Chapter 11
Water Resources

11.1 River Basin Hydrologic Units

Under the federal system, the Little Tennessee River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). Cataloging units are further divided into smaller watershed units (14-digit hydrologic units or local watersheds) that are used for smaller scale planning like that done by NCEEP (Chapter 13). There are 3 local watershed units in the basin, all of which are listed in Table 19.

Table 19 Hydrologic Subdivisions in the Little Tennessee River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-Digit Codes	USGS 8-Digit Hydrologic Units	USGS 14-Digit Hydrologic Units Local Watersheds*
Upper Little Tennessee River Cullasaja River, Lake Sequoyah Catoojechaye Creek Nantahala River, Nanatahala Lake	04-04-01 and 04-04-03	06010202	020010, 020020, 020030, 030010, 030020, 030030, 040010, 040020, 040030, 040040, 050010, 050020, 050030
Tuckasegee River Lake Glenville, Wolf Creek Reservoir Oconoluftee River, Deep Creek	04-04-02	06010203	050040, 050050, 060010, 060020, 060030, 060040, 060050, 060060, 060070, 070010, 070020, 080010, 080020, 080030, 080040, 010010, 010020, 010030, 010040, 010050, 010060, 010070, 020010, 020020, 020030, 020040, 030010, 030020, 030030, 030040, 030050, 030060, 030070, 030080, 040010, 040020, 040030, 040040, 040050, 040060, 040070
Lower Little Tennessee River Santeetlah Lake, Snowbird Creek Tulula Creek, Cheoah River	04-04-04	06010204	010010, 010020, 010030, 020010, 020020, 020030, 020040, 020050, 030010

* Numbers from the 8-digit and 14-digit column make the full 14-digit HU.

11.2 Minimum Streamflow

Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. The Division of Water Resources (DWR), in conjunction with the Wildlife Resources Commission (WRC), recommends conditions related to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources (DLR) issues the permits.

Under the authority of the Federal Power Act, the Federal Energy Regulatory Commission (FERC) licenses all non-federal dams located on the navigable waters in the United States that

produce hydropower for the purposes of interstate commerce. The license may include requirements for flows from the project for designated in-stream or off-stream uses.

The studies to support the license application of Duke Power for the bypass projects: Nantahala Project (FERC Project No. 2692), West Fork Project (FERC Project No. 2686), East Fork Project (FERC Project No. 2698); and the run-of-river projects: Dillsboro (FERC Project No. 2602), Franklin (FERC Project No. 2603), and Bryson City (FERC Project No. 2601) have been completed. The license application has been submitted and the Federal Energy Regulatory Commission is now proceeding through the National Environmental Policy Act (NEPA) process. To review the studies, go to: http://www.nantahalapower.com/lakes/relicensing/. The results of these projects are discussed in more detail in the Subbasin Chapters (1-4).

The licenses for Dillsboro, Franklin and Bryson City expired on 7/31/2005; the licenses for West Fork and East Fork expired on 1/31/2006; and the license for Nantahala expired on 2-28-2006. The projects will continue to operate until the new licenses are issued with annual licenses issued by the FERC, containing terms and conditions from the expired licenses.
Under the authority of Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers issues permits for the discharge of fill material into navigable waters. The permit may include requirements for flows for designated in-stream or off-stream uses. A 404 permit will not only apply to dams under state and federal regulatory authorities mentioned above, but will also cover structures that are not under their authority, such as weirs, diversions, and small dams. Table 20 presents minimum streamflow projects in the Little Tennessee River basin.

Table 20 Minimum Streamflow Projects in the Little Tennessee Basin

Name	Subbasin	Waterbody	Drainage Area (sq. mi.)	Min. Streamflow (cubic feet/sec)
East Fork Project				
Tanasee Dam	04-04-02	Tanasee Creek	25	0
Wolf Creek Dam	04-04-02	Wolf Creek	15	0
Bear Creek Dam	04-04-02	Tuckasegee River	75.3	0
Cedar Cliff Dam	04-04-02	Tuckasegee River	80.7	10[1]
West Fork Project				
Thorpe Dam	04-04-02	West Fork Tuckasegee River	36.7	0
Little Glenville Dam	04-04-02	West Fork Tuckasegee River	54.7	20
Tapoco (Tallassee) Project				
Cheoah Dam	04-04-02	Little Tennessee River	1608	Run-of-river[2]
Calderwood Dam	Tennessee	Little Tennessee River	1856	Run-of-river[2]
Chilhowee Dam	Tennessee	Little Tennessee River	1977	Run-of-river[2]
Santeetlah Dam	04-04-04	Cheoah River	176	0
Nantahala Project				
Diamond Valley Dam	04-04-03	UT to Dicks Creek	0.4	Run-of-river[2]
Dicks Creek Dam	04-04-03	Dicks Creek	3.5	Run-of-river[2]
Whiteoak Dam	04-04-03	Whiteoak Creek	13.8	8[4]
Nantahala Dam	04-04-03	Nantahala River	91	606[1]
Queens Creek Project				
Queens Creek Dam	04-04-03	Queens Creek	3.6	2.0 or 1.0[3]
Other Projects				
Franklin (Lake Emory	04-04-01	Little Tennessee River	310	Run-of-river[2]
Dillsboro Dam	04-04-02	Tuckasegee River	290	Run-of-river[2]
Bryson City	04-04-02	Oconaluftee River	188	Run-of-river[2]
Pyle Dam	04-04-01	Potts Branch	0.5	0.2
Westgate Plaza Dam	04-04-01	UT to Cartoogechaye Creek	0.47	0.3

[1] Release made at the powerhouse.

[2] The project generates or dam spills in a run-of-river mode, i.e., inflow equals outflow. Dams with more storage capacity can have a greater effect on streamflow.

[3] Minimum flow of 2.0 cfs from December 1 through May 31 and 1.0 cfs from June 1 through November 30, or inflow, whichever is less.

[4] The release is from July 1 to November 15; and the release is actually from the Whiteoak pipeline(penstock) into Dicks Creek which flows into the Nantahala River upstream of the Whiteoak Creek confluence. There currently is no flow requirement below the Whiteoak Creek dam.

11.3 Interbasin Transfers (IBT)

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more. Also, persons wishing to transfer more than the minimum transfer quantity allowed by the IBT law (usually 2 MGD) must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State, and included as part G.S. 143-215.22G of the law. These boundaries differ slightly from the 17 major river basins delineated by DWQ.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer must outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as support documentation for a transfer petition. Currently, there are no certified interbasin transfers in the Little Tennessee River basin. However, the Town of Highlands straddles the Little Tennessee and Savannah River basin divide, resulting in a minor transfer estimated to be less than 0.1 MGD. For more information on interbasin transfers, visit the website at http://www.ncwater.org/or call DWR at (919) 733-4064.

11.3.1 Local Water Supply Planning

The North Carolina General Assembly mandated a local and state water supply planning process in 1989 to assure that communities have an adequate supply of potable water for future needs. Under this statute, all units of local government that provide, or plan to provide, public water supply service are required to prepare a Local Water Supply Plan (LWSP) and to update that plan at least every five years. The information presented in a LWSP is an assessment of a water system's present and future water needs and its ability to meet those needs.

Table 21 shows the water use and the service population for water systems that use water from the Little Tennessee River Basin and submit a Local Water Supply Plan to the Division of Water Resources. Except where noted, the data is from the systems' 2002 LWSP.

Table 21 Local Water Supply Planning in the Little Tennessee River Basin

Population and Water Use for LWSP systems using water from the Little Tennessee River Basin					
County	System	Average Daily Demand (mgd)		Population Served	
		2002	2020	2002	2020
Graham	Robbinsville	0.53	0.546	2800	2844
Graham	Santeetlah	0.025	0.03	60	70
Macon	Franklin (1997 Data)	1.044	2.06	7125	10000
Macon	Highlands	0.485	1.176	1173	1614
	Totals	**2.084**	**3.812**	**11158**	**14528**

11.3.2 Registered Water Withdrawals

Large water users are required to register their withdrawals with the Division of Water Resources. General Statute 143-215.22H requires non-agricultural users that withdraw 100,000 gallons per day or more and agricultural users that withdraw 1,000,000 gallons per day or more to report their withdrawals. Details of this program can be found on the Division's website at: www.ncwater.org. Table 22 lists the registered water withdrawers in the Little Tennessee River Basin.

Table 22 Registered Water Withdraws in the Little Tennessee River Basin

2004 Registered Water Withdrawals in the Little Tennessee River Basin			
County	Registered Facility	Source of Withdrawal	Average for Days Used (mgd)
Graham	Alcoa Power Generating Inc.-Tapoco Division -- Santeetlah Powerhouse	Cheoah River	379
Graham	Alcoa Power Generating Inc. - Tapoco Division -- Cheoah Powerhouse	Cheoah River	3074
Jackson	Duke Energy - Bear Creek Hydro-electric Facility	East Fork Tuckasegee River	151
Jackson	Duke Energy - Cedar Cliff Hydro-electric Facility	East Fork Tuckasegee River	151.60
Macon	Duke Enregy - Nantahala Hydro-electric Facility	Nantahala River	259.70
Macon	Duke Energy - Queens Creek Hydro-electric Facility	Queens Creek	4.60
Jackson	Duke Energy - Tanasee Creek Hydro-electric Facility	East Fork Tuckasegee River	87.20
Jackson	Duke Energy - Thorpe Hydro-electric Facility	West Fork Tuckasegee River	73.90
Jackson	Duke Energy - Tuckasegee Hydro-electric Facility	Tuckasegee River	71
Cherokee	Nantahala Talc & Limestone Co Inc - Hewitt Quarry	Nantahala River	0.39
Graham	Fontana Village Resort	Fontana Lake	0.26
Jackson	Forest Hills - Carolina Water Service (1999 Data)	Ground Water	0.04
Macon	Otter Creek Trout Farm (1999 Data)	Otter Creek	1.44
Swain	Cooper Creek Trout Farm	Cooper Creek	1.69
Swain	Tumbling Waters Campground & Trout Pond	Panther Creek	0.20

11.4 Water Quality Issues Related to Drought

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients. These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures, algae grow more due to longer periods of sunlight, and streamflows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When streamflows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges

make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.
As streamflows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause problems for recreation and difficulty in water treatment resulting in taste and odor problems in finished drinking water.

11.5 Source Water Assessment of Public Water Supplies

11.5.1 Introduction

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

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

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

11.5.2 Delineation of Source Water Assessment Areas

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

Wellhead Protection (WHP) Program

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

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

Water Supply Watershed Protection (WSWP) Program

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at http://h2o.enr.state.nc.us/wswp/index.html.

11.5.3 Susceptibility Determination – North Carolina's Overall Approach

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

Overall Susceptibility Rating

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

Inherent Vulnerability Rating

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

characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).

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

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

11.5.4 Source Water Protection

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

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

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

Information related to SWP can be found at http://www.deh.enr.state.nc.us/pws/swap.

11.5.5 Public Water Supply Susceptibility Determinations in the Little Tennessee River Basin

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

In the Little Tennessee River Basin, 354 public water supply sources were identified. Eleven are surface water sources, 3 are groundwater source that are under the influence of surface water (like springs) and 340 are groundwater sources. All of 340 groundwater sources have a Higher susceptibility rating. Table 23 identifies the eleven surface water sources, 3 groundwater sources under the influence of surface water and the overall susceptibility ratings for all of these sources. It is important to note that a susceptibility rating of Higher does not imply poor water quality.

Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 23 SWAP Results for Surface Water Sources in the Little Tennessee River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
0138010	H	L	M	Cheoah River	Robbinsville Water Treatment Plant
0138010	M	L	M	Rock Creek	Robbinsville Water Treatment Plant
0138010	M	L	M	Burgin Creek	Robbinsville Water Treatment Plant
0138010	M	L	M	Long Creek	Robbinsville Water Treatment Plant
0138101	H	L	M	Fontana Lake	Fontana Village Resort Water Treatment Plant
0150035	H	L	M	Tuckasegee River	Tuckasegee Water & Sewer Authority
0150116	H	L	M	Tuckasegee River	Western Carolina University Water Treatment Plant
0157010	H	L	M	Cartoogechaye River	Town of Franklin
0157015	H	L	M	Big Creek	Highlands Water Treatment Plant
0157015	M	L	M	Lake Sequoia	Highlands Water Treatment Plant
0187010	H	L	M	Deep Creek	Bryson City
0150190*	H	L	M	Well #1	Moonshine Creek Campground
0157117*	H	L	M	Spring #1	King Mountain Club Water
0157117*	H	L	M	Spring #2	King Mountain Club Water

* Groundwater sources under the influence of surface water