

Chapter 1

Savannah River Subbasin 03-13-01

Including: Tahlullah and Chattooga Rivers

1.1 Subbasin Overview

Subbasin 03-13-01 at a Glance

Land and Water Area

Total area:	72 mi ²
Land area:	71mi ²
Water area:	<1 mi ²

Population (County)

2000 Est. Pop:	4,215 people
Pop. Density:	59 persons/mi ²

Land Cover (percent)

Forest/Wetland:	96.8%
Water:	0.6%
Urban:	0.4%
Cultivated Crop:	0.1%
Pasture/ Managed Herbaceous:	2.1%

Counties

Clay, Jackson, Macon

Municipalities

Cashiers, Highlands

Monitored Streams Statistics

Aquatic Life

Total Streams:	87.4 mi
Total Supporting:	18.1 mi
Total Impaired:	0.0 mi
Total Not Rated:	68.7 mi

Recreation

Total Streams:	0 mi/0 ac
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This mountainous subbasin is divided into two pieces: a small portion of the Tullulah River headwaters in Clay County and a larger portion of the basin that includes the Chattooga River, Norton Mill, Big, Clear and Overflow Creeks. The majority of streams in this subbasin flow generally south toward Georgia. The Chattooga River forms part of the state boundary between Georgia and South Carolina. The Chattooga and Tullulah Rivers join to form the Tugaloo River in Georgia. A map of this subbasin including water quality sampling locations is presented as Figure 3.

This subbasin lies within the level IV ecoregion of the Southern Crystalline Ridges and Mountains. This ecoregion is characterized by elevations ranging between 1,200 and 4,500 feet, high rainfall rates, abundant forest cover, and acidic, loamy, well-drained soils (Griffith *et al* 2002). As would be expected for an area with rugged topography, most of the land within this subbasin is forested (96.8 percent) and lies within the Nantahala National Forest and includes the Southern Nantahala Wilderness and the Ellicott Rock Wilderness areas. Notable exceptions include the urbanizing areas in and around the Town of Highlands and the Cashiers community. Residential development is increasing rapidly around these communities and along primary roadways.

There are five NPDES dischargers in this subbasin; two are required to perform whole effluent toxicity testing. The Cashiers WWTP (NC0063321, 0.1 MGD) discharges to an unnamed tributary of the Chattooga River and has

had three toxicity violations since 2001. The Mountain (formerly Highlands Camp and Conference Center) facility (NC0061123, MGD .006) discharges to Abes Creek and has had seven toxicity violations since 2000.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 3. Table 3 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support ratings for waters in the subbasin. Refer to Appendix VIII for more information about use support methodology.

Figure 3 Savannah River Subbasin 03-13-01

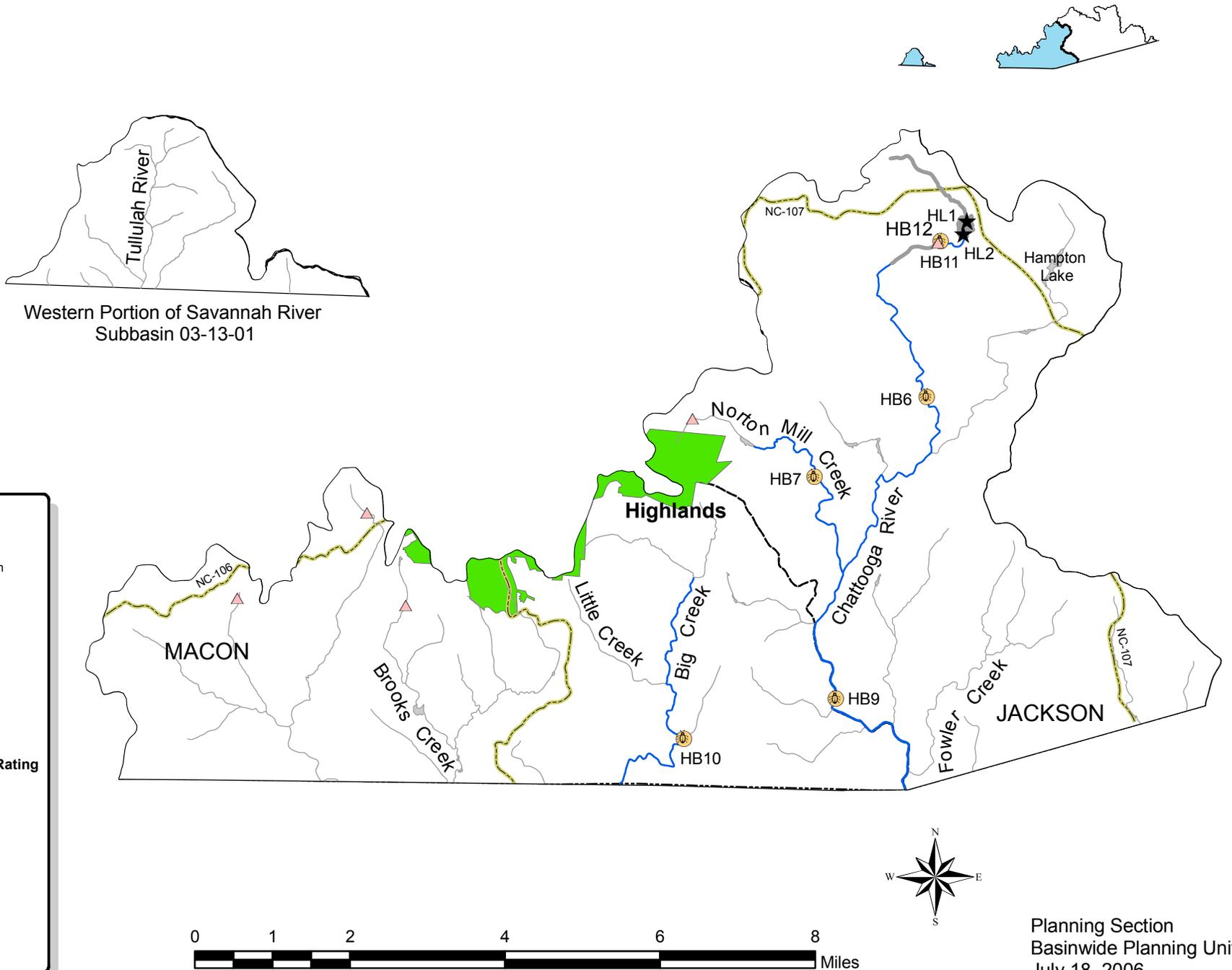


Table 3 Savannah Subbasin 03-13-01

AU Number	Classification	Length/Area	Aquatic Life Assessment				Recreation Assessment			
			AL Rating	Station	Result	Year/ Parameter % Exc	REC Rating	Station	Result	Stressors
Big Creek										
3-10-3	C Tr ORW	4.1 FW Miles	S							
	From source to North Carolina-Georgia State Line				HB10	E	2004			
CHATTOOGA RIVER										
3a2	B Tr ORW	0.5 FW Miles	S							
	From dam at Cashiers Lake to Cashiers WWTP				HB11	NI	2001			
3a3	B Tr ORW	0.6 FW Miles	NR							
	From Cashiers WWTP to Ut below Cashiers Lake at the base of Timber Ridge				HB12	NR	2001			Toxic Impacts WWTP NPDES
3b	B Tr ORW	10.4 FW Miles	S							
	From Ut below Cashiers Lake at the base of Timber Ridge to North Carolina-Georgia State Line				HB9	E	2004			Habitat Degradation Land Clearing
					HB6	E	2004			Habitat Degradation Road Construction Habitat Degradation Impervious Surface Habitat Degradation WWTP NPDES
CHATTOOGA RIVER (Cashiers Lake)										
3a1	B Tr ORW	23.7 FW Acres	NR		HL1	ID				
					HL2	ID				
	From source to dam at Cashiers Lake									Sediment Unknown
Norton Mill Creek										
3-3b	C Tr +	3.1 FW Miles	S							
	From dam at Camelot Lake to Chattooga River				HB7	G	2004			Nutrient Impacts Unknown

Table 3 Savannah Subbasin 03-13-01

AU Number	Classification	Length/Area	Aquatic Life Assessment				Recreation Assessment				
			AL Rating	Station	Result	Year/ Parameter % Exc	REC Rating	Station	Result	Stressors	Sources
Use Categories:		Monitoring data type:		Results:			Use Support Ratings 2006:				
AL - Aquatic Life		HF - Fish Community Survey				E - Excellent				S - Supporting, I - Impaired	
REC - Recreation		HB - Benthic Community Survey				G - Good				NR - Not Rated	
		HA - Ambient Monitoring Site				GF - Good-Fair				NR*- Not Rated for Recreation (screening criteria exceeded)	
		HL- Lake Monitoring				F - Fair				ND-No Data Collected to make assessment	
						P - Poor					
						NI - Not Impaired					
Miles/Acres		m- Monitored					Results				
FW - Fresh Water		e- Evaluated					CE-Criteria Exceeded > 10% and more than 10 samples				
							NCE-No Criteria Exceeded				
							ID- Insufficeint Data Available				
Aquatic Life Rating Summary				Recreation Rating Summary				Fish Consumption Rating Summary			
S	m	18.1	FW Miles	ND	87.4	FW Miles	I	e	87.4	FW Miles	
NR	m	0.6	FW Miles	ND	40.7	FW Acres	I	e	40.7	FW Acres	
NR	m	23.7	FW Acres								
ND		68.7	FW Miles								
ND		17.0	FW Acres								

There were 4 benthic macroinvertebrate community samples collected during this assessment period. All streams sampled for benthic macroinvertebrates were classified using mountain criteria. Based on benthic macroinvertebrate data, two sites on the Chattooga River were Excellent and Big Creek maintained the Excellent bioclassifications generated from the 1999 basinwide sampling period. Norton Mill Creek declined in bioclassification from Excellent in 1999, to Good in 2004. There are no ambient monitoring locations in this subbasin. Refer to the *2005 Basinwide Assessment Report Savannah River Basin* at <http://h2o.enr.state.nc.us/esb/Basinwide/SAV2005.pdf> and Appendix IV for more information on monitoring.

Waters in the following sections and in Table 3 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters, and is used to identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same. For example, index number 11-3-(14) might be split into two assessment units 11-3-(14)a and 11-3-(14)b.

1.2 Use Support Assessment Summary

Table 4 Summary of Use Support Ratings by Category in Subbasin 03-13-01

Use Support Rating	Aquatic Life	Recreation
Monitored Waters		
Supporting	18.1 mi	0
Impaired*	0	0
Not Rated	0.6 mi 23.7 ac	0
Total	18.7 mi 23.7 ac	0
Unmonitored Waters		
No Data	68.7 mi 17.0 ac	87.4 mi 40.7 ac
Total	68.7 mi 17.0 ac	87.4 mi 40.7 ac
Totals		
All Waters	87.4 mi 40.7 ac	87.4 mi 40.7 ac

** The noted percent Impaired is the percent of monitored miles/acres only.

* The noted percent Impaired is the percent of monitored miles/acres only.

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair, or Poor bioclassification are assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to Appendices IV and VIII, respectively. Appendix IX provides definitions of the terms used throughout this basin plan.

In subbasin 03-13-01, use support was assigned for the aquatic life, recreation, fish consumption and water supply categories. Waters are Supporting, Impaired, Not Rated, and No Data in the aquatic life and recreation categories on a monitored or evaluated basis. Waters are Impaired in the fish consumption category on an evaluated basis based

on fish consumption advice issued by the Department of Health and Human Services (DHHS). All waters are Supporting in the water supply category on an evaluated basis based on reports from Division of Environmental Health (DEH) regional water treatment plant consultants. Refer to Table 4 for a summary of use support for waters in subbasin 03-13-01.

1.3 Status and Recommendations of Previously and Newly Impaired Waters

No stream segments were rated impaired in the 2002 basin plan and none were rated as impaired based on recent DWQ monitoring in the current assessment period (1999-2004). Section 1.4 below discusses specific streams where water quality impacts have been observed.

1.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and to locate sources of water quality protection funding. Additionally, water quality education on local issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix VII.

1.4.1 Chattooga River Including Cashiers Lake [AU# 3a1, 3a2, 3a3, and 3b]

Current Status

The Chattooga River watershed is classified as Recreation, Trout, and Outstanding Resource Waters and is subject to the special management strategy described in Section 1.5.2. Four sites were sampled for benthic macroinvertebrates in the Chattooga River headwaters during this assessment period (HB6, HB9, HB11, & HB12). None of the results from these collections indicate the river is impaired, but they do indicate that nonpoint source runoff from the Cashiers Community and the discharge from the Cashiers WWTP are impacting water quality in the headwaters. The data also indicate these negative impacts are reduced as clean water entering the river from undisturbed watersheds dilutes the upstream pollution. Because the benthic community at site HB12 could not be rated due to its small size, assessment unit 3a3 (From Cashiers WWTP to UT below Cashiers Lake at the base of Timber Ridge) is Not Rated for aquatic life.

Tuckasegee Water and Sewer Authority (TWSA) owns and operates the Cashiers WWTP. In 2001, DWQ evaluated benthic communities about 50 meters upstream (Site HB11) and downstream of the plant discharge (Site HB12). These two sites were compared directly to each other to evaluate the effects of the discharge. They were also compared to an unnamed tributary of Shortoff Creek in an undisturbed watershed to evaluate the impacts of development and Cashiers Lake. The study indicated the discharge, Cashiers Lake, and upstream development impact the Chattooga River benthic community. Habitat diversity was low at both sites; the substrates were primarily sand and gravel, and pools and riffles were infrequent. Some of these habitat deficiencies can be attributed to upstream development activities and Cashiers Lake. The benthic community below the discharge indicated a substantial impact from the WWTP. Benthic diversity and abundance dropped dramatically there, indicating slightly toxic conditions.

TWSA received authorization to expand their plant capacity to the maximum permitted flow of 200,000 gallons per day with the addition of another aeration basin and supplemental clarifiers. These devices will improve their treatment capability. At the time of this writing, the plant is still under construction. Once completed, the plant's monitoring requirements for ammonia and temperature will increase from twice per month to once per week.

Cashiers Lake is a small, shallow impoundment located in Jackson County, and was sampled at the request of the Asheville Regional Office. Regional staff expressed concerns related to suspended sediments. Despite sampling during rainy conditions, turbidity was not above the trout waters standard of 10 mg/l. On-going wind mixing due to the shallow nature of the lake probably contributes to the perceived sediment problem. A review of all parameters sampled indicated that other standards and assessment criteria are being met. However, the minimum ten samples necessary to assign a use support rating were not collected. Therefore, Cashiers Lake is Not Rated for aquatic life.

DWQ continues to implement an Outstanding Resource Water (ORW) Management Strategy for the Chattooga River watershed (Section 1.5.1).

2007 Recommendations

Toxicity issues that may remain at the Cashiers WWTP after the upgrade is complete will be captured by the increased monitoring requirements. DWQ will continue to provide technical assistance to the plant operators and/or take necessary enforcement action to bring the plant into compliance should any toxicity problems arise.

In the face of expanding residential communities and urbanization in the Cashiers area, nonpoint source pollution presents a far greater threat to water quality in the Chattooga River and Cashiers Lake than the impact of Cashiers WWTP. In order to protect water quality, development along the river and, more importantly, its many tributaries must be conducted in an ecologically sound manner, with an emphasis on stormwater runoff management. Refer to Chapter 5 for information on how local governments can achieve effective stormwater control on existing and future development.

In addition to local government action, residents should take an active role in water quality management. Citizens are encouraged to report erosion problems and possible water quality violations to state and county authorities. A list of contacts is provided in Appendix VII. They should also work through their homeowner associations to encourage and establish appropriate stormwater controls in their communities. Citizens can also track changes in water quality by starting a volunteer monitoring program to supplement state water quality data. Interested citizens should contact the VWIN program at the University of Asheville for guidance on how to start such a program.

1.4.2 Norton Mill Creek [AU# 3-3b]

Current Status

Norton Mill Creek is a large tributary to the Chattooga River. This segment receives runoff associated with second home building from some of the fast growing residential areas near Highlands and Cashiers. DWQ sampled benthic macroinvertebrates at site HB7 in 2004. This site declined from Excellent to Good during the period between 1999 and 2004. The most obvious habitat problems were infrequent riffles, prevalence of sand, and disturbance of the

riparian zone. The types of benthic species collected in 2004 indicate the decline could be due to an increase in nutrient runoff from the watershed.

Fish and Wildlife Associates, Inc. performed a biological assessment of Norton Mill Creek and Camelot Lake in 2000. This study evaluated nutrient concentrations, sediment accumulation, and benthic populations at two sites in and above the lake. The study noted that sediment deposition had reduced the lake's depth to less than two feet at the dam (Boaze, 2001).

2007 Recommendations

The recommendations given for the Chattooga River regarding stormwater control (Section 1.4.1) also apply to Norton Mill Creek. Residential landowners along the creek can use a variety of techniques to reduce pollution caused by runoff from their property. Residents should refer to Section 5.2.3 and the document "Improving Water Quality in Your Own Backyard." This pamphlet is available free of charge through the Division of Water Quality Website. <http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf>. DWQ will continue to monitor this stream.

1.4.3 Abes Creek [AU# 3-10-2-2-2]

Current Status

Abes Creek is part of the Overflow Creek watershed and is classified Outstanding Resource Waters. The Mountain Retreat and Learning Center WWTP (NPDES Permit# NC0061123) is one of two dischargers in the watershed permitted before the ORW designation and management strategy were applied. This facility has struggled with toxicity problems since monitoring began in 1993. The 2002 basin plan described enforcement action taken by DWQ to bring the facility into compliance. The basin plan also noted that DWQ engineers would continue to provide technical assistance. For much of the current assessment period (1999-2004) toxicity was under control and the facility was compliant.

In 2004, toxicity problems resurfaced at The Mountain WWTP. Onsite inspection by DWQ staff indicated that the problems were due to sampling technique and ammonia concentrations. As a variable use facility, The Mountain WWTP does not discharge continuously. In order to collect effluent samples, a technician must manually pump out the system. In this condition, the facility is not functioning efficiently and can produce wildly varying sample results. The type of treatment technology used at this facility normally produces consistent ammonia readings. This leads DWQ to believe the inconsistent readings are due primarily to the way in which samples are collected.

2007 Recommendations

In the short term, DWQ suggests The Mountain review its sampling methods to determine if they can be adjusted to better reflect the plant's operation. In the long term, The Mountain should consider switching to a non-discharge system (septic, drip-irrigation, low-pressure-pipe, etc). DWQ recognizes the difficulty non-profit organizations, such as The Mountain, face when trying to raise funds for facility improvements. DWQ will alert the facility operators to any assistance programs available for treatment plant upgrades. The Mountain may also be able to enter into a Special Order of Consent with DWQ that would reduce their fines for violation if they establish a suitable plan to upgrade their system.

1.5 Additional Water Quality Issues within Subbasin 03-13-01

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes, or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also discusses ideas, rules and practices in place to preserve and maintain the pristine waters of the Savannah River basin. In subbasins 03-13-01 and 03-13-02 (Chapter 2), this is particularly important since many of the waters are designated as high quality, outstanding resource, or trout waters (HQW, ORW, and Tr, respectively). Special management strategies, or rules, are in place to better manage the cumulative impact of pollutant discharges and residential development.

1.5.1 Management Strategies for Water Quality Protection

Municipalities and smaller outlying communities are expanding. This involves construction and development along pristine waters in Subbasin 03-13-01. High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the primary freshwater classification(s) placed on a waterbody. Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect water quality. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, 2004). This document is available on-line at <http://h2o.enr.state.nc.us/admin/rules/>. Definitions of the primary and supplemental classifications can be found in Chapter 3.

New discharges and expansions of existing discharges may, in general, be permitted in waters classified as HQW provided that the effluent limits are met for dissolved oxygen (DO), ammonia/nitrogen levels (NH₃-N), and the biochemical oxygen demand (BOD₅). More stringent limitations may be necessary to ensure that the cumulative effects from more than one discharge of oxygen-consuming wastes will not cause the dissolved oxygen concentration in the receiving water to drop more than 0.5 milligrams per liter (mg/l) below background levels. Discharges from single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (Administrative Code 15A NCAC 2B .0224)

In addition to the above, development activities which require an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). Under these rules, stormwater management strategies must be implemented if development activities are within one mile of and draining to waters designated as HQW. There are two development options outlined in the rule. The low-density option requires a 30-foot wide vegetative buffer between development activities and the stream. This option can be used when the built upon area is less than 12 percent of the total land area or the proposed development is for a single-family residential home on one acre or greater. Vegetated areas may be used to transport stormwater in the low-density option, but it must not lead to a discrete stormwater collection system (e.g.,

constructed). The high-density option is for all land disturbing activities on greater than one acre. For high-density projects, structural stormwater controls must be constructed (e.g., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch or more of rainfall. More stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water (Administrative Code 15A NCAC 2H .1006).

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

Many of the streams in this subbasin are also classified as trout (Tr) waters, and therefore, are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), “waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater.” The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at <http://www.dlr.enr.state.nc.us/>.

1.5.2 Outstanding Resource Waters Special Management Strategy

With the exception of the Tullulah River and Clear Creek watersheds, an Outstanding Resource Water (ORW) management strategy applies to all waters within this subbasin. Figure 4 presents the area and Table 5 lists the waters to which an ORW management strategy applies. Table 5 also distinguishes between those waters classified ORW and those to which the modified management strategy applies.

Figure 4 Chattooga River ORW Area

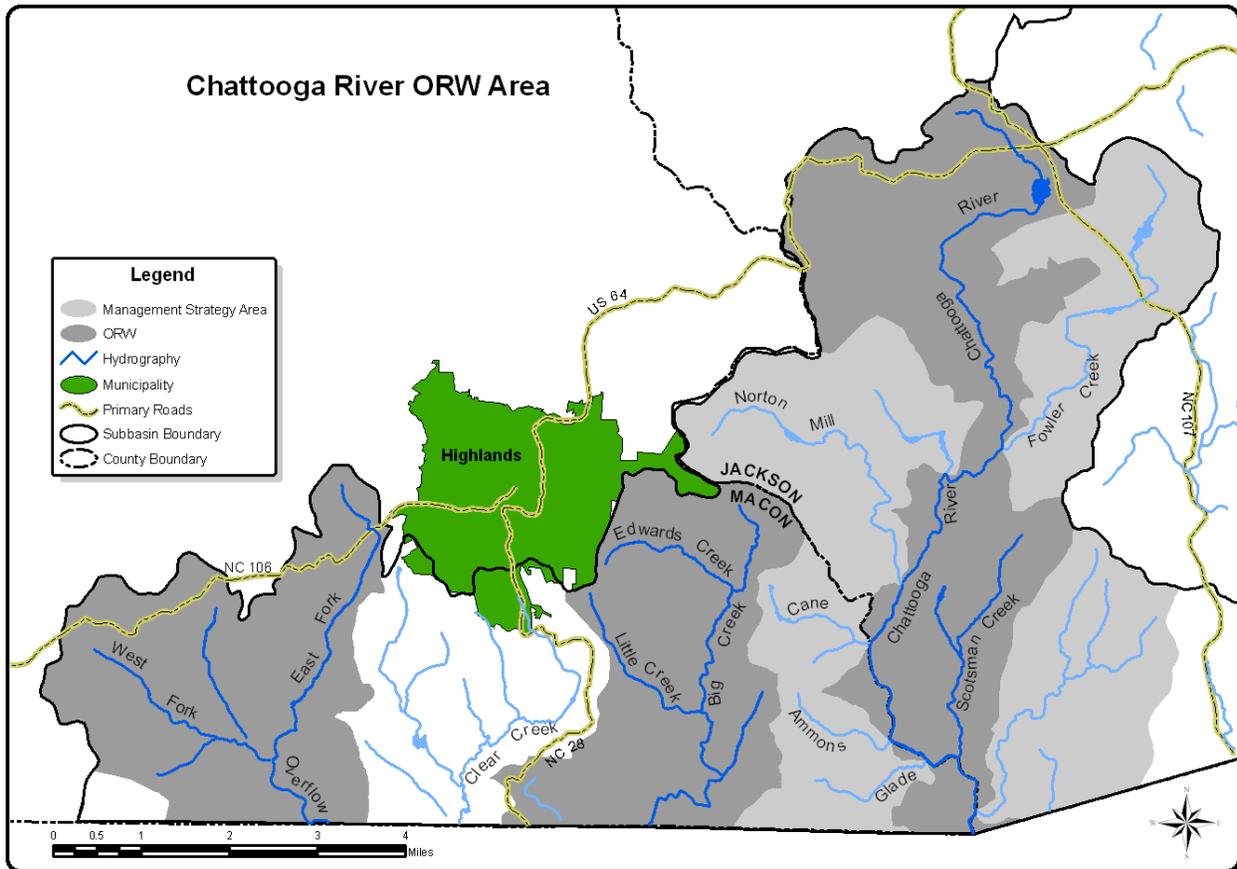


Table 5 Waters to which an ORW Management Strategy Applies

Watershed	Management Strategy Status
Chattooga River mainstem & two headwater tributaries	Classified ORW
Scotsman Creek and its tributaries	Classified ORW
Big Creek and its tributaries incl. Edwards & Little Creeks	Classified ORW
East & West Fork Overflow Creeks and tributaries	Classified ORW
North & South Fowler Creeks and tributaries	Modified management strategy applies
Green & Norton Mill Creeks and tributaries	Modified management strategy applies
Cane Creek and its tributaries	Modified management strategy applies
Ammons Branch and Glade Creek	Modified management strategy applies

Special protection measures that apply to waters classified ORW are set forth in 15A NCAC 02B.0225. No new discharges or expansions are permitted and a 30-foot buffer or stormwater controls are required for most new development. Specifically, development activities requiring a Sediment/Erosion Control Plan will be regulated as follows:

Low Density Option: Developments which limit single family developments to one acre lots and other types of developments to 12 percent built-upon area, have no stormwater collection system

as defined in 2H .1002(13), and have built-upon areas at least 30 feet from surface waters will be deemed to be in compliance.

High Density Option: Higher density developments will be allowed if stormwater control systems described in 2H .1003(i), (k) and (l) are installed, operated and maintained, so that the runoff from all built-upon areas generated from one inch of rainfall is controlled. The size of the control system must take into account the runoff from any pervious surfaces draining to the system.

The Asheville Regional Office of the Division of Land Resources (DLR), Land Quality Section has maps depicting and ORW areas throughout the region. When a construction project on land that is larger than one acre is proposed in an ORW watershed, DWQ is notified by DLR and these more stringent development standards are required as part of the sediment/erosion control plan approval process. Additionally, when DWQ receives a request for a permit for a discharge from a new subdivision, construction of a new sewer line, or for a 401 certification, DWQ determines the stream classification and notifies the local government and the applicant of these requirements.

The difference between the two strategies presented in Table 5 is that existing discharges on waters not classified ORW will be allowed to expand, provided there is no increase in pollutant loading. The prohibition of new discharges and the development restrictions outlined above apply equally to those waters classified ORW and to those with a modified management strategy. There are only three existing discharges within the modified management strategy area: Cullasaja Homeowner's Association, Mark Laurel Homeowner's Association and The Mountain.

1.5.3 Woolly Adelgid Pesticide Use

Citizens in the Savannah River basin informed DWQ of widespread, improper pesticide use by untrained persons attempting to control the spread of woolly adelgid infestations in eastern hemlock stands. The eastern hemlock is common along streams in the southern Appalachians. When used improperly or excessively, pesticides intended for use on trees can runoff into nearby streams causing catastrophic declines in aquatic communities. The NC Division of Forrest Resources can advise concerned citizens on the proper techniques for woolly adelgid control. <http://www.dfr.state.nc.us/>

1.5.4 Septic System Concerns

Development of rural land in areas not served by sewer systems is occurring rapidly in the Savannah River basin. Hundreds of permit applications for onsite septic systems are approved every year. Septic systems generally provide a safe and reliable method of disposing of residential wastewater when they are sited (positioned on a lot), installed, operated, and maintained properly. Rules and guidelines are in place in North Carolina to protect human health and the environment. Water quality is protected by locating the systems at least 50 feet away from streams and wetlands, limiting buildable lot sizes to a $\frac{3}{4}$ -acre minimum, and installing drain fields in areas that contain suitable soil type and depth for adequate filtration; drinking water wells are further protected by septic system setbacks.

Septic systems typically are very efficient at removing many pollutants found in wastewater including suspended solids, metals, bacteria, phosphorus, and some viruses. However, they are

not designed to handle other pollutants that they often receive such as solvents, automotive and lubricating oil, drain cleaners, and many other household chemicals. Additionally, some byproducts of organic decomposition are not treated. Nitrates are one such byproduct and are the most widespread contaminant of groundwater in the United States (Smith, et al., 2004).

One septic system generates about 30 to 40 pounds of nitrate nitrogen per year (NJDEP, 2002). Nitrates and many household chemicals are easily dissolved in water and therefore move through the soil too rapidly to be removed. Nitrates are known to cause water quality problems and can also be harmful to human health (Smith, et al., 2004).

Proper location, design, construction, operation, and maintenance of septic systems are critical to the protection of water quality in a watershed. If septic systems are located in unsuitable areas, are improperly installed, or if the systems have not been operated and/or maintained properly, they can be significant sources of pollution. Additionally if building lots and their corresponding septic systems are too densely developed, the natural ability of soils to receive and purify wastewater before it reaches groundwater or adjacent surface water can be exceeded (Smith, et al., 2004). Nutrients and some other types of pollution are often very slow to leave a lake system. Therefore, malfunctioning septic systems can have a significant long-term impact on water quality and ecological health (PACD, 2003).

Local governments, in coordination with local health departments, should evaluate the potential for water quality problems associated with the number and density of septic systems being installed throughout their jurisdiction. Long-term county-wide planning for future wastewater treatment should be undertaken. There are water quality concerns associated with both continued permitting of septic systems for development in outlying areas and with extending sewer lines and expanding wastewater treatment plant discharges. Pros and cons of various wastewater treatment options should be weighed for different parts of the county (based on soil type, depth, proximity to existing sewer lines, etc.) and a plan developed that minimizes the risk of water quality degradation from all methods employed.

In addition, local governments, again in coordination with local health departments, should consider programs to periodically inform citizens about the proper operation of septic systems and the need for routine maintenance and replacement. Owners of systems within 100 feet of streams or lakes should be specifically targeted and encouraged to routinely check for the warning signs of improperly functioning systems and to contact the health department immediately for assistance in getting problems corrected.

