

9.1 River Basin Hydrologic Units

Under the federal system, the Hiwassee 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 11). There are 22 local watershed units in the basin, all of which are listed in Table 13.

Table 13 Hydrologic Subdivisions in the Hiwassee River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-Digit Codes	USGS 8-Digit Hydrologic Units	USGS 14-Digit Hydrologic Units Local Watersheds*
<i>Hiwassee River</i>	04-05-01 and 04-05-02	06020002	050010, 050020, 060010, 070010, 071010, 090010, 100050, 090020, 100010, 100020, 100030, 100040, 110010, 170010, 170020, 170030, 180010, 180020, 180030, 210010
Chatuge Lake	04-05-01		
Hiwassee Lake, Apalachia Lake	04-05-02		
Valley River, Nottely River	04-05-02		
<i>Ocoee Drainage</i>	04-05-02	06020003	030010, 100010

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

9.2 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.

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 14 presents minimum streamflow projects in the Hiwassee River basin.

Table 14 Minimum Streamflow Projects in the Hiwassee River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cu.ft/sec)
Hydroelectric Dams				
Chatuge Dam	Near the NC/GA state line near Hayesville, NC	Hiwassee River	189	83
Mission Dam	Clay County near the Clay/Cherokee county line	Hiwassee River	292	280
Hiwassee Dam	Cherokee County NW of Murphy below Beaverdam Cr.	Hiwassee River	968	
Apalachia Dam	Near the NC/TN state line	Hiwassee River	1,018	
Nottely dam	In Georgia near the NC/GA state line	Nottely River	215	50

9.3 Interbasin Transfers

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 Interbasin Transfer (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 or known potential interbasin transfers in the Hiwassee River basin. For more information on interbasin transfers, visit the website at <http://www.ncwater.org> or call DWR at (919) 733-4064.

9.4 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.

9.5 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.

The table below shows the water use and the service population for water systems that use water from the Hiwassee 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.

Population and Water Use for LWSP systems using water from the Hiwassee River Basin					
County	System	Average Daily Demand (mgd)		Population Served	
		2002	2020	2002	2020
Cherokee	Murphy	0.916	1.272	3880	4685
Cherokee	Andrews	0.6	0.761	3541	4533
Cherokee	Marble CWS	0.127	0.18	1300	1660
Clay	Clay Co WSD	0.137	0.171	950	995
Totals		1.78	2.384	9671	11873

9.5.1 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. The table below lists the registered water withdrawers in the Hiwassee River Basin.

Registered Water Withdrawals in the Hiwassee River Basin (1999 Data)

County	Registered Facility	Source of Withdrawal	Average for Days Used (mgd)
Cherokee	Carolina Water Service	Ground Water	0.027
Cherokee	Craig's Trout Farm, Inc.	Owl Creek	0.864
Cherokee	Harrison Const. Div. of APAC TN - Cherokee Quarry	Unnamed Stream	0.000
Clay	Harrison Const. Div. of APAC TN - Hayesville Quarry	Unnamed Stream	0.005

9.6 Source Water Assessment of Public Water Supplies

9.6.1 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>.

9.6.2 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>.

9.6.3 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.

9.6.4 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>.

9.6.5 Public Water Supply Susceptibility Determinations in the Hiwassee 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 Hiwassee River Basin, 70 public water supply sources were identified. Three are surface water sources, and 67 are groundwater sources. All 67 groundwater sources have a Moderate susceptibility rating. Table 15 identifies the three surface water sources and the overall susceptibility rating. 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 15 SWAP Results for Surface Water Sources in the Hiwassee River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
0120010	H	L	M	Hiwassee River	Town of Murphy
0120020	M	L	M	Beaver Creek	Town of Andrews
0120020	M	L	M	Dan Holland Creek	Town of Andrews

