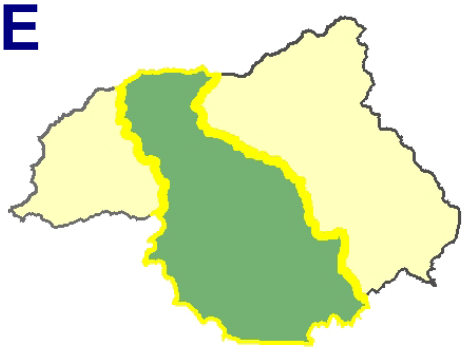
Upper Little Tennessee River Subbasin



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

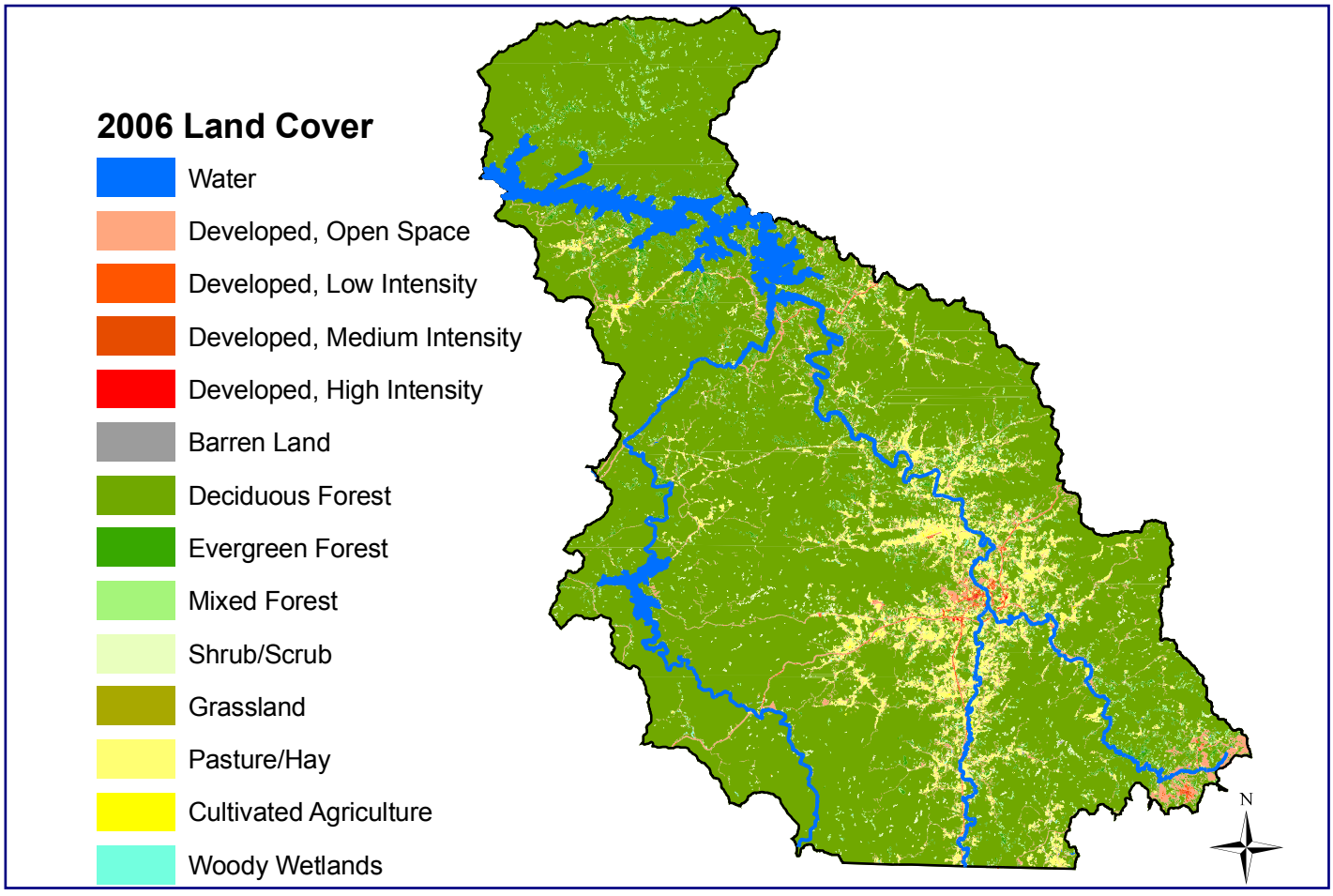
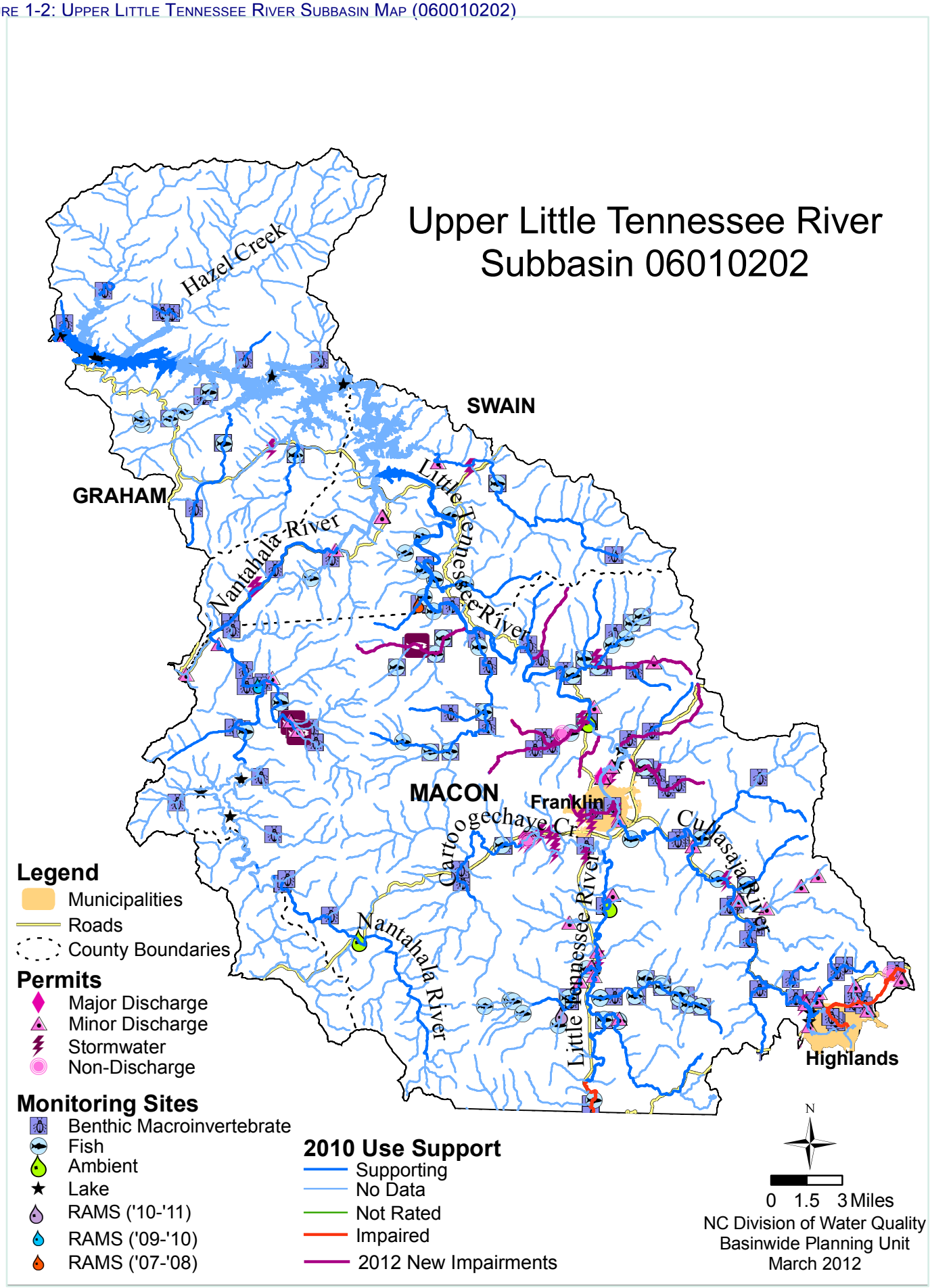


Figure 1-2: Upper Little Tennessee River Subbasin Map (060010202)

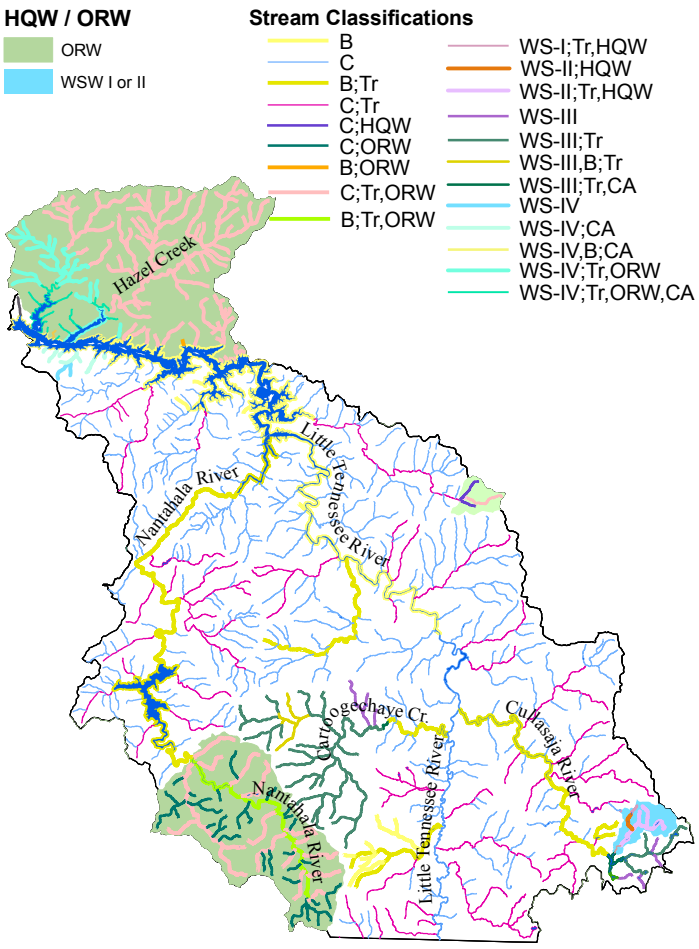


Water Quality Overview

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

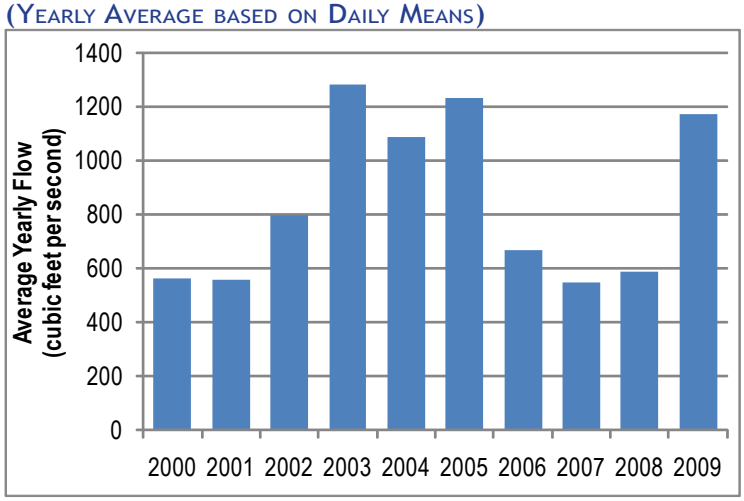


In 2011, The Little Tennessee Watershed Association completed their State of the Streams report. This document is an excellent resource, covering land use changes, natural history, local biomonitoring program results and restoration initiatives.

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)

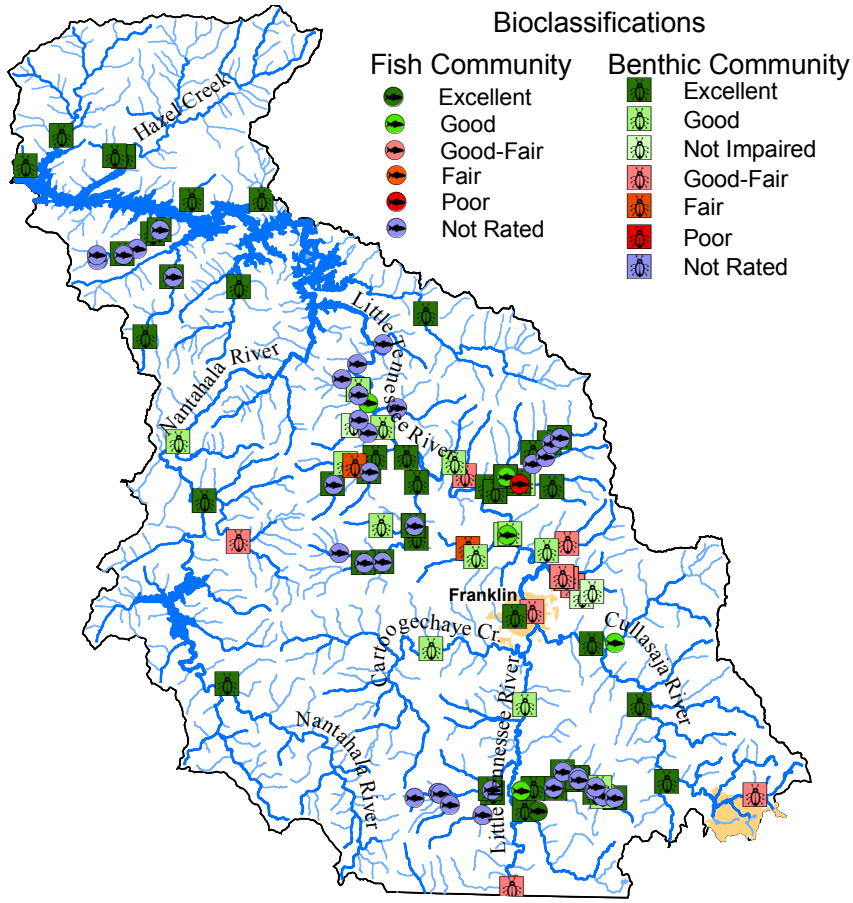


Biological Monitoring

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

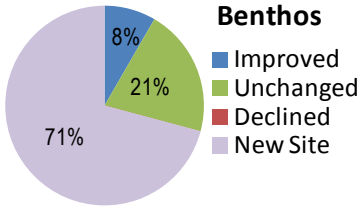
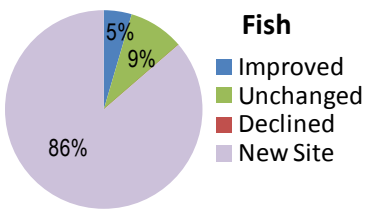


Figure 1-7: Fish Community Sample Status



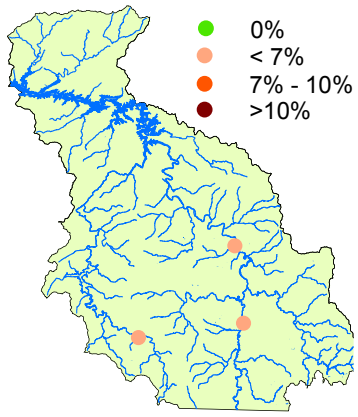
In addition, over 20 years of fish community data collected by Dr. Bill McLarney of the Little Tennessee Watershed Association (LTWA) was assessed for Brush, Cowee, Crawford Branch, Cullasaja, Ellijay, Skeenah and Watauga Creeks. A discussion of IBI scores, fish abundance, diversity, and land cover comparisons 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

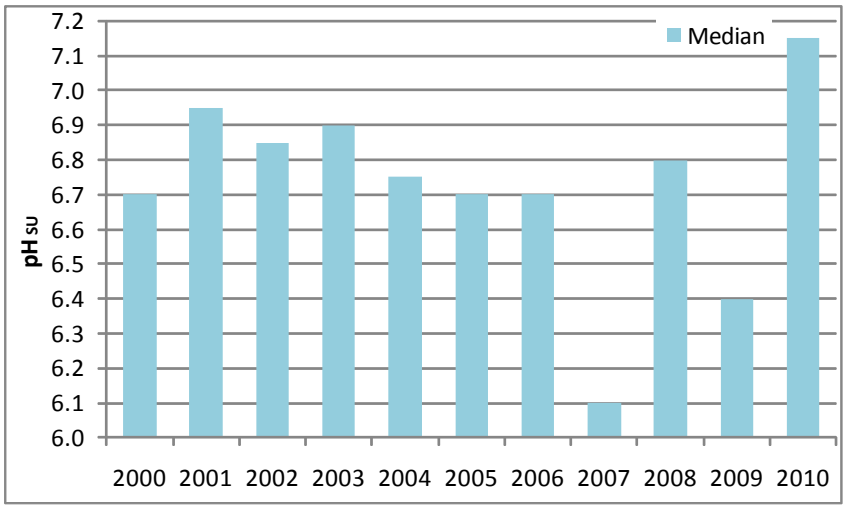


The following discussion of ambient monitoring parameters includes concentration value graphs for AMS station G2000000 over a 11 year period (2000-2010). Each major parameter is discussed, even if no current impairment exists. The graphs are not intended to provide statistically significant trend information, 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.



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

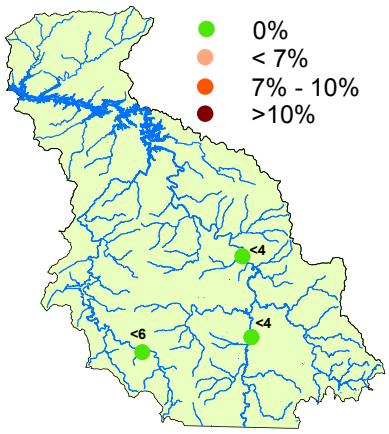
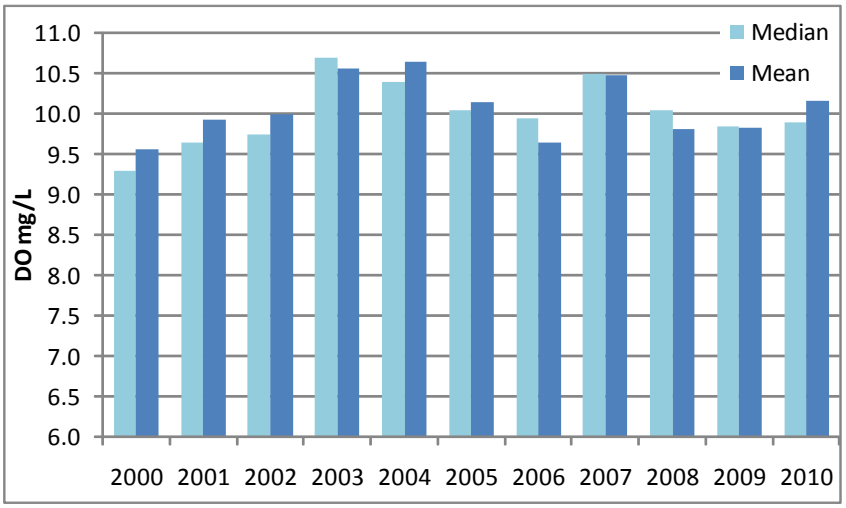


Figure 1-11: Summarized DO data at AMS G2000000 site between 2000-2010.



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

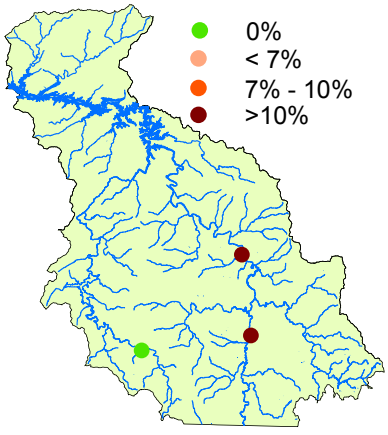
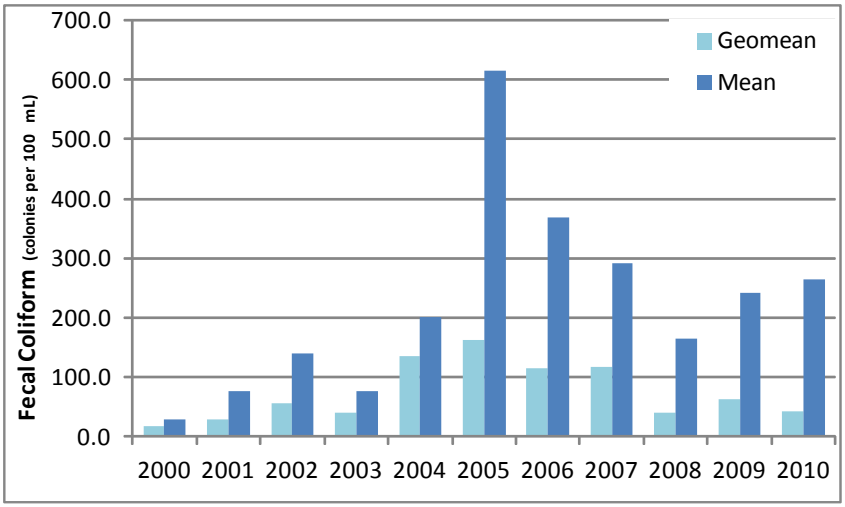


Figure 1-13: Summarized Fecal Coliform Bacteria data at AMS G2000000 site between 2000-2010.



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

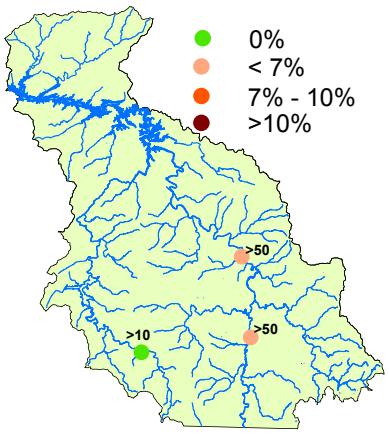
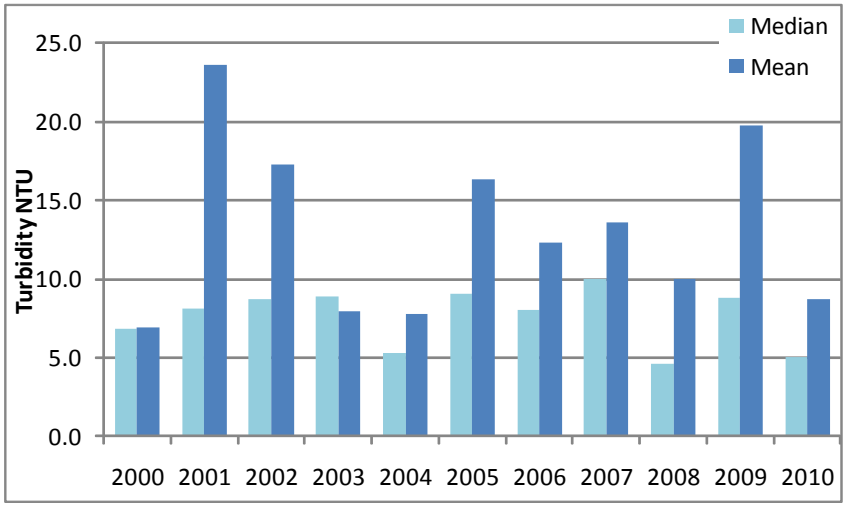


Figure 1-15: Summarized Turbidity data at AMS G2000000 site between 2000-2010.



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.

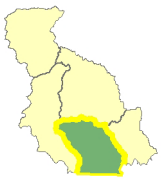
Other measurements include physical measurements of the stream bed, including coarse woody debris, width, depth, etc. and biological measurements such as salamander, fish, and macroinvertebrate surveys. These data will be made available when published.

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

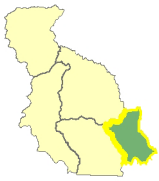
and some large-lot residential areas. Before Cartoogechaye Creek enters the Little Tennessee River, it goes through an area within the town limits of Franklin with more dense residential and some light industrial/ commercial property. The creek provides drinking water to the Town of Franklin.

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.

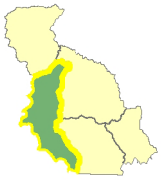
Turtle Pond Creek [AU# 2-21-8] (C;Tr) is a 4 mile creek that has consistently rated Excellent for its benthic community since sampling commenced in 1999 at site GB47.

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.

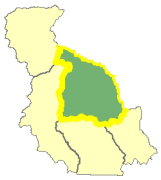
Whiteoak Creek [AU# 2-57-45a, 2-57-45b, & 2-57-45c] (C;Tr) is a 3.6 mile creek with its headwaters in Nantahala National Forest. The creek rated Good-Fair in 2009 at site GB36, the same rating it received in 2004. Since first being sampled in 1988, this waterbody has rated Fair twice and Good-Fair four 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.

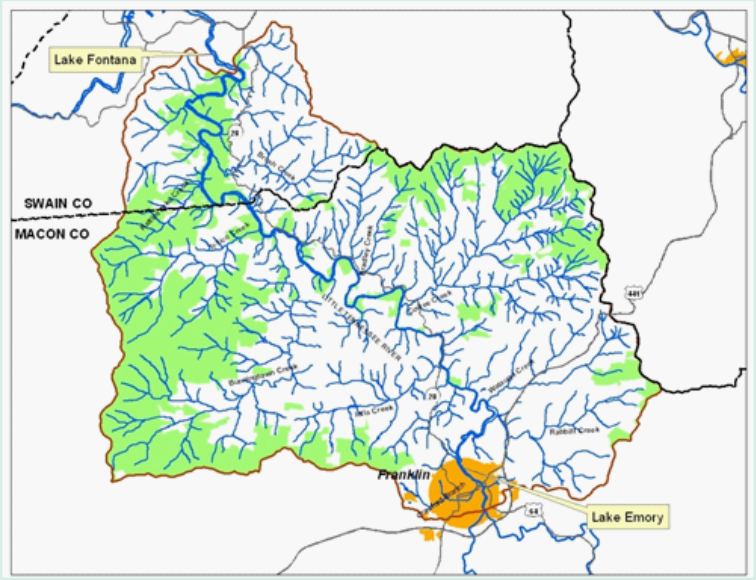
In September 2008, a lake fish consumption advisory was announced for Fontana Lake based on high levels of mercury found in walleye fish. Fontana Lake is also under a statewide consumption advisory for largemouth bass due to mercury contamination.

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