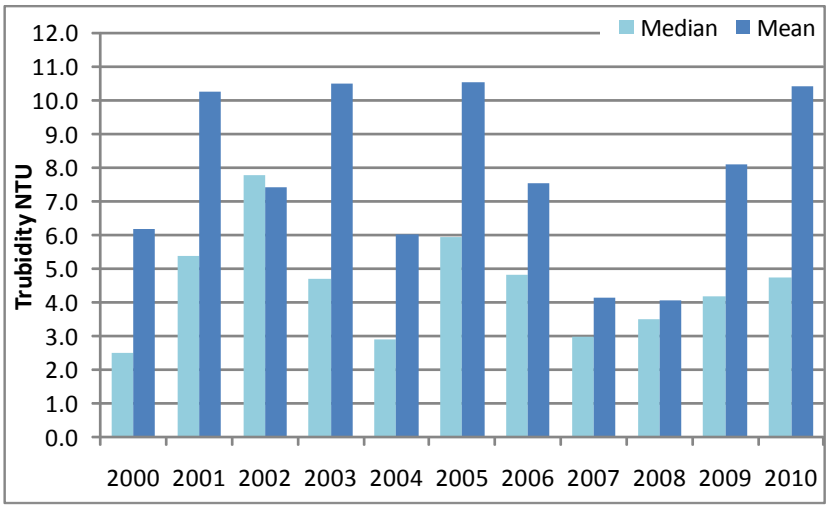


Figure 1-15: Summarized Turbidity data at AMS G8600000 site between 2000-2010.

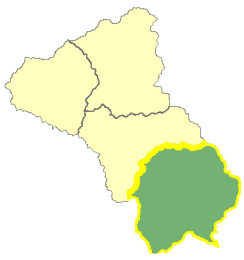


Protection and Restoration Opportunities

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.

Upper Tuckasegee River Watershed (HUC 0601020301)



This watershed encompasses 152,466 acres and has an estimated 2010 population of 15,325 people. A majority of the watershed is within a WS-III area.

West Fork Tuckasegee River/ Thorpe Lake [2-79-23-(1)] (WS-III,B;HQW) also known as Glenville Lake, is a man-made impoundment on the Tuckasegee River located in Jackson County. The lake is used for recreational fishing, swimming, and boating. Owned by Duke Energy, the reservoir also has been used for hydroelectric power generation since its construction in 1941. Thorpe Lake was monitored by DWQ in 2009, which determined the Lake is still oligotrophic as it has been since it was first monitored in 1988. Trillium

Links & Village WWTP discharges into Hurricane Creek which a tributary to Thorpe Lake. The facility has had several permits violations over the past five years, including exceedances for BOD, TSS, ammonia and low DO.

Wolf Creek (Wolf Creek Lake) [2-79-9-(1)] (WS-III,B;Tr,HQW) Wolf Creek Reservoir is a small hydroelectric reservoir built by Nantahala Power and Light Company in 1955 on the Tuckasegee River and is currently owned by Duke Energy. Wolf Creek Reservoir has a forested watershed. The shoreline of the lake has a relatively low density of private homes, however evidence of land clearing and new home construction was observed in 2009. Monitoring by DWQ field staff of Wolf Creek Lake was conducted monthly from May through September, 2009. Data collected indicated that the lake's trophic state to be oligotrophic. This trophic state has not changed since monitoring by DWQ began in 1988.

Tuckasegee River [AU# 2-79-(0.5)] (WS-III,B;Tr,ORW) was sampled at site GB38 in 2009 resulting in an Good benthos bioclassification.

Tuckasegee River/ Bear Creek Lake [2-79-(5.5)b & 2-79-(5.5)c] (WS-III,B;Tr) is a hydroelectric impoundment of the Tuckasegee River. Most of the 194 mi^2 upland drainage area is forested with steep slopes and clean, fast-moving streams. Bear Creek Lake was built in 1953 and is currently owned by Duke Energy. DWQ field staff monitored Bear Creek Lake five times from May through September in 2009. This reservoir has remained oligotrophic since it was first monitored by DWQ in 1994. In past evaluations of Bear Creek Reservoir, it was observed that the shoreline was predominantly forested with a relatively undisturbed drainage area that helped to maintain the reservoir's low nutrient concentration and very clear water. It was noted in 2009 that residential development has significantly increased along the shoreline and in the watershed of this reservoir.

Tuckasegee River/ Cedar Cliff Lake [2-79-(5.5)c] (WS-III,B;Tr) is a picturesque mountain lake on the Tuckasegee River. The lake is owned by Duke Energy and was built in 1952. Water quality in the lake supports swimming, boating, and trout fishing. The name of the lake was probably derived from a sheer rock cliff, which faces it from the north. This lake was sampled in 2009 by DWQ, which determined the Lake is still oligorophic as it has been since it was first monitored in 1988.

Unnamed tributary to Tuckasegee River [2-79-(24)ut4] was sampled for macroinvertebrate communities in 2007 resulting in a Not Impaired status. A Random Ambient Monitoring System site (G4210000) also collected data along this tributary between Jan. 2007 - Dec. 2008. Data collected included normal field parameters along with metals, volatile organics, semi-volatiles, and pesticides. Over 18% of the samples had low pH, but no other water quality problems were detected. This creek is now Impaired for Aquatic Life because of the low pH levels.

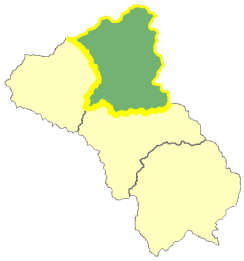
Caney Fork [AU# 2-79-28-(2.5)] (WS-III;Tr) drains a small portion of east-central Jackson County, a mostly forested landscape, and ultimately feeds into the Tuckasegee River. Caney Fork, for most of it's length, is paralleled by roadway and is lined by agricultural fields and residences. The stream is lacking significant riparian vegetation and is often denuded on both sides streambanks. However, most of the watershed is forested thereby protecting the Excellent water quality that has persisted in Caney Fork over the last two decades. The stream was sampled at sites GB27 and GF4 resulting in an Excellent benthos and Good fish community bioclassifications.

Moses Creek [2-79-28-8] (WS-III;Tr) is a tributary of Caney Fork. This stream has a catchment that is largely forested with only the lower segment paralleling a rural residential road. It was noted that riparian loss was occurring due to residential lawns, some upstream agriculture, and the nearby road. The Creek was sampled at site GB26 in 2010 resulting in an Excellent benthos rating.

Cullowhee Creek [AU# 2-79-31a & b] (C;Tr) flows north through Jackson County in the southwestern portion of North Carolina. The majority of the headwaters are forested and of good water quality. The lower portion of the watershed includes Western Carolina University, light commercial, and residential development.

The stream through this section was historically moved and channelized resulting in poor habitat and flood protection. In 2009, DWQ sampled Cullowhee Creek at two locations upstream of the university. The benthic community at site GB29 rated Excellent, and the fish community at GF13 received a Good bioclassification. The biologists noted high levels of sand, silt and macrophytes. Although Cullowhee Creek rated as Excellent in 2009, habitat degradation is an issue and may negatively affect the fauna in the future.

Oconaluftee River Watershed (HUC 0601020302)

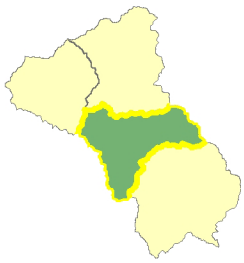


This watershed encompasses 120,226 acres and has an estimated 2010 population of 8,833 people.

Bradley Fork {AU# 2-79-55-12-(11)] (B;Tr,HQW) a tributary to the Oconaluftee River, is located within Great Smoky Mountain National Park and as such has a completely undeveloped and forested watershed. This stream has high recreational usage among the public as it lies next to a campground just inside the park border The creek was sampled in 2009 at site GB1 resulting in an Excellent benthos bioclassification.

Oconaluftee River [AU# 2-79-55-(16.5)] (C;Tr) is a large tributary to the Tuckasegee River draining the eastern portion of Great Smoky Mountain National Park. The lower segment of this river is tracked on both sides by roads and receives large amounts of urban runoff from Cherokee. High development pressures have introduced sediments into the river and removed large amounts of riparian vegetation. The River was sampled in 2009, at site GB11, resulting in an Excellent benthos bioclassification, however the Excellent rating is likely supported from the unimpacted tributaries as conditions in the Oconaluftee River itself are deteriorating.

Middle Tuckasegee River Watershed (HUC 0601020303)



This watershed encompasses 104,486 acres and has an estimated 2010 population of 19,373 people.

Savannah Creek [AU# 2-79-36] (C;Tr) watershed drains the west-central portion of Jackson County. Savannah Creek itself flows alongside US 441 and NC 116 for much of its length before joining the Tuckasegee River near Webster. Traditionally, land use in the watershed was agricultural with light residential and commercial activity along the transportation corridors. Residential development is increasing substantially and elevating sediment and erosion concerns. DWQ does not have an ambient monitoring station but DWQ did sample fecal coliform bacteria concentrations in Savannah Creek as part of a Class B (Recreation) use-attainability study for the Tuckasegee River initiated in 2003. The samples exceeded state standards and indicate Savannah Creek, from its source to the Tuckasegee River (13.4 miles), is Impaired in the recreation category. The sources of fecal coliform contamination are unknown, but may include failing septic systems and/or agricultural runoff. DWQ also sampled the fish and benthic communities at sites GF23 and GB23, both resulting in Excellent ratings. However, these data do not reflect the habitat threats posed by development in the watershed. Many stream reaches have been channelized and riparian vegetation removed.

The Watershed Association for the Tuckasegee River (WATR) is currently writing a watershed plan and coordinates sampling in the Savannah Creek Watershed. Data collected at Savannah Creek and its largest tributary, Greens Creek, from July 2003 through September 2010 show turbidity levels that exceed the 10 NTU standard for trout habitat waters.

	Savannah Ck.	Greens Ck.
N	89	87
Exceeding 10 NTUs	~37%	~33%
Mean	19.4	9.7
Median	7.7	7.5
Maximum	450	80

Measurements exceeded turbidity standards 37% of the time for Savannah Creek and 33% for Greens Creek [AU# 2-79-36-11]. These results were obtained despite the regional drought conditions. Monthly sampling also detected high flow and high turbidity conditions during the summers of 2007 and 2008.

WATR notes that DWQ's sample site at NC116 is not representative of stream conditions. The monitoring site at bridge on NC116 has a relatively large gradient as compared to stream reaches up and downstream. The station occupies a small water gap in a local ridge and it has a rocky substrate. These factors combine to yield a short zone that does not accumulate deposited sediments and is favorable habitat for macroinvertebrates WATR recommends that if it is necessary to acknowledge this biologically productive stream segment, then Savannah Creek should be divided into three assessment reaches. Moving upstream from the confluence, the first reach is a section of stream that is characterized by low gradient. It passes through a wide floodplain with agriculture, and stream banks are unstable and eroding. The second assessment reach starts with the high gradient segment at Bridge along NC116. In the upstream direction it forms a large curve in an isolated patch of flood plain, again dedicated to agriculture. This reach extends into a larger water gap paralleled by Rt 116. The high gradient section in the water gap, a place frequented by anglers, marks the upper end of this section. The third assessment reach starts at the mid point in the water gap and extends upstream for the remaining length of Savannah Creek.

Since the temporary moratorium on construction in 2008 and the downturn in home building in 2009, the relative effect of construction on erosion and turbidity has decreased significantly. Enforcement, and especially clarity and enforcement of temporary and final vegetative cover, remains critically important to improving water quality in the Savannah Creek watershed. Developing agriculture buffers and public education on maintaining fallow land, road ways and road ditches are recommended. Fecal coliform contamination sources in the Savannah Creek watershed should be identified and corrected. Additionally, sediment and erosion control problems should be addressed to prevent further habitat degradation.

Water Quality Initiatives

WATR is working diligently to inform the public on the critical role of stream side buffers in maintaining a healthy aquatic ecology and good water quality. Partnering with the Town of Dillsboro WATR volunteers and staff have build the Stream Buffer Demonstration Trails at Monteith Farmstead Park. These short nature trails with educational signs are specifically aimed at informing the landowners, and stream-side landowners in particular, about the necessity of riparian buffers to healthy mountain streams. This work has been supported by **Resourceful Communities Program**. WATR also has conducted youth environmental education events funded by the Cherokee Preservation Foundation, the USDA Natural Resources Conservation Service, and by WATR members and contributors.

Scott Creek [AU# 2-79-39] (C;Tr) is a large, swift tributary to the Tuckasegee River. Draining northeastern Jackson County, US 19/23 and Old US 19/23 parallel the creek is for most of its length. The stream passes through many residential areas before entering the urban environment in Sylva and Dillsboro. DWQ sampled fecal coliform bacteria concentrations in Scotts Creek as part of a Class B Recreation use-attainability study for the Tuckasegee River initiated in 2003. The samples exceeded state standards and indicate Scotts Creek, from its source to the Tuckasegee River (15.3 miles), is Impaired in the recreation category.

Rafting on Scott Creek

The sources of fecal coliform contamination are unknown, but may include failing septic systems, leaking sewer systems and/or nonpoint source runoff. In 2009, DWQ evaluated the benthic macroinvertebrate community at site GB167 resulting in an Excellent bioclassification. This is an noted improvement compared to the 2004 conditions, however the Creek still has turbidity and habitat issues. The stream channel is highly modified and the bank is armored by riprap.

The Morningstar of Jackson WWTP facility discharges into Blanton Branch (AU# 2-79-39-10) which is a tributary to Scott Creek. In 2010 the facility exceeded fecal coliform bacteria levels.

A small pond dam failure in the Balsam Mountain Preserve development occurred on June 7, 2007. The resultant sediment and debris slide entered Sugarloaf Creek [AU# 2-79-39-5-1] (C) and finally the lower segments of Scott Creek. A special benthos study was completed in 2007 to assess the impacts from the dam failure. A total of three streams were sampled in this study. Two of the streams sampled (Sugarloaf Creek and Scott Creek) were directly affected by the sediment. The third stream, Licklog Branch [2-79-39-3-6] (C), was sampled as a comparative reference site to Sugarloaf Creek and was similar in both landuse and drainage area. Results of the study indicate that the dam failure did affect the macroinvertebrate community in Sugarloaf Creek as it had a “Fair” bioclassification while the reference site was “Good”. The downstream reaches of Scott Creek received an “Excellent” bioclassification.

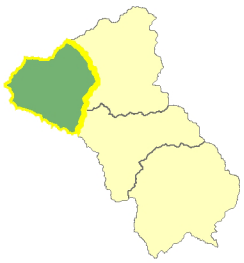
Tuckasegee River [2-79-(35.5)a & 2-79-(35.5)b & 2-79-(38)] (C;Tr) receives effluent from the municipalities of Sylva, Webster, and Dillsboro and drains almost the entirety of Jackson County. The River is Impaired for recreational uses due to exceedances of the fecal coliform bacteria levels. The Jackson County WWTP has had numerous permit violations within the five years, including exceedances in fecal coliform bacteria, BOD, TSS levels and low pH.

Downstream [AU# 2-79-(40.5)] the in the Tuckasegee River a biological sample was taken in 2009 at site GB19 resulting in an Good benthos bioclassification. The most significant event for aquatic biology in the Tuckasegee River watershed was the removal of the low-head dam at Dillsboro in early winter of 2009. Prior to dam removal, Duke Energy pumped out and removed much of the impounded sediment. Dam removal allows fish species to migrate upstream, with the potential for host species for the endangered Appalachian Elktoe Mussel to also migrate upstream. As part of the dam removal, the river bank along the former impoundment has been restored with stone armoring at the toe of the slope affected by water level changes caused by daily discharge related to hydroelectric generation.

Camp Creek [AU# 2-79-49] (C) watershed, including the Beck Branch [AU# 2-79-49-1] (C) watershed, encompasses approximately 4.5 square miles in northwestern Jackson County. The creek is a tributary to the Tuckasegee River. Visible landuses in the watershed include forest, rural residential, infrastructure (secondary roads and US 441), commercial, active pastures, horse pastures, and fallow fields. There is one NPDES permitted discharger to Camp Creek (NC0074250) with no recent permit violations. DWQ received a request to reclassify Camp Creek to trout waters in 2004. In 2005, the fish community was sampled at several sites in the Camp Creek watershed to determine if determine if there were wild, reproducing populations of trout in Camp Creek and Beck Branch. The survey did indicate significant habitat problems in the watershed. The primary habitat problems were unstable, eroding stream banks, and narrow or non-existent riparian vegetation. In this Camp Creek reclassification/use attainability study, it was determined after sampling 4 locations that only the upper 2.3 square mile watershed of the creek met the trout waters regulation criteria. Suitable instream habitats were present at the lower two sites on Camp Creek for trout, but the lack of wide forested riparian zones and nonpoint source runoff may prevent their occupation of those reaches of the creek on a year-round basis. Stream restoration activities would benefit the likelihood of trout recolonizing, inhabiting on a year-round basis, and reproducing in the middle and lower reaches of the creek. (memorandum 20050605).

Conley Creek (Connelly Creek) [2-79-52] (C;Tr) is a small tributary to the Tuckasegee River and drains a small portion of southeastern Swain County. Only the lower portion of the watershed is developed, consisting mostly of residences and a golf course, while majority of the upper watershed is forest. The stream follows a road for much of its length which has reduced or removed the riparian on one side for much of the segment. However, overall habitat was good and the stream banks were stable with little erosion. The Creek was sampled in 2009 resulting in an Excellent benthos bioclassification.

Lower Tuckasegee River Watershed (HUC 0601020304)



This watershed encompasses 92,429 acres and has an estimated 2010 population of 5,630 people. A majority of the watershed (the northern portion) falls within the Great Smoky Mtn National Park.

Deep Creek [2-79-63-(16) & 2-79-63-(21)] (B;Tr) flows through a primarily forested area and has high recreational use draining into the Tuckasegee River. The lower 1.8 miles of the creek are not within the Great Smoky Mtns National Park and the land use turns to agriculture. Sedimentation was noted in this reach of the Creek but not enough to prevent the sample site GB7 from receiving an Excellent benthos bioclassification. The Creek has maintained an Excellent rating for the last 20 years.

However, Deep Creek experienced effluent overflow from a sewer spill in 2010 that was captured on video. The video can be viewed through this youtube link: http://www.youtube.com/user/RogerWATR

Noland Creek [2-90] (C;Tr) lies within the south central portion Great Smoky Mountain National Park and drains into Fontana Lake. It is an undeveloped and forested watershed. The habitat of Noland Creek is exceptional and consists of a series of cascades, riffles, and pools; site GB6 rated Excellent in 2009.

Forney Creek [2-97] (C;Tr,ORW) lies within and drains the south-central portion of Great Smoky Mtns into Fontana Lake. It is an entirely undeveloped and forested watershed. The habitat of this stream is as expected for a stream in a natural setting and consists of a series of riffles, cascades, and pools with excellent riparian zones. The Creek rated Excellent in 2009 at site GB4.

Tuckasegee River [2-(78)a] (C) downstream of Bryson City from Lemmons Creek to Peachtree Creek is Impaired for Recreational uses due to exceedances of fecal coliform bacteria levels. Just upstream is AMS station G8600000 which also detected high levels of fecal coliform bacteria and had several incidences of low pH. Bryson City's WWTP discharges into the Tuckasegee River and over the last five years has had several incidences of permit violations, including fecal coliform bacteria and TSS.

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 Waters

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Cullowhee Creek	2-79-31a 2-79-31b	C;Tr	sediment, nutrients	development	S	S&E, P
Oconoaluftee R	2-79-55-(16.5)	C;Tr	sediment	development	S	S&E, P
Savannah Creek	2-79-36	C;Tr	fecal coliform bacteria, sediment	development, agriculture, failing septic systems	I	S&E, BMPs
Scott Creek	2-79-39	C;Tr	fecal coliform bacteria, sediment	non-point source runoff, failing septic systems, impoundments	I	R, BMPs
Tuckasegee R	2-79-(35.5)a 2-79-(35.5)b 2-79-(38) [2-(78)a	C; Tr C; Tr C C	fecal coliform bacteria	WWTP, non-point source runoff	I	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.)						
Status = I=Impaired, IM= Impacted, S=Supporting, IP= 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= sediment and erosion controls						

Table 1-2: NPDES Permits within the Tuckasegee River Subbasin

NPDES Permits within the Tuckasegee River Subbasin			
Permit #	**Permit Type**	**Outfall location**	**Facility Name**
NPDES Permits within the Upper Tuckasegee River Watershed			
NC0075736	WWTP	Grassy Swamp Cr	Whiteside Estates Inc
WQ0017530	Non-discharge	irrigation	Highlands Cove
WQ0028693	Non-discharge	reuse	Mountaintop Golf & Lake Club
NC0066958	WWTP	Hurricane Cr	Blue Ridge School
NC0059200	WWTP	Hurricane Cr	Trillium Links & Village LLC
NC0038687	WWTP	Trout Cr	Singing Waters Camping Resort
WQ0031427	Non-discharge	irrigation	Legasus of North Carolina LLC
NCG500127	Wastewater	W Fork Tuckasegee R	Thorpe Hydroelectric Station
NCG500126	Wastewater	W Fork Tuckasegee R	Tuckasegee Hydroelectric Station
NCG500125	Wastewater	W Fork Tuckasegee R	Cedar Cliff Hydroelectric Station
NCG500124	Wastewater	W Fork Tuckasegee R	Bear Creek Hydroelectric Plant

NPDES Permits within the Tuckasegee River Subbasin			
Permit #	**Permit Type**	**Outfall location**	**Facility Name**
NCG500123	Wastewater	Tennessee Cr	Tennessee Cr Hydroelectric Station
WQ0029233	Non-discharge	reuse	Bear Lake Reserve
NCG550374	Wastewater	Tilley Cr	Cullowhee Valley Baptist Church
NCG510066	groundwater remediation	Tuckasegee R	Lewis Oil Company
NC0074624	WTP	Tuckasegee R	Western Carolina University
NCG150027	Stormwater	Ditch to Tuck. R	Jackson County Airport
NPDES Permits within the Oconaluftee Watershed			
NCG500129	Wastewater	Oconaluftee R	Bryson Hydroelectric Station
NPDES Permits within the Middle Tuckasegee River Watershed			
NCG210134	Stormwater	Scott Cr	T&S Hardwoods Inc
NCG100168	Stormwater	Scott Cr	Dr Automotive
NCG050383	Stormwater	Scott Cr	Stonewall Packaging, LLC
NCG140158	Stormwater	Scott Cr	Southern Concrete Materials Inc
NCS000295	Stormwater	Scott Cr	Jackson Paper Manufacturing Co.
NC0020214	WWTP	Scott Cr	Sylva WWTP
NC0032808	WWTP	Blanton Br	Morningstar of Jackson
NCG080191	Stormwater	Yellow Bird Br	United Parcel Service Inc
WQ0005207	Non-discharge	Wastewater Recycling	Jackson Paper Manufacturing Co.
NCG551046	Wastewater	Savannah Cr	single family residence
NCG080730 NCG080731	Stormwater	South Fork Blair Cr	Rolling Frito-Lay
WQ0005763	Non-discharge	Biosolids	Tuckasegee Water & Sewer Authority
NC0000264	WWTP	Tuckasegee R	Jackson Co Industrial Park
NC0039578	WWTP	Tuckasegee R	Jackson County WWTP
NCG110111	Stormwater	Tuckasegee R	Tuckasegee Water & Sewer Authority
NCG160031	Stormwater	Tuckasegee R	Dillsboro Asphalt Plant
NCG020247	Stormwater	Tuckasegee R	Dillsboro Quarry
NCG550375	Wastewater	W Fork Dicks Cr	single family residence
NC0074250	WWTP	Camp Creek	Gateway Chevron
NC0084441	WWTP	Connelly Cr	Smoky Mountain Country Club
NPDES Permits within Lower Tuckasegee River Watershed			
NCG530095	Wastewater	Cooper Cr	Cooper Creek Trout Farm
NC0061620	WWTP	Tuckasegee R	Hide Away Campground
NC0026557	WWTP	Tuckasegee R	Town of Bryson City
NCG210098 NCG210095	Stormwater	Tuckasegee R	Powell Industries
WQ0005557	Non-discharge	Wastewater Recycling	Mini Apolis Grand Prix Corp
NCG050249	Stormwater	Cochran Br	Consolidated Metco Inc
NCG140395	Stormwater	Cochran Br	Southern Concrete Materials Inc
NCG210392	Stormwater	ditch to Cochran Br	Zickgraf Hardwood Flooring LLC
NCG160199	Stormwater	ditch to Cochran Br	Hmc Paving & Construction Co Inc

References & Useful Websites

NC Division of Water Quality

Biological Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=de0dbb2d-3417-44c4-9736-1710d2e18d43&groupId=38364

Ambient Report- http://portal.ncdenr.org/c/document_library/get_file?uuid=ac3b7afe-e2f1-4d1e-93df-c2ba9d897888&groupId=38364

Lakes & Reservoir Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=0b586b2a-6851-4783-a4e1-a7f58b2549f4&groupId=38364

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

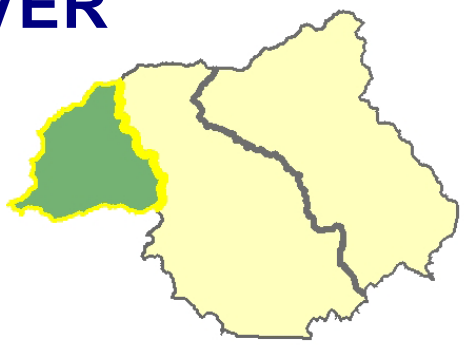
NC Division of Water Resources

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

Watershed Association for the Tuckasegee River (WATR)

http://watrnc.wordpress.com/

Lower Tennessee River Subbasin



HUC 06010204

Includes: Tulula Creek, Snowbird Creek, Santeetlah Creek & Cheoah River

Watershed at a Glance

Counties:
Cherokee, Graham, Swain

Municipalities:
Robbinsville, Santeetlah

EPA Level IV Ecoregions:
High Mtns., Southern Metasedimentary Mtns.

Population:
2000: 7,012
2010: 7,480

Area 274 mi²

2006 Land Cover:
Open Water.....2%
Developed.....3%
Forested.....93%
Agriculture.....2%

Permitted Facilities:
NPDES
Wastewater Discharge.....9
Wastewater Nondischarge....1
Stormwater.....3
Trout Farms.....1

Figure 1-1: NLCD 2006 Land Cover

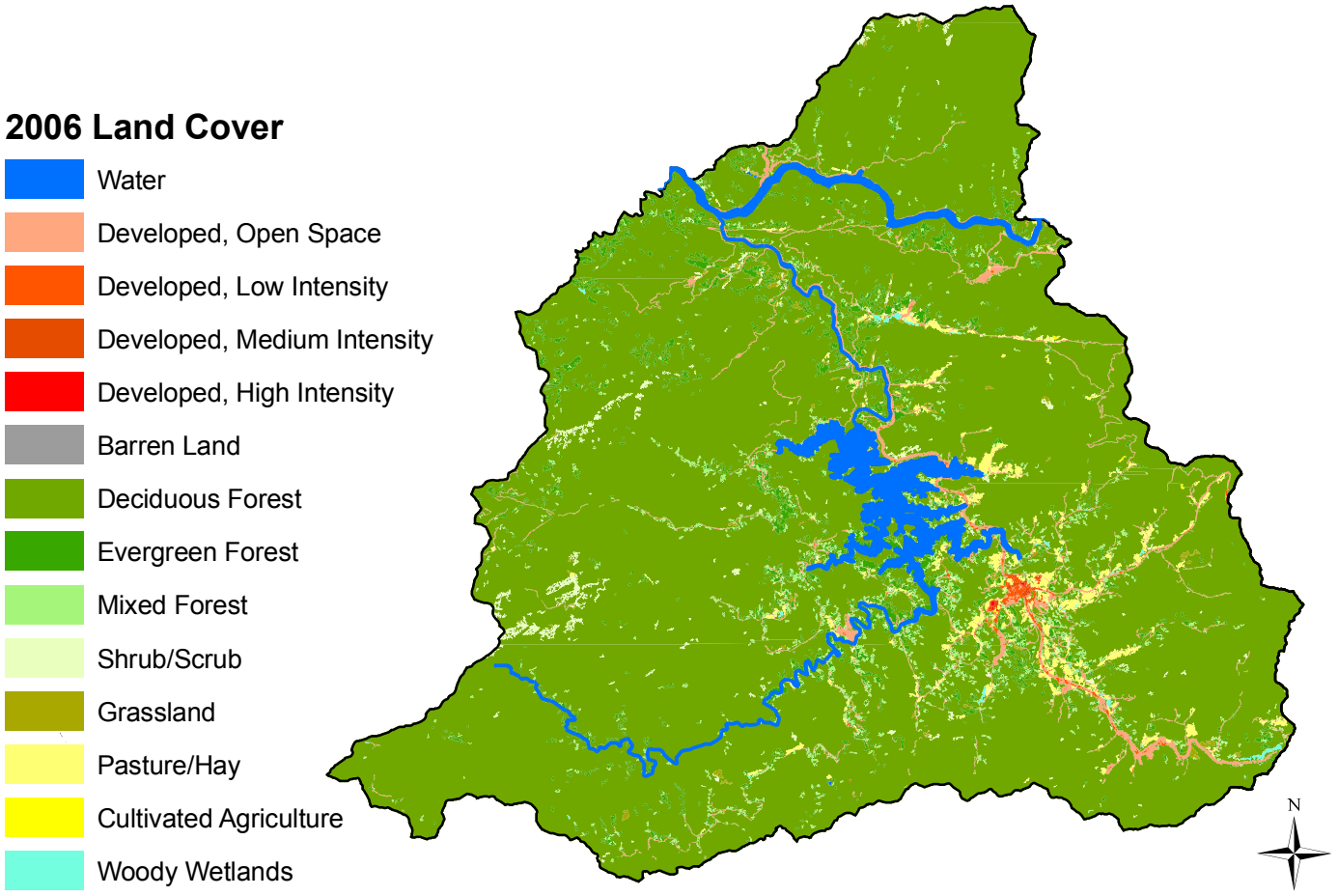
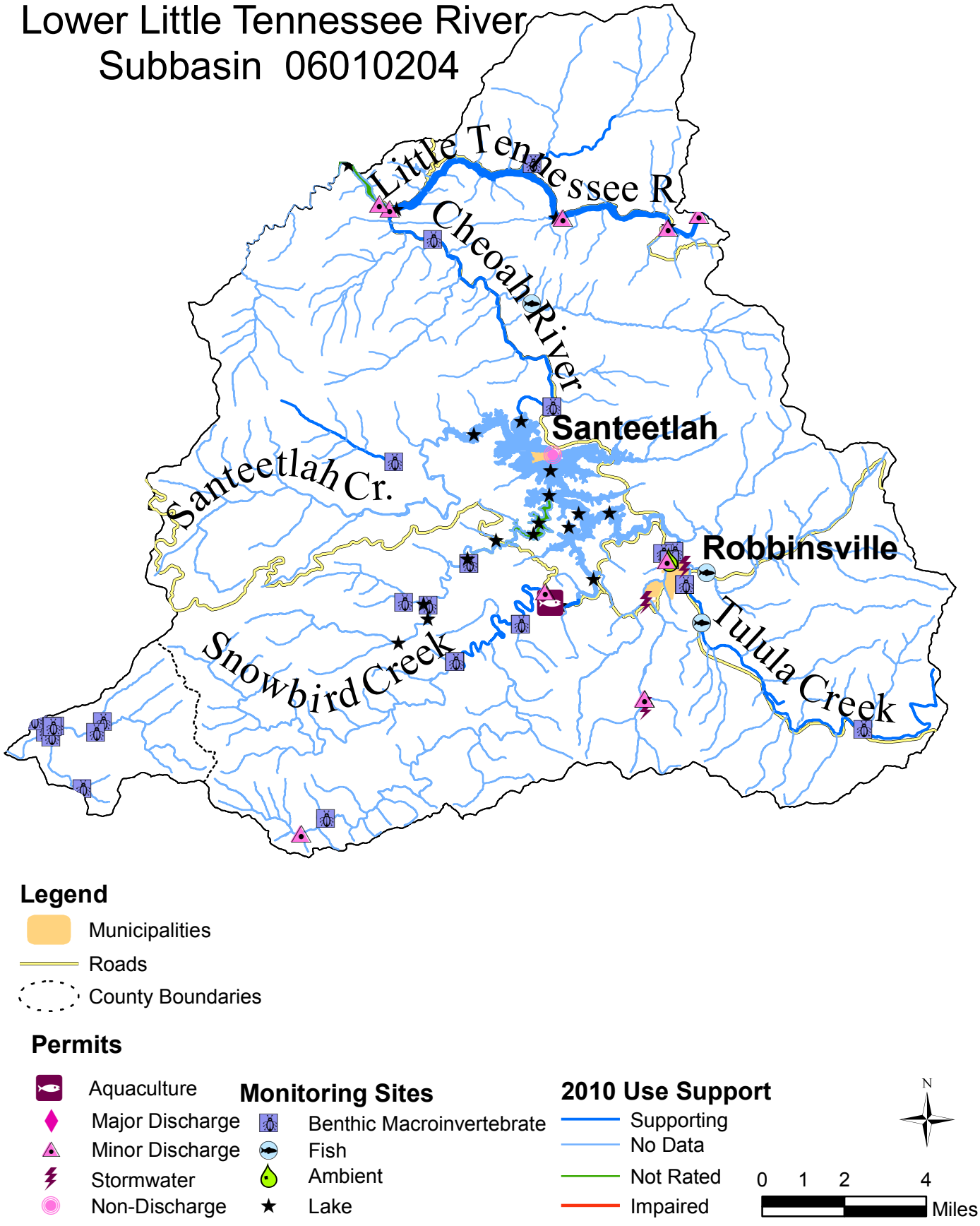


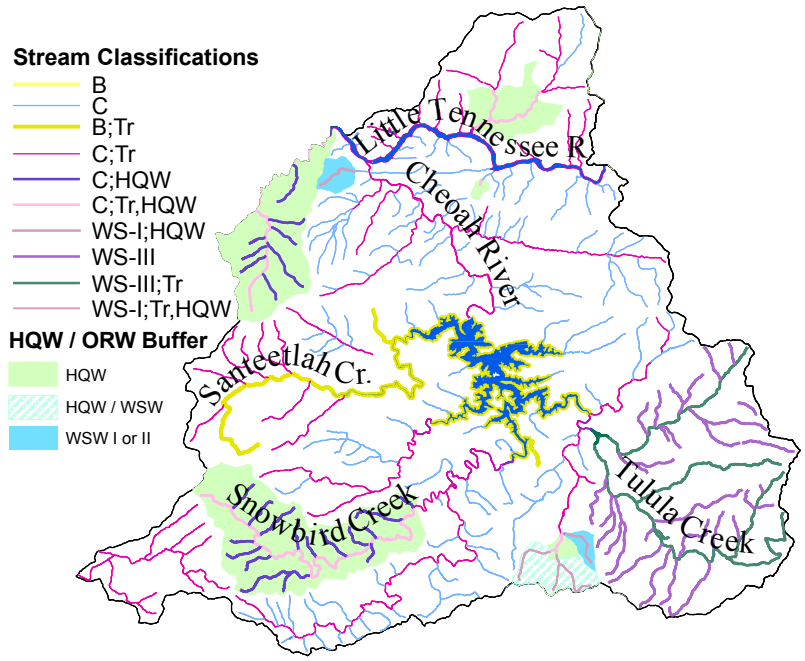
Figure 1-2: Lower Tennessee River Subbasin Map (HUC 06010204)



Water Quality Overview

The Lower Little Tennessee River Subbasin, hydrologic unit 06010204, was represented in previous Basin Plans as Subbasin 04-04-04. This subbasin covers 274 sq. miles and is 93% forested; containing portions of Nantahala National Forest and Joyce Kilmer Wilderness Area. (Figure 1-1). There are approximately 980 reservoir acres and ~420 classified stream miles, not including the numerous unnamed tributaries. Several tributaries flow into Santeetlah Lake, an impoundment on the Cheoah River. The Cheoah River drains into the Little Tennessee River (Cheoah Lake) just before the Tennessee / North Carolina border. A map of the subbasin showing Impaired streams, monitoring and permit locations is shown in Figure 1-2.

Figure 1-3: Stream Classifications

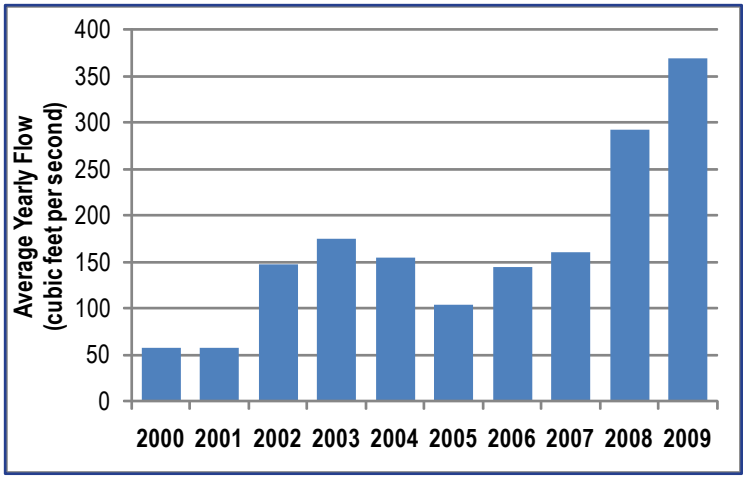


This subbasin contains high quality waters and supports numerous trout streams (Figure 1-3). Water quality issues of concern in this subbasin include agricultural runoff, stream bank erosion, and individual onsite wastewater failures. There are no waterbodies on the 2010 303(d) list of Impaired waters, although the 2012 303(d) will include a portion of the Cheoah River because of high turbidity levels. A fish advisory was issued in 2008 for Lake Santeetlah due to the potential mercury content in walleye. Water quality improvements were made in West Buffalo Creek with the removal of four trout farms that were contributing nutrients to Santeetlah Lake, in the Cheoah River with the improved management of water releases from Santeetlah Dam to support aquatic habitat, and in the Tellico River watershed resulting from the restoration of forest and stream conditions impacted from off-highway vehicle recreation.

Stream flow

Stream flow is monitored at US Geological Survey gaging stations. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). There is one gaging station in this subbasin. Figure 1-4 provides an example of average stream flow over a 10 year period and gives an idea of which years received heavier precipitation. The flow rate in a stream can impact the measurement of physical and chemical parameters. For more information about instream flow see DWR website: http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html.

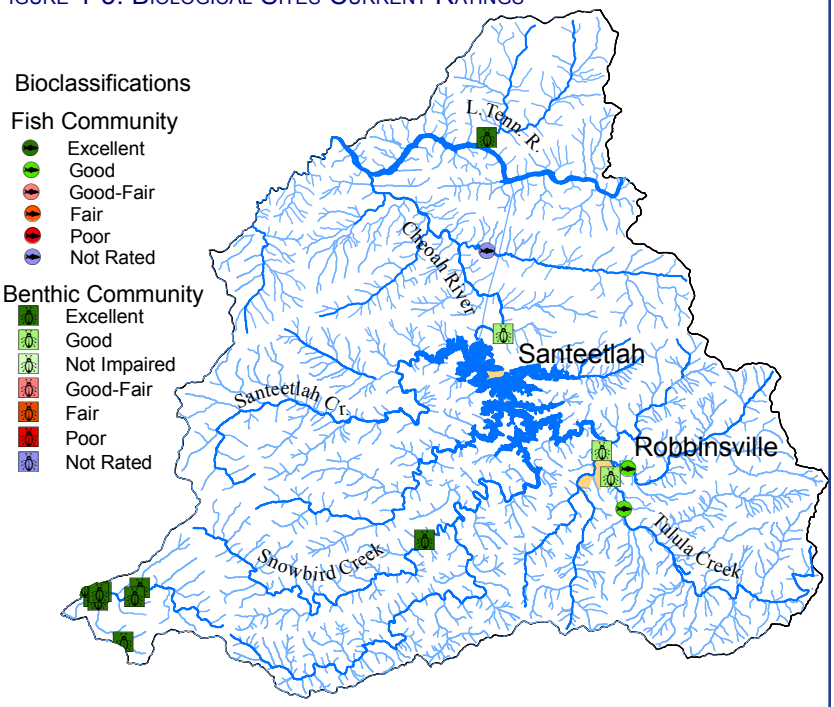
Figure 1-4: Stream flow at USGS 0351706800 Cheoah River near Tapoco
(Yearly Average based on Daily Means)



Stream flow conditions were assessed between 2005-2009 and detected drought conditions in 2006, 2007 and 2008 (see page 16 AMS Report). In particular, droughts can have major effects on parameters such as dissolved oxygen, turbidity, pH, and others by reducing stream flow.

Biological Monitoring

Figure 1-5: Biological Sites Current Ratings



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. Biological samples were collected during the spring and summer months of 2004 and 2009-10 by the DWQ-Environmental Sciences Section as part of the five-year basinwide sampling cycle. Four benthic macroinvertebrate sites and three fish community sites were evaluated in 2009-10. Each basinwide biological station monitored during the current cycle is shown in Figure 1-5 and color coded based on its current rating. As seen on the map, the majority of benthic macroinvertebrate samples taken in this watershed received an Excellent or Good ratings. Two fish community sites rated Good and one resulted in a Not Rated status, due to the absence of criteria for rating high gradient mountain trout waters. There were 10 samples taken at new locations.

Figure 1-6: Benthic Macroinvertebrate Sample Status

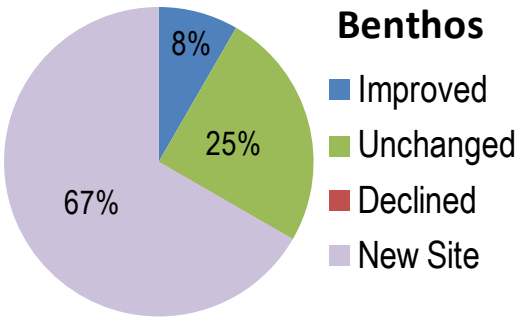
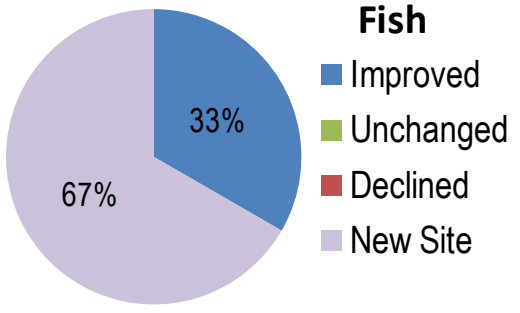


Figure 1-7: Fish Community Sample Status



Benthos

Among the benthic macroinvertebrate sample sites, one site improved, and three retained the same bioclassification in 2009-2010 as observed in 2004 (Figure 1-6). There were an additional eight benthic samples taken to support special studies.

Fish Among the three fish community sites, one improved from 2004 while the other two represent new sample locations (Figure 1-7).

For more information about biological data in this watershed, see the 2010 Little Tennessee River Basinwide Assessment Report. Detailed data sheets for each sampling site can be found in Appendix 1-B.

Long Term Ambient Monitoring

The DWQ's Ambient Monitoring System (AMS) is a network of stream stations strategically located for the collection of physical and chemical water quality data. There is one AMS station (G9550000) in this subbasin; data has been collected from this site since 1973. The following discussion of ambient monitoring parameters includes concentration value graphs for AMS station G9550000 over a 11 year period (2000-2010). Each major parameter is discussed, even if no current impairment exists. The graphs are not intended to provide statistically significant trend information, but rather an idea of how changes in land use or climate conditions can affect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the data set. Box and whisker plots of individual ambient stations were completed by parameter for data between 2005 and 2009 by DWQ's Environmental Sciences Section (ESS) and can be found in the Little Tennessee River Basin Ambient Monitoring Report.

pH

As seen in Figure 1-8, which represents the data window for the 2010 303(d) list, ambient site G9550000 had at least one sample that fell below the pH standard of 6su. Over these 11 years (Figure 1-9) there were three incidences of pH dropping below the minimal standard of 6 su in the samples collected by DWQ. Figure 1-9 shows are decline in pH values with a jump in 2010.

Figure 1-8: Percentage of Samples Exceeding the pH <6 Standard between 2004-2008

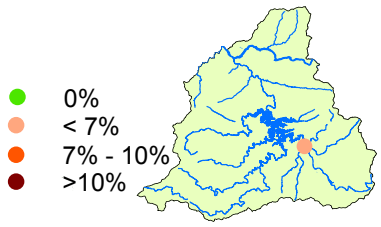
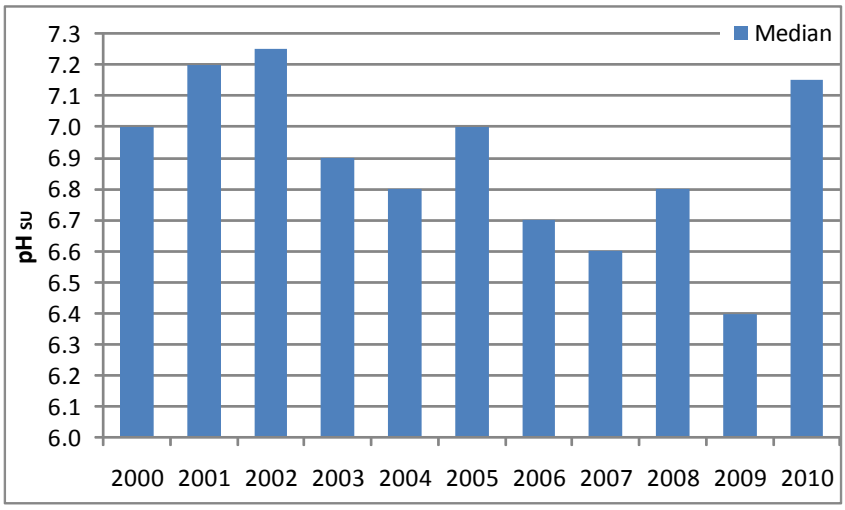


Figure 1-9: Summarized pH data at AMS G9550000 site between 2000-2010.



Dissolved Oxygen

Over the past 11 years (Figure 1-10), no samples were collected with dissolved oxygen levels below 6mg/l standard for trout waters. As seen in Figure 1-11, which represents the data window for the 2010 303(d) list, AMS station G9550000 did not have any exceedances of its DO standards.

Figure 1-11: Percentage of Samples Exceeding the DO <6 Standard between 2004-2008

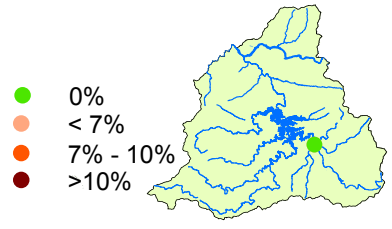
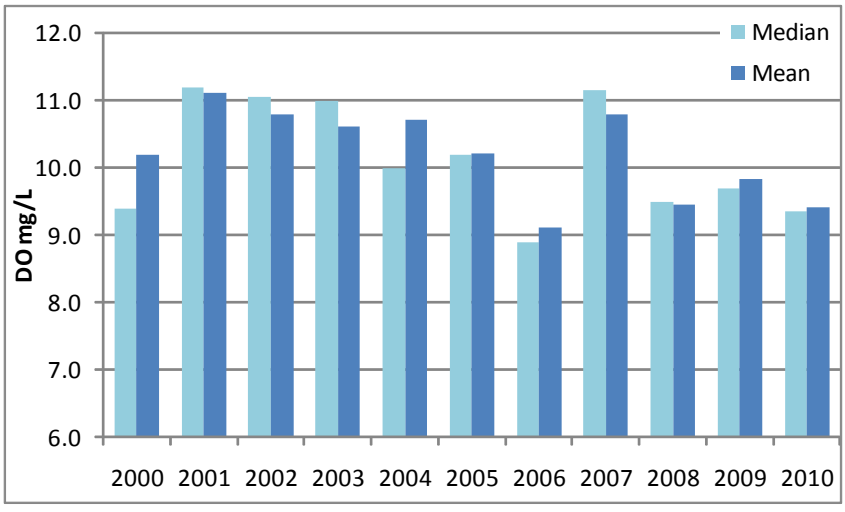


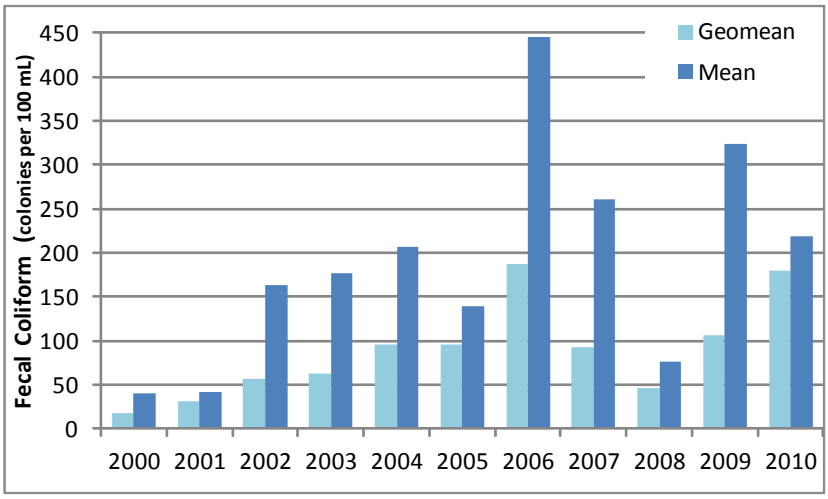
Figure 1-10: Summarized DO data at AMS G9550000 site between 2000-2010.



Fecal Coliform Bacteria

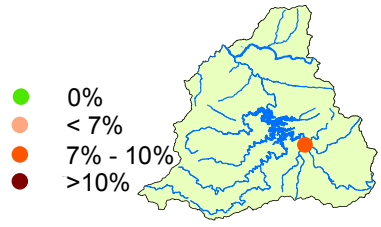
Fecal coliform bacteria occurs in water as a result of the overflow of domestic sewage and from other nonpoint sources of human and animal waste, including pets, wildlife and farm animals. The fecal coliform bacteria standard for freshwater streams is not to exceed the geometric mean of 200 colonies/100 ml or 400 colonies/100 ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are to be used to indicate whether a stream is Impaired or Supporting. Waters with a use classification of B (primary recreational waters) receive priority for 5-in-30 studies. Other waters are studied as resources permit.

Figure 1-12: Summarized Fecal Coliform Bacteria data at AMS G9550000 site between 2000-2010.



There were several incidences of high bacteria counts as indicated by several peaks in mean values, shown in Figure 1-12. Over 11 years there were 10 samples with bacteria colony counts over 400/100ml. As seen in Figure 1-13, which represents the data window for the 2010 303(d) list, ambient station G9550000 did have samples that recorded high bacteria levels.

Figure 1-13: Percentage of Samples Exceeding the Fecal Coliform Bacteria >400 Standard between 2004-2008



Turbidity

Over 11 years (Figure 1-14) there were seven samples with that exceeded the 10 NTU standard for water classified for trout protection. As seen in Figure 1-15, which represents the data window for the 2010 303(d) list, ambient site G9550000 had at least one sample that was >10NTUs, but did not exceed the standard in 10% or more of the samples.

Figure 1-15: Percentage of Samples Exceeding the >10 Turbidity Standard between 2004-2008

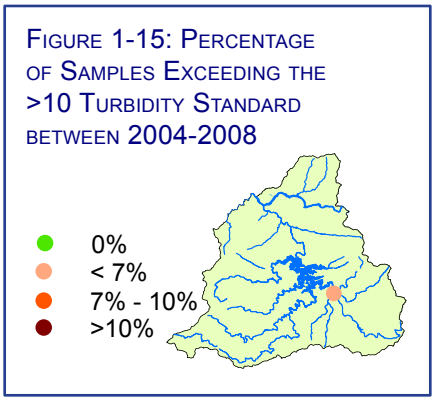
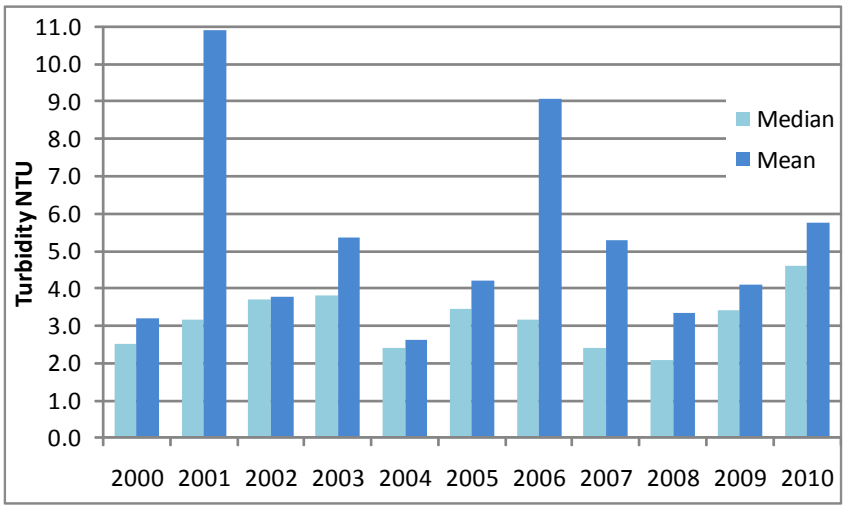


Figure 1-14: Summarized Turbidity data at AMS G9550000 site between 2000-2010.

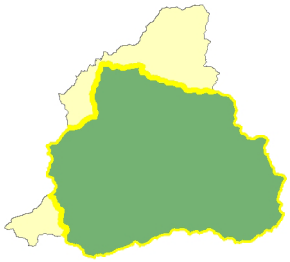


Protection and Restoration Opportunities

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.

Cheoah River Watershed (HUC 0601020401)



This watershed encompasses 137,710 acres and has an estimated 2010 population of 7,332 people. There are six subwatersheds that drain into Santeetlah Lake, which then flows into Cheoah River and eventually the Little Tennessee River.

NPDES Permits within the Cheoah River Watershed

Permit #	Permit Type	Outfall location	Facility Name
NC0083071	WTP	Rock Cr	Town of Robbinsville WTP
NC0025879	WWTP	Long Cr	Town of Robbinsville
NCG180053	Stormwater	Long Cr	Stanley Furniture Comp.
NCG200437	Stormwater	Atoah Cr	Graham Co. Recycling Facility
NC0079090	Wastewater	Snowbird Cr	Coldwater Farms, Inc.
NCG530076	Wastewater	Little Snowbird Cr	Hemac Inc- Fish Farm
NCG140260	Stormwater	Chedah R	Southern Concrete Materials
WQ0031396	Non-discharge	reuse	Santeetlah Lakeside

Tulula Creek [AU# 2-190-2-(0.5)] (WS-III; Tr) subwatershed drains ~18,300 acres within the southeastern corner of Graham County. The whole watershed is classified as a WS-III and the headwaters drain Nantahala National Forest. For much of its length, US 129 and a railroad parallel the creek as it courses down the valley before flowing through the urban areas in and around Robbinsville. Land use in the headwater portions are generally forested, but the mainstem valley is mostly agriculture and residential. Tulula Creek was sampled in 2009 and received a Good benthos (GB22) and fish (GF29) ratings. Biologists noted bluegreen algal mats with the possibility of upstream straight-piping or nonpoint-source erosion contributions of nutrients, but also noting the stream supports its supplemental designation as trout waters.

Sweetwater Creek [AU# 2-190-3-(0.5)] (WS-III; Tr) drains ~9,000 acres. The entire subwatershed is classified as WS-III with headwater portions in Nantahala National Forest and much of the rest of the drainage is used for hay production. Sweetwater Creek was sampled (GF36) by DWQ fish biologists for the first time in 2009 resulting in a Good Bioclassification rating. Water quality conditions support its supplemental designation as trout waters. The Graham County Soil and Water Conservation District is aware of streambank stability problems and has assisted landowners along the creek with planning and installing BMPs. The District plans to continue to devote conservation resources to this watershed but will require landowner participation.

Snowbird Creek [AU#s 2-190-9-(0.5) & 2-190-9-(15.5)] (C;Tr) subwatershed is ~29,950 acres. Snowbird and Little Snowbird Creeks are supplementally classified as trout waters, with the upper portion of Snowbird Creek, within the boundary of Nantahala National Forest, also being classified as HQW. The 2009 benthos sample (GB25) in Snowbird Creek resulted in an Excellent Bioclassification. There is one permitted (NC0079090) trout farm with a discharge into Snowbird Creek.

West Buffalo Creek [AU# 2-190-12a] (C;Tr) drains ~10,625 acres. The creek is classified as trout waters and as it flows into Santeetlah Lake it becomes classified for primary recreation also. The last benthic samples taken in this subwatershed were during the 1990's and all resulted in Excellent Bioclassifications.

West Buffalo Creek Arm of Santeetlah Lake [AU# 2-190-12b] (B;Tr) is Not Rated due to inconclusive temperature and DO data. However, it was on the 303(d) list (289 acres) of impaired waters due to nutrient enrichment (chlorophyll *a*) based on special studies conducted by the DWQ in 1993 and 1999. Nutrient concentrations were especially high immediately downstream of trout farms on West Buffalo Creek. The Clean Water Management Trust Fund awarded $1.25 million dollars to support the buyout of the four trout farms on the West Buffalo Creek arm responsible for the largest contributions of nutrients to the creek. The four farms were fully decommissioned by the end of March 2004.

During the spring, summer, and fall of 2005, the Division of Water Quality conducted a special study of West Buffalo Creek and the West Buffalo Creek arm of Santeetlah Lake. This study was conducted to document changes or improvements to the water quality of Buffalo Creek following the de-population and dismantling of the trout farms. The study examined both physical, chemical and biological water quality parameters on West Buffalo Creek and Santeetlah Lake to determine the degree of nutrient reduction obtained from the trout farm removal. Results from that study indicate that the nutrient reduction strategy was effective. Nutrient loading into the West Buffalo Creek arm of the lake was reduced up to 92 percent and algal blooms were diminished.

Santeetlah Creek [AU# 2-190-19] (B;Tr) drains ~20,900 acres, all of which is in Nantahala National Forest. Three Significant Natural Heritage Areas are also located in this subwatershed including: Stratton Meadows, Santeetlah Bluffs and Joyce Kilmer Wilderness Area.

Santeetlah Lake subwatershed drains ~22,450 acres. Within the subwatershed, Long Creek [AU# 2-190-4-(5)] drains from tributaries classified as WS-I, Tr, HQW and flows into the Cheoah River. Downstream of Robbinsville, DWQ, in 2009, collected a benthos sample in the Cheoah River [AU# 2-190-(3.5)] (C;Tr) at site GB133 resulting in a Good Bioclassification. Turbidity data collected at AMS G9550000 through 2010 show exceedances in turbidity levels causing the Cheoah River from the Town of Robbinsville's proposed water supply intake to Mountain Creek [AU# 2-190-(3.5)] to be Impaired on the 2012 303(d) list.

The Robbinsville WWTP (NC0025879) discharges into Long Creek and is old and outdated, has limited capacity and for years has failed to meet compliance criteria. Robbinsville proposed a relocation of the existing WWTP to a larger 12-acre site on the Cheoah River, approximately 0.2 mile downstream of the present location on Long Creek. DWQ conducted a water quality study of the Cheoah River Arm of Santeetlah Lake to assess current water quality conditions near the site of the proposed relocation and expansion of the Robbinsville WWTP and outfall. DWQ field staff sampled sites located upstream and downstream of the current Robbinsville WWTP outfall on Long Creek, upstream of the confluence of Long Creek and the Cheoah River, at the vicinity of the proposed new outfall on the Cheoah River and upstream of US Hwy 129 on the Cheoah River. Study results indicated that the current discharge does affect nutrient concentrations in Long Creek, but its effect appears to be negligible downstream in the Cheoah River and in the lake (Memorandum 20100105). In 2011, the Town of Robbinsville received ~$4.6 million grant to build a new WWTP facility that will relocate the discharge from Long Creek into the Cheoah River.

Santeetlah Lake [AU# 2-190-(5)] (B;Tr) is owned by the Aluminum Company of America (ALCOA) and is used to generate hydroelectric power as well as for recreational purposes. Santeetlah Lake is classified for the protection of primary recreation and propagation of trout (B; Tr). Santeetlah Lake is a deep lake with a maximum depth of 213 feet and a mean depth of 56 feet with an average retention time of 161 days. Santeetlah Lake continues to demonstrate low biological productivity (oligotrophic).

In September 2008, a fish consumption advisory was announced for Santeetlah Lake due to high levels of mercury found in walleye fish. Santeetlah Lake is also under the statewide consumption advisory for largemouth bass – also associated with elevated levels of mercury found in this fish.

In August, 2008, the Asheville Regional Office reported an algal bloom in the Cheoah River arm of Santeetlah Lake downstream of the US Hwy 129 bridge. An analysis of a phytoplankton sample from the bloom indicated that the dominant algae were filamentous blue greens *Anabaena plantonica*, *Anabaena spirodes* and/or *Anabaena circinalis*. Filamentous blue-green algae form significant blooms that discolor the water and produce taste and odor problems in drinking water. In 2009, no surface blooms of *Anabaena* sp. were observed in the Cheoah River by DWQ staff.

Santeetlah Dam is located on the Cheoah River [AU# 2-190-(22)a] (C;Tr) in Graham County. The Santeetlah Development was completed in 1928, and consists of a dam, pipeline/tunnel, and powerhouse. Santeetlah Dam creates Santeetlah Reservoir, which has a normal full pool area of approximately 2,881 acres and a drainage area of 176 square miles. The normal full pool elevation of Santeetlah Reservoir is 1,940.9 feet (USGS).

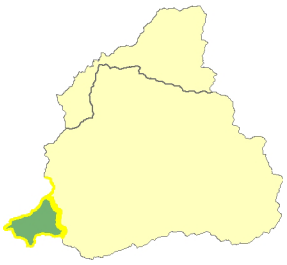
The Santeetlah powerhouse is located on the left bank of the Little Tennessee River (Cheoah Reservoir) about five miles upstream of Cheoah Dam. Water is withdrawn from Santeetlah Reservoir through an intake in the Santeetlah Dam and is passed through a 5-mile tunnel and pipeline to the powerhouse located on the Little Tennessee River.

The Santeetlah Development is operated as a storage impoundment in accordance with an annual operating curve, which establishes target seasonal reservoir levels. The current operating curve was adopted in 2004 as part of the Tapoco Project Relicensing Settlement Agreement. Under the current operating guide, Santeetlah Reservoir is operated to maintain high recreational elevations during the summer months, followed by fall drawdown to allow for collection of rainfall and runoff during the late fall, winter, and early spring. The current operating curve was developed to also provide protection and enhancement for a variety of other resources and uses, including aquatic species and habitat, water quality, reservoir wetlands, archaeological sites, and scenic appearance throughout the year. During the period April 1 to November 1, the maximum drawdown at Santeetlah Reservoir is 4-5 feet. The reservoir is filled during the month of March at such a rate that by April 1 the maximum drawdown is 5 feet. During the period December 1 to March 1, the maximum drawdown is 10 feet. During the month of November, the reservoir is drawn down at such a rate that by December 1 the maximum drawdown is 10 feet. Prior to the Relicensing Settlement Agreement, there were no regular flow releases from Santeetlah Dam into the Cheoah River. Water from Santeetlah Reservoir was diverted to the powerhouse located on the Little Tennessee River upstream of Cheoah Dam. The drainage area for the Cheoah River below Santeetlah Dam was made up of leakage from the dam, tributary inflow and occasional spills from the dam. The lack of flow severely impacted the benthic community (GB15) in this reach and resulted in Impairment in the aquatic life category from Santeetlah Dam to Rock Creek (3.4 miles). Beginning September 1, 2005 as part of the Relicensing Settlement Agreement, Tapoco began releasing minimum flows designed to enhance and protect the biologic community in the Cheoah River below the dam. The benthic community at site GB15 was resampled in 2008 resulting in a Good Bioclassification and the river is no longer Impaired.

As an additional enhancement, Tapoco established a fund intended to improve resource management in the river. The fund provides monetary support to the North Carolina Wildlife Resources Commission, North Carolina Department of Environment and Natural Resources, US Forest Service, Eastern Band of Cherokee Indians, and U. S. Fish and Wildlife Service. These agencies may use the fund to monitor biology and habitat in the river, add large woody debris (habitat), manage gravel and vegetation (bank stabilization), and other natural resource stewardship activities including threatened and endangered species recovery efforts, exotic species control, and environmental outreach and education directly related to segments of the Cheoah River and Little Tennessee River affected by dam operation. The complete consensus agreement can be found in the Tapoco (FERC #2169), Final License Application filed with FERC. These and other associated documents can be obtained at: http://www.ferc.gov.

Yellow Creek [AU# 2-190-29] (C;Tr) was sampled for the first time in 2009 at site GF37 and was given a Not Rated status. No reproducing populations of trout were detected in this trout classified stream, however there was no evidence of water quality impairments.

Tellico River Watershed (HUC 0601020403)



This watershed encompasses 20,771 acres and has an estimated 2010 population of 12 people. Land use in this general area is composed of large tracts of relatively undisturbed forest associated with the Nantahala National Forest. Streams here are high gradient with heterogeneous rocky substrates and well-developed riffle-pool sequences.

The US Forest Service (USFS) manages a large Off-Highway Vehicle (OHV) recreation area located within the upper Tellico River watershed in northern Cherokee County. According to the USFS, the use of the OHV area has resulted in water quality issues to nearby waterbodies. In an effort to determine possible impacts from the OHV system DWQ sampled 12 streams for benthic macroinvertebrates in 2009. The data generated from these collections suggest adverse impacts to many of the streams in the OHV despite the Excellent bioclassification ratings. The smallest of the streams sampled for this study showed the most noteworthy impacts to the benthic communities relative to reference sites. Adverse sediment-mediated effects on the benthos communities in Jenks Branch, and the two lower reaches of Tipton Creek were noted. The specifics of this study are available in requesting BAU memorandum 20090817, from DWQ.

Tellico River [AU# 2-195] (C;Tr) samples at sites GB181, GB183 & GB182 resulted in Excellent benthos bioclassifications

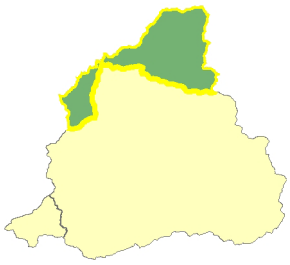
Peckerwood Creek [AU# 2-195-4] (C;Tr) sample at site GB180 resulted in an Excellent benthos bioclassification

Tipton Creek [AU# 2-195-5] (C;Tr) samples at sites GB177, GB178 & GB179 resulted in Excellent benthos bioclassifications

Jenks Branch [AU# 2-195-5-2] (C;Tr) sample at site GB185 resulted in an Excellent benthos bioclassification

In October 2009, the USFS closed the Upper Tellico OHV trail system due to sediment loading to the Tellico River and its tributaries. Many of the trails were located adjacent to streams, on steep slopes and were highly eroding. The USFS was violating its own standards of preventing visible sediment from reaching perennial and intermittent stream channels and state water quality turbidity standards of 10 NTUs. Field surveys sited 1,889 sources of visible sediment along the 34 miles of trails, which was negatively impacting brook trout habitat. In 2010, the USFS Tusquitee Ranger District obliterated ~26 miles of degraded trails and completed restoration activities to allow natural forest regeneration to occur. DWQ surveyed the area in 2011 and noted that water quality issues have been resolved and stream banks are stable.

Upper Tellico Lake Watershed (HUC 0601020404)



This watershed encompasses 65,629 acres and has an estimated 2010 population of 72 people.

NPDES Permits within the Upper Tellico Lake Watershed

Permit #	Permit Type	Outfall location	Facility Name
NC0027341	Wastewater	Little Tenn. R	TVA Fontana Hydro Plant
NCG500050	Wastewater	Little Tenn. R	Alcoa Santeelah Powerhouse
NCG500049	Wastewater	Little Tenn. R	Alcoa Cheoah Powerhouse
NC0023086	WWTP	Little Tenn. R	Fontana Village Resort
NC0023281	WWTP	Little Tenn. R	Tapoco Lodge Inc.

Little Tennessee River (Cheoah Lake/Calderwood Lake) [AU# 2-(167)a] (C;Tr) is a narrow, deep impoundment of the Little Tennessee River on the North Carolina/Tennessee border. Inflow to this Lake is dominated by the hypolimnetic discharge from Fontana Lake, located directly upstream. The upstream portion of the Lake flows swiftly in response to this discharge and temperatures in the Lake are generally low. The Lake was monitored by DWQ field staff monthly from June through August 2009. Surface water temperatures were cool in this Lake, ranging from 7.8 C to 21.1 C. Surface dissolved oxygen ranged from 8.4 mg/L to 9.9 mg/L and were elevated to the low water temperatures which allowed more oxygen to dissolve into the water. Surface pH values ranged from 6.6 s.u to 7.5 s.u. Secchi depths, which ranged from 1.8 meters on an overcast day following a rain event to 7.6 meters, indicated that the water clarity was very good. Lake Cheoah continues to have very low biological productivity (oligotrophic) since 1988.

Twentymile Creek [AU# 2-178-(4)] (C;Tr,HQW) was sampled in 2010 at site GB2 resulting in an Excellent benthos bioclassification. Twenty Mile Creek lies within and drains North Carolina's western portion of Great Smoky Mountain National Park (GSMNP) and ultimately joins the Little Tennessee River (Cheoah Lake) downstream of Fontana Dam. It has an undeveloped (hiking trails aside) and forested catchment. The habitat of this picturesque stream is as expected for a stream in a natural setting and consists of a series of cascades, riffles, and plunge pools. Typical of undisturbed mountain streams, the specific conductance was very low.

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.

Stream Name	AU#	Class.	Stressor	Source	Status	Actions Needed
Little Tenn. River (Cheoah Lake)	2-(167)b	C;Tr	turbidity	unknown	IM	P, BMPs
Tulula Creek	2-190-2-(0.5)	WS-III; Tr	nutrients	non-point source runoff, straight pipes	S	P, BMPs
West Buffalo Creek Arm of Santeetlah Lake	2-190-12b	B;Tr	temperature, DO, nutrients	trout farms	IP	P
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.)						
Status = I=Impaired, IM= Impacted, S=Supporting, IP= 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= sediment and erosion controls						

References & Useful Websites

Federal Energy Regulatory Commission (FERC)
http://www.ferc.gov/industries/hydropower.asp

NC Department Health and Human Services
Fish Advisory- http://epi.publichealth.nc.gov/fish/current.html

NC Division of Water Quality
Biological Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=de0dbb2d-3417-44c4-9736-1710d2e18d43&groupId=38364
Ambient Report- http://portal.ncdenr.org/c/document_library/get_file?uuid=ac3b7afe-e2f1-4d1e-93df-c2ba9d897888&groupId=38364
Lakes & Reservoir Assessment- http://portal.ncdenr.org/c/document_library/get_file?uuid=0b586b2a-6851-4783-a4e1-a7f58b2549f4&groupId=38364
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

NC Division of Water Resources
Flow- http://www.ncwater.org/Permits_and_Registration/Instream_Flow/

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.

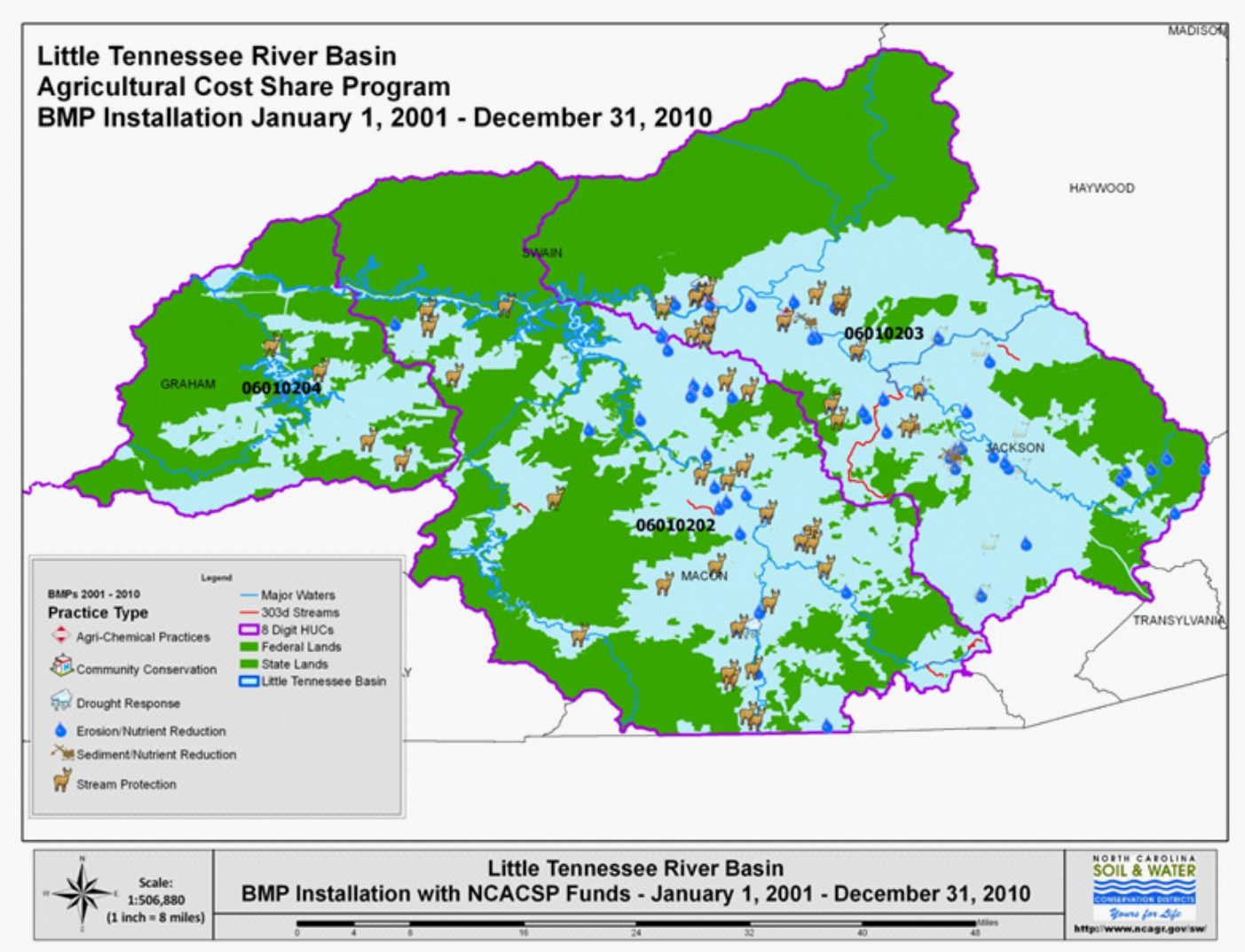
• Proper Animal Waste Management - A waste management system is a planned system in which all necessary components are installed for managed liquid and solid waste to prevent or minimize degradation of soil and water resources. Practices include: animal waste lagoon closures, constructed wetlands, controlled 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, 598 individual BMPs were installed that affected over 6,400 acres. The majority of these practices are categorized as “Stream Protection” measures. Stream Protection practices accounted for nearly 48% of the affected area. Nitrogen and phosphorus reductions were achieved primarily by Erosion/Nutrient Reduction practices. however, over 83% of the soil savings was achieved through Streamside Protection practices.

BMPs installed by the NC Agricultural Cost Share Program for the period January 1, 2001 through December 31, 2010 are shown in the map below:



Aquaculture

There are 4 permitted trout farms in the Little Tennessee River Basin, including the largest commercial trout hatchery in the eastern United States. This number excludes farms not meeting permit coverage requirements related to annual fish production and feed usage. Cold-water fish farms are required to obtain an NPDES general fish farm permit if they harvest over 20,000 pounds of fish per year, feed more than 5,000 pounds per month, and discharge more than 30 days per year. (See NPDES General Permit NCG530000 for more information.) Macroinvertebrate and chemical sampling data collected in streams utilized by farms indicate negative impacts to water quality standards. Additional data need to be collected and analyzed.

In an effort to support the industry in the region and improve and protect water quality, a collaborative approach has been undertaken which includes trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The collaborative work outcomes should be a better understanding of farm operations, BPMs, water resource/quality protection and regulatory needs for all parties. The NCG530000 permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by DWQ and stakeholders during the renewal period.

During this process, DWQ encourages trout farms to contact their local extension service and/or research institutions to use management measures such as those recommended/developed by DWQ in Collaborative Assessment for Watershed and Streams (CAWS) Project (funded by an EPA 104(b)(3) grant):
- Use hand feeding as much as possible to reduce the amount of food that enters the raceways and stream;
- Use high quality feed, which results in less manure production;
- Clean raceways regularly and land apply the manure as fertilizer; and
- Consider reducing the amount of fish being raised if the assimilative capacity has been exceeded.

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 Little Tennessee River Basin TLWs occurred in 2008. Nineteen 14-digit HUs (of 63 total in the basin) have been selected as TLWs by EEP in the Little Tennessee River basin:

Upper Little Tennessee Subbasin (06010202):

- Upper Little Tennessee River/ Middle Creek (06010202020010);
- Coweeta/ Tessentee Creek (06010202020020);
- Cartoogechaye Creek (06010202020030)
- Upper Cullasaja River (06010202030010)
- Lower Cullasaja River (06010202030020)
- Rabbitt/Watauga Creek (06010202040010)
- Iotla/Crawford/upper Burningtown Creek (06010202040020)
- Cowee Creek (06010202040030)
- Tellico/Lower Burningtown Creek (06010202040040)
- Brush/Rattlesnake Creek (06010202060010)

Tuckaseegee River Subbasin (06010203):

- Caney Fork (06010203010060)
- Cullowhee Creek (06010203010070)
- Lower Scott Creek (06010203020010)
- Upper Scott Creek (06010203020020)
- Savannah Creek: 06010203020030
- Soco Creek: 06010203030080

Lower Little Tennessee Subbasin (06010204):

- Tulula Creek (06010204010010),
- Sweetwater Creek (06010204010020)
- Long/Atoah Creek (06010204010030)

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

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, Franklin to Fontana. This plan is summarized in the Upper Little Tennessee Subbasin section.

EEP Projects

In the Upper Little Tennessee River Subbasin, there is one restoration project in the Franklin to Fontana Local Watershed planning area. The Cat Creek project restored almost 9,000 ft of stream channel and riparian area and 8 acres of riparian wetland through old and current cattle pasture and an old golf course. In addition, EEP contributed funds to protect the 4,500 acre Needmore Tract, which includes riparian wetland, field, and forest along the Little Tennessee River and numerous high quality tributaries.

There is one EEP restoration project in the Tuckaseegee River Subbasin. The Junes Branch project will be constructed in 2012 and will restore the stream channel and riparian area on a 3,000 ft reach on the outskirts of Sylva.

There are three EEP restoration projects that have been constructed in the Lower Little Tennessee River Subbasin. The East Buffalo Creek project restores about 3,000 ft of stream channel and riparian area and preserves almost 9,000 ft of additional headwater forested stream channel. The Snowbird Tributaries project restores only about 600 ft of stream channel and riparian area but preserves 7,500 ft of additional forested stream channel along tributaries to lower Snowbird Creek. The Tulula Bog project is a large project in a Significant Natural Heritage Area, and it restored almost 9,000 ft of stream channel, preserved about 5,000 additional stream feet, restored 81 acres of riparian wetland, and protected 141 additional wetland acres.

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 Little Tennessee Watershed Association was granted an award in 2010 for watershed restoration planning in the Upper Cullasaja Watershed. The project involves review of past data and collection of new baseline data to be analyzed and combined into an approved nine element watershed restoration plan.

WaDE

In the Little Tennessee 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.

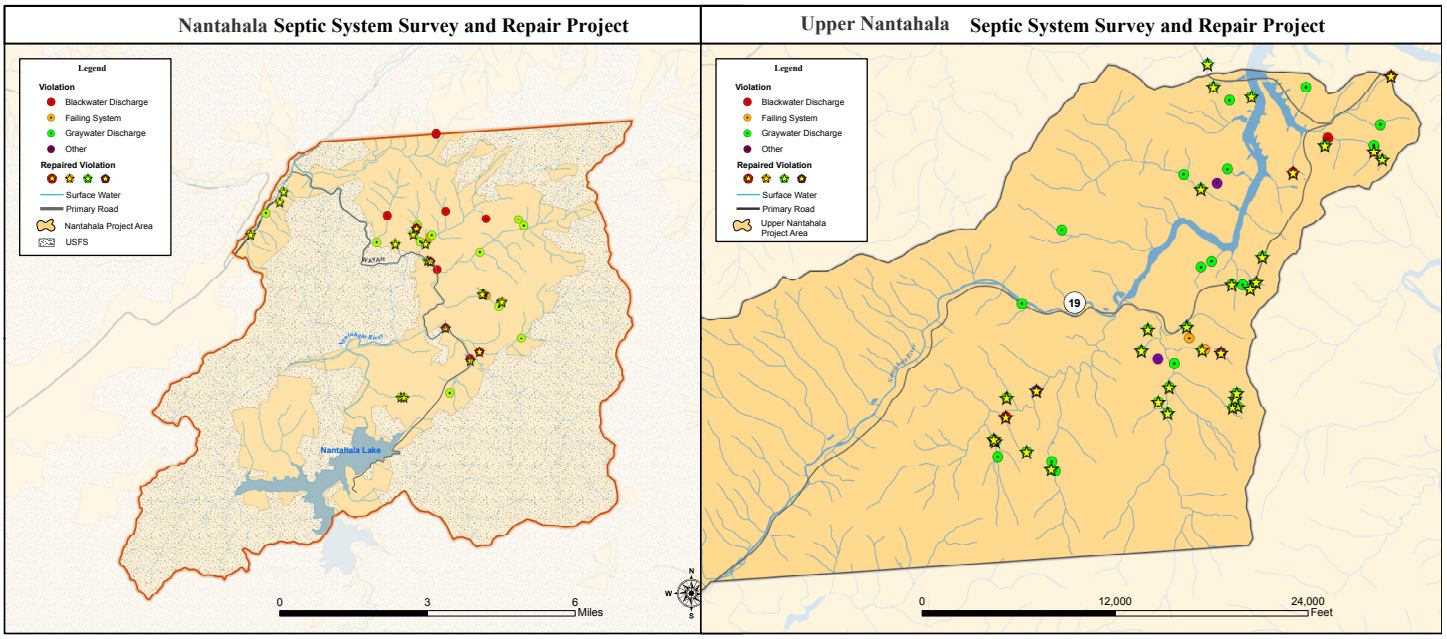
The discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemical nutrients, disease pathogens and endocrine disrupting chemicals. Special study requests in the Little Tennessee 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 58 stream miles (11 streams) and 171 acres of Fontana Lake 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.

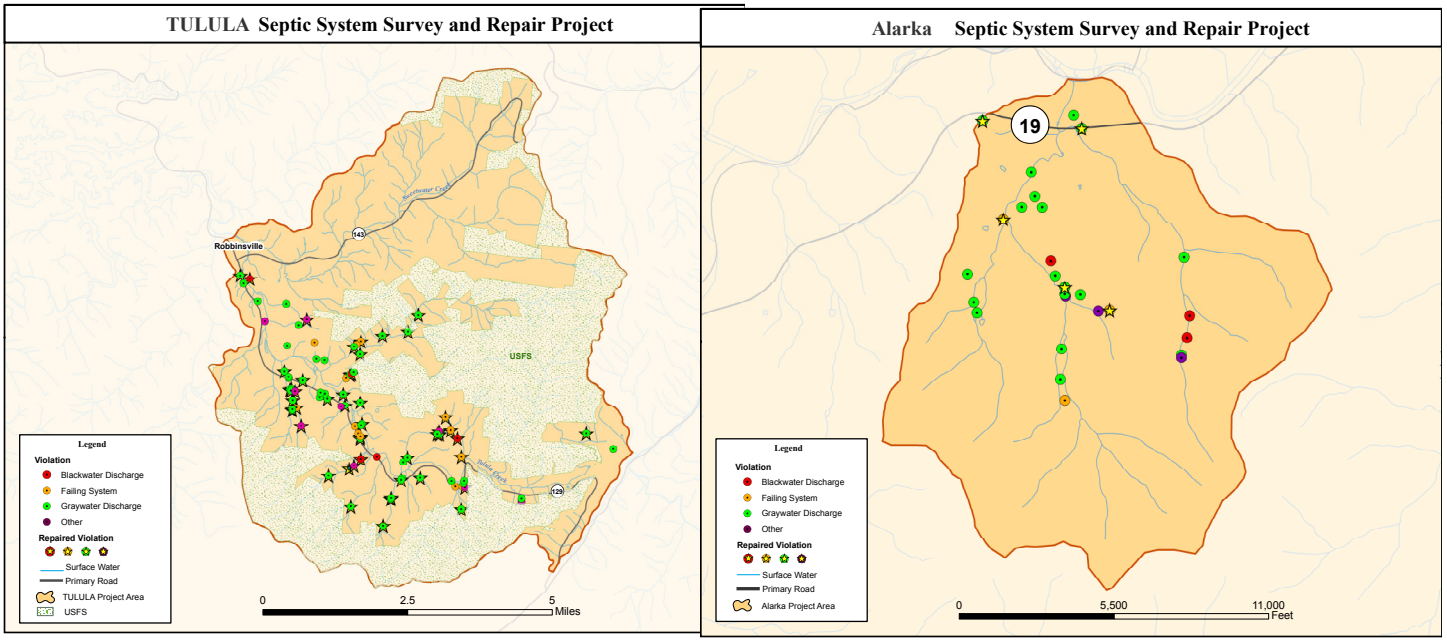
The NC Wastewater Discharge Elimination (WaDE) Program was actively helping to identify and remove straight pipes (and failing septic systems) in the western portion of North Carolina. This program used door-to-door surveys to locate straight pipes and failing septic systems, and offered deferred loans 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.

As of 2009, WaDE surveys in the Little Tennessee Basin resulted in 215 wastewater violations.

County	Project Area	Septic Survey Completed	Violations	Repairs
Macon	Nanatahala	447	44	18
Swain	Upper Nantahala	266	53	32
Swain	Alarka	104	28	6
Graham	Tulula	435	90	55

The following maps show areas surveyed by the WaDE program.





Forestry

Forestry in the Little Tennessee River Basin: 2012 Update

Forestland Ownership*

Approximately 56% of the forestland in the basin is privately-owned, with the remainder being publically-owned land, primarily the Nantahala National Forest and Great Smoky Mountains National Park.

* 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.Other Water Quality Regulations

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 Little Tennessee basin we surveyed 6 sites, evaluated 275 individual BMPs, and observed a BMP implementation rate of 72 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 an estimated 649 acres of land were established or regenerated with forest trees across the basin. During this same time period, approximately 607 acres had a final harvest conducted and 3,393 acres had an intermediate harvest conducted. In addition, 593 individual forestry-related management plans were produced for landowners, encompassing more than 31,400 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 Little Tennessee River Basin:

Office Location	Contact Person	Phone
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