LITTLE TENNESSEE RIVER BASINWIDE WATER QUALITY MANAGEMENT PLAN

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This document was approved and endorsed by the NC Environmental Management Commission on May 8, 1997 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the Little Tennessee River Basin.

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Top: Dry Falls on the Cullasaja River, Darlene Kucken
Bottom Left: Santeetlah Lake, NC Division of Travel and Tourism
Bottom Right: Nantahala River, NC Division of Travel and Tourism

FOREWORD

The Little Tennessee River basin is very rich in history, culture, recreation, scenery, wildlife and other assets. Clean water in the Little Tennessee River basin is critical to the health, economic well-being and quality of life of residents and tourists alike. Native Americans have long used the rivers. Even today, local churches use the waters for baptisms. The first documented baptism alongside the Cullasaja River was that of a female slave in 1837. Festivals held along the river banks promote enjoyment of the river and instill community pride.

Most water users in the basin, including industry, agriculture, tourists, and residents, rely on water for basic needs. These needs include water supply and/or disposal of treated wastewater. In addition, many businesses and residents of the basin rely directly or indirectly on the waters of the basin to meet their recreational needs and supply a living source through tourism. The highly successful multi-million dollar whitewater industry brings thousands of visitors annually. Tubing is also a popular form of recreation. Unique scenic beauty of gorges, waterfalls, wildlife and abundant flora has made the area popular for tourists. The waters of the Little Tennessee River basin are well known for lake recreation activities and trout fishing. To these groups and the public they serve, it is important that the basin's waters support viable fisheries, that the waters be relatively safe (low risk of contracting water-borne disease) and that they be aesthetically desirable (free of objectionable colors, odors and smells). Yet maintaining clean water becomes increasingly difficult and more expensive as the population grows, as land is developed and as competition for resources heighten.

The majority of the surface waters in the basin are of good quality based on Division of Water Quality monitoring data. The Use-Support assessment methodology used by DWQ found only about seven stream miles to be impaired. However, there are reasons to be concerned about the quality of several Support Threatened waters in the basin. In addition, many streams have not been monitored by DWQ, so there are potentially other streams with water quality problems.

Some areas of the basin have experienced significant population growth between 1970 and 1990. This growth rate is expected to continue. The construction of roads, driveways, commercial and recreational areas and homes must be undertaken with proper care to prevent sediments from reaching surface waters. In addition, timber harvesting and agricultural activities should use best management practices to avoid erosion and the resulting sedimentation to streams.

Preserving and enhancing the quality of water in the basin is beyond the capabilities of any one agency or group. State and federal government regulatory programs will play an important part, but much of the responsibility will be at the local level. Those who live, work and recreate in the basin have the most at stake.

This document provides a summary of the causes and sources of water pollution in the basin, the status of the basin's water quality, a summary of water quality rules and statutes that apply to water quality protection in the basin, and recommended strategies to protect and enhance the quality of the surface waters in the Little Tennessee River basin. The *Little Tennessee River Basinwide Water Quality Management Plan* will be used a guide by the NC Division of Water Quality (formerly Division of Environmental Management) in carrying out its water quality program responsibilities in the basin.

Beyond that, it is hoped that the plan will provide a framework for cooperative efforts between the various stakeholders in the basin toward a common goal of protecting the basin's water resources while accommodating reasonable economic growth.

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EXECUTIVE SUMMARY

NORTH CAROLINA'S BASINWIDE APPROACH TO WATER QUALITY MANAGEMENT - PURPOSE OF LITTLE TENNESSEE RIVER BASIN PLAN

Basinwide management is a watershed-based water quality management initiative being implemented by the North Carolina Division of Water Quality (previously Division of Environmental Management). The *Little Tennessee River Basinwide Water Quality Management Plan* is the twelfth basinwide water quality management plan prepared by the Division of Water Quality (DWQ) in a series of plans being prepared for all seventeen of the state's major river basins. DWQ uses the plans as guides in carrying out its water quality programs in each river basin.

The basinwide water quality management plans are not new regulatory documents. They are planning documents used to communicate the state's rationale, approaches and long-term water quality management strategies to policymakers, the regulated community and the general public. Each plan is completed and approved prior to the scheduled date for basinwide discharge permit renewals. The plans are then evaluated, based on follow-up water quality monitoring, and updated at five year intervals.

DWQ uses this approach as a means to report to the public on the current status of water quality in the basin, major water quality concerns and issues, projected trends in development and water quality, the long-range water quality goals for the basin, and recommended point and nonpoint source management options.

The *Little Tennessee River Basinwide Water Quality Management Plan* was approved by the Environmental Management Commission (EMC) in May 1997 and will be updated in 2002. Basinwide NPDES permitting is scheduled to commence in October 1997.

GOALS OF THE BASINWIDE APPROACH

The primary goals of DWQ's basinwide program are:

1) to identify and restore full use to impaired waters,
2) to identify and protect highly valued resource waters and biological communities of special importance, and
3) to manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.

In addition, DWQ uses this approach as a means to better identify water quality problems, develop appropriate management strategies, maintain and protect water quality and aquatic habitat, assure equitable distribution of waste assimilative capacity for dischargers, and improve public awareness and involvement in the management of the state's surface waters.

PUBLIC WORKSHOPS

Three public workshops were held in the Little Tennessee River basin on July 25, 1995 in Franklin and on April 9, 1996 on the Cherokee Indian Reservation and in Bryson City. A total of 45 people attended the three workshops. The workshops were co-sponsored by the North Carolina Cooperative Extension Service, the Little Tennessee Watershed Association and DWQ.

The purpose of the workshops was to familiarize stakeholders in the basin with DWQ's basinwide approach and to solicit comments for the basin plan. Workshop participants were asked to comment on what they see as the priority issues in the basin and how these issues could be addressed. A summary of the comments received from the workshop participants and DWQ's responses is provided in Chapter 6.

Priority issues identified at the workshop included:

1. Local involvement critical to success of water quality protection initiatives
2. Sedimentation, erosion and streambank stabilization are major water quality concerns
3. Effects of water quality regulations on agriculture need to be considered
4. Population growth and development
5. Need for more monitoring data and scientific-based pollution identification and problem-solving
6. Cooperation, communication and education between states and local groups
7. Protection of existing water uses
8. Private property rights versus regulation
9. Aesthetic and environmental impacts of abandoned cars, appliances and debris used for erosion control on the basin's rivers
10. Land-use planning
11. Wastewater treatment plant discharges

Many of these issues are interrelated and point to the need for growth management and planning at the local level to address population growth, increased sedimentation and stormwater runoff from developing areas and protection of existing water uses. Accordingly, growth management and planning are emphasized in the plan.

LITTLE TENNESSEE RIVER BASIN OVERVIEW

The Little Tennessee River basin is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina (Figure 1). The headwater reaches of the Little Tennessee River are located in Georgia. The Little Tennessee River basin encompasses about 1,800 square miles in Swain, Macon, Clay, Graham, Cherokee and Jackson counties. Much of the land in the basin is federally owned and lies within the Nantahala National Forest, Great Smoky Mountains National Park (GSMNP) or the Joyce Kilmer/Slick Rock Wilderness area. The basin also includes the entire Cherokee Indian Reservation.

Based on 1990 census data, the population of the basin was 67,083 people. The overall population density is 38 persons per square mile versus a statewide average of 123 persons per square mile. While population in the basin is low, there has been significant population growth. The percent population growth over the twenty year period between 1970 to 1990 was 31.5%. There is the potential for a significant increase in tourism and second home development associated with the opening (1996-1997) of the gambling casino on the Cherokee Indian Reservation. It is expected that the casino may draw 2 million additional visitors per year to the Reservation.

The land comprising the Little Tennessee River basin is mountainous (elevations to greater than 6,500 feet) and mostly rural. Nearly half of the land in the basin is federal lands (49%), most of which is forested. Most of the remaining non-federal lands are also forested. While most of the watershed is in forest lands, many retirement and second home developments are being built in the area. Most agriculture and development activities occur in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors increases the chances for sedimentation and erosion problems. Urban and built-up lands increased the most in the upper and lower Little Tennessee River subbasins from 1982 to 1992.

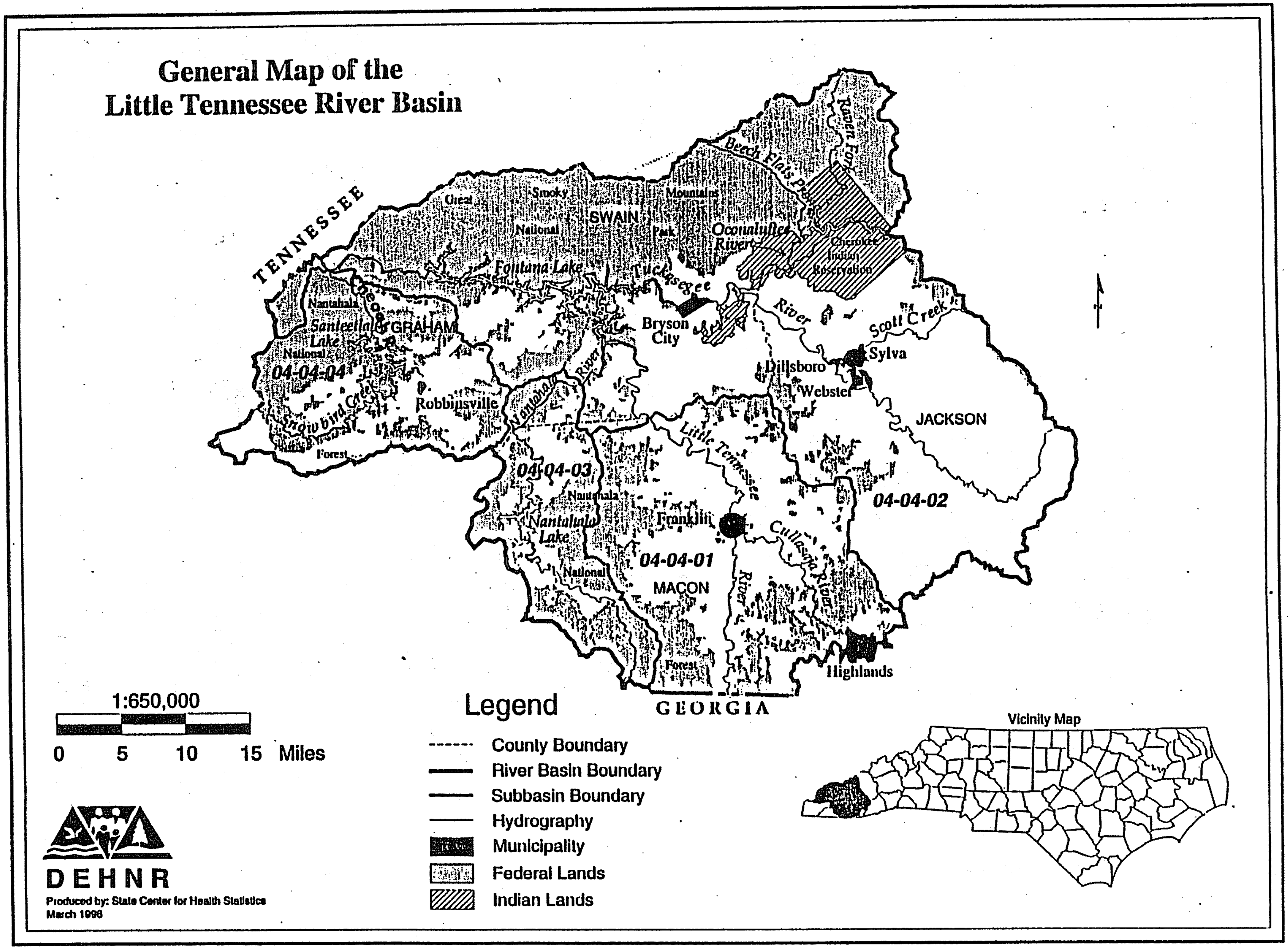


Figure 1 General Map of the Little Tennessee River Basin

There are a number of high quality and outstanding resource waters in the basin. The Little Tennessee River basin contains a high number of trout water streams and waterfalls as an attraction for tourists to the area. The Little Tennessee River basin is home to two federally listed endangered mussel species: the Appalachian elktoe and the Littlewing pearlymussel. Three other important aquatic species found in the Little Tennessee River are the Slippershell mussel, the Tennessee pigtoe mussel (both are state listed as endangered) and a fish called the Spotfin chub (listed as federally threatened).

The streams and rivers of the Little Tennessee River basin are still generally of high water quality. However, there are sedimentation and erosion problems occurring in the upper Little Tennessee River and several other streams in the basin. Turbidity is common in even good areas after rainfall. Sources of sedimentation include agriculture, mining operations, development, highway construction, and forest clearing. Several areas of concern include residential and commercial development in the Highlands area (upper Cullasaja River), effects of nonpoint source runoff, sand dredging operations, streambank erosion in the upper Little Tennessee River and runoff from ruby and gem mines to tributaries near Franklin, especially Caler Fork.

The Little Tennessee River basin, is vulnerable to the effects of acid deposition, due to its high elevations, low buffering ability of streams, and areas of aged growth forests and Anakeesta rock formations. Streamwater sulfate and nitrate concentrations have increased between 1975 and 1995 as the soils have reached their absorptive capacity for these nutrients. Portions of this basin receive high rates of both sulfates and nitrogen from atmospheric deposition.

ASSESSMENT OF WATER QUALITY IN THE LITTLE TENNESSEE RIVER BASIN

An assessment of water quality information collected by DWQ and other agencies indicate that the Little Tennessee River basin has generally good water quality. There are three streams that are impaired and several streams that are threatened. Below is a summary of some key monitoring data that reflect water quality in the basin. A more detailed presentation of this information can be found in Chapter 4.

Summary of DWQ Monitoring Data

Benthic Macroinvertebrates - These are primarily bottom-dwelling aquatic insect larvae such as species of mayflies, stoneflies, and caddisflies that are used as biological indicators of water quality. Measurements of the number and diversity of these organisms at strategic sampling sites is an important means of assessing water quality.

Benthic macroinvertebrate data were collected at 30 basin assessment sites during 1994, and a total of 81 sites have been rated since 1983. Of these, 47% were Excellent, 35% were Good, 13% were Good-Fair, 4% were Fair and 1% (1 site) was Poor (the Cullasaja River above Lake Sequoyah in 1991).

Fish Community Sampling - Approximately 61 species have been collected from the Little Tennessee River basin in North Carolina. Eight of these species have been given special protection status by the North Carolina Wildlife Resources Commission or the North Carolina Natural Heritage Program under the North Carolina State Endangered Species Act. Refer to Chapter 2 for a list of these species.

Fish Tissue Analysis - Fish tissue samples were collected from the Little Tennessee River at Topoco and Calderwood Reservoir. Results of fish tissue analysis indicated that levels of metals and organics contaminants in both samples were non-detectable or present at levels below FDA and EPA criteria.

Lakes Assessments - There were ten lakes in the Little Tennessee River Basin sampled as part of the Lakes Assessment Program. These lakes were rated Fully Supporting their uses. Lake Sequoyah was rated as Support Threatened. There was also a 200-acre section of Lake Santeetlah located in the West Buffalo Creek arm of the lake that was rated as impaired due to nuisance algal blooms. These lakes, by river subbasin, are presented in Chapter 4.

Ambient Monitoring - There are seven ambient monitoring stations in the Little Tennessee River basin where water quality samples are collected monthly by DWQ. Water quality at these stations infrequently exceeded state water quality standards. The most notable feature of the water chemistry data is low pH levels starting in the winter of 1991 and extending through 1994. Present pH levels appear to be more normal. This situation occurred throughout most of the basin and is not readily explained. Atmospheric deposition may have contributed to the low pH levels during this time.

Use-Support Ratings

Use-support ratings are a method to analyze water quality information and to determine whether the quality is sufficient to support the uses for which the waterbody has been classified by the state. The word *uses* refers to activities such as swimming, fishing and water supply. All surface waters in the state have been assigned a classification (Appendix II).

DWQ has collected chemical and biological water quality monitoring data throughout the basin, some of which is summarized above. Available data for a particular stream segment has been assessed to determine the overall *use support* rating; that is, whether the waters are *fully supporting, support-threatened, partially supporting,* or *not supporting* their uses. Fully supporting and support-threatened streams are not considered impaired. Streams referred to as *impaired* are those rated as either partially supporting or not supporting their uses. Use support ratings in the Little Tennessee River basin, described more fully in Chapter 4, are summarized below.

Of the 2702 miles of freshwater streams and rivers in the Little Tennessee basin, use support ratings were determined for 99% or 2684 miles with the following breakdown:

	Miles	Percent of Total
SUPPORTING		99%
Fully supporting:	2281	85%
Support-threatened:	376	14%
IMPAIRED		<1%
Partially supporting:	2.4	(0.09%)
Not supporting:	4.8	(0.18%)
NOT EVALUATED:		1%

The majority of the streams have good to excellent bioclassifications and very few standards were violated at the ambient stations. In fact, as noted above, there are only three impaired waters in the basin. However, although water quality is high in this basin, nonpoint source pollutants such as increased sedimentation, were evident at many of the sampling sites. Also, point source discharges pose potential water quality concerns in the upper portion of the Little Tennessee River. Those waters considered Impaired or Support Threatened based on monitoring data are discussed below by subbasin.

RECOMMENDED MANAGEMENT STRATEGIES FOR RESTORING IMPAIRED WATERS AND PROTECTING THREATENED WATERS

Upper Little Tennessee (Subbasin 04-04-01)

This subbasin includes the Cullasaja River watershed in its entirety and the upper portion of the Little Tennessee River. Refer to Figure 1 for a map of subbasin boundaries.

Little Tennessee River

The Little Tennessee River above Lake Emory is considered Support-Threatened. Nonpoint pollution is considered to be the major source of degradation to this reach of the river. This portion of the river has a high rate of streambank erosion. While some streambank erosion is natural, this issue may be heightened in this subbasin by urbanization, high population growth and agricultural practices. Best management practices for the various agricultural, urban and silvicultural activities in this subbasin are hoped to provide efficient and reliable means of protecting these waterbodies. Many efforts have been undertaken to address this issue through demonstration projects and Section 319 grants. Major challenges to the installation of best management practices will be getting funding and locating willing property owners.

This section of the river is the major focus of the Little Tennessee Watershed Association (LTWA). The Little Tennessee Watershed Association, in cooperation with others, continues to conduct streambank restoration projects to stabilize the eroding streambanks often seen in this subbasin. DWQ will continue to cooperate with and support the LTWA in their efforts.

There are indications that point source dischargers in Georgia may also be affecting water quality during low flow conditions. Ambient monitoring results at the station closest to the Georgia state line (Little Tennessee at Prentiss) show few excursions from water quality standards. However, under low flow conditions and maximum concentrations of certain parameters, water quality may be negatively affected. There are three wastewater treatment facilities near the state line (Burlington Industries, Vulcan Materials and City of Dillard).

The Little Tennessee River, from the North Carolina state line to the Town of Franklin, is considered federal critical habitat for the spotfin chub. There is no legislation to back the designation of critical habitat areas to protect endangered species at the state level. However, if requested, the Wildlife Resource Commission can prepare a conservation plan for endangered or threatened species that are found in habitats that support these species.

Recommendations:

The State of North Carolina and DWQ should work more closely with Georgia's Environmental Protection Division (EPD) to assure that proper NPDES limits are established and maintained for those dischargers in the upper Little Tennessee River watershed as these streams enter North Carolina. DWQ should also continue to support efforts by the LTWA and others to address streambank erosion along the Little Tennessee.

Cartoogechaye Creek

Much of the upper watershed of Cartoogechaye Creek, a tributary to the Little Tennessee, is classified as a water supply. Although monitoring of this watershed has not indicated any problems, further sampling and protection of this resource should continue. The lower section and mouth of the Cartoogechaye Creek is Support-Threatened due to nonpoint sources of pollution including erosion from development and runoff from US 64.

Recommendations:
To protect this resource from further degradation, the sources of runoff and potential ways to reduce the inputs need to be identified and addressed. Local governments and agencies and the nonpoint source team members may be good resources for this activity.

Mill Creek
Biological sampling in 1990 and 1991 on Mill Creek above and below the Town of Highlands WWTP resulted in a Fair bioclassification. This discharge has since been moved to below Lake Sequoyah on the Cullasaja River. It is likely that current impairment is due to runoff from the highly urbanized Town of Highlands. The Town has recently developed: 1) a Land Use Plan that addresses the need to "maintain or improve the present quality of the natural environment", 2) a Soil Erosion and Sedimentation Control Ordinance and 3) Subdivision Regulations.

Recommendations:
The implementation and enforcement of these local regulations, and the pursuance of Lake Sequoyah and its watershed for drinking water supply should help minimize further water quality degradation to Mill Creek. Further monitoring of Mill Creek in light of these local ordinances to demonstrate water quality improvements should be conducted.

Upper Cullasaja River
The Cullasaja River above Mirror Lake at Highlands (from its source to SR 1545, a distance of approximately 4.8 miles), is impaired due to nonpoint source pollution. The Cullasaja River is surrounded by areas of high population growth accompanied by accelerated urbanization. Nonpoint sources of pollution in the upper Cullasaja are likely from stormwater runoff, home construction sites, numerous golf courses and roads.

The construction process and poor access road design are thought to be significant causes of erosion. As roads are graded, the spoil is placed in roadside ditches and carried to streams through runoff. Many private drives have 18-19% slopes, even though 12% is considered to be the maximum permissible slope in sound engineering design. The steep slopes and thin soils found in this area make this region particularly vulnerable to land disturbances.

Further downstream from SR 1545 the Cullasaja River has a Support-Threatened status, which may be due to continued development as well as the addition of fertilizers from surrounding golf courses and residential construction.

In 1985, the Town of Highlands applied for an increase in the discharge from its wastewater treatment plant along with a relocation of the discharge to the Cullasaja River. Effluent limits and monitoring requirements for relevant pollutants were determined by Division staff for the expanded discharge to protect instream water quality. In the 1990's numerous public hearings were held and legal suits were filed due to concerns that the discharge would adversely affect local water uses (including baptismal services) and that low flow estimates of the waterbody were not correct. The final permit included effluent limits designed to protect both water quality and the various public uses of this waterbody. The discharge location is downstream of Lake Sequoyah and the impaired section of the river discussed above.

Recommendations:
This river, as well as the surrounding waterbodies, will be very dependent on best management practices for construction and long-term urban planning. The implementation and enforcement of local land use, subdivision and sediment controls, as discussed under Mill Creek are needed to minimize growth impacts. Additional efforts may be needed to restore full use to these waters.

DWQ's Regional Office in Asheville has added two additional ambient monitoring sites on the Cullasaja River downstream of the Highlands wastewater treatment effluent. DWQ will continue to monitor these sites monthly to assess the impacts of the effluent on downstream water quality.

Iotla Creek
Iotla Creek is Support-Threatened and appears to be affected by both sedimentation and high scouring of the substrate during rainfall events.

Recommendations:
To protect this resource from further degradation, the sources of runoff and potential ways to reduce the inputs should be identified. Local governments and agencies and the nonpoint source team members may be good resources for this activity.

Cowee Creek
Cowee Creek was selected to assess the effects of discharges from 8 ruby and gem mines and from Perry's Water Gardens. During macroinvertebrate sampling the site was very turbid, the stream bottom was heavily embedded with siltation and macroinvertebrate populations indicated nutrient enrichment.

Recommendation:
Additional biological surveys should be conducted to determine the sources of enrichment.

Lower Little Tennessee Subbasin (04-04-02)

The Lower Little Tennessee subbasin is the largest tributary watershed to the Little Tennessee River. This subbasin includes the Tuckasegee River with flow from the Oconaluftee River (refer to Figure 1 for map of the subbasin boundaries). Many of the High Quality and Outstanding Resource Waters within the Little Tennessee River basin are located in this subbasin.

Two waterbodies within this subbasin have a Support-Threatened status. Scott Creek, near the Town of Sylva, and Beech Flats Prong, a headwater of the Oconaluftee River.

Scott Creek
Scott Creek, a tributary to the Tuckasegee River, has a use-support rating of Support Threatened. The causes and sources of this rating have not been determined, but are likely due to nonpoint pollution.

Recommendation:
To protect this creek from further degradation, potential pollutants should be identified. Local governments and agencies, along with the nonpoint source team members, may be good resources for identifying the problem and solutions for restoring this waterbody.

Beech Flats Prong
Construction of US 441 in the Great Smoky Mountains National Park near Clingman's Dome at Newfound Gap exposed Anakeesta rock formations (locally known as "hot rocks"), resulting in low pH values and heavy metal concentrations in the headwaters of Beech Flats Prong. The stream reach most affected is limited in length to less than one mile. This long-term source of pollution has resulted in the classification of Support -Threatened for this stream. The National Park Service is extremely limited in available funds and has no plans to remediate this situation.

Tuckasegee River
Much of the southeast corner of this subbasin in the headwaters of the Tuckasegee River is designated as a water supply. Cedar Cliff, Bear Creek and Thorpe Reservoir (Lake Glenville)

Reservoirs are classified water supply. In April 1997, the Environmental Management Commission (EMC) voted to implement a supplemental classification of Alternative HQW Rule for Thorpe Reservoir (Lake Glenville), Hurricane Creek and Laurel Branch. Under the Alternative HQW Rule, sedimentation and erosion control requirements as implemented by the NC Division of Land Resources will apply to areas within one mile and draining to the HQW designated waters (refer to Section 6.5 for further details).

Recommendations:
DWQ will cooperate with the Division of Land Resources to implement the Alternative HQW Rule for Thorpe Reservoir, Hurricane Creek and Laurel Branch.

Many of the waters within the Cherokee Indian Reservation have High Quality classifications. Because of this, more communication and cooperation needs to take place with Cherokee Indian Reservation officials. Continued pressure to build and urbanize these areas will require attention to best management practices for construction and long term planning of urban areas. Refer to Section 6.5 for regulations and strategies applying to the Outstanding Resource Waters and High Quality Waters designations.

Fontana Lake
In the western section of this subbasin, Fontana Lake has water supply and HQW classifications in various streams around the lake. Development around this waterbody will need to be monitored closely to insure that sedimentation and nutrient enrichment of the reservoir does not occur.

Nantahala River (Subbasin 04-04-03)

This is the smallest subbasin in the Little Tennessee River basin, containing the majority of the Nantahala River watershed (refer to Figure 1 for subbasin boundary map). Much of the headwaters of the Nantahala River are classified as Outstanding Resource Waters.

White Oak Creek
White Oak Creek has a Partially Supporting status based on macroinvertebrate sampling. The impairment is due to impacts from a trout farm discharge to this waterbody. The impacts from the trout farm are localized to a short stream length. The trout farm implemented best management practices to reduce the amount of particulates in the discharge. This stream, like other streams with trout farms discharging to them, is more affected by the discharge during low flow conditions and higher water temperatures.

Recommendation:
Continued monitoring of this site to verify the effects of best management practices on stream water quality is recommended.

Silvermine Creek and Dicks Creek
Silvermine Creek and Dicks Creek, both tributaries to the Nantahala River, have a Support-Threatened status. The source of this impact is unknown and further monitoring will be required to verify its current status and possible causes.

Nantahala River
This is one of the most heavily used rivers in the southeast for primary recreation. Due to the popularity of this river for recreation, future development along the river could negatively impact water quality. This river serves the area as a valuable natural and economic resource.

Recommendation:
Local stakeholders (landowners, businesses and governments) should organize to assure the

water quality of the river is protected from uncontrolled growth.

Cheoah River (Subbasin 04-04-04)

The major waterbodies in this subbasin are the Cheoah River and Santeetlah Lake (refer to Figure 1 for subbasin boundary map).

West Buffalo Creek Arm of Santeetlah Lake
While not impaired, the West Buffalo Creek arm of the lake has been observed with nuisance algal blooms. This condition appears to be a result of excessive nutrient loading from trout farms located on this creek and Snowbird Creek.

Recommendations:
Operation of these farms should be examined to determine whether cost-effective measures exist to reduce nutrient discharges to these streams. Also, consideration should be given to not allowing any additional farms on these streams until this problem can be corrected.

POTENTIAL RECLASSIFICATION TO HIGH QUALITY WATERS OR OUTSTANDING RESOURCE WATERS

DWQ monitoring has found several waters that may be considered eligible for reclassification to HQW or ORW (Table 1) because they have excellent water quality. At present, the Nantahala River/Lake is pending reclassification to ORW. Wesser Creek (Swain County) is pending reclassification to include the supplemental classification of Tr (Trout).

Table 1 Potential HQW/ORW Reclassifications for the Little Tennessee River Basin

Subbasin	Catchment	Streams
Upper Little Tennessee River (04-04-01)	Nantahala National Forest	Coweeta Creek and nearby catchments
Nantahala River (04-04-03)	Nantahala River above Lake	upper White Oak Creek
Cheoah River (04-04-04)	Nantahala National Forest	Snowbird Creek Slickrock Creek Santeetlah Creek Deep Creek Tulula Creek Bear Creek Buffalo Creek Little Buffalo Creek

Thorpe Reservoir (Lake Glenville) Reclassification to Alternative HQW Rule
In 1989, DWQ received a request to determine whether Thorpe Reservoir would classify as HQW. DWQ biologists determined that Thorpe Reservoir had Excellent water quality and was eligible for reclassification. A public hearing and comment period was held in August 1994 on the proposed reclassification. Due to significant public interest and debate, the Environmental Management Commission instructed DWQ to proceed back to rule making with two options: Option One - Alternative HQW Rule and Option Two - Water Quality Management Plan. A public meeting and comment period was held in November 1996. A summary of public comments and DWQ staff recommendations were presented to the Environmental Management Commission (EMC) in April 1997. The EMC voted to implement Option One - Alternative HQW Rule for Thorpe Reservoir (Lake Glenville), Hurricane Creek and Laurel Branch.

Under both options, wastewater discharge requirements were identical and no additional stormwater requirements were applicable. Under the Alternative HQW Rule, sedimentation and erosion control requirements as implemented by the NC Division of Land Resources will apply to areas within one mile and draining to the HQW designated waters.

MAJOR WATER QUALITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES

A. GROWTH AND DEVELOPMENT

Growth Trends and Water Quality

There have been significant growth trends in the Little Tennessee River basin and these trends are expected to continue. The majority of growth has occurred in the upper and lower Little Tennessee River subbasins. Impacts to water quality from growth and development can include sedimentation, streambank erosion and degradation from a variety of fertilizers, chemicals, and road salts.

Traditionally, growth and development within the basin have occurred mostly along streams and rivers where lands are less steep. Growth along waterways can have a significant negative impact on water quality if construction activities are not undertaken with proper care. Recently, construction activities have also occurred on mountain ridges and slopes to obtain views of valleys and ridges. Building on slopes can be particularly harmful to water quality if appropriate erosion and sedimentation control measures are not used. Slopes tend to have soil types that are more shallow and unstable than those in valleys. Often, driveways to home sites on slopes are greater than 12% slope, the recommended slope for reducing erosion potential (Willett, pers. comm.).

In recent years, there has been a wave of development from Atlanta, Georgia to the North Carolina state line. Parcels of property have sold rapidly throughout many areas of the Little Tennessee River basin. To date, most of these parcels have not been built upon because they are held by out-of-state developers that intend to subdivide these large parcels when the market is most receptive. When these developers perceive that the timing is right for building out these parcels, the rate of growth within this basin will accelerate quickly and may be too fast for local governments to keep pace with (Willett, pers. comm). The basin also receives a tremendous seasonal population fluctuation.

Influence of the Cherokee Reservation Gambling Casino on Growth and Water Quality

The Cherokee Reservation gambling casino, the only legalized gambling casino in the Southeast, is geographically situated to become "...one of the primary gambling centers east of the Mississippi. It will be centrally located to many eastern cities and is within 500 miles of over half the U.S. population " (Willett and Eller, 1995). The development of the gambling casino on the Cherokee Indian Reservation is estimated to attract an additional 2 million visitors per year to the Reservation (Willett and Eller, 1995). It is expected that these visitors will tour surrounding areas.

A recent NC Division of Community Assistance study (Willett and Eller, 1995) suggests that western North Carolina will be permanently impacted by the development of the Cherokee

Indian Reservation gambling casino. In addition to other effects not related to water quality, the region is likely to experience:

1) The need for additional state support for road improvements. Road improvements will entail construction and the potential for increased erosion and sedimentation, as well as the potential for increased effects of acid runoff to streams if Anakeesta rock formations are exposed (See Multi-Lane Highways discussion below);

2) Increased traffic which may result in increased water quality impacts through stormwater runoff and exhaust emissions that contribute to acid rain (See discussion on acid deposition below);

3) The need for higher taxes to pay for increased local government services (water and sewer improvements alone are estimated at $5.6 million); and

4) The diversion of dollars from existing businesses to gambling enterprises (termed "economic cannibalism", Goodman 1994) and displacement (occurs when non-gambling tourists travel to other areas to avoid increased traffic, lack of hotel accommodations, and avoidance of the gambling atmosphere (Willett and Eller, 1995)) in relation to the tourism industry.

The gambling casino may have effects on water quality as the outlying areas experience accelerated commercial activity due to displacement and spill-over. Commercial activity in these outlying areas will increase the demand for roads and services. In addition, strong economic activity may be viewed as an additional reason to build second homes or establish a new business by an outside entrepreneur. Construction of homes, commercial areas and roads increase stormwater runoff and sedimentation problems. This demand for goods, services and homes will need to be planned for and managed in order to reduce the potential for degradation of water resources. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Multi-Lane Highways

The NC Division of Community Assistance report estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout western North Carolina. At present, there are six major corridors (See Chapter 2) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation and provide opportunities for easy access to rather remote areas of the state.

However, during road construction there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are frequently found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff.

Acid Rain/Deposition

The developments of thoroughfares will make it easier for tourists and developers to access and use the area. As traffic flow increases, the emission of nitrous oxides from vehicles to the atmosphere will increase. Nitrous oxides react with volatile organic compounds to create ozone. At times, ozone levels in the Great Smoky Mountains National Park can reach levels nearly double the average ozone level in Raleigh (News and Observer, Sept. 1, 1996). The man-made pollutants that trouble the peaks of the Smokies is creating more widespread problems throughout the Southern Appalachians, as noted by the Southern Appalachian Man and the Biosphere (SAMAB) The region of the GSMNP presently receives some of the most acidic deposition in the country. This high amount of deposition combined with low stream buffering ability and the fact that the capacity of the soils to absorb excess nutrients has been reached in many areas, has produced many low pH streams at higher elevations and higher stream nitrogen levels than in any other national park (News and Observer, Sept. 1, 1996). Refer to Chapter 4 for a more thorough discussion of the effects of acid deposition of high elevation streams in western North Carolina.

Recommendations for Addressing Growth Issues in Western North Carolina

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains the high water quality that is presently attracting people to the area. Local governments are responsible for the institution of programs and initiatives to balance economic growth with water quality protection. The following strategies are examples of a few of the initiatives local governments could pursue.

- Develop a Regional Organization. Over time, it will become important for western North Carolina to develop a regional organization representative of the eight counties (covering the Hiwassee, Little Tennessee, Savannah and French Broad River basins) that will be affected the most by the gambling casino (Willett and Eller 1995). While the focus of this group would primarily be aimed at economic development, a separate task force should be developed to conduct an analysis of the impacts of the casino on natural resources. Several economic development organizations are already in existence in the region.

- Develop a variety of land use management tools. Land use management issues will need to be addressed either by the local governments or by the natural resource task force of the regional organization. The lack of land use planning can have long-term negative impacts on water quality. Chapter 5, Section 5.6.3 presents information on local governments that have some land use planning in effect.

  Each of the 5 counties within the Little Tennessee River basin should have a Sedimentation and Erosion Control Ordinance, Pre-Development Ordinance (or subdivision ordinance) and a Land Use Plan in effect. The development of a Land Use Guidance System (LUGS) may be a feasible system to enact within these counties. LUGS is a systematic land use planning and management tool that allows for land use decisions to be made on a site specific basis. The concept behind LUGS is that projects are heard case-by-case, often based on a pre-existing growth guidance assessment. A committee reviews the project for its compatibility with the growth guidance assessment. Anyone from the surrounding area that may be affected by the project is invited to attend review meetings. The Board of Commissioners typically makes a final decision on the project. This process is less generic in its approach than zoning and yet allows for protection of the integrity of the community.

- Pursue Funding for Local Water Quality Protection Projects. The Clean Water Management Trust Fund (see Chapter 5, Section 5.8) may be a source of funding to assist local governments in obtaining a balance between economic growth and protecting surface waters of the state. Local governments will need to take responsibility for planning for the additional tourists and growth and development. This region of the state typically has a lower tax base than other areas of the state. Problems with aging infrastructure are also typical, especially for the small towns in the region. The Clean Water Management Trust Fund can be used for many purposes including: acquiring land for conservation easements and riparian buffers, restoring degraded lands to protect water quality, repairing failing waste treatment systems and septic tank systems and improving stormwater management. Local governments and regional organizations should consider pursuing funding through the Clean

Water Management Trust Fund as a means to upgrade infrastructure and manage land to protect water quality. Contact the Executive Director, Dave McNaught at (919) 974-5497 for more information.

- Support Local Initiatives for Water Quality Protection. Local governments and regional organizations can also promote local efforts to protect areas by developing greenways and bikeways, supporting citizen monitoring efforts and protecting lands near surface waters and wetlands.

- Encourage participation in the Straight Pipe Elimination Amnesty Program. This program is described further in Appendix VI.

At the state level, it may be possible to develop an incentive program for local governments to encourage the development and implementation of land use plans. This incentive policy has been applied in other states. The premise of an incentive program is to provide partial funding to staff the program if a local government develops a land use plan and then enforces its plan. If the land use plan is not developed or enforced, no funding would be available. Such a program has not yet been developed in North Carolina.

B. URBAN AND INDUSTRIAL STORMWATER CONTROL

Urban stormwater runoff can be a significant contributor to water quality problems. In the Little Tennessee River basin, urban development is relatively limited at present. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the urban areas in the basin. There are no municipalities in the Little Tennessee River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

Recommendations:

The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schueler, 1995).

The entire community plays a role in controlling the quality and quantity of urban stormwater. The following is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.

- Mapping of the municipal storm sewer systems and outfall points, and developing procedures to update this information.
- Evaluating existing land uses in the local government's jurisdictional area to determine where sources of stormwater pollution may exist. In addition, local government activities and programs could be evaluated to determine where existing activities address stormwater management in some way, or could be modified to do so.
- Developing educational programs to inform citizens of activities that may contribute pollutants to stormwater runoff (dumping oil, paint or chemicals down storm drains) and offering ways of carrying out such activities in an environmentally sound manner. Storm drain stenciling is a good example of a low cost educational tool.
- Developing programs to locate and remove illicit connections (illegal discharge of non-stormwater materials) to the storm sewer system. These often occur in the form of floor drains and similar connections.
- Reviewing local ordinances pertaining to parking, curb and gutter and open space requirements. Many of these local ordinances could be modified to enhance water quality

protection from urban stormwater runoff impacts. Maintaining riparian buffer strips along streams is an example.

- Creating wetlands along streams in urbanized areas of the watershed to receive stormwater runoff can be an effective way to remove pollutants by burial, chemical breakdown, and/or assimilation into plant tissue. Careful design of these systems is needed in order to adequately handle the altered hydraulics of urban areas.

Throughout the Little Tennessee River basin, various industrial activities with point source discharges of stormwater are required to be permitted under the federally mandated National Pollutant Discharge Elimination System (NPDES) stormwater program. These include activities related to manufacturing, processing, materials storage areas and construction activities with greater than five acres of disturbance. These dischargers must develop Stormwater Pollution Prevention Plans (SWPPP) to minimize and control pollutants discharged from their stormwater systems. These SWPPPs are subject to review and modification by the permitted facilities and DWQ to assure that management measures are appropriate.

C. EROSION AND SEDIMENTATION

Sedimentation has been identified as a source of stream impairment in the Little Tennessee River basin. Sedimentation has also been identified as a source of water quality degradation in the basin, resulting in the classification rating of Support Threatened of some waters. Sedimentation is a widespread nonpoint source-related water quality problem that results from land-disturbing activities such as land clearing, agriculture and development (e.g., highways, shopping centers, and residential subdivisions).

Such land disturbing activities can be especially harmful in the mountains where slopes are steep and rainfall is frequent. Also, since the mountain counties are increasingly popular areas for home, commercial and golf course construction, there is increasing potential for sediment to enter streams during land clearing and construction activities. After construction is complete, poorly designed roads, trails, and driveways may continue to erode into water bodies. In addition, as the amount of impervious surface area increases, the rate and volume of runoff after storms can, in turn, cause erosion of streambanks and flooding.

The degree of sedimentation affects both the habitat of aquatic macroinvertebrates and the quality and amount of fish spawning and rearing habitat. Sedimentation is one of the main factors limiting trout production in western North Carolina. Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West et. al, 1982).

Sedimentation impacts streams in several other ways. Eroded sediments may gradually fill lakes and navigable waters and may increase drinking water treatment costs. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals, pesticides, and road salts.

Recommendations:

For each of these major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.6 and are briefly described in Appendix VI.

Construction activities, private access roads, and state road construction are sources of sediment and management strategies are presented in the plan for reducing sedimentation to streams in the Little Tennessee River basin. The responsibility for controlling sediment from construction activities falls on many shoulders. Those with the greatest responsibility include: homeowners, developers/contractors, local governments, and the NC Division of Land Resources.

Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. Often, landowners do not realize the importance of building driveways for lasting service. Most of the responsibility for an access road rests on the landowner. However, local governments, citizens, and state/federal agencies can also make their contribution to solving this problem.

Table 2 Sediment Related Activities and Groups with Greatest Responsibility

Activity	Responsibility Groups	Chapter 6 Table Reference (with Recommended Measures)
Construction	Homeowners Developers Contractors Local Governments NC Division of Land Resources	Table 6.6
Private Roads	Homeowners Local Governments State/Federal Agencies	Table 6.7
State Roads	NC Department of Transportation	Table 6.8

D. FECAL COLIFORM BACTERIA

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

There are no monitored waterbodies in the Little Tennessee River basin where fecal coliform bacteria standards have been exceeded in at least 25% of the samples taken by DWQ. However, the Little Tennessee River at Prentiss and Cartoogechaye Creek have had a high percentage of samples greater than the standard of 200/100ml.

Recommendations:

Several general management strategies for addressing fecal coliform contamination include:
- Proper maintenance and pumping of the septic tank every three to five years.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Elimination of direct unpermitted discharges of domestic waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.13.

E. TOXIC SUBSTANCES

Toxic substances, or toxicants, routinely regulated by DWQ include metals, organics, chlorine, and ammonia, as described in Chapter 3.

The waters of the Little Tennessee River basin need to be protected from immediate acute effects and the residual chronic effects of toxic substances. Toxic limitations for point source discharges are based on the volume of the effluent released and the 7Q10 flow condition of the receiving stream. In the Little Tennessee River Basin, there are three facilities that have quarterly chronic toxicity test requirements: Franklin WWTP, Bryson City WWTP and Tuckasegee WSA WWTP. None of these plants discharge to streams with HQW or ORW classifications. All three plants have consistently passed the toxicity tests. The Town of Highlands is not required to conduct toxicity testing because the town is a minor discharger (500,000 gallon per day flow limit) with 100 percent domestic waste. Minor dischargers with 100 percent domestic waste are given the option of ammonia limits (9 mg/l summer and 20 mg/l winter) or toxicity test requirements. The Town of Highlands opted for ammonia limits, which they have consistently met.

Toxics from nonpoint sources of pollution typically enter streams during storm events through runoff from roads, parking lots, agricultural lands or golf courses. In the Little Tennessee River basin, low pH levels have been observed in many high elevation streams. These low pH levels have been attributed to chronic acid deposition and the low buffering capacity of high elevation streams in the basin. This issue is discussed further in Chapter 4.

Recommendations:
Continued research and monitoring will be important to fully understand the relationship between acid deposition and water quality and for furthering the development of policies to reduce impacts to surface waters from the chronic introduction of atmospheric pollution.

For wastewater treatment plants, DWQ will continue to require toxicity testing at qualifying facilities and to correct problems as necessary.

Chapter 6 also includes recommendations for residents to play their part in keeping toxic substances out of streams and lakes. Tables 6.11 and 6.12 in Chapter 6 contain environmentally-friendly recommendations for lawn, automobile and home care.

F. NUTRIENTS

Control of nutrients is necessary to limit algal growth potential, to assure protection of the instream chlorophyll *a* standard and to avoid the development of nuisance conditions on the state's waterways. Point source controls are typically NPDES permit limitations on total phosphorous (TP) and total nitrogen (TN). Nonpoint controls of nutrients generally include best management practices (BMPs) to control nutrient loading from areas such as agricultural land and urban areas.

Recommendations:

In the Little Tennessee River basin nutrient enrichment from point sources has been implicated as a potential source of water quality degradation on White Oak Creek, Cowee Creek, the West Buffalo Creek arm of Santeetlah Lake and in Lake Sequoyah near Highlands. These situations will continue to be monitored.

In addition, DWQ is aware of preliminary plans to site net pen trout farm operations in lakes in the Little Tennessee River basin. These net pen operations, if large enough in scale, can significantly increase phosphorous loading to lakes and result in local to lake-wide eutrophication. No net pen operations exist in North Carolina at present. DWQ envisions that requests for net pen production of trout be permitted only as pilot projects. Refer to Chapter 7, Section 7.3.6 for more details.

FUTURE INITIATIVES IN THE LITTLE TENNESSEE RIVER BASIN

Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts

Improving knowledge of and controlling nonpoint source pollution will be a high priority over the next five years. Nonpoint source pollution is primarily responsible for the impaired and threatened waters in the Little Tennessee River basin. The following two initiatives are underway to address the protection of surface waters from nonpoint sources of pollution.

- Establishment of nonpoint source basin teams in each basin. DWQ has begun to establish a nonpoint source team in each of the state's 17 major river basins. A nonpoint source team has been established in the Little Tennessee River basin. Refer to Section 7.2.2 of Chapter 7 for further description.

- Interagency Water Quality Monitoring. DWQ has begun the process of coordinating with other natural resource agencies on the idea of interagency water quality monitoring across the state. Refer to Section 7.2.3 of Chapter 7 for more information.

National Pollutant Discharge Elimination System (NPDES) Program

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes to municipal wastewater treatment plants so as to maintain reduced toxicity in effluent wastes;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or the use of alternative disinfectants;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for expansion well before they reach capacity.

Longer-term objectives will include refining overall management strategies after obtaining feedback on current management efforts during the next round of water quality monitoring. Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling byproducts of the treatment process (including nonpotable reuse of treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

Use of Discharger Self-Monitoring Data

DWQ will continue to explore the possibilities of using discharger self-monitoring data to a greater degree to augment the data it collects through the programs described in Chapter 4. Quality assurance, timing and consistency of data from plant to plant would have to be addressed. Also, a system would need to be developed to enter the data into a computerized database for later analysis. One method of data collection that is currently being explored includes developing a comprehensive list of monitoring sites for the basin that would be monitored by an association of NPDES dischargers with data input to STORET. A basinwide sampling program has been established for dischargers in the Neuse River Basin and to date appears to be successful.

Coordinating Basinwide Management With the Construction Grants and Loans Program

The potential exists to use the basinwide planning process to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. Completed basin documents are provided to the Construction Grants and Loan office for its use.

Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data including permitted dischargers, effluent limits, compliance information, water quality data and stream classifications, will be put in a central data center which will be made accessible to most staff at desktop computer stations. Much of this information is also being entered into the state's GIS computer system. As all this information is made available to the GIS system, including land use data from satellite or air photo interpretation, and as the system becomes more user friendly, the potential to graphically display the results of water quality data analysis will be tremendous.

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this Basinwide Water Quality Management Plan is to report to citizens, policy makers and the regulated community on:

- the current status of surface water quality in the basin,
- major water quality concerns and issues,
- projected trends in development and water quality,
- the long-range water quality goals for the basin, and
- recommended point and nonpoint source management options.

This Plan presents strategies for management of both point and nonpoint sources of pollution. The Division of Water Quality (previously Division of Environmental Managment) is preparing a basinwide water quality management plan for each of the state's 17 major river basins, as shown in Figure 1.1

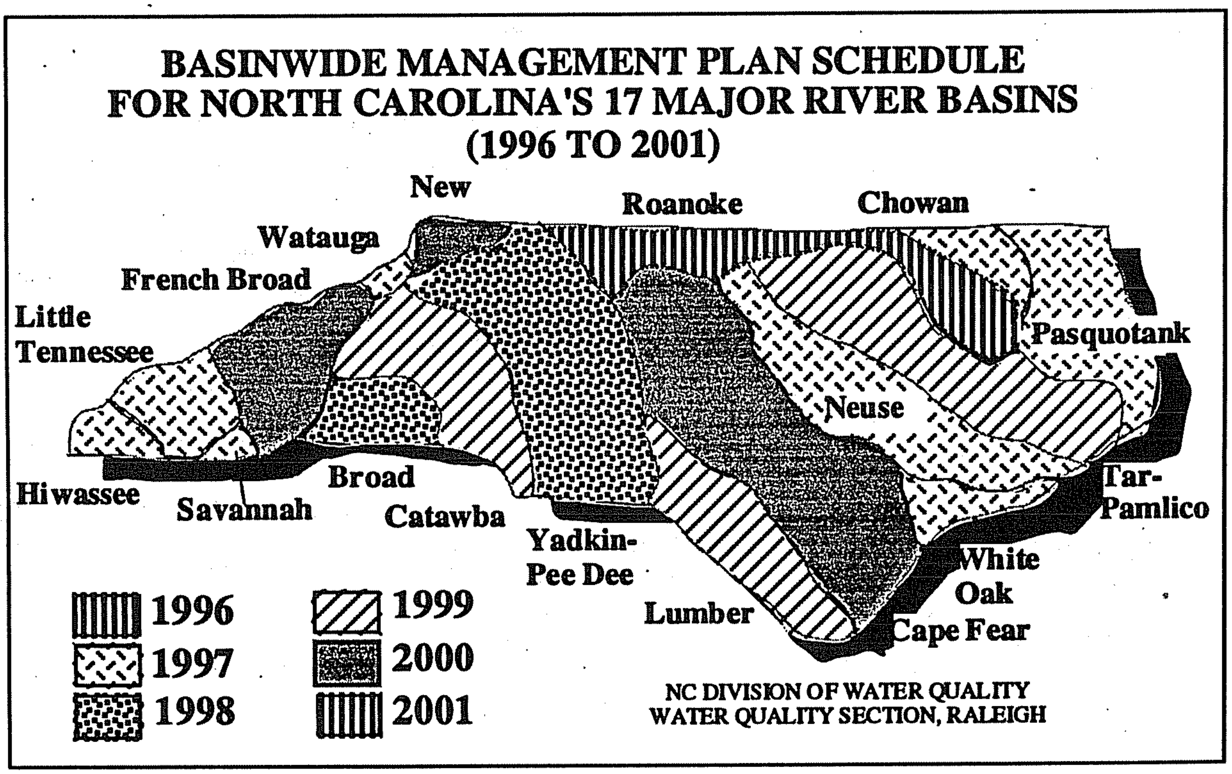


Figure 1.1 Basinwide Management Plan Schedule (1996 to 2001)

1.2 GUIDE TO USE OF THIS DOCUMENT

CHAPTER 1: Introduction - This chapter provides a non-technical description of the purpose of this plan, the basinwide water quality management approach and how this approach will be administered. The description of the basinwide management approach is based primarily on a 54-page framework document entitled *North Carolina's Basinwide Approach to Water Quality Management: Program Description - Final Report/August 1991* (Creager and Baker, 1991).

CHAPTER 2: General Basin Description - Some of the specific topics covered in this chapter include:

- an overview of the major features such as location, rainfall, population, physiography, etc.
- hydrology of the basin and its subbasins
- a summary of land cover within the basin based on results of a 1982 and 1992 Nationwide Resources Inventory (NRI) conducted by the US Department of Agriculture Natural Resources Conservation Service.
- population growth trends and densities by subbasin using 1970, '80 and '90 census data.
- major water uses in the basin and DWQ's program of water quality classifications and standards.

CHAPTER 3: Causes of Impairment and Sources of Water Pollution - This chapter describes both point and nonpoint sources of pollution. It also describes a number of important causes of water quality impacts including sediment, biochemical oxygen demand (BOD), toxic substances, nutrients, color, fecal coliform bacteria and others. Pollutant loading in the basin and general water quality problem areas are discussed.

CHAPTER 4: Water Quality and Use Support Ratings - This chapter describes the various types of water quality monitoring conducted by DWQ, summarizes water quality in each of the subbasins in the basin and presents a summary of use support ratings for those surface waters that have been monitored or evaluated.

CHAPTER 5: Water Quality Programs and Program Initiatives in the Basin - Chapter 5 summarizes the existing point and nonpoint source control programs available to address water quality problems. These programs are management tools available for addressing the priority water quality concerns and issues that are identified in Chapter 6. Chapter 5 also describes the concept of Total Maximum Daily Loads (TMDLs). TMDLs represent management strategies aimed at controlling point and nonpoint source pollutants. This chapter also describes various program initiatives being implemented in the basin to address water quality problems.

CHAPTER 6: Major Water Quality Concerns and Recommended Management Strategies - Water quality issues identified in Chapters 2, 3 and 4 are evaluated and prioritized based on use-support ratings, degree of impairment, and the sensitivity of the aquatic resources being affected. Recommended management strategies, or TMDLs, are presented that describe how the available water quality management tools and strategies described in Chapter 5 will be applied in the basin. This includes generalized wasteload allocations for dischargers and recommended programs and best management practices for controlling nonpoint sources.

CHAPTER 7: Future Initiatives - This chapter presents future initiatives for protecting or improving water quality in the basin. These may include both programatic initiatives such as improving permit compliance, or basin-specific initiatives such as developing strategies for restoring impaired waters.

1.3 NORTH CAROLINA'S BASINWIDE MANAGEMENT APPROACH

Introduction - Basinwide water quality management is a watershed-based management approach being implemented by DWQ which features basinwide permitting, integrating existing point and nonpoint source control programs, and preparing basinwide management plans. DWQ is applying this approach to each of the seventeen major river basins in the state as a means of better identifying water quality problems, developing appropriate management strategies, maintaining and protecting water quality and aquatic habitat, and assuring equitable distribution of waste assimilative capacity for dischargers.

After conducting public workshops to identify areas of concern and major issues, a basinwide management plan is prepared for each basin. The plans are circulated for public review and are presented at public meetings in each river basin. The management plan for a given basin is completed and approved preceding the scheduled date for basinwide discharge permit renewals in that basin. The plans are then evaluated, based on followup water quality monitoring, and updated at five year intervals.

DWQ began formulating the idea of basinwide management in the late 1980s, established a basin permitting schedule in 1990, began basinwide monitoring activities in 1990, and published a basinwide program description in August 1991. Basinwide management entails coordinating and integrating, by major river basin, DWQ's water quality program activities. These activities, which are discussed further in Section 1.4, include permitting, monitoring, modeling, nonpoint source assessments, and planning.

Water Quality Program Benefits - Several benefits of basinwide planning and management to North Carolina's Water quality program include:

- ***Improved program efficiency.*** By reducing the area of the state covered each year, monitoring, modeling, and permitting efforts can be focused. As a result, *increased fficiency* can be achieved for a given level of funding and resource allocation.
- ***Increased effectiveness.*** The basinwide approach is in consonance with basic ecological watershed management principles, leading to *more effective* water quality assessment and management. Linkages between aquatic and terrestrial systems are addressed (e.g., contributions from nonpoint sources). All inputs to aquatic systems and potential interactive, synergistic and cumulative effects are considered.
- ***Better consistency and equitability*.** By clearly defining the program's long-term goals and approaches, basinwide plans will encourage *consistent* decision-making on permits and water quality improvement strategies. Consistency and greater attention to long-range planning will promote a *more equitable* distribution of assimilative capacity, explicitly addressing the trade-offs among pollutant sources and allowances for economic growth.
- ***Increased public awareness of the state's water quality protection programs.*** The basinwide plans are an educational tool for increasing public awareness on water quality issues within the basin.
- ***Basinwide management promotes integration of point and nonpoint source pollution assessment and controls.*** Once waste loadings from both point and nonpoint sources are established, management strategies can be developed to prevent overloading of the receiving waters and to allow for a reasonable margin of safety to ensure compliance with water quality standards.

Basinwide Planning Schedule - The following table presents the overall basin schedule for all 17 major river basins in the state. Included are the dates for permit reissuance and the dates by which management plans are to be completed for each basin.

Table 1.1 Basinwide Permitting and Planning Schedule for North Carolina's 17 Major River Basins (1993 through 1998).

Basin	Target Date for Basin Plan Approval	Discharge Permits to be Issued	Basin	Target Date for Basin Plan Approval	Discharge Permits to be Issued
Neuse	2/93(approved)	4/93	Roanoke	9/96(approved)	1/97
			White Oak	1/97(approved)	6/97
Lumber	5/94(approved)	11/94	Savannah	4/97(approved)	8/97
			Watauga	4/97(approved)	9/97
Tar-Pamlico	12/94(approved)	1/95	Little Tennessee	5/97(approved)	10/97
Catawba	2/95(approved)	4/95	Hiwassee	5/97(approved)	12/97
French Broad	5/95(approved)	8/95			
New	7/95(approved)	11/95	Chowan	8/97	1/98
			Pasquotank	8/97	1/98
Cape Fear	9/95(approved)	1/96	Neuse (2nd cycle)	11/97	4/98
			Yadkin-Pee Dee	1/98	7/98
			Broad	6/98	11/98

The number of plans to be developed each year varies from one to six and is based on the total number of permits to be issued each year. For example, the Cape Fear basin, the state's largest, has about as many dischargers as all six of the small basins in 1997. This has been done in order to balance the permit processing workload from year to year. In years where more than one basin is scheduled to be evaluated, an effort has been made to group at least some of the basins geographically in order to minimize travel time and cost for field studies and public meetings.

Plans to be updated every five years - The earliest basin plans will likely not achieve all of the long-term objectives for basinwide management outlined above. However, plans are updated every 5 years. Updated plans will incorporate additional data and new assessment tools (e.g., basinwide water quality modeling) and management strategies (e.g., for reducing nonpoint source contributions) as they become available.

Basinwide Plan Preparation, Review and Public Involvement - Preparation of an individual basinwide management plan is a five year process which is broken down into four phases as described below.

Year	Activity
Year 1 to 3	Water Quality Data Collection/Identification of Goals and Issues: Year 1 entails identifying sampling needs and canvassing for information. It also entails coordinating with other agencies, the academic community and local interest groups to begin establishing goals and objectives and identifying and prioritizing problems and issues. Biomonitoring, fish community and tissue analyses, special studies and other water quality sampling activities are conducted in Years 2 and 3 by DWQ's Environmental Sciences Branch (ESB). These studies provide information for assessing water quality status and trends throughout the basin and provide data for computer modeling.

Year 3 to 4	Data Assessment and Model Preparation: Modeling priorities are identified early in this phase and are refined through assessment of water quality data from the ESB. Data from special studies are then used by DWQ's Technical Support Branch (TSB) to prepare models for estimating potential impacts of waste loading from point and nonpoint sources using the TMDL approach. Preliminary water quality control strategies are developed based on modeling, with input from local governments, the regulated community and citizen groups during this period.
Year 4	Preparation of Draft Basinwide Plan: The draft plan, which is prepared by DWQ's Planning Branch, is due for completion by the end of year 4. It is based on support documents prepared by DWQ's Environmental Sciences Branch (water quality data) and the Technical Support Branch (modeling data and recommended pollution control strategies). Preliminary findings are presented at informal meetings through the year with local governments and interested groups, and comments are incorporated into the draft.
Year 5	Public Review and Approval of Plan: At the beginning of year 5, the draft plan, after approval of the Environmental Management Commission (EMC), is circulated for review and public meetings are held. Revisions are made to the document, based on public comments, and the final document is submitted to the EMC for approval midway through year 5. Basinwide permitting begins at the end of year 5.

Implementation - The implementation of basinwide planning and management will occur in phases. Permitting activities and associated routine support activities (field sampling, modeling, wasteload allocation calculations, etc.) have already been rescheduled by major river basin. All National Pollutant Discharge Elimination System (NPDES) permit renewals within a basin occur within a prescribed time period after completion of the final basin plan, and will be repeated at five year intervals.

Nonpoint source management proposals will be implemented by several different avenues. The Water Quality Section is setting up nonpoint source (NPS) teams for each basin. These teams are made up of representatives of nonpoint source agencies, resource agencies, and special interest groups. The NPS teams are responsible for prioritizing specific watersheds for follow-up investigations, educational efforts, and best management practice (BMP) implementation. Funding for BMP implementation will be sought from sources such as existing cost-share monies or from federal Section 319 grants. In addition to projects in specific watersheds, the NPS team will develop programmatic action plans for each category of nonpoint source pollution. The action plans detail voluntary actions that agencies and groups have committed to complete to protect and improve water quality in the basin. Many of the action plan items involve increased educational efforts or enforcement of existing programs.

1.4 BASINWIDE RESPONSIBILITIES WITHIN THE DWQ WATER QUALITY SECTION

The Division of Water Quality is the lead state agency for the regulation and protection of the state's surface waters. The Division is comprised of four sections: Water Quality, Groundwater, Construction Grants and Loans and the Water Quality Laboratory.

The primary responsibilities of the Division of Water Quality are to maintain or restore an aquatic environment to sufficient quality to protect the existing and best intended uses of North Carolina's surface waters and to ensure compliance with state and federal water quality standards. The Division receives both state and federal allocations as well as funding through permit fee collections. Policy guidance is provided by the Environmental Management Commission. The major areas of responsibility are water quality monitoring, permitting, planning, modeling (wasteload allocations) and compliance oversight.

The Central office is divided into four branches, each branch is subdivided into two units (Figure 1.2 and Appendix A). The Planning Branch is responsible for developing surface water quality standards and classifications, nonpoint source program planning, administering the basinwide management program, modeling nonpoint pollution sources, developing use support ratings and improving the section's GIS capabilities. It also coordinates EPA water quality planning grants, state environmental policy act responsibilities and the implementation of the Comprehensive Conservation and Management Plan (CCMP) that resulted from the Albemarle-Pamlico Estuarine Study (APES).

The Operations Branch is responsible for permit compliance tracking, the pretreatment program, water supply watershed protection/local government technical support, and the operator training and certification program.

The Technical Support Branch is responsible for reviews and processing of discharge and nondischarge permits, coordinating development of TMDLs and wasteload allocations for dischargers, and providing primary computer modeling support.

The Environmental Sciences Branch is responsible for all biological and chemical water quality monitoring and evaluation including benthic macroinvertebrate monitoring (biomonitoring), fish tissue and fish communities studies, and the wetlands 401 Water Quality Certification program. The Branch is also responsible for effluent toxicity testing and evaluations, algal analyses, long term biochemical and sediment oxygen demand, and lakes assessments.

The seven Regional Offices carry out activities such as wetland reviews, compliance evaluations, permit reviews and facility inspections for both discharging and nondischarging systems, ambient water quality monitoring, state environmental policy act reviews, stream reclassification reviews, pretreatment program support and operator training and certification assistance. In addition, they respond to water quality emergencies such as oil spills and fish kills, investigate complaints and provide information to the public. Figure 1.3 shows the location of the regional offices and the counties that they serve.

REFERENCES CITED: CHAPTER 1

Creager, C.S., and J. P. Baker, 1991, North Carolina's Basinwide Approach to Water Quality Management: Program Description, DWQ Water Quality Section, Raleigh, NC.

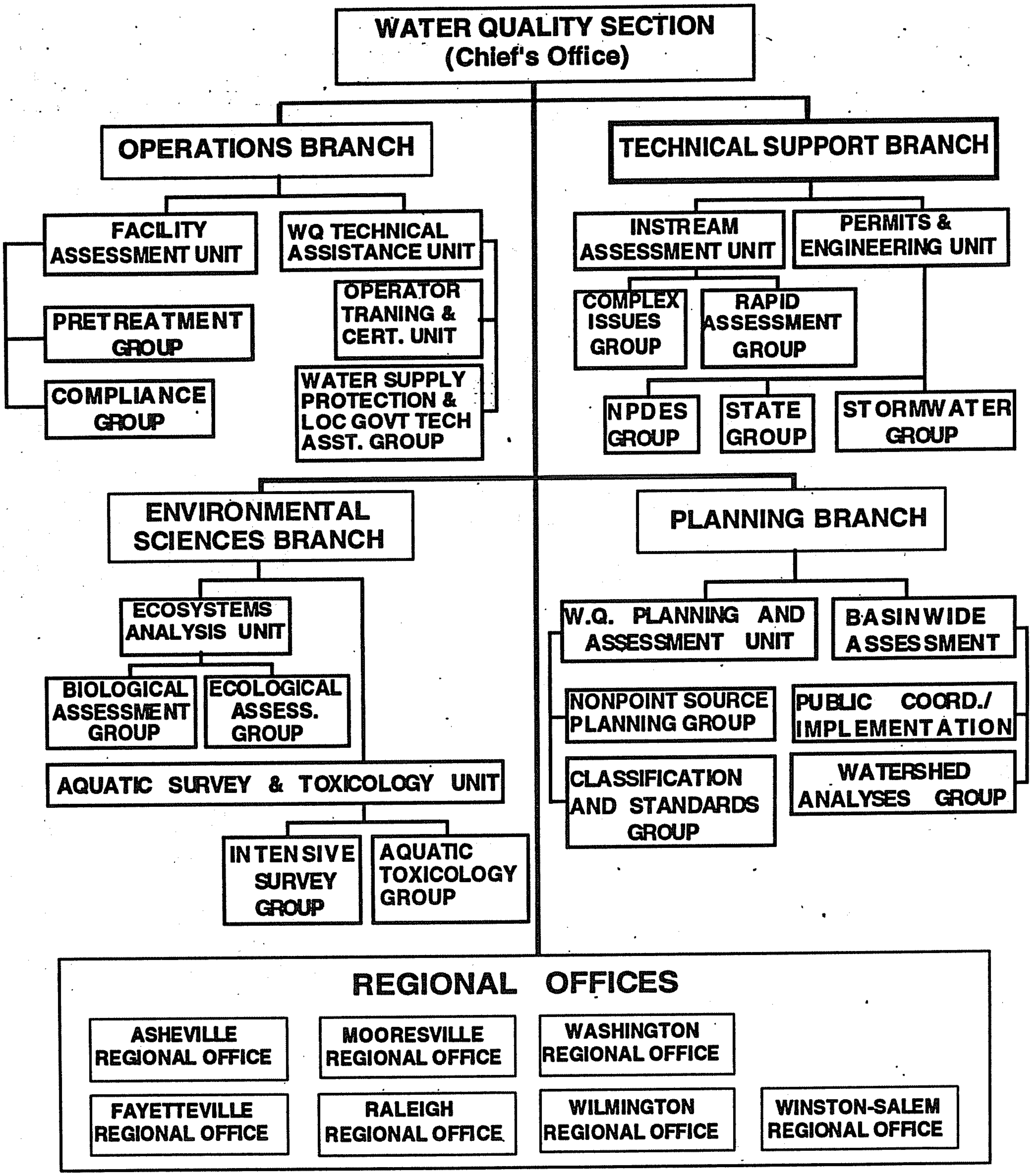
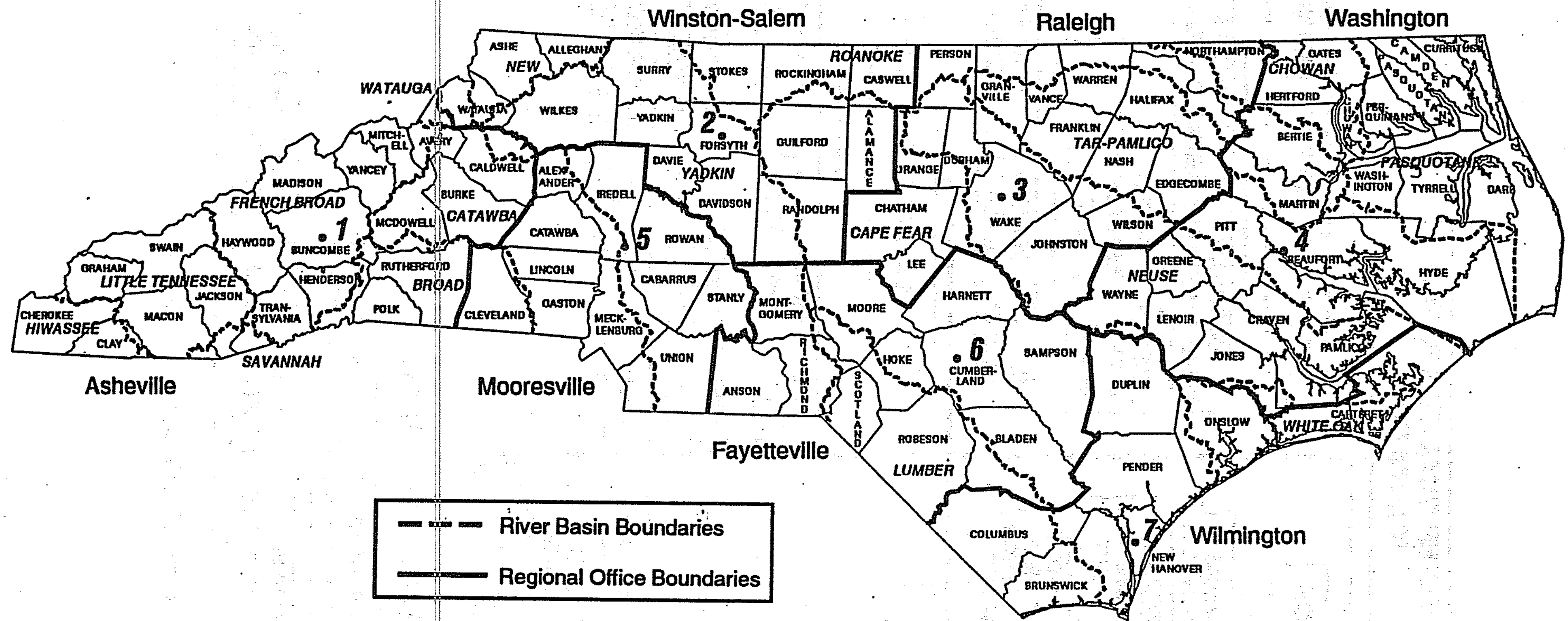


Figure 1.2 Organizational Structure of the DWQ Water Quality Section

DWQ CENTRAL AND REGIONAL OFFICES (WITH RIVERS BASINS)

N.C. Department of Environment, Health, and Natural Resources



1 - ARO
Mr. Roy Davis
Regional Supervisor
59 Woodfin Place
Asheville, NC 28801
(704)251-6208
Fax (704)251-6098

2 - WSRO
Mr. Larry Coble
Regional Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
(919)771-4600
Fax (919)771-4631

3 - CENTRAL OFFICE
DEHNR, DEM
Water Quality Section
P.O. Box 29535
Raleigh, NC 27626-0535
(919)733-5083
Fax (919)733-9919

3 - RRO
Mr. Ken Schuster
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4 - WaRO
Mr. Jim Mulligan
Regional Supervisor
1424 Carolina Avenue
Washington, NC 27889
(919)946-6481
Fax (919)975-3716

5 - MRO
Mr. Keith Overcash
Regional Supervisor
919 North Main Street
Mooresville, NC 28115
(704)663-1699
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6 - FRO
Mr. Tommy Stevens
Regional Supervisor
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(910)486-1541
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7 - WIRO
Mr. Rick Shiver
Regional Supervisor
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Wilmington, NC 28405-3845
(910)395-3900
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Figure 1.3 Location of Division of Water Quality Regional Offices

CHAPTER 2

GENERAL BASIN DESCRIPTION

2.1 LITTLE TENNESSEE RIVER BASIN OVERVIEW

The Little Tennessee River basin is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina (Figure 2.1). The headwater reaches of the Little Tennessee River are located in Georgia. The Little Tennessee River basin encompasses about 1,800 square miles in Swain, Macon, Clay, Graham, Cherokee and Jackson counties. Much of the land in the basin is federally owned and lies within the Nantahala National Forest, Great Smoky Mountains National Park (GSMNP) or the Joyce Kilmer/Slick Rock Wilderness area. The basin also includes the entire Cherokee Indian Reservation. The basin contains approximately 2,702 miles of freshwater streams and rivers and 10 reservoirs.

The North Carolina portion of the Little Tennessee River is typical of many other mountain rivers. Most tributaries are high gradient streams capable of supporting trout populations in the upper reaches. However, lower reaches of many tributary catchments are farmed or developed and may be affected by erosion, scour, and sediment deposition. The fall in the river is approximately 500 feet from the North Carolina/Georgia border to Fontana Lake (North Carolina State Department of Water Resources 1960).

The streams and rivers of the Little Tennessee River basin are still generally of high water quality. However, there are apparent sedimentation problems occurring. These sedimentation problems are associated with nonpoint sources of pollution such as agriculture, mining operations, development, and silviculture, construction, and urban growth. Several areas of concern include residential and commercial development in the Highlands area (upper Cullasaja River), road construction, sand dredging operations, and runoff from ruby and gem mines to tributaries near Franklin, especially Caler Fork. There are several trout farms operating in the Little Tennessee River basin. Some trout farming activities have been shown to impact aquatic life downstream.

Based on 1990 census data, the population of the basin was 67,083 people. While population in the basin is low, there has been significant population growth. The percent population growth over the twenty year period between 1970 to 1990 was 31.5%. There is the potential for a significant increase in tourism and second home development associated with the opening of the gambling casino on the Cherokee Indian Reservation. It is expected that the casino may draw 2 million persons and an additional 1,040,000 vehicles per year to the Reservation (Willett and Eller 1995).

The land comprising the Little Tennessee River basin is mountainous (elevations to greater than 6,500 feet) and primarily rural. Nearly half of the land in the basin is federal lands (49%), most of which is forested. Most of the remaining non-federal lands are also forested (37%). While most of the watershed is forested, many retirement and second home developments are being built in the area. Most agriculture and development activities occur in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors increases the chances for sedimentation and erosion problems.

Steep slopes limit the land area suitable for development and crop production. Slopes of less than 12% are desirable for development purposes and, in the absence of public sewer lines, soil depth

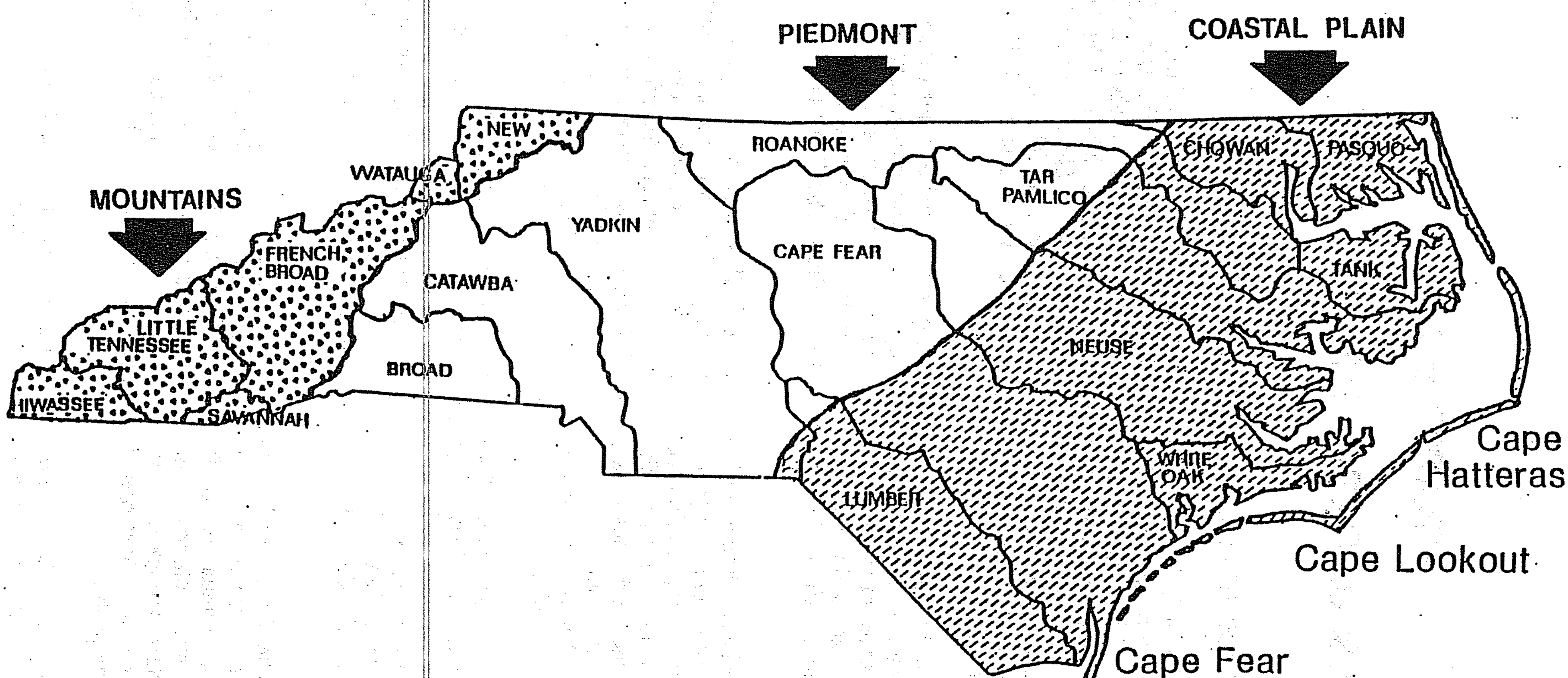

Figure 2.1 Physiographic Regions and Major River Basins of North Carolina

of three feet or more over bedrock is desirable in order to allow construction of onsite septic systems. It is estimated that just 18% of lands in North Carolina's mountains meet these requirements (Clay et. al., 1975). Statistics provided by the US Department of Agriculture's Natural Resources Conservation Service indicate that cultivated cropland is shrinking as developed lands are increasing. Major industries in the basin include silviculture, agriculture and tourism.

There are a number of High Quality and Outstanding Resource Waters in the basin, as discussed later in this chapter. The Little Tennessee River basin contains a high number of trout water streams and waterfalls, which attract many tourists to the area. The Little Tennessee River basin is home to three federally listed endangered species: the Spotfin chub, the Appalachian elktoe, and the Little-wing Pearlymussel. Two other important aquatic species found in the Little Tennessee River are the Slippershell mussel and the Tennessee pigtoe, found only in a portion of the Little Tennessee River in North Carolina (although more extensive populations are known from the Mississippi drainage or from Tennessee). Both are state listed as endangered.

The Little Tennessee River basin is vulnerable to the effects of acid deposition due to its high elevations, low buffering ability of streams, and areas of aged growth forests and Anakeesta rock formations. Streamwater sulfate and nitrate concentrations have increased between 1975 and 1995 as the soils have reached their absorptive capacity for these nutrients. Portions of this basin receive high rates of both sulfate and nitrogen inputs (SAMAB 1996).

The watershed is divided into 3 major hydrologic areas (*8-digit hydrologic units*) by the U.S. Water Resources Council and the U.S. Geological Survey (USGS). These major hydrologic areas are further subdivided by DWQ for management purposes (denoted by 6-digit numbers). The Little Tennessee River basin is naturally divided into four distinct subbasins: the Upper Little Tennessee with the Cullasaja River (04-04-01), the Lower Little Tennessee with the Tuckasegee River (04-04-02), the Nantahala River (04-04-03), and the Cheoah River (04-04-04). Table 2.1 presents the USGS hydrologic units and DWQ's corresponding subbasins. Figure 2.2 illustrates the location of the basin within North Carolina and the municipalities and major streams within the basin. Each subbasin will be discussed separately within this plan.

Table 2.1 Hydrologic Divisions in the Little Tennessee River Basin

Subbasin Name	USGS 8-digit Hydrologic Units	DWQ Subbasin 6-digit codes
Upper Little Tennessee River	06010202	04-04-01
Lower Little Tennessee River	06010203	04-04-02
Nantahala River	06010202	04-04-03
Cheoah River	06010204	04-04-04

Upper Little Tennessee (Subbasin 04-04-01)

The Upper Little Tennessee subbasin contains the Towns of Highlands and Franklin. Franklin, the only municipality in this area with a discharge greater than 0.5 MGD, discharges to the Little Tennessee River. The Town of Highlands discharges to the Cullasaja River. The Cullasaja River and Cartoogechaye Creek are the major tributaries to the Upper Little Tennessee River. Smaller tributaries include Middle, Coweeta, Cowee and Burningtown Creeks.

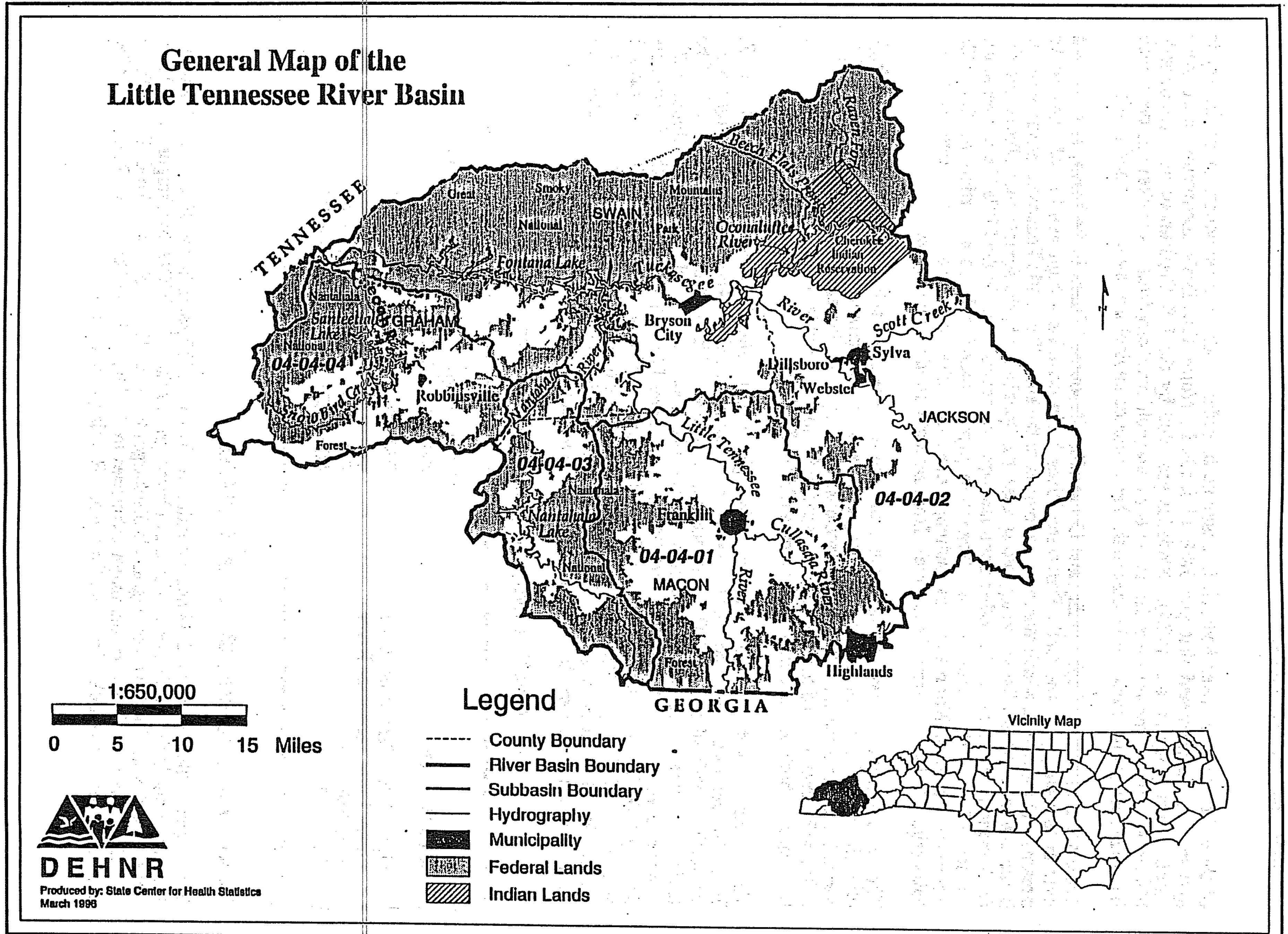

Figure 2.2 General Map of the Little Tennessee River Basin in North Carolina

Lower Little Tennessee (Subbasin 04-04-02)

The Lower Little Tennessee subbasin is the largest tributary watershed to the Little Tennessee River. This subbasin includes the Tuckasegee River, with flow from the Oconaluftee River. Much of this watershed is within either the Great Smoky Mountains National Park or the Cherokee Indian Reservation. Most streams on the north side of Fontana Lake are in a roadless wilderness region, and can be reached only by boat or by hiking. The area contains some of the most pristine areas in North Carolina, and some of the cleanest water in the state, including Hazel, Forney, Deep and Noland Creeks. Most of the rest of this watershed is included in the Nantahala National Forest, although this does not preclude some other land uses. Portions of this area are developed, and erosion from these areas causes some minor nonpoint source problems. Major municipal areas include Bryson City and Sylva.

High Quality Waters in the subbasin include the headwaters of Alarka Creek, the Tuckasegee River upstream of Tennessee Creek, Caney Fork and tributaries above Mull Creek, most of the Oconaluftee River catchment, and several small streams that were formerly classified for water supply. Streams in this area are characterized by slightly acidic pH, low nutrients and low conductivity. Most of the major streams (especially those outside of the Great Smoky Mountains National Park) become turbid after rainfall events, and sediment inputs have caused habitat degradation in some areas. The lower portion of the Oconaluftee River receives discharges from several large trout farms, but has maintained an Excellent bioclassification. Tellico Creek had heavy periphyton growths in a segment downstream of several trout farms, but was given an Excellent bioclassification.

The Tuckasegee River subbasin contains Fontana Lake and four other impoundments: Wolf Creek Reservoir, Bear Creek Reservoir, Cedar Cliff Lake, and Thorpe Reservoir. All five reservoirs are classified as oligotrophic. Thorpe Reservoir is currently being considered for reclassification to a High Quality Water (HQW).

Nantahala River (Subbasin 04-04-03)

The Nantahala River, from its source to the confluence with Roaring Fork, is currently classified as Outstanding Resource Waters. Much of the land adjacent to this reach is privately owned by the Rainbow Springs Corporation. The Nantahala River and most tributaries are high gradient systems capable of supporting wild trout populations. Nantahala Power and Light Company maintains a power generation facility at Beechertown below Nantahala Lake. The regulated reach of the Nantahala River below the power generators is very popular for rafting and canoeing. Recreational development has increased along the Nantahala Gorge corridor as it relates to the rafting and canoeing industry.

The Nantahala River subbasin contains Nantahala Lake, which was selected as a reference lake for the mountain ecoregion and was extensively studied by DWQ from 1991 through 1993. Results of these investigations have consistently shown excellent water quality. Nantahala Lake is being considered for reclassification to an Outstanding Resource Water (ORW).

Cheoah River (Subbasin 04-04-04)

The Cheoah River subbasin and significant sections of most tributary catchments are within the Nantahala National Forest and are minimally impacted. These tributaries are typically high-gradient streams capable of supporting trout populations. However, lower reaches of some tributaries and corridors along Tulula Creek, Sweetwater Creek, Little Snowbird Creek, Yellow Creek, and the Cheoah River are not in the National Forest and are prone to the effects of land-disturbing activities. The Robbinsville WWTP is the largest discharger in the watershed (0.63 MGD) and discharges a tributary of the Cheoah River (Long Creek).

The Cheoah River forms the headwaters of Santeetlah Lake. Seven trout farms discharge to Snowbird Creek or West Buffalo Creek. Phytoplankton blooms in Lake Santeetlah have been associated with the effluents from these trout farms, but there appeared to be little impact to the biota of the receiving streams. In addition to these facilities, there also are 10 other trout farms operating in Graham County (1996 data).

2.2 LOCAL GOVERNMENT AND PLANNING JURISDICTIONS

The basin encompasses part of Cherokee, Clay, Graham, Jackson, Macon and Swain counties and eight municipalities as presented in Table 2.2. All municipalities are located in District XII of the North Carolina League of Municipalities and within the Lead Regional Organization jurisdiction of the Southwestern North Carolina Planning and Economic Development Commission (Region A Council of Governments).

Table 2.2 Local Governments and Local Planning Units within the Little Tennessee River basin

County	% of county in basin	Municipality
Cherokee	2%	None
Clay	5%	None
Jackson	95%	Dillsboro Highlands* Sylva Webster
Macon	95%	Franklin Highlands*
Graham	100%	Robbinsville Santeetlah
Swain	100%	Bryson City

* Portions of Highlands are in both Jackson and Macon counties.

The basin also encompasses the Qualla Boundary, home of the Cherokee Indian Reservation. The Reservation contains 61,000 acres and a resident population of 6,951 persons. The Reservation lies at the foot of the Great Smoky Mountains National Park and contains six communities: Yellowhill, Birdtown, Painttown, Snowbird, Big Cove and Wolftown. The Reservation is governed by its own Tribal Council.

2.3 LAND COVER, POPULATION AND GROWTH TRENDS

2.3.1 General Land Cover

Land cover information in this section is from the US Department of Agriculture (USDA), Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) of 1992 and 1982 (USDA, 1994). The NRI is a multi-resource national inventory based on soils and other resource data collected at scientifically selected random sample sites. It is considered accurate to the 8-digit hydrologic unit scale established by the US Geological Survey (NRCS, 1993). A 1992 update of this data was recently released.

Table 2.3 summarizes acreage and percentage of land cover from the 1992 NRI for the Little Tennessee River basin. Land cover in the basin is dominated by private forest lands (approximately 37%) and federal lands (49%), which are also mostly forested. Together, these two forested land cover types account for 86% of the basin's land cover. There were no dramatic changes exhibited between 1982 and 1992 land covers for the basin as a whole (Figure 2.3). However, there are some notable changes within the subbasins. For example, in the Upper Little Tennessee subbasin there has been a decrease in cultivated cropland (-4,500 acres) and an increase in urban/built-up areas (+8,900 acres). The Tuckasegee subbasin shows similar trends with a decrease in cultivated and pasture lands (5,400 and 10,300 acres respectively) and an increase in urban/built-up areas (12,600 acres) and uncultivated croplands (8,200 acres). These trends are less visible in the Lower Little Tennessee, but there is a notable increase in urban/built-up lands in the Bryson City and Cherokee Reservation area of the subbasin (1,300 acres).

Land cover types identified by the NRI as occurring in the Little Tennessee River basin include cultivated cropland, uncultivated cropland, pastureland, forest land, urban and built-up lands, and other (rural transportation, small water areas and census waters). Descriptions of these land covers can be found in Table 2.4.

In addition, several state agencies including the NC Department of Transportation and the Department of Environment, Health and Natural Resources are working with the state's Center for Geographic Information and Analysis (CGIA) to develop statewide land cover information based on recent satellite imagery. However, until these other land coverages become available, the 1992 NRI data is the most recent comprehensive data for the basin as a whole.

More recent land cover information is available in the Southern Appalachian Assessment Report (1996). This land cover analysis was conducted by remotely sensed Landsat scenes into 17 classes of land cover. Hydrologic areas and watersheds were defined by the 8-digit Hydrologic Unit Code areas and ecological regions as defined by Omernik's Ecoregions of the Continental United States. The 17 classes were aggregated into 9 cover types (Table 2.5). Landsat image data was acquired between June 1990 and September 1994.

The Landsat data shows the majority of land cover in the basin to be in forest lands (Table 2.6). The SAA land cover data was obtained using different methodology than the NRCS land cover data, so direct comparisons can not be made between the two datasets. The data were obtained to look at the entire Appalachian Mountain region, rather than at a statewide scale or river basin scale. However, the data are useful for showing breakdown of cover types by Landsat image data taken at a regional scale and applied to a river basin.

Table 2.3 Estimated Acreage by Broad Land Use for the Little Tennessee River Basin - 1982 versus 1992 (Source: NRI)

1992 Broad Land Use

	Upper Little Tennessee* 06010202		Tuckasegee 06010203		Lower Little Tennessee 06010204			
LAND COVER	Acres	(%)	Acres	(%)	Acres	(%)	Total Acres	% of Total
Cult. Crop	2,500	1	2,900	1	1,300	1	6,700	1
Uncult. Crop	3,600	1	13,200	3	900	1	17,704	2
Pasture	20,900	4	7,600	2	6,500	4	35,010	3
Federal	248,200	50	204,500	44	106,600	60	559,455	49
Forest	164,900	33	199,000	43	46,700	27	410,787	37
Urban/Built-up	35,400	7	27,300	6	4,800	3	67,516	6
Other	16,800	3	9,700	2	9,400	5	35,911	3
Totals	492,300	100	464,200	100	176,200	100	1,133,100	100
% of Basin	43		41		15			

1982 Broad Land Use

	Upper Little Tennessee* 06010202		Tuckasegee 06010203		Lower Little Tennessee 06010204			
LAND COVER	Acres	%	Acres	%	Acres	%	Total Acres	% of Total
Cult. Crop	7,000	1	8,300	2	1,300	1	16,619	2
Uncult. Crop	3,100	1	5,000	1	900	1	9,003	1
Pasture	21,000	4	17,900	4	6,500	4	45,412	4
Federal	246,800	50	198,800	43	105,700	60	551,453	48
Forest	171,500	35	209,700	45	48,100	27	429,492	38
Urban/Built-up	26,500	5	14,700	3	3,500	2	44,711	4
Other	16,400	3	9,800	2	10,200	6	36,411	3
Totals	492,300	100	464,200	100	176,200	100	1,133,100	100
% of Basin	43		41		15			

* Includes Nantahala watershed

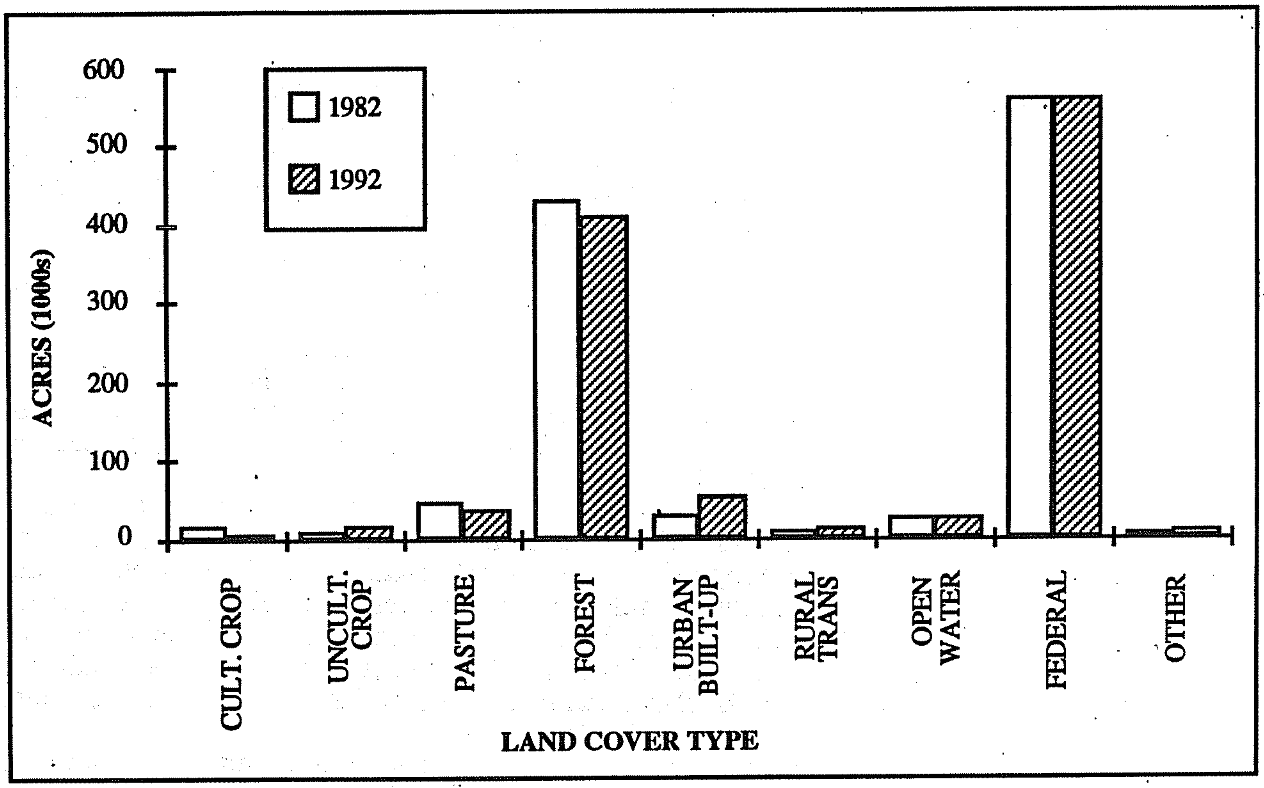

Figure 2.3 Land Cover Changes from 1982 to 1992 for Little Tennessee River Basin (Source: USDA-NRCS 1992 NRI)

Table 2.4 Description of Land Cover Types (1992 NRI - USDA SCS)

Land Cover Type (No.)	Land Cover Description
1) Cultivated Cropland	Land used for the production of adapted crops for harvest, including row crops, small-grain crops, hay crops, nursery crops, orchard crops, and other specialty crops. The land may be used continuously for these crops or they may be grown in rotation with grasses and legumes.
2) Uncultivated Cropland	Summer fallow, aquaculture in crop rotation, or other cropland not planted (may include cropland in USDA set-aside or similar short-term program).
3) Pastureland	Land used primarily for production of introduced or native forage plants for livestock grazing. This category includes land that has a vegetative cover of grasses, legumes, and /or forbs, regardless of whether or not it is being grazed by livestock.
4) Forest Land	Land at least 10 percent stocked by single-stemmed trees of any size which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover and not currently developed for non-forest use. Ten percent stocked, when viewed from a vertical direction, is a canopy cover of leaves and branches of 25 percent or greater. The minimum area for classification of forest land is 1 acre, and the area must be at least 1,000 feet wide.
5) Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Highways, railroads, and other transportation facilities are considered part of this category if surrounded by other urban and built-up areas. Tracts of less than 10 acres that do not meet this category's definitions (e.g., small parks or water bodies) but are completely surrounded by urban and built-up lands are placed in this category.
6) Other	Rural Transportation: Consists of all highways, roads, railroads, and associated rights-of-way outside Urban and Built-up areas; private roads to farmsteads, logging roads; and other private roads (but not field lanes). Includes the following three categories Small Water Areas: Water bodies less than 40 acres in size and streams less than one-half mile wide. Census Water: Large water bodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. Minor Land: Lands not in one of the other categories.

Table 2.5 Descriptions of SAA Landsat Land Cover Types

Cover Type	Description
Forest	Represents all forest types including: hardwood, coniferous, and mixed.
Herbaceous	Represents all areas that are vegetated and contain a crown closure of less than 25% (not forested), and are not classified by USGS land use data as agricultural (cropland or pasture).
Barren	Represents all areas that are greater than 75% non-vegetated, and contain less than 50% synthetic surfaces. Exposed rock surfaces (quarries) fall into this land cover type.
Pasture	Represents all areas defined as agricultural pasture lands.
Cropland	Represents all areas defined as agricultural crop lands.
Wetlands	Represents all areas that are coded as lacrustine or palustrine in the National Wetlands Inventory data, but are not subclassified as open water or forested with bottomland hardwood species.
Developed	Represents all areas that are greater than 75% non-vegetated and contain greater than 50% synthetic surfaces from USGS land use data. Urban land cover falls into this type.
Water	Represents all areas in water.
Indeterminate	Represents all other categories that could not be determined during analysis and includes clouds, shadows, etc.

Table 2.6 Land Cover in the Little Tennessee River Basin Using the Southern Appalachian Mountain Region (1990 to 1994) Landsat Data.

Cover Type	Acres	% of Total
Forest	1,062,912	89
Herbaceous	9,174	<1
Barren	1,363	<1
Pasture	41,543	4
Cropland	46,036	4
Wetlands	28	0.0
Developed	12,542	1
Water	17,407	2
Indeterminate	0	0.0
Total	1,191,008	100

Table 2.7 shows, by county, the estimated percentage of lands within the basin that are within the Nantahala National Forest.

Table 2.7 Acreage and Percent of Area (by County) Within National Forest Lands (Source: Ed Brown, USDA Forest Service, pers. comm.).

County	Total Acres in County	National Forest Lands (acres)	% of Area
Cherokee	289,171	93,163	32
Clay	136,902	65,716	48
Graham	184,762	113,241	61
Jackson	313,933	65,159	21
Macon	330,611	108,295	33
Swain	336,627	7,364	2
Total	1,592,006	452,938	29

Table 2.8 shows the major land uses on the Qualla Boundary of the Cherokee Indian Reservation. The Qualla Boundary encompasses most of the lands on the Reservation (93%).

Table 2.8 Major Land Uses of the Qualla Boundary (Source: Overall Economic Development Plan - Eastern Band of Cherokee Indians, 1976)

Land Use	% of Total Acreage
Forest/Timber	88.
Roads	4
Residential	3
Commercial	2
Agriculture	1
Govt/Schools/Utilities/Misc.	<1
Vacant	<1
Total	100

2.3.2 Population, Growth Trends and Tourism in the Basin

Population

There are six counties and seven municipalities located in whole or in part in the basin. The basin also contains the Cherokee Indian Reservation and the community of Cullowhee with Western Carolina University. Based on 1990 census data, the population of the basin was 67,083 people. Table 2.9 presents census data for 1970, 1980, and 1990 for all of the subbasins and the percent population growth within each subbasin. It also includes land and water areas and population densities (persons/square mile) by subbasin based on land area for each subbasin.

Figure 2.4 shows 1990 population densities by census block group for the Little Tennessee River basin. The overall population density was 38 persons per square mile versus a statewide average of 123 persons per square mile. Population density in the Little Tennessee River basin is low when compared to other basins such as the Cape Fear, which averages 160 persons/square mile and the Catawba, which averages over 300 persons per square mile.

The total population of the Cherokee Indian Tribe is 10,397 members. Of this, 6,951 are residents of the Cherokee Indian Reservation. The population of the Reservation grew 10.3% between 1980 and 1990. The population shifted from the rural areas of Cherokee and Graham counties to the more developed areas in Jackson and Swain counties (Espey, Huston & Associates 1996).

Table 2.9 Little Tennessee River Basin Population (1970, 1980, and 1990), Percent Population Change and Land Area Summaries

	POPULATION (Number of Persons)			POPULATION DENSITY (Persons/Square Mile)			LAND AND WATER AREAS			
							Total Land and Water Area		Water Area	Land Area
SUBBASIN	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
04-05-01	5,236	6,839	7,445	26	35	38	128,717	201	6	195
04-05-02	15,694	18,102	19,278	36	41	44	282,981	442	11	431
Totals	20,930	24,941	26,723	33	40	43	400,896	643	17	626

Note: Population, land area and water area were derived from 1970, 1980 and 1990 census data.

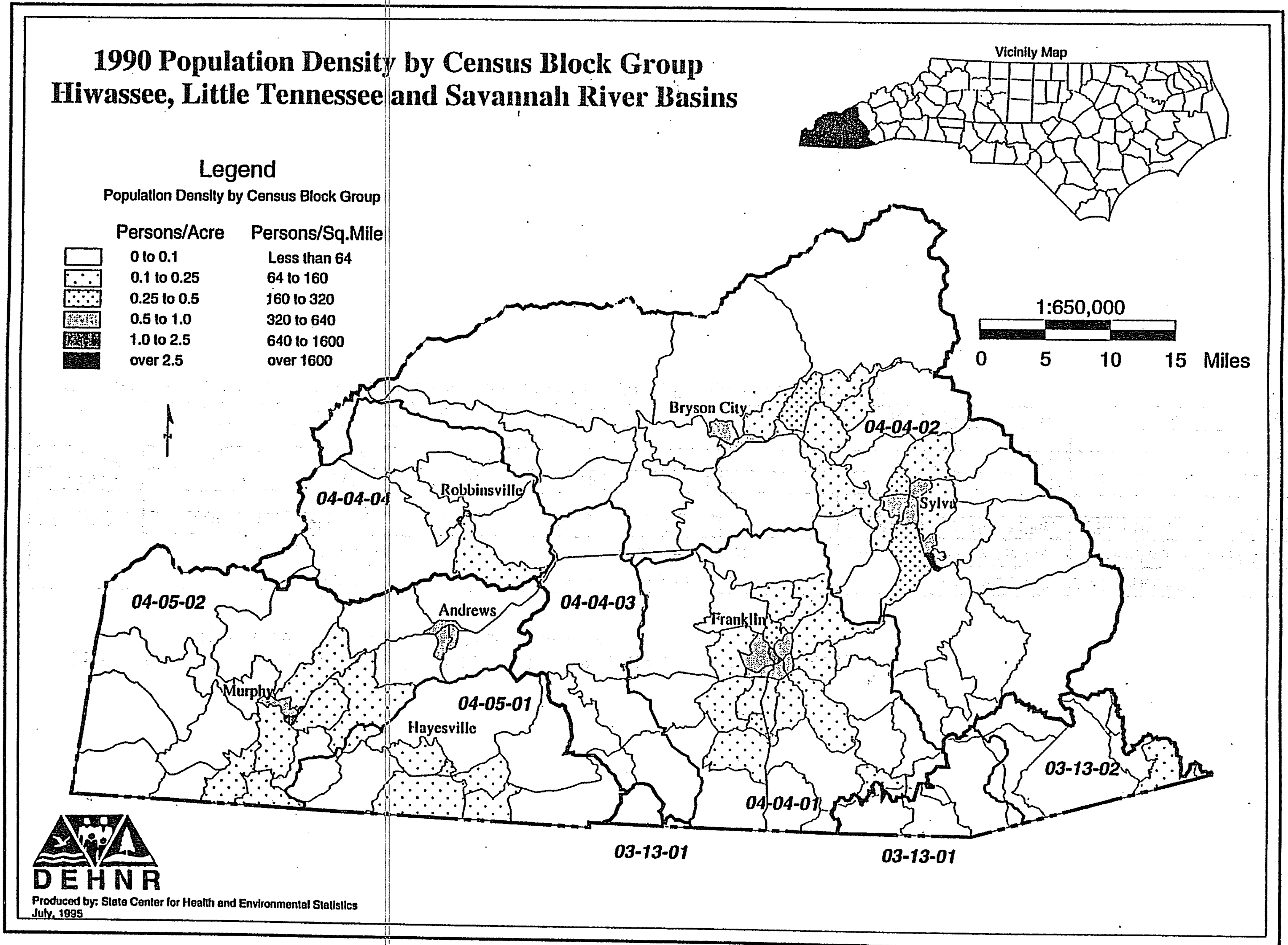

Figure 2.4 1990 Population Density by Census Block Group

In using these data, it should be noted that some of the population figures are estimates because the census block group boundaries do not generally coincide with subbasin boundaries. The census data are collected within boundaries such as counties and municipalities. By contrast, the subbasin lines are drawn along natural drainage divides separating watersheds. Therefore, where a census block group straddles a subbasin line, an estimate is made on the percentage of the population that is located in the subbasin. This is done by simply estimating the percentage of the census block group area located in the subbasin and then taking that same percentage of the total census block group population and assigning it the subbasin. This method assumes that population density is evenly distributed throughout a census block group, which is not always the case. However, the level of error associated with this method is not expected to be significant for the purposes of this document. It is also important to note that the census block groups change each ten years so comparisons between years must be considered approximate.

Growth Trends

Figure 2.5 presents the percent population growth by subbasin. The percent population growth over the last ten year census period (1980 - 1990) was 7.5% versus a statewide average of 12.7%. While population in the basin is low in comparison to many other basins in the state, the population has grown significantly (31.5%) between 1970 and 1990. The most populated area is near Franklin, but the other municipalities are also experiencing steady growth (Figure 2.4).

Growth rates for the municipalities within the Little Tennessee River basin can be found in Table 2.10 and Figure 2.6. When looking at the increase in population within the municipal boundaries it can be seen that growth rates are very high for a few of the municipalities between the years of 1990 to 1994. Between the years of 1980 and 1994, population increases were far more significant for the municipalities of Franklin (18%), Highlands (59%), Webster (126%) and Sylva (12%). For those municipalities showing a decrease in population, it is probable that the population is not actually leaving the basin, but moving instead to outside the municipal boundaries. For each of the counties in the basin, less than 12% of the population lives within a municipality (Office of State Planning). Much of the growth occurring within the basin is occurring along stream and river corridors, which can have a more significant impact on water quality due to a lack of municipal regulations and a dependence on septic systems. As noted earlier, increases in population tend to offset land cover previously held in forest lands. These numbers do not reflect changes in growth on the Cherokee Indian Reservation.

Table 2.11 shows the projected percent change in growth between 1990 and 2020 for the percentage of the county estimated to be within the basin. With the exception of Graham county, all other counties in the basin are expected to see increases in population growth. Macon and Swain counties are expected to see the greatest increases. These projections were made by the Office of State Planning prior to knowledge of the development of a gambling casino on the Cherokee Indian Reservation. It is likely that the presence of this facility will dramatically increase the population within at least the Upper Little Tennessee subbasin. The effects of growth and development associated with the casino may be visible not only throughout the entire basin, but throughout the entire western region of the state.

Tourism

There are great seasonal fluctuations in the population within the basin due to the influence of summer tourism. The population of Highlands can fluctuate from 2,000 in the winter to more than 20,000 in the summer (Highlands Chamber of Commerce). Highlands, at 4,118 feet is the second highest town east of the Mississippi; second only to Beech Mountain in Watauga county (Watauga River Basin) at 5,005 feet. The elevation of the Town of Highlands means it is surrounded by falling water (Adams, 1994), which makes it especially desirable as a tourist area.

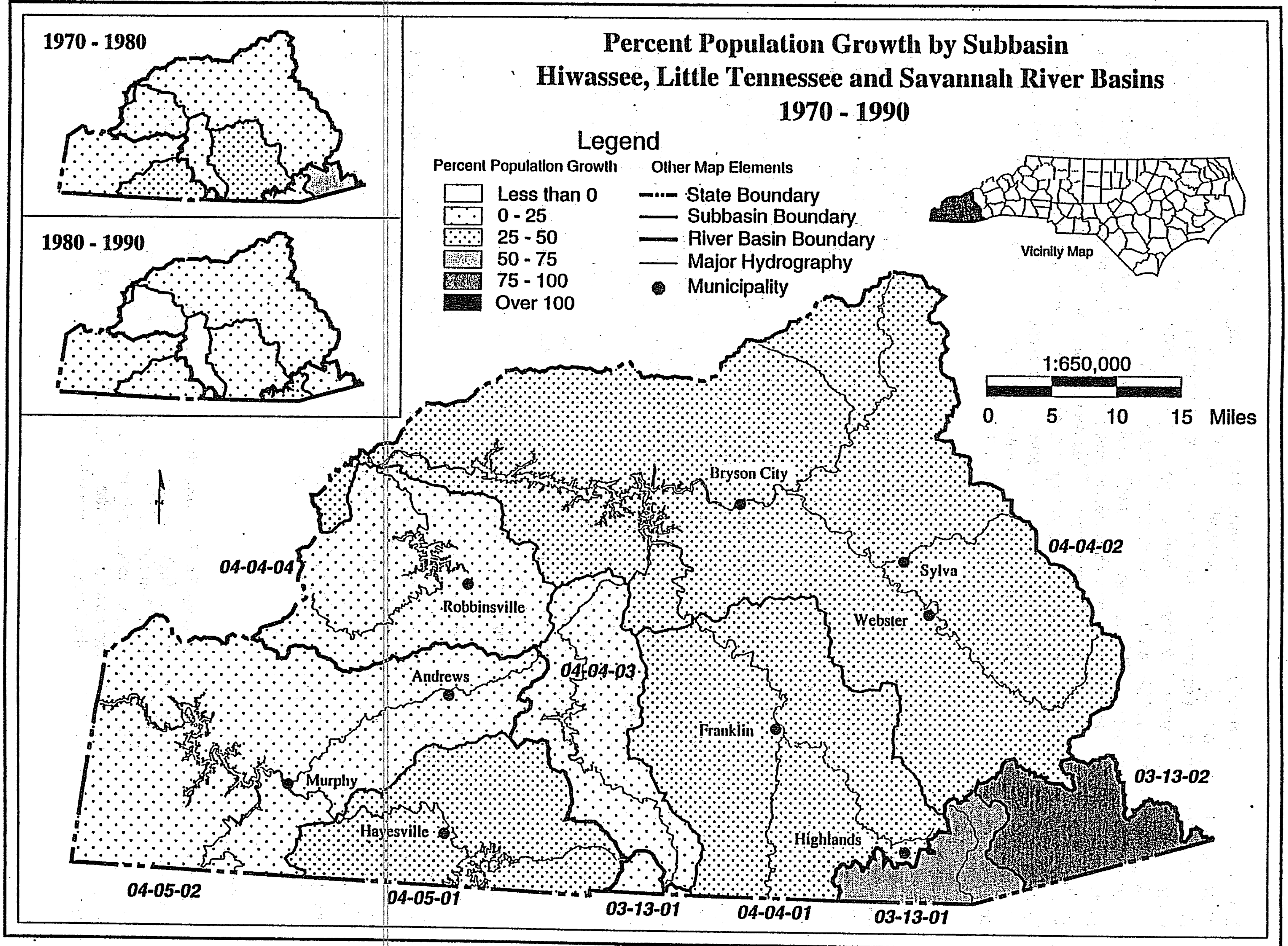

Figure 2.5 Percent Population Growth for Little Tennessee River Basin

Table 2.10 Growth Rates for Little Tennessee River Basin Municipalities

Municipality	April 1980	April 1990	July 1994	% Change (1980-1994)	% Change (1990-1994)
Robbinsville	814	709	783	-4%	+10%
Santeetlah	80	47	46	-43%	-2%
Franklin	2,640	2,873	3,111	+18%	+8%
Highlands*	653	948	1,039	+59%	+10%
Bryson City	1,556	1,145	1,092	-30%	-5%
Webster	200	410	452	+126%	+10%
Sylva	1,699	1,809	1,909	+12%	+6%
Dillsboro	179	121	150	-16%	+24%

* = Highlands is split between Jackson and Macon counties

Source: North Carolina Municipal Population 94. Office of State Planning, Fall 1995.

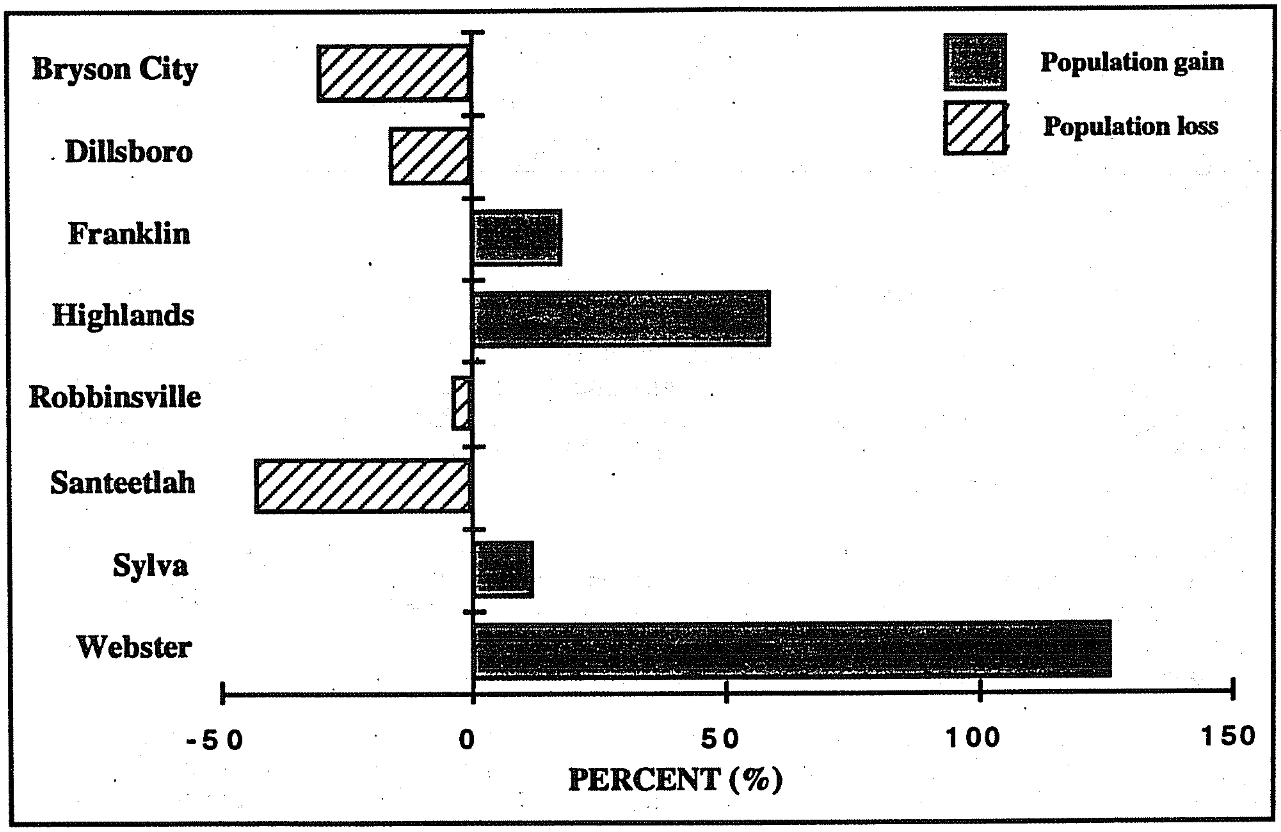

Figure 2.6 Percent Change for Municipalities in Little Tennessee River Basin - 1980 to 1994.

Table 2.11 Projected Population Changes (1990 to 2020) by County (Source: Office of State Planning 1995)

County	1990 Population	2020 Population	Projected % Change
Cherokee	403	428	+6
Clay	358	382	+7
Graham	7,198	6,563	-9
Jackson	23,060	23,870	+4
Macon	23,029	28,543	+24
Swain	11,268	13,151	+17

The Great Smoky Mountains and Cherokee Indian Reservation are also significantly affected by seasonal tourism. The development of a gambling casino on Reservation Lands within the Qualla boundary is expected to dramatically increase tourism not only on the reservation, but throughout the outlying areas as well. It is estimated that approximately 2 million additional visitors will be visiting the area as a result of the gambling casino (Willett and Eller 1995).

The NC Division of Community Assistance report (Willett and Eller 1995) estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout the region. At present, there are six major thoroughfares (referred to as Corridor 1 through 6, see Figure 2.7) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation. The projected increase in traffic on each of Corridor 1 through 6 can be found in Table 2.12.

Corridor 1 through Cherokee County will carry travelers through the Hiwassee River basin along US Hwy. 19/129, which parallels much of the Valley River. The development of the four-lane thoroughfare from Andrews to Almond (via Robbinsville) will provide access to Robbinsville and Graham County for economic development in the area (DOT 1996). Corridor 6 (US Hwy. 23/441) through Macon County will carry travelers through the upper Little Tennessee River basin along the upper Little Tennessee River to Dillsboro. Both of these Corridors are expected to drastically increase traffic flow (approximately 309,400 vehicles annually) over the mountains from the region of Atlanta, Georgia.

Corridor 2 (US Hwy. 441) allows travelers access to the Cherokee Indian Reservation from Gatlinburg and eastern Tennessee. US Hwy. 441 is the route through the Great Smoky Mountains National Park and provides access to the Blue Ridge Parkway (already the most visited National Park and the most traveled national parkway in the U.S.). It is anticipated that an additional 119,080 vehicles will annually travel through the Great Smoky Mountains National Park.

Corridors 3 and 4 are anticipated to increase annual vehicular traffic by 583,440 vehicles from Haywood and Jackson Counties and beyond. Corridor 3 (US Hwy. 19) is a narrow, curving and, in places, steep road from Maggie Valley, Waynesville, and I-40. This route is already congested in peak tourist seasons and accidents are frequent. Corridor 4 (US Hwy. 23/74) will serve as a main route for travelers from Waynesville, Asheville and I-40.

Corridor 5 is expected to bring an additional 28,080 vehicles on US 107 through the Savannah River basin and the community of Cashiers.

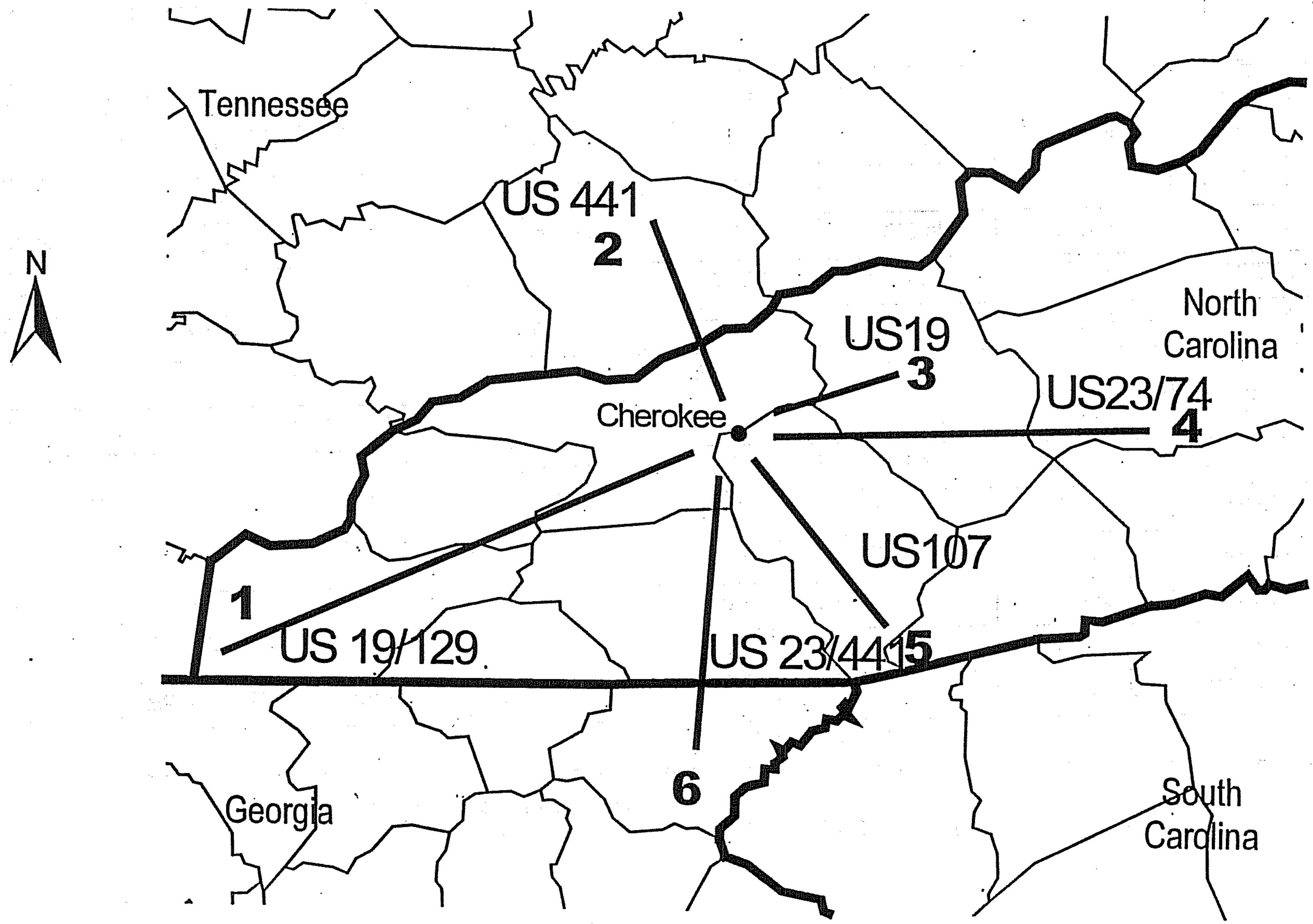

Figure 2.7 Major Traffic Routes to the Cherokee Indian Reservation Casino

Table 2.12 Projected Increase in Traffic along Major Corridors as a Result of the Cherokee Indian Reservation Gambling Casino

Month	Volume Increase							
	Percentage	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Total
January	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
February	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
March	4.9	3,567	5,835	7,211	21,378	1,376	11,593	50,960
April	6.2	4,514	7,383	9,124	27,049	1,741	14,669	64,480
May	8.6	6,261	10,241	12,656	37,520	2,415	20,348	89,441
June	11.1	8,081	13,218	16,335	48,427	3,117	26,263	115,441
July	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
August	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
September	11.1	8,081	13,218	16,335	48,427	3,117	26,263	115,441
October	13.6	9,901	16,195	20,014	59,334	3,819	32,178	141,441
November	6.2	4,514	7,383	9,124	27,049	1,741	14,669	64,480
December	3.7	2,694	4,406	5,445	16,142	1,039	8,754	38,480
Totals	100.0	72,800	119,080	147,160	436,280	28,080	236,600	1,040,000

Source: DCA study, September, 1995.

US Hwy. 19 is expected to be improved to a multi-lane road through the Cherokee Indian Reservation and to 4 - 5 miles on either side of the Reservation. In addition, due to the increased traffic flow expected as a result of the gambling casino, Business 441 on Reservation lands may be widened. The feasibility study is now being conducted on the US Hwy. 19 improvements (DOT 1996).

Improved, multi-lane roads provide opportunities for quicker and easier access to rather remote areas of the state. However, during construction of these roads there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are frequently found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff from roads.

2.4 IMPORTANT NATURAL RESOURCES

2.4.1 National Forests, Rivers, Waterfalls, and Lakes

A significant portion of the Little Tennessee River basin is held as public lands in the Nantahala National Forest, Joyce Kilmer Memorial Forest, and the Great Smoky Mountains National Park. Nantahala is a Cherokee word meaning "Land of the Noonday Sun", which is descriptive of the deep and narrow valleys that get primarily noon-day sun rays. The rivers and lakes of the basin are prime recreation sites for rafting, canoeing, boating, fishing and other leisure activities. The forest lands complement these activities with opportunities for hiking, camping, and mountain biking. The steep slopes, high elevation, and high rainfall results in a spectacular water resource in the basin. It is this resource that draws people to the area to live, build second homes, and to enjoy the scenery.

Upper Little Tennessee Subbasin (Subbasin 04-04-01)

This portion of the basin receives the highest annual rainfall in the state, averaging 100 inches of rain per year (Mark Burrows, pers. comm). The area surrounding the Town of Highlands is well endowed with some of the most spectacular waterfalls in the state. The location of the Nantahala National Forest within this subbasin also provides some scenic waterfalls.

The headwaters of the Cullasaja River (comes from the Cherokee word "Kulsetsiyi", meaning "honey locust place") begin in the Highlands area. The Cullasaja River drops 1,400 feet in a 7.1 mile stretch of river from Lake Sequoyah to the bottom of Cullasaja Falls. This stretch of river follows U.S. 64, a National Forest Service Scenic Byway. The gorge, which has four major waterfalls and several cascades, is a North Carolina Natural Heritage Area. The most popular of these waterfalls are the Bridal Veil Falls (60 foot cascade which can be driven under), Dry Falls (80 foot cascade which can be walked under), Cullasaja Falls (250 foot cascade) and Upper Buck Creek Falls (100 foot cascade) (Adams 1994).

In the Franklin area there are three waterfalls in the Nantahala National Forest that are well worth visiting: Rufus Morgan Falls (70 foot cascade), Big Laurel Falls (two tiers totaling 30 foot), and Mooney Falls (30 foot cascade). In addition to waterfalls, the area surrounding Franklin has a large number of gem mines (Adams 1994).

This subbasin contains both Lake Sequoyah, a non-recreational lake near Highlands and Lake Emory near Franklin, which is owned by Nantahala Power and Light Company. These reservoirs are discussed further in Chapter 4.

Lower Little Tennessee Subbasin (Subbasin 04-04-02)

The headwaters of the Lower Little Tennessee subbasin flow from Thorpe Reservoir into West Fork and from Wolf Creek and Bear Creek Reservoirs to form the Tuckasegee River. The Tuckasegee flows north to northwest through Jackson County. Near the community of Cullowhee, there are two waterfalls with significant scenic beauty located in the Nantahala National Forest: Moses Creek Falls (steep cascade several hundred feet in length) and Rough Butt Creek Falls (60 foot cascade) (Adams 1994).

The Oconaluftee River, the main tributary to the Tuckasegee River, flows from the Great Smoky Mountains National Park (GSMNP) through the Cherokee Indian Reservation. The Oconaluftee River joins the Tuckasegee just east of Bryson City.

Approximately 60% of the 550,000 acres of the GSMNP are located in western North Carolina, primarily in the Lower Little Tennessee subbasin. Beautiful waterfalls and streams can be found throughout the GSMNP. These include Flat Creek Falls (200 foot cascade), Chasteen Creek (30 foot cascade), and Forney Creek Cascade (200 foot long sliding cascade). In the Deep Creek area of the GSMNP, near the campground and picnic area, are four other notable waterfalls: Juneywhank Falls (30 foot cascade), Toms Branch Falls (80 foot drop), Indian Creek Falls (45 foot cascade), and Little Creek Falls (75 foot cascade) (Adams 1994). There are many pullouts to view the Oconaluftee River as it flows along U.S. 441 though the GSMNP.

Within the Qualla Boundary of the Cherokee Indian Reservation there are two waterfalls of particular beauty: Soco Falls (50 foot cascade) and Mingo Falls (over 150 foot cascade) (Adams 1994).

These waters flow into Fontana Lake, a TVA owned and operated reservoir. Fontana Lake is the largest reservoir in the basin and offers opportunities for boating, swimming and fishing. This subbasin also contains Wolf Creek Reservoir, Bear Creek Reservoir, Thorpe Reservoir (all owned by Nantahala Power and Light) and Lake Cheoah (owned by Tallassee Power, a subsidiary of ALCOA). These reservoirs also offer recreational opportunities.

Nantahala River Subbasin (Subbasin 04-04-03)

The Nantahala River begins in Macon County and winds its way through the mountains to form a deep gorge well-known and loved by canoeists, rafters, kayakers and fishermen. Nantahala Lake is within the headwaters above the gorge. Below the lake, the river joins the Little Tennessee River at Fontana Lake. Most of the Nantahala River is within the Nantahala National Forest. This area of the Forest has three waterfalls within Clay county: Bull Cove Falls (40 foot cascade), High Falls (over 150 foot cascades), and Thomas Falls (40 foot cascade) (Adams 1994). Other waterfalls in the National Forest near the community of Wesser are Camp Branch Falls (over 200 foot cascade), which is a North Carolina Natural Heritage Area and falls directly into the Nantahala River, and Bird Falls (100 foot cascade that flows into Nantahala Lake) (Adams 1994).

The Nantahala River flows into Nantahala Lake, owned by Nantahala Power and Light. The lake is a minimally impacted lake offering recreational activities.

Cheoah River Subbasin (Subbasin 04-04-04)

Tulula Creek and its tributaries in the Snowbird Mountains are the headwaters of Santeetlah Lake. Tulula Creek flows through the Town of Robbinsville. The wild boar, an exotic and nuisance animal that continues to be a problem in the Great Smoky Mountains National Park (subbasin 04-04-02) first escaped from captivity in the Snowbird Mountains into the surrounding areas.

The Nantahala National Forest in this subbasin offers many exciting waterfalls. Of these are Burgan Creek Falls (40 foot cascade), Sassafras Falls (50 foot cascade), Big Falls (really several small cascades), Middle Falls (20 foot cascades), Upper Falls (small sliding cascades) (Adams 1994).
The Joyce Kilmer Memorial Forest is 3,800 acres of virgin growth (the only virgin forest in the eastern U.S.). Within the Joyce Kilmer Forest, significant waterfalls on Slickrock Creek are Wildcat Falls (several drops) and Lower Falls (12 foot falls) (Adams 1994).

This subbasin contains Santeetlah Lake and Lake Cheoah, and a small portion of Lake Calderwood. Both lakes are owned by Aluminum company of America for hydroelectric generation. Santeetlah Lake offers a wide variety of recreational activities including fishing, boating, camping and swimming.

2.4.2 Rare Aquatic Faunal Species

In the Little Tennessee River basin, there are nineteen aquatic faunal species that are listed by North Carolina as Endangered, Threatened, Special Concern, or Significantly Rare (Table 2.13). Three of these are also listed by the federal government as Endangered or Threatened. Endangered species are those species that are in danger of becoming extinct. Threatened species are considered likely to become endangered within the foreseeable future. Species of Special Concern have limited numbers and vulnerable populations and are in need of monitoring. Significantly Rare species are those whose numbers are small and whose populations need monitoring (NC DEHNR 1995).

North Carolina's lower Little Tennessee River provides important habitat for a great diversity of fish, mollusks, and other aquatic species. The Little Tennessee River has one of the most significant aquatic faunal assemblages in the state.

Several rare mussels occur in a cluster in the Little Tennessee River above Fontana Dam, including the slippershell mussel (*Alasmidonta viridis*), Appalachian elktoe (*Alasmidonta raveneliana*), wavy-rayed lampmussel (*Lampsilis fasciola*), spike (*Elliptio dilatata*), Tennessee pigtoe (*Fusconaia barnesiana*), and Alabama rainbow (*Villosa iris*). These species are clustered in an area that corresponds to the protected critical habitat of the spotfin chub (*Cyprinella monacha*), a Federal Threatened fish. These rare mussels are part of a mussel community which is North Carolina's best extant example of the Mississippi Drainage Basin's diverse mussel assemblage. However, because Fontana Dam separates this assemblage from other populations in Tennessee, if the populations in North Carolina are lost, there will be no chance for natural reestablishment.

The littlewing pearlymussel (*Pegias fabula*), a State and Federal Endangered species, was last observed in the Little Tennessee River basin in 1990. A small, chalky-white mussel, the littlewing pearlymussel generally likes to be buried in substrate between riffles and pools.

Two rare crustaceans found in the Little Tennessee River basin are the Little Tennessee crayfish (*Cambarus georgiae*) and the Carolina skistodiaptomus (*Skistodiaptomus carolinensis*). The Little Tennessee crayfish remains hidden in its burrow during the day, coming out between dusk and dawn to feed and move about. The very small (1mm) copepod, Carolina skistodiptomus, is found only in Lake Ravenel, Macon County. Little is known about its ecology.

Table 2.13 Rare Aquatic Species in the Little Tennessee River Basin (Source: NC Natural Heritage Program 1996)

Common Name	Scientific Name	Listing Status: State	Listing Status: Federal
Slippershell Mussel	*Alasmidonta viridis*	E	
Tennessee Pigtoe	*Fusconaia barnesiana*	E	
Appalachian Elktoe	*Alasmidonta raveneliana*	E	E
Littlewing Pearlymussel	*Pegias fabula*	E	E
Wavy-rayed Lampmussel	*Lampsilis fasciola*	SC	
Little Tennessee Crayfish	*Cambarus georgiae*	SR	
Smoky Dace	*Clinostomus Sp*	SC	
Spotfin Chub	*Cyprinella monacha*	SR	T
Wounded Darter	*Etheostoma vulneratum*	SC	
Tangerine Darter	*Percina aurantiaca*	SR	
Olive Darter	*Percina squamata*	SC	
Rosyside Dace*	*Clinostomus funduloides*	SC	
Yellowfin Shiner*	*Notropis lutipinnis*	SC	
Hellbender	*Cryptobranchus alleganiensis*	SC	
Spike	*Elliptio dilatata*	SC	
Margaret's River Cruiser	*Macromia margarita*	SR	
Carolina Skistodiaptomus	*Skistodiaptomus carolinensis*	SR	
Gray Petaltail	*Tachopteryx thoreyi*	SR	
Alabama Rainbow	*Villosa iris*	SC	

Listing abbreviations: E = Endangered, T = Threatened, SR = Significantly Rare, SC = Special Concern
* = species identified as present in the basin by DWQ biologists

Rare fishes in the Little Tennessee River basin include the spotfin chub (*Cyprinella monacha*), wounded darter (*Etheostoma vulneratum*), tangerine darter (*Percina aurantiaca*), Olive darter (*Percina squamata*), smoky dace (*Clinostomus funduloides sp 1*), and yellowfin shiner (*Notropis lutipinnis*). The yellowfin shiner is essentially restricted to Atlantic, rather than Mississippi, drainages.

The hellbender (*Cryptobranchus alleganiensis*) is a very large aquatic salamander (often 18 to 20 inches long) with wrinkled, fleshy folds of skin on either side of its body. The hellbender feeds on crayfish in large streams with cool, clean and fast-flowing water, which it needs for cutaneous respiration. It is a myth that hellbenders are poisonous. Pollution and siltation have damaged much of the hellbender's habitat, making this amphibian species rare in North Carolina.

The Little Tennessee River basin contains natural communities of high quality and rarity. One of the most significant wetland types in the basin are mountain bogs. Mountain bogs often contain rare plants and animals, including the state Threatened bog turtle (*Clemmys muhlenbergii*) and the federally Endangered green pitcher plant (*Sarracenia oreophila*). Many mountain bogs are threatened due to drainage for farmland, nutrient input, plant succession, ground water pumping, lack of natural fires, and other development pressures.

The olive darter (*Percina squamata*) was noted at two sites on the Little Tennessee River just downstream from the mouth of Cartoogechaye Creek and one specimen was found in Cartoogechaye Creek during fish community investigations. These investigations also noted two Hellbenders (*Cryptobranchus allegheniensis*) on Cartoogechaye Creek. In addition, the studies located the Little Tennessee River crayfish (*Cambarus georgiae*) in the length of Cartoogechaye

Creek as well as several tributaries (Wayah, Muskrat, Jones and Allison Creeks) to the creek (McLarney, October 1995).

Other non-aquatic endangered or threatened species of amphibians, mammals, and plants occur along the streambanks. These non-aquatic species may be affected by water quality degradation in the basin.

2.5 ANIMAL OPERATIONS

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) to establish procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. The deadline for submittal of registrations to DWQ for existing facilities was December 31, 1993.

In the Little Tennessee River basin there are a total of 14 registered livestock operations. One of these is certified, meaning it has an approved waste management plan (the remainder must have approved plans in place before the end of 1997). The majority of these are located in the Cheoah River subbasin (04-04-04) near Robbinsville. All of these operations are cattle operations (which includes dairy operations), except for two swine farms.

Table 2.14 summarizes the estimated total capacity of animals for livestock operations as of February 1995. This includes both registered and unregistered facilities. Figures are presented for each subbasin. There were no operations in the Nantahala River subbasin as of February 1995. Even though the change in swine population increased dramatically between 1990 and 1994 (+128%), these numbers are small compared to state totals (<1%) for swine populations.

Table 2.14 Estimated Animal Populations in the Little Tennessee River Basin (Source: NCDA Veterinary Division, February 1995)

Subbasin	Swine 1994	Swine 1993	Swine 1990	Swine Change(%)	Dairy 1994	Dairy 1993	Poultry Capacity
Upper Little Tenn.	96	96	232	-59%	820	820	0
Lower Little Tenn.	472	472	207	128%	348	348	150
Nantahala River	0	0	0	0%	0	0	0
Tuckasegee River	5	5	24	-79%	0	0	0
Totals	573	573	463		1,168	1,168	150

2.6 SURFACE WATER CLASSIFICATIONS AND STANDARDS IN THE LITTLE TENNESSEE RIVER BASIN

All surface waters in the state are assigned a primary water classification. They may also be assigned one or more supplemental classifications. Classifications are assigned to protect uses of the waters such as swimming, aquatic life propagation or water supplies. For each classification, there is a set of water quality standards that must be met in order to protect the uses. Appendix I and Chapter 5 provide a more detailed summary of the state's primary and supplemental classifications including (for each classification) the best usage, water quality standards, stormwater controls and other protection requirements as appropriate. This information is derived from 15A NCAC 2B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.

The waters of the Little Tennessee River basin have a variety of surface water quality classifications applied to them (Table 2.15). The majority of the waters are classified as C (64%), WS-III (15%) or HQW (11%). There are currently 105 miles of streams in the Little Tennessee River basin supplementally classified as Outstanding Resource Waters (ORW), primarily located in the tributaries of the Nantahala River. There are 297 miles of streams supplementally classified as High Quality Waters (HQW). These waters are located primarily in the tributaries of the Tuckasegee and the Oconaluftee Rivers. The Little Tennessee River basin is well-known for its trout waters. The supplemental classification of Tr is also applied to many miles of streams in the basin (53%). Water Supply Watersheds within the basin range from WS-I to WS-IV. These Water Supply Watersheds are for the Towns of Franklin, Highlands, Sylva, Bryson City, and Robbinsville, the Cherokee Indian Reservation and Western Carolina University. Figure 2.8 depicts the locations of water supply watersheds, high quality waters, and outstanding resource waters in the basin.

Table 2.15 Percent of Miles per Water Quality Classification in the Little Tennessee River Basin

	HQW	ORW	WS-I	WS-II	WS-III	WS-IV	Tr	B	C
Stream miles	297	105	19.3	77.1	407	44.6	1441	133	1,733
% of Total	11	4	1	3	15	2	53	5	64

Information in Table 2.15 was calculated by the Center for Health Statistics using GIS applications. The above stream length summaries were calculated by first identifying the blue lines (referred to as arcs) representing stream segments, and subsequently attributing them by their class. This was an iterative process as many of the arcs were redundantly attributed (e.g. 'HQW' and 'C'), and therefore measured twice. This explains why the sum of the percentages for the various classes is greater than 100 percent.

Stream length summaries do not include the length of arcs representing pond and/or lake shorelines. Therefore, the measurement of the length of a particular stream will stop when entering an impounded area (lake), and begin again where the stream flows out of the impoundment.

A complete listing of classifications for all surface waters in the basin can be found in a DEM publication entitled "Classifications and Water Quality Standards Assigned to the Waters of the Little Tennessee River Basin and Savannah River Drainage Area". This has been reprinted in Appendix II. Pending reclassifications are discussed in Chapter 6.

2.7 WATER USE IN THE LITTLE TENNESSEE RIVER BASIN

2.7.1 Local Government Water Supply Plans and General Water Use

In 1989 the North Carolina General Assembly adopted a law that requires local governments that operate public water supply systems to develop and approve a Local Water Supply Plan (GS 143-355 (l)). In order to assure the availability of adequate supplies of good water quality to protect public health and to support desirable growth, the North Carolina Division of Water Resources (DWR) is compiling a State Water Supply Plan Database pursuant to GS 143-355 (m)). The Database contains information reported in the Local Water Supply Plans. The State Water Supply Plan will identify potential water use conflicts among water suppliers and identify ways to better coordinate water supply programs.

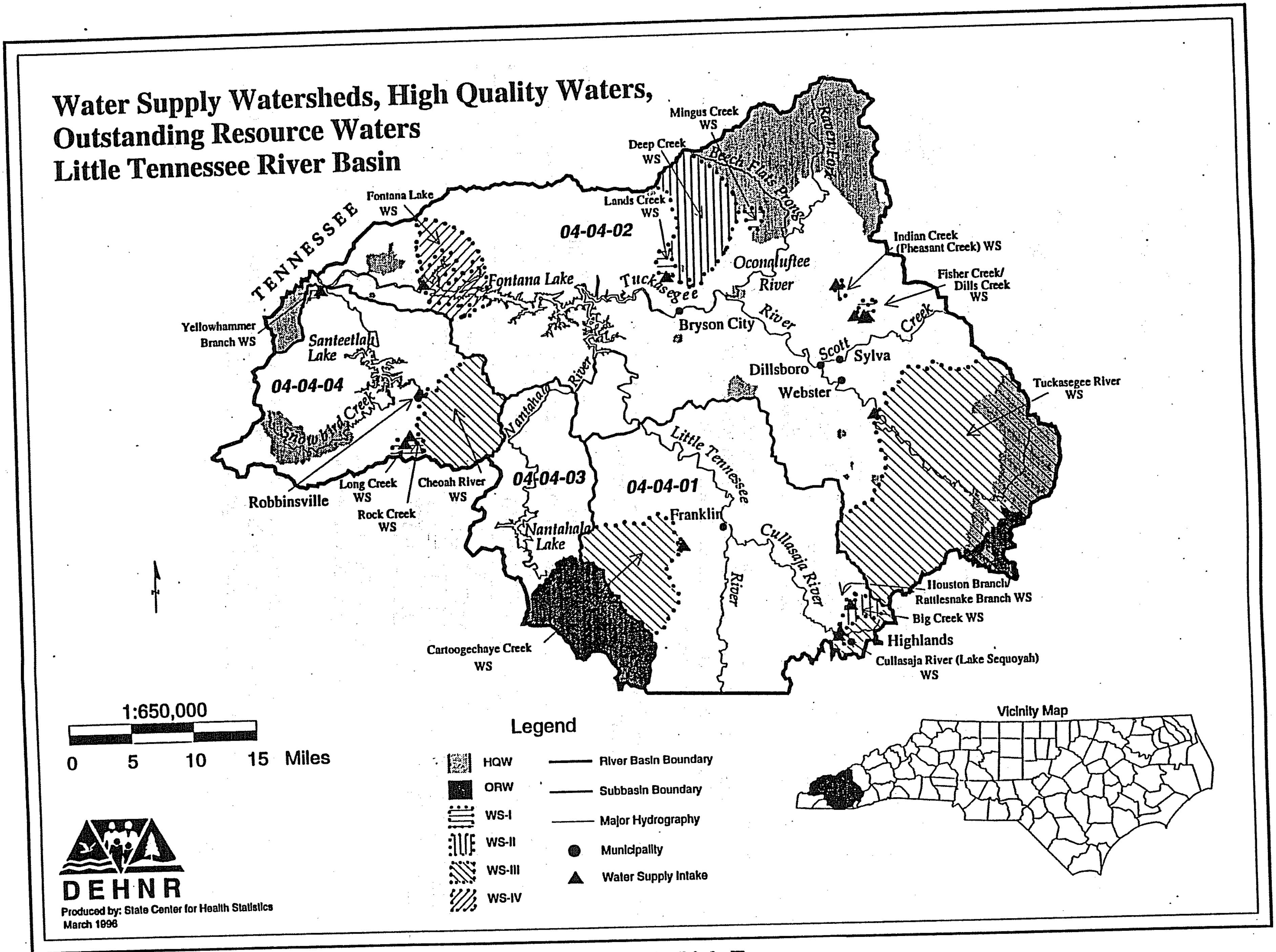

Figure 2.8 Water Supply Watersheds, HQW and ORW Waters in the Little Tennessee River Basin

There are seven water systems in the Little Tennessee River basin that are currently deemed to be subject to G.S. 143-355 (l). These are Robbinsville, Santeetlah, Franklin, Highlands, Bryson City, Whittier Sanitary District (SD), and Tuckaseigee. Four of these seven systems (Santeetlah, Franklin, Highlands, and Whittier SD) have submitted approved plans that have been entered into the SWSP database. The following summary provided by DWR pertains to current and future population and water use based on these four water systems.

Table 2.16 presents the 1992 and projected serviced population for these water systems to the year 2020. Based on this table it may be expected that the population serviced by these systems will increase by 40 percent over the next few decades.

Table 2.16 1992 and Projected Service Populations (Source: Division of Water Resources)

System Name	1992	2000	2010	2020
Whittier Sanitary District	175	188	198	204
Franklin	6,500	7,500	8,500	10,000
Santeetlah	300	302	304	306
Highlands	977	1,091	1,233	1,375
Total	9,944	11,081	12,245	13,905

The 1992 water use profile for these systems is presented in Table 2.17. DWR's data for these systems indicates an average daily use of 1.304 million gallons per day (MGD). It is important to note that, based on these systems' reports 0.026 MGD came from ground water sources and 1.278 MGD was supplied from surface water.

Table 2.17 1992 Water Use and Water Sources Profile (MGD)
(Source: Division of Water Resources)

System Name	Avg. Day	Max. Day	Residential Use	Non-Residential Use	Unaccounted for Water	Safe Yield (Surface Water)	12-Hour Yield (Ground water)
Whittier SD	0.010	0.015	0.010	0.000	0.001	0.000	0.144
Franklin	0.814	1.275	0.330	0.485	0.000	5.100	0.000
Santeetlah	0.016	0.049	0.014	0.002	0.000	0.000	0.048
Highlands	0.464	0.785	0.165	0.111	0.186	2.600	0.000
Total	1.304	-----	0.519	0.598	0.187	7.700	12.192

In 1992 the average daily discharge for these systems was 0.90 MGD with a high monthly discharge of 1.06 MGD occurring in November and a low monthly discharge of 0.73 MGD occurring in January.

The 1992 water use comparison with future water use forecasts is presented in Table 2.18. A 141% increase in water use is forecasted by the year 2020. The forecasted use does not exceed the current 12 hour and safe yield totals. Accordingly, additional water supplies are not expected to be needed to meet forecasted demand.

Table 2.18 1992 and Projected Water Use (MGD) (Source: Division of Water Resources)

System Name	1992	2000	2010	2020
Whittier SD	0.010	0.011	0.011	0.012
Franklin	0.814	1.295	1.816	2.215
Santeetlah	0.016	0.020	0.020	0.020
Highlands	0.464	0.600	0.750	0.900
Total	1.304	1.926	2.597	3.147

Table 2.19 presents data on the available and surplus supplies for the systems considered here. None of these systems are projecting a 2020 water supply deficit based on their current and proposed water supply sources.

Table 2.19 1992 to 2020(Projected) Water Supply Profile (MGD)
(Source: Division of Water Resources)

System Name	Total Available Supply 1992	Total Surplus Supply 1992	Total Available Supply 2020	Total Surplus Supply 2020
Whittier SD	0.144	0.134	0.144	0.132
Franklin	5.100	4.286	5.100	2.885
Santeetlah	0.048	0.032	0.068	0.028
Highlands	2.600	2.136	3.600	1.700
Total	7.892	6.588	8.912	4.745

USGS 1990 Water Use information for the Little Tennessee River Basin (HUC# 06010202, HUC# 06010203 and HUC# 06010204) indicates that the total water withdrawals for the basin was 4,950.91 MGD. Ground water sources supplied 2.51 MGD and the remaining 4,948.40 MGD was withdrawn from surface water sources. The water withdrawal profile for these basins is presented in Table 2.20. It should be noted that 4889.58 MGD, or 99%, was withdrawn for hydroelectric power generation.

Table 2.20 Little Tennessee River Basin Water Withdrawals for 1990 (MGD)
(Source: USGS Water Use Database)

Withdrawal Category	Ground Water	Surface Water	Total Water
Public Water Supply	0.20	3.20	3.40
Commercial Self Supply	0.07	0.00	0.07
Domestic Self Supply	2.05	0.00	2.05
Industrial Self Supply	0.00	0.01	0.01
Electric Power Self Supply	0.00	4,889.58	4,889.58
Mining Self Supply	0.00	0.36	0.36
Livestock Self Supply	0.19	53.63	53.82
Irrigation Self Supply	0.00	1.62	1.62
Total	2.51	4,948.40	4,950.91
	<1%	>99%	100%

2.7.2 Water Withdrawal and Transfer Registration

The 1993 Water Withdrawal and Transfer Registrations, pursuant to G.S. 143-215.22H, are managed by the North Carolina Division of Water Resources (DWR). DWR's Water Withdrawal and Transfer Registration Database for 1991 contains several surface water withdrawals in the Little Tennessee River Basin and these are presented in Table 2.21.

Table 2.21 1991 Water Withdrawal Registrations for the Little Tennessee River Basin

Facility	County	Source	Use Type	Average Daily Withdrawal MGD
Tapoco, Inc.	Graham	Lake Santeetlah	Hydroelectric Power	361.17
Sylva	Jackson	Fisher Cr	Public Water Supply	0.80
Franklin	Macon	Cartoogechaye Cr	Public Water Supply	0.79
Total				362.76

The maximum (combined) daily withdrawal was listed as 590 MGD and occurred in March. Of this total, 588 MGD was attributed to hydroelectric use.

The 1993 Water Withdrawal and Transfer Registrations, pursuant to G.S. 143-215.22H, includes several surface water withdrawals and one facility with ground water withdrawals in the Little Tennessee River Basin. These are presented in Table 2.22. The average (combined) daily withdrawal from surface water sources as listed was 12.914 MGD.

Table 2.22 1993 Water Withdrawal Registrations for the Little Tennessee River Basin

Facility	County	Source	Avg. Withdrawal (MGD)	Max. Withdrawal (MGD)	Max. Withdrawal (MGD)	Use Type
Hemac Inc	Graham	Little Snowbird Creek	2.671	4.5	unknown	Aquaculture
Tumbling Waters Cmpgrnd. and Trout Farm	Graham	Panther Creek	2.7	2.7	unknown	Aquaculture
Pure Streams Inc.	Graham	Snowbird Crk	0.822	0.92	unknown	Aquaculture
Riverbend Trout Farm	Graham	West Buffalo River	2.493	4.32	32,071	Aquaculture
Otter Creek Trout Farm	Macon	Otter Creek	1.162	1.2	unknown	Aquaculture
Pure Streams Inc.	Macon	Tellico Creek	0.069	0.099	unknown	Aquaculture
Cooper Creek Trout Farm	Swain	Cooper Creek	2.997	4.4	unknown	Aquaculture
Cooper Creek Trout Farm (groundwater)	Swain	3 springs, 1 well	0.04	unk	unknown	Aquaculture

2.8 MINIMUM STREAMFLOW REQUIREMENTS

DWR's Instream Flow Unit is conducting a number of instream flow studies in the Little Tennessee River Basin (Table 2.23). The Instream Flow Unit operates under the rules applied to the Dam Safety Law that require dams to release minimum stream flows to adequately maintain aquatic habitat (G.S. 143-215.24.0500). They are described in the following discussion.

Table 2.23 Minimum Streamflow Studies in the Little Tennessee River Basin

Subbasin	Waterbody	Basis for Study	Outcome
Upper Little Tennessee (04-04-01)	Lake Sequoyah	Noxious Weed Control	stocking of grass carp
Lower Little Tennessee (04-04-02)	West Fork Tuckasegee River	FERC post-licensing requirement	study completed - will provide min. instream flow to 7.7 stream miles
Lower Little Tennessee (04-04-02)	Tuckasegee River	FERC post-licensing requirement	study underway - will provide min. instream flow to 3.3 stream miles
Nantahala River (04-04-03)	Nantahala River, Dicks Creek and White Oak Creek	FERC post-licensing requirement	study completed - will provide min. instream flow to 11 stream miles
Nantahala River (04-04-03)	Queens Creek	FERC relicensing requirement	study scheduled - will provide min. instream flow to 1.4 stream miles

Nantahala River Subbasin

Nantahala River, Dicks Creek and Whiteoak Creek

Nantahala Power and Light's (NPL) hydropower generating facility, located on the banks of the Nantahala River, receives the waters of the Nantahala River, Dicks Creek and Whiteoak Creek through a network of tunnels and pipe. Eight and seven-tenths miles of the Nantahala River is bypassed with 5.6 miles of conduit; one and two-tenths miles of the Dicks Creek is bypassed with 0.7 miles of conduit; two and two-tenths miles of the Whiteoak Creek is bypassed with 2.1 miles of conduit. The Division of Water Resources and other agencies are working with NPL under a Federal Energy Regulatory Commission (FERC) post-licensing requirement to conduct instream flow studies for aquatic habitat and recreational activities. Two study sites were selected on the Nantahala with one above and one below the confluence with Whiteoak Creek. Whiteoak and Dicks Creeks each have one study reach. Minimum flows are being negotiated.

Queens Creek

NPL operates a hydropower facility on the banks of the Nantahala River using water piped one mile from Queens Creek Lake. The bypassed reach of Queens Creek equals 1.4 miles. As part of the FERC relicensing for the project, DWR will be cooperating with NPL and other agencies in studying the need for minimum flows to provide suitable aquatic habitat below the dam.

Tuckasegee River Subbasin

West Fork Tuckasegee River

A post-licensing requirement following the FERC licensing of NPL's West Fork Tuckasegee River Project directed the owner to work with DWR and other state agencies to determine the need for minimum flows. Two projects comprise the licensed project. The upper impoundment is Thorpe Reservoir which has three miles of conduit and 6.4 miles of bypassed reach. The lower impoundment is Tuckasegee Reservoir and has 0.6 miles of conduit and 1.3 miles of bypassed reach. Instream flow study sites are located at three locations on the West Fork Tuckasegee: two sites upstream of the Thorpe powerhouse and one downstream of the Tuckasegee Reservoir. Minimum flows are being negotiated.

Tuckasegee River

A post-licensing requirement following the FERC licensing of NPL's Tuckasegee River Project directed the owner to work with DWR and other state agencies to determine the need for minimum flows. Four impoundments comprise the licensed project. The waters of Wolf Creek Reservoir and Tanasee Creek Reservoir are piped 1.2 miles downstream to a hydropower facility on the backwaters of Bear Creek Reservoir. The Wolf and Tanasee bypasses equal 1.7 and 1.6 miles, respectively. Both the West Fork and the main stem of the Tuckasegee are subject to considerable variations in flow due to the upstream NPL projects. There are three instream flow study reaches. Minimum flows are being negotiated.

Upper Little Tennessee River Subbasin

Lake Sequoyah

The FERC license application for the hydropower facility located at Lake Sequoyah, Cullasaja River Hydro, was recently withdrawn by the applicant. DWR was prepared to participate in a post-licensing instream flow study downstream of the impoundment.

DWR assisted the Town of Highlands with a request to control Elodea canadensis in Lake Sequoyah. Five hundred triploid grass carp were stocked in the lake in 1993.

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CHAPTER 3

CAUSES OF IMPAIRMENT AND SOURCES OF WATER POLLUTION

3.1 INTRODUCTION

Water pollution is caused by a number of substances including sediment, nutrients, bacteria, oxygen-demanding wastes, metals, color and toxic substances. *Sources* of these pollution-causing substances are divided into broad categories called *point* sources and *nonpoint* sources. Point sources are typically piped discharges from wastewater treatment plants and large urban and industrial stormwater systems. Nonpoint sources can include stormwater runoff from urban areas, forestry, mining, agricultural lands, rural residential development, and others. **Section 3.2** identifies and describes the major causes of pollution in the basin. **Sections 3.3** and **3.4** describe point and nonpoint source pollution in the basin.

3.2 CAUSES OF IMPAIRMENT

Causes of impairment refers to the substances which enter surface waters from point and nonpoint sources and result in water quality degradation. The major causes of water quality impairment include biochemical oxygen demand (BOD), sediment, nutrients, toxicants (such as heavy metals, chlorine, pH and ammonia) and fecal coliform bacteria (Table 3.1). Each of these causes of impairment is discussed in the following sections.

Table 3.1 Causes of Impairment and Sources of Water Pollution

Cause of Impairment	Source of Pollution
Sediment	Construction and mining sites, disturbed land areas, streambank erosion and alterations, cultivated farmland
Nutrients	Fertilizer on agricultural, residential, commercial and recreational lawns, animal wastes, trout farm effluent, leaky sewers and septic tanks, atmospheric deposition, municipal wastewater
Toxic and Synthetic Chemicals	Pesticide applications, disinfectants (chlorine), automobile fluids, accidental spills, illegal dumping, urban stormwater runoff
Oxygen-Consuming Substances	Wastewater effluent, organic matter, leaking sewers and septic tanks, animal waste
Fecal Coliform Bacteria	Failing septic tanks, animal waste, runoff from livestock operations, wildlife, improperly disinfected wastewater effluent
Road Salt	Applications to snow and ice
Oil and Grease	Leaky automobiles, industrial areas, illegal dumping
Thermal Impacts	Heated landscape areas, runoff from impervious areas, tree removal along streams, wet detention ponds

3.2.1 Sedimentation

Erosion is a natural process by which soil and rock material is removed by water, wind, and ice. Natural erosion occurs on a geologic time scale, but when human activities alter the landscape, erosion can be greatly accelerated. The sediment produced by erosion generally winds up in the surface waters.

Sediment is the most widespread cause of stream degradation and potential impairment in the state, including the Little Tennessee River basin. While no streams in the Little Tennessee River basin are classified as impaired due to sedimentation, Cowee Creek (Macon) and Scott Creek (Jackson) have been rated Support-Threatened due to sediments. Several other streams have been determined to be negatively affected to a lesser degree by sedimentation. These include Middle and Tessentee Creeks in the Upper Little Tennessee subbasin and Cullowhee and Savannah Creeks in the Lower Little Tennessee subbasin.

Some of the activities that increase sediment loads to waterbodies include: construction activities, unpaved private access roads, state road construction, golf courses, uncontrolled urban runoff, mining, timber harvesting, agriculture, and livestock operations.

Some of the adverse impacts of sediment include:

- Streambank erosion: Streams with high sediment load have a much greater potential to scour the streambank. Also, as the streambed fills in with sediment, the stream will widen to carry the flow. Streambank erosion causes the loss of valuable property.
- Damaged aquatic communities: Sediment damages aquatic life by destroying stream habitat, clogging gills, and reducing visibility.
- Polluted water: Sediment often carries other pollutants with it, including nutrients, bacteria, and toxic/synthetic chemicals. This pollution can also threaten public health if drinking water sources and fish tissue become contaminated.
- Increased costs for treating drinking water: Sedimented waters require costly filtration to make them suitable for drinking. Water supply reservoirs lose storage capacity when they become filled with sediment, necessitating expensive dredging efforts.

Recommendations aimed at addressing sedimentation are listed in Chapter 6, Section 6.6. Programs aimed at addressing nonpoint source pollution are briefly described in Chapter 5.

Effects of Sedimentation

Sedimentation is often divided into two categories: *suspended load* and *bed load*. Suspended load is composed of small particles that remain in suspension in the water. Bed load is composed of larger particles that slide or roll along the stream bottom. Suspension of load types depends on water velocity and stream characteristics. Biologists are primarily concerned with the *concentration* of the suspended sediments and the *degree of sedimentation* on the streambed (Waters 1995).

The concentration of suspended sediments affects the availability of light for photosynthesis, as well as the ability of aquatic animals to see their prey. Several researchers have reported reduced feeding and growth rates by fish in waters with high suspended solids. In some cases it was noted that young fish left those stream segments with turbid conditions. Suspended sediments can clog the gills of fish and reduce their respiratory abilities. These forms of stress may reduce the tolerance level of fish to disease, toxicants and chronic turbid conditions. Suspended solids are reported as Total Suspended Solids or as Turbidity. They are measured in parts per million or milligrams per liter (Waters 1995).

The degree of sedimentation affects both the habitat of aquatic macroinvertebrates and the quality and amount of fish spawning and rearing habitat. Degree of sedimentation can be estimated by observing the amount of streambed covered, the depth of sedimentation, and the percent saturation of interstitial space or embeddedness. Eggs and fry in interstitial spaces may be suffocated by the sediments thereby reducing reproductive success (Waters 1995). Effects of sedimentation on macroinvertebrates can be seen in alterations in community density, diversity, and structure (Lenat et al. 1979).

The findings of academic research have noted the potential impact of sedimentation on fisheries, in particular on wild trout populations. This topic is also discussed in Chapter 4 of this plan. Sedimentation is one of the main factors limiting trout production in western North Carolina. Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West 1982).

The impact of sedimentation on fish populations depends on both concentration and degree of sedimentation, but impact severity can also be affected by the duration (or dose) of sedimentation. Suspended sediments may occur at high concentrations for short periods of time, or at low concentrations for extended periods of time. The greatest impacts to fish populations will be seen at high concentrations for extended time periods. The use of a dose-response matrix in combination with field investigations can help predict the impact of suspended sediments on various life stages of fish populations (Newcombe 1996).

Sedimentation impacts streams in several other ways. Eroded sediments may gradually fill lakes and navigable waters and may increase drinking water treatment costs. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals, pesticides, and road salts.

Measuring Sediment Loads

Suspended sediment is a very useful indicator of active erosion in a particular basin. Suspended sediment concentrations are very sensitive to landscape disturbance, and its conceptual simplicity as a measurement tool gives it broad appeal. The primary problem with using suspended sediment as a monitoring tool is its inherent variability. Representative samples are difficult to obtain, and suspended sediment samples vary tremendously over time and space. Most sampling schemes take individual or composite samples at regular time intervals (e.g. daily). Since high flows are relatively rare, a sampling system based on equal time intervals will result in a large number of samples at relatively low flows, when suspended sediment concentrations are low, and very few samples at high flows, which is when most of the suspended sediment transport takes place. This is both inefficient and results in a high level of uncertainty with regard to the total sediment load. For a clear picture of sediment dynamics in a particular watershed, sediment sampling programs should be carefully designed using staged, point integrated, or depth integrated samplers to include measurements at relatively high flows.

Statistics compiled by the US Department of Agriculture, Natural Resource Conservation Service (formerly known as the Soil Conservation Service) indicate a statewide decline in erosion from 1982 to 1992 (USDA, NRCS, 1992) as shown in Table 3.1.

Table 3.2 Overall Erosion Trends in North Carolina

	1982	1987	1992
Area (1,000 acres)	33,708.2	33,708.2	33,708.2
Gross Erosion (1,000 tons/yr)	46,039.5	43,264.6	36,512.9
Erosion Rate (Tons/Yr/Ac)	1.1	1.4	1.3

The most widely used tool to evaluate erosion at the landscape level is the Universal Soil Loss Equation (USLE). The NRCS statistics also indicate a statewide reduction per acre on cropland erosion using the Universal Soil Loss Equation (Table 3.3). However, the USLE produces results which are difficult to interpret for the NC mountains. Although tons/acre/year is a standard unit of measurement for erosion, it does not reflect the high spatial and temporal variability of erosion. Sediment impacts do not in generally originate from a county wide "average" area; the majority of sediment comes from localized high impact areas. It is very easy to average out a sediment impact over a whole watershed or county or state area and thereby give the impression that the problem is less significant than it actually is in the immediate area. It makes much more sense from a management perspective to reduce sediment from 40 tons/acre to 2 tons/acres in a high impact area than to reduce erosion from cropland from 6.5 to 6.3 tons/acre. This points to the need for targeted management efforts coupled with a monitoring strategy which effectively measures sediment transport under both average and extreme conditions.

Table 3.3 USLE Erosion on Cultivated Cropland in North Carolina

	1982	1987	1992
Cropland Area (1,000 acres)	6,318.7	5956.8	5538.0
Gross Erosion (1,000 tons/yr)	40,921.4	37475.3	30,908.3
Erosion Rate (Tons/Yr/Ac)	6.5	6.3	5.6

In the Blue Ridge Mountains region, which encompasses the entire Little Tennessee River basin and several others, the overall erosion picture is not very clear. Table 3.3 shows a significant decline in cultivated cropland acreage and a corresponding decline in gross erosion over the past ten years, but the erosion rate per acre increased from 12.7 tons/acre/year in 1982 to 20.8 tons/acre/year in 1987 and then dropped to 18.3 tons/acre/year in 1992. Non-cultivated cropland erosion rates also increased over the ten year period from 1.4 tons/acre/year in 1982 to 1.7 tons/acre/year although pasture land rates dropped from 2.6 to 2.2 tons/acre/year over the same period.

According to the Raleigh NRCS office, several factors may explain the large erosion rate increase from 1982 to 1987. The mountains were the last region of the state to be accurately soil-mapped, and so more recent data may reflect an improved knowledge of soil loss. Secondly, there have been some revisions in soil loss coefficients for individual soil types. And third, Christmas tree farms have been included in the cropland acreage figures. Many farms are located on extremely steep lands and the large increase in the Christmas tree industry could play an important role in these numbers.

Table 3.4 North Carolina Erosion in Blue Ridge Mountain Region

	1982	1987	1992
Cropland Area (1,000 acres)	122.9	97.9	76.2
Gross Erosion (1,000 tons/yr)	1555.6	2035.2	1397.5
Erosion Rate (Tons/Yr/Ac)	12.7	20.8	18.3

Compared to other regions of the state, the overall erosion rate per acre for cultivated cropland in the mountains is very high although it is noted that the rate has dropped since 1987 (Table 3.4).

Much of this data relates to cropland and the need to continue to improve cropland erosion controls in the mountains. It also carries a broader message of the high erosion potential in the mountains, not only from agricultural activities, but for all land-disturbing activities on the steep slopes which are so prevalent in this region. Of particular concern are potential sediment losses from logging operations that do not follow forestry best management practices, streambank erosion, second home development and highway construction.

Table 3.5 North Carolina Erosion on Major Land Resource Areas (MLRA)

	1982	1987	1992
Blue Ridge Mountains	12.7	20.8	18.3
Southern Piedmont	12.3	12.0	10.5
Carolina and Georgia Sand Hills	6.0	5.6	5.1
Southern Coastal Plain	3.9	3.9	4.0
Atlantic Coast Flatwoods	3.2	3.1	3.2
Tidewater Area	1.4	1.5	1.6

Sediment and Streamflow

Peak flows have important effects on stream channel morphology and bed material particle size. Specifically, since higher flows move larger particles, peak flows determine the stable particle size in the bed material. Large stable particles provide important habitat niches for invertebrates and small fish. The size of peak flows is also important in determining the stability of large woody debris and the rate of bank erosion. Increased bank erosion and channel migration will affect the riparian vegetation and alter the amount of active sediment in the stream channel. Periods of high flow are periods of bank modification and deposition on active floodplains, especially in areas with dense riparian vegetation.

The vast majority of the sediment transport occurs during peak flows, as sediment transport capacity increases exponentially with discharge. The ability of a stream to transport the incoming sediment will help determine whether there is deposition or erosion within the active stream channel. The relationship between sediment load and sediment transport capacity will affect the distribution of habitat types, channel morphology, and bed material particle size. Increased size of peak flows due to urbanization have been shown to cause rapid channel incision and severe decline in fish habitat quality.

In developing areas, the erosive forces brought by increased flood flows must be addressed at the source—increased runoff—for instream fixes to be successful. Recent studies underscore the importance of overall watershed imperviousness in determining stream water and habitat quality. Increased impervious cover in a watershed has many direct impacts on streams in the watershed. Streams broaden or deepen to accommodate larger flushes of water, specialized habitats such as pool and riffle structures and overhanging vegetation are lost, instream water quality declines, stream temperatures rise and stream biodiversity, from aquatic insects to anadromous fish declines. Each of these impacts has been shown to increase with higher levels of watershed imperviousness.

A change in the size of peak flows can also have important consequences for human life and property. Structures such as bridges, dams, and levees are designed according to a presumed distribution of peak flows. If the size of the peak flows is increased, this could reduce the factor of safety and lead to more frequent and severe damage.

Sediment and Streambank Erosion

Streambank erosion, which can contribute sediment loads to a stream, has many potential causes, such as clearing of instream obstacles or streamside vegetation, livestock trampling of stream banks, or higher than normal floods resulting from increased impervious cover. In alluvial channels, the stream and river banks tend towards a dynamic equilibrium with the discharge and sediment load. The bank material, vegetation type, and vegetation density also affect the stability and form of the streambanks. Change in any one of these factors is likely to be reflected in the size and shape of the stream channel, including the banks.

Streambank stability is a term which refers to the propensity of the stream bank to change in form or location over time. Streambank stability can be an important indicator of watershed condition and can directly affect several designated uses of streams. A higher incidence of bank instability can be initiated by natural events that disrupt the quasi-equilibrium of the stream, or by human disturbance. Unstable banks contribute sediment to the stream channel by slumps and surface erosion. Because all the material from an eroding streambank is delivered directly to the stream channel, the adverse impact of bank instability can be much greater than the adverse effects of a comparable area of eroding hillslope.

Even in undisturbed streams some streambank instability usually occurs. In valleys with a defined floodplain there is often lateral migration through bank erosion and point bar accretion. In V-shaped valleys there is less opportunity for lateral migration and bank instability may steam from the input and eventual removal of obstructions emanating from fallen trees, landslides, or debris flows.

Although in some cases the erosion of one bank will be matched by deposition on the opposite bank, streambank erosion caused by human activities generally will increase stream width. The corresponding increase in stream surface area allows more direct solar radiation to reach the stream surface, and this will raise maximum summer water temperatures. In most cases an eroding streambank will provide little or no cover for fish.

Actively eroding streambanks also support little or no riparian vegetation, and the loss of this vegetation adversely affects a wide range of wildlife species, reduces available forage for domestic livestock, and reduces the long-term input of organic matter into the aquatic ecosystem. Both the increase in summer water temperatures and the loss of fish cover along an eroding stream bank will be exacerbated by the reduction in riparian cover.

Historic practices of disturbing the stream channel and removing large woody debris have been shown to increase the amount of fine sediment in the steam channel. Removal of, or a reduction in, the riparian vegetation is another mechanism by which management activities can increase the amount of fine sediments. Grazing often exacerbates the effect of reducing the vegetative cover by simultaneously trampling the vegetation, compacting the soil, and trampling the streambanks. The use of structural techniques such as: bank sloping, use of tree roots for stabilization, buffer strips, and fencing cattle out of streams can greatly reduce streambank erosion. Average annual soil loss has been shown to be decreased by 40% after cattle were fenced away from streams. This decrease resulted in nearly a 60% reduction in average sediment concentration during stormflow events (Owens, et al 1996). Stormwater management measures for urban development areas can also lessen the potential for streambank erosion.

Stream Modification

Natural streams around the world have certain physical characteristics in common, regardless of location and geologic conditions. One of the most important of these characteristics is known as bankfull stage. The bankfull stage corresponds to the flow at which channel maintenance is most effective, that is, the discharge that results in the average size and shape of channels.

Almost all natural streams have a bankfull discharge with a recurrence interval of 1-1.5 years. In other words, natural stream channels do not form with the capacity to carry a 50 year, 25 year, or even 2 year storm without overflow. Natural channels on average can carry the flow from an annual storm without overflow. In streams that have not been channelized or manipulated by human activities, streamflows larger than a typical annual event are generally carried in both the channel and a floodplain.

Humans have modified many natural streams by increasing the capacity of the stream channel to carry high flows, sometimes to carry even the flow from a 50 or 100 year storm. Such modifications are conceived in the name of flood control and are often used to justify development of floodplains for human occupance and other activities which constrict or encroach upon the floodplain.

Most engineering channel designs give a great deal of attention to conveyance of floodwaters. Very few channel designs include close attention to sediment conveyance. Given that the equilibrium channel size tends toward a bankfull discharge with a 1-1.5 year recurrence interval, larger stream channels will naturally initiate disequilibrium erosional processes. For example, a channel that has been straightened and enlarged to carry a 50 year storm, will begin building a smaller channel, point bars, floodplains, meanders, etc. as a result of the natural physical behavior of sediment and the frequency distribution of streamflows. As a result, we have created streams which are unstable; they lose their equilibrium shape and slope and erode, degrade, and aggrade rapidly. Such unstable channel conditions can ultimately lead to degraded water quality as result of excessive sediment loads.

<u>Sedimentation and Erosion in the Little Tennessee River Basin</u>
Sedimentation is a problem parameter on Middle, Tessentee, Cowee, Cullowhee, Savannah and Scott Creeks and the upper Little Tennessee. Although all of these creeks are currently supporting their designated uses, their quality has been degraded. Cowee and Scott Creeks and the upper Little Tennessee are now rated as support threatened.

3.2.2 Oxygen-Consuming Wastes

Oxygen-consuming wastes include decomposing organic matter or chemicals that reduce dissolved oxygen in the water column through chemical reactions or biological activity. Maintaining a sufficient level of dissolved oxygen in the water is critical to most forms of aquatic life, especially trout.

A number of factors affect dissolved oxygen concentrations. Higher dissolved oxygen is produced by *turbulent actions*, such as waves, rapids and waterfalls, which mix air and water. *Lower water temperature* also generally allows for retention of higher dissolved oxygen concentrations. Therefore, the cool swift-flowing streams of the mountains are generally high in dissolved oxygen. Low dissolved oxygen levels tend to occur more often in warm, slow-moving waters that receive a high input of effluent from wastewater treatment plants during low flow conditions. In general, the lowest dissolved oxygen concentrations occur during the warmest summer months and particularly during low flow periods. *Water depth* is also a factor. In deep slow-moving waters, such as reservoirs or estuaries, dissolved oxygen concentrations may be very high near the surface due to wind action and plant (algae) photosynthesis but may be entirely depleted (anoxic) at the bottom.

Sources of dissolved oxygen depletion include wastewater treatment plant effluent, the decomposition of organic matter (such as leaves, dead plants and animals) and organic waste matter that is washed or discharged into the water. Sewage from human and household wastes is high in organic waste matter, as is waste from trout farms. Bacterial decomposition can rapidly deplete dissolved oxygen levels unless these wastes are adequately treated at a wastewater treatment plant. In addition, some chemicals may react with and bind up dissolved oxygen. Industrial discharges with oxygen consuming wasteflow may be resilient instream and continue to use oxygen for a long distance downstream.

Oxygen-Consuming Wastes in the Little Tennessee River Basin
Oxygen-consuming wastes have not been identified as a significant source of water quality impairment in the Little Tennessee River basin.

3.2.3 Nutrients

The term *nutrients* in this document refers to the two major plant nutrients, phosphorus and nitrogen. These are common components of fertilizers, animal and human wastes, vegetation, trout farms and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources. Nutrients are beneficial to aquatic life in small amounts. However, in overabundance and under favorable conditions, they can stimulate the occurrence of algal blooms and excessive plant growth in quiet waters such as ponds, lakes, reservoirs and estuaries.

Nutrients in the Little Tennessee River Basin
Nutrients have been identified as a source of water quality degradation in the Little Tennessee River basin. Some of these waters may be experiencing excess nutrients due to waste from trout farms. The impact of this nutrient loading tends to be localized and occur more frequently under conditions of low flow and elevated water temperatures. These waters include the Snowbird Creek and West Buffalo Creek arms of Santeetlah Lake, Tellico Creek and White Oak Creek (BMPs have been implemented at this trout farm since sampling and the status of this impaired creek will be monitored). Sequoyah Lake (support threatened) is an enriched lake (mesotrophic), probably due to stormwater runoff from the Town of Highlands, golf courses and aging septic tanks at homes around the lake. Nutrient enrichment resulting in the support threatened status of Cowee Creek will need to be assessed to determine its source.

3.2.4 Toxic Substances

Regulation 15A NCAC 2B. 0202(36) defines a toxicant as "any substance or combination of substances ... which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, has the potential to cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions or suppression in reproduction or growth) or physical deformities in such organisms or their offspring or other adverse health effects". Toxic substances frequently encountered in water quality management include chlorine, ammonia, organics (hydrocarbons and pesticides) heavy metals and pH. These materials are toxic to different organisms in varying amounts. The effects may be evident immediately, or may only be manifested after long-term exposure or accumulation in living tissue.

North Carolina has adopted standards and *action levels* for several toxic substances. These are contained in 15A NCAC 2B .0200. Usually limits are not assigned for parameters which have action levels unless 1) monitoring indicates that the parameter may be causing toxicity or, 2) federal guidelines exist for a given discharger for an action level substance. This process of determining action levels exists because these toxic substances are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics and/or associated waste characteristics. Water quality based limits may also be assigned to a given NPDES permit if data indicate that a substance is present for which there is a federal criterion but no water quality standard.

Whole effluent toxicity (WET) testing is required on a quarterly basis for major NPDES dischargers and any discharger containing complex (industrial) wastewater. This test shows whether the effluent from a treatment plant is toxic, but it does not identify the specific cause of toxicity. If the effluent is found to be toxic, further testing is done to determine the specific cause. This follow-up testing is called a toxicity reduction evaluation (TRE). WET testing is discussed in Chapter 4 and Appendix III respectively. Other testing, or monitoring, done to detect aquatic toxicity problems include fish tissue analyses, chemical water quality sampling and assessment of fish community and bottom-dwelling organisms such as aquatic insect larvae. These monitoring programs are discussed in Chapter 4.

Each of the parameters below can be toxic if sufficient in quantity or concentration.

pH

Changes in pH to surface waters is primarily through point source discharges. However, changes can also occur with the introduction of substances in the form of spills to a waterbody and through acid deposition or exposure of Anakeesta Rock formations. Refer to Section 4.2.6 of Chapter 4 for more information on acid deposition and its effects on water quality in the Little Tennessee River basin.

As the pH of a water decreases, metals are more bioavailable within the water column and are therefore more toxic to the aquatic organisms. As the pH increases, metals are precipitated out of the water column and less toxic to aquatic organisms. If a surface water has had chronic introductions of metals and the pH gradually or dramatically decreases, the metals in the substrate will become more soluble and be readily available in the water column. While lower pH values may not be toxic to the aquatic organisms, the lower values can have chronic effects on the community structure of macroinvertebrates, fish, and phytoplankton. Macroinvertebrates will show a shift from tolerant species to intolerant species and have less community diversity.

The NC standard for pH in surface waters is 6.0 to 9.0. Trout will not survive in waters with pH values below 5.5.

Metals

Municipal and industrial dischargers and urban runoff are the main sources of metals contamination in surface water. North Carolina has stream standards for many heavy metals, but the most common ones in municipal permits are cadmium, chromium, copper, nickel, lead, mercury, silver and zinc. Standards are listed in Appendix II. Each of these, with the exception of silver, is also monitored through the ambient network along with aluminum and arsenic. Point source discharges of metals are controlled through the NPDES permit process. Municipalities with significant industrial users discharging wastes to their treatment facilities limit the heavy metals from these industries through a *pretreatment program.* Source reduction and wastewater recycling at WWTPs also reduces the amount of metals being discharged to a stream. Nonpoint sources of pollution from urban runoff are controlled through best management practices, stormwater control programs, and sedimentation and erosion control plans.

Chlorine

Chlorine is a commonly used disinfectant at NPDES discharge facilities which have a domestic (i.e., human) waste component. These discharges are a major source of chlorine in the State's surface waters. Chlorine dissipates fairly rapidly once it enters the water, but its toxic effects can have a significant impact on sensitive aquatic life such as trout and mussels. At this time, no standard exists for chlorine in waters supplementally classified as trout waters and an action level of 17 milligrams per liter (mg/l) for chlorine has been established for all other waters. A standard for all waters may be adopted in the future. All new and expanding dischargers are required to dechlorinate their effluent if chlorine is used for disinfection. If a chlorine standard is developed for North Carolina, chlorine limits may be assigned to all dischargers in the State that use chlorine for disinfection.

<u>Ammonia (NH_3)</u>
Point source dischargers are one of the major sources of ammonia. In addition, fertilization of agricultural land, golf courses, lawns and decaying organisms (which may come from nonpoint source runoff and bacterial decomposition of animal waste) also contribute to the level of ammonia in a waterbody. At this time, there is no numeric standard for ammonia in North Carolina. However, DWQ has developed an interim set of instream criteria of 1.0 mg/l in the summer (April - October) and 1.8 mg/l in the winter (November - March). These interim criteria are under review, and the State may adopt a standard in the near future.

<u>Toxic substances in the Little Tennessee River Basin</u>
There are no waters in the Little Tennessee River basin known to be impacted by toxic substances. However, low pH values have been noted in the Nantahala River and many waters in the Lower Little Tennessee River subbasin. It is likely this effect is due to chronic acid deposition or exposure of Anakeesta Rock formations (as with Beech Flats Creek in the Great Smokies National Park). This issue is discussed further in Chapter 4.

3.2.5 Fecal Coliform Bacteria

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals. Common sources of fecal coliform bacteria include leaking or failing septic systems, leaking sewer lines or pump station overflows, runoff from livestock operations and wildlife, and improperly disinfected wastewater effluent.

Fecal coliform bacteria are widely used as indicators of the potential presence of waterborne pathogenic organisms (which cause such diseases as typhoid fever, dysentery, and cholera). Fecal coliform bacteria in treatment plant effluent are controlled through disinfection methods including chlorination (sometimes followed by dechlorination), ozonation or ultraviolet light radiation.

Due to the low number of farm animal operations and limited development in the basin, the chances of bacterial contamination in streams is relatively low. However, failing septic systems, straight piping of waters to streams and animal operations without appropriate best management practices in place can cause elevated bacterial levels in any of the unmonitored streams.

<u>Fecal Coliform Bacteria in the Little Tennessee River Basin</u>
There are no DWQ ambient monitoring stations in the basin where state standards (based on geometric mean) for fecal coliform bacteria are being exceeded. However, two sites (Little Tennessee River at Prentiss and Cartoogechaye Creek) have a high percentage of samples exceeding the criteria. Sample results and further discussion are presented in Chapter 4, Table 4.4.

3.3 POINT SOURCES OF POLLUTION

3.3.1 Defining *Point* Sources

Point sources refers to discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge. The term applies to wastewater and stormwater discharges from a variety of sources. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems that may serve schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for medium and large municipalities which serve populations greater than 100,000 and stormwater discharges associated with industrial activity as defined in the Code of Federal Regulations [40 CFR 122.26(a)(14)]. The primary pollutants associated with point source discharges are oxygen-demanding wastes, nutrients, suspended solids, pathogens, sediment, color and toxic substances including chlorine, ammonia and metals. Definitions and examples of the various categories can be found in Table 3.5.

Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state. Discharge permits are issued under the NPDES program which is delegated to North Carolina by the EPA. See Chapter 5 for a description of the NPDES program and permitting strategies.

3.3.2 Wastewater Point Source Discharges in the Little Tennessee River Basin

There are 128 permitted NPDES wastewater dischargers in the Little Tennessee River basin. There are fifty dischargers covered under individual permits and forty-six under general permits. Appendix XI lists the wastewater dischargers in the Little Tennessee River basin along with a summary of general information. The locations of these permitted facilities are shown in Figure 3.1 to 3.4. Permit renewals are conducted at five year intervals. Permits for the Little Tennessee River basin are scheduled to be renewed from October through December 1997.

The total permitted flow for all facilities is 5.93 million gallons per day (MGD). The average actual flow from all facilities is 4.95 MGD. Table 3.6 provides the total and average discharge for each category of permitted facility.

There are numerous trout farms with an NCG permit located in the Little Tennessee River basin. Trout farms can be a source of nutrients to waters if the farms are not managed properly. The impacts from trout farms are typically found within a short stream length from the farm. In this way, impacts from trout production are localized and can result in lower macroinvertebrate ratings. Changes caused by trout farms can be in the form of algal production and higher than normal nutrients. The effects from trout farms are more often seen during low flows and high water temperatures. Trout farms can also cause water quality problems if there is more than one farm on a stream reach. See Appendix IV for the requirements of a general permit.

Water quality degradation at sampling sites below trout farms has been noted in Tellico Creek, White Oak Creek, and the Snowbird Creek and W. Buffalo Creek arms of Santeetlah Lake.

3.3.3 Stormwater Point Source Discharges in the Little Tennessee River Basin

Excluding construction general permits, there are 30 general permits and 1 individual stormwater permit issued within the river basin. Activities covered under the general stormwater permits include construction; mining/borrow pits; manufacture of timber products; apparel, printing, paper, leather, and rubber products manufacturing; manufacture of stone, clay, glass, and concrete products; vehicle maintenance, transportation, and postal service activities, public warehousing and petroleum bulk stations and terminals; ready mixed concrete production; manufacture of asphalt paving mixtures and blocks; and furniture and fixture manufacturing. Packaging Corporation of America is covered under an individual permit. There are currently no municipalities in the Little Tennessee River basin that are subject to NPDES stormwater permitting. A list of general information on permitted stormwater dischargers in the Little Tennessee River basin is provided in Table 3.7. A map showing locations of NPDES stormwater permittees can be found in Figure 3.5.

Table 3.6 Definitions of Categories of NPDES Permits

CATEGORY	DEFINITION	EXAMPLES
Major vs. Minor discharges (NC00 Facilities)	For publicly owned treatment works, any facility discharging over 1 MGD is defined as a Major discharge. For industrial facilities, the EPA provides evaluation criteria including daily discharge, toxic pollutant potential, public health impact and water quality factors. Any facilities which do not meet the criteria for Major status are defined as Minor discharges.	NC0039578 - Tuckaseigee Water and Sewer Authority
General Permits (NCG Permit Facilities)	Permits for dishcargers in categories which all have similar discharges, operations and monitoring, and limits. Generally minor effluent on receiving stream individually.	Trout farms and most stormwater permits.
100% Domestic	A system which treats wastewater containing household-type wastes (bathrooms, sinks, washers, etc.).	Housing subdivision WWTPs, schools, mobile home parks.
Municipal	A system which serves a municipality of any size.	NC0039578 - Tuckaseigee Water and Sewer Authority
Process Industrial	Water used in an industrial process which must be treated prior to discharge.	NC0027243 - Mearl corporation, Mineral Division (gem mining operation)
Nonprocess Industrial	Wastewater which requires no treatment prior to discharging[1].	NCG500136 - Nantahala Hydro (Non-contact cooling water)
Stormwater Facilities	Discharges of runoff from rainfall or snow melt. NPDES permits are required for "stormwater discharges associated with industrial activity" and from municipal stormwater systems for towns over 100,000 in population.	"Stormwater discharges associated with industrial activity" include most types of manufacturing plants. Landfills, mines, junkyards, steam electric plants, transportation terminals and any construction activity which disturbs 5 acres or more during construction.

1. Non-contact cooling water may contain biocides; however, the biocides must be approved by our Aquatic Survey and Toxicology Unit. The approval process verifies that the chemicals involved have no detrimental effect on the stream when discharged with the non-contact cooling water.

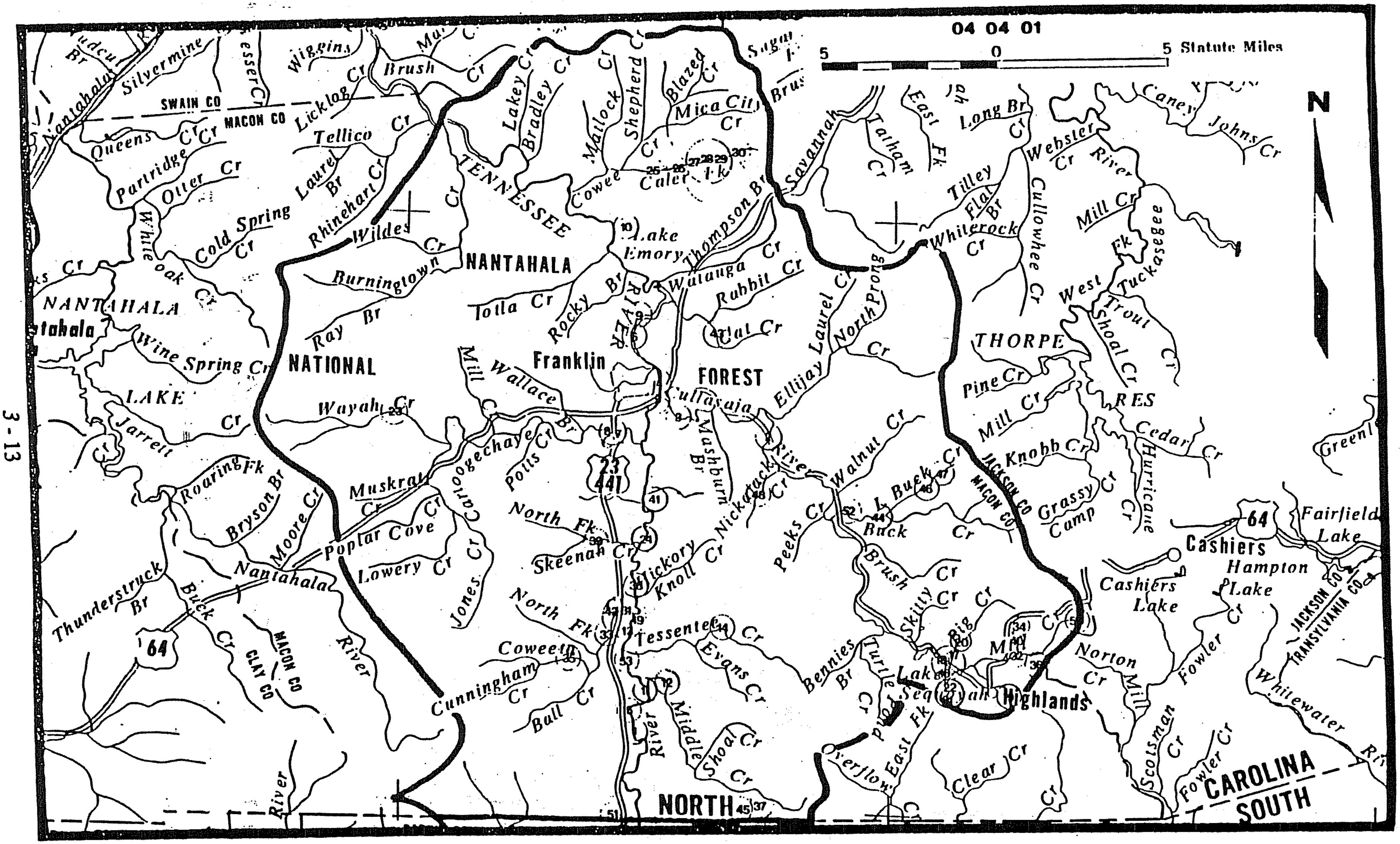


Figure 3.1 Map of NPDES Wastewater Permittees in the upper Little Tennessee River (Subbasin 04-04-01)

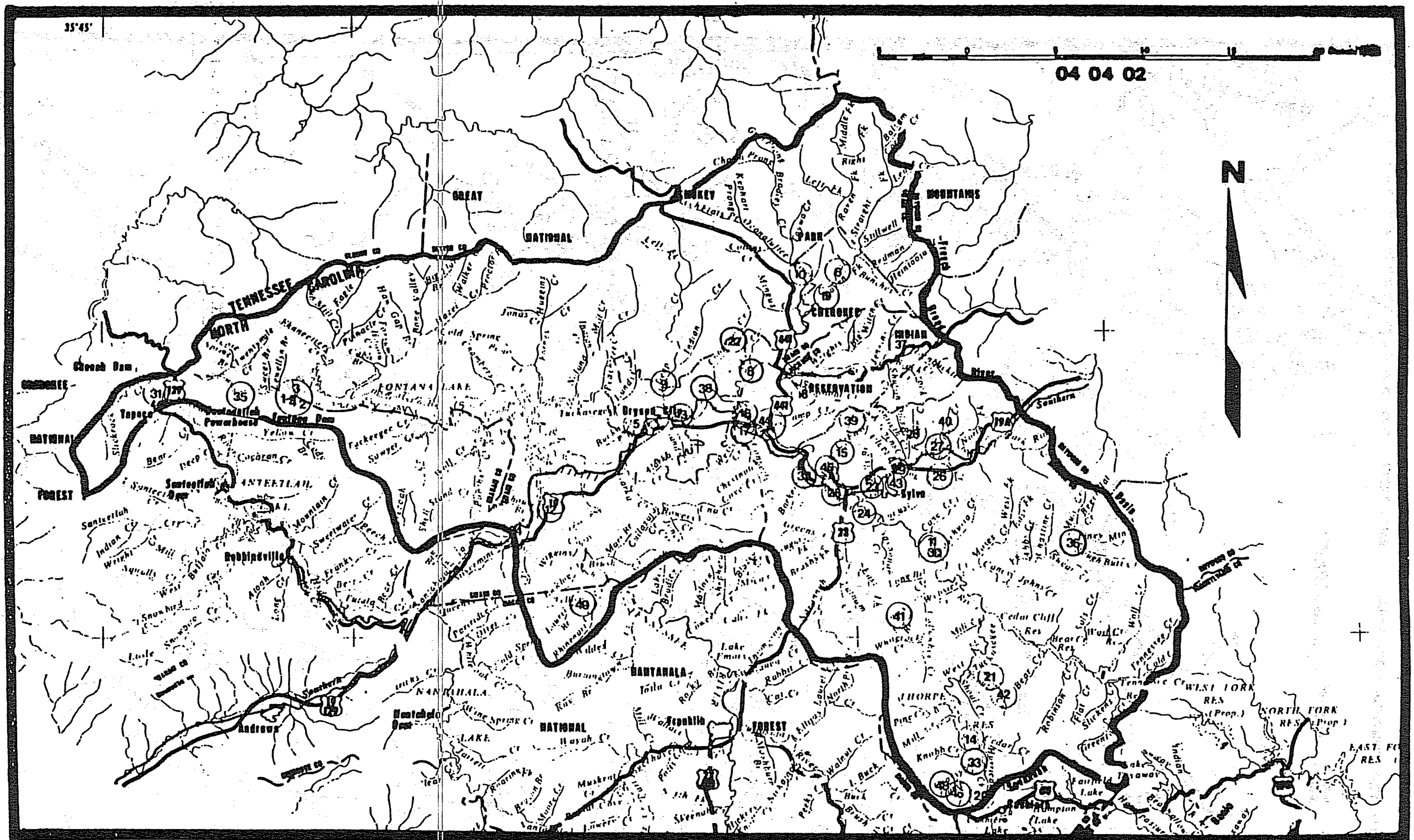


Figure 3.2 Map of NPDES Wastewater Permittees in the lower Little Tennessee River (Subbasin 04-04-02)

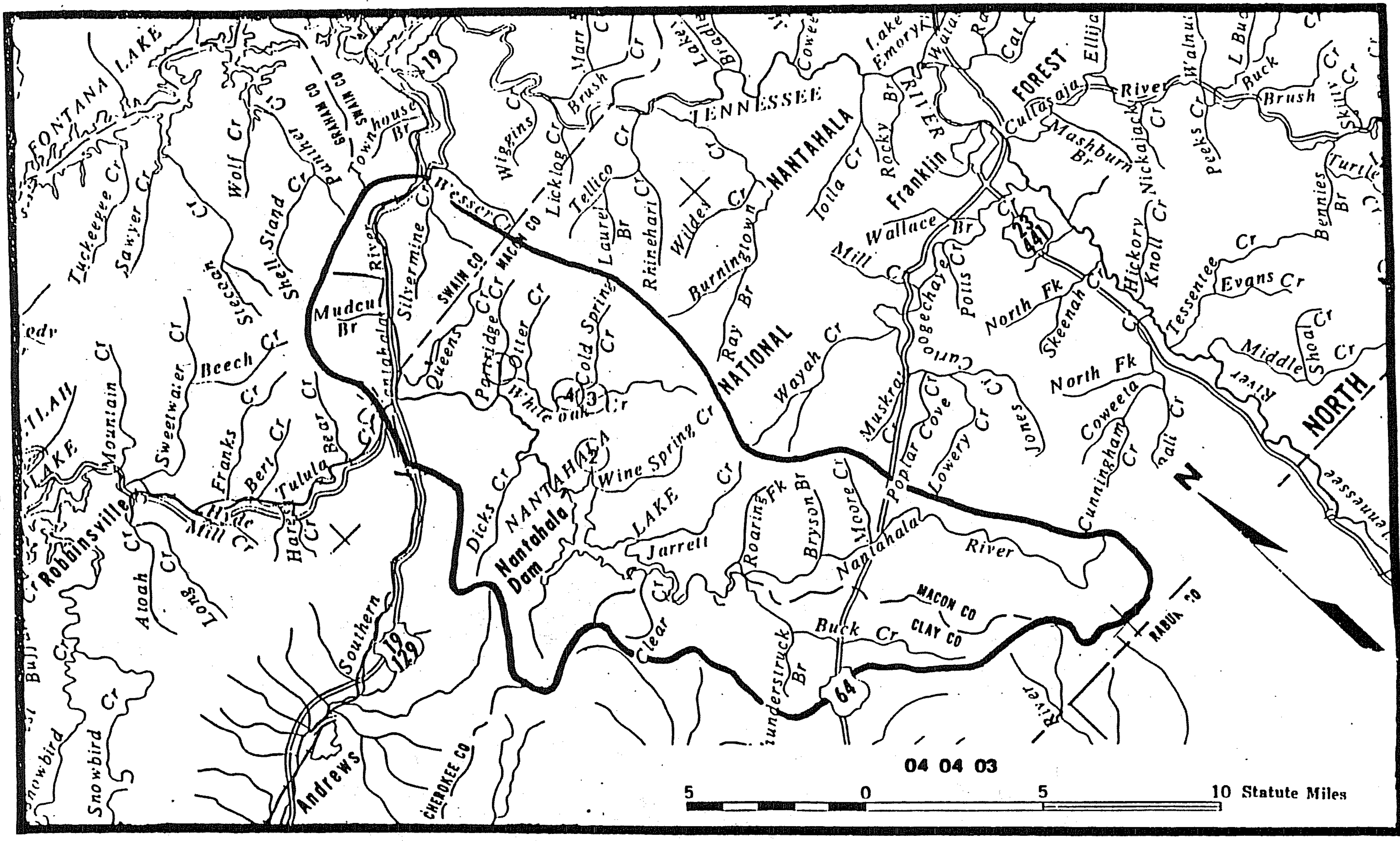


Figure 3.3 Map of NPDES Wastewater Permittees in the Nantahala River (Subbasin 04-04-03)

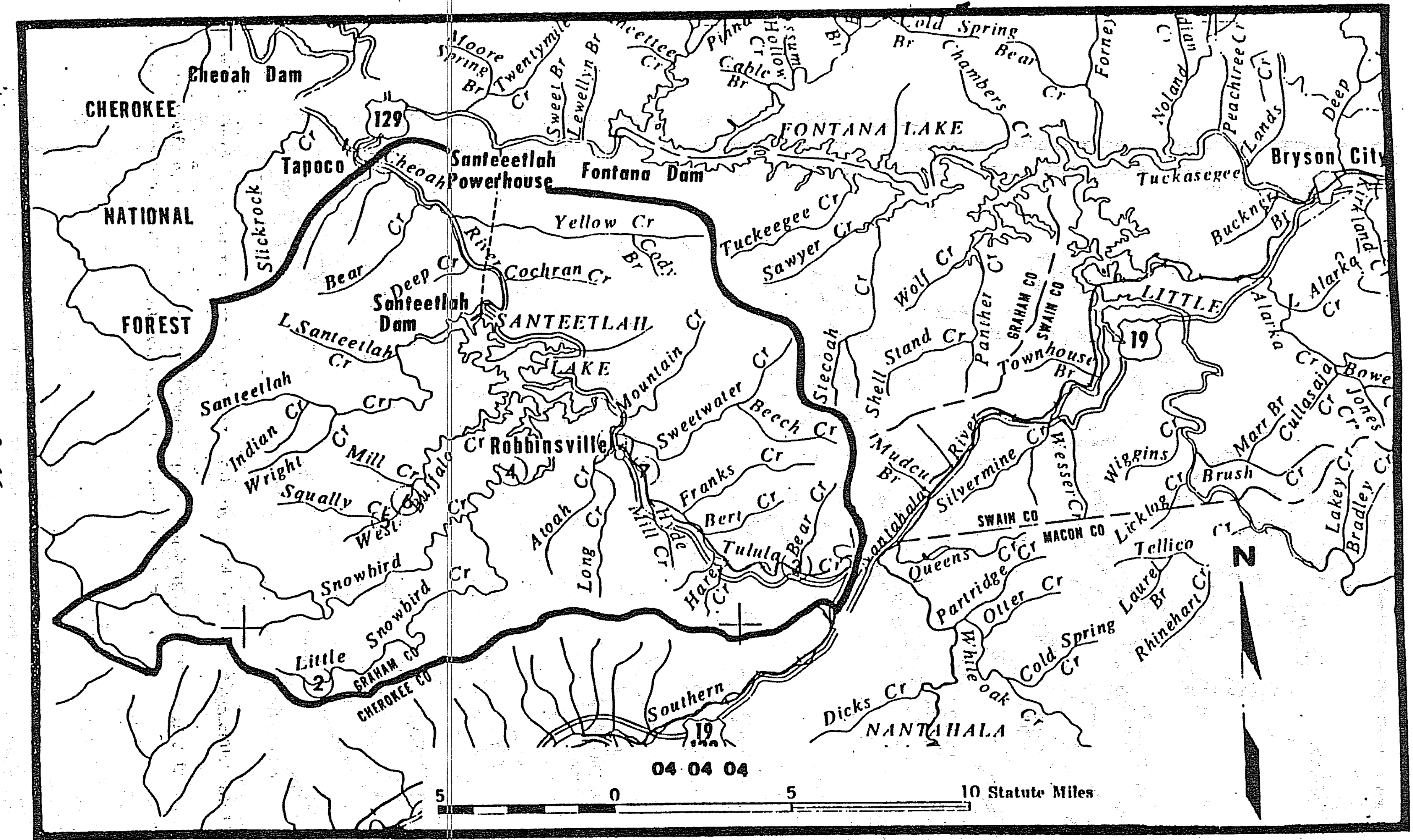


Figure 3.4 Map of NPDES Wastewater Permittees in the Cheoah River (Subbasin 04-04-04)

Table 3.7 Summary of NPDES Dischargers and Permitted and Actual Flows for the Little Tennessee River Basin.

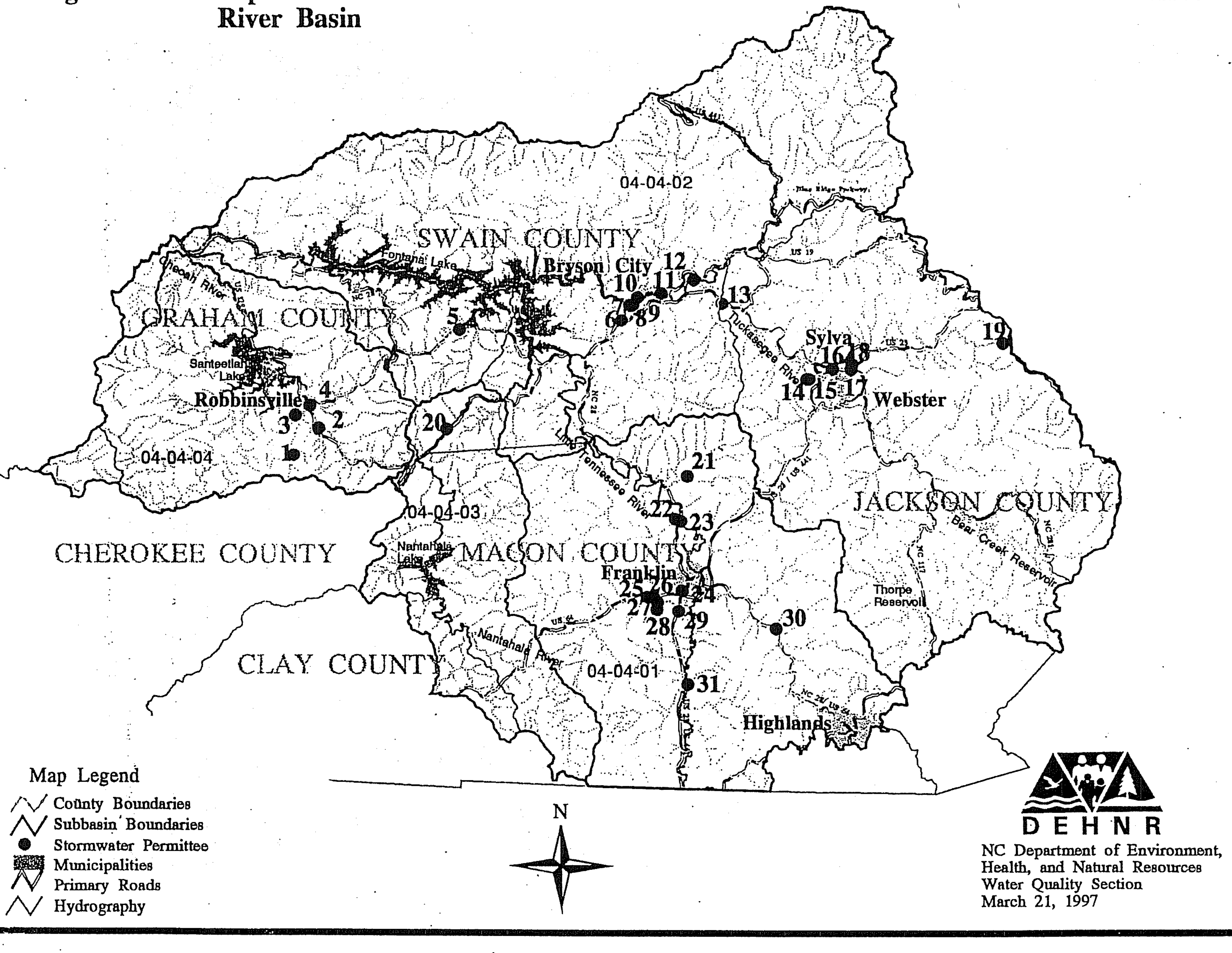
	Subbasin Number				
FACILITY CATEGORIES	04-04-01	04-04-02	04-04-03	04-04-04	Totals
Total Facilities	44	68	5	11	128
NC00 Facilities	17	29	1	3	50
Stormwater Facilities	11	15	1	5	32
NCG General Permit Facilities	16	24	3	3	46
Total Permitted Flow (MGD)	1.87	3.41	0.01	0.64	5.93
# of Facilities Reporting	11	19	1	1	32
Total Avg. Flow (MGD)	1.10	2.54	0.46	0.85	4.95
***Major Discharges**	0	1	0	0	1
Total Permitted Flow (MGD)	0	1.5	0	0	1.5
# of Facilities Reporting	0	1	0	0	1
Total Avg. Flow (MGD)	0.00	0.70	0.00	0.00	0.70
***Minor Discharges**	17	28	1	3	49
Total Permitted Flow (MGD)	1.87	1.91	0.01	0.64	4.43
# of Facilities Reporting	11	18	1	1	31
Total Avg. Flow (MGD)	1.10	1.84	0.46	0.85	4.25
100% Domestic Wastewater	7	11	1	0	19
Total Permitted Flow (MGD)	0.32	0.46	0.01	0.00	0.79
# of Facilities Reporting	7	11	1	0	19
Total Avg. Flow (MGD)	0.05	0.05	0.01	0.00	0.11
Municipal Facilities	2	4	0	1	7
Total Permitted Flow (MGD)	1.50	2.64	0.00	0.63	4.77
# of Facilities Reporting	2	4	0	1	7
Total Avg. Flow (MGD)	1.00	1.18	0.00	0.22	2.40
Major Process Industrial	0	0	0	0	0
Total Permitted Flow (MGD)	0	0	0	0	0
# of Facilities Reporting	0	0	0	0	0
Total Avg. Flow (MGD)	0.00	0.00	0.00	0.00	0.00
Minor Process Industrial	2	2	0	0	4
Total Permitted Flow (MGD)	0.05	0.31	0.00	0.00	0.36
# of Facilities Reporting	2	2	0	0	4
Total Avg. Flow (MGD)	0.04	0.10	0.00	0.00	0.14
Nonprocess Industrial	0	2	0	0	2
Total Permitted Flow (MGD)	0.00	0.01	0.00	0.01	0.02
# of Facilities Reporting	0	2	0	0	2
Total Avg. Flow (MGD)	0.00	0.04	0.00	0.00	0.04

* NC00 / Individual permit facilities

Table 3.8 Summary of NPDES Stormwater Permits in the Little Tennessee River Basin

Permit #	Facility	Receiving Stream	County
Subbasin 04-04-01			
NCG020146	Sheffield Mine - John Kellberg		Macon
NCG020245	Harrison Construction Co.- Tub Mill Quarry	Cartoogechaye Br	Macon
NCG020249	Jacobs Ruby Mine	Caler Fork	Macon
NCG020262	Angus C. Martinez- Rose Creek Mine & Campground	UT To Iotla Cr	Macon
NCG040008	Franklin Lumber And Kiln Company	Wallace Br	Macon
NCG040171	Cook Brothers Lumber Co., Inc.	Cullasaja Rvr	Macon
NCG070022	B & B Concrete Products, Inc.	UT To Cartoogechaye Cr	Macon
NCG070136	Metromont Materials Corp.	Little Tennessee Rvr	Macon
NCG080179	United Parcel Service- Franklin	Cartoogechaye Cr	Macon
NCG140009	Southern Concrete Materials	Cullasaja Rvr	Macon
NCG160033	APAC Tennessee Inc Harrison Div-Hwy 64	Cartoogechaye Cr	Macon
Subbasin 04-04-02			
NCG020247	Harrison Construction Co.- Dillsboro Quarry	Tuckaseegee Rvr	Jackson
NCG040055	DeHart Lumber Company	Wolf Cr	Graham
NCG040095	Powell Lumber And Kiln Co., Inc.	Tuckasegee Rvr	Swain
NCG040098	Smokey Cove, Inc.	Turkasegee Rvr	Swain
NCG040112	Manes Manufacturing Company	Tuckasegee Rvr	Swain
NCG040134	T & S Hardwoods, Inc.	Scotts Cr	Jackson
NCG040221	Monteith Lumber Co., Inc.	Tuskeegee Rvr	Swain
NCG040283	Georgia-Pacific Corp.-Bryson City Log Yard	Tuckasegee Rvr	Swain
NCG050249	Consolidated Metco Inc.-Swain	Cochran Br	Swain
NCG080191	Unitd Parcel Service- Sylva	Yellow Bird Cr	Jackson
NCG140113	Southern Concrete Materials	Toot Hollow Br	Swain
NCG140158	Southern Concrete Materials Inc-Main Street	Scott Cr	Jackson
NCG160031	APAC Tennessee Inc Harrison Div-Macktown Rd	Tuckasegee Rvr	Jackson
NCG180091	Drexel Hertiage Furnishings Inc.-Plant 51	Tuckasegee Rvr	Jackson
NCS000295	Packaging Corp Of America	Scott's Cr	Jackson
Subbasin 04-04-03			
NCG160030	APAC Tennessee Inc Harrison Div.-Nantahala	Nantahala Rvr	Swain
Subbasin 04-04-04			
NCG050079	American Uniform Co.	Tulula Cr	Graham
NCG080055	Veach-Wilson Oil Company	Tulula Cr	Graham
NCG160052	S. T. Wooten-Benson	Ut Stony Fork	Johnston
NCG180025	Stanley Furniture Company	Long Cr	Graham
NCG180053	Stanley Furniture Comapany	Long Cr	Graham

Figure 3.5 Map of the Location of NPDES Stormwater Permittees in the Little Tennessee River Basin



The primary source of concern from industrial facilities is the contamination of stormwater from contact with exposed materials. In addition, poor housekeeping can lead to significant contributions of sediment and other pollutants which have a detrimental effect on the water quality in receiving streams. There have been no reported water quality concerns directly related to permitted point source stormwater discharges in the Little Tennessee River basin.

3.4 NONPOINT SOURCES OF POLLUTION

Nonpoint source (NPS) pollution refers to runoff that enters surface waters through stormwater, snowmelt or atmospheric deposition (e.g. acid rain). There are many types of land use activities that are a source of nonpoint source pollution including land development, construction, mining operations, crop production, animal feeding lots, failing septic systems, landfills, roads and parking lots. As noted earlier, stormwater from large urban areas (>100,000 people) and from certain industrial sites is considered a point source since NPDES permits are required for piped discharges of stormwater from these areas. However, a discussion of urban runoff will be included in this section.

Sediment and nutrients are major pollution-causing substances associated with nonpoint source pollution. Others include fecal coliform bacteria, heavy metals, oil and grease, and any other substance that may be washed off the ground or removed from the atmosphere and carried into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur at random time intervals depending on rainfall events. Below is a brief description of major areas of nonpoint sources of pollution in the Little Tennessee River basin.

Nonpoint source pollution has been identified as a source of stream impairment in the basin for 4.8 miles of the Cullasaja River above Mirror Lake. An additional 61.7 miles of streams have been identified as Support-Threatened due to nonpoint sources of pollution. While presently fully-supporting their uses, several other streams have been affected by nonpoint sources of pollution. These waters include Middle, Tessentee, Cartoogechaye, Tellico, Cullowhee, Savannah, Stecoah, Tulula and W. Buffalo Creeks (DWQ Basinwide Assessment Report). Refer to Chapters 4 and 6 for lists of impaired and threatened waters.

3.4.1 Agriculture

There are a number of activities associated with agriculture that can serve as sources of water pollution. Land clearing and plowing make soils susceptible to erosion, which can then cause stream sedimentation. Pesticides and fertilizers (including chemical fertilizers and animal wastes) can be washed from fields, orchards, Christmas tree farms or improperly designed storage or disposal sites. Construction of drainage ditches on poorly drained soils enhances the movement of stormwater into surface waters. Concentrated animal feed lot operations or dairy farms without adequate waste management systems or fencing to keep animals away from streams can be a significant source of BOD, fecal coliform bacteria, sediments and nutrients. Untreated discharge from a large operation can be compared to the nutrient load in the discharge from a secondary waste treatment plant serving a small town.

Sediment production and transport is greatest from row crops and cultivated fields (Waters, 1995; Lenat et al. 1979). Contour plowing, terracing and grassed waterways are several common methods used by most farmers to minimize soil loss. Maintaining a vegetated buffer between fields and streams is another excellent way to minimize soil loss to streams. Fencing cattle and dairy cows from streams protects streambanks from trampling, protects streamside vegetation, and decreases the introduction of nutrients and fecal coliform bacteria from animal waste.

Chapter 5 discusses agricultural nonpoint source control programs. A list of BMPs for addressing agricultural runoff is presented in Appendix V.

3.4.2 Urban/Residential

It is commonly known that urban streams are often polluted streams. There are questions concerning what aspects of urbanization cause the degradation, to what extent urbanization alone can be called the source of degradation, and what can be done about the pollutants and human habits that cause the degradation. Some potential impacts of stormwater runoff include:

- Polluted water: Numerous pollutants may be present in urban stormwater, including sediment, nutrients, bacteria, oxygen demanding substances, oil and grease, trace metals, road salt, and toxic/synthetic chemicals. These pollutants can impair aquatic life, reduce recreational value and threaten public health if drinking water sources and fish tissue become contaminated.
- Flooding: Flooding damages public and private property, including infrastructure. It can also threaten public safety.
- Eroded streambanks: Sediment clogs waterways and fills lakes and reservoirs. It can also smother the plants and animals in waterbodies and destroy the habitat necessary for reproduction of fish and aquatic animals. The erosion of streambanks causes loss of valuable property as stream width grows.
- Economic impacts: The economy can be impacted from a loss of recreation-related business and an increase in drinking water treatment costs.

Runoff from urbanized areas, as a rule, is more localized but can often be more severe than agricultural runoff. Any type of land-disturbing activity such as land clearing or excavation can result in soil loss and cause sedimentation into the waters in the watershed. The rate and volume of runoff in urban areas is much greater due both to the high concentration of impervious surface areas and to storm drainage systems that rapidly transport stormwater to nearby surface waters. This increase in volume and rate of runoff can result in streambank erosion and sedimentation in surface waters.

These drainage systems, including curb and guttered roadways, also allow urban pollutants to reach surface waters quickly and with little or no filtering. Pollutants include lawn care products such as pesticides and fertilizers; automobile-related pollutants such as fuel, lubricants, abraded tire and brake linings; lawn and household wastes (often dumped in storm sewers); road salts, and fecal coliform bacteria (from animals and failing septic systems). The diversity of these pollutants makes it very challenging to attribute water quality degradation to any one pollutant.

Replacement of natural vegetation with pavement, removal of streamside buffers and managed lawns reduce the ability of the watershed to filter pollutants before they enter the stream. The chronic introduction of these pollutants and increased flow and velocity into a stream results in degraded waters. Many urban streams are rated as biologically poor.

The population density map presented in Chapter 2 is an indicator of where urban development and potential urban stream impacts are likely to occur. Biological sampling has noted two sampling sites with probable degradation due to urban sources of nonpoint source pollution. These streams are Mill Creek near Highlands and the Little Tennessee River at Iotla Creek near Franklin. There may be other streams affected by urbanization which have not been sampled.

Management strategies for addressing urban runoff are presented in Chapter 6. A list of BMPs for addressing urban runoff is presented in Appendix V.

3.4.3 Construction

Construction activities that entail excavation, grading or filling (such as road construction or land clearing for development) can produce significant sedimentation if not properly controlled. Sedimentation from developing urban areas can be a major source of pollution due to the cumulative number of acres disturbed in a basin. Construction of single family homes in rural areas can also be a source of sedimentation when homes are built too near to streams or drainages. This latter form of development can be seen throughout the Little Tennessee River basin.

As a pollution source, construction activities are typically temporary, but the impacts can be severe and long lasting (see discussion in sediment section above). Construction activities tend to be concentrated in the more rapidly developing areas of the basin. However, road construction is widespread and often involves stream crossings in remote or undeveloped areas of the basin. In addition, resort development in relatively undeveloped areas can be devastating to previously unimpacted streams.

Construction-related sedimentation is addressed through the Sedimentation Pollution Control Act (see Chapter 5 and Appendix VI). A list of BMPs for controlling erosion and sedimentation is presented in Appendix V.

3.4.4 Timber Harvesting

Undisturbed forested areas are an ideal land cover for water quality protection. They stabilize the soil, filter rainfall runoff and produce minimal loadings of organic matter to waterways. In addition, forested stream buffers can filter impurities from runoff from adjoining nonforested areas. Improper timber harvesting can destroy these buffers and destabilize soils.

Improper forest management practices can adversely impact water quality in a number of ways. This is especially true in mountainous regions where steep slopes and fragile soils are widespread. Without proper BMPs, large clearcutting operations can change the hydrology of an area and significantly increase the rate and flow of stormwater runoff. This results in both downstream flooding and stream bank erosion. Clearcutting, when compared to selective cutting, can cause a much higher rate of erosion (Waters 1995). The hydrology of a watershed can also change due to selective cutting sites if best management practices are not used (Henson, pers. comm.)

Careless harvesting and road and stream crossing construction can transport sedimentation to downstream waters. Streams with sedimentation may require many years to restore. Removing riparian vegetation along stream banks can cause water temperature to rise, destabilize the shoreline and minimize or eliminate the runoff protection benefits of the buffer. Sedimentation due to forestry practices is most often associated with the development and use of logging roads, particularly when roads are built near streams (Waters 1995). Density and length of logging roads can be major factors in the amount of sedimentation produced.

Other adverse effects resulting from forestry operations include: 1) an increase in woody debris clogging stream channels which can alter the stream channel and prevent fish movement; 2) loss of riparian vegetation which can reduce shade cover and raise stream temperatures; 3) loss of canopy which can alter the interface of the aquatic and terrestrial ecosystems. This is especially true where populations of amphibians are concerned.

Timber harvesting is an important industry in the Little Tennessee River basin. However, it is critical that all efforts be made to minimize sediment loss and runoff so as to protect other natural resources in this basin. These resources include trout waters, drinking water supplies and aesthetics. This is especially important in light of a trend toward increased logging in North Carolina and in the southeast United States, in general.

The NC Division of Forest Resources (DFR) presently tracks timber harvesting trends by county rather than by river basin. The DFR is working toward tracking information by river basin in the future. Table 3.8 presents timber harvest trends for private lands in Cherokee, Clay, Graham, Jackson, Macon and Swain counties. Actual harvest trends within the basin boundaries are unknown, since only a portion of each county lies within the Little Tennessee River basin. Table 3.8 shows that 1987 to 1994 were high timber harvest years for the region. Harvest totals for each county are significantly higher than they were in 1979 and 1983. Harvest trends vary by county and by year, with Cherokee, Clay, Macon and Swain counties showing increased harvest rates since 1992.

Compliance inspections are done by DFR continuously. A recent limited statewide sampling survey (based on 450 site inspections statewide) showed overall compliance rate with forestry BMPs and Forest Practice Guidelines (FPGs) was 92% (Henson 1995; 1996). A summary of activities and past accomplishments in the Little Tennessee River basin is reported in Chapter 5.

Appendix VI describes several programs that are aimed at either encouraging or requiring utilization of forest best management practices at the state and federal level. A list of forest BMPs is also presented in Appendix V.

Table 3.9 Timber Harvest Removal Trends (in Thousand Cubic Feet) by County for 1979 to 1994 (Division of Forest Resources).

County	1979	1983	1987	1990	1992	1994
Cherokee	3476	4071	8004	4939	2635	4290
Clay	784	857	1971	1575	695	986
Graham	803	1078	1441	1822	1789	1665
Jackson	1514	1315	2259	3817	3944	2964
Macon	1332	3638	4479	4439	2926	3683
Swain	1583	1460	906	2316	2043	2661
Totals	9492	12,419	19,060	18,908	14,032	16,249

3.4.5 Mining

Mining operations can produce high sedimentation in localized streams if not properly conducted. The North Carolina Mining Act of 1971 covers all persons or firms that are involved in any activity or process that disturbs or removes the surface soil in order to remove minerals or other solid matter, or prepares, washes, cleans or in any way treats minerals or other solid materials to make them suitable for commercial, industrial, or construction use. These operations can range from large quarries to small borrow pits. The Mining Act applies only to those operations that affect one acre or more.

The Mining Act requires a permit application form with mine maps and design calculations for erosion and sediment control measures to be submitted to the Division of Land Resources (DLR) for review and approval. The Land Quality Section of DLR is required by law to make routine inspections of all permitted mines and determine if the operator is in compliance with provisions of the mining permit. The Mining Act allows for civil penalties and fines if the Act is violated.

The Mining Act also requires operators to submit a reclamation plan that outlines the method to be used in restoring the land to a condition suitable for its intended future use.

In the Little Tennessee River basin there are several gem mining operations. These mines are not required to file a permit application form if these operations affect less than one acre of soil surface. Many of the gem mines in the Little Tennessee River basin are too small to fall within the requirements of the Mining Act. The majority of gem mining operations are located on Caler Fork and Cowee Creek in the Upper Little Tennessee River subbasin. Cowee Creek has shown very turbid conditions, heavy siltation and effects of enrichment on benthic macroinvertebrates.

Information on the North Carolina Mining Act and the state's mining program are listed in Appendix VI. Mining BMPs are listed in Appendix V.

3.4.6 Onsite Wastewater Disposal

Septic systems receive wastewater from a household or business. The septic tank removes some wastes, but the soil drainfield provides further absorption and treatment. Septic tanks can be a safe and effective method for treating wastewater if they are sized, sited, and maintained properly. However, if the tank or drainfield malfunction or are improperly placed, constructed or maintained, nearby wells and surface waters may become contaminated.

Some of the potential problems from malfunctioning septic system include:

- <u>Polluted groundwater</u>: Pollutants in sewage include bacteria, nutrients, toxic substances, and oxygen-consuming wastes. Nearby wells can become contaminated by septic tanks.
- <u>Polluted surface water</u>: Often, groundwater carries the pollutants mentioned above into surface waters, where they can cause serious harm to aquatic ecosystems. Septic tanks can also leak into surface waters both through or over the soil.
- <u>Risks to human health</u>: Septic system malfunctions can endanger human health when they contaminate nearby wells, drinking water supplies, and fishing and swimming areas.

Pollutants associated with onsite wastewater disposal may also be discharged directly to surface waters through *straight pipes* (i.e., direct pipe connections between the septic system and surface waters). These types of discharges, if unable to be eliminated, must be permitted under the NPDES program and be capable of meeting effluent limits specified to protect receiving stream water quality, including disinfection. The prevalence of straight piping in some western counties of the state recently drew the attention of the Year of the Mountains Commission. Legislation was passed to establish a program to eliminate domestic sewage or wastewater discharges from straight pipes or failing septic systems.

Onsite wastewater disposal is most prevalent in rural portions of the basin and at the fringes of urban areas. Fecal coliform bacteria contamination from failing septic systems is of particular concern in waters used for swimming, tubing, water supply and other related activities. Regulatory programs and BMPs pertaining to onsite wastewater disposal are presented in Appendix V.

3.4.7 Solid Waste Disposal

Solid wastes may include household wastes, commercial or industrial wastes, refuse or demolition waste, infectious wastes or hazardous wastes. Improper disposal of these types of wastes can serve as a source of a wide array of pollutants. The major water quality concern associated with modern solid waste facilities is controlling the leachate and stabilizing the soils used for covering many disposal facilities. Properly designed, constructed and operated facilities should not significantly effect water quality.

Groundwater and surface water monitoring is required at all permitted Municipal Solid Waste Sites (MSW) and all Construction and Demolition landfills. Monitoring efforts have been required since

July 1989. All MSW landfills must have a liner system in place by January 1, 1998. All existing unlined landfills must close at this same time.

In the Little Tennessee River basin there are is one closed landfill site near Franklin for Macon county. There is no known ground or surface water contamination associated with this site. The site is located in the Clear Creek drainage area. The county also has a new lined landfill. There are three operating Septage Land Application Sites near Franklin in Macon county. Nutrient Management Plans are required for these sites to prevent excessive loading of soils. Buffer areas are required between septage land application areas and surface waters. Appendix VI briefly summarizes state, local and federal solid waste recycling programs.

3.4.8 Golf Courses

Golf courses can impact water quality during construction and due to intensive turf management practices that rely heavily on the use of fertilizers and chemicals. Golf course runoff can carry these pollutants to nearby streams. The construction phase of golf courses can result in sedimentation to streams as has been seen in Connely's Creek. Grassy Camp Creek has been affected by both sediment inputs and low pH resulting from golf course management practices. Golf course construction and runoff may be affecting the upper Cullasaja River as well.

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CHAPTER 4

WATER QUALITY IN THE LITTLE TENNESSEE RIVER BASIN

4.1 INTRODUCTION

This chapter provides a detailed overview of water quality and use support ratings in the Little Tennessee River Basin.

DWQ Water Quality Monitoring and Assessment

- **Section 4.2** presents a summary of water quality monitoring programs conducted by DWQ's Environmental Sciences Branch (NCDWQ, 1994) as well as information reported by researchers and other agencies.
- **Section 4.3** presents a narrative summary of water quality findings for both of the subbasins. The summary is based on the monitoring approaches described in Section 4.2. Subbasin maps showing the locations of monitoring sites are also included.

Use-Support Ratings

- **Section 4.4** describes the use-support concept and the methodology for developing use-support ratings. Using this approach, surface waters in the basin are assigned one of four ratings: fully supporting, fully supporting but threatened, partially supporting, or not supporting uses.
- **Section 4.5** presents a series of tables, figures, and a color-coded use-support map for many of the streams in the basin.

4.2 WATER QUALITY MONITORING PROGRAMS

DWQ's monitoring program integrates biological, chemical, and physical data assessment to provide information for basinwide planning. Below is a list of the five major monitoring programs from which data is available for this basin. Each of these is briefly described in the following text.

- Benthic macroinvertebrate monitoring (Section 4.2.1),
- Fish population and tissue monitoring(Section 4.2.2),
- Lakes assessment (including phytoplankton monitoring) (Section 4.2.3),
- Aquatic toxicity monitoring (Section 4.2.4),
- Ambient water quality monitoring (covering the period 1988-1994) (Section 4.2.5).

In addition, Section 4.2.6 briefly describes other water quality and acid rain studies conducted by other agencies and academic researchers in the Little Tennessee River basin. These studies include:

- Acid Deposition and Sensitivity Studies
- Western Carolina University, Cullowhee, NC
- Tennessee Valley Authority
- Western North Carolina Alliance/TVA
- Duke Power

4.2.1 Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable water quality monitoring tool because these organisms are relatively immobile and sensitive to subtle changes in water quality. Since many organisms in a community have life cycles of six months to one year, the effects of short term pollution (such as an oil or chemical spill) will generally not be overcome until the following generation appears. The benthic community also responds to and shows the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification rating to each benthic sample based on the number of different species present in the pollution-intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies); or commonly referred to as EPTs. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. The ratings fall into five categories ranging from Poor to Excellent. Likewise, ratings can be assigned with a Biotic Index (Appendix III). This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis.

<u>Macroinvertebrate Sampling in the Little Tennessee River Basin</u>
Benthos data were collected at 30 basin assessment sites during 1994, and a total of 81 sites have been rated using benthic macroinvertebrate data since 1983. Looking at bioclassifications assigned with the most recent data, 47% were Excellent, 35% were Good, 13% were Good-Fair, 4% were Fair and 1% (1 site) was Poor (the Cullasaja River above Lake Sequoyah in 1991).

4.2.2 Fisheries Monitoring

The condition of the fishery is one of the most meaningful indicators of ecological integrity to the public. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web (such as macroinvertebrates) will affect the abundance, species composition, and condition of the fish population. Two types of fisheries monitoring are conducted by DWQ and are described briefly below.

Fish Community Assessment

The first method involves assessing the overall health of the fish community. This information can be used as an indicator of water quality. The North Carolina Index of Biotic Integrity (NCIBI) is a modification of Karr's IBI (1981). The NCIBI was developed to assess the biological integrity of streams by examining the structure and health of the fish community. The index incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. At this time DWQ has no Index of Biotic Integrity calculated for fish populations in lakes and the NCIBI is not used for trout streams due to their naturally limited fish diversity.

<u>Fish Community Sampling in the Little Tennessee River Basin</u>
Approximately 61 species have been collected from the Little Tennessee River basin in North Carolina (Menhinick 1991; 1995 (pers. comm.) Appendix III). Seven of these species have been given special protection status by the North Carolina Wildlife Resources Commission or the North Carolina Natural Heritage Program under the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337) (LeGrand and Hall 1995). Refer to Chapter 2 for a list of these species.

Fish Tissue Analysis

The second monitoring method involves analyzing fish tissues to determine whether they are accumulating chemicals. This information is also useful as a water quality indicator and can be used to determine whether human consumption of fish poses a potential health risk.

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Therefore, by analyzing fish tissue, chemicals in the water can be identified. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species has been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be ingested by fish or shellfish tissues either directly or through aquatic food webs (defined as bioaccumulation). Results from fish tissue monitoring can serve as an important indicator of contamination of sediments and surface water. Fish tissue analyses are also used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

<u>Fish Tissue Analysis in the Little Tennessee River Basin</u>
Fish tissue samples were collected from the Little Tennessee River at Topoco and Calderwood Reservoir. Results of fish tissue analysis indicated that levels of metals and organics contaminants in both samples were non-detectable or present at levels below FDA and EPA criteria.

4.2.3 Lakes Assessment Program (including Phytoplankton)

Lakes are valued for the multiple benefits they provide to the public. These benefits include recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lakes Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the general health, or trophic state, of each lake. The North Carolina Trophic State Index (NCTSI) is a measure of nutrient enrichment and productivity. Lakes are evaluated on whether the designated uses of the lake have been threatened or impaired by pollution. This index is explained more fully in Appendix III.

<u>Lakes Assessed in the Little Tennessee River Basin</u>
There were ten lakes in the Little Tennessee River Basin sampled as part of the Lakes Assessment Program. These lakes, by river subbasin, are presented below:

Upper Little Tennessee Subbasin 040401	Lower Little Tennessee Subbasin 04042	Nantahala River Subbasin 040403	Cheoah River Subbasin 040404
Lake Sequoyah	Wolf Creek Reservoir	Nantahala Lake	Santeetlah Lake
Lake Emory	Bear Creek Reservoir		Calderwood Lake
	Thorpe Reservoir		
	Fontana Lake		
	Lake Cheoah		

Each lake is individually discussed in the appropriate subbasin section with a focus on the most recent available data.

4.2.4 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory. The Aquatic Survey and Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Aquatic Toxicity Monitoring in the Little Tennessee River Basin

There are three facilities in this basin that currently monitor effluent toxicity as per a permit requirement. Those facilities are:

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Franklin WWTP	NC0021547/001	Little Tenn R	Macon	1.65	1.600
Bryson City WWTP	NC0026557/001	Tuckasegee R.	Swain	0.60	0.253
Tuckasegee WSA WWTP	NC0039578/001	Tuckasegee R.	Jackson	1.50	1.380

Whole effluent toxicity monitoring results for all dischargers in the Little Tennessee Basin are presented in Appendix III. The toxicity monitoring records of these facilities have been such that there has been no need for regulatory relief through a special or judicial order.

4.2.5 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake, and estuarine (saltwater) water quality monitoring stations (about 380 statewide) strategically located for the collection of physical and chemical water quality data (or water quality parameters). Sampling stations are sited under one or more of the following monitoring designations:

Fixed Monitoring Stations
Point source
Nonpoint source
Baseline Water Supply

Rotating Monitoring Stations
Basinwide Information
HQW & ORW

Water quality parameters are arranged by freshwater or saltwater waterbody classification and corresponding water quality standards. Under this arrangement, Class C waters are assigned minimum monthly parameters. Additional parameters are assigned to waters with additional classifications, such as trout waters and water supplies. Water quality parameters are organized as shown in Table 4.1.

Water quality data collected at seven sites in the Little Tennessee River basin were evaluated for the period 1990-1994 since basinwide permitting is done in five year cycles. These data were downloaded from STORET to a desktop computer for analysis. Because the methodology for determining parametric coverage within the AMS program has recently been revised, some stations have little or no data for several parameters. However, for the purpose of standardization it was felt that data summaries for each station should include all parameters that will be sampled in the future. These data summaries are found at the end of each subbasin section.

Table 4.1 Ambient Monitoring System Freshwater Parametric Coverage.

C WATERS (minimum monthly coverage for all stream stations)

Field Parameters: dissolved oxygen, pH, conductivity, temperature, chlorine,
Nutrients: total phosphorus, ammonia, total Kjeldahl nitrogen, nitrate+nitrite
Physical Measurements: total suspended solids, turbidity, hardness
Bacterial: fecal coliforms (Millipore Filter method)
Metals: aluminum (no present water quality standard), arsenic, cadmium, chromium, copper*, iron*, lead, mercury, nickel, silver*, zinc*

TROUT WATERS

No changes or additions

WATER SUPPLY

Chlorides, total coliforms, manganese, total dissolved solids

NUTRIENT-SENSITIVE WATERS

Chlorophyll *a* (where appropriate)

PLUS any additional parameters of concern for individual station locations.

*Action level water quality standard.

Table summaries of ambient water chemistry data for all Ambient Monitoring System (AMS) stations within the Little Tennessee River Basin are presented by subbasin in Appendix III. These tables summarize data from 1990 through 1994 for common selected chemical parameters and include station summary information, descriptive statistics for parametric data, water quality criteria information for the station's classification, a yearly breakdown of selected parametric data and descriptive statistics for parametric data from summer months. The April-October months are used in summer modeling applications, June-September months are used in worse-case, lowest-flow analyses.

AMS stations for the basin are listed in Table 4.2 below. North Carolina has 7 stations in the Little Tennessee River Basin. The ambient data results are discussed by subbasin.

Table 4.2 Ambient Monitoring System Stations Within the Little Tennessee Basin.

Primary No	STORETNo	Station Name	Subbasin	Class
Little Tennessee Drainage				
03500000	G0035000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	040401	C
03500240	G0130000	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	040401	B Tr
03502000	G2000000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	040401	C
Nantahala Drainage				
03504000	G3510000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	040403	B Tr
Tuckasegee Drainage				
03512000	G8550000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	040402	C Tr
03513000	G8600000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	040402	C
Cheoah Drainage				
03515633	G9550000	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	040404	C Tr

Table 4.3 summarizes, by parameter, data collected at ambient stations in the Little Tennessee Basin. This table summarizes only those parameters with a DWQ state criterion. Each station is listed with associated parameter, along with the total number of samples, those samples with less than detection level recorded, and the number of samples for that parameter that represented an excursion from a water quality criterion. It should be noted that the criteria are presented as numerical and represent instantaneous measurements. The actual standard may include a narrative, such as turbidity, and, as in some metals criteria, may be based on extended exposure at or above

the criteria to expect chronic toxicity of the most sensitive species of organism. Therefore the table is useful for relative comparisons between locations and screening areas where frequent excursions of individual or multiple parameters suggest waters that might be targeted for more detailed evaluations and/or specific management strategies. A more thorough evaluation can include review of temporal and spatial trends, association of concentrations to flow, degree of excursion from the criterion, or use of other analytical methods.

Ambient Monitoring Summaries by Subbasin

Upper Little Tennessee Drainage

The most noticeable feature of water chemistry data from the Little Tennessee drainage is a drop in pH starting in the winter of 1991 (Figure 4.1) and running through the fall of 1994. This general decline in pH also appears in data from other drainages in this basin. The pH values may have recovered (to values near 7.0) in the first part of 1995. No low pH values have been recorded through April of 1996.

There are several flow related events of note in this drainage. The suspended residue and turbidity data reflect high flow events in the summers of 1982, 1991 and 1994 plus the winter of 1986. One or more of these events are also reflected in the data for metals, including aluminum, arsenic, chromium, copper, lead, mercury, nickel and zinc. On November 26, 1986 and June 27, 1994, each of the three ambient stations in this watershed demonstrated a notable spike in metals and turbidity and suspended solids.

Flow measurements were relatively low from November 1-25, 1986 (annual period of record mean was 512 cfs). On November 26, the daily mean flow was 1450 cfs, reflecting a recent storm event delivering not only an increased volume of water, but high levels of suspended residue, turbidity, aluminum, arsenic, copper, lead, and zinc.

The period of record annual mean daily flow at Prentiss from 1943 until 1994 was 369 cfs. Maximum daily flows in 1994 occurred on March 27 (3470 cfs) and August 17 (3560 cfs), however the highest measures of turbidity, suspended solids, and metals were from the June 27 sample. As in November, 1986 discussed above, flow had been relatively low throughout most of June (232 cfs on June 26), and increased dramatically the day of sampling (855 cfs on June 27).

These data suggest that measured suspended solids and metal concentrations in the Little Tennessee River increase substantially when samples are collected during high flow conditions immediately following dry periods. The "flashy" nature of both water delivery and nonpoint source pollutant load are evident, not only by the elevated levels described above, but by the absence of similarly high levels of turbidity, suspended solids, and metals in March or August of 1994 when samples were collected (April 14, and August 29) about 2 weeks after peak flows.

Nantahala Drainage

There are two immediately noticeable features in the data from the Nantahala drainage. The pH data (Figure 4.2) exhibits a very similar feature as that of the Little Tennessee. There is a drop in pH starting in the winter of 1991 and then appears to recover through the last samples taken in the summer of 1995. The dissolved oxygen data show a peculiar feature. The lower summer readings do not appear to have changed since 1980, however, the higher winter readings have steadily dropped since 1986. The nutrient levels are generally low in the Nantahala, however, there are some erratic peaks of nutrients in recent years that are not related to flow data.

Tuckasegee Drainage

The pH concentrations from the two sites in the Tuckasegee drainage also show the same drop from 1990. In the case of the Tuckasegee, however, the concentrations in this area have shown a steady recovery through 1995 (Figure 4.3). There is also a peak in metals concentrations for the

Table 4.3 Summary of Ambient Monitoring System Station Data Excursions from the NC Water Quality Criteria by Parameter. January 1990 to December 1994.

Station Number	Station Name	Parameter/Criterion	Samples All	Samples <Det	Excur
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Arsenic (µg/l) [50]	26	26	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Cadimum (µg/l) [2]	26	26	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Chlorophyll a (Corr)(µg/l) [40]	N/S		
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Chromium (µg/l) [50]	26	26	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Dissolved Oxygen (mg/l) [4]	26	0	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Fecal Coliform (#/100ml) [200]	18	1	2
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Lead (µg/l) [25]	26	25	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Mercury (µg/l) [0.012]	26	26	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Nickel (µg/l) [88]	26	25	0
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	pH (SU) [6.0-9.0]	26	0	3
03500000	LITTLE TENNESSEE RIVER AT SR 1651 NEAR PRENTISS NC	Turbidity (NTU) [50]	26	0	1
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Arsenic (µg/l) [50]	30	30	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Cadimum (µg/l) [0.4]	31	31	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Chlorophyll a (Corr)(µg/l) [15]	N/S		
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Chromium (µg/l) [50]	32	32	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Dissolved Oxygen (mg/l) [6]	53	0	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Fecal Coliform (#/100ml) [200]	24	3	3
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Lead (µg/l) [25]	31	31	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Mercury (µg/l) [0.012]	30	29	1
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Nickel (µg/l) [88]	32	30	0
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	pH (SU) [6.0-9.0]	51	0	1
03500240	CARTOOGECHAYE CREEK AT SR1152 NEAR FRANKLIN NC	Turbidity (NTU) [10]	54	1	5
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Arsenic (µg/l) [50]	27	27	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Cadimum (µg/l) [2]	27	27	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Chlorophyll a (Corr)(µg/l) [40]	N/S		
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Chromium (µg/l) [50]	27	27	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Dissolved Oxygen (mg/l) [4]	53	0	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Fecal Coliform (#/100ml) [200]	21	2	2
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Lead (µg/l) [25]	27	27	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Mercury (µg/l) [0.012]	27	26	1
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Nickel (µg/l) [88]	27	26	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	pH (SU) [6.0-9.0]	51	0	0
03502000	LITTLE TENNESSEE RIVER AT NC HWY 28 AT IOTLA NC	Turbidity (NTU) [50]	54	0	3
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Arsenic (µg/l) [50]	32	32	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Cadimum (µg/l) [0.4]	33	33	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Chlorophyll a (Corr)(µg/l) [15]	N/S		
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Chromium (µg/l) [50]	34	34	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Dissolved Oxygen (mg/l) [6]	54	0	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Fecal Coliform (#/100ml) [200]	48	24	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Lead (µg/l) [25]	33	33	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Mercury (µg/l) [0.012]	32	32	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Nickel (µg/l) [88]	34	34	0
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	pH (SU) [6.0-9.0]	51	0	7
03504000	NANTAHALA RIVER NEAR RAINBOW SPRINGS NC	Turbidity (NTU) [10]	54	26	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Arsenic (µg/l) [50]	28	28	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Cadimum (µg/l) [0.4]	28	28	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Chlorophyll a (Corr)(µg/l) [15]	N/S		
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Chromium (µg/l) [50]	28	28	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Dissolved Oxygen (mg/l) [6]	55	0	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Fecal Coliform (#/100ml) [200]	21	9	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Lead (µg/l) [25]	28	28	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Mercury (µg/l) [0.012]	28	25	3
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Nickel (µg/l) [88]	28	28	0
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	pH (SU) [6.0-9.0]	53	0	4
03512000	OCONALUFTEE RIVER AT SR1359 AT BIRDTOWN NC	Turbidity (NTU) [10]	55	10	2
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Arsenic (µg/l) [50]	29	29	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Cadimum (µg/l) [2]	29	29	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Chlorophyll a (Corr)(µg/l) [40]	N/S		
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Chromium (µg/l) [50]	29	29	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Dissolved Oxygen (mg/l) [4]	56	0	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Fecal Coliform (#/100ml) [200]	19	5	1
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Lead (µg/l) [25]	29	29	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Mercury (µg/l) [0.012]	29	27	2
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Nickel (µg/l) [88]	29	29	0
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	pH (SU) [6.0-9.0]	54	0	5
03513000	TUCKASEGEE RIVER AT SR 1364 AT BRYSON CITY	Turbidity (NTU) [50]	56	1	1
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Arsenic (µg/l) [50]	28	28	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Cadimum (µg/l) [0.4]	28	28	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Chlorophyll a (Corr)(µg/l) [15]	N/S		
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Chromium (µg/l) [50]	28	28	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Dissolved Oxygen (mg/l) [6]	28	0	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Fecal Coliform (#/100ml) [200]	21	3	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Lead (µg/l) [25]	28	27	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Mercury (µg/l) [0.012]	28	27	1
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Nickel (µg/l) [88]	28	27	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	pH (SU) [6.0-9.0]	28	0	0
03515633	CHEOAH RIVER AT SR 1138 AT ROBBINSVILLE NC	Turbidity (NTU) [10]	28	4	0

Figure 4.1 pH Concentrations from Ambient Monitoring Sites in the Little Tennessee Drainage. 15 Year Period of Record.

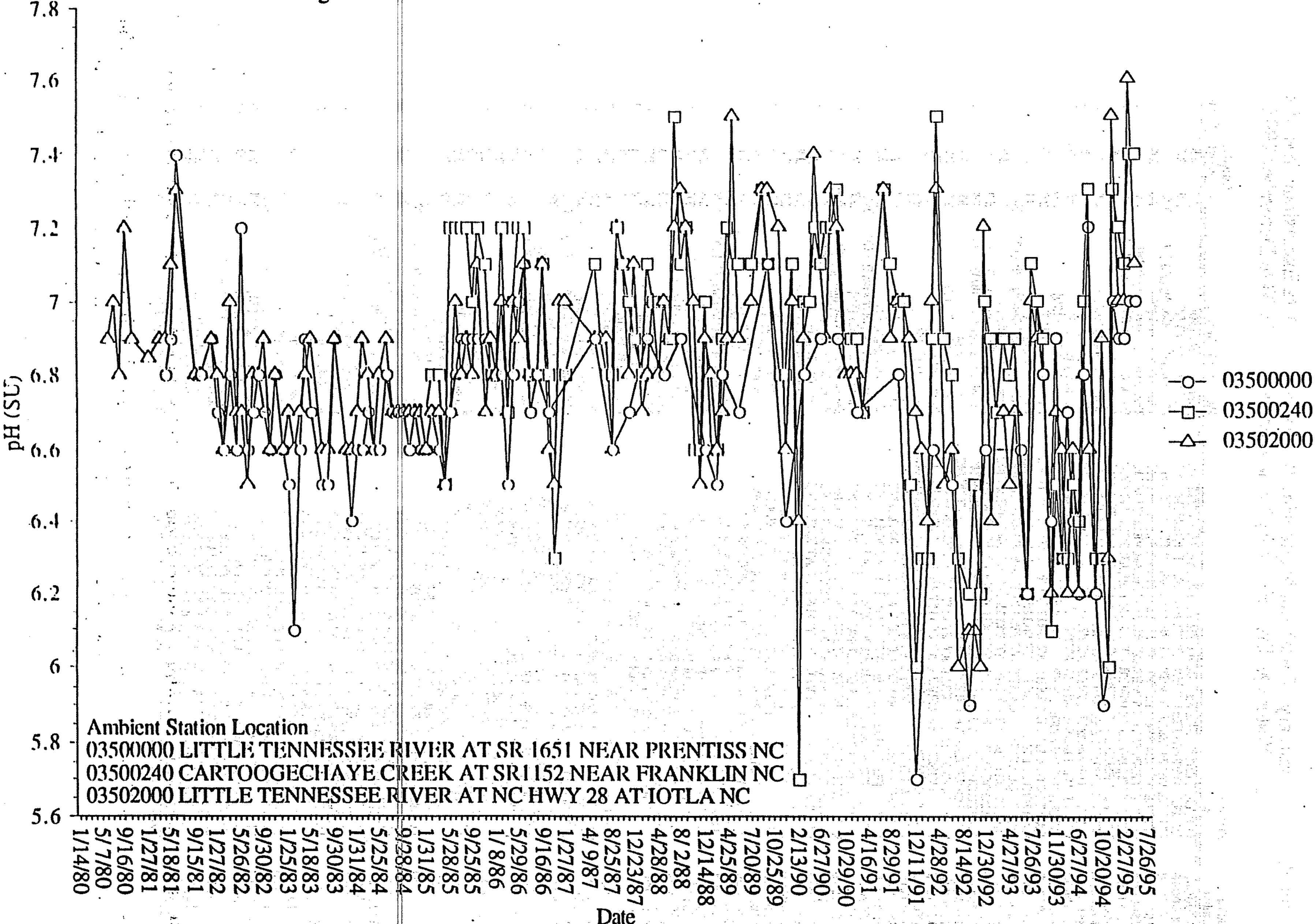


Figure 4.2 pH Concentrations at Nantahala River near Rainbow Springs. 15 Year Period of Record.

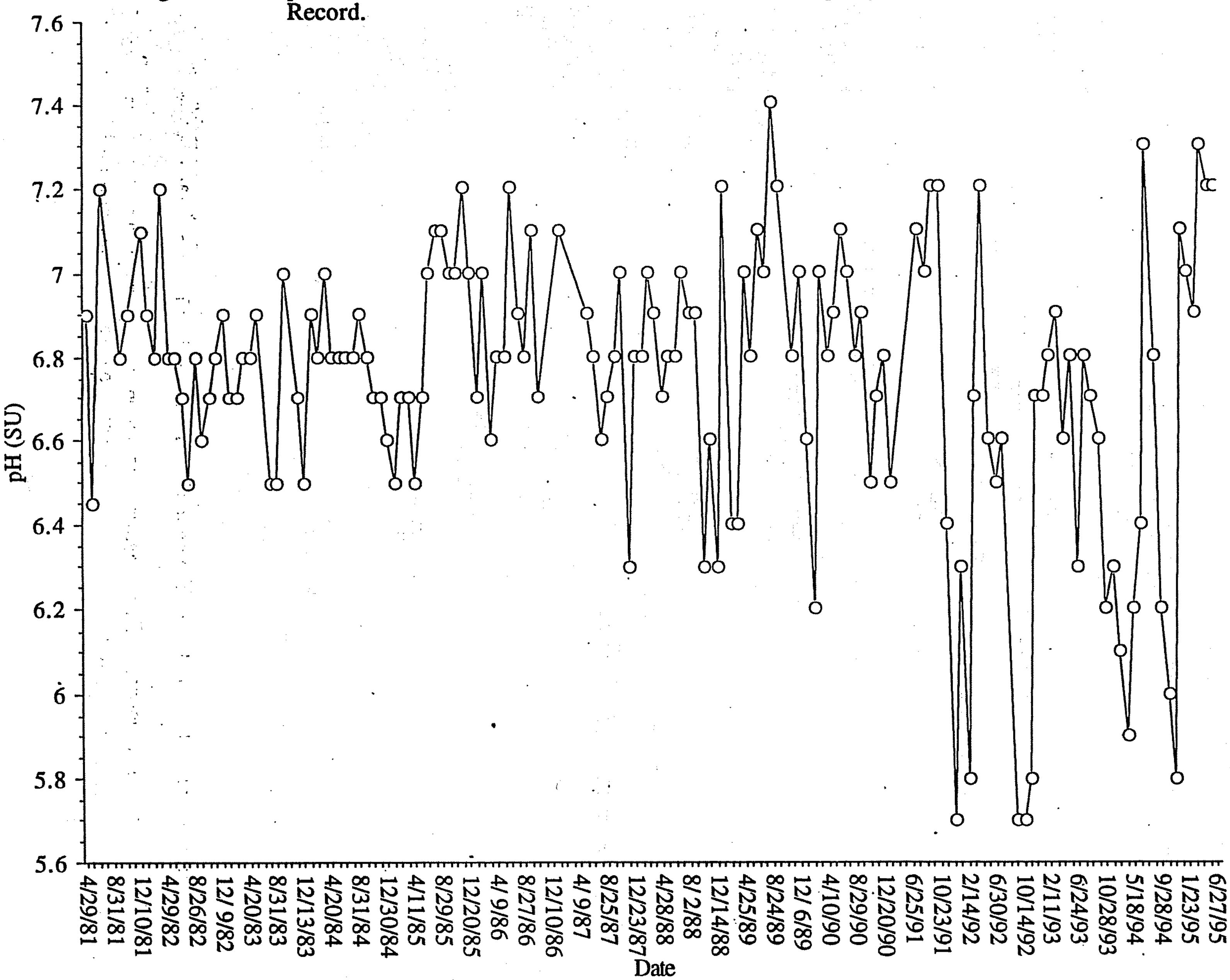
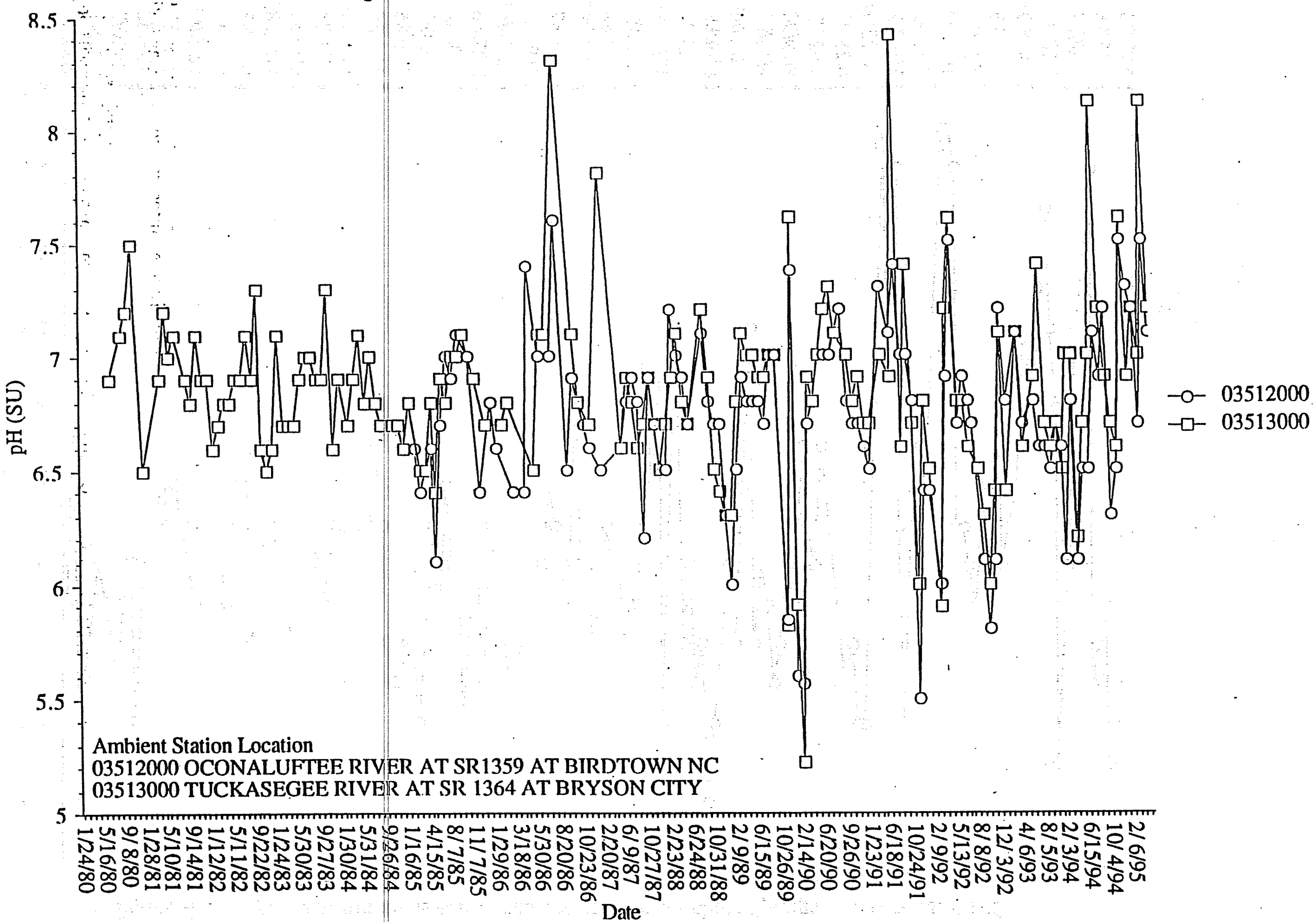


Figure 4.3 pH Concentrations from Ambient Monitoring Sites in the Tuckasegee River Drainage. 15 Year Period of Record.



Tuckasegee River at Bryson City in 1987 involving copper, chromium, nickel and, to a lesser extent, zinc. The USGS flow data from this site indicates relatively stable flows prior to and on the day of sampling very near the annual mean of 1580 cfs.

Cheoah Drainage
The Cheoah River site does not show the drastic drop in pH observed for other Little Tennessee drainages. There were two low pH samples in 1991 and 1992 but otherwise the data appears relatively stable through the period.

Fecal Coliform Bacteria

Fecal coliform bacteria behave differently than most other water quality parameters, and these differences must be considered when evaluating water quality. Available information was reviewed to identify potentially impaired waters and locate potential sources of pollutants in order to help develop appropriate management strategies. Fecal coliform bacteria are most useful as a screening tool to estimate the cumulative inputs from multiple sources, but in some instances can be used to locate a single large source of bacteria.

The primary screening tool used in establishing potential fecal coliform levels is the geometric mean. The most severe problems are identified for sites with 10 or more fecal coliform samples within the last 5 years and that have a geometric mean exceeding 200 /100 ml. This information will be reflected in the Use Support Rating for that stream or river.

There are no sites in the Little Tennessee River Basin with a geometric mean greater than 200/100 ml. Two sites, Little Tennessee at Prentiss and Cartoogechaye Creek (Table 4.4), have a high percentage of samples greater than 200/100 ml but the overall sample size is low for a five year period due to past quarterly sampling. When analyzing the data from 1980 to the present, the overall fecal coliform numbers can be seen to have decreased to the present.

Table 4.4 Fecal Coliform summary data for the Little Tennessee River Basin. 1990 to 1995.

Site	Total Samples	Geometric Mean	Samples > 200/100 ml	Percent >200/100 ml	First Sample	Last Sample
L Tennessee at Prentiss	18	15.04	2	11.1	9/11/91	12/28/94
Cartoogechaye Creek	24	19.86	3	12.5	8/17/90	12/28/94
Little Tennessee at Iotla	21	17.25	2	9.5	9/11/91	12/28/94
Nantahala River	48	1.95	0	0.0	1/9/90	12/28/94
Oconaluftee River	21	3.92	0	0.0	6/18/91	12/1/94
Tuckasegee River	19	6.47	1	5.3	9/3/91	12/1/94
Cheoah River	21	9.77	0	0.0	6/18/91	12/1/94

4.2.6 Other Water Quality Monitoring Programs

Acid Deposition and Sensitivity Studies

The Southern Appalachian Man and Biosphere (SAMAB) was established under the guidelines of the U.S. Man and Biosphere Program. The primary roles of SAMAB are to: 1) bring together agencies and oprganizations responsible for natural and cultural resource management or economic development and to guide them in working cooperatively to promote knowledge and undersatnding of the regions' resources; to encourage wise use of resoureces; and to foster associated research and training; 2) to develop anmd maintain a dynamic regional example of cooperative, integrated resource management. Interagency assessment teams were formed to gather and interpret information about the status, management and ecosystem use. The teams prepared status reports on Terrestrial, Aquatic, Social/Cultural/Economic and Atmospheric ecosystems. Of particular interest to this basinwide plan are the effects of acid deposition on the surface waters of the Southern Appalachian mountains. The Great Smoky Mountains National Park (GSMNP) and Joyce Kilmer/Slickrock Wilderness areas are within the boundaries of both SAMI and the Little Tennessee River basin. Discussion of SAMAB in this plan is limited to these wilderness areas and water quality issues. The National Acid Precipitation Assessment Program (NAPAP) also studied the effects of acid deposition on surface waters. These reports are the basis for the following summaries made by SAMAB (SAA 1996).

Based on these studies, several conclusions are made about the effects of acid deposition on streams within the GSMNP. Perhaps the most important factor is the low acid neutralizing capacity (ANC) of streams throughout the GSMNP. ANC is considered to be the measure of the ability of the stream to neutralize (or buffer) acid inputs. A low ANC is an indicator that the stream is sensitive to acid inputs. The ANC of streams tends to be lower at higher elevations. This makes streams at higher elevations more vulnerable to acid deposition . Therefore, these high elevation streams tend to have a lower pH (at or below 5.5 (Flum and Nodvin 1985)). Fish and amphibian populations need to have pH levels above 5.5 to survive and reproduce. The levels of stream pH are currently not detrimental to fish, however, the low buffering capacity of these streams makes the waters very vulnerable to chronic acid deposition.

Increasing stream acidity may result in the loss of aquatic species richness and diversity. Nitrates and sulfates are deposited into the forest ecosystem through acid deposition. The concentrations of these inputs can play a major role in ANC. Nitrate and sulfate concentrations tend to be higher at higher elevations. The GSMNP receives some of the highest nitrate concentrations (and the lowest soil nitrogen retention ability) from the atmosphere of any region of SAMAB. Thus, nitrate is entering streams in concentrations as great or greater than sulfate concentrations.

ANC is also affected by bedrock geology. In areas with underlying limestone, ANC is higher and the streams are more buffered from the effects of acid deposition. However, in many watersheds of the GSMNP there are non-limestone areas and Anakeesta rock formations. When Anakeesta is exposed to air and water, the rock reacts to leach sulfuric acid and heavy metals into the watershed. If a stream is nearby (as is the case with Beech Flats Prong, a Support-Threatened HQW in the GSMNP), the effects of the acidification can be long-term and severe.

Some watersheds with long-term monitoring sites show a trend of increasing streamwater sulfate concentrations between 1975 and 1995. Soils in these areas have gradually become saturated with sulfates. Nitrates in streams have also likely increased. In the GSMNP, stream nitrate concentrations are highest at high elevations where forests are older (forest demand for nitrogen is lower). Fifty year projections using a 1985 deposition rate show an increase in the percentage of acidic streams from 0% to 10% (SAMAB 1996).

Acid deposition sensitivity has been broadly determined for the Southern Appalachian Assessment area (Peper et. al.., open file report) by federal agencies of the Southern Appalachian Man and Biosphere Cooperative. Sensitivities to acid deposition are assigned on the basis of bedrock compositions and associated soils, along with their capacity to neutralize acid precipitation. Acid-base status is defined as the balance between acids and bases in the soils and surface waters. This issue is of particular concern in the SAA region due to the low ANC of higher elevation streams, the high rate of acid deposition as compared to other areas in the U.S., the area is affected by surface water acidification due to acid deposition, and the potential for further decreases in pH values in streams as a consequence of continued acidic deposition. Bedrock geology and associated soil types are known to play an important role on the chemical composition of surface water and on the sensitivity of aquatic ecosystems to acidic deposition. This work was done on a broad scale and can only be applied in a general sense to the waters of the Little Tennessee River basin. Approximately 631,062 (54.9%) acres of the Little Tennessee River basin are considered to

be highly sensitive to acid deposition. An additional 508,096 (44.2%) acres have medium sensitivity and 10, 830 (<1%) acres have low sensitivity to acid deposition.
The Integrated Forest Study (IFS) demonstrated in the 1980's that high elevation spruce-fir ecosystems (common to the GSMNP) receive the highest loadings of nitrogen and sulphur (Nodvin, et. al.. 1985). Nitrification of soils have been known to elevate soil aluminum concentration to values that inhibit calcium uptake in red spruce (Nodvin, et. al.. 1985), thereby altering the forest canopy to a degree that can have additional impacts on water quality and aquatic ecosystems.

An extensive water quality monitoring program within the GSMNP determined that the area receives high rates of both sulfates and nitrogen inputs and that the nitrogen loading has the greatest effect on stream chemistry since sulfate retention by the forest and the soils is high. Nitrogen loading to streams is especially elevated in watersheds with aged growth forests and high elevations. With the likelihood of continued loadings to the ecosystem, it is also likely that nitrogen saturation will extend downslope and downstream as catchments mature and soil saturation is reached (Flum and Nodvin 1985). It is likely that without drastic reductions in acid deposition that further changes in stream chemistry toward more acidic streamwater will occur in high elevations (greater than 5000 feet).

The National Biological Service has documented low pH problems in some of the streams within the Great Smoky Mountains National Park, including many streams in the Lower Little Tennessee subbasin. They have information on 350 sites in North Carolina and Tennessee, including almost 2500 measurements of stream pH. These data are summarized as follows:

About 5% of the samples were found to have pH values less than 5.0, 11% had pH values less than 5.5, and 22% had pH values less than 6.0. Low pH values were found in two types of streams:

1. *Streams in catchments with Anakeesta rock deposits.* This includes Beech Flats Prong and Bradley Fork. A characteristic symptom of this problem is high sulphate levels, as the weathering of the Anakeesta rock produces sulfuric acid. High concentrations of heavy metals is also indicative of the weathering of Anakeesta rock. Road cuts or landslides in areas of Anakeesta rock can result in stream pH values <5.0.

2. *Streams above 3500' in old-growth (undisturbed) forest.* These terrestrial systems may become nitrogen saturated after many years of acid rain, and the acid-neutralizing capacity of the catchment becomes used up. A characteristic of this problem is high nitrate levels in stream water, especially after rainfall. Catchments with low pH values (usually at sites > 4000') include several tributaries of Fontana Lake (Eagle Creek, Forney Creek, Noland Creek), and Raven Fork. Lower elevation sites rarely have records of pH < 6.2, but this may reflect monthly or biannual sampling frequency. It is possible that these lower elevation sites may have occasional pH values less than 6.0, but for a period of only a few days. It is interesting that this data set confirms a hypothesis advanced from our Little Tennessee basin-wide sampling, i.e., that Forney Creek has lower pH values than nearby Hazel Creek.

Western Carolina University, Cullowhee, N.C.

The high water quality of the waters of the basin are an important resource, both for aesthetics and for the economy of the area. Tourism and trout fishing both contribute to the economy of the area. Sedimentation has been highlighted in this basin plan as a cause of stream impairment. Sedimentation not only alters the aesthetics of a stream, it also impacts the fishery the stream supports. The findings of academic research at Western Carolina University have noted the potential impact of sedimentation on fisheries, in particular on the wild trout populations.

The amount of sedimentation in a stream is one of the most important factors in the reproductive success of fish populations. It also plays an important role in the health of the entire ecosystem. Chapter 3 further explains the effects of sedimentation on fish populations.

Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West 1982).

A comparison of the effects of sedimentation in the reproductive success, standing fish crop biomass and trout growth was conducted on two streams in Jackson County (Wayehutta and Mull Creeks). Both the streams are comparable in basin size, length, order and drainage aspect. The primary difference between the two streams was the amount of construction, pasturelands, cultivation, residential development and traffic on logging roads was greater in the Wayehutta basin. Wayehutta Creek had significantly higher suspended solids (2 - 5 times greater), conductivity, turbidity, silica, and sediments as compared to Mull Creek.

The study (West et. al. 1982) found a significant negative correlation between the percent of trout embryo hatchings and concentrations of pollutants. Increased concentrations of conductivity, turbidity, silica, suspended solids, and percent sand are all indicators of increased erosion and sedimentation. Mean trout standing crop was nearly 4 times greater in Mull Creek than in Wayehutta and was also negatively correlated with the pollutants. However, the higher hatching rate of trout embryos in Mull Creek did not result in faster growth rates. Trout that are able to emerge in Wayehutta Creek grew more rapidly. Other researchers have noted similar findings from other trout streams both in western North Carolina and elsewhere. These investigations agree that excessive sedimentation on trout spawning beds is perhaps the most critical and detrimental factor on trout productivity. Since trout fisheries are an important economic resource for the Little Tennessee River and other mountain basins, maintaining low sediment loadings is especially important to the survival of this resource.

Tennessee Valley Authority (TVA)

TVA has developed an extensive monitoring program that combines the expertise of water quality professionals with the interests and dedication of local citizens, interest groups, businesses and industry, and other governmental agencies. Refer to Chapter 5 for a more complete summary of this TVA water quality initiative.

Within the Little Tennessee River basin, TVA has maintained a sampling site on the Little Tennessee River below Lake Emory, the Tuckasegee River above Bryson City and three sites on Fontana Lake (near the dam, on the Tuckasegee River arm and on the Little Tennessee River arm).

Little Tennessee River

Sampling results show the Little Tennessee River continued to receive a Good rating for fish community structure with one of the best scores observed at a TVA stream sampling site, macroinvertebrates rated Fair, and nutrient and algae levels rated Good. Upstream siltation was cited as conditions affecting aquatic life.

Tuckasegee River

The first sampling year for this site was 1994 so no comparative analysis to earlier sampling years could be done. The fish community had one of the best scores (Good) observed at all TVA stream sampling sites. Nutrients and algae rated Good. Macroinvertebrates rated Fair. Upstream siltation and land use practices were noted as conditions affecting aquatic life.

Fontana Lake

Fontana Lake continued to receive a Fair rating. Oxygen conditions rated higher in the most recent sampling near the dam and in the Tuckasegee arm of the lake. However, sediment quality at all three sites rated Poor because of the presence of Chlordane and toxicity problems. Macroinvertebrate numbers and variety were lower in 1994 than in 1993 at the Tuckasegee arm and Little Tennessee River arm sites. These sites were rated Poor for bottom life. Fish community was rated Fair at all three sites. Dissolved oxygen and algae were rated Good at each site.

DWQ biologists have not established sampling sites at these same locations, so no comparison of these data can be made at this time. It is important to note that there are differences in sampling methodology used by DWQ and TVA. For example; 1) TVA does not have an Excellent rating for their EPT methodology, and 2) DWQ biologists identify macroinvertebrate samples to a lower level of taxonomy (to genus and species level). With proper training, it is realistic for volunteers to achieve family level taxonomy. However, it appears that family level identification and the use of a national list of tolerance values may not be sensitive enough to detect subtle water quality changes. It has been further suggested that the use of regionalized data for family tolerance values would improve the quality of volunteer generated data (Penrose and Call 1995) and allow for better comparison between datasets.

In the future, it may be possible for the DWQ biologists to work with TVA to coordinate sampling locations on sites within the Little Tennessee River basin. It may also be possible for DWQ to conduct follow-up field work or QA/QC investigations on those TVA stream sites that do not correspond with DWQ findings.

TVA/Western North Carolina Alliance

An ongoing watershed survey and educational program was jointly funded by TVA and the Western North Carolina Alliance (a non-profit environmental organization based in Asheville, NC) in 1988. This project generated participation from many community volunteers within the Little Tennessee River watershed. The initial survey led to more detailed monitoring on waters of the upper Little Tennessee River. These monitoring efforts have continued through 1996, resulting in the accumulation of several years of monitoring data at eight fixed sites in the upper Little Tennessee Watershed and one year of Index of Biological Integrity (IBI) monitoring at 60 sites.

Fish communities at two sites on Rabbit Creek and Middle Creek, both within the Upper Little Tennessee River basin, were monitored using IBI methods (TVA August 1993a; TVA February 1996d). At present, DWQ does not have sample sites on either of these streams. Land use in the Rabbit Creek watershed is predominantly residential development and pastureland. Land use in the Middle Creek watershed is primarily in cabbage farming, residential, livestock, forest and farming. During the study, both streams were characterized by sedimentation and turbidity. Rabbit Creek was reportedly most affected by livestock access to the stream and development of a golf course. Sediments in Middle Creek were reported to be due to runoff from cabbage farms on steep slopes, where rates of soil loss have been recorded up to 500 tons/acre from some fields. Water quality in Rabbit Creek continues to rate Poor as per the sampling techniques used (TVA February 1996d).

Between sample years there was a noted reduction in sedimentation in Rabbit Creek, presumably due to the adoption of land use practices promoted by the Macon County Soil Conservation Service (SCS) and Agricultural Cost-Share Program. The Macon County SCS installed BMPS to fence cattle out of the stream and took other measures to reduce stream bank damage on Rabbit Creek and measures to reduce soil loss from cabbage farms on Middle Creek.

To better define the problems noted in the Rabbit Creek watershed additional studies were conducted using IBI techniques and macroinvertebrate biomonitoring (TVA August 1993b). In addition, a visual reconnaissance for the Rabbit Creek and its major tributaries, including Cat Creek, was conducted. The visual survey determined that sedimentation was a problem throughout the watershed and the major contributor was livestock in unfenced pastures. Recommendations were made to the Holly Springs Community Club for restoration/improvement projects for their stream.

During these investigative studies it was noted that Cat Creek had very low IBI scores and a high disease rate among fish samples (TVA August 1993c). The diseases were noted to be of the type typically associated with toxics. It was suspected that runoff from the Holly Springs Golf Course was the likely source of toxic effects in the fish. Other negative factors affecting water quality may have been livestock operations, the presence of beaver ponds and channelization of the creek. Although sedimentation was not as apparent in Cat Creek as in Rabbit Creek, it was assumed that this was primarily due to the lower gradient of Rabbit Creek. Recommendations were made to continue the efforts of the Macon County SCS to fence cattle out of streams, re-establish a riparian vegetative zone and approach the golf course about turf management practices.

In 1995 additional work, including fish community assessments and macroinvertebrate sampling, was conducted on 31 small streams in the upper Little Tennessee River watershed. The results of these studies will be available in the next reporting year (TVA February 1996d). Dr. McLarney has conducted many water quality studies in the Little Tennessee River basin. Publications are available at cost from the Little Tennessee Watershed Association (704-369-6402), the Western North Carolina Alliance office in Asheville (704-258-8737) or TVA.

Duke Power

Duke Power has an ongoing erosion control assessment program designed to document baseline conditions, quickly detect sedimentation impacts and to assess the effectiveness of erosion control measures in protecting water quality. This program is used particularly for transmission line construction activities conducted by Duke Power (see Section 5.6.4 for additional information). The focus of this program is to monitor Total Suspended Solids (TSS) and Total Phosphorous (TP) as key parameters relating to the effects of erosion and sedimentation. Samples are collected using vertical series of depth-integrated single-stage samplers to document before, during and after construction impacts to a waterbody. Information is used to quickly alert field crews where stabilization efforts need to be undertaken. Duke Power has over 100 monitoring sites in western North Carolina and northern South Carolina.

In the Little Tennessee River basin, Duke Power has sixteen sampling stations. These stations are located on Blazed Creek, Beaseley Creek, Caler Fork, Cowee Creek (3 sites), Little Tennessee at Lost Bridge, Tellico Creek (six sites), Sugar Cove, Indian Branch, and the Cartoogechaye Creek (4 sites). Raw data is availaable from Duke Power on these sites. Summary information is yet to be published, with the exception of the Tellico Creek sites.

An erosion control assessment program was begun on Tellico Creek in November 1990 due to the concerns of Duke Power for a trout farming operation on Tellico Creek below transmission line construction activities (Braatz 1993,1994). At the onset of the project sedimentation problems on the creek had already been identified. Five sites were monitored on the creek. In addition, Sugar Cove Creek and Indian Branch, tributaries to Tellico Creek, were also monitored. Within four months of sampling, sedimentation problems were found to primarily originate from about 550 yards of agricultural property.

Comparisons were made between estimated sediment delivery to the farm and sediment leaving the farm. The study indicated that over 90% of the TSS at the Lower Tellico site was originating from the farming operation. Sedimentation was due to livestock trampling streambanks and negligible buffer zones between garden areas, raw-dirt slopes and the creek. An agricultural erosion control Demonstration Project was recommended for this farming operation.

BMPs were applied in 1994 and 1995 to improve water quality. These BMPs included fencing about 5000 feet of the creek to exclude cattle and allow vegetation to grow on the bank, a bridge crossing for the cattle and water tanks to eliminate the need for the cattle to access the stream. In 1994 extreme rainfall and flooding occurred in the watershed which resulted in record high TSS concentrations. The flooding event cause seversal sampling stations to be lost, landslides and road slumping occurred, as well as extreme channel erosion. Barring additional extreme stormflow evernts, it is expected that the exclusion of the cattel from the stream will result in natural revegataion and the further reduction in sediement transposrt to the stream (Braatz and Hollifield, 1995).

4.3 NARRATIVE WATER QUALITY SUMMARIES BY SUBBASIN

4.3.1 Upper Little Tennessee (Subbasin 04-04-01)

Description

The Upper Little Tennessee River subbasin 04-04-01 contains the uppermost reaches of the Little Tennessee River. The Cullasaja River and Cartoogechaye Creek are the major tributaries to the Little Tennessee in this subbasin. Other smaller tributaries include Middle Creek, Coweeta Creek, Cowee Creek and Burningtown Creek.

Much of the land area in this subbasin is within the Nantahala National Forest and is characterized by many peaks, ridges, and mountain ranges. Most tributaries are high gradient streams capable of supporting trout populations in the upper reaches. However, lower reaches of many tributary catchments are farmed or developed and may be affected by erosion, scour, and sediment deposition. The fall in the river is approximately 500 feet from the North Carolina/Georgia border to Fontana Lake (North Carolina State Department of Water Resources 1960).

Overview Of Water Quality

The water quality of rivers and streams in this subbasin is generally high with few violations of water quality standards. Biological and water quality sampling sites are depicted in Figure 4.3. Most sites have received Good or Good/Fair bioclassifications based on benthos data. However, portions of the Little Tennessee River basin are being rapidly developed and much of this development is along river and stream corridors. The Little Tennessee River and many of its tributaries become very turbid after rainfalls and sedimentation is the dominant water quality problem. Sources of sedimentation include agriculture, mining operations, development, and silviculture. Several areas of concern include residential and commercial development in the Highlands area (upper Cullasaja River), effects of nonpoint source runoff to the upper Little Tennessee River, and runoff from ruby and gem mines to tributaries near Franklin.

This subbasin contains 53 permitted dischargers, although only the Franklin WWTP (which discharges to the Little Tennessee River) has a design flow of ≥ 0.5 MGD. Currently there are three sand-dredging facilities operating in the Little Tennessee River and five ruby and gem mines that discharge sediment to small streams. Most of the ruby and gem mines discharge to Caler Fork. There are three trout farms operating in Macon County under the NPDES permit program. Some trout farming activities have been shown to impact benthic macroinvertebrate communities (Biological Assessment Group report numbers B-901029 and B-891141, and Alabaster, 1982).

Little Tennessee River Basin 040401

Legend

- (A) Ambient Monitoring Station
- (L) Lake Assessment
- (F) Fish Community
- (T) Fish Tissue
- (B) Benthic Macroinvertebrate Ambient Station

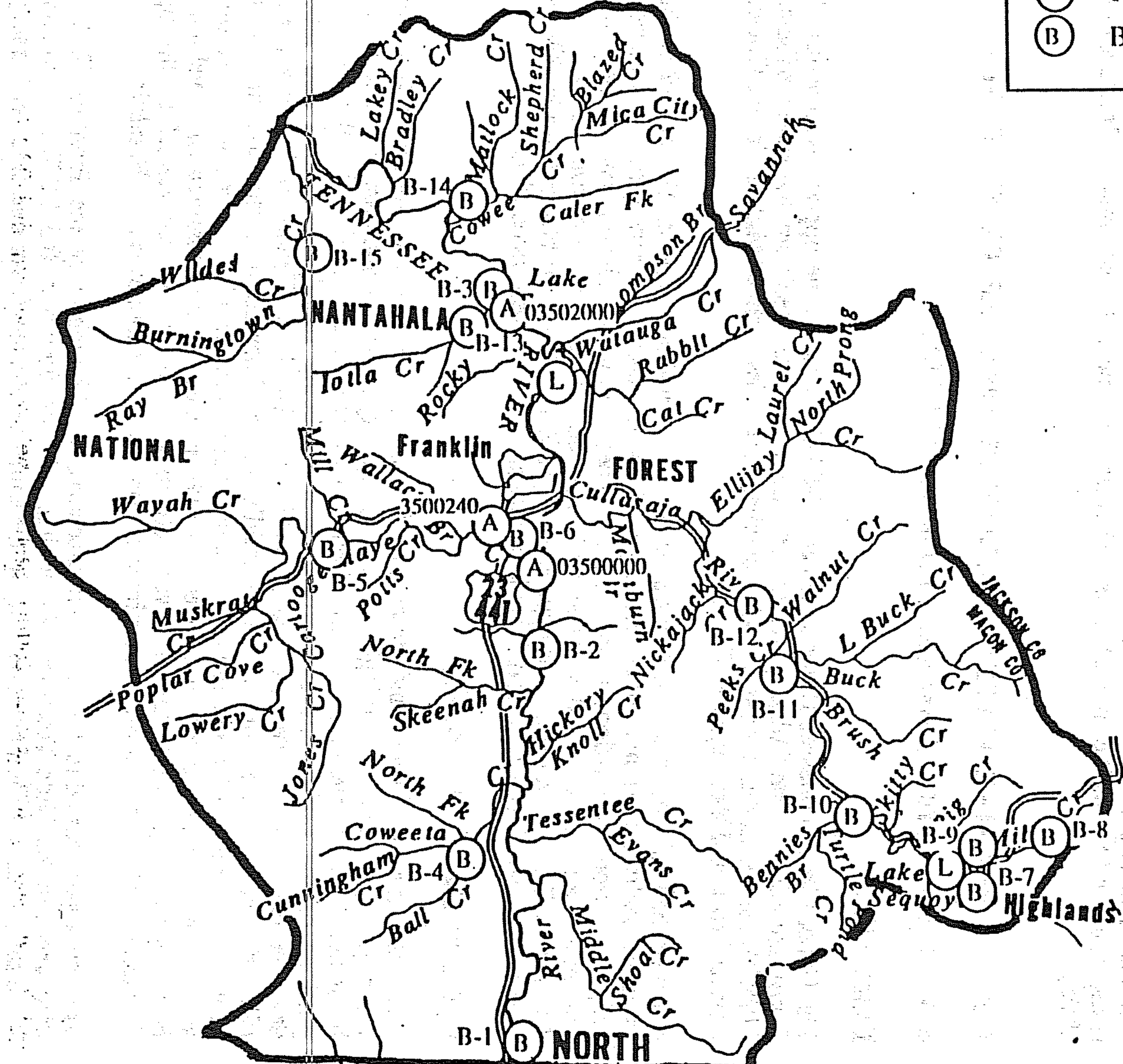


Figure 4.3 Sampling Location in the Upper Little Tennessee River (Subbasin 04-04-01)

Benthic macroinvertebrate samples have been collected from 15 locations in this subbasin since 1983. Good and Good/Fair bioclassifications have been given to the two mainstem Little Tennessee River ambient monitoring locations in this subbasin. Nonpoint source runoff appears to cause some of the degradation at the most upstream monitoring location near Prentiss, although point source dischargers in Georgia may cause some problems under low flow conditions. The Little Tennessee River at Iotla is below Franklin and the bioclassification at this location may be affected by runoff and point sources in the Franklin area. Nine benthic macroinvertebrate samples were collected from this subbasin during the 1994 basinwide investigations. Excellent bioclassifications were given to Coweeta Creek and to the Cullasaja River below Cullasaja Falls. Good and Good/Fair bioclassifications were given to all of the other sites.

Fish community structure data were collected from six sites in this subbasin during basinwide sampling. The North Carolina Index of Biotic Integrity classified the fish communities at Middle Creek, Tessentee Creek, Coweeta Creek and Cartoogechaye Creek as Good. Fair-Good and Fair IBI scores were given to the Little Tennessee River at SR 1629 near the Georgia State line and Iotla Creek. Lower IBI scores were due to a lower than expected number of individuals and an absence of darter species at these two locations.

Lake monitoring investigations have been conducted on two lakes in this subbasin: Lake Sequoyah and Lake Emory. Lake Sequoyah, located near Highlands on the Cullasaja River, was classified as mesotrophic during a 1994 DWQ investigation. Elevated total phosphorus values and anoxic conditions on the lake bottom suggested that Lake Sequoyah's designated uses (WS-III TR CA) are threatened. DWQ also conducted an earlier investigation (1988) of this lake and found eutrophic conditions.

Lake Emory is a run-of-the-river impoundment on the Little Tennessee River near Franklin. Two DWQ investigations were conducted on Lake Emory. A 1988 survey noted eutrophic conditions with high suspended solids, chlorophyll *a* , and nutrients. The 1994 investigation noted a slight decrease in suspended solids and a more dramatic decrease in nutrients and chlorophyll *a*.. Field observations noted that the lake looked as though it was filling in and becoming a wetland, with sediment bars formed and plant life growing on the bars. During the 1994 investigation, Lake Emory obtained a low TSI score indicating oligotrophic conditions. This between year change may be due to wet weather conditions prior to sample collection in 1994, nutrient uptake by plants on the sediment bars, the closing of a large farm upstream, or the expansion and upgrade of the Franklin wastewater treatment plant.

Ambient water quality information is currently being collected from three monitoring locations in this subbasin: the Little Tennessee River near Prentiss and Iotla, and Cartoogechaye Creek near Franklin. These data generally indicate good water quality with few exceedances in water quality standards. Some exceedances for fecal coliform and turbidity were observed at all three locations, suggesting the potential effects of nonpoint source runoff.

Three exceedances in the pH standard (<6.0) were found for the Little Tennessee River near Prentiss. A basinwide decline in pH was noted at many monitoring locations in the Little Tennessee during a three year period from the winter of 1991 through the fall of 1994. Near neutral pH values have again been recorded during the first part of 1995 and no low pH values have been recorded through April of 1996. Peak concentrations in turbidity and metals were noted in November 1986 and June of 1994 when samples were collected immediately following increased flow. Additionally, an unexplained peak in many metal concentrations was noted at most western North Carolina ambient monitoring locations in late 1989.

Benthic Macroinvertebrates

Nine locations were sampled for benthic macroinvertebrates during the 1994 basinwide investigations (Table 4.5). However, analysis of these data are somewhat complicated by extremely high stream flows immediately prior to sample collection. Benthic macroinvertebrate samples were collected from an upstream site on the Little Tennessee River near the Georgia state line, the ambient location on the Little Tennessee River near Iotla, from two Cullasaja River locations, and from 5 previously unassessed tributary locations. Benthic macroinvertebrate samples have been collected from 15 locations since 1983, including two special studies.

Benthic macroinvertebrate samples could not be collected from the ambient monitoring location at Prentiss during the scheduled collection due to extremely high flows. However, a survey was conducted near the North Carolina/Georgia state line during a follow-up investigation in August, 1994. This site was selected to assess the water quality of the Little Tennessee River as it enters North Carolina. A Good/Fair bioclassification was assigned to this site. The drainage area at this point is 56 square miles. Three Georgia wastewater treatment facilities discharge to the Little Tennessee River near the state line (Burlington Industries, Vulcan Materials, and City of Dillard). These facilities may affect water quality in North Carolina during low-flow periods. A Good bioclassification was given to a site further downstream on the Little Tennessee River at Iotla.

Bioclassifications from the two Cullasaja River locations were similar to ratings given to these two locations during a special investigation in 1991, suggesting that there has been no change in water quality between surveys.

Benthic macroinvertebrate samples were collected during the basinwide network from 4 previously unassessed catchments and an unassessed upstream reach of Cartoogechaye Creek. These locations were selected to get a general impression of water quality from tributary catchments of the Little Tennessee River. A severe rain event and extremely high flows prevented collection from Middle Creek, and monitoring locations were moved upstream in Coweeta and Cartoogechaye Creeks.

Coweeta Creek was selected to represent a relatively undisturbed catchment. An Excellent bioclassification was given to Coweeta Creek based on benthic macroinvertebrate data collected at SR 1115. Coweeta Creek is a medium-sized tributary (10 meters wide, drainage area of 17 square miles near the confluence) of the Little Tennessee River in Macon County. The substrate at the collection location was primarily rubble with very little embeddedness, suggesting little erosion in the catchment.

~~Benthic macroinvertebrate samples were collected from a previously unassessed reach of~~ Cartoogechaye Creek at SR 1146. A Good/Fair bioclassification was given to Cartoogechaye Creek near the confluence with the Little Tennessee River in August 1988 and a Good bioclassification was given to the upstream site at SR 1146 during the 1994 investigation. Cartoogechaye Creek is a relatively large tributary of the Little Tennessee River (57 square mile catchment size). Water quality data from the ambient monitoring location on Cartoogechaye Creek had few exceedances in water quality standards. Much of Cartoogechaye Creek flows parallel to US 64 corridor, a potential source of nonpoint runoff. The substrate at the upstream location had a high proportion of sand, suggesting the instream effects of erosion within the catchment. EPT taxa abundance was very low at this location, probably due to high flow, scour and difficult collection conditions. However, an EPT taxa richness was within the Good bioclassification range for mountain stream systems. The lower bioclassification near the confluence with the Little Tennessee River may reflect the cumulative effects of development and nonpoint source runoff.

Iotla Creek is a small tributary catchment (5 meters wide with a catchment size of 10 square miles) of the Little Tennessee River. This site was selected to assess the potential effects of runoff from the Macon County airport. The substrate at the collection location consisted primarily of sand (65%) and silt (20%), which indicates that erosion is occurring in the catchment. The effects of this erosion are more severe in this tributary due its low gradient. EPT taxa richness resulted in a Good/Fair bioclassification. Only three benthic insect taxa were abundant, suggesting the effects of substrate scour during spate events.

Cowee Creek is a fairly large tributary catchment (10 meters wide and a catchment area of 26 square miles at West's Mill) of the Little Tennessee River near Iotla. The collection site on Cowee Creek was selected to assess the effects of discharges from 8 ruby and gem mines and the discharge from Perry's Water Gardens. The substrate is dominated by boulders (35%) and rubble (30%) at the NC 28 collection location with little accumulation of sand and silt. However, the stream was very turbid during sample collection and most of the boulders and rubble were heavily embedded. A Good/Fair bioclassification was assigned to this location based on EPT taxa richness. The benthic population at this location suggests the effects of enrichment. Additional surveys might determine any sources of enrichment.

Burningtown Creek is also a fairly large tributary catchment (11 meters wide and has a catchment area of 27 square miles at Stiles) of the Little Tennessee River and is the most downstream tributary in this subbasin. Data were collected at this downstream location at SR 1371 to assess water quality in the entire catchment and because it is typical of other streams in the lower reaches of this subbasin. The substrate at this site is composed primarily of boulder (35%) and rubble (30%), suggesting that there is little erosion in the catchment. EPT taxa richness produced a Good bioclassification.

Table 4.5 Basin Assessment Sites in Little Tennessee River Subbasin 04-04-01, 1994, Taxa Richness Values and Bioclassifications.

Site #	Creek	Date	County	Road	S/SEPT	Rating
B-1	L Tennessee R	940831	Macon	SR 1629	69/27	Good-Fair
B-3	L Tennessee R	940726	Macon	NC 28	57/27	Good
B-4	Coweeta Cr	940727	Macon	SR 1115	-/39	Excellent
B-5	Cartoogechaye Cr	940727	Macon	SR 1146	-/30	Good
B-10	Cullasaja R	940726	Macon	US 64	70/27	Good-Fair
B-11	Cullasaja R	940726	Macon	SR 1678	85/42	Excellent
B-13	Iotla Cr	940727	Macon	SR 1372	-/21	Good-Fair
B-14	Cowee Cr	940726	Macon	NC 28	-/24	Good-Fair
B-15	Burningtown Cr	940726	Macon	SR 1371	-/30	Good

Long Term Benthos Locations

Little Tennessee River at NC 28 near Iotla

Benthic macroinvertebrate samples have been collected from this location on 6 different occasions. These collections have produced Good and Good/Fair bioclassifications with very little variation in EPT taxa richness values between collections. Total taxa richness and EPT abundance values were much lower in 1994 (during high flow conditions) than during all other collection periods. This is a very large river and access to some habitats is difficult during high-flow conditions. Many taxa showed a sharp decline in abundance in 1994. It is interesting to note that the two Good bioclassifications recorded from this location have been during high flow periods. This could reflect the effects of scour on tolerant benthic taxa related to higher flows in 1994. Based on these observations, it is assumed that there has been no change in water quality at this site.

Turbidity (80 NTU) and fecal coliform (2000 fecal coliform/100 ml) concentrations were elevated during a spate event in June 1994 at this location and at many other Little Tennessee River monitoring locations. These data reflect the effects of nonpoint source runoff on water quality conditions in this basin.

Special Studies

Data from all special studies since 1983 are presented in Table 4.6, with a reference to the Biological Assessment Group file number, if more detailed information is needed. Benthic macroinvertebrate samples have been collected from these locations to assess the effects of the Highlands WWTP to Mill Creek and the upper reaches of the Cullasaja River. These surveys also served to evaluate the Cullasaja River for a High Quality Waters classification. Poor and Fair bioclassifications were found in the Cullasaja River upstream of Lake Sequoyah. These bioclassifications are likely the effects of nonpoint source runoff due to a highly urbanized watershed with houses, golf courses and roads adjacent to the river. Fair bioclassifications were noted at Mill Creek above and below the Highlands WWTP during both the 1990 and 1991 investigations. A site 3/4 of a mile below Lake Sequoyah has consistently been given a Good/Fair bioclassification. Excellent water quality conditions were given to a site on the Cullasaja River below Cullasaja Falls at SR 1678 during 1994 and 1991 investigations. The most downstream monitoring location at NC 64/SR 1524 has been assigned Good bioclassifications. High Quality Water reclassification was not recommended for the Cullasaja River because the Excellent reach was too small and fragmented (B-950103, B-940829, B-910115).

Table 4.6 Benthic Macroinvertebrate Special Studies, Little Tennessee River Subbasin 04-04-01, 1983-1994.

Site #	Creek	Date	Study	County	Road	S:Rating
B-7	Cullasaja R	911016	Highlands WWTP/HQW	Macon	NC 64	- /9:Poor
		901211	Highlands WWTP/HQW	Macon	NC 64	-/14:Fair
B-8	Mill Cr	911016	Highlands WWTP/HQW	Macon	ab WWTP	36/12:Fair
		901212	Highlands WWTP/HQW	Macon	ab WWTP	-/15:Fair
B-9	Mill Cr	911016	Highlands WWTP/HQW	Macon	be WWTP	50/12:Fair
		901212	Highlands WWTP/HQW	Macon	be WWTP	-/17:Fair
B-10	Cullasaja R	940726	Highlands WWTP/HQW	Macon	be L Sequoyah	70/27:G/F
		911016	Highlands WWTP/HQW	Macon	be L Sequoyah	-/20:G/F
		901211	Highlands WWTP/HQW	Macon	be L Sequoyah	-/29:G/F
B-11	Cullasaja R	940726	Highlands WWTP/HQW	Macon	SR 1678	85/42:Exc
		911015	Highlands WWTP/HQW	Macon	SR 1678	95/48:Exc
		901211	Highlands WWTP/HQW	Macon	SR 1678	-/38:Good
B-12	Cullasaja R	911015	Highlands WWTP/HQW	Macon	NC 64/SR 1524	-/35:Good
		901212	Highlands WWTP/HQW	Macon	NC 64/SR 1524	-/28:Good

A survey was conducted on the Little Tennessee River in 1983, 1985 and 1987. This is the most upstream ambient monitoring location on the Little Tennessee River in North Carolina and reflects water quality conditions in North Carolina and Georgia. A survey could not be conducted at this location in 1994 due to extremely high flows. Benthic macroinvertebrate data from this location have produced Good/Fair and Fair bioclassifications with very little variation in the EPT values between collection periods. Very few exceedances in water quality standards have been found at this location. However, extremely high suspended solids and turbidity values were recorded from this location in June 1994 during a spate event. The extremely high turbidity value (250 NTU) is a likely result of nonpoint source runoff. During that same water quality survey, a fecal coliform concentration of 11,000/100 ml. was recorded. These values are extremely elevated when compared to average values for this location (turbidity of 7.8 NTU and fecal coliform of 26/100 ml).

Potential HQW/ORW Streams

Many of the tributary streams that flow into the upper reaches of the Little Tennessee River within the Nantahala National Forest appear to be minimally impacted, as exemplified by the data collected during the basinwide survey from Coweeta Creek. This catchment and other nearby catchments may qualify for HQW/ORW reclassification. The Coweeta Creek catchment includes the Coweeta Hydrologic Laboratory, which contains 5,600 acres in the upper reaches of Coweeta Creek.

Fisheries

Fish Community Structure
Fish community structure data were collected from six sites in this subbasin (Table 4.7 and Appendix III).

The "Fair-Good" and "Fair" ratings were attributed to a combination of several metrics which were scored as "1"-- including: number of individuals, number of species of darters and suckers, or number of intolerant species. A lower than expected number of individuals and an absence of darters are usually indicative of habitat degradation such as siltation.

This information is in general agreement with the macroinvertebrate studies which also identified Iotla Creek and portions of the Little Tennessee River as affected by nonpoint source runoff. Fisheries data, however, did not assign an Excellent rating to any of the streams sampled during 1995.

Table 4.7 Basin Fish Community Assessment Sites in the Little Tennessee River Subbasin 04-04-01, North Carolina Index of Biotic Integrity (NCIBI) Score, and Rating.

Map #	Site	Location	Drainage Area (mi^2)	Sampling	County	NCIBI Score	NCIBI Rating	Class.
F-1	Little Tennessee R	SR 1629	55.8	950501	Macon	46	Fair-Good	C
F-2	Middle Cr	SR 1635/1684	13.9	950503	Macon	48	Good	C Tr
F-3	Tessentee Cr	SR 1636	14.8	950503	Macon	52	Good	C Tr
F-4	Coweeta Cr	US 23/441	16.9	950501	Macon	52	Good	B Tr
F-5	Cartoogechaye Cr	SR 1168	40.8	950502	Macon	52	Good	WS-IIITr CA
F-6	Iotla Cr	SR 1372	9.95	950503	Macon	40	Fair	C

Aquatic Toxicity Monitoring

One facility in this subbasin currently monitors effluent toxicity as per a permit requirement. That facility is:

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Franklin WWTP	NC0021547/001	Little Tenn R	Macon	1.65	1.600

Whole effluent toxicity monitoring results for all dischargers in the Little Tennessee Basin are presented in Appendix III. The toxicity monitoring record of this facility has been such that there has been no need for regulatory relief through a special or judicial order.

Lakes Assessment Program

Lake Sequoyah
Lake Sequoyah is located near Highlands on the Cullasaja River. The Town of Highlands uses the lake as a backup water supply. This shallow lake has a maximum depth of only 13 feet (4 meters)

and a surface area of 150 acres (60 hectares). The lake's shoreline consists of residential homes and commercial businesses. The Highlands Country Club, which consists of a golf course and private homes, is also located in the watershed. Several other golf courses are located within the watershed.

Lake Sequoyah was most recently sampled on August 9, 1994. Stratification was noted near the dam. Dissolved oxygen levels decreased with depth and anoxic conditions were found on the lake bottom. The surface dissolved oxygen at the dam station was 9.4 mg/l and bottom dissolved oxygen was 0.2 mg/l. At the time of sampling, the lake appeared turbid with a brownish coloration. The brownish water coloration and slightly elevated surface dissolved oxygen levels prompted a phytoplankton collection. The algal community was dominated by green algae that most frequently occur in slightly acidic, soft, relatively unpolluted waters. Two species of diatoms indicative of cool, slightly acidic lakes dominated the biovolume on this date. Algal numbers were elevated, but the dominant taxa were not nuisance species.

The TSI value in 1994 indicated mesotrophic conditions. Lake Sequoyah is currently classified WS-III Tr CA and listed as Threatened in the 1992-1993 305(b) Report due to elevated nutrients and turbidity and chlorophyll *a* violations for "Trout Waters" observed in 1988. Elevated total phosphorus values observed in 1994 and relatively high concentration of algae, indicate that Lake Sequoyah's designated uses may still be threatened.

Lake Sequoyah was previously sampled in 1988. At two of the three stations, turbidity exceeded the state standard for "Trout Waters" of 10 NTU (12 and 17 NTU). The chlorophyll *a* standard for these waters (15µg/l) was exceeded at all three stations (range = 19 µg/l to 23 µg/l). Nutrients were also elevated, especially total phosphorus and inorganic forms of nitrogen (ammonia and nitrite plus nitrates). Phytoplankton biovolumes and densities were moderate at all three stations on Lake Sequoyah. The algal species found in Lake Sequoyah are commonly found in slightly acidic mountain lakes or in more enriched waters of North Carolina. Eutrophic conditions (NCTSI score = 1.3) were indicated in 1988.

Lake Emory

Lake Emory is a run-of-the-river impoundment on the Little Tennessee River near the Town of Franklin. The lake was built in the 1920's and bought by Nantahala Power and Light Company in 1933. It covers 188 acres (76 hectares) and is quite shallow (mean depth = five feet or 1.6 meters). The 310 mi^2 (803 km^2) watershed has a significant amount of agriculture in addition to private residences and commercial/urban areas. The Town of Franklin constructed a new wastewater treatment plant (WWTP) which began operation in September 1994. It is permitted to discharge 1.65 MGD (the old facility was permitted to discharge 0.75 MGD). The new WWTP discharges into the same area of Lake Emory as the old WWTP (above the most upstream ambient lake station). No discharge limits for nutrients were placed on either the older facility or the new facility. Lake Emory is currently classified C.

Lake Emory was most recently sampled on August 9, 1994. Lake Emory appeared to be filling in. Sediment bars were observed in the lower portion of the lake near the dam and emergent vegetation was observed both in the water and colonizing the sediment bars. The TSI in 1994 was -3.4 indicating an oligotrophic status. This was a drastic change from the eutrophic status recorded in 1988. This change in status can not be readily explained at this time. This between year change may be due to wet weather conditions prior to sample collection in 1994, nutrient uptake by plants on the sediment bars, the closing of a large farm upstream, or the expansion and upgrade of the Franklin wastewater treatment plant. Continued monitoring of the health of Lake Emory will be conducted.

Lake Emory was previously sampled in 1988. Poor erosion controls upstream caused heavy sedimentation in the lake. A large amount of suspended and floating solids were noted during sampling. Chemical sampling corroborated visual observations of turbid water. Suspended solids were at least 18 mg/l at each station. Similarly, turbidity values were elevated (greater than 15 NTU). Chlorophyll *a* and nutrients were also elevated. In particular, total phosphorus suggested highly enriched conditions. The NCTSI score in 1988 was 3.8, indicating eutrophic conditions in the lake. The prevalence of specific algal species indicated organic enrichment. Lake Emory was designated as Threatened in the 1990-1991 and 1992-1993 305(b) Reports due to elevated nutrients based on data collected in 1988.

4.3.2 Lower Little Tennessee River (Subbasin 04-04-02)

Description

The Lower Little Tennessee River subbasin is located in the northern portion of the basin. Fontana Lake, operated by the Tennessee Valley Authority, is the largest impoundment in this region. Much of the catchment to the north of the Little Tennessee River is within either the Great Smoky Mountains National Park or the Cherokee Indian Reservation. Most streams on the north side of Fontana Lake are in a roadless wilderness region, and can be reached only by boat or by hiking. This portion of the basin contains some of the most famous trout streams in North Carolina including Hazel Creek, Forney Creek, Deep Creek and Noland Creek. Most of the rest of this subbasin is included in the Nantahala National Forest, although this does not preclude some other land uses. This subbasin includes the Towns of Bryson City, Cherokee, and Sylva. Principal tributaries to the Lower Little Tennessee River are the Oconaluftee and Tuckasegee Rivers, Hazel Creek and Deep Creek.

Overview Of Water Quality

The area contains some of the most pristine areas in North Carolina, and some of the cleanest water in the state. Biological and water quality sampling locations are depicted in Figure 4.4. HQW streams include the headwaters of Alarka Creek, the Tuckasegee River upstream of Tennessee Creek, Caney Fork and tributaries above Mull Creek, and most of the Oconaluftee River catchment. Several small streams that were formerly classified for water supply also have been reclassified as HQW: Whiterock Creek, Wolf Creek, Long Branch, Jenkins Branch, Clingman's Creek, Dednan Branch, Twentymile Creek, and Moore Spring Branch. The Lower Little Tennessee River is critical habitat for two federally listed endangered species: the Appalachian elktoe (Alasmidonta raveneliana) and the Littlewing Pearlymussel (Pegias fabula). Other important aquatic species in this portion of the Little Tennessee River include: Slippershell mussel (A. viridis) and Tennessee pigtoe (Fusconaia barnesiana) (both state listed endangered), and the Spotfin chub (Hybopsis monacha), which is federally listed as Threatened.

Streams in the Lower Little Tennessee subbasin are characterized by slightly acidic pH, low nutrients and low conductivity. Portions of this area are developed and erosion from these areas causes some minor nonpoint source problems. Most of the major streams (especially those outside of the park) become turbid after rainfall events, and sediment inputs have caused habitat degradation in some areas. Trout farming may become a concern for some streams, although few problems have been reported. The lower portion of the Oconaluftee River receives discharges from several large trout farms, but has maintained an Excellent rating. Tellico Creek had heavy periphyton growths, indicating excess nutrients, in a segment downstream of several trout farms.

Chemistry samples from two ambient sites (Oconaluftee River at Birdtown and the Tuckasegee River at Bryson City) indicated few water quality problems. As with other Little Tennessee basin sites, both areas had some low (<6.0) pH values, especially from 1990-1992. There appears to be

Little Tennessee River Basin
(Subbasin 04-04-02)

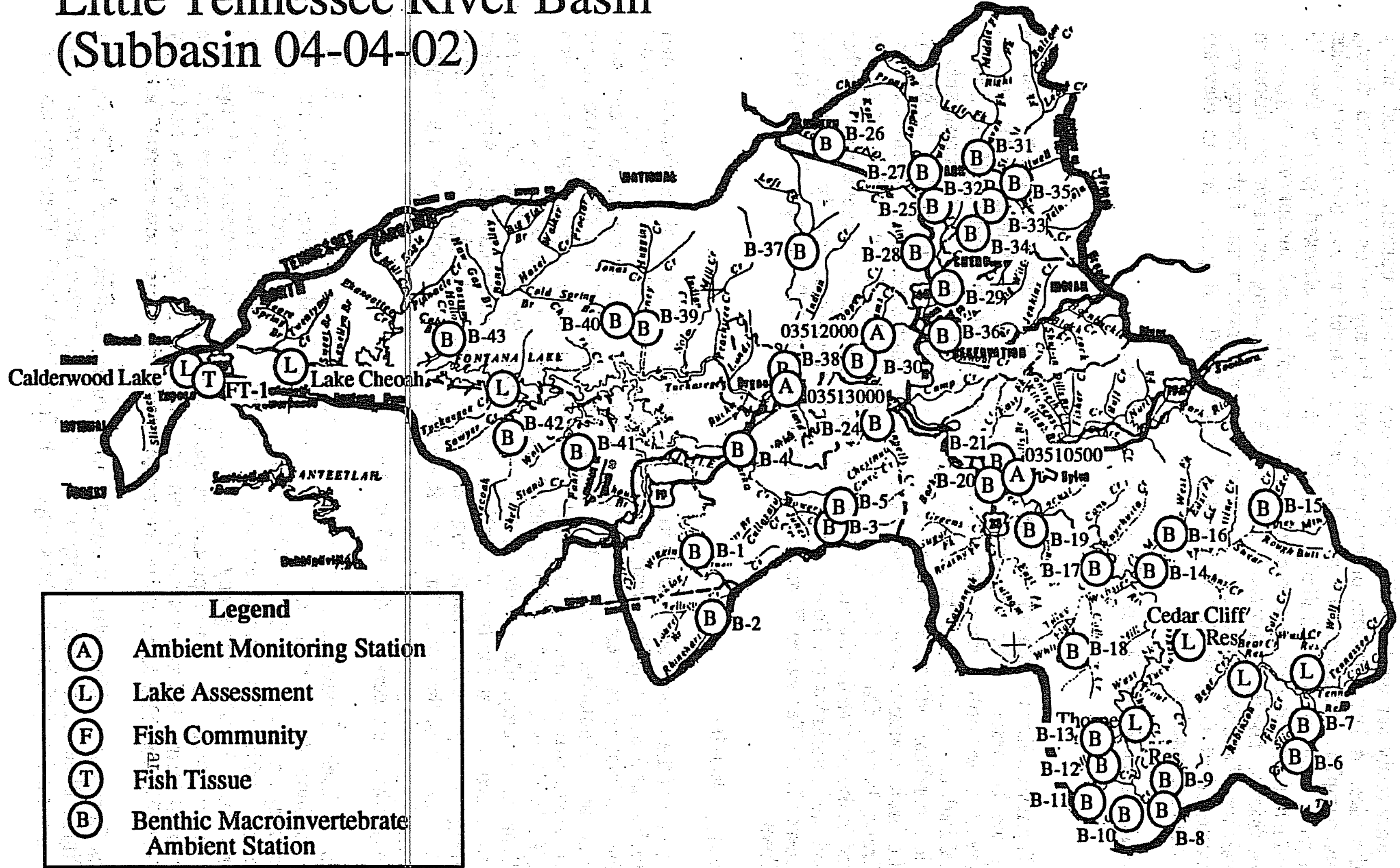


Figure 4.4 Sampling Locations in the Lower Little Tennessee River (Subbasin 04-04-02)

some recovery since this period, although the cause of the problem remains a concern. For more information on this issue, refer to Chapter 3 and 4.

DWQ has evaluated five reservoirs in this subbasin: Fontana Lake and four impoundments of the Tuckasegee River (Wolf Creek Reservoir, Bear Creek Reservoir, Cedar Cliff Lake, and Thorpe Reservoir). The Tuckasegee River lakes are owned by Nantahala Power & Light (NPL), while Fontana is owned by TVA; all are operated for hydroelectric power generation. All five lakes have been classified as oligotrophic.

DWQ biologists have not sampled fish community structure for any streams in this basin, but park biologists report streams within the Great Smoky Mountains National Park support high quality trout populations. Limited fish tissue sampling (2 sites) did not indicate any significant problems.

Benthic Macroinvertebrates

Twenty-two locations were sampled for benthic macroinvertebrates in 1994 (Table 4.8). Two mainstem sites have been sampled during the summer months for many years, and data from these stations are discussed in the Long Term section. Benthic macroinvertebrate samples were collected at 44 sites in this basin since 1983, including six special studies.

Only the Tuckasegee River at Dillsboro and Oconaluftee River at Birdtown were sampled as long term assessment sites. These sites are discussed in more detail in the "Long Term Benthos Sites" section. Out of 22 collections in 1994, 14 sites received an Excellent bioclassification, although three of these sites (Tuckasegee River, Connelly Creek, and Savannah Creek) had substantial amounts of sediment (≥40% gravel/sand/silt) and might receive a lower rating using fisheries information.

Four sites were selected within undisturbed (forested) sections of the Great Smoky Mountains National Park: Hazel Creek, Forney Creek, Bear Creek, and upper Deep Creek. These streams were characterized by rocky substrate (65-80% boulder/rubble) and very clear water. Forney Creek was selected as a small stream reference site (4 meters in width), but the other three sites were medium-sized streams, 12-15 meters in width. All sites had high EPT taxa richness and were dominated by highly intolerant species, but some between-site differences were readily apparent.

The upper portion of the Tuckasegee River (SR 1140) is also considered a reference site, as it drains the Panthertown Valley ORW area. This area, however, is quite different from the other reference sites. Streams in this area are naturally sandy (55% sand and 20% gravel at the SR 1140 site) with humic-colored water. This area had been subject to high flows and severe scour prior to sampling, but still received an Excellent rating based on EPT taxa richness.

Seven sites received Excellent ratings that were in more developed areas: Tellico Creek, Alarka Creek, Caney Fork, Savannah Creek, Connelly Creek, lower Deep Creek, and Panther Creek. These are all medium-sized streams, 7-16 meters in width. Although these sites received the same rating as the reference sites, they often had very different macroinvertebrate communities. Several sites actually had EPT taxa richness values greater than those recorded at reference sites: Alarka Creek, Caney Fork, and lower Deep Creek. This difference is likely associated with slight enrichment and higher pH values. Both Alarka Creek and Tellico Creek had abundant growths of periphyton. The Tellico Creek site is downstream of several trout farms.

Higher amounts of sediment were observed at some of these sites, especially Caney Fork (50%), Connelly Creek (45%), and Savannah Creek (40%). The most distinct difference between this group of sites and the reference sites was an increase in the biotic index. This indicates a shift towards more tolerant species, although still within the criteria for an Excellent bioclassification.

Table 4.8 Basin assessment sites in Little Tennessee River subbasin 02 (040402), 1994, taxa richness values and bioclassifications.

Site #	Creek	Date	County	Road	S/SEPT	BI	Rating
B-1	L Tennessee R	940713	Swain	SR 1113	83/40	4.47	Good
B-1	L Tennessee R	940623	Swain	SR 1113	79/32	4.40	Good
B-2	Tellico Cr	940714	Macon	SR 1367	84/43	3.26	Excellent
B-4	Alarka Cr	940711	Swain	SR 1185	91/48	3.50	Excellent
B-8	Tuckasegee R	940901	Jackson	SR 1140	-/39	-	Excellent*
B-15	Caney Fk	940715	Jackson	SR 1740	93/56	3.04	Excellent
B-16	Mull Cr	940901	Jackson	SR 1740	-/29	-	Good*
B-17	Moses Cr	940715	Jackson	SR 1740	-/33	-	Good
B-18	Cullowhee Cr	940831	Jackson	SR 1001	-/32	-	Good
B-20	Savannah Cr	940726	Jackson	SR 1367	77/40	3.63	Excellent
B-21	Tuckasegee R	940714	Jackson	SR 1137	100/47	4.29	Excellent
B-22	Scott Cr	940714	Jackson	SR 1556	69/29	4.88	Good-Fair
B-25	Conley Cr	940714	Swain	SR 1177	94/42	3.42	Excellent
B-27	Beech Flats Prong	940901	Swain	US 441	-/22	-	Good-Fair
B-28	Bradley Fk	940901	Swain	Off US 441	-/31	-	Good
B-32	Oconaluftee R	940714	Swain	SR 1359	87/47	3.84	Excellent
B-39	Deep Cr	940711	Swain	ab campground	-/41	-	Excellent
B-40	Deep Cr	940711	Swain	SR 1340	88/50	2.91	Excellent
B-41	Forney Cr	940712	Swain	nr mouth	79/46	2.30	Excellent
B-42	Bear Cr	940712	Swain	nr mouth	71/44	2.10	Excellent
B-43	Panther Cr	940713	Graham	SR 1233	-/37	-	Excellent
B-44	Stecoah Cr	940713	Graham	SR 1237	-/29	-	Good
B-45	Hazel Cr	940712	Swain	nr mouth	96/47	2.67	Excellent

The 1994 sampling was preceded by a period of very high flow, which scoured out many of the more tolerant taxa. Collections under lower flow conditions might result in a Good rating for some of these sites.

Four sites received a Good rating based on EPT samples: Moses Creek, Mull Creek, Stecoah Creek, and Cullowhee Creek. These streams are 5-7 meters in width, and two of these sites had a high proportion of sand, gravel, and silt: Moses Creek (45%) and Cullowhee Creek (50%). There was evidence of erosion for all sites in this group, but the high gradient tends to quickly flush out much of the sediment. Three streams were in agricultural areas (Mull Creek, Moses Creek, Stecoah Creek), while Cullowhee Creek drained a more urban area. These streams had a reduction in both EPT taxa richness and EPT abundance.

~~Only one site received a Good-Fair rating: Scott Creek at Dillsboro. This site is downstream of the~~ Sylva WWTP. It was dominated by more tolerant taxa. The high flow (high dilution) conditions during spring and summer 1994 may have reduced the impact of this discharger.

The Little Tennessee River site was chosen for comparisons with collections by TVA biologists in June 1994. This portion of the river became very turbid after heavy rains, and considerable deposition of sand occurred near the banks and in pools. This area is of special interest due to the occurrence of several threatened or endangered species (see overview). Collections in both June and July produced a Good rating for this site. Information from this site also was used to help evaluate this site for ORW classification.

Bradley Fork and Beech Flats Prong are in areas where low pH values have been associated with Anakeesta rock formations, although pH at the time of our samples was close to 7.0. Construction along US 441 near Clingman's Dome has exposed Anakeesta Rock formations, resulting in very low pH (< 5.0) and elevated metal concentrations. A subsequent study (October 1995) showed that severe pH problems in Beech Flats Prong were limited to a small (< 1 mile) headwater segment (Poor), although some alteration of community structure could be observed at a site 1 mile downstream (Good-Fair). Ephemeroptera are the group most sensitive to low pH, and their taxa richness was reduced in both the upper portion of Beech Flats Prong and in Bradley Fork. The 1994 EPT collection from Bradley Fork was assigned a Good bioclassification due to a slight reduction in EPT taxa richness. This site was upgraded to Excellent in October 1995 based on a standard qualitative sample.

Long Term Benthos Sites

There has been little change at the Oconaluftee River near Birdtown site (SR1359) between 1985 and 1994, with an Excellent rating assigned for four out of the five collections. High flows were associated with a reduction in both total taxa richness and EPT abundance, but both EPT taxa richness and the NCBI have remained relatively stable. This site is downstream of several trout farms, and occasional pulses of elevated nutrients were measured.

Collections from the Tuckasegee River near Dillsboro (SR 1377) site have shown a steady increase in both total taxa richness and EPT taxa richness between 1984 and 1994. These improvements have been largely independent of between-year changes in flow. A Good rating was assigned from 1984-1988, while an Excellent rating was assigned in both 1990 and 1994. While it is difficult to attribute between-years changes to any single factor, Sylva improved their sewer system, the amount of dredging in the river has decreased, and sedimentation from Savannah Creek (site of a highway construction project through 1985) also has declined. Conductivity values from this site were sparse during some years, but there was a general decline when comparing 1984-1988 (yearly means of 32-34) with 1989-1994 (yearly means of 22-29). Field notes still indicate substantial amounts of sediment in the river, and other evaluation methods (fish, etc.) might give a slightly lower rating.

Special Studies

Data from all special studies since 1983 are presented in Table 4.9, with a reference to the Biological Assessment Group report file number, if more detailed information is needed.

Grassy Camp Creek was compared to a control site (UT Shortoff Creek) to evaluate the possible effects of runoff from golf course construction. Grassy Camp Creek appeared to be affected by both sediment inputs and low pH. (B-841012)

Table 4.9 Benthic Macroinvertebrate Special Studies, Little Tennessee Subbasin 04-04-02, 1983-1994.

Site #	Creek	Date	Study	County	Road	S:Rating
B-11	Grassy Camp Cr	840822	Golf Course	Jackson	nr SR 1145, ab lake	52/21: G-F
B-12	UT Shortoff Cr	840822	Golf Course	Jackson	US 64	54/27: Exc*

*Small stream criteria

Fisher Creek was sampled above and below the discharge from the Sylva Water Treatment Plant. No effect of the discharge could be detected. (No Report)

The headwater portion of Alarka Creek (above Bearmeat Branch) was found to qualify for Outstanding Resource based on an Excellent bioclassification and a good brook trout population, and was reclassified as HQW by the Environmental Management Commission. (B-890316)

Two sites on the upper Tuckasegee River were sampled to evaluate its suitability for Outstanding Resource Water classification. Both sites received an Excellent bioclassification. (B-910714)

Most of the sites in the Oconaluftee River basin were found to have Excellent water quality, and qualified for High Quality Water classification. The only site with a Good rating was the lower part of Raven Fork. This study does not preclude the chance of more severe stress (especially from trout farm discharges) during periods of high temperatures and lower flow. (B-891117)

As part of the HQW study of Thorpe Reservoir, all major tributaries of the Reservoir were sampled. These included Hurricane, Cedar, Grassy Camp, Mill, and Pine Creeks. Only Hurricane Creek achieved an Excellent rating. Nonpoint source problems (sediment inputs) seemed to be responsible for minor problems in the other streams. (B-930107)

Both Hurricane Creek and White Rock Creek were losing a water supply classification. Benthic macroinvertebrate data indicated that they could be reclassified as HQW. (B-920207)

Fish Tissue

Fish tissue samples were collected at two sites within the Lower Little Tennessee subbasin. Fish samples were collected from the Little Tennessee River at Topoco and analyzed for metals and organic contaminants in 1981. Samples consisted of white sucker and rainbow trout individuals. Results of fish tissue analyses indicated that levels of metals and organics contaminants in Topoco samples were non-detectable or present at levels below FDA and EPA criteria.

A second set of fish samples were collected at the Calderwood Reservoir in 1987. These samples were analyzed for organic contaminants and consisted of white sucker and channel catfish. Trace amounts of DDE, a DDT metabolite, were detected in two channel catfish samples, with levels below FDA and EPA criteria. PCB's were also detected in two channel catfish samples from Calderwood. PCB levels of 0.40 and 0.12 ppm, exceeded the EPA screening value of 0.01 ppm in both samples but remained below the FDA criteria of 2.0 ppm. Both DDE and PCB represent compounds which are extremely persistent once introduced into the environment and may be detectable in trace amounts for decades.

Aquatic Toxicity Monitoring

Two facilities in this subbasin currently monitor effluent toxicity as per permit requirements. Those facilities are:

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Bryson City WWTP	NC0026557/001	Tuckasegee R.	Swain	0.60	0.253
Tuckasegee WSA WWTP	NC0039578/001	Tuckasegee R.	Jackson	1.50	1.380

Whole effluent toxicity monitoring results for all dischargers in the Little Tennessee Basin are presented in Appendix T.1. The toxicity monitoring record of these facilities show overall compliance and there has been no need for regulatory relief through a special or judicial order.

Lakes Assessment Program

Wolf Creek Reservoir

Wolf Creek is a small reservoir built and owned by Nantahala Power and Light Company. Located on the Tuckasegee River, the reservoir was constructed in 1955. Maximum depth of the lake is 180 feet (55 meters) with a mean depth of 89 feet (27 meters) and surface area of 30 acres (78 hectares). Wolf Creek Reservoir has a small drainage area of 40 mi^2 (103 km^2) which is predominantly forested. It is classified WS-III B Tr HQW.

Wolf Creek Reservoir was not sampled in 1994 due to lowering of the lake's water level to permit maintenance activities on the dam. This reservoir was most recently sampled by DWQ on July 26, 1988. At that time, the NCTSI score for Wolf Creek Reservoir was -4.1, indicating oligotrophic conditions. Wolf Creek Reservoir supported all of its designated uses.

Bear Creek Reservoir

Bear Creek Reservoir, an impoundment located on the Tuckasegee River, is owned by the Nantahala Power and Light Company. The mean depth is 108 feet (33 meters) and maximum depth is 164 feet (50 meters) and a surface area of 475 acres (192 hectares). The drainage area is 75 mi^2 (194 km^2) and is primarily forested. Bear Creek reservoir is classified WS-III B Tr.

This reservoir was most recently sampled by DWQ on August 9, 1994. At that time, Bear Creek was oligotrophic with a NCTSI score of -4.3. All of the lake's designated uses were supported. Bear Creek reservoir was previously sampled in 1988 with a resulting NCTSI score of -3.6 indicating oligotrophic conditions in the lake.

Cedar Cliff Lake

Cedar Cliff Lake is a picturesque, undisturbed mountain lake on the Tuckasegee River. The lake is owned by Nantahala Power and Light Company and was built in 1952. The lake has a maximum depth of 173 feet (53 meters) and a watershed of 80.7 square miles, which is mostly forested. Water quality in the lake supports swimming, boating and trout fishing. The name of the lake was probably derived from a sheer rock cliff which faces it from the north. Cedar Cliff Lake is currently classified WS-III B Tr.

Cedar Cliff Lake could not be sampled during 1994 due to water levels too low to launch a boat. According to Nantahala Power and Light Company, work was being conducted on the dam.

Cedar Cliff Lake was one of sixteen lakes selected statewide as representative of a minimally impacted lake by which other lakes in the same region could be compared. To determine Cedar Cliff Lake's suitability to be considered as a reference lake for the Mountain region, the lake was extensively monitored by DWQ from 1991 through 1992. Cedar Cliff Lake was found to be oligotrophic throughout the growing seasons of these two sampling years.

Cedar Cliff Lake was also sampled by DWQ as part of the ambient lakes monitoring program on July 28, 1988. Cedar Cliff Lake had the third best TSI in North Carolina in 1988 (-6.0), indicating that this lake was one of the cleanest lakes in North Carolina at that time.

Thorpe Reservoir

Thorpe Reservoir, also known as Glenville Lake, is a man-made impoundment of the Tuckasegee River located in Jackson County. The lake is used for recreational fishing, swimming, and boating. Owned by Nantahala Power and Light, the reservoir has been used for hydroelectric power generation since its construction in 1941. The lake covers 1,462 acres (592 hectares), with most of the 95 km^2 drainage area forested. It is fed by the West Fork Tuckasegee River, Norton Creek, Hurricane Creek, Cedar Creek, Mill Creek, and Pine Creek. Thorpe Reservoir is currently designated WS-III. At the time of this writing, Thorpe Reservoir was under consideration for reclassification to High Quality Waters (HQW) (NCDEHNR, 1992 and 1995).

Historical sampling in 1988, 1989, 1990, and 1993 has indicated very consistent oligotrophic conditions in Thorpe Reservoir. Thorpe Reservoir was resampled on August 8, 1994. The 1994 TSI of -4.6 indicated Thorpe Reservoir is oligotrophic. Chemical and biological parameters also reflected the low productivity of the lake. Thorpe Reservoir was evaluated in 1995 and was found to have excellent water quality. No violations of water quality standards were documented and Thorpe Reservoir fully supported its designated uses.

Fontana Lake

Fontana Lake, located along the southern boundary of the Great Smoky Mountain National Park, provides power and flood control on the Little Tennessee River. Fontana Lake is owned and operated by the Tennessee Valley Authority and is used for generating hydroelectric power. Construction on the dam was begun in 1942 and was completed in 1944. At a height of over 480 feet (146 meters), Fontana dam is the highest dam east of the Mississippi River. Fontana Lake has a maximum depth of 440 feet (134 meters) and a mean depth of 135 feet (41 meters). The lake is 29 miles (47 km) long, and the shoreline measures 249 miles (400 km) at full pool. Major tributaries include the Little Tennessee River, Tuckasegee River, and the Nantahala River. The drainage area of Fontana Lake covers 1,552 mi^2 (4,020 km^2) of mountainous terrain. Over 50% of this watershed is forested, and another 25% to 33% is pasture. Various segments of the lake are classified for use as water supply, primary recreation, secondary recreation and/or trout waters (WS-IV-Tr, B-Tr, B and C).

The lake was last sampled on August 29, 1994. The TSI for the lake in 1994 was -5.5 (oligotrophic), the lowest TSI recorded for this lake. At the time of assessment, no violations of state water quality standards were observed at Fontana Lake and the reservoir was fully supporting its designated uses.

Fontana Lake was previously sampled in 1981, 1982 and 1987. The TSI score of-4.0 in 1987, which was similar to the value in 1981 of -3.7 and -5.1 in 1982, demonstrates the consistently oligotrophic conditions found in Fontana Lake.

Lake Cheoah

Lake Cheoah is a narrow, deep reservoir located on the Little Tennessee River near the North Carolina/Tennessee state border. This lake is owned by the Tallassee Power Company (TAPOCO), a subsidiary of ALCOA and is used for hydroelectric power generation and recreation. Inflow is dominated by hypolimnetic discharge from Fontana Lake, which is located immediately upstream. The headwaters flow swiftly in the vicinity of Fontana Dam. Lake Cheoah has a maximum depth of 197 feet (60 meters) and a mean depth of 131 feet (40 meters) and a surface area of 632 acres (256 hectares). The watershed is 1608 mi^2 (4165 km^2) in size and is primarily forested. Lake Cheoah is classified C Tr.

This reservoir was most recently monitored by DWQ on August 10, 1994. The NCTSI score for 1994 was -5.3 (oligotrophic) and the reservoir supported all of its designated uses.

Lake Cheoah was previously monitored in 1988. In 1988, the NCTSI score was -7.4, indicating oligotrophic conditions.

4.3.3 Nantahala River (Subbasin 04-04-03)

Description

The Nantahala River subbasin of the Little Tennessee River basin contains most of the Nantahala River catchment. Headwaters of this river system are entirely within the Nantahala National Forest. The Nantahala River, from its source to the confluence with Roaring Fork, is currently classified as Outstanding Resource Water. Much of the land adjacent to this reach is privately owned by the Rainbow Springs Corporation. The Nantahala River and most if its tributaries are high gradient systems capable of supporting wild trout populations. Nantahala Power and Light Company maintains a power generation facility at Nantahala Lake. Flow is diverted to downstream power generators, bypassing a seven-mile reach of the river prior to discharging back into the original channel above the Nantahala Gorge. The Division of Water Resources is working with Nantahala Power and Light to maintain a minimum instream flow (Refer to Chapter 2). The regulated reach of the Nantahala River below the power generators is very popular for rafting and canoeing. Recreational development has increased along the Nantahala Gorge corridor as it relates to the rafting and canoeing industry.

Overview Of Water Quality

Benthic macroinvertebrate samples have been collected from 14 locations in this subbasin. Biological and water quality sampling sites are depicted in Figure 4.5. Major reaches of the Nantahala River above Nantahala Lake and its tributaries are undisturbed. Excellent bioclassifications have consistently been recorded from the ambient monitoring location near Rainbow Springs. Many unusual and rare benthic macroinvertebrate taxa have been collected from this location. Bioclassification of the Nantahala River below the bypass reach near Wesser has generally been in the Good or Good/Fair categories suggesting impacts due to power generation and flow regulation. Heavy periphyton and macrophyte growths have been recorded during all collections. However, an Excellent bioclassification was given to this location during the basinwide survey. This subbasin contains 4 permitted dischargers, all of which are less than 0.5 MGD. However, two of these are trout farms that discharge to Whiteoak Creek. Fair and Good/Fair bioclassifications have been recorded below these facilities.

Lake monitoring investigations have been conducted on Nantahala Lake within this subbasin. Nantahala Lake was selected as a reference lake for the mountain ecoregion and was extensively studied by DWQ from 1991 through 1993. Results of these investigations have consistently shown excellent water quality. These data and the results from the most recent investigation (August, 1994) suggest that the lake is currently meeting its intended use (B-Tr).

Ambient water quality information is currently being collected from the Nantahala River at Rainbow Springs. These data have noted very few exceedances in water quality standards. However, 7 exceedances in the pH standard have been noted at this location. This value represents the greatest number of exceedances for monitoring locations in the Little Tennessee River basin. In addition, pH records from this location also illustrate the trends evident at other Little Tennessee River locations. A general decline in pH (especially minimum values) was noted during a three year time period from winter 1991 through the fall of 1994. There have been no low pH values since that time (through April 1996).

Benthic Macroinvertebrates

Two locations were sampled for benthic macroinvertebrates (Nantahala River at Rainbow Springs and near Wesser) in 1994. Excellent bioclassifications were assigned to both of these locations during the 1994 investigations. Biological data from the Nantahala River at Rainbow Springs has consistently received an Excellent bioclassification, however prior data from the Nantahala River near Wesser were rated Good and Good/Fair. The 1994 data suggests that the water quality has improved at this location between collection periods , but there were no major management actions taken to explain this improvement. Benthic macroinvertebrates have been collected from 14 locations in this subbasin since 1983, including two special studies.

Long Term Benthos Locations

Nantahala River, Forest Service Road #437 near Rainbow Springs

Seven surveys have been conducted at this ambient monitoring location. Excellent bioclassifications have been consistently recorded during all surveys. The benthic fauna is characterized by many intolerant taxa. Water quality data from this monitoring location have noted very few exceedances in water quality standards for the period of record.

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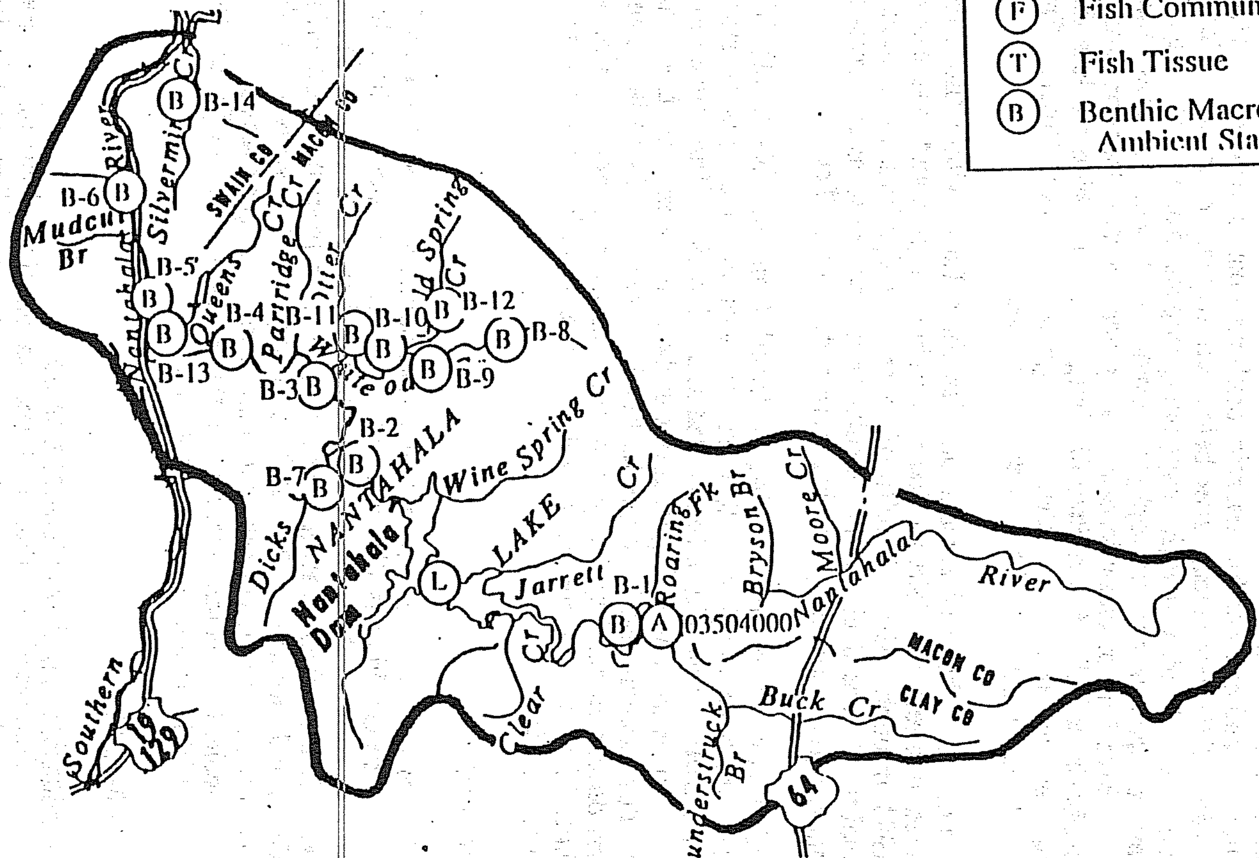

Legend
(A) Ambient Monitoring Station
(L) Lake Assessment
(F) Fish Community
(T) Fish Tissue
(B) Benthic Macroinvertebrate Ambient Station

Figure 4.5 **Sampling Location in the Nantahala River (Subbasin 04-04-03)**

Water chemistry collections at this site had noted seven low pH records (<6.0) from 1991 to 1994. During this same time period, there was a decline in total taxa richness. A similar relationship between pH and total taxa richness also has been suggested in comparing sites in the Lower Little Tennessee subbasin.

Nantahala River, US 19 near Wesser

Benthic macroinvertebrate samples have been collected from this location on four different occasions. EPT taxa richness and abundance values have increased during each investigation and biotic index values have steadily declined, suggesting an improvement in water quality between investigations.

Many more intolerant taxa were collected from this location during the 1994 basinwide survey than during all other investigations. In addition, there has been a decline in the numbers of tolerant taxa collected at this location. This apparent change in the benthic community suggests that water quality has improved between collection periods.

Special Studies

Data from all special investigations conducted since 1983 are presented in Table 4.10, with a reference to the Biological Assessment Group report file number, if more detailed information is needed.

These investigations were conducted to evaluate the lower reaches of the Nantahala River for an Outstanding Resource Water classification. This investigation concentrated on the bypass reach and sections of the river within the Nantahala River gorge, where the river receives heavy

Table 4.10 Benthic Macroinvertebrate Special Studies, Little Tennessee River Subbasin 04-04-03, 1983-1994.

Site #	Creek	Date	Study	County	Road	S:Rating
B-1	Nantahala R	931117	Nantahala River ORW	Macon	FS #437	80/46:Exc
B-2	Nantahala R	931117	Nantahala River ORW	Macon	SR 1401	- /33:Good
B-3	Nantahala R	931116	Nantahala River ORW	Macon	FS #308	72/37:Good
B-4	Nantahala R	931116	Nantahala River ORW	Macon	SR 1310	66/39:Good
B-5	Nantahala R	931115	Nantahala River ORW	Macon	US 19	65/32:Good
B-6	Nantahala R	931115	Nantahala River ORW	Macon	US 19/74	54/24:G/F
B-7	Dicks Cr	931116	Nantahala River ORW	Macon	SR 1400	-/26:G/F
B-11	White Oak Cr	931116	Nantahala River ORW	Macon	SR 1310	-/34:Good
B-13	Queens Cr	931116	Nantahala River ORW	Macon	FS #422	-/27:Good
B-14	Silvermine Cr	931116	Nantahala River ORW	Macon	NC 28	-/22:G/F

recreational use. The river is nationally known for its whitewater rafting, canoeing and kayaking. Data collected during this investigation determined that this section of the river was not eligible for reclassification.

Several investigations have been conducted on White Oak Creek to assess the impact of the C.R. Brown Trout Farm (Table 4.11). An initial survey was conducted in November 1988 and three subsequent surveys were conducted in 1990 following changes in wastewater treatment. The initial survey clearly indicated that the facility severely impacted the stream fauna. The implementation of best management practices at this facility (largely to reduce the amount of particulates), and higher stream flows appeared to greatly reduce the degree of impact observed during the January and May investigations. However, severe impacts also were noted during the survey in August which was conducted during low flow and high water temperature conditions. Improvements in bioclassification were noted downstream, suggesting that the impacts from the C.R. Brown Trout Farm appear to be localized. These investigations indicate that flow and temperature conditions are main factors in determining the degree of impact to a stream from a trout farm discharge (B-901029, B-900220, B-900720, and B-881209).

Table 4.11 White Oak Creek Special Study - 1988 to 1990.

Site #	Creek	Date	Study	County	Road	S:Rating
B-8	White Oak Cr	900810	C.R. Brown Trout Farm	Macon	ab trout farm	84/47:Exc
		900515	C.R. Brown Trout Farm	Macon	ab trout farm	83/48:Exc
		900123	C.R. Brown Trout Farm	Macon	ab trout farm	78/46:Exc
		881108	C.R. Brown Trout Farm	Macon	ab trout farm	59/35:Exc
B-9	White Oak Cr	900809	C.R. Brown Trout Farm	Macon	SR 1397	60/20:Fair
		900515	C.R. Brown Trout Farm	Macon	SR 1397	79/35:G/F
		900123	C.R. Brown Trout Farm	Macon	SR 1397	83/39:G/F
		881108	C.R. Brown Trout Farm	Macon	SR 1397	41/10:Fair
B-10	White Oak Cr	900809	C.R. Brown Trout Farm	Macon	SR 1423	94/31:Good
		900515	C.R. Brown Trout Farm	Macon	SR1423	104/46:Good
		900123	C.R. Brown Trout Farm	Macon	SR 1423	77/37:Good
B-11	White Oak Cr	900809	C.R. Brown Trout Farm	Macon	SR 1310	78/26:Good
		900515	C.R. Brown Trout Farm	Macon	SR 1310	96/44:Good
		881108	C.R. Brown Trout Farm	Macon	SR 1310	-/33:Good
B-12	Cold Springs Cr	900122	C.R. Brown Trout Farm	Macon	FS #711	-/41:Good

Potential HQW/ORW Streams

Benthic macroinvertebrate samples have been collected from White Oak Creek above the C.R. Brown trout farm during four investigations. These data have consistently recorded Excellent bioclassifications. Based on these observations, this catchment above the trout farm could be considered for reclassification to High Quality Waters or Outstanding Resource Waters.

Fisheries

Although no fish community assessments were conducted within this subbasin in 1994, a study was conducted in 1993 to evaluate the lower Nantahala River watershed as a candidate for Outstanding Resource Waters classification. The NCIBI could not be used to evaluate small, cold-water trout streams or trout streams receiving a cold water discharge from a hydroelectric facility, so three of the four sites (Nantahala River at US 19, White Oak Creek and Silvermine Creek) could not be accurately rated. The Nantahala River at SR 1401 in the bypassed reach received a Good rating.

Lakes Assessment Program

Nantahala Lake

Nantahala Lake lies in the western tip of North Carolina on the Nantahala River. Nantahala Power and Light owns this reservoir, which was impounded in 1942 for hydroelectric power. The Lake is 249 feet (76 meters) deep at the dam at maximum pool. The rugged, mountainous drainage area measures 174 mi^2 (280 km^2) and is mostly forested. The lake is currently classified as B-Tr. However, Nantahala Lake is being considered for reclassification to an Outstanding Resource Water (ORW).

Prior to being selected as a reference lake Nantahala Lake was sampled in 1981, 1982 and 1989. The most recent sampling of Nantahala Lake occurred on August 30, 1994. Results of sampling were very similar to the results from previous years. Results from 1994 indicated that Nantahala Lake is continuing to have excellent water quality. Designated uses of the lake were fully supported at the time of this assessment.

Nantahala Lake is one of sixteen lakes selected, statewide, as representative of a minimally impacted lake by which other lakes in the same region can be compared. To determine Nantahala Lake's suitability to be considered as a reference lake for the Mountain region, the lake was extensively monitored by DWQ from 1991 through 1993. Results of these sampling events have shown the lake to have consistently excellent water quality.

4.3.4 Cheoah River (Subbasin 04-04-04)

Description

The Cheoah River subbasin of the Little Tennessee River basin contains most of the Cheoah River and all of its tributaries. Significant sections of most tributary catchments are within the Nantahala National Forest and are minimally impacted. These tributaries are typically high-gradient streams capable of supporting trout populations. However, lower reaches of some tributaries and corridors along Tulula Creek, Sweetwater Creek, Little Snowbird Creek, Yellow Creek, and the Cheoah River are not in the National Forest and are, therefore, prone to the effects of land-disturbing activities. The Cheoah River forms the headwaters of Santeetlah Lake.

Overview Of Water Quality

Good and Excellent bioclassifications have been recorded at all benthic macroinvertebrate monitoring locations in this subbasin. Biological and water quality sampling sites are depicted in Figure 4.6. Small portions of the Cheoah River corridor are being developed. Sedimentation is the dominant water quality problem in the subbasin, resulting in streams becoming very turbid after rainfall. This was evident in June of 1989 when elevated concentrations of metals and turbidity were measured following increased flows. Potential sources of sediment in the subbasin include agriculture, residential and commercial development, and silviculture.

This subbasin contains 7 permitted dischargers. Only the Robbinsville WWTP (0.63 MGD) has a design flow of ≥ 0.05 MGD. Seven trout farms discharge to Snowbird Creek or West Buffalo Creek. Phytoplankton blooms in Lake Santeetlah have been associated with the effluent from these trout farms, but there appeared to be little impact to the biota of the receiving streams. There are a total of 5 trout farms operating in Graham County under the NPDES permit program. This is the second largest trout producing county in North Carolina, capable of 1.5 million lbs. of fish at maximum production (memo from Paul White, ARO, 6/20/96). Trout farming activities have been shown to impact benthic macroinvertebrate communities particularly during low flow, high water temperature conditions (DWQ report numbers B-901029 and B-891141, and Alabaster, 1982).

Benthic Macroinvertebrates

Four locations were sampled for benthic macroinvertebrates during the 1994 basinwide monitoring program (Table 4.12). Sites were selected on Tulula Creek and the Cheoah River to bracket the Robbinsville WWTP. Sites also were selected at one previously unassessed monitoring location (Bear Creek) and at Snowbird Creek as reference information. However, analysis of these data are somewhat complicated by extremely high stream flows immediately prior to sample collection. Benthic macroinvertebrate samples have been collected from 9 locations in this subbasin since 1983, including one special study.

The Robbinsville WWTP discharges to the Cheoah River, via Long Creek, immediately below the confluence of Tulula and Sweetwater Creeks. The Cheoah River at NC 129 below Robbinsville is a high gradient and relatively large river (approximately 22 meters wide with a catchment of 43 square miles at Robbinsville). The bottom substrate reflects the high gradient of this reach of the Cheoah River as it is dominated by boulders and rubble with very little sand or silt accumulation.

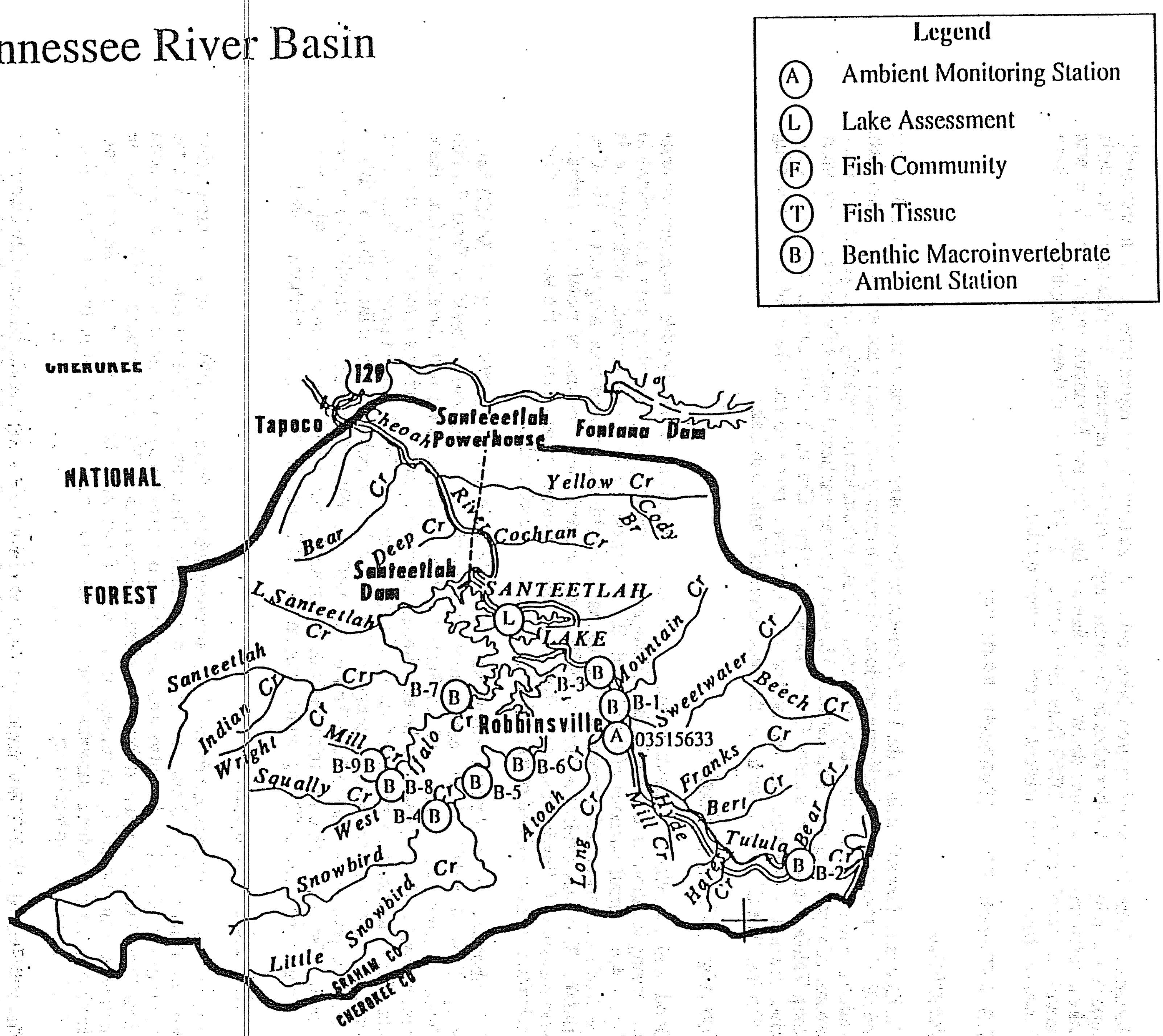

Figure 4.6 Sampling Locations in the Cheoah River (Subbasin 04-04-04)

Table 4.12 Basin Assessment Sites in Little Tennessee River Subbasin 04-04-04, 1994, Taxa Richness Values and Bioclassifications.

Site #	Creek	Date	County	Road	S/SEPT	Rating
B-1	Tulula Cr	940725	Graham	SR 1138	78/34	Excellent
B-2	Bear Cr	940725	Graham	SR 1401	64/34	Excellent
B-3	Cheoah R	940725	Graham	US 129	73/32	Good
B-5	Snowbird Cr	949726	Graham	SR 1120	-/33	Good

Benthic macroinvertebrate samples have been collected from Tulula Creek at SR 1138 above the WWTP. Biological data were collected from the Cheoah River below the WWTP during the 1994 basinwide monitoring program. Excellent and Good bioclassifications were given to Tulula Creek and the Cheoah River above and below the Robbinsville WWTP. However, the taxa richness totals and biotic index values were fairly similar, suggesting that there is very little difference between these two sites. These observations suggest that the Robbinsville WWTP is having a negligible effect on the benthos. The water quality data from this reach of the Cheoah River supports the benthic macroinvertebrate data, as very few exceedances of water quality standards have been recorded.

A survey was conducted on Bear Creek to assess the potential for reclassification of this catchment to Outstanding Resource Water. Bear Creek is a small tributary of Tulula Creek (4 meters wide with a drainage area of less than 3 square miles) near its headwaters. The collection location on Bear Creek is near the confluence with Tulula Creek. Bear Creek at this point is below 2-3 small private trout farms and may receive some limited nonpoint runoff from local sources. The substrate at this location was dominated primarily by rubble and gravel, although there were small boulders present and sand was deposited along the banks of the stream. The headwaters of this stream appear to be unimpacted. An Excellent bioclassification was given to this stream using small stream criteria. These data support the ORW recommendation.

A survey was also conducted on Snowbird Creek near a previously assessed location. However, the results of the 1994 investigation indicated a decline in taxa richness compared to data collected from Snowbird Creek in 1990. These results may be due to either high flow conditions or impact from an upstream silvicultural operation. Additional data should be collected from this catchment to determine trends in water quality.

Long Term Benthos Locations

Tulula Creek SR 1138 at Robbinsville

This site is located above the confluence of Sweetwater Creek and the Robbinsville WWTP. Benthic macroinvertebrate data have been collected from this location on 5 occasions. These data have produced Excellent bioclassifications during the 1994 and 1989 investigations, but Good bioclassifications during all three previous investigations. The Excellent bioclassifications are based primarily on lower biotic index values. These two lower biotic index values, and subsequent higher bioclassifications, may be related to the high flow conditions prior to collection. The water quality conditions at this location do not appear to be affected by urban runoff from the Robbinsville area.

Special Studies

Data from all special studies conducted since 1983 are presented in Table 4.13, with a reference to the Biological Assessment Group report number, if more detailed information is needed.
Benthic macroinvertebrate samples were collected from these tributary streams as part of an intensive investigation to determine the source of enrichment resulting in persistent algal blooms on the West Buffalo Creek arm of Lake Santeetlah. Macroinvertebrate collections from Little Buffalo

Creek suggested some enrichment (nutrient inputs) as well as inputs of particulate organic material. Only a slight reduction in diversity of the fauna was noted during this collection (B-900817).

Table 4.13 Benthic Macroinvertebrate Special Studies, Little Tennessee River Subbasin 04-04-04, 1983-1994.

Site #	Creek	Date	Study	County	Road	S:Rating
B-4	Snowbird Cr	900620	Lake Santeetlah Bloom	Graham	SR 1120	-/49:Exc
B-6	Snowbird Cr	900619	Lake Santeetlah Bloom	Graham	SR 1119	-/47:Exc
B-7	W Buffalo Cr	900619	Lake Santeetlah Bloom	Graham	SR 1123	-/43:Exc
B-8	L Buffalo Cr	900619	Lake Santeetlah Bloom	Graham	SR 1123	83/40:Exc
B-9	Hooper Mill Cr	900619	Lake Santeetlah Bloom	Graham	nr SR 1123	85/49:Exc

Potential HQW/ORW Streams

Snowbird Creek from its source to the confluence of Polecat Creek is one of only a few catchments currently classified as High Quality Waters within this subbasin. However, benthic macroinvertebrate investigations in this subbasin have found many excellent stream reaches. These streams include Tulula Creek, Bear Creek, West Buffalo Creek, and Little Buffalo Creek. These streams, in addition to other forested streams in the Nantahala National Forest, such as Slickrock Creek, Santeetlah Creek, and Deep Creek, may qualify for HQW or ORW reclassification.

Lakes Assessment Program

Santeetlah Lake

Santeetlah Lake is located on the Cheoah River in the mountains of western North Carolina. The lake is owned by the Aluminum Company of America (ALCOA) and is used to generate hydroelectric power as well as for recreational purposes. Santeetlah is a deep lake with a maximum depth of 213 feet (65 meters) and a mean depth of 56 feet (17 meters). Major tributaries to Santeetlah Lake include the Cheoah River, Santeetlah River, West Buffalo Creek and Snowbird Creek. The watershed is 280 mi^2 (450 km^2) of rugged, mountainous terrain, which is nearly all forested. Santeetlah Lake is designated B-Trout.

The main body of Santeetlah Lake was most recently sampled on August 30, 1994. At the time of sampling the lake was approximately six feet below normal water level. With the exception of the West Buffalo Creek arm (partially supporting) Santeetlah Lake was oligotrophic and fully supported all of its designated uses.

In 1993, in response to concerns about water quality in the West Buffalo and Snowbird Creek arms of Santeetlah Lake, a study was conducted by the Division of Environmental Management from April through October of 1993 to determine the source and extent of nutrient loading into the lake (NCDEHNR, 1994). Monitoring sites were located upstream and downstream of trout farms on both creeks, on an unimpacted creek within the lake's watershed (Hooper Mill Creek), and within the West Buffalo Creek and Snowbird Creek arms of Santeetlah Lake. Elevated nutrient concentrations and nutrient loads were observed at the stream monitoring sites downstream of the trout farms. Nutrient concentrations were especially high immediately downstream of the trout farms on West Buffalo Creek. AGPT testing determined that the monitoring sites downstream of the West Buffalo Creek trout farms were capable of supporting nuisance algal blooms, while sites upstream of the trout farms would not support excessive algal blooms. During this study, algal blooms were observed in the West Buffalo Creek arm of Santeetlah Lake from June through October, 1993. Results from this study indicate that the algal blooms documented on the West Buffalo Creek arm of Santeetlah Lake are enhanced by inputs of nutrients from the upstream trout farms. These algal blooms occurred during the summer months of the study.

While the main body of the lake continues to exhibit excellent water quality, algal blooms and elevated nutrient levels in the West Buffalo Creek and Snowbird Creek Arms elicit concerns for the lake's water quality. Improvement in the quality of effluent discharged from the trout farms on West Buffalo Creek and Snowbird Creek will be necessary to reduce downstream nutrient loading and excessive algal growth. Expansion of the trout farms and/or construction of new farms in the Santeetlah Lake watershed should be limited until improvement of downstream water quality can be verified through periodic monitoring.

The main body of Santeetlah lake was previously monitored by DWQ in 1981, 1982, 1987 and 1990. The lake was rated by the NCTSI as oligotrophic in all three samplings.

Calderwood Lake

Construction of Calderwood Lake was completed in 1930 by the Aluminum Company of America (ALCOA) to produce hydroelectric power. This reservoir is now owned by a subsidiary of ALCOA called the Tallassee Power Company (TAPOCO). Calderwood Lake is located on the Little Tennessee River in the Great Smoky Mountains. Situated on the North Carolina/Tennessee state border, this reservoir is downstream of Lake Cheoah. Calderwood Lake is narrow and deeply channeled by two forested cliffs. The maximum depth is 148 feet (45 meters) and the mean depth is 95 feet (29 meters). This reservoir has a surface area of 140 acres (57 hectares) and a drainage area of 1856 mi^2 (4807 km^2). Tributaries include Dalton Gap Branch, Cooper Camp Branch and Slickrock Creek. Calderwood Lake is classified C Tr.

Calderwood Lake was most recently monitored by DWQ on August 10, 1994. The NCTSI score was -5.2 in 1994, indicating oligotrophic conditions. Calderwood Lake supported all of its designated uses. This reservoir was previously sampled in 1988. The NCTSI score in 1988 was -7.3 (oligotrophic). Conditions observed in Calderwood Lake in 1988 were similar to those observed in 1994, demonstrating a range in water quality parameters consistent with excellent water quality.

4.4 USE-SUPPORT: DEFINITIONS AND METHODOLOGY

4.4.1 Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses (*use support* status) is another important method of interpreting water quality data and assessing water quality. Use support assessments for the Little Tennessee River basin are presented in Section 4.5.

Surface waters (streams, lakes or estuaries) are rated as either *fully supporting* (S), *support-threatened* (ST), *partially supporting* (PS), or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported, partially supported or are not supported. For instance, waters classified for fishing and water contact recreation (class C) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as ST, PS or NS, depending on the degree of exceedence.

Streams rated as either partially supporting or nonsupporting are considered *impaired.* A waterbody is fully supporting but threatened (ST) for a particular designated use when it fully supports that use now, but may not in the future unless pollution prevention or control action is taken. This rating describes waters for which actual monitored or evaluated data indicate an apparent declining trend (i.e., water quality conditions have deteriorated, compared to earlier assessments, but the waters still support uses). Although these waters are currently supporting uses, they are treated as a separate category from waters fully supporting uses. Streams which had no data to determine their use support were listed as non-evaluated (NE).

For the purposes of this document, the term *impaired* refers to waters that are rated either partially supporting or not supporting their uses based on specific criteria discussed more fully below. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad.

4.4.2 Interpretation of Data

The assessment of water quality presented below involved evaluation of available water quality data to determine a water body's use support rating. In addition, an effort was made to determine likely causes (e.g., sediment or nutrients) and sources (e.g., agriculture, urban runoff, point sources) of pollution for impaired waters. Data used in the use support assessments include biological data, chemical physical data, lakes assessment data, and monitoring data. Although there is a general procedure for analyzing the data and determining a waterbodys use support rating, each stream segment is reviewed individually, and best professional judgment is applied during these determinations.

Interpretation of the use support ratings compiled by DWQ should be done with caution. The methodology used to determine the ratings must be understood, as should the purpose for which the ratings were generated. The intent of this use-support assessment was to gain an overall picture of the water quality, how well these waters support the uses for which they were classified, and the relative contribution made by different categories of pollution within the basin. In order to comply with guidance received from EPA to identify likely sources of pollution for all impaired stream mileage, DWQ used the data mentioned above.

The data are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Since the assessment methodology is geared toward general conclusions, it is important to not manipulate the data to support policy decisions beyond the accuracy of these data. For example, according to this report, nonpoint source pollution is the greatest source of water quality degradation. However, this does not mean that there should be no point source control measures. All categories of point and nonpoint source pollution have the potential to cause significant water quality degradation if proper controls and practices are not utilized.

The threat to water quality from all types of activities heightens the need for point and nonpoint source pollution control. It is important to consider any source (or potential source) of pollution in developing appropriate management and control strategies. The potential for further problems remains high as long as the activity in question continues carelessly. Because of this potential, neglecting one pollution source in an overall control strategy can mask the benefits achieved from controlling all other sources.

4.4.3 Assessment Methodology - Freshwater Bodies

Many types of information were used to determine use support assessments and to determine causes and sources of use support impairment A use support data file is maintained for each of the 17 river basins. In these files stream segments are listed as individual records. All existing data pertaining to a stream segment (from the above list) is entered into it's record. In determining the use support rating for a stream segment, corresponding ratings are assigned to data values where this is appropriate. The following data and the corresponding use support ratings are used in the process: (note: The general methodology for using this data and translating the values to use support ratings corresponds closely to the 305(b) guidelines with some minor modifications.)

A. Biological Data

Benthic Macroinvertebrate Bioclassification

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT). The bioclassifications are translated to use support ratings as follows:

Bioclassification	Rating
Excellent	Supporting
Good	Supporting
Good-Fair	Support Threatened
Fair	Partially Supporting
Poor	Not Supporting

Fish Community Structure

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a streams biological integrity by examining the structure and health of its fish community. The index incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. The index is translated to use support ratings as follows:

NCIBI	Rating
Excellent	Supporting
Good-Excellent	Supporting
Good	Supporting
Fair-Good	Support Threatened
Fair	Partially Supporting
Poor-Fair	Partially Supporting
Poor	Not Supporting
Very Poor - Poor	Not Supporting
Very Poor	Not Supporting

Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of alga may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5,000 mm3/m3, density greater than 10,000 units/ml, or chlorophyll a concentration approaching or exceeding 40 micrograms per liter (the NC state standard) constitutes a bloom. A waterbody is rated ST if the biovolume, density and chlorophyll a concentrations are approaching bloom concentrations. If an algal bloom occurs, the waterbody is rated PS.

B. Chemical/Physical Data

Chemical/physical water quality data is collected through the Ambient Monitoring System as discussed in section 4.2.7. This data is downloaded from STORET to a desktop computer for analysis. Total number of samples and percent exceedences of the NC state standards are used for use support ratings. Percent exceedences correspond to use support ratings as follows:

Standards Violation	Rating
Criteria exceeded < 10%	Fully Supporting
Criteria exceeded 11-25%	Partially Supporting
Criteria exceeded >25%	Not Supporting

C. Fish Consumption Advisory

Fish consumption advisories are issued by the State Health Director based on the recommendations of the NC Division of Epidemiology. The advisories correspond to the use support ratings as follows:

Advisory	Rating
No Restriction	Fully Supporting
Restricted Consumption	Partially Supporting
No Consumption	Partially Supporting

D. Lakes Program Data

As discussed in section 4.2.3, assessments have been made for all publicly accessible lakes, lakes supplying domestic drinking water, and lakes where water quality problems have been observed.

E. Sources and Cause Data

In addition to the above data, existing information was entered for potential sources of pollution (point and nonpoint). It is important to note that not all impaired streams will have a potential source and/or cause listed for them. Staff and resources do not currently exist to collect this level of information. Much of this information is obtained through the cooperation of other agencies (federal, state and local), organizations, and citizens.

F. Point Source Data

Whole Effluent Toxicity Data
Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Streams that receive a discharge from a facility that have failed its whole effluent toxicity test may be rated ST (unless water quality data indicated otherwise), and have that facility listed as a Point Source potential source of impairment.

Daily Monitoring Reports
Streams which received a discharge from a facility significantly out of compliance with permit limits may be rated ST (unless water quality data indicated otherwise), and have that facility listed as a Point Source potential source of impairment.

G. Nonpoint Source Data

Information related to nonpoint source pollution (i.e., agricultural, urban and construction) was obtained from monitoring staff, other agencies (federal, state and local), land-use reviews, and workshops held at the beginning of each basin cycle.

H. Problem Parameters

Causes of use support impairment (problem parameters) such as sedimentation and low dissolved oxygen, were also identified for specific stream segments. For ambient water quality stations, those parameters which exceeded the water quality standard > 10% of the time for the review period were listed as a problem parameter. For segments without ambient stations, information from reports, other agencies, and monitoring staff were used if it was available.

I. Monitored vs. Evaluated

Assessments were made on either monitored (M) or evaluated (E) basis depending on the level of information available. A monitored basis represents monitored data which are not more than five years old. An evaluated basis refers to data older than five years, and/or the use of best professional judgment.

4.4.4 Assigning Use Support Ratings

At the beginning of each assessment, all data is reviewed by subbasin with the monitoring staff, and data is adjusted where necessary based on best professional judgment. Discrepancies between data sources are resolved during this phase of the process. For example, a stream may be sampled for both benthos and fish community structure, and the bioclassification may differ from the NCIBI (i.e., the bioclassification may be S while the NCIBI may be PS). To resolve this, the final rating may defer to one of the samples (resulting in S or PS), or, it may be a compromise between both of the samples (resulting in ST).

After reviewing the existing data, ratings are assigned to the streams. If one data source exists for the stream, the rating is assigned based on the translation of the data value as discussed above. If more than one source of data exists for a stream, the rating is assigned according to the following hierarchy:

- Fish Consumption Advisories
- Benthic Bioclassification / Fish Community Structure
- Chemical/Physical Data
- Monitored Data > 5 years old
- Compliance / Toxicity Data

This is only a general guideline for assigning use support ratings and not meant to be restrictive. Each segment is reviewed individually and the resulting rating may vary from this process based on best professional judgment which takes into consideration site specific conditions.

After assigning ratings to streams with existing data, streams with no existing data were assessed. Streams that were direct or indirect tributaries to streams rated S or ST received the same rating (with an evaluated basis) if they had no known significant impacts, based on a review of the watershed characteristics and discharge information. Streams that were direct or indirect tributaries to streams rated PS or NS were assigned a Not Evaluated (NE) rating.

4.5 USE SUPPORT RATINGS FOR THE LITTLE TENNESSEE RIVER BASIN

4.5.1 Streams and Rivers

Of the 2702 miles of freshwater streams and rivers in the Little Tennessee basin, use support ratings were determined for 99% or 2684 miles with the following breakdown:

	Miles	Percent of Total
SUPPORTING		99%
Fully supporting:	2281	85%
Support-threatened:	376	14%
IMPAIRED		<1%
Partially supporting:	2.4	(0.09%)
Not supporting:	4.8	(0.18%)
NOT EVALUATED:		1%

These use support values are different from the values in the 1992-1993 305(b) Report. The total waters supporting their uses appear to have increased, while those that are impaired appear to have decreased. While the water quality may have improved since the 1992-1993 305(b) report, the changes in values may also be due to the following:

- Methodology for determining use support has been altered. In the 1992-1993 305(b) Report, evaluated information from older reports and workshops were included in the use support process. Streams rated using this information were considered to be rated on an evaluated basis. In the current use support process, this older, evaluated information has been discarded, and streams are now rated using only monitored information (including current and older monitoring data), or evaluated based on being a tributary to a stream that is monitored.

- The basinwide process allows for concentrating more resources on individual basins during the monitoring phase. Therefore, more streams were monitored, and more information was available to use in the use support process.

Although the majority of the streams have good to excellent bioclassifications and very few standards were violated at the ambient stations, nonpoint source effects such as increased sedimentation, were evident at many of the sampling sites. Table 4.14 provides information on streams and stream segments that were monitored. This includes bioclassification and collection date for macroinvertebrate samples, fish community structure bioclassification, ambient monitoring station information, problem parameters such as sediment, potential sources of pollution (point or nonpoint), and the overall use support rating. Table 4.15 presents the use support determinations by subbasin and Figure 4.7 is a color map showing use support for the basin.

<u>Impaired Waters</u>

Only three streams were given an impaired rating of Partially Supporting or Not Supporting. In the Upper Little Tennessee subbasin, 4.8 miles of the Cullasaja River above Mirror Lake was rated Not Supporting. This section of the river was sampled in 1991 and received a Poor bioclassification. Mill Creek was also sampled in 1991 above and below the Highlands WWTP and both sites received Fair bioclassifications. This resulted in a Partially Supporting rating. The bioclassifications for both of these streams were likely due to the effects of nonpoint source runoff due to highly urbanized watersheds with houses, golf courses and roads adjacent to the streams.

In the Nantahala River subbasin, several investigations have been conducted on White Oak Creek to assess the impact of the C.R. Brown Trout Farm. Although improvements were seen in bioclassifications downstream after implementation of best management practices, severe impacts were still noted directly below the farm during the survey in August 1990. This 1.0 mile stretch of the creek received a Fair bioclassification, resulting in a Partially Supporting rating.

4.5.2 Lakes

Use support ratings were determined for 11 reservoirs in the Little Tennessee River basin. Table 4.16 shows the use support determinations for each lake sampled in each subbasin.

<u>Upper Little Tennessee River (Subbasin 04-04-01)</u>

Lake Sequoyah is located on the Cullasaja River and is currently classified WS-III Tr CA. Lake Sequoyah was most recently sampled in August 1994, and elevated total phosphorous values and relatively high concentration of algae indicate that its designated uses may be threatened.

Lake Emory is on the Little Tennessee River and is currently classified C. Lake Emory was sampled in August 1994 which resulted in a change in trophic status from eutrophic to oligotrophic. Signs of sedimentation were also noted. It is currently supporting its uses.

Table 4.14 Monitored Stream Sites in the Little Tennessee River Basin

Station Number	Station Location	Classification	Index Number	Miles	Chem. Rating 90-94	<----Biological Rating----> 1990	1991	1992	1993	1994	Fish Comm.	OVERALL/GOVERNING RA Prob. Param.	Use Support	Major Source
40401														
3500000,	Little Tenn. R., SR 1629, SR 1651 (Prentiss), and NC 28(Iotla	C	2-(1)a	38.3	S					Good-Fa	Fair-Good		ST	NP
03502000														
	Little TN River at nr Needmore, Swain	C	2-(1)b	12.8						Good			S	NP
	Middle Cr SR 1635/1684 Macon	C Tr	2-8	8.7							Good	Sed	S	NP
	Tessentee Cr SR 1636	C Tr	2-9	8.0							Good	Sed	S	NP
	Coweeta Cr, SR 1115 Macon	B Tr	2-10	4.6						Exceller	Good		S	
	Cartoogechaye Creek SR 1146, Macon	WS-III Tr	2-19-(1)	9.1						Good			S	NP
	Cartoogechaye Creek SR 1168, Macon	WS-III Tr CA	2-19-(10.3)	1.6							Good		S	
03500240	Cartoogechaye Creek SR 1152, Macon	B Tr	2-19-(10.5)	4.5	S								ST	NBT
	Cullasaja River above Mirror Lake, Macon Co.	WS-III Tr	2-21-(0.5)	4.8		Fair	Poor						NS	NPB
	Mill Cr ab & be WWTP, Macon	WS-III C Tr	2-21-3	1.4		Fair	Fair						PS	
	Cullasaja River 3/4 mi below the dam, Macon Co.	B Tr	2-21-(5.5)a	8.5		Good-Fa	Good-Fair			Good-Fair			ST	
	Cullasaja River at both SR 1678, and US64/SR 1524, Macon	B Tr	2-21-(5.5)b	10.2		Good-Fa	Good-Fair/Good			Excellent			S	P
	Iotla Cr, SR 1372, Macon	C	2-27	5.4						Good-Fa	Fair		ST	
	Cowee Cr, NC 28, Macon	C Tr	2-29	4.3						Good-Fair		Sed	ST	NP
	Burnington Cr, SR 1371	B Tr	2-38	11.5						Good			S	
40402														
	Tellico Cr SR 1367, Macon	C Tr	2-40	5.8						Excellent			S	NP
	Alarka Creek at SR 1140, SR 1185, Swain County	C Tr	2-69-(2.5)	12.5						Excellent			S	
	Tuckasegee R. at be Greenland Cr & SR 1140, Jackson Co.	WS-III&B Tr OR	2-79-(0.5)	4.8		Excellent				Excellent			S	
	Hurricane Creek at SR 1145, Jackson Co.	WS-III Tr	2-79-23-2	2.0			Excellent						S	
	Caney Fk, SR 1740, Jackson	WS-III Tr	2-79-28-(2.5)	11.0						Excellent			S	
	Mull Cr., SR 1740, Jackson	WS-III Tr	2-79-28-3	4.4						Good			S	
	Moses Cr, SR 1737, Jackson	WS-III Tr	2-79-28-8	4.0						Good			S	
	Cullowhee Cr, SR 1001, Jackson	C Tr	2-79-31	29.6						Good		Sed	S	NP
	Whiterock Cr, nr school, Jackson	C HQW	2-79-31-1-(1)	0.2			Excellent						S	
	Savannah Cr, SR 1367, Jackson	C Tr	2-79-36	12.6						Excellent		Sed	S	NP
03513000	Tuckasegee R. Dillsboro, SR-1377, and SR 1364 Bryson City	C	2-79-(38)	20.4	S	Excellent				Excellent			S	
	Scott Cr, SR 1556, Jackson	C Tr	2-79-39	14.6						Good-Fair		Sed	ST	NP
	Connelly Cr, SR 1177, Swain	C Tr	2-79-52	7.6						Excellent			S	
	Beech Flats Prong, US 441 Swain	C Tr HQW	2-79-55-2	4.8						Good-Fair			ST	
	Bradley Fork off US 441, Swain Co.	B Tr HQW	2-79-55-12-(11)	1.7						Good			S	
	Mingus Creek at US 441, Swain Co.	C Tr HQW	2-79-55-16-(2)	2.2									S	
03512000	Oconaluftee River at US 441 & SR 1359 Birdtown, Swain Co.	C Tr	2-79-55-(16.5)	8.2	S					Excellent			S	
	Straight Fk, be hatchery, Swain	C Tr	2-79-55-17-16-(20.5)	1.6									S	
	Soco Creek, old US 441 nr mouth, Swain	C Tr	2-79-55-21	14.8									S	
	Deep Cr, ab campground, Swain	WS II&B Tr	2-79-63-(16)	0.7						Excellent			S	
	Deep Cr, SR 1340, Swain	C Tr	2-79-63-(21)	1.8						Excellent			S	
	Forney Cr, nr mouth, Swain	C Tr	2-97	9.5						Excellent			S	
	Bear Cr, nr mouth, Swain	C Tr	2-97-17	3.8						Excellent			S	
	Panther Cr, SR 1233, Graham	C Tr	2-115	2.4						Excellent			S	
	Stecoah Cr, SR 1237, Graham	C Tr	2-130	7.4						Good			S	NP
	Hazel Cr, nr mouth, Swain	WS-IV Tr CA	2-146-(19)	0.7						Excellent			S	
40403														
03504000	Nantahala R ner Rainbow Springs, benthic at FS Rd #437	B Tr ORW	2-57-(0.5)	13.4		Excellen	Excellent		Excellen	Excellent			S	
	Nantahala R. SR 1401, FS Rd #308, SR 1310, Macon & US19 nr Wesser, Swain	B Tr ORW	2-57-(22.5)	28.6					Good	Excellent			S	
	Dicks Cr., SR 1400, Macon	C Tr	2-57-42	3.3					Good-Fair				ST	
	White Oak Creek, FS Rd, ab trout farm, Macon	C Tr	2-57-45a	3.5		Excellent							S	
	White Oak Creek, SR-1397 be Trout Farm		2-57-45b	1.0		Fair							PS	P

Table 4.14 Monitored Stream Sites in the Little Tennessee River Basin (Cont'd)

Station Number	Station Location	Classification	Index Number	Miles	Chem. Rating 90-94	<----Biological Rating----> 1990	1991	1992	1993	1994	Fish Comm.	OVERAL[illegible] RA Prob. Param.	Use Support	Major Source
	White Oak Cr SR 1423, SR 1310, Macon		2-57-45c	4.0		Good							S	
	Cold Springs Cr, FS Rd #711, Macon	C Tr	2-57-45-8	2.5		Good							S	
	Queens Cr, FS Rd #422, Macon	C Tr	2-57-51	5.5					Good				S	
	Silvermine Cr, NC 28, Swain	C	2-57-55	4.5					Good-Fair				ST	
40404														
	Tulula Cr, SR 1138, Graham	WS-III Tr	2-190-2-(0.5)	11.9						Excellent			S	NP
	Bear Cr, SR 1401, Graham	WS-III Tr	2-190-2-1	3.6						Excellent			S	
03515633	Cheoah R. at Robbinsville, US 129 & SR 1138	C Tr	2-190-(3.5)	1.1	S					Good			S	
	Snowbird Cr, SR 1120, Graham	C Tr HQW	2-190-9-(0.5)	13.3		Excellent							S	
	Snowbird Creek at SR 1120 and SR 1119, Graham Co.	C Tr	2-190-9-(15.5)	7.7		Excellent				Good			S	
	West Buffalo Creek at SR 1123, Graham Co.	C Tr	2-190-12	5.0		Excellent							S	NP
	Little Buffalo Creek at SR 1123, Graham Co.	C Tr	2-190-12-2	2.4		Good							S	
	Hooper Mill Creek at SR 1123, Graham Co.	C	2-190-12-3	3.5		Excellent							S	

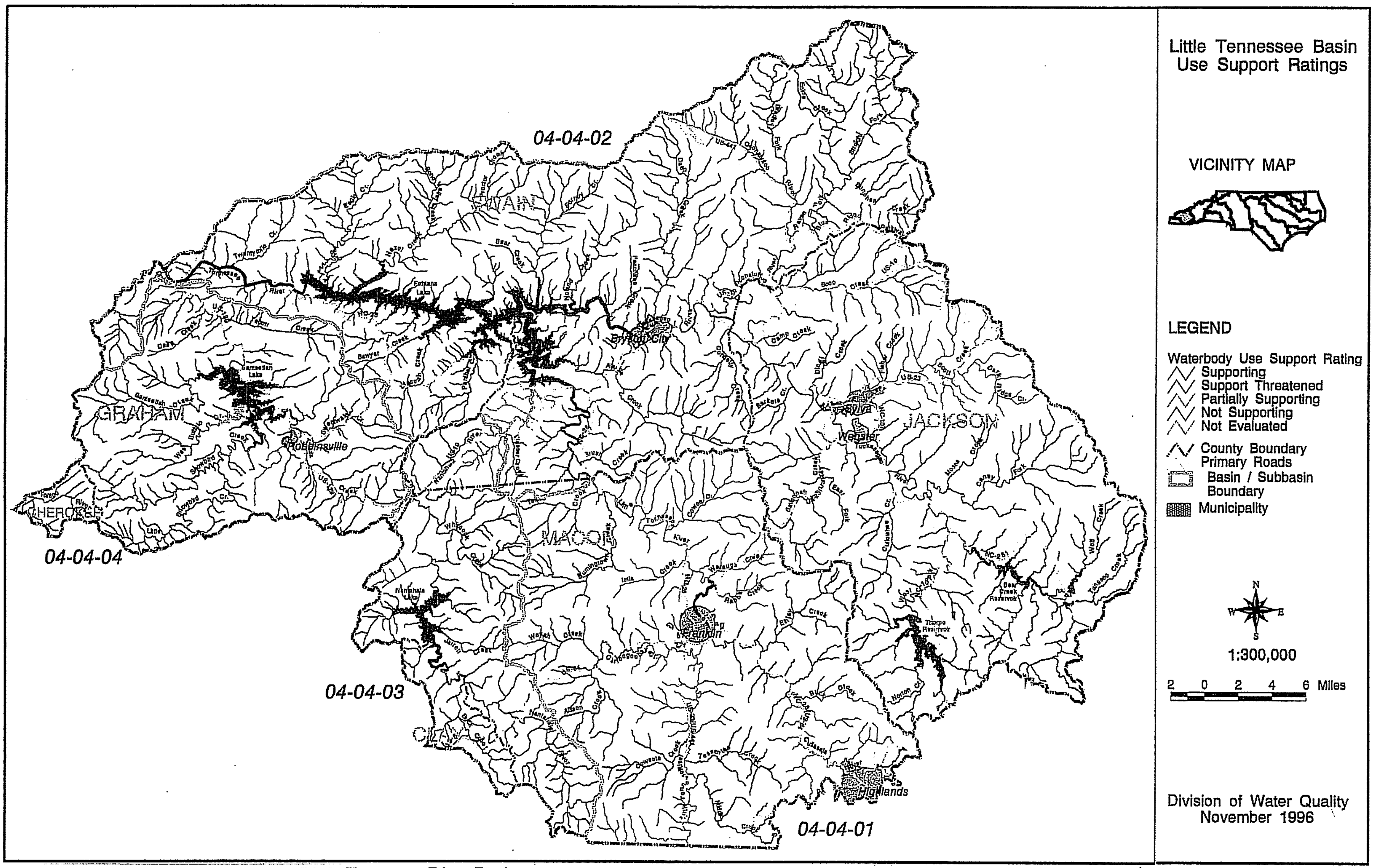

Figure 4.8 Use Support Map for the Little Tennessee River Basin

Table 4.15 Overall Use Support Ratings by Subbasin for Little Tennessee River Basin

USE SUPPORT STATUS FOR FRESHWATER STREAMS (MILES) (1990-1994)						
Subbasin	S	ST	PS	NS	NE	Total Miles
Upper Little Tenn. River 04-04-01	234.9	249.1	1.4	4.8	3.1	493.3
Lower Little Tenn. River 04-04-02	1484.4	92.3	0	0	15.7	1592.4
Nantahala River 04-04-03	228	19.1	1	0	0	248.1
Cheoah River 04-04-04	361.8	6.8	0	0	0	368.6
TOTAL	2309.1	367.3	2.4	4.8	18.8	2702.4
PERCENTAGE	85	14	0	0	1	

Lower Little Tennessee River (Subbasin 04-04-02)
The Lower Little Tennessee River subbasin contains Wolf Creek, Bear Creek, and Thorpe Reservoirs, Cedar Cliff Lake and Fontana Lake. All of these lakes are supporting their current designated uses. For further information on these reservoirs and lakes refer to the Lower Little Tennessee River Subbasin in Chapter 4.

Nantahala River (Subbasin 04-04-03)
Nantahala Lake was sampled in August 1994 and found to be supporting all of its designated uses.

Cheoah River (Subbasin 04-04-04)
Lake Santeetlah was sampled in August 1994 and Fully Supported all of its designated uses, except for 280 acres on the West Buffalo Creek arm. Trout farms located on the West Buffalo Creek and Snowbird Creek contributed to elevated nutrient concentrations and algal blooms in the West Buffalo Creek arm of the lake, resulting in the Partially Supporting rating.

Lake Cheoah and Calderwood Lake are located on the Little Tennessee River. Both waters were sampled in August 1994 and were found to be supporting their designated uses.

Table 4.16 Use Support Determinations for Lakes in the Little Tennessee River Basin

LAKE NAME	COUNTY NAME	SUBBASIN	SIZE (acres)	CLASS	OVERALL USE	FISH CONSUMP.	AQ. LIFE & SECONDARY CONTACT	SWIMMING	DRINKING WATER	TROPH STATUS	PROBLEM PARAMETERS
LAKE EMORY	MACON	40401	200	C	S	S	S	n/a	n/a	OLIGOTROPHIC	
LAKE SEQUOYAH (HIGHLANDS LAKE)	MACON	40401	150	WS-III CA TR	ST	S	S	n/a	S	MESOTROPHIC	
BEAR CREEK RESERVOIR	JACKSON	40402	475	WS III B-Tr	S	S	S	S	n/a	OLIGOTROPHIC	
CEDAR CLIFF LAKE	JACKSON	40402	145	WS-III Tr CA	S	S	S	S	S	OLIGOTROPHIC	
FONTANA LAKE	SWAIN/GRAHAM	40402	10670	WS-IV-Tr,B-Tr,B, C	S	S	S	S	S	OLIGOTROPHIC	
THORPE RESERVOIR	JACKSON	40402	1300	WS-III B	S	S	S	S	n/a	OLIGOTROPHIC	
WOLF CREEK RESERVOIR	JACKSON	40402	183	WS-III B Tr HQW	S	S	S	S	n/a	OLIGOTROPHIC	
NANTAHALA LAKE	MACON	40403	1605	B-Tr	S	S	S	S	n/a	OLIGOTROPHIC	
CALDERWOOD LAKE (NC portion)	GRAHAM/SWAIN	40404	110	C-Tr	S	S	S	n/a	n/a	OLIGOTROPHIC	
LAKE CHEOAH	SWAIN/GRAHAM	40404	615	C-Tr	S	S	S	n/a	n/a	OLIGOTROPHIC	
SANTEETLAH LAKE	GRAHAM	40404	2850	B-Tr	S	S	PS(280ac)	S	n/a	OLIGOTROPHIC	

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5.2.2 State Authorities for NC's Water Quality Program

- **G.S. 143-214.1** - Directs and empowers the NC Environmental Management Commission (EMC) to develop a water quality standards and classifications program.
  G.S. 143-214.2 - Prohibits the discharge of wastes to surface waters of the state without a permit.
- **G.S. 143-214.5** - Provides for establishment of the state Water Supply Watershed Protection Program.
- **G.S. 143-214.7** - Directs the EMC to establish a Stormwater Runoff Program.
- **G.S. 143-215** - Authorizes and directs the EMC to establish effluent standards and limitations.
- **G.S. 143-215.1** - Outlines methods for control of sources of water pollution (NPDES and nondischarge permits, statutory notice requirements, public hearing requirements, appeals, etc.).
- **G.S. 143-215.1** - Empowers the EMC to issue *special orders* to any person whom it finds responsible for causing or contributing to any pollution of the waters of the state within the area for which standards have been established.
- **G.S. 143-215.3(a)** - Outlines additional powers of the EMC including provisions for adopting rules, charging permit fees, delegating authority, investigating fish kills and investigating violations of rules, standards or limitations adopted by the EMC.
- **G.S. 143-215.6A, 143-215.6B and 143-215.6C** - Includes enforcement provisions for violations of various rules, classifications, standards, limitations, provisions or management practices established pursuant to G.S. 143-214.1, 143-214.2, 143-214.5, 143-215, 143-215.1, 143-215.2. 6A describes enforcement procedures for civil penalties. 6B outlines enforcement procedures for criminal penalties. 6C outlines provisions for injunctive relief.
- **G.S. 143-215.75** - Outlines the state's Oil Pollution and Hazardous Substances Control Program.

5.3 Surface Water Classifications and Water Quality Standards

<u>**Program Overview**</u>

North Carolina has established a water quality classification and standards program pursuant to G.S. 143-214.1. Classifications and standards are developed pursuant to 15A NCAC 2B. 0100 - Procedures for Assignment of Water Quality Standards. Waters were classified for their "best usage" in North Carolina beginning in the early 1950's, with classification and water quality standards for all the state's river basins adopted by 1963. The effort to accomplish this included identification of waterbodies (which included all named waterbodies on USGS 7.5 minute topographic maps), studies of river basins to document sources of pollution and appropriate best uses and formal adoption of standards/classifications following public hearings.

The Water Quality Standards program in North Carolina has evolved over time and has been modified to be consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters and the protection of unique and special pristine waters with outstanding resource values. Classifications and standards are applied to provide protection of uses from both point and nonpoint source pollution.

Statewide Classifications

Appendix II summarizes the state's primary and supplemental classifications including, for each classification, the best usage, key numeric standards, stormwater controls and other requirements as appropriate. This information is derived from 15A NCAC 2B .0200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.

Primary Classifications

Under this system, all surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water body (e.g., aquatic life support and swimming). Primary freshwater classifications include the following: *C*, *B* and *WS* (Water Supply) *I* through *WS-V*. The WS freshwater classifications may also include a *CA* designation which stands for critical area. The critical area is an area in close proximity to a water supply intake and/or the shoreline of the reservoir in which it is located. Primary saltwater classifications include *SC*, *SB* and *SA*. SC and SB are saltwater counterparts to the freshwater C and B classifications. SA is a classification assigned to waters used for shellfish harvesting. SA, WS-I and WS-II are also, by definition, considered to be High Quality Waters, as discussed below.

Supplemental Classifications

In addition to primary classifications, surface waters may be assigned a supplemental classification. The supplemental classifications include *HQW* (High Quality Waters), *ORW* (Outstanding Resource Waters), *NSW* (Nutrient Sensitive Waters), *Tr* (Trout Waters) *FWS* (Future Water Supply) and *Sw* (Swamp Waters). Most of these have been developed in order to afford special protection to sensitive or highly valued resource waters. Therefore, while all surface waters are assigned a primary classification, they may also have one or more supplemental classifications. For example, a typical freshwater stream in the mountains might have a C Tr classification where C is the primary classification followed by the Tr supplemental classification.

Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in the water body to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C and SC waters establish the basic protection level for all state surface waters. With the exception of Sw, all of the other primary and supplemental classifications have more stringent standards than for C and SC and therefore require higher levels of protection.

High Quality Waters

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish or rare and endangered aquatic species.

In an effort to protect waters that possess such characteristics, surface waters in the following categories qualify for classification as High Quality Waters or HQW:

1) waters rated as Excellent based on chemical and biological sampling (Division of Water Quality (DWQ) assigns water quality ratings to North Carolina's surface waters based on biological and chemical data);
2) streams designated by the Wildlife Resources Commission as native and special native trout waters or primary nursery areas;
3) waters designated as primary nursery areas by the Division of Marine Fisheries; and

4) critical habitat areas designated by the Wildlife Resources Commission or the Department of Agriculture. Waters classified by the Division of Water Quality as WS-I, WS-II and SA are HQW by definition, but these waters are not specifically assigned the HQW classification because the standards for WS-I, WS-II and SA waters are at least as stringent as those for waters classified as HQW.

Special HQW protection management strategies are presented in 15A NCAC 2B.0201(d), and implemented through 15A NCAC 2B .0224. Copies of these rules can be found in Appendix II. These measures are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

For nonpoint source pollution, development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B . 0218, and which drain to and are within one mile of HQWs will be required to control runoff from the development using either a low density or high density option described in 15A NCAC 2H. 1006. In addition, the Division of Land Quality requires more stringent sedimentation controls for land disturbing projects within one mile and draining to HQWs.

Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource. The Outstanding Resource Waters rule defines outstanding resource values as:

1) outstanding fishery resource;
2) a high level of water-based recreation;
3) a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
4) being within a state or national park or forest; or
5) having special ecological or scientific significance.

Special protection measures that apply to North Carolina ORWs (15A NCAC 2B .0225) are more stringent than those for HQWs. At a minimum, no new discharges or expansions are permitted, and stormwater controls for most new development are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a specialized (or customized) ORW management strategy be developed.

5.4 NORTH CAROLINA'S POINT SOURCE CONTROL PROGRAM

North Carolina does not allow point source discharges without a permit. Discharge permits are issued under the authority of North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination System (NPDES) program. The NPDES program was delegated to North Carolina from the US Environmental Protection Agency. These permits serve as both state and federal permits. North Carolina has a comprehensive NPDES program which includes the permitting of both wastewater and stormwater discharges. Refer to Appendix VI for a full program description and Appendix I for the Organizational Duties Flow Chart for the DWQ Water Quality Section.

NPDES permits are issued in two categories; individual or general. Individual permits are issued to a specific facility and contain site specific requirements and incorporate recommendations from the basinwide water quality management plan. Individual NPDES permits are typically issued for a five year cycle with all permits in a river basin expiring at the same time. This permitting strategy allows for comprehensive review of individual dischargers within the basin and implementation of recommendations contained in the basinwide water quality management plan. New discharge permits issued during an interim period are given a shorter cycle so that expiration coincides with the basin permitting cycle. Individual permits in the Little Tennessee River basin are scheduled for expiration and renewal from October through December 1997.

General permits are developed for a general type of industry and contain permit requirements that are appropriate for a typical facility within a specific industrial classification. Facilities engaged in the specific industrial activities are eligible for permit coverage under the general permit. Facilities that are deemed to be atypical or have a history of water quality problems are required to obtain an individual permit. Because general permits are specific to a type of industrial activity and are issued statewide they do not contain basin specific measures. A general permit is typically issued for a five year cycle, which expires statewide on the same date.

5.4.1 NPDES Wastewater Discharges

Under the NPDES wastewater permitting program, each NPDES discharger is assigned either *major* or *minor* status. For municipalities, all dischargers with a flow of greater than 1 million gallons per day (MGD) are classified as major.

All new wastewater discharge permit applications must include an engineering proposal which includes a description of the origin, type, and flow of wastewater, a summary of waste treatment and disposal options, and a narrative description of the proposed treatment works and why the proposed system and point of discharge were selected. The summary must contain sufficient detail to assure that the most environmentally sound alternative was selected from the reasonably cost effective options. An assessment report describing the impact on waters in the area must be submitted for all applications of new discharges in excess of 500,000 gallons per day or 10 million gallons per day of cooling water or any other proposed discharge of 1 million gallons per day or more.

Under the NPDES program, wastewater treatment systems must be operated by a certified operator. Training and certification of operators is conducted by DWQ. It is the goal of the program to provide competent and conscientious professionals that will protect both the environment and public health.

The amount or loading of specific pollutants that are allowed to be discharged into surface waters are defined in the NPDES permit and are called *effluent limits*. Point source discharges generally have the most impact on a stream during low flow conditions when the percentage of treated effluent within the stream is greatest. Effluent limits are generally set to protect the stream during these low flow conditions. The standard low flow used for determining point source impacts is called the *7Q10*. This is the lowest flow which occurs over seven consecutive days and which has an average recurrence of once in ten years. Computer modeling may be used to determine the fate and transport of pollutants, reduction goals for contaminants, and to derive effluent limits for NPDES permits. A wasteload allocation is performed to ensure the effluent limits are set at levels that can be safely assimilated by the receiving stream.

Most dischargers are required to periodically sample their treated effluent. This process is called self-monitoring. Larger and more complex dischargers are also required to sample both upstream and downstream of the discharge point. NPDES facilities are required to monitor for all pollutants for which they have permit limits as well as other pollutants which may be present in their wastewater. Sampling results are submitted to DWQ each month for compliance evaluations. If limits are not being met, various legal actions may be taken against the discharger to ensure future compliance.

All domestic wastewater dischargers are required to monitor flow, dissolved oxygen, temperature, fecal coliform, BOD, ammonia, and chlorine (if they use it as a disinfectant). In addition, wastewater treatment facilities with industrial sources may have to monitor for chemical specific toxicants and/or whole effluent toxicity, and all dischargers with design flows greater than 50,000 gallons per day (GPD) monitor for total phosphorus and total nitrogen. Minimum NPDES wastewater monitoring requirements are provided in 15A NCAC 2B .0500.

Other methods of collecting point source information include effluent sampling by DWQ during inspections and special studies. The regional offices may collect data at a given facility if they believe there may be an operational problem or as a routine compliance check. DWQ may collect effluent data during intensive surveys of segments of streams. Extensive discharger data have been collected during on-site toxicity tests.

A pretreatment program is aimed at protecting municipal wastewater treatment plants and the environment from the adverse impacts that may occur when hazardous or toxic wastes are discharged into a public system. This program requires that businesses and other entities that use or produce toxic wastes pretreat their wastes prior to discharging into a public wastewater system.

5.4.2 NPDES Stormwater Discharges

As currently defined by the NPDES program, stormwater point source discharges originate from two distinct sources; municipalities and selected industrial facilities. Subject municipalities are defined as those incorporated areas that encompass a population of 100,000 or more. There are currently no municipalities in the Little Tennessee River basin that are subject to NPDES stormwater permitting.

Stormwater discharges directly related to manufacturing, processing or raw materials storage areas at industrial plants are also subject to NPDES stormwater permitting. A complete definition of "stormwater discharge associated with industrial activity" including a comprehensive listing of subject industries can be found in 40 CFR 122.26. The types of industrial activities that are subject to permitting are typically defined by Standard Industrial Classification (SIC) codes. SIC codes have been developed by the federal Office of Management and Budget to define industries in accordance with the composition and structure of the economy.

There are currently 19 general stormwater permits available for specific types of industrial activities across the state. The general stormwater permits incorporate requirements determined to be appropriate based upon an analysis of available analytical monitoring data, input from industry and associations, site visits, and review of federal and other documents providing guidance on specific types of industries, pollutants and stormwater discharges. General permits may specify monitoring and reporting requirements for both quantitative and qualitative assessment of the stormwater discharge as well as operational inspections of the entire facility, including all stormwater systems. The specific pollutant parameters for which sampling must be performed are based upon the types of materials used and produced in the manufacturing processes and the potential for contamination of the stormwater runoff at a typical facility.

All NPDES stormwater permits require the development and implementation of a Stormwater Pollution Prevention Plan (SPPP). The SPPP requires the permitted facility to develop a comprehensive stormwater management plan. This plan is the basis for evaluating the pollution potential of the site and implementing best management practices (BMPs) to reduce pollutants in runoff from the site.

All stormwater permits specify qualitative monitoring of each stormwater outfall for the purposes of evaluating the effectiveness of the Stormwater Pollution Prevention Plan and assessing new sources of stormwater pollution. Qualitative monitoring parameters include color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution.

Stormwater permits may provide for the use of cut-off concentrations in order to minimize the required analytical monitoring for facilities which are not significant contributors to stormwater pollution. These cut-off concentrations are not intended to be effluent limits (as used in wastewater permitting), but to provide guidelines for determining which facilities are major contributors to stormwater pollution and need further monitoring. The arithmetic mean of all monitoring data collected during the term of the permit must be calculated for each parameter and compared to the permitted cut-off concentration. If the mean is below the cut-off concentration, then the facility may discontinue analytical monitoring for that parameter until the final year of the permit. This approach inhibits facilities from using the cut-off concentrations as target concentrations for purposes of evaluating the effectiveness of the Stormwater Pollution Prevention Plan while ensuring that problem facilities continue to collect analytical information on their discharges.

5.5 NONPOINT SOURCE CONTROL PROGRAMS

When rainfall or snowmelt washes off an undisturbed natural area, it contains few pollutants and a significant portion of it infiltrates into the ground. This infiltration process cleanses, reduces and delays runoff. However, human disturbances of land often cause runoff of pollutants into surface waters. For instance, runoff from agricultural lands can include fertilizers, sediment and pesticides; runoff from roads and parking lots in urban areas can include petroleum products and toxic substances (these impervious surfaces also increase flow volume and velocity); construction activities can cause runoff of sediment, etc. These are examples of *nonpoint source* (NPS) pollution. Unlike effluent from a wastewater treatment plant, NPS pollution often originates from harder to identify, widely dispersed areas.

In addition to over-land runoff, some NPS pollution originates from the atmosphere, such as acid deposition. Some of the most common nonpoint sources of pollution and their causes are presented in Chapter 3.

The two approaches that are used to address nonpoint source pollution are prevention and engineered controls. Some of the methods of pollution prevention include minimizing built-upon areas, protection of sensitive areas, optimum site planning, use of natural drainage systems rather than curb and gutter, nutrient management plans, public/farmer education, storm drain stenciling, and hazardous waste collection sites. It is generally more cost-effective to prevent and minimize pollution than to build engineered controls. For example, developers who are subject to stormwater requirements often choose to build low density developments rather than bearing the expense of building engineered BMPs. Engineered BMPs also have on-going expenses associated with long-term operation and maintenance.

Engineered BMPs generally work by capturing, retaining, and treating runoff before it leaves an area. Some commonly used types of BMPs include stormwater wetlands, wet detention ponds, water control structures, bioretention areas, and infiltration basins. Often higher levels of pollutant removal can be achieved by using a combination of different control systems. The main advantage of engineered controls is that they can treat runoff from high density developments.

The current trend is toward a more comprehensive "systems approach" to managing nonpoint source pollution. This involves using an integrated system of preventive and control practices to accomplish nonpoint pollution reduction goals. This approach emphasizes site planning, protecting important natural areas such as wetlands, and finding the most cost-effective engineered controls for high density areas. Programs which are currently using the systems approach include the animal waste regulations and the regulations for coastal stormwater management and water supply watersheds. In general, the goals of the nonpoint source management program include the following:

- Continue to build and improve existing programs,
- Develop new programs to control nonpoint pollution sources that are not addressed by existing programs,
- Continue to target geographic areas and waterbodies for restoration and protection,
- Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico Estuarine Study, Clean Water Trust Fund and Wetlands Restoration Program), and
- Monitor the effectiveness of BMPs and management strategies for both surface and groundwater quality.

Table 5.1 lists a number of federal and state programs that address nonpoint source pollution. These programs are listed by category based on the type of activity. A complete program description can be found in Appendix VI for nonpoint source control programs. Refer to Table 5.2 for a brief description of each program and the contact persons within the basin for each program.

Table 5.1 List of Nonpoint Source Programs

PROGRAM	LOCAL	STATE	FEDERAL
AGRICULTURE:			
Agriculture Cost Share Program	SWCD	SWCC, DSWC	
N.C. Pesticide Law of 1971		NCDA	
Pesticide Disposal Program		NCDA	
Animal Waste Management	SWCD	DWQ,DSWC, CES	NRCS
Laboratory Testing Services		NCDA	
Watershed Protection (PL-566)			NRCS
1985 ,1990 and 1995 Farm Bills			USDA
- Conservation Reserve Program; Conservation Compliance; Sodbuster/Swampbuster; Conservation Easement; Wetland Reserve; Water Quality Incentive Program			
URBAN			
Coastal Stormwater Program		DWQ	
ORW, HQW, NSW Management Strategies		DWQ	
Water Supply Watershed Protection Program	city, county	DWQ	
Stormwater Control Program	city, county	DWQ	EPA
CONSTRUCTION			
Sedimentation and Erosion Control	ordinance	DLR, DOT	
Coastal Area Management Act	ordinance	DCM	
Coastal Stormwater Program		DWQ	
ON-SITE WASTEWATER DISPOSAL			
Sanitary Sewage Systems Program	county	DEH	
SOLID WASTE DISPOSAL			
Resource Conservation and Recovery Act			EPA
Solid Waste Management Act of 1989	city, county	DSWM	
FORESTRY			
Forest Practice Guidelines		DFR	
National Forest Management Act			NFS
Forest Management Program Services		DFR	
Forestry Best Management Practices		DFR	
Forest Stewardship Program		DFR	
MINING			
Mining Act of 1971			DLR
HYDROLOGIC MODIFICATION			
Clean Water Act (Section 404)		DCM, DWQ	COE
Rivers and Harbors Act of 1899			COE
Dam Safety Permit		DLR	
WETLANDS:			
Wetlands Restoration Program		DWQ	
Clean Water Act (Sections 401 and 404)		DWQ	COE
Wetland Reserve Program			USDA

COE: US Army Corps of Engineers
DWQ: Division of Water Quality
DFR: Division of Forest Resource
DSW: Division of Soil and Water
USDA: US Department of Agriculture
DCM: Division of Coastal Management
DLR: Division of Land Resources
DOT: Department of Transportation
DSWM: Division of Solid Waste Mgt.
NCDA: NC Department of Agriculture
NRCS: Natural Resources Conservation Service
SWCC: Soil and Water Cons. Commission
SWCD: Soil and Water Conservation District

Table 5.2 Little Tennessee River Basin Nonpoint Source Program Description and Contacts

Agriculture

USDA Natural Resources Conservation Service -- Soil & Water Conservation Districts:

Formerly the Soil Conservation Service; provides technical assistance for numerous issues, including:

- certifying waste management plans and training animal waste applicators;
- helping farmers and ranchers to develop conservation systems suited to their individual land and business;
- assisting rural/urban communities in reducing erosion, protecting water, and solving other resource problems;
- conducting site evaluations and soil surveys;
- administering the Agriculture Cost-Share Program and assisting landowners in installing BMPs; and
- administering the Wetlands Reserve Program and offering technical assistance for wetlands determination.

Graham/Macon County	Lavourn Wiggins	704-369-5347	35 Sloan Rd. Franklin, NC 28724
Jackson/Swain County	Kayla Hudson	704-586-6344	Rm. 134, 102 Scots Creek Rd. Sylva, NC 28779

NC Division of Soil and Water Conservation:

Provides administrative and technical assistance to the Soil & Water Conservation Districts in areas pertaining to soil science and engineering; distributes Wetlands Inventory maps for a small fee. Administers the Agriculture Cost Share Program (ACSP).

Central Office	Donna Moffitt (ACSP)	919-715-6108	512 N. Salisbury St. Raleigh NC 27626
Regional Office	Ralston James	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

NC Department of Agriculture (NCDA) Regional Agronomists:

Provides technical specialists for certifying waste management plans. Provides certified trainers for animal waste applicators training sessions. Tracks, monitors, and accounts for use of nutrients on agricultural lands. Identifies and evaluates the use of nutrient management plans.

Central Office	Tom Ellis	919-733-7125	Box 27647 Raleigh, NC 27611

NC Cooperative Extension Service:

Provides practical, research-based information and education programs to help individuals, families, farms, businesses and communities.

Macon County	Kenneth McCaskill	704-349-2000	County Courthouse Admin Bldg. 5 W. Main St. Franklin, NC 28734
Graham County	Doug Clement	704-479-7979	P.O. Box 486 Mains St. Robbinsville, NC 28771
Jackson/Swain County	Harvey Fouts	704-586-4009	538 Scotts Creek Rd. Sylva, NC 28779

Forestry

NC Division of Forest Resources:

Develop, protect and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.

Central Office	Mickey Henson	919-733-2162	P.O. Box 29581 Raleigh, NC 27626-0581

US Department of Agriculture - US Forest Service:

Develop, protect and manage North Carolina's federal forest lands for multiple uses including sustainable timber harvest, recreation, and motorized vehicle access.

Asheville Office	Richard Burns	704-257-4248	PO Box 2750 Asheville, NC 28802

Table 5.2 Little Tennessee River Basin Nonpoint Source Program Description and Contacts

General Water Quality

NC DWQ Water Quality Section:

Control of water pollution from point sources such as municipal and industrial wastewater discharges, and from nonpoint sources that originate from agricultural drainage, urban runoff, land clearing, construction, mining, forestry, septic tanks and land application of waste; issues permits for both discharging and on-site wastewater treatment systems, conducts compliance inspections, operates an ambient water quality monitoring program, and performs a wide variety of special studies on activities affecting water quality; administers the 319 projects statewide.

Central Office	Linda Hargrove (319 Projects)	919-733-5083	DWQ - Planning Branch, P.O. Box 29535 Raleigh, NC 27626
Asheville Region	Forrest Westall	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

NC Wildlife Resources Commission:

To manage, restore, develop, cultivate, conserve, protect, and regulate the wildlife resources of the State, and to administer the laws relating to game, game and freshwater fishes, and other wildlife resources enacted by the General Assembly to the end that there may be provided a sound, constructive, comprehensive, continuing, and economical game, game fish, and wildlife program.

Central Office	Frank McBride	919-528-9886	P.O. Box 118 Northside, NC 27564
Local Office	Mark Davis	704-452-0422	Balsam Depot, Rt. 1, Box 624 Waynesville 28786

U.S. Army Corps of Engineers:

Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 401 Water Quality certifications.

Asheville Office	David Baker	704-271-4854	151 Patton Ave., Rm. 141 Asheville, NC 28801-5006

NC DWQ Groundwater Section:

Groundwater classifications and standards, enforcement of groundwater quality protection standards and cleanup requirements, review of permits for wastes discharged to groundwater, issuance of well construction permits, underground injection control, administration of the underground storage tank (UST) program (including the UST Trust Funds), well head protection program development, and ambient groundwater monitoring.

Central Office	Carl Bailey	919-733-3221	P.O. Box 29578 Raleigh, NC 27626-0578
Asheville Region	Don Link	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

Table 5.2 Little Tennessee River Basin Nonpoint Source Program Description and Contacts

Construction/Mining

NC Division of Land Resources:

Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources. Administers the NC Sedimentation and Erosion Control Program.

Central Office	Mel Nevills	919-733-4574	512 N. Salisbury St. Raleigh NC 27626
Asheville Region	Dennis Owenby	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

Solid Waste

NC Division of Solid Waste Management:

Management of solid waste in a way that protects public health and the environment. The District includes three sections and one program -- Hazardous Waste, Solid Waste, Superfund, and the Resident Inspectors program.

Asheville Region	Jim Patterson	704-251-6208	59 Woodfin Pl. Asheville, NC 28801

On-Site Wastewater Treatment

NC Division of Environmental Health:

Safeguards life, promotes human health, and protects the environment through the practice of modern environmental health science, the use of technology, rules, public education, and above all, dedication to the public trust.
Services include:

- Training of and delegation of authority to local environmental health specialists concerning on-site wastewater
- Engineering review of plans and specifications for wastewater systems 3,000 gallons or larger and industrial process wastewater systems designed to discharge below the ground surface
- Technical assistance to local health departments, other state agencies, and industry on soil suitability and other site considerations for on-site wastewater systems.

Central Office - DEH	Steve Steinbeck	919-715-3273	2728 Capital Blvd. Raleigh, NC 27604
Swain County	Linda White	704-488-3198	P.O. Box 546 Bryson City, NC 28713
Graham County	Alicia Brown	704-479-2110	P.O. Box 546 Main St. Robbinsville, NC 28771
Macon County	Dave Simpson	704-349-2081	5 W Main St. Franklin, NC 28734
Jackson County	Randall Turpin	704-586-8994	102 Scots Creek Rd. Sylva, NC 28779

5.6 PROGRAM INITIATIVES IN THE LITTLE TENNESSEE RIVER BASIN

Through the development of this plan, efforts were made to identify initiatives undertaken within the basin to protect water quality. The following discussion focuses on program initiatives that have been implemented or are underway within the Little Tennessee River basin. These initiatives demonstrate a tremendous effort to protect surface waters in the basin. There may be other initiatives underway in the basin which we are not yet aware of. Table 5.3 presents a summary of the agency or organizations that have program initiatives in the basin.

Table 5.3 Program Initiatives in the Little Tennessee River Basin

Level of Agency	Name of Agency	Type of Initiative
Federal	Southern Appalachian Man and Biosphere	Assessment of Ecosystem, Social/Cultural/Economic and Atmospheric Conditions
	National Park Service - Great Smoky Mountains National Park	Long Term Ecosystem Monitoring
	US Department of Agriculture - National Resource Conservation Service	Various Projects
	US Forest Service	Land and Resource Management Plan for the Nantahala National Forest
	US Forest Service - Coweeta Hydrologic Laboratory	Hydrologic Studies
State	NC Division of Soil and Water Conservation	Various Projects
	NC Division of Forest Resources	Forest Practice Guidelines Best Management Practices Forest Management Program Services
	NC Department of Transportation	Road Construction Erosion Control
	NC Cooperative Extension Service	Various Projects
	NC Division of Land Resources	Sedimentation Pollution Control Act
	Southern Appalachian Mountains Initiative	Regional Partnership on Air Quality Issues
	NC Division of Water Resources	Stream Restoration
Local Govt. and Citizen Groups	Town of Highlands	Water, Sewer and Land Use Planning
	Town of Franklin	Wastewater Treatment Plant Upgrade
	Jackson County	Planning and Land Use Ordinances
	Swain County	Land Use Ordinance
	Macon County	Clean Water Management Trust Fund Grant
	Little Tennessee Watershed Association	Various Projects
	Save Our Rivers, Inc.	Various Projects
Corporate	Tennessee Valley Authority	Clean Water Initiative
	Duke Power	Total Suspended Solids and Total Phosphorous Studies
Academic	Western Carolina University	Sedimentation Impacts on Trout Waters
Regional Organizations and Commissions	Year of the Mountains Commission	Recommendations to Governor Relating to Natural Resource Protection

5.6.1 Federal Initiatives

The Southern Appalachian Assessment

The Southern Appalachian Assessment (SAA) is a cooperative effort among many federal and state agencies and was conducted through the coordination of the Southern Appalachian Man and Biosphere program. The SAA began in the summer of 1994 and was completed in May 1996. Public meetings were conducted in the SAA study area (Figure 5.1) to get input from the public on specific issues. Several teams of professionals were formed to gather and interpret information about terrestrial and aquatic ecosystems, social/cultural/economic status, and atmospheric conditions for the SAA area. Full reports have been published on each of these categories (The SAA Summary Report 1996).

While the findings of the SAA are based on information to be used at a larger scale than a single river basin, some of the key findings of the SAA pertaining to water quality are notable here. Of particular interest to the Little Tennessee River basin are the findings related to acid deposition and its effects on the aquatic ecosystem. While overall atmospheric sulfate concentrations seem to be decreasing, so too is the ability of the aquatic systems to buffer the incoming acidity (The SAA Summary Report 1996). This issue is discussed further in Chapter 4.

National Park Service - Great Smoky Mountains National Park Long-Term Monitoring Plan

The National Park Service has long recognized the unique ecosystems and vast diversity within the Great Smoky Mountains National Park (GRSM). It is these characteristics, combined with the knowledge of potential impacts of air pollution and acidic deposition to the GRSM, that have inspired Park officials to establish a long-term ecological monitoring program. The objective of the monitoring program are:

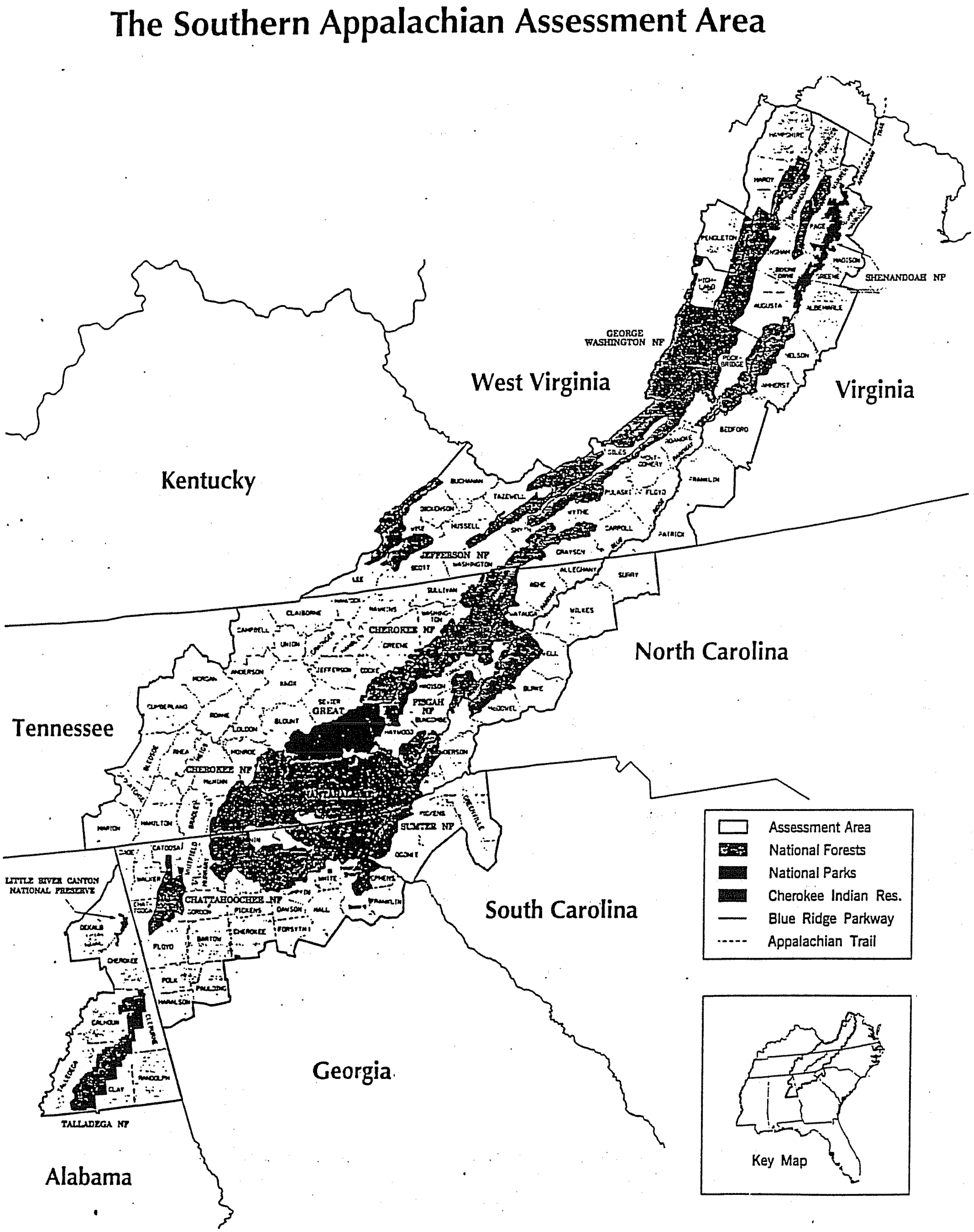
- Establish and implement a monitoring program to measure change over time in the biotic conditions of selected key populations, communities, and systems.
- Analyze and present data to provide managers with practical information to help them preserve the park resources.
- Establish a data management system to encourage further scientific investigation in the park.
- Establish and implement a prototype monitoring program to help establish other monitoring programs in National Park Service managed area.

Watershed related efforts of the Long-Term Monitoring Plan include extensive macroinvertebrate surveys, watershed hydrology and nutrient cycling, fishery studies and water quality monitoring studies. Park management is attempting to find answers to such questions as: Are macroinvertebrate populations in the GRSM adversely affected by acidic deposition? What are the trends in precipitation chemistry and how is this affecting stream chemistry? How is the forest ecosystem being affected by changes in nutrient export? What is the extent in variations of physical, chemical and biotic parameters that affect fisheries in the park?

U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS)

- NRCS has developed several prototypes of trout waste management systems using Agriculture Cost Share Funds. One of these projects is the first trout waste spray irrigation system in the state. Another farm, located in the Savannah basin on Thompson River, has retrofit its existing trout raceways with baffles and computer actuated valves to collect waste and uneaten food. These trout waste management facilities exceed the requirements of the law; however, managing this type of waste is important to protecting water quality in this part of the state.
- NRCS is initiating "critical area treatment", the control of sediment by vegetating areas that show serious erosion problems. Many of their critical areas include highway corridors.

Figure 5.1 Southern Appalachian Assessment Study Area (Source: SAMAB 1996)



- In 1995, the NRCS completed streambank stabilization projects on four farms in the Little Tennessee basin through a $15,000 grant from the Partners in Wildlife Program, U.S. Fish and Wildlife Service.
- The NRCS has been approved for a grant of $14,000 to conduct additional streambank stabilization projects.
- The NRCS has been approved for a $100,000 grant through the U.S. Environmental Protection Agency Section 319(h) program to conduct a riparian area and streambank restoration project on the upper Tennessee River, lower Cullasaja River, and the lower Cartoogechaye Creek. Some of the methods that will be used include bank stabilization using willows or other fast-growing plants, bank and buffer zone revegetation, low-intensity structural methods (e.g., revetments), and fencing to exclude livestock.
- The NRCS is conducting a streambank stabilization project along Cartoogechaye Creek with a $25,000 grant from the NC Wildlife Resources Commission.

US Forest Service - Land and Resource Management Plan (Amendment 5) for Nantahala-Pisgah National Forests

The US Forest Service released the Land and Resource Management Plan Amendment 5 in April 1994. Amendment 5 is a major revision to the 10 year 1987 forest plan established to manage the 1.2 million acres of Nantahala-Pisgah National Forests in North Carolina. The revised plan was in response to public concerns over past forest management practices. The new forest service approach applies the principles of ecosystem management; fostering old growth forests, neo-tropical bird habitat, and biodiversity; reducing clearcutting activities by providing a wood product supply that is sustainable and cost-effective; and maintaining forest aesthetics.

The 1994 amendment reduces the clearcutting rate from 1,500 acres per year to 240 acres per year. Under the new plan, total timber harvested will be reduced by 50% with a reduction from 72 million board feet annually to 34 million board feet. In addition, the primary method of harvesting trees shifted away from clearcutting to shelterwood (2-age) regeneration and selection harvesting in 1990. The two-age shelterwood harvest method allows 15 to 40 percent of the trees to grow, creating a stand with at least two ages of trees. Selective harvesting allows for groups of trees averaging one acre in size or less to be removed. Harvested acres and percent of total acreage per county in the basin can be found in Chapter 2 of this plan. Total harvest activities on the Nantahala and Pisgah National Forests as an annual percentage of total National Forest acres has gradually declined from 44% in 1990 to 26% in 1995.

There are many miles of gravel roads throughout the National Forest lands. Many of these roads follow streams and have the potential to cause severe sedimentation to surface waters in the Forests. Under the guidelines of the new Management Plan, the US Forest Service has identified transportation system management standards (Appendix VII) in an effort to reduce water quality problems due to roads. Implementation of these standards in all National Forests should help reduce sedimentation due to roads. The US Forest Service is also testing the effectiveness of BMP's to reduce sedimentation from roads (Burns, 1994). A pamphlet entitled "Road Runoff Control" describing simple measures to control runoff from graveled mountain road is available from the Forest Service.

US Forest Service Coweeta Hydrologic Laboratory

Coweeta Hydrologic Laboratory is a 5,400 acre site that serves as a living hydrologic laboratory. Forest hydrologists at Coweeta have been conducting on-site research for over 60 years. This extensive research has resulted in numerous thesis papers, doctorates and professional publications on subjects such as the effects of grazing and logging on water flow and quality, proper road construction practices to reduce impacts to water quality, water yield studies, multiple use land management techniques, ecosystem chemistry studies that determine the effects of acid deposition and ozone on the forest ecosystem and water quality, and studies on insect populations and nutrient budgets. Researchers at Coweeta are coordinating to conduct studies throughout the Little Tennessee River basin. The knowledge obtained form these studies will help determine the best management practices for protecting water quality from manmade disturbances on the land.

5.6.2 State Agency Initiatives

<u>NC Division of Soil and Water Conservation (SWCD)</u>

- The NC Division of Soil and Water Conservation administers the *NC Agriculture Cost Share Program for Nonpoint Source Pollution Control (NCACSP)*. This program provides incentives to farmers to install best management practices (BMPs) by offering to pay up to 75% of the average cost of approved BMPs. The NC Agriculture Cost Share Program funding totals for the Little Tennessee River basin from 1985 through 1995 is $133,282. Farmers in the basin have spent up to $28,000 in matching funds for cost share money. The cost share figures include a wide array of BMPs including conservation tillage, sod based rotation, diversions, critical area planting, crop conversion to grass, trees, spring development, stock trails, land application of waste, livestock exclusion, waste management.
- The Macon County SWCD in cooperation with the Little Tennessee Watershed Association, held a volunteer work day on April 1, 1996. Eleven volunteers planted 2,500 trees along the Little Tennessee River.
- The Macon County SWCD and the Little Tennessee Watershed Association had a water quality display in April 1996 in the Macon County public library.
- The Jackson and Swain County Districts along with NRCS provide private landowners and users with conservation plans, sedimentation control plans and technical assistance for the installation of systems in these plans. The staff also provides assistance in the completion of Army Corps of Engineers permits as requested.
- Since 1988, the Jackson County SWCD has overseen the installation of the following: 29 tanks, 1 waste management system, 21,206 feet of fencing, 1,609 feet of stock trails, 299 acres of cropland conversion to grass/trees, 17.4 acres of critical area seeded to grass, and 9 diversions.
- The Jackson County SWCD restored 180 feet of Greens Creek.
- The Jackson County SWCD worked with the Critical Area Treatment Project on the Cherokee Indian Reservation. From 1985 to 1995, over 25 miles of access roads were stabilized. In addition, 150 acres of critical area was seeded and mulched. The District also assisted the reservation in securing funds to close their landfill and open a recycling center.
- The Jackson County SWCD is working with Fairview School personnel to establish and stabilize over 975 feet of Nature Trails adjacent to a perennial stream. The District also assisted the Jackson Parks and Recreation Department with two projects. These projects included stabilizing the streambanks along the Tuckaseigee River at East La Port Park and stabilizing the shoreline, road, and roadbank adjacent to Lake Thorpe at Andrews Park.
- The Swain County SWCD has an active hydroseeding business. From 1992 through 1996, 153 acres of non-agricultural land in both Jackson and Swain Counties have been seeded.
- Since 1988, the Swain County SWCD has overseen the installation of: 59 tanks and heavy use areas, 39 spring developments, 4 waste management systems, 18,300 feet of fencing, and 1,300 feet of stock trails.
- The Swain County SWCD assisted the county with the closure of their landfill. Over 10 acres of seeding was completed (seeding amount included in the hydroseeding total).
- Periodically, the Swain SWCD cosponsors workshops for contractors and land-use planners on proper construction and erosion control techniques.
- Each year, the Swain SWCD sponsors a "Conservation Field Day" for approximately 125 eighth-grade students. The Jackson County SWCD sponsors a field day for fifth-grade students. Both Districts sponsor a student to attend the Resource Conservation Workshop and a Poster and Essay Contest for fourth through sixth graders.

- The Swain County SWCD restored over 30,00 feet of the Ravens Fork and the Oconaluftee rivers following a major storm event in 1992.

NC Division of Forest Resources

The DFR is implementing various measures for protecting water quality statewide. These measures include the continued implementation of the Forest Practice Guidelines (FPGs) Related to Water Quality of 1976 and Best Management Practices (BMPs) of 1987. The FPGs have mandatory performance standards that must be met in order for landowners to remain exempt from all of the requirements associated with the Sedimentation Pollution Control Act enforced by the Division of Land Resources.

The FPG requirements include:
- establishment of a Streamside Management Zone,
- prohibition of debris entering streams,
- access and skid trail stream crossing protection measures,
- access road entrance restriction,
- prohibition of waste entering streams,
- waterbodies, and groundwater,
- pesticide and fertilizer application restrictions, and
- rehabilitation of project site requirements.

Refer to Appendix V, page A-V-14 for a complete list of FPG requirements.

Overall, BMP compliance in the Little Tennessee River basin is very good according to the Division of Forest Resources. Permanent logging roads in the basin avoided sensitive areas, met grade specifications, crossed streams properly and BMPs were used and prevented sediment from reaching the stream. Skid trails and temporary roads in the basin had minimized and correct stream crossings, BMPs were used and prevented sediment from reaching the stream, water bars were evident and working 50% of the time. Streamside Management Zones (SMZs) in the basin were usually free of activity, ground cover was adequate and the stream was clear of debris. SMZs in the Little Tennessee River basin met Forest Practice Guidelines (FPG) requirements 90% of the time and met BMPs (a 50-foot buffer recommendation) only 22% of the time. In the Little Tennessee River basin all landings were in good shape. Landings were free of oil and trash, were located outside of the SMZ, were on a well-drained location and were adequately stabilized.

NC Department of Transportation

- DOT uses intensive erosion controls for road construction in mountain areas. Some of the practices they use include working on only a small portion of roadway at once, seeding and mulching immediately after construction, and using straw bales in addition to the required silt fences.
- DOT's Transportation Improvement Program calls for paving all gravel roads by the year 2002. This will reduce sediment runoff from gravel roads which is one of the biggest contributors of sediment in the basin.
- Anakeesta rock formations are often found as underlying rock in the Little Tennessee River basin. As explained in Chapter 4 and 6, this type of rock formation can cause serious water quality impairment when the rock is disturbed and exposed to air and water. DOT geotechnical staff do exploratory drilling for Anakeesta early in the stages of road planning to allow time for road alignment to minimize contact with the rock. DOT implements two primary management strategies to reduce the potential for leachate from the rock surfaces from entering surface waters. These strategies include: 1) removing waste rock from the site and placing on DOT property in clay liners that are encapsulated or using as road fill materials and encapsulating with the paved surface; or 2) creating wetlands areas downstream of the site to allow wetland

plants to reduce the acidity of the water before entering a surface water. Using this method, a series of dams are built with Gabion baskets to catch overflow. The dams are filled and islands are built within the pond. Riparian vegetation is planted around the wetland.

- Where there is the potential for water quality degradation due to unavoidable disturbance with Anakeesta rocks, stream sites are monitored for water quality changes over time. Monitoring is coordinated with the US Army Corps of Engineers, the Department of Environmental Health, the US Fish and Wildlife Service and private consultants. Streams are monitored at least one year in advance of construction for baseline data. The streams are monitored throughout construction and then for one year after construction is complete.

NC Cooperative Extension Service

- The Cooperative Extension Service works with the NRCS on trout farm projects. They have an aquacultural specialized agent who helps trout farmers to address waste management problems. One of the demonstration projects is on Buffalo Creek. (Contact Skip Thompson, 704-456-3575)
- The CES has produced an educational booklet and cassette titled "Tobacco Scouting Manual" that instructs farmers about how to determine if pesticide applications are necessary. The material is easy to understand and using this program reduced pesticide use up to 40% for those who have implemented it. This program not only saves the environment, it saves money. (Contact Alan Caldwell, 704-757-1290)
- The CES has a comprehensive natural resources education program for children and adults. Some of the components of this program include Project Learning Tree, Teacher education, and field days (four each year). (Contact Craig Mauney, 704-389-6305)
- The CES also facilitates recycling and composting programs as well as Community Development Groups which clean up unattractive, bare urban areas.

NC Division of Land Resources

The NC Division of Land Resources (DLR) is responsible for administering the Sedimentation Pollution Control Act of 1973 (SPCA). Since the inception of the SPCA, the Sedimentation Control Commission has funded extensive workshops and educational programs aimed at children throughout the state. During fiscal year 1996, the DLR conducted workshops and symposiums, funded research and intern programs, reprinted manuals and developed video modules and produced newsletters on a budget of over $270,000 for the entire state. The DLR has the following materials available.

- Erosion and Sediment Control Field Manual
- Erosion and Sediment Control Practices: Video Modules
- Erosion and Sediment Control "Inspector's Guide"
- Erosion and Sediment Control Planning and Design Manual
- "Erosion Patrol" Package for Grade 3

Southern Appalachian Mountains Initiative (SAMI)

Research and monitoring in national parks and national forest wilderness areas of the Southern Appalachian Mountains have documented adverse air pollution effects on visibility, streams, soils, and vegetation. Beginning in 1990, the Federal Land Managers for Shenandoah National Park, Great Smoky Mountains National Park, and Jefferson National Forest/James River Face Wilderness Area made several adverse impact determinations in the review of proposed air permits for major new sources of air pollution. These actions led to the voluntary formation of a regional public-private partnership called the Southern Appalachian Mountains Initiative (SAMI) in 1992. Now a nonprofit organization, SAMI's goal is to provide a regional strategy for assessing and improving air quality, based on sound science and data, to protect this unique and sensitive ecosystem.

SAMI is a partnership of more than 100 agencies, including eight state environmental regulatory agencies (AL, GA, KY, NC, SC, TN, VA, and WV), several federal agencies, industries, academia, environmental organizations, and other stakeholders across the region. SAMI addresses the public, policy, and technical aspects of air quality issues through the consensus-building efforts of three main advisory committees comprised of leading scientific experts, as well as corporate, citizen and government stakeholders. SAMI gives affected states, federal agencies, regulated industry and the public an opportunity to broadly debate environmental issues and to propose reasonable solutions to identified problems, based on available science.

Since it's formation in 1992, SAMI has operated with limited funding from the EPA and state regulatory agencies and countless in-kind contributions from all participants. By pooling regional resources, SAMI has worked to identify, gather, and evaluate all existing data, models, and studies to establish a foundation of current knowledge and identify critical information gaps. SAMI is now finalizing the design for an integrated assessment framework (IAF) that will project the environmental and socioeconomic responses to changes in air emissions. This tool will be useful to decision-makers in evaluating the costs and benefits to society and the environment of the 1990 Clean Air Act Amendments (CAAA) and selected emission management options.

The IAF is divided into six linked areas of concern: (1) base year emission inventory, emissions projections and control costs, (2) atmospheric transport and air chemistry, (3) effects of acid deposition on aquatic and terrestrial resources, (4) effects of ozone deposition on terrestrial resources, (5) effects of visibility degradation, and (6) socioeconomic consequences.

The entire integrated assessment is projected to cost about $3 million overall and should be completed June 1998. SAMI peer-reviewed reports have been compiled on the following topics which describe the current state of knowledge as it pertains to air quality related values of the Southern Appalachian region: (1) emission inventories, (2) atmospheric transport and air chemistry, (3) acid deposition effects to aquatic resources, (4) acid deposition effects to terrestrial resources, (5) ozone effects to terrestrial resources, (6) visibility degradation, and (7) IAF design. During this information gathering phase, SAMI collaborated with other organizations with similar regional concerns to avoid duplication of efforts.

In order to evaluate how changes in emissions will affect natural resources, SAMI is establishing an emission-response relationship for the entire SAMI region by a series of computer model runs. By first characterizing an emission-response "surface," SAMI hopes to produce an analytical tool that can be used by decision-makers to estimate the benefits and costs of custom "what if" emission management scenarios. Currently, SAMI is attempting to determine what pollutants and magnitude of emissions reductions will be necessary to detect a change at the resource (receptor) of concern.

For instance, work in the acid deposition area is occurring in two phases. The first phase focuses on understanding how selected sensitive receptors might respond to changes in deposition levels of sulfate and nitrate using indicators, such as soil solution chemistry, stream water quality, vegetation nutrient content, or forest productivity. Of particular interest to this basinwide report, Noland Divide in Swain County, North Carolina (having tributaries to the Little Tennessee River) has been selected as one of three targeted watersheds for this scope of work. The second phase will take a more regional approach to assessing resource responses to changes in deposition and will use indicators that are more meaningful to the general public, such as acres of forests that are healthy or miles of streams that support fish. Work in the other IAF areas of concern is proceeding concurrently or in phases, as appropriate.

Upon completion of this project, SAMI will have accomplished several things: a better understanding of the current health of the ecosystem (baseline); a projection of the changes in ecosystem health due to the CAAA; an idea as to whether or not such changes are enough to protect and preserve the air quality related values of the region; an evaluation of many options for reducing emissions (appropriateness, cost effectiveness, environmental benefit, etc.); better working relations among government, industries, and public interest groups; and recommendations for managing air quality in the Southern Appalachians.

SAMI has undertaken a task of monumental proportions with enormous implications for future economic development and environmental sustainability. The most extraordinary aspect of SAMI is that it is a voluntary effort not required by federal nor state statutes. This is truly the first attempt to define an equitable and objective process for addressing complex environmental issues fraught with uncertainties. It is hoped that this process will stimulate efforts to develop cost-effective, innovative and flexible solutions to balance future economic growth with environmental protection.

The above summary was exerpted from chapter titled: "Air Quality Management: A Policy Perspective", in J. Peine et. al.., In Press.

<u>NC Division of Water Resources</u>

The Division of Water Resources is cooperating in a stream restoration project on Cartoogechaye Creek . The project is in cooperation with the land owner, Wildlife Resources Commission and the Natural Resource Conservation Service. The site is just upstream of Wayah Creek. The intent of the project is to re-establish natural stream morphology to prevent bank erosion, reduce flood peaks and improve water quality and aquatic habitat. Floodplain best management practices are also planned.

5.6.3 Local Government and Citizen Initiatives

<u>Town of Highlands</u>

The Town of Highlands has taken an active role in developing programs and ordinances to protect and improve water quality. The town has been active for a number of years in water, sewer and land use planning. The town has conducted and adopted a comprehensive Water Study, a Comprehensive Sewer Plan, a Water Supply Plan and a Land Use Plan. For twenty-five years the town has enforced a Zoning Ordinance which includes Watershed Protection requirements more stringent than those mandated by the State of North Carolina.

The town has also enforced a local Subdivision Ordinance and Soil Erosion and Sedimentation Ordinance. Town officials have recently adopted a Sewer Connection Ordinance that established connections standards, policies and priorities. A Lake Ordinance and Reservoir Recreation Plan has been adopted by the town as part of the reclassification of Lake Sequoyah as a water supply.

In January 1995, the town put a new $2.8 million state-of -the-art wastewater treatment plant on line. The plant is a Sequential Batch Reactor (SBR) facility, designed to remove point source sewer discharges from Lake Sequoyah and provide sewer service for existing residences along the shores of both Lake Sequoyah and Mirror Lake. This service extension will replace inadequate on-site subsurface wastewater treatment systems.

<u>Town of Franklin</u>

The Town of Franklin voluntarily improved the design of the wastewater treatment plant. The new design resulted in a discharge more stringent than required by the NPDES permit. Changes included longer retention time for landfill leachate, more frequent toxicity testing and backup chlorination.

Jackson County

- Has a Planning Board but no full time planner.
- Has developed and adopted several county-wide ordinances including:
  Land Use Plan (also considering developing a Land Use Guidance System for the county)
  Manufactured Home Park Ordinance
  Flood Damage Prevention Ordinance
  Watershed Protection Ordinance
  Limited Subdivision Controls

Swain County

- Has developed some ordinances for the county including:
  Land Use Plan
  Flood Damage Prevention Ordinance

Macon County

Macon County has been awarded a Clean Water Management Trust Fund grant for $3.85 million. The project is to include greenway restoration and conservation efforts in the Little Tennessee River basin. The project also includes extensive streambank stabilization, wetland restoration and acquisition and a conservation easement element.

Little Tennessee Watershed Association

An environmental group located within this subbasin deserves special recognition. The Little Tennessee Watershed Association has worked very hard to both promote responsible environmental practices and followed through with various 'pilot' programs to restore and repair numerous river banks through innovative measures. The Little Tennessee Watershed Association has influenced legislation that would both promote and enhance farmland preservation. The work of the Association is an excellent example of how local citizens can band together to enhance the environment and educate the public on the value of natural resources.

The Little Tennessee Watershed Association is dedicated to working with community groups, private and public land owners, conservation interests, and public agencies to develop and implement a strategy for the conservation and improvement of the water quality and habitat of the Little Tennessee River and its tributaries upstream of Fontana Reservoir. Some of the association's activities include:

- Collaborated with Macon Savings Bank to provide an erosion control seminar for local contractors in 1994.
- Conducts an annual clean-up of the Needmore area of the Little Tennessee where public camping is permitted by Nantahala Power & Light Company.
- Helps plan and implement streambank restoration projects on both private and public lands within the watershed. These projects include "tree revetments." Trees, such as cedar, willow, or hemlock are cut and pounded into the streambank, sometimes requiring extensive stabilization well back from the bank. These cuttings will sprout buds and grow into a canopy along the stream bank to stabilize the bank.
- Helps provide volunteers for the Western North Carolina Alliance Little Tennessee Watershed Project directed by Dr. William O. McLarney (see Chapter 4, Section 4.2.6).
- Publishes and sends out to approximately 600 readers a quarterly newsletter (financed by TVA).

- Has initiated an education brochure about the special features of the Little Tennessee River to be produced in cooperation with Nantahala Power & Light Company and the US Fish and Wildlife Service.
- Is in the process of preparing a packet of informational material about erosion and sediment control aimed at homeowners who may be considering further development of their property.
- EPA has awarded a $100,000 grant to the Association, to be coordinated with the Southwestern NC Resource Conservation and Development Council and the Macon Soil and Water Conservation District. The primary objective of the project is to target the Little Tennessee and its main tributaries for NPS pollution reduction, primarily sedimentation. Money will be made available to interested landowners on a cost share basis for protection measures as streambank stabilization, livestock exclusion, in-stream monitoring and purchase of easements.

Save Our Rivers, Inc.

Save Our Rivers, Inc. is a non-profit grassroots organization which was founded in January 1991 in response to a proposed sewage treatment plant outfall on the Cullasaja River for the town of Highlands. Since the treatment plant and outfall was built, Save Our Rivers, Inc. has actively monitored water quality below the outfall to assure the Cullasaja River is not impacted by the effluent.

Save Our River, Inc. has also worked towards the p[reservation of other rivers across the state. Some of its activities include the promotion of: the NC Rivers Assessment, the watershed concept using inclusion and partners, federal designation of Wild and Scenic for the Cullasaja River, alternative methods of sewage treatment, water conservation, soil erosion prevention and protection of wildlife. The organization works closely with agencies, churches, civic organizations, schools and participants of programs such as Outward Bound and Russian students in the EcoBridge program.

5.6.4 Corporate Initiatives

Tennessee Valley Authority Clean Water Initiative

The goal of the Tennessee Valley Authority (TVA) Clean Water Initiative is to develop a partnership approach to preventing and cleaning up pollution on the Tennessee River and its watershed. In North Carolina, the Watauga, French Broad, Little Tennessee and Hiwassee River basins make up portions of the Tennessee River basin watershed. TVA is working with other agencies to identify pollution problems and implement solutions. TVA is looking for answers to key questions such as: If the water safe for swimming? Are the fish safe to eat? What is the health of the lake? Answers to these questions have been provided to the public in the form of an annual report called, RiverPulse. The RiverPulse report has recently been replaced by a fold-out brochure. A brochure is prepared for each river basin of the Tennessee Valley.

TVA has developed a very comprehensive monitoring program that combines the professional expertise of water resource specialists with local citizens, interest groups, business and industry, and other governmental agencies. This is the baseline for the concept of River Action Teams (RAT's). Water quality data collected from key locations on lakes and streams in the Tennessee River watershed is used to draw attention to pollution problems, set cleanup goals, and measure the effectiveness of water quality improvements over time. Measurements on water quality are based on physical, chemical, and biological variables. There is no RAT for the Little Tennessee River basin, however TVA has conducted water quality monitoring on some of the streams and lakes of the Little Tennessee River basin. The results of this monitoring can be found in Chapter 4.

For more information on the TVA Clean Water Initiative contact: Wayne Poppe at (423) 632-8502 or Vicki Warren at (423) 632-3034.

Lakes in the Little Tennessee River basin are operated and managed by TVA. Lake shorelines are under severe residential development pressure. TVA has recognized the need to control the development of lake shorelines to preserve their aesthetic quality and to reduce the potential for shoreline erosion. The Shoreline Management Initiative (SMI) was launched in 1994 to establish policy to protect shoreline and aquatic resources while allowing adjacent residents reasonable access to the water. TVA requested comments during the scoping phase of the SMI from other agencies and the public. With this feedback, TVA developed a Draft Environmental Impact Statement (DEIS) to examine the issues and alternatives of the expressed viewpoints and alternatives. At the time of writing, the DEIS was out for public review and comment.

Key issues identified in the scoping process are Resource Issues (shoreline vegetation, wetlands, aquatic habitat, water quality, etc.) and Other Public Issues (education and communication, land use rights, enforcement/patrol and design standards). Six alternatives that focus on such activities as dredging and filing, soil erosion, pollution, increased human presence on shoreline areas,, and construction of buildings, piers, etc. are presented in the DEIS.

For more information on the TVA Shoreline Management Initiative contact: David Harrell at (423) 632-1636.

Duke Power

Duke Power Company is the major hydroelectric power generating industry in western North Carolina. Crescent Resources and Nantahala Power and Light are both subsidiaries of Duke Power Company. Duke Power is involved in transmission line construction activities, including clearing tower sites and upgrading access roads. After the purchase of the subsidiaries, over one hundred miles of transmission lines were constructed.

These transmission line activities can increase the potential for erosion and sedimentation which can have an impact on water quality. One of the water quality monitoring programs developed by Duke Power focuses on stormflow total suspended solids (TSS) and total phosphorous (TP). Monitoring sites have been established at over 40 sites in western North Carolina.

The goal of the Duke Power monitoring program is to assess the effects of BMP's and sediment control plans developed and implemented by Duke Power and to estimate transport to reservoirs. The program is designed to also identify the extent and source of pre-existing impacts (Braatz 1994).

Depth-integrated composite samples collect baseflow conditions and vertical series of single-stage samplers are used to collect representative samples of the rising stage of storm hydrographs. In this way, under the rising stage storm event, samples are collected that represent the worst-case sediment loads to a stream. Any impacts from Duke Power transmission line activities can be compared to control areas (upstream vs. downsteam) to paired watersheds, or by time series changes (before, during, and after site activity).

Results from sampling devices are collected on a regular basis and feedback is provided to the field crews if impacts are documented. This gives field crews quick feedback on where remediation efforts need to be implemented to correct sedimentation problems.

For more information on the Duke Power Stream Sediment Transport Program contact: Dave Braatz at 704-875-5430. For more information on the Duke Power Erosion Control Programs contact: Jim Hollifield at 704-875-5430.

5.6.5 Academic Research

Western Carolina University

Over the past 20 years there have been a number of graduate students working on fisheries projects, primarily in the Little Tennessee River basin. There are a significant number of trout waters in the Little Tennessee River basin and numerous trout farms. Sedimentation has been highlighted in this basin plan as a cause of stream impairment. Sedimentation not only alters the aesthetics of a stream, it also impacts the fishery the stream supports. Research findings from Western Carolina University have noted the potential impact of sedimentation on fisheries, in particular on the wild trout populations. This topic is also discussed in Chapter 4, Section 4.2.6 of this plan.

Other Research

The University of Georgia, Virginia Polytechnic Institute and North Carolina State University are planning and developing water quality related research projects within the Little Tennessee River basin. To date, results are not available from these research efforts.

5.6.6 Regional Organizations and Commissions

Year of the Mountains Commission

The Year of the Mountains Commission was created and organized under an Executive Order in March 1995 by Governor James B. Hunt. The work plan of the Commission was fashioned after the work of the "Year of the Coast" Commission. The objectives of the Commission were to: 1) Educate, promote and celebrate the distinctive natural and cultural heritage of the western North Carolina (WNC) communities and region; and 2) Develop and market public policy goals which can address the issues of quality growth and development, natural resource protection, and preservation of the cultural identity of the WNC mountain region. The recommendations of the Commission were presented to the Governor at the final conference of the Commission in June 1996. The Commission was dissolved as of June 30, 1996.

The recommendations of the Commission are presented in Chapter 6, Section 6.2.

5.7 Integrating Point And Nonpoint Source Pollution Control Strategies

Integrating point and nonpoint source pollution controls and determining the amount and location of the remaining assimilative capacity in a basin are key long-term objectives of basinwide management. The information is used for a number of purposes including: determining if and where new or expanded municipal or industrial wastewater treatment facilities can be allowed; setting the recommended treatment level at these facilities; and identifying where point and nonpoint source pollution controls must be implemented to restore capacity and maintain water quality standards.

Total Maximum Daily Loads

The U.S. Environmental Protection Agency (USEPA) has developed the means to help accomplish these objectives. The approach, called *total maximum daily loads (TMDL)*, uses the concept of determining the total waste (pollutant) loading from point and nonpoint sources that a waterbody (such as a stream, lake or estuary) can assimilate while still maintaining its designated uses. USEPA requires the TMDL approach pursuant to Section 303(d) of the Clean Water Act.

Under the TMDL approach, waterbodies that do not meet water quality standards are identified. States establish priorities for action, and then determine reductions in pollutant loads or other actions needed to meet water quality goals. The approach is flexible and promotes a watershed approach driven by local needs and States' priorities. The overall goal in establishing the TMDL is to establish the management actions on point and nonpoint sources of pollution necessary for a waterbody to meet water quality standards.

As DWQ improves its abilities to quantify and predict the impacts of point and nonpoint source pollution, the basinwide approach will make more innovative management strategies possible.

Other Possible Strategies

- *Agency banking* refers to the concept of holding assimilative capacity in reserve by DWQ for future growth and development in the basin.
- *Pollution trading* involves trading of waste loading and stream assimilative capacity among permitted dischargers, or between point and nonpoint sources, adding flexibility to the permitting system and using the free market system as an aid to identifying the most cost effective solution to water quality protection.
- *Industrial recruitment mapping* involves providing specific recommendations on the types of industry and land development best suited to the basin's long-term water quality goals and an individual basin's ability to assimilate a particular type or quantity of discharge or nonpoint source pollutants.
- *Consolidation of wastewater discharges*, also referred to as regionalization, entails combining several dischargers into one facility. Local authorities, regulated industries, landowners, and other interested parties are encouraged to provide ideas to develop these strategies. By accommodating, to the degree possible, local needs and preferences, the probability of the plan's long-term success will be increased.

5.8 POTENTIAL SOURCES OF FUNDING FOR WATER QUALITY PROJECTS

Section 319(h) Grants:

Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer establishment, and others. DWQ established a Workgroup process in 1995 for prioritizing and selecting projects from the pool of cost-share proposals and includes this list in its annual application to EPA. The Workgroup consists of representatives from the state and federal agencies that deal with NPS issues, including agricultural, silvicultural, on-site wastewater, mining, solid waste and resource protection.

DWQ staff first reviews proposals for minimum 319 eligibility criteria such as:

- Does it support the state NPS Management Program milestones?
- Does the project address targeted, high priority watersheds (See Table 5.4)?
- Is there sufficient nonfederal cost-share match available (40% of project costs)?
- Is the project period adequate?
- Are measurable outputs identified?
- Is monitoring required? Is there a QA/QC plan for monitoring?
- If GIS is used, is it compatible with those of the state?
- Is there a commitment for educational activities and a final report?

Workgroup members separately review and rank each proposal which meets the minimum Section 319 eligibility criteria. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; degree of balance lent to the statewide NPS Program in terms of project type; and competence/reliability of contracting agency. They then convene to discuss individual projects' merits, to pool all rankings and to arrive at final rankings for the projects. The Workgroup seeks a balance between geographic regions of the state and types of projects. All proposals that rank above the funding target are included in the annual grant application to EPA, with DWQ reserving the right to make final changes to the list. Actual funding depends on approval from EPA and yearly Congressional appropriations.

While it is preferable that 319(h) proposals address high or medium priority watersheds, it is not a requirement.

Table 5.4 Nonpoint Source (NPS) 319 Priority Ratings for Non-Coastal Waters

High priority waters
- monitored waters that have an overall use support rating of non-supporting,
- monitored waters that have a use support rating of partially supporting but have a high predicted loading for one or more pollutants,
- highly valued resource waters as documented by special studies
  - High Quality Waters
  - Outstanding Resource Waters
  - Water Supply I, Water Supply II, Critical areas of WS-II, WS-III or WS-IV

Medium priority waters
- monitored waters that have an overall use support rating of partially supporting,

Low priority waters:
- All other waters not considered high or medium priority

All proposals that rank above the annual funding target are included in the grant application to EPA, with DWQ reserving the right to make final changes to the list. Obtaining the funding

depends on approval from EPA and yearly Congressional appropriations. To obtain more information about applying for section 319(h) grants, contact:

Linda Hargrove, DWQ - Planning Branch
P.O. Box 29535, Raleigh, NC 27626-0535
(919) 733-5083 ext. 352

Other Sources of Funding

Besides Section 319(h) funding, there are numerous sources of funding for all types of water quality projects. The sources of funding include federal and state agencies, nonprofits, and private funding. Funds may be loans, cost-shares, or grants.

If a local government, environmental group, university researcher, or other individual or agency wants to find funding to address a local water quality problem, it is well worth the time to prepare a thorough but concise proposal and submit it to applicable funding agencies. The list of goals for Section 319(h) proposals can be used as a guideline for other funding agencies. Even if a project is not funded, persistence may be beneficial when funding agencies observe several consecutive proposals from the same group.

Tables 5.5 and Appendix VIII provide summaries of the agencies that are potential sources of funds for point sources of pollution. Table 5.6 and Appendix IX provide summaries of the agencies that are potential funding sources for nonpoint sources of pollution.

In addition to these sources, the Clean Water Management Trust Fund will be another source of funding for both point and nonpoint sources of pollution. The 1996 General Assembly earmarked 6.5% annually of the year end General Fund credit balance to help finance projects that address water pollution problems and focus on upgrading surface waters, eliminating pollution and protecting and preserving unpolluted surface waters. Contact the Executive Director, Dave McNaught at (919) 974-5497 and refer to Appendix VI for more details on this program.

Table 5.5 Funding Agencies for Assistance With Point Sources

Source	**Agency and Name of Funding Source**
Federal	U.S. Rural Utilities Service: Water and Wastewater Loan and Grant Program Rural Business and Cooperative Service: Rural Business Enterprise Grants Appalachian Regional Commission: Supplements to Other Federal Grants in Aid U.S. Economic Development Administration: Public Works and Development Facilities Grant Program
State	NC Division of Water Quality: Construction Grants and Loans Program NC Division of Community Assistance: Small Cities Community Development Block Grant NC Commerce Finance Center: Industrial Development Fund
Private	Rural Economic Development Center, Inc.: Supplemental and Capacity Grants Program

Table 5.6 Funding Agencies for Assistance with Nonpoint Sources

NPS Assistance Needed	Name of Funding Source
Agriculture	NC Agriculture Cost Share Program for NPS Pollution Control (NCACSP) Environmental Quality Incentives Program (EQIP) Conservation Reserve Program (CRP) Wetland Reserve Program (WRP) Small Watershed Program, PL-566 Conservation Easement Soil and Water Conservation Loan Program
Education	GTE Foundation Toyota TAPESTRY Grants National Environmental Education and Training Foundation (NEETF)
Water Quality Planning	Section 205(j) Water Quality Planning Grants
Stream Restoration	NC Division of Water Resources Stream Repair Funding
Forestry	Forestry Stewardship Incentive Program Forestry Incentives Program
Land Conservation	National Wetland Priority Conservation Plan NC Conservation Tax Credit Program Federal Wild and Scenic Rivers Program Emergency Wetlands Resources Act of 1986

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CHAPTER 6

MAJOR BASINWIDE WATER QUALITY CONCERNS AND RECOMMENDED MANAGEMENT STRATEGIES

6.1 INTRODUCTION

Clean water is critical to the health, economic and ecologic well-being of this region of the state. Tourism, water supplies and a high quality of life for local residents are dependent on the water resources of this basin. Fortunately, many of the waters within the basin are still of high quality. However, there are reasons to be concerned about the quality of specific waters in the basin such as the upper Cullasaja, Mill Creek and White Oak Creek. These waters are considered to be impaired waters. There are several other waters in the basin that are classified as Support Threatened waters including the upper Little Tennessee River.

Sedimentation from construction, agriculture and logging is the major water quality problem identified in the basin. Looking to the future, major concerns for water quality in this basin include growth and development, tourism, acid deposition, the Cherokee Indian Reservation gambling casino and planned multi-lane highways. Other concerns include nutrients, urban and industrial stormwater, fecal coliform bacteria and toxic substances. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge.

The long range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the Little Tennessee River basin's surface waters. Growth and other priority issues are discussed in Section 6.2, below. In striving towards its mission, DWQ's highest priority near-term goals are as follows:

- **To identify and restore impaired waters in the basin**. Section 6.3 discusses impaired and threatened waters and how these waters are prioritized for restoration and protection. Priority Issues and Recommended Management Strategies are presented for each subbasin in Section 6.4.

- **To identify and protect high value resource waters and biological communities of special importance**. Section 6.5 discusses management strategies for protecting the HQW/ORW's in the basin.

- **To manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.** Major water quality issues addressed under this topic in Section 6.6 include sedimentation, nutrients, urban stormwater runoff, fecal coliform bacteria, toxic substances and oxygen-consuming wastes.

6.2 MAJOR WATER QUALITY CONCERNS AND PRIORITY ISSUES

6.2.1 Growth and Development

Growth Trends and Water Quality

There have been significant growth trends in the Little Tennessee River basin and these trends are expected to continue. The majority of growth has occurred in the upper and lower Little Tennessee River subbasins. Impacts to water quality from growth and development can include sedimentation, streambank erosion and degradation from a variety of fertilizers, chemicals, and road salts.

Traditionally, growth and development within the basin have occurred mostly along streams and rivers where lands are less steep. Growth along waterways can have a significant negative impact on water quality if construction activities are not undertaken with proper care. Recently, construction activities have also occurred on mountain ridges and slopes to obtain views of valleys and ridges. Building on slopes can be particularly harmful to water quality if appropriate erosion and sedimentation control measures are not used. Slopes tend to have soil types that are more shallow and unstable than those in valleys. Often, driveways to home sites on slopes are greater than 12%, the recommended slope for reducing erosion potential (Willett, pers. comm.).

In recent years, there has been a wave of development from Atlanta, Georgia to the North Carolina state line. Parcels of property have sold rapidly throughout many areas of the Little Tennessee River basin. To date, most of these parcels have not been built upon because they are held by out-of-state developers that intend to subdivide these large parcels when the market is most receptive. When these developers perceive that the timing is right for building out these parcels, the rate of growth within this basin will accelerate quickly and may be too fast for local governments to keep pace (Willett, pers. comm). The basin also receives a tremendous seasonal population fluctuation.

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains the high water quality that is presently attracting people to the area. These planning efforts will need to find a balance between water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases as well as maintaining a strong tourism base. These actions are critical to water quality management and the quality of life for the residents of the basin. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Influence of the Cherokee Reservation Gambling Casino on Growth and Water Quality

The Cherokee Reservation gambling casino, the only legalized gambling casino in the Southeast, is geographically situated to become "...one of the primary gambling centers east of the Mississippi. It will be centrally located to many eastern cities and is within 500 miles of over half the U.S. population " (Willett and Eller 1995). The development of the gambling casino on the Cherokee Indian Reservation is estimated to attract an additional 2 million visitors per year to the Reservation (Willett and Eller 1995). It is expected that these visitors will tour surrounding areas in the basin such as the Great Smoky Mountains National Park, Bryson City and other urban areas.

A recent NC Division of Community Assistance study (Willett and Eller 1995) suggests that western North Carolina will be permanently impacted by the development of the Cherokee Indian Reservation gambling casino. In addition to other effects not related to water quality, the region is likely to experience:

1) The need for additional state support for road improvements. Road improvements will entail construction and the potential for increased erosion and sedimentation, as well as the potential for increased effects of acid runoff to streams if Anakeesta rock formations are exposed (See Multi-Lane Highways discussion below);

2) Increased traffic which may result in increased water quality impacts through stormwater runoff and exhaust emissions that contribute to acid rain (See discussion on acid deposition below);

3) The need for higher taxes to pay for increased local government services (water and sewer improvements alone are estimated at $5.6 million); and

4) The diversion of dollars from existing businesses to gambling enterprises (termed "economic cannibalism", Goodman 1994) and displacement (occurs when non-gambling tourists travel to other areas to avoid increased traffic, lack of hotel accommodations, and avoidance of the gambling atmosphere (Willett and Eller 1995)) in relation to the tourism industry.

The gambling casino may have effects on water quality as the outlying areas experience accelerated commercial activity due to displacement and spill-over. Commercial activity in these outlying areas will increase the demand for roads and services. In addition, strong economic activity may be viewed as an additional reason to build second homes or establish a new business by an outside entrepreneur. Construction of homes, commercial areas and roads increase stormwater runoff and sedimentation problems. This demand for goods, services and homes will need to be planned for and managed in order to reduce the potential for degradation of water resources.

Multi-Lane Highways

The NC Division of Community Assistance report estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout western North Carolina. At present, there are six major corridors (See Chapter 2) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation and provide opportunities for easy access to rather remote areas of the state.

However, during road construction there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are frequently found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff.

Acid Rain/Deposition

The developments of thoroughfares will make it easier for tourists and developers to access and use the area. As traffic flow increases, the emission of nitrous oxides from vehicles to the atmosphere will increase. Nitrous oxides react with volatile organic compounds to create ozone. At times, ozone levels in the Great Smoky Mountains National Park can reach levels nearly double the average ozone level in Raleigh (News and Observer, Sept. 1, 1996). The man-made pollutants that trouble the peaks of the Smoky Mountains is creating more widespread problems throughout the Southern Appalachians, as noted by the Southern Appalachian Man and the Biosphere (SAMAB). The region of the GSMNP presently receives some of the most acidic deposition in the country. This high amount of deposition combined with the low stream buffering capacity and the fact that the capacity of the soils to absorb excess nutrients has been reached in many areas, has produced many low pH streams at higher elevations and higher stream nitrogen levels than in any other national park (News and Observer, Sept. 1, 1996). Refer to Chapter 4 for a more thorough discussion of the effects of acid deposition of high elevation streams in western North Carolina.

6.2.2 Priority Issues and Recommended Actions Identified by Workshop Participants

Three public workshops were conducted in the Little Tennessee River basin on July 25, 1995 (Franklin) and April 9, 1996 (Cherokee and Bryson City). Participants were asked to identify what they saw as the priority issues for the Little Tennessee River basin. After issues were identified, participants were asked to recommend management actions to address the priority issues. Issues and actions were grouped into major categories by DWQ. A complete listing of workshop responses is presented in Appendix XII.

Table 6.1 provides the priority issues as identified by workshop participants. Issues are identified by category with a summary of the comments for each category. While each identified issue may not be directly responded to in the plan, an effort has been made to consider these issues within the framework of the basinwide approach. Where there has been some discussion about the category or specific comments within the plan, the table provides this reference.

Some suggested solutions to the identified priority issues were also presented by workshop participants and they have been incorporated into the summaries. Many of these solutions have likewise been recommended within this plan. Other recommendations by workshop participants will require further discussion with other agencies over the five year planning cycle of the Little Tennessee River basin. These recommendations should also be considered by local governments where applicable.

6.2.3 Priority Issues and Recommended Actions Identified by the Nonpoint Source (NPS) Team Members

DWQ has begun setting up nonpoint source teams in each of the state's 17 major river basins. These teams will have representatives from agriculture, urban stormwater, construction, mining, on-site wastewater disposal, forestry, solid waste, wetlands, groundwater, natural resource agencies, local governments, special interest groups and citizens. These teams will provide descriptions of current NPS management activities within a basin, conduct assessments of NPS controls in targeted watersheds, prioritize impaired waters for development and implementation ~~(including funding) of restoration strategies and NPS issues for remedial action. The team will~~ develop five year action plans to reflect these priorities.

At their first meeting in 1996, the Little Tennessee River basin NPS Team members described their vision of priority issues and recommended actions for water quality problems in the basin. A summary of these issues and recommendations are presented in Table 6.2. Issues and recommendations presented by the NPS team members will be incorporated into the five-year action plan being developed by the team. DWQ will continue to work with the NPS team to clarify the water quality issues of the Little Tennessee River basin and formulate implementable strategies to deal with these issues.

Table 6.1 Priority Issues Identified by Workshop Participants and Reference Sections in the Little Tennessee River Basinwide Water Quality Management Plan

F	C	B	Comment Summary	DWQ Comments	Reference
•	•	•	LOCAL INVOLVEMENT AND LEADERSHIP		
			Local leadership and responsibility is essential for protecting water quality. This includes involvement of local governments (more stringent development controls), property owners, farmers, developers, civic organizations, businesses and others. Local efforts can be enhanced through citizen education programs (e.g., high schools, 4H, contractor and farmer organizations). User fees (from rafting?) may be generated for salaries of local government inspectors/administrators.	DWQ recognizes and strongly supports local efforts to protect water quality. This is one of the reasons the Division has begun establishing nonpoint source teams in each basin. This is a way of encouraging and involving governments, ag community reps and others in water quality management activities. NPS teams may play a growing role in targeting expenditure of state & federal funds for WQ protection.	Sections 5.6.3 and 7.2.2
•	•	•	SEDIMENTATION AND EROSION CONTROL		
			Sedimentation and erosion control for all sources including highways and forest timbering is needed. The Governor's Year of the Mountain Program recognizes the seriousness of sedimentation control and includes recommendations for addressing the problem.	This basinwide plan identifies sedimentation and erosion (S&E) control as the major cause of pollution in the basin. The recommendations section for S&E in Chapter 6 has been expanded to address the issue.	Sections 3.2.1 and 6.6.2
•	•	•	AGRICULTURE AND WATER QUALITY REGULATIONS		
			Farmers can and are willing to do the right thing in protecting water quality, but education on pollution and cost-effective control measures are needed. Also, the pollution contributions from agriculture and the financial impacts of regulatory programs (0.200 rules) need to be addressed. For example, it needs to be recognized that there are many sources of sedimentation in addition to agriculture. Use support data presented by the DWQ at the public workshops showed agriculture as the leading cause of sedimentation even though ag lands are only 5% of the basin's land cover. This needs to be reexamined as the basinwide plan is produced. Also need to ensure policies that sustain family farms and keep dairy farms from going out of business. Cost share incentives for buffers and restricting cattle access to streams is very necessary.	Use support data in the basin plan have been revised and an effort has been made to more accurately describe the sources of sedimentation. On education, closely with the Cooperative Ext. Serv., Div. of Soil and Water and NRCS to provide WQ and BMP information to farmers.	
•		•	GROWTH AND DEVELOPMENT/URBAN RUNOFF		
			The impacts of increased population growth and development need to be addressed if water quality is to be protected for the future. Impacts could include increased traffic; sedimentation from residential developments, roads and shopping centers; pollution runoff from roads, parking lots and lawns; increased flooding from forest clearing and more impervious surfaces. Local planning and control measures are needed.	A section on growth and development has been added to chapter 6 making specific note of growth that may be induced by the Cherokee Reservation gambling casino. A section on urban runoff has also been expanded in Chapter 6 to include more recommendations for addressing this issue.	Sections 6.2, 6.6.1 and 6.6.3

Table 6.1 Priority Issues Identified by Workshop Participants (Sheet 2 of 3)

F	C	B	Comment Summary	DWQ Comments	Reference
•		•	COOPERATION, COMMUNICATION AND EDUCATION		
			Cooperation (including data information sharing) between states (Georgia and NC) as well as between various local groups will be needed to accomplish water quality goals. Cooperation can be enhanced through improved communication between groups as well as through educational efforts to enhance public awareness of these issues. Cooperation can also be enhanced by publicizing the good work of farmers, towns, developers, citizens and others in protecting water quality. Giving out environmental stewardship awards would be ones means to accomplish this. In any event, local involvement and leadership is needed.	DWQ has been in contact with Georgia state officials and other agencies and organizations with interest in this basin. A major effort has been made in preparing plan to include the work of state, federal and local agencies, citizen group, business interests, and others in protecting water quality in this basin for the purposes of enhancing communication and cooperation (see chapter 5). DWQ is also working to improve cooperation through the NPS team concept mentioned under local involvement, above, discussed in Chapter 7 of the plan.	Sections 5.6 and 7.2
	•	•	MONITORING AND SCIENTIFIC-BASED POLLUTION IDENTIFICATION AND PROBLEM SOLVING		
			More complete water quality monitoring is needed to better understand sources of pollutants. A recommendation was made to establish a cost-efficient and extensive monitoring system to prevent expensive remediation of problems in the future, to monitor acid rain effects, and to help distinguish between natural and manmade problems	DWQ agrees with the need for accurate and comprehensive monitoring data for both assessing water quality and identifying pollution sources. Resources are limited and so efforts are underway to explore data sharing with others such as TVA.	Chapter 4 and Section 7.3
•		•	PROTECTING EXISTING USES		
			Need to recognize and accommodate a wide range of stream uses. This can range from protecting critical habitats for aquatic life, swimming, fishing, recreation, aesthetics, and waters supplies to accommodating industry water use, sand dredging and discharge of effluent from wastewater treatment plants. Sharing limited resources is a must, and user fees may be a means of generating revenue for local land use planning.	Protecting water uses is a basic premise of the federal Clean Water Act and the state's Water Quality Program. Finding ways of protecting competing uses is a major challenge and is one of the reasons for establishing the basinwide approach. Protecting uses is assessed through use-support ratings.	Sections 4.4, 4.5 and Appendix I
•	•		IMPACTS OF ABANDONED CARS FOR RIVER BANK STABILIZATION		
			Old cars, appliances and construction debris had been used in the past as an inexpensive ways of stabilizing eroding river banks. While aesthetically undesirable, it was cost-effective. However, some citizens are concerned about possible water quality impacts and whether anything can be done now to correct the problem in a more aesthetically desirable manner.	No studies have been conducted by DWQ to assess water quality impacts of these makeshift bank stabilization projects. It is doubtful that they would be significant impacts. Bioengineering might one day offer of hope of providing a cost-effective and more environmentally sound alternative. The Little Tenn. Watershed Assoc. is trying this technique on the upper L. Tenn. above Franklin.	Section 5.6.3

Table 6.1 Priority Issues Identified by Workshop Participants (Sheet 3 of 3)

F	C	B	Comment Summary	DWQ Comments	Reference
	•	•	PRIVATE PROPERTY RIGHTS		
			Private property owner rights (the "takings" issue) needs to be addressed, particularly as it relates to wetlands regulation. If lands or land uses are to be restricted or taken away, then compensation should be provided. Development of a local conservation trust that could help property owners gain tax relief for setting aside buffers or other lands is a possibility.	DWQ has recently adopted new wetlands rules that help address this issue through providing more flexibility to property owners in the form of mitigation. In addition, The General Assembly passed a Wetlands Restoration Bill (HB 53) that is intended, in part, to simplify mitigation and streamline permit processing for permit applicants.	
•			WASTEWATER TREATMENT PLANT DISCHARGES		
			Stringent NPDES permits and enforcement are needed in order to protect water quality, however, these permits, issued by the state, need to take into account the financial ability of municipalities to operate the plants at the permitted limits.	NPDES permit limits are set to protect stream uses. Permit limits are established for each individual discharger, and issues of cost and operation are addressed for each facility.	See Sections 3.3, 5.4, 6.5.2 and 7.3

Notes:	1	F = Franklin, C = Cherokee, B = Bryson City. Dots in a column indicate which workshops this topic was discussed.
	2	Comment Summary is a summary of workshop comments summarized by DWQ. Complete comments are presented in the Appendix.
	3	DWQ Comments are comments/responses from the Division of Water Quality.
	4	Reference means the section of the basinwide plan where additional information may be found. The first number of each section refers to the chapter.

Table 6.2 NPS Team Member Priority Issues and Recommended Actions

Category	Comments
Sediment	Many of the streams and rivers in the basin are polluted with sediment from various sources, including roads, development, agriculture, and silviculture. Buffer zones would be helpful in controlling sediment problems. We need some good standards for secondary roads. Streambank erosion is a big problem throughout the basin. We also need to study how impervious surfaces in the basin contribute to sediment pollution and flooding.
Trout Farming	Trout farms need to adopt a waste management system. This system should include a long-run system to remove solids including a settling basin.
General Approach	We need to target our resources to the areas we identify as the largest priority. Our action plan should focus on prevention. The action plan we create should include incentives for "good actors." We should utilize existing resources/programs for education (e.g., Little Tennessee Watershed Association, Wildlife Commission, Year-of-the-Mountains Commission, Southern Appalachian Mountain Initiative).
Golf Courses	Fertilizer and pesticide use may be impacting water quality.
Agriculture	We need to expand the use of BMPs. Agricultural ditches may be causing water quality problems. Some farm roads are not properly designed.

6.2.4 Priority Issues and Recommended Actions Identified by the Year of the Mountains Commission

The Year of the Mountains Commission was organized under an Executive Order of the Governor in 1995. The objectives of the Commission were to: 1) Educate, promote and celebrate the distinctive natural and cultural heritage of the WNC communities and region; and 2) Develop and market public policy goals which can address the issues of quality growth and development, natural resource protection, and preservation of the cultural identity of the WNC mountain region.

The following recommendations relating to natural resource protection and specifically to water quality issues were made by the Commission .

- The establishment and/or expansion of sound planning capabilities throughout the 29 counties involved in The Year of the Mountains. The State should provide direct financial assistance to the counties of Haywood, Jackson, Swain, and Macon to assist in planning and preparing for development pressures as direct or indirect consequences from gaming on the Cherokee Indian Reservation.
- The State should encourage local governments to implement capital improvement planning in western North Carolina (WNC). Encourage a system of long-term capital improvements planning through project grants or loans to local governments, perhaps through a baseline capital improvements financing fund; encourage congressional delegates to reconfigure and increase federal payments to local governments that have a lot of public lands.
- Protect and Enhance Water Quality. Establish a state and regional partnership to aggressively pursue a program to eliminate "straight-piping"; increase funding to the N.C. Agricultural Cost Share Program; increase funding and personnel for inspections of mines, dams and development sites; increase funding to the Governor's Task Force on Forest Sustainability to ensure inspection and mitigation of any negative forest impacts on water quality.

- Improve the air quality in WNC to reduce adverse effects on human health and the environment. Encourage support of the Southern Appalachian Mountain Initiative (SAMI) and the Southern Appalachian Man and Biosphere (SAMAB) initiatives; seek and support federal and state regulations to limit air pollutants and to monitor the effects of air pollutants on ecosystems.
- Improve integration of environmental education into school curricula. Increase appropriations to the N.C. Environmental Education Plan and establish an Environmental Education Trust Fund for education grants to schools and communities.

6.3 STRATEGIES FOR RESTORING IMPAIRED AND "THREATENED" WATERS

6.3.1 What Are the Impaired Waters?

Impaired waters are those waters identified in Chapter 4 as partially supporting or not supporting their designated uses. Table 6.3, below, presents impaired waterbodies in the Little Tennessee River basin, the source of impairment, NPS Priority rating (see Section 6.3.3) and summary of recommended management strategy.

Table 6.3 Partially Supporting or Not Supporting Waters in the Little Tennessee River Basin

Subbasin	Water-body	Use Rating	No. of Miles	Source	Management Strategy	Chp. 6 Reference Section
04-04-01	Cullasaja River (above Mirror Lake)	NS	4.8	NPS	Impairment is likely partially due to urban runoff from the town of Highlands. Since monitoring was conducted, Highlands has developed several water quality protection ordinances. Further monitoring to assess water quality is recommended. The highly developed watershed of this portion of the river also contributes to impairment. There are many homes and several golf courses in the watershed. The implementation of best management practices for construction and urban planning are important to improving water quality in the upper Cullasaja River.	Section 6.4.1
04-04-01	Mill Creek (above and below WWTP)	PS	1.4	NPS	Impairment is likely due to Town of Highlands runoff. Since monitoring was conducted, Highlands developed water quality protection ordinances. Further water quality monitoring is recommended.	Section 6.4.1
04-04-03	White Oak Creek	PS	1.0	P	Impairment is due to discharge from a trout farm. Since sampling occurred, the farm implemented best management practices (BMPs). Further monitoring to assess water quality improvements from the installation of BMPs is recommended.	Section 6.4.3
NOTES:						
PS	Partially Supporting classified uses					
NS	Not Supporting classified uses					
NPS	Impairment due to Nonpoint Source pollution, though specific sources may not be known					
P	Impairment attributed to Point source pollution					

There are two waterbodies in the Upper Little Tennessee River subbasin (upper Cullasaja River and Mill Creek) and White Oak Creek in the Nantahala River subbasin that were identified as impaired based upon biological or chemical monitoring data collected between 1990 and 1994. Some impaired waterbodies may not have been identified by DWQ due to the unavailability of chemical or biological monitoring data for those areas, so it cannot be assumed that there are no other impaired waters in the Little Tennessee River basin. See Chapter 4 for explanation of use support ratings.

6.3.2 What are the "Threatened Waters"?

The following waters have notable water quality problems but the impact of the problem is not severe enough to cause the stream to be considered impaired under the state use-support designation described in Chapter 4. These waters are rated Support-Threatened. Refer to Table 6.4 for a list of these waterbodies, their use-support rating, source of degradation, NPS Priority rating (see Section 6.3.3), and recommended management strategy for protecting these waters form further degradation.

Table 6.4 Support-Threatened Waterbodies in the Little Tennessee River Basin

Subbasin	Waterbody	Use Rating	No. of Miles	Source	Management Strategy	Chp. 6 Reference Section
04-04-01	Little Tenn. R (at Prentiss and Iotla)	ST	38.3	NPS	Best management practices for land disturbing activities are needed.	Section 6.4.1
04-04-01	Cartooge-chaye Creek	ST	4.5	NPS	Sources of degradation need to be identified.	Section 6.4.1
04-04-01	Cullasaja R. (3/4 mi. below dam)	ST	8.5	NPS	Best management practices and long-term urban planning are needed.	Section 6.4.3
04-04-01	Iotla Creek	ST	5.4	NPS	Sources of degradation need identification.	Section 6.4.1
04-04-01	Cowee Creek	ST	4.3	NPS	Additional surveys needed to determine sources of nutrients.	Section 6.4.1
04-04-01	Lake Sequoyah	ST	150 Acres	NPS	Urban runoff is the likely source of water quality degradation. Since sampling occurred, Highlands implemented several ordinances.. Additional monitoring may determine if these ordinances are improving water quality. Aging septic tanks along the lake perimeter should be placed on city sewer lines.	Section 6.4.1
04-04-02	Scott Creek	ST	14.6	NPS	Sources of degradation need to be identified.	Section 6.4.2
04-04-02	Beech Flats Prong	ST	4.8	NPS	The National Park Service has no plans to remediate.	Section 6.4.2
04-04-03	Dicks Creek	ST	3.3	unknown	Sources of degradation need identification	Section 6.4.3
04-04-03	Silvermine Cr	ST	4.5	unknown	Sources of degradation need identification	Section 6.4.3
NOTES:						
PS	Partially Supporting classified uses					
NS	Not Supporting classified uses					
NPS	Impairment due to Nonpoint Source pollution, though specific sources may not be known					
P	Impairment attributed to Point source pollution					

The identification of Support-Threatened waters can be used to determine the sources and causes of degradation and to determine if management strategies can be used to reduce or eliminate the causes of pollution.

6.3.3 How are Waters Prioritized for Restoration or Protection?

Priority Waters for Nonpoint Source (NPS) Management Strategies

DWQ has developed criteria for assisting in the selection of NPS-impaired for prioritization by NPS agencies. It is expected that theses priority waterbodies will be targeted by the various NPS agencies and groups in the allocation of the financial, technical, or educational assistance they deliver. These criteria are discussed in Appendix VI in the discussion of NPS Teams. In summary, the criteria for NPS-impaired waters are:

- highly valued resource waters in need of restoration or protection from NPS pollution, and
- waters with impaired water quality as a result of NPS pollution.

In all cases, waters prioritized for action should be those that have a high likelihood for restoration.

Section 303(d) of the Clean Water Act (CWA)

States are required to develop a list of waters not meeting water quality standards or which have impaired uses (Partially Supporting or Not Supporting) under Section 303(d) of the Clean Water Act. Waters may be excluded form the list if existing control strategies are expected to achieve the standards or uses. Control strategies may be both point or nonpoint programs. Waterbodies which are listed must be prioritized and a management strategy or Total Maximum Daily Load (TMDL) must be developed.

Use support ratings for the 303(d) list are based on monitoring data collected in the last five years. Further information on the 303(d) program and a complete list of waters in the Little Tennessee River basin can be found in Appendix X. The list includes use support ratings, major causes and sources of impairment, descriptions of potential sources of pollution and the stream priority rating.

6.4 PRIORITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES BY SUBBASIN

6.4.1 Upper Little Tennessee (Subbasin 04-04-01)

Overview

This subbasin includes the Cullasaja River watershed in its entirety and the upper portion of the Little Tennessee River. Refer to Chapter 2 for a map of subbasin boundaries and Chapter 4 for a map of sampling location sites.

Issues and Recommended Management Strategies

Little Tennessee River
The Little Tennessee River above Lake Emory is considered Support-Threatened. Nonpoint pollution is considered to be the major source of degradation to the river. This portion of the river has a high rate of streambank erosion. While some streambank erosion is natural, this issue may be heightened in this subbasin by urbanization and high population growth and agricultural practices. Best management practices for the various agricultural, urban and silvicultural activities

in this subbasin are hoped to provide efficient and reliable means of protecting these waterbodies. Many efforts have been undertaken to address this issue through demonstration projects and Section 319 grants. Major challenges to the installation of best management practices will be getting funding and locating willing property owners.

This section of the river is the major focus of the Little Tennessee Watershed Association (LTWA) (discussed in Section 5.6.3). The Association is concerned with sedimentation, lack of recreational fishing, streambank stabilization and possible toxicity problems with dischargers in Georgia. The Little Tennessee Watershed Association, in cooperation with others, continues to conduct streambank restoration projects to stabilize the eroding streambanks often seen in this subbasin. DWQ will continue to cooperate with and support the LTWA in their efforts.

There are indications that point source dischargers in Georgia may also be affecting water quality during low flow conditions. Ambient monitoring results at the monitoring station closest to the Georgia state line (Little Tennessee at Prentiss, refer to Section 4.2.5 in Chapter 4) show few excursions from water quality standards. However, under low flow conditions and maximum concentrations of certain parameters, water quality may be negatively affected. There are three wastewater treatment facilities near the state line (Fruit of the Loom Industries, Vulcan Materials and City of Dillard).

Senior U.S. District Judge Marvin Shoob recently noted that Georgia's Environmental Protection Division (EPD) had missed the 1979 Clean Water Act deadline for states to identify which waters are heavily polluted and to identify the assimilative capacity of these waters. This realization occurred due to a suit brought against EPA by the Sierra Club in 1994. By 1994, Georgia had set pollution limits for only two of the 340 polluted waterways it had identified. The Judge ordered the EPA and the Sierra Club to submit plans to remedy the problem and ordered a trial to consider whether the EPA should have approved Georgia's list of 340 polluted waters. The results of this case are still pending.

This subbasin is also habitat for the Spotfin Chub, a fish on the endangered species list. There is no legislation to back the designation of critical habitat areas to protect endangered species. However, if requested, the Wildlife Resource Commission can prepare a conservation plan for endangered or threatened species that are found in habitats that support these species. The Commission would coordinate in the development of the conservation plan with other agencies. The conservation plan would report on the status of the species and the numbers of the species known to survive. In addition, the plan would identify those populations that could be saved and the environmental and land-use threats to the populations (such as sedimentation, scouring, etc.). The plan would then be presented to DWQ. The Commission would request that DWQ develop management strategies under existing regulatory authority to protect the habitat and populations. If DWQ does not develop management strategies, the Commission has the recourse to go to the legislature with a request for assistance in developing protective strategies.

Recommendations:
The State of North Carolina and DWQ should work more closely with Georgia's Environmental Protection Division (EPD) to assure that proper NPDES limits are established and maintained for those dischargers in the upper Little Tennessee River watershed as these streams enter North Carolina. DWQ should also continue to support efforts by the LTWA and others to address streambank erosion along the Little Tennessee.

Cartoogechaye Creek
Much of the upper watershed of the Cartoogechaye Creek, (a tributary to the Little Tennessee) is classified as a water supply. Although monitoring of this watershed has not indicated any problems, further sampling and protection of this resource should continue. The lower section and

mouth of the Cartoogechaye Creek is Support-Threatened due to nonpoint sources of pollution including erosion from development and runoff from US 64.

Recommendations:
To protect this resource from further degradation, the sources of runoff and potential ways to reduce the inputs need to be identified and addressed. Local governments and agencies and the nonpoint source team members may be good resources for this activity.

Mill Creek
Biological sampling in 1990 and 1991 on Mill Creek above and below the WWTP discharge for the Town of Highlands resulted in a Fair bioclassification. This discharge point has since been moved to below Lake Sequoyah on the Cullasaja River. It is likely that the upstream impairment was due to urban runoff from the Town of Highlands. The Town has recently developed a Land Use Plan (September 1989) that addresses the need to "maintain or improve the present quality of the natural environment." It has also adopted a Soil Erosion and Sedimentation Control Ordinance and a Subdivision Regulation (August 1995).

Recommendations:
The implementation and enforcement of these local regulations, and the pursuance of Lake Sequoyah and its watershed for drinking water supply should help minimize further water quality degradation to Mill Creek. Further monitoring of Mill Creek in light of these local ordinances to demonstrate water quality improvements should be conducted.

Upper Cullasaja River
The upper Cullasaja River above Mirror Lake at Highlands (from its source to SR 1545, a distance of approximately 4.8 miles), is impaired due to nonpoint source pollution. This portion of the Cullasaja River is surrounded by areas of high population growth accompanied by accelerated urbanization. Nonpoint sources of pollution in the upper Cullasaja are likely stormwater runoff, home construction sites, numerous golf courses and roads.

The construction process and poor access road design are thought to be significant causes of erosion. As roads are graded, the spoil is placed in roadside ditches and carried to streams through runoff. Many private drives have 18-19% slopes, even though 12% is considered to be the maximum permissible slope in sound engineering design. The steep slopes and thin soils found in this area make this region particularly vulnerable to land disturbances.

Further downstream from SR 1545, the Cullasaja River has a Support-Threatened status. This status may be due to continued development as well as the addition of fertilizers from surrounding golf courses and nutrient and toxic runoff from residential areas.

In 1985, the Town of Highlands applied for an increase in the discharge from its wastewater treatment plant, along with a relocation of the discharge to the Cullasaja River. Effluent limits and monitoring requirements for relevant pollutants were determined by Division staff for the expanded discharge to protect instream water quality. In the 1990's numerous public hearings were held and legal suits were filed due to concerns that the discharge would adversely affect local uses (including baptismal services) and that low flow estimates of the waterbody were not correct. The final permit included effluent limits designed to protect both water quality and the various public uses of this waterbody. The discharge location is downstream of Lake Sequoyah and the impaired section of the river discussed above.

A special study was conducted by the NC DWQ's Biological Assessment Group in October 1996 to determine if the benthic macroinvertebrate and fish communities in the upper, middle, and lower Cullasaja River were affected by the relocated effluent from the upstream WWTP at Highlands. The study concluded that the relocation of the Town of Highlands NPDES-permitted wastewater treatment plant's discharge to the Cullasaja River below Lake Sequoyah was not having a detectable impact on the river's macroinvertebrate or fish communities. The ecological health of the fish community in the lower reaches of the Cullasaja River were more affected by upstream and local watershed degradation and other dischargers than the discharge from the Highlands WWTP located approximately 19 miles upstream. There have also been no detectable changes in the macroinvertebrate communities in the upper and middle portions of the river which have been monitored four times since 1990. The fish and macroinvertebrate communities in the Cullasaja River will be monitored again in 1999 as part of the Division's more extensive Little Tennessee River Basinwide Monitoring Program.

Recommendations:
This river, as well as the surrounding waterbodies, will be very dependent on best management practices for construction and long-term urban planning. The implementation and enforcement of local land use, subdivision and sediment control ordinances as discussed above under Mill Creek are needed to minimize growth impacts. Additional efforts may be needed to restore full use to these waters.

DWQ's Regional Office in Asheville has added two additional ambient monitoring sites on the Cullasaja River downstream of the Highlands wastewater treatment effluent. DWQ will continue to monitor these sites monthly to assess the impacts of the effluent on downstream water quality.

Iotla Creek
Iotla Creek is Support-Threatened and appears to be affected by both sedimentation and high scouring of the substrate during rainfall events.

Recommendations:
To protect this resource from further degradation, the sources of runoff and potential ways to reduce the inputs should be identified. Local governments and agencies and the nonpoint source team members may be good resources for this activity.

Cowee Creek
Cowee Creek was selected to assess the effects of discharges form eight ruby and gem mines and from Perry's Water Gardens (commercial nursery). During sampling the site was very turbid, the stream bottom was heavily embedded with siltation and macroinvertebrate population indicated enrichment.

Recommendations:
Additional biological surveys should be conducted to determine the sources of enrichment.

6.4.2 Lower Little Tennessee River (Subbasin 04-04-02)

Overview

This is the largest subbasin in the Little Tennessee River basin, containing the Little Tennessee River and the entire Tuckasegee River watershed which includes the Oconaluftee River. Many of the High Quality and Outstanding Resource Waters within the Little Tennessee River basin are located in this subbasin.

Two waterbodies within this subbasin have a Support-Threatened status. Scott Creek, near the Town of Sylva, is a tributary to the Tuckasegee River and has nonpoint pollution as its major source of impact. Beech Flats Prong, a headwater of the Oconaluftee River has been impacted by the exposure of Anakeesta rock materials (locally known as "hot rocks").

Issues and Recommended Management Strategies

Scott Creek

Scott Creek, a tributary to the Tuckasegee River, has a use-support rating of Support Threatened. The causes and sources of this rating have not been determined.

Recommendations:

To protect this creek from further degradation, potential pollutants should be identified. Local governments and agencies, along with the nonpoint source team members, may be good resources for identifying the problems and solutions for restoring this waterbody.

Beech Flats Prong

Construction of US 441 in the Great Smoky Mountains National Park near Clingman's Dome at Newfound Gap exposed Anakeesta rock formations, resulting in low pH values and heavy metal concentrations in the headwaters of Beech Flats Prong. The stream reach most affected is limited in length to less than one mile. This long-term source of pollution has resulted in the classification of Support -Threatened for this stream. The National Park Service is extremely limited in available funds and has no plans to remediate this situation.

Tuckasegee River

The Bear Creek Reservoir watershed has High Quality Waters classifications throughout most of its headwaters. The furthest upstream waters of this reservoir, the Greenland Creek area,. is classified as Outstanding Resource Waters. This watershed, which feeds into the Tuckasegee River near its headwaters is located in the southeastern corner of this subbasin.

Much of the southeast corner of this subbasin in the headwaters of the Tuckasegee River is designated as a water supply. Cedar Cliff, Bear Creek and Thorpe Reservoir (Lake Glenville) Reservoirs are classified water supply. In April 1997, the Environmental Management Commission (EMC) voted to implement a supplemental classification of Alternative HQW Rule for Thorpe Reservoir (Lake Glenville), Hurricane Creek and Laurel Branch. Under the Alternative HQW Rule, sedimentation and erosion control requirements as implemented by the NC Division of Land Resources will apply to areas within one mile and draining to the HQW designated waters (refer to Section 6.5 for further details). ,

Recommendations:

DWQ will cooperate with the Division of Land Resources to implement the Alternative HQW Rule for Thorpe Reservoir, Hurricane Creek and Laurel Branch.

Many of the waters within the Cherokee Indian Reservation have High Quality classifications. Because of this, more communication and cooperation needs to take place with Cherokee Indian Reservation officials. Continued pressure to build and urbanize these areas will require attention to best management practices for construction and long term planning of urban areas. Refer to Section 6.5 for regulations and strategies applying to the Outstanding Resource Waters and High Quality Waters designations.

Fontana Lake

In the western section of this subbasin, Fontana Lake has water supply and HQW classifications in various areas around the lake. Development around this waterbody will need to be monitored closely to insure that sedimentation and nutrient enrichment of the reservoir does not occur.

6.4.3 Nantahala River (Subbasin 04-04-03)

Overview

This is the smallest subbasin in the Little Tennessee River basin, containing the majority of the Nantahala River watershed. Much of the headwaters of the Nantahala River are classified as Outstanding Resource Waters.

Issues and Recommended Management Strategies

White Oak Creek
White Oak Creek has a Partially Supporting status based on macroinvertebrate sampling. The impairment id due to impacts from the discharge from a trout farm to this waterbody. The impacts from the trout farm are localized to a short stream length. The trout farm implemented best management practices to reduce the amount of particulates in the discharge. This stream, like other streams with trout farms discharging to them, are more affected by the discharge during low flow conditions and higher water temperatures.

Recommendations:
Continued monitoring of this site to verify the effects of best management practices on stream water quality is recommended.

Silvermine Creek and Dicks Creek
Silvermine Creek and Dicks Creek, both tributaries to the Nantahala River, have a Support-Threatened status. The source of this impact is unknown and further monitoring will be required to verify its current status and possible causes.

Nantahala River
This is one of the most heavily used rivers in the southeast for primary recreation. Due to the popularity of this river for recreation, future development along the river could negatively impact water quality of the river. Since the river did not rate as Excellent for macroinvertebrates, it cannot be reclassified as High Quality Waters. This river serves the area as a valuable natural and economic resource. Local stakeholders should organize a Nantahala River association to assure the water quality of the river is protected.

Recommendations:
Local stakeholders should include: those that live on or near the river or Nantahala Lake, those that use the river for recreation, those that make a living off of the river, and those that discharge waste ~~into the river. Other stakeholders may be identifiable by these groups upon meeting.~~

6.4.4 Cheoah River (Subbasin 04-04-04)

Overview

The major waterbodies in this subbasin are the Cheoah River and Santeetlah Lake.

Issues and Recommended Management Strategies

West Buffalo Creek Arm of Santeetlah Lake
While not impaired, the West Buffalo Creek arm of the lake has been observed with nuisance algal blooms. This condition appears to be a result of excessive nutrient loading from trout farms located on this creek and Snowbird Creek.

Recommendations:
Operation of these farms should be examined to determine whether cost-effective measures exist to reduce nutrient discharges to these streams. Also, consideration should be given to not allowing any additional farms on these streams until this problem can be corrected.

6.5 IDENTIFICATION AND PROTECTION OF HIGHLY VALUED RESOURCE WATERS

6.5.1 Overview of High Quality and Outstanding Resource Waters as well as Special Classifications and Habitats

Waters considered to be biologically sensitive or of high resource value may be given protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters), Tr (trout) or WS (water supply), or they may be protected through more stringent NPDES permit conditions. Waters eligible for reclassification to HQW or ORW may include native trout waters, designated critical habitat for threatened or endangered species (as designated by the NC Wildlife Resources Commission), waters classified for domestic water supply purposes (WS I and II), or waters having Excellent water quality based on DWQ biological monitoring. Based on DWQ monitoring, there are several waters that received an Excellent biological rating and may be considered eligible for HQW or ORW (Table 6.5). The HQW, ORW and WS classifications generally require more stringent point and nonpoint source pollution controls than do primary water quality classifications such as C or SC. Refer to Chapter 2 and Appendix II for more information on classifications and standards. The Little Tennessee River basin contains a large number of streams that have either ORW or HQW classifications, as well as trout (Tr) and water supply (WS) status.

At present, the Nantahala River/Lake is pending reclassification to ORW. Wesser Creek (Swain County) is pending reclassification to include the supplemental classification of Tr (Trout).

There are seventeen species listed by the NC Natural Heritage Program as Special Concern, Significantly Rare, or Threatened in the Little Tennessee River basin. These species are given special protection status by the North Carolina Wildlife Resources Commission and/or the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337). The species and the status of each can be found in Section 2.5. Where waters are known to support state or federally listed endangered or threatened species or species of concern, consideration will be given during the NPDES permitting process to minimize impacts to habitat areas consistent with the requirements of the federal Endangered Species Act and North Carolina's endangered species statutes. Possible protection measures may include but are not limited to dechlorination or alternative disinfection, tertiary or advanced tertiary treatment, outfall relocation, and backup power provisions to minimize accidental plant spills. The need for special provisions will be determined on a case-by-case basis during review of individual permit applications and take into account the degree of impact and the costs of protection.

Table 6.5 Potential HQW/ORW Waters for the Little Tennessee River Basin

Subbasin	Catchment	Streams
Upper Little Tennessee River (04-04-01)	Nantahala National Forest	Coweeta Creek and nearby catchments
Nantahala River (04-04-03)	Nantahala River above Lake	upper White Oak Creek
Cheoah River (04-04-04)	Nantahala National Forest	Snowbird Creek Slickrock Creek Santeetlah Creek Deep Creek Tulula Creek Bear Creek Buffalo Creek Little Buffalo Creek

Thorpe Reservoir (Lake Glenville) Reclassification to Alternative HQW Rule

In 1989, DWQ received a request to determine whether Thorpe Reservoir would classify as HQW. DWQ biologists determined that Thorpe Reservoir had Excellent water quality and was eligible for reclassification. A public hearing and comment period was held in August 1994 on the proposed reclassification. Due to significant public interest and debate, the Environmental Management Commission instructed DWQ to proceed back to rule making with two options: Option One - Alternative HQW Rule and Option Two - Water Quality Management Plan. A public meeting and comment period was held in November 1996. A summary of public comments and DWQ staff recommendations were presented to the Environmental Management Commission (EMC) in April 1997. The EMC voted to implement Option One - Alternative HQW Rule for Thorpe Reservoir (Lake Glenville), Hurricane Creek and Laurel Branch.

Under both options, wastewater discharge requirements were identical and no additional stormwater requirements were applicable. Under the Alternative HQW Rule, sedimentation and erosion control requirements as implemented by the NC Division of Land Resources will apply to areas within one mile and draining to the HQW designated waters.

6.5.2 Strategies for Controlling Discharges to High Quality Waters (HQWs) and Outstanding Resource Waters (ORWs)

High Quality Waters (HQWs)

Many streams in the Little Tennessee River basin are classified as high quality waters. A list of these streams is provided in Chapter 2. For HQWs, a distinct set of management strategies applies to wastes discharged from a facility. New discharges and expanding discharges that have an increase in pollutant load to HQW streams are subject to the following management strategies adopted by DWQ pursuant to 15A NCAC 2B.0224 (1) and 15A NCAC 2B .0224 (1)(b)(vii):

- Discharges from new single family residences will be prohibited. Those that must discharge must install a septic tank, dual or recirculating sand filters, disinfection and step aeration. (15A NCAC 2B.0224 (1)(a)).
- All new or expanded wastewater discharges (except single family residences) will be required to meet effluent limitations for oxygen consuming wastes as follows: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l, and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen consuming wastes will not cause the DO of the receiving water to drop more that 0.5 mg/l below background levels, and in no case

below the standard. Where background information is not readily available, evaluations will assume a percent saturation determined by staff to be generally applicable to that hydroenvironment. (15A NCAC 2B .0224 (1)(b)(i)).

- Emergency Requirements: Failsafe treatment designs will be employed (except single family residences), including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs. (15A NCAC 2B .0224 (1)(b)(iv).

- Volume: The total volume of treated wastewater for all discharges combined will not exceed 50 percent of the total instream flow under 7Q10 conditions. (15A NCAC 2B 0.224 (1)(b)(v)).

- Toxics: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor will be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent will be allocated at one half of the normal standard at design conditions. Whole effluent toxicity will be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration or 90 percent. Ammonia toxicity shall be evaluated according to EPA guidelines promulgated in "Ambient Water Quality Criteria for Ammonia - 1984"; EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784).

- North Carolina does not have a numeric water quality standard for suspended solids. Discharges to high quality waters (HQW) must meet a total suspended solids (TSS) limit of 10 mg/l for trout waters and primary nursery areas and 20 mg/l for all other HQWs.

Outstanding Resource Waters (ORWs)

There are a number of ORWs in the Little Tennessee River basin. A list of ORWs is provided in Chapter 2. No new discharges nor expansions of existing discharges directly to waters classified as ORW are permitted in accordance with 15 NCAC 2B .0225 (c)(1) (see Appendix II). Those existing discharges will be handled on a case-by-case basis following standard operating procedures.

6.6 GENERAL MANAGEMENT STRATEGIES FOR PROTECTING WATER QUALITY IN THE BASIN

6.6.1 Management Strategies for Growth and Development in Western North Carolina

The institution of programs and initiatives to balancing economic growth with water quality protection is the responsibility of local governments. The following strategies are examples of a few of the initiatives local governments could pursue.

- Develop a Regional Organization. It is suggested that a regional organization be developed for the western eight counties of North Carolina (covering the Hiwassee, Little Tennessee, Savannah and French Broad River basins). While the focus of this group could primarily be aimed at sustainable economic growth development, a separate task force could be developed to conduct an analysis of the impacts of the Cherokee gambling casino on natural resources. Several economic development organizations are already in existence in the region.

- Develop a variety of land use management tools. Land use management issues will need to be addressed either by the local governments or by the natural resource task force of the regional organization. The lack of land use planning can have long-term negative impacts on water quality. Chapter 5, Section 5.6.3 presents information on local governments that have some land use planning in effect.

  Each of the 5 counties within the Little Tennessee River basin should have a Sedimentation and Erosion Control Ordinance, Pre-Development Ordinance (or subdivision ordinance) and a Land Use Plan in effect. The development of a Land Use Guidance System (LUGS) may be a feasible system to enact within these counties. LUGS is a systematic land use planning and management tool that allows for land use decisions to be made on a site specific basis. The concept behind LUGS is that projects are heard case-by-case, often based on a pre-existing growth guidance assessment. A committee reviews the project for its compatibility with the growth guidance assessment. Anyone from the surrounding area that may be affected by the project is invited to attend review meetings. The Board of Commissioners typically makes a final decision on the project. This process is less generic in its approach than zoning and yet allows for protection of the integrity of the community.

- Pursue Funding for Local Water Quality Protection Projects. The Clean Water Management Trust Fund (see Chapter 5, Section 5.8) may be a source of funding to assist local governments in obtaining a balance between economic growth and protecting surface waters of the state. Local governments will need to take responsibility for planning for the additional tourists and growth and development. This region of the state typically has a lower tax base than other areas of the state. Problems with aging infrastructure are also typical, especially for the small towns in the region. The Clean Water Management Trust Fund can be used for many purposes including: acquiring land for conservation easements and riparian buffers, restoring degraded lands to protect water quality, repairing failing waste treatment systems and septic tank systems and improving stormwater management. Local governments and regional organizations should consider pursuing funding through the Clean Water Management Trust Fund as a means to upgrade infrastructure and manage land to protect water quality. Contact the Executive Director, Dave McNaught at (919) 974-5497 for more information.

- Support Local Initiatives for Water Quality Protection. Local governments and regional organizations can also promote local efforts to protect areas by developing greenways and bikeways, supporting citizen monitoring efforts and protecting lands near surface waters and wetlands.

- State support to encourage the development and implementation of land use plans. This incentive policy has been applied in other states. The premise of an incentive program is to provide partial funding to staff the program if a local government develops a land use plan and then enforces its plan. If the land use plan is not developed or enforced, no funding would be available. Such a program has not yet been developed in North Carolina.

- DWQ assistance to local governments for wastewater planning. Over the past several years DWQ has been involved in a number of projects to encourage and assist local governments in carrying out wastewater planning and growth management activities. DWQ will continue to work with local governments to encourage them to take steps to manage the effects of growth.

6.6.2 Management Strategies For Controlling Sedimentation

Sedimentation has been identified as a source of stream impairment in the Little Tennessee River basin. Sedimentation has also been identified as a source of water quality degradation in the basin, resulting in the classification rating of Support Threatened of some waters.

Since the mountain counties are increasingly popular areas for home, commercial and golf course construction, there is the potential for greater sediment loads to enter streams during land clearing and construction activities. After construction is complete, poorly designed roads, trails, and driveways may continue to erode into water bodies.

Sedimentation is a widespread nonpoint source-related water quality problem that results from land-disturbing activities. The most significant of these activities include agriculture and land development (e.g., highways, shopping centers, and residential subdivisions). For each of these major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.4 and are briefly described in Appendix VI.

Construction activities, private access roads, state road construction and agriculture are sources of sediment and are discussed below. Golf courses and urban stormwater are other potential sources of sediment that are discussed in separate sections.

Before action is taken to restore a stream channel and riparian area, it is essential to understand the cause and nature of the problem. For example, if a landowner notices that excess gravel is accumulating in the stream on their property, they should first investigate the causes on their property and, if necessary, throughout the watershed. Stabilizing a streambank can result in an expense of time and money which will have to be repeated until the underlying cause is addressed. It is important to understand that a streambank may erode for many different reasons and the cause is not always obvious. Underlying causes might be as simple as a lack of bank vegetation to hold the soil in place or as complex as changes in runoff caused by urban runoff, poor logging or farming practices or other activities in the watershed.

Also, watershed inventories should not focus solely upon problem areas. Without advance planning and protection, sensitive resources, highly productive resource or critical components of natural systems are easily degraded or lost through development or overuse. Riparian buffers, wetlands, floodplains, animal movement corridors and rare species should be identified and their protection incorporated into watershed planning and management efforts.

Proven Techniques for Controlling Sediment and Protecting Streams

The following techniques are proven to be effective at controlling sedimentation to streams, thereby protecting the water quality of streams.

- Protect existing riparian forest buffers.
- Avoid disturbance of streams and the riparian zone. Restore vegetation that has been cleared from the riparian zone.
- Use BMPs for sediment control. A wide variety of agricultural BMPs have proven effective for sediment control. These include conservation tillage/residue management, filter strips and field borders, and cover crops.
- Don't straighten channels. Maintain natural channels or, if modification is unavoidable, design channels based on the stability and behavior of natural stream channels. Channel designs based on natural stability principles will be less susceptible to erosion, dissipate energy more effectively, remain more stable, and provide more habitat than traditional engineered channel designs.
- Maintain pre-development peak flows, flow velocities, and flow timing to the extent possible through the use of stormwater management techniques and appropriate BMPs.

The Use of Riparian Buffers to Protect Stream Quality and Integrity

A stream and its riparian area function as one. The condition of the riparian area and its vegetation play a central role in determining the integrity of stream channels and water quality. Although streamside vegetation of any kind is desirable, forests provide the greatest amount of benefit and highest potential for meeting both water quality and habitat restoration objectives. A sound scientific foundation exists to support the sediment reduction, nutrient reduction, and ecological values and functions of riparian forest buffers. The use of riparian buffers as a management tool should be promoted.

Riparian Forest Buffers are streamside ecosystems, managed for the protection of water quality through control of nonpoint source pollution and maintenance of the stream environment. Riparian Forest Buffer Systems are typically managed as three integrated streamside zones which are designed to intercept surface runoff and subsurface flow. They comprise an area of trees, usually accompanied by shrubs and other vegetation, that is adjacent to a body of water. The Riparian Forest Buffer is managed to:

- maintain the integrity of stream channels and shorelines,
- reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals, and
- supply food, cover, and thermal protection to fish and other wildlife.

Table 6.6 State and Federal Sediment Control-Related Programs

Agricultural Nonpoint Source (NPS) Control Programs	North Carolina Agriculture Cost Share Program NC Cooperative Extension Service and Agricultural Research Service Watershed Protection and Flood Prevention Program (PL 83-566) Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA). (Includes Conservation Reserve Program, Conservation Compliance, Sodbuster, Swampbuster, Conservation Easement, Wetland Reserve and Water Quality Incentive Program)
Construction, Urban and Developed Lands	Sediment Pollution Control Act Federal Urban Stormwater Discharge Program Water Supply Protection Program ORW and HQW Stream Classification
Forestry NPS Programs	Forest Practice Guidelines ~~National Forest Management Act~~ Forest Stewardship Program Forestry Best Management Practices Forest Management Program Services
Mining	The Mining Act of 1971
Wetlands Regulatory NPS Programs	Section 10 of the Rivers and Harbors Act of 1899 Section 404 of the Clean Water Act Section 401 of the Water Quality Certification (from CWA) North Carolina Dredge and Fill Act (1969)

Construction Activities

Construction activities can dramatically increase the sediment delivered to streams. Construction activities can be especially harmful in the mountains where slopes are steep and rainfall is frequent.

Construction activities are controlled under the Sedimentation and Erosion Control Act administered by the NC Division of Land Resources (DLR). This act requires anyone disturbing more than one acre of land to submit a Sedimentation and Erosion Control Plan to DLR. One of the major requirements is that there are adequate erosion control measures to retain all sediment on a development site during the 25-year storm. Generally, a land owner must install acceptable Best Management Practices (BMPs) when the land is disturbed by construction or development activities. Management practices may include barriers, filters, or sediment traps to reduce the amount of sediment that leaves a site. Under this act, local governments may take responsibility for reviewing and enforcing the Sedimentation and Erosion Control Program within their jurisdiction; however, their program must be at least as stringent as DLR's.

In the Little Tennessee River basin, development pressure is likely to increase. In order to match the pace of land disturbing activity, more staff hours will be needed within the DLR in order to effectively administer and fully enforce the provisions of the Act. At present, planning and inspection staff are stretched thinly across large geographic areas and a wide variety of projects. Careful planning prior to construction, perhaps the most important part of erosion control, may often be neglected due to lack of available staff time.

The responsibility for controlling sediment from construction activities falls on many shoulders. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, and the NC Division of Land Resources. Table 6. 7 presents actions that will help to address sediment problems associated with construction activities.
No sediment control measures are 100% effective so some level of sedimentation will occur with land-disturbing activities. Education and promotion of stewardship are keys to reducing sedimentation, along with judicious strengthening of regulations and enforcement.

References/Resources:

- The following can be ordered from the NC Division of Land Resources at P.O. Box 27687, Raleigh, NC 27611, (919)733-3833:
  1) *NC Erosion and Sediment Control "Planning and Design Manual"* ($55 for in-state, $75 for out-of-state)
  2) *NC Erosion and Sediment Control "Inspector's Guide"* ($20 for in-state or out-of-state)
  3) *NC Erosion and Sediment Control "Field Manual"* ($20 for in-state or out-of-state)
  4) *NC Erosion and Sediment Control "Video Modules"* ($15 for in-state, $50 for out-of-state)

- Asheville Regional Office of the Division of Land Resources at (919)251-6208.

Private Access Roads

Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. Often, landowners do not realize the importance of building driveways for lasting service. Some landowners depend entirely on their contractor to design the road. Others try to design it themselves without consulting a reputable source. The consequences of not paying attention to an access road as it is designed and constructed can be serious. In addition to losing the road and potentially losing land and property, the washed-out road can damage water quality. Table 6.8 offers suggestions for addressing these issues.

Table 6.7 Recommended Actions to Address Construction-Related Sediment Problems

Homeowners	Know and follow state and local erosion and sedimentation ordinances. Fit the development to existing site conditions. Follow natural contours and avoid flood plains and highly erodible soils to control erosion and sedimentation. Establish, maintain, and protect vegetation beside streams on your property. Buffers provide a filter for sediment and other pollutants. Carefully monitor the construction process. Ensure permanent vegetation is established and maintained on construction site ASAP. Continue to control sediment after construction is complete.
Developers/ Contractors	Fit the development to existing site conditions. Development that follows natural contours and avoids flood plains and highly erodible soils is much easier to control erosion and sedimentation. Minimize the extent and duration of exposure. Schedule construction according to weather and season. Try to pick dry times. Protect areas to be disturbed from stormwater runoff. Use dikes, diversions, and waterways to intercept runoff and divert it away from cut-and-fill slopes or other disturbed areas. To reduce erosion, install these measures before clearing and grading. Keep runoff velocities low. Convey stormwater away from steep slopes to stabilized outlets, preserving natural vegetation when possible. Inspect and maintain control structures during the construction process. If not properly maintained, some erosion control measures can cause more damage than they correct. Retain sediment onsite. Protect low points below disturbed areas. Build barriers to reduce sediment loss. When possible, construct sediment traps before other land disturbing activities. Stabilize disturbed areas as soon as possible after construction. Apply mulch and vegetation to land and line channels for protection. Consider future repairs and maintenance of these measures. Train equipment operators to execute erosion and sediment control practices.
Citizens	Report any serious sediment problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls.
Local Govts. Without Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control before they begin construction activities and ensure they understand their responsibilities under the State Sedimentation Pollution Control Act. Report any serious problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls. If your resources allow, consider taking responsibility for sediment and erosion control in your jurisdiction. This will allow greater control over implementation and enforcement of the program. It will also offer the opportunity to require sediment control on developments disturbing under one acre. ~~Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land.~~
Local Govts. With Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control. Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts.

Table 6.7 Recommended Actions to Address Construction-Related Sediment Problems (Cont'd.)

NC Div. of Land Quality	Continue to promote effective implementation and maintenance of erosion and sediment control measures on construction sites. Research innovative new ways to control sediment on construction sites. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts. Encourage more delegated programs by local governments where resources allow, especially in rapidly developing areas.

Table 6.8 Recommended Actions to Address Problems Associated with Private Access Roads

Homeowners	Know the state and local laws, ordinances and regulations about access road construction. Be prepared to pay the cost of constructing a good road that will last.. The cost of constructing a road will vary greatly from site to site. The cost may increase due to steep or rocky land, low stability soils, or drainage needs. In the long run, it does not pay to skimp. Avoid steep grades. Sustained grades should not exceed 10% for gravel or crushed stone roads. Make sure the road has adequate drainage. Adequate drainage is necessary to control erosion. The following water sources must be considered: rainfall on the roadbed and cut/fill slopes, overland storm flows from the watershed above the road, and springs or streams intercepted by the road. Use drainage methods that protect water quality. These methods include capture areas to treat runoff and routing runoff parallel to streams. Avoid grading access road drainage ditches directly to streams. Inspect the road periodically. Check for ruts and dips in the road, the condition of the drainage outlets, and the general condition of the cut and fill slopes. Repair any problems immediately. Any problems with ruts, drainage outlets, bare areas, etc. should be repaired before a small problem turns into a large problem.
Contractors	Watch for signs of subsurface drainage problems before, during, and after construction. Some things to look for include: soils that are gray in color, areas with springs or seeps, low areas, and areas dominated by water-tolerant plants such as alders, black walnut, poplar, cattails, reeds, etc. Road and ground cover should be applied as soon as possible after construction.
Citizens	Report any serious problems with access roads. Some problems to look for include big ruts in the roadway, wash-outs, and clogged drainage outlets. You can report problems to your local government officials. If they are not able to help, contact the regional office of the NC Division of Land Resources.
Local Governments	Require properly designed and constructed roads as part of the building permit process. Institute ordinances requiring proper maintenance of private access roads.
State and Local Agencies	Provide citizens with information about how to properly construct private access roads. Investigate innovative new ways of constructing private access roads while protecting water quality.

Most of the responsibility for access roads rests on the landowner. However, local governments, citizens, and state/federal agencies can also make their contribution to solving this problem.

References/Resources:

- *Guidelines for Drainage Studies,* NCDOT Hydraulic Design Unit (1995). To obtain, call NCDOT at (919)250-4128.
- *Final Report: Timbered Branch Demonstration/BMP Effectiveness Monitoring Project* by Richard Burns, USDA Forest Service (1994). To obtain, call USDA at (704)257-4214.
- Asheville Regional Office of the Division of Land Resources, (919)251-6208.

State Road Construction

Like any impervious surface, roadway systems have the potential to generate stormwater runoff problems. Various types of pollutants from the road surface can be carried to surface waters by rainfall. In addition, roadway construction, roadside vegetation management and roadway operation and maintenance activities can contribute to stormwater pollution problems.

The Division of Water Quality is currently working with the NC Department of Transportation (DOT) to finalize a stormwater management permit for DOT activities. This permit will address pollution from stormwater runoff related to roadways, road construction, vegetation management, operation and maintenance and other related DOT activities throughout the state. The major permit requirements are the implementation of a comprehensive stormwater management program, monitoring programs to direct the stormwater program and annual reports to outline the effectiveness and direction of the program.

The initial emphasis of the stormwater programs will be on high volume roadway segments in sensitive water areas such as coastal areas and water supply watersheds. The stormwater management programs will try to locate and characterize pollutant problems and to develop and implement appropriate best management practices to protect surface waters.

DOT is responsible for its own sedimentation and erosion control program. DOT has a number of projects with effective sedimentation and erosion control. Table 6.9 presents recommended road construction measures.

References/Resources: Dan Martin, District Office of DOT, (704)586-2141.

Table 6.9 Recommended Sediment Control Measures for State Road Construction

NC Dept. of Transportation	Know the state and local laws, ordinances and regulations about construction. Use high quality sediment and erosion controls, especially on steep slopes. Increase staff training to ensure that sedimentation and erosion control devices are properly sized and installed. Include instructions for sediment and erosion control and phasing on plans so contractors understand their responsibility. Inspect sedimentation and erosion control devices frequently. This is particularly important when contractors are responsible for the work. Implement pre-, during, and post-construction water quality monitoring at selected sites to determine effects of sediment and erosion controls. Replant exposed areas on steep slopes as quickly as possible.
Citizens and Local Governments	Contact the district DOT office if you observe sediment problems at a road construction site. Some things to watch out for include: bare soil that is not mulched and/or planted within 30 days, washed-out sediment basins and filter cloths, and soil disposal sites that are placed in or directly adjacent to creeks.

Agriculture

Streambank Fencing and Alternative Livestock Water Supply

Streambanks trampled by livestock can be a significant source of sediment. Streambank fencing and livestock watering facilities outside the riparian zone can help maintain the vegetation necessary for stabilizing streambanks and preventing erosion. The water quality benefits of streambank fencing have been well documented. Fencing and exclusion can create vegetative buffer strips along streams that trap sediment and reduce pesticide and nutrient runoff before they enter the stream. Streambank fencing also provides food, cover, and nesting sites for upland and aquatic wildlife. Allowing natural vegetation to re-establish can not only provide better habitat within the stream but also create a corridor for wildlife movement and a connection with other habitat.

Livestock exclusion may also improve water quality by preventing manure deposition in the stream. For example, according to Penn State University, one cow produces approximately 5.4 billion fecal coliform bacteria per day. At this rate, unrestricted access of fifty cows to a stream for a 24 hour period could contaminate the equivalent of one day's untreated water supply for a city the size of Baltimore.

Exclusion from the riparian area may also improve the health of livestock. Bacteria and other disease-causing organisms entering the stream can transmit diseases between and within livestock herds. Streambank fencing reduces contact with disease-causing organisms that thrive in these environments. For example, environmental mastitis is most commonly caused by coliform bacteria which enter teats as cows wade in streams. The first recommendation in any mastitis prevention program is to provide a clean, dry environment for the cows. Streambank fencing also reduces the risk of foot and leg injuries and can be part of an effective lameness prevention program.

6.6.3 Management Strategies For Urban and Industrial Stormwater Control

Recommendations for Controlling Industrial Stormwater

Throughout the Little Tennessee River basin various types of industrial activities with point source discharges of stormwater are required to be permitted under the NPDES stormwater program. These include facilities engaged in industrial activities such as manufacture of ready mixed concrete; asphalt paving mixtures and blocks; furniture and fixtures; stone, clay, glass and concrete products; timber products; apparel and printing; mining activities; and vehicle maintenance activities.

Surface waters can be significantly impacted by stormwater runoff from industrial facilities, particularly those that store or transfer materials out of doors. The types of chemicals, industrial operations and various ancillary sources influence the pollution potential of each individual facility. As such, industrial facilities can reduce stormwater impacts by developing a comprehensive site-specific Stormwater Pollution Prevention Plan (SPPP or Plan) which is based on an accurate understanding of the pollution potential of the site. The Plan provides a flexible basis for developing site-specific measures to minimize and control the amounts of pollutants in stormwater runoff by implementing best management practices (BMPs). With respect to stormwater, the ultimate BMP is the elimination of exposure of any significant materials to rainfall or runoff.

Facilities subject to NPDES stormwater permitting are required to develop and implement a SPPP. The SPPP approach focuses on two major objectives: 1) to identify sources of pollution potentially affecting the quality of stormwater discharges from the facility; and 2) to describe and ensure that practices are implemented to minimize and control pollutants in stormwater discharges from the facility. The basic components of a SPPP include a site plan detailing the facility layout and locations of potential pollutant sources, a stormwater management plan describing materials management practices and feasibility of employing best management practices, a spill prevention and response plan, a preventive maintenance and housekeeping plan, annual employee training and semi-annual facility inspections. The facility SPPP must be periodically reviewed and updated to reflect changes at the facility.

In addition to the SPPP, all permitted facilities are required to perform qualitative monitoring. This monitoring requires the periodic visual inspection of each stormwater outfall. Inspections are performed for parameters including color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. Facilities with significant stormwater pollution potential are also required to perform quantitative analytical monitoring.

Recommendations for Urban Stormwater Control

Urban stormwater runoff can be a significant contributor to water quality problems. In the Little Tennessee River basin, urban development is relatively limited at present. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the urban areas in the basin. There are no municipalities in the Little Tennessee River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

The entire community plays a role in controlling the quality and quantity of urban stormwater. Table 6.10 is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.
The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schueler 1995).

References/Resources for Urban Stormwater:

- *Stormwater Management Guidance Manual*, 1993, Cooperative Extension Service
- *Stormwater Management in North Carolina: A Guide for Local Officials*, 1994, Land-of-Sky Regional Council, Asheville, NC (Eaker 1994)
- Stormwater Fact Sheets by Land-of-Sky Regional Council, 1994
  1. *Stormwater Problems and Impacts: Why all the Fuss?*
  2. *Stormwater Control Principles and Practices*
  3. *Stormwater Management Roles and Regulations*
  4. *Local Stormwater Program Elements and Funding Alternatives*
  5. *Municipal Pollution Prevention*
  6. *Managing Stormwater in Small Communities: How to Get Started*
  7. *Maintaining Wet Detention Ponds*
  8. *Plan Early for Stormwater in Your New Development*
  9. *How Citizens Can Help Control Stormwater Pollution*
- *Stormwater Best Management Practices*, 1995, NC Division of Environmental Management.
- Asheville Regional Office of DWQ, Stormwater Group: (704)251-6208.

Table 6.10 Recommendations for Urban Stormwater Control

Local governments	Create public education programs. These programs advise citizens on how to care for their homes, businesses, and neighborhoods while minimizing stormwater pollution. Topics to cover can include environmentally sensitive methods of caring for lawns and vehicles (see Table 6.11). Support stream clean-up programs. Clean-up programs such as Big Sweep remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. Create and enforce strict penalties for improper waste disposal. In addition, local governments should protect dumpsters by fencing around them and cleaning them regularly. Institute land use planning to protect water quality. Through planning, local governments can reduce flooding by limiting the total area of impervious surfaces and directing runoff into vegetated areas or stormwater control devices. Also, planning can be used to protect surface waters by directing growth away from sensitive areas/waters such as floodplains, steep slopes, wetlands, and water supplies. Review local ordinances pertaining to parking and curb and gutter. Local ordinances often require larger parking lots than are needed. Parking lots should be designed to handle the average parking needs with overflow areas in grass. When possible, it is best to eliminate curbs and gutters to allow runoff to flow off the street or parking lot in sheet flow. Protect open spaces and streamside buffers in and around urban areas. This will preserve recreational areas and significant natural resources near the town or city. Attend stormwater workshops for local government officials. Many agencies like DWQ offer work-shops on stormwater management or reference materials. For more information, contact the DWQ stormwater group at (919)733-5083. Map the storm sewer system. If local governments map inlets, pipes, and outlets that make up their storm drain system, they will be well equipped to identify sources of observed stormwater problems. Offer hazardous waste collection days.
Citizens	Participate in stream clean-up programs. Clean-up programs remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. An annual Big Sweep event is held each year in September. Stream clean-up is a great service activity for groups such as Scouts, 4-H, Rotary Clubs, etc. Practice environmentally-friendly lawn care. Table 6.11 has a list of suggestions for keeping a green lawn while minimizing harm to the environment. When possible, use less-harmful substances in the home for cleaning or painting. Any time hazardous substances are used, there is a risk that they can enter the water by interfering with the proper functioning of septic tanks, leaking out of sanitary sewers, etc. When possible, use less hazardous substances such as latex instead of oil paint (see Table 6.12). Educate adults and children about how to protect water quality. Educational materials can be obtained from the NC Office of Environmental Education, (919)733-0711. Utilize hazardous waste collection centers for paints, petroleum products, and other chemicals. Never dispose of oil, yard wastes, or other materials in storm drain inlets or dump these materials on lands. Storm drains connect directly to nearby streams without any treatment of the water. Maintain and protect riparian buffers on private property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove a wide array of pollutants, including sediment, nutrients, and toxic substances. They can also increase property value. Support your local government's land use planning initiatives.
Developers	Incorporate stormwater management in the planning of projects. Plan developments to reduce impervious areas (roads, driveways, and roofs). Do not build in environmentally sensitive areas such as floodplains and wetlands. (This is also a flood insurance policy.) Maintain natural drainage ways and buffers along streams.

Table 6.10 Recommendations for Urban Stormwater Control (Cont'd)

Businesses	Maintain and protect riparian buffers on commercial property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove sediment, nutrients, and toxic substances. Cover and contain waste materials. This will prevent runoff from the disposal area from becoming contaminated and polluting the receiving water. Practice good housekeeping. A clean and litter-free facility will promote good water quality. Institute hazardous waste collection sites. Automobile service centers, hardware stores, and other pertinent businesses can institute hazardous waste collection sites for used oil, antifreeze, paint, and solvents.
State and Federal Agencies	Provide technical information about urban stormwater. State and federal agencies should strive to increase their communication with local governments, businesses, and citizens. Create and maintain stormwater wetlands along streams. Like buffers, stormwater wetlands treat stormwater and reduce flows. Stormwater wetlands must be designed and maintained properly to be effective.

Table 6.11 How to Take Care of Your Lawn and Car and Protect Water Quality

If you are caring for...	This is the environmentally-friendly practice.
your lawn	• Use only fertilizers that are needed, based on soil tests and plant needs. • Keep fertilizers off driveways and sidewalks. • Avoid using fertilizers within 75 feet of any waterbody. • If you use a lawn service, request natural rather than chemical management. • Plant hardy, native species that do not require chemical inputs. • Contact your Cooperative Extension Agent for more information.
your vehicle	• Maintain motor vehicles and repair leaks promptly. • Dispose of used motor oil and antifreeze in recycling centers. • Avoid gas tank overflows during refueling.

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

Table 6.12 Substitutions for Household Hazardous Substances

Instead of...	Try...
• Ammonia-based Cleaners	• Vinegar + Salt + Water
• Abrasive Cleaners	• Lemon Dipped in Borax or Salt + Baking Soda
• Furniture Polish	• Lemon Juice + Olive Oil
• Toilet Cleaner	• Baking Soda + Toilet Brush
• Oven Cleaner	• Liquid Soap + Borax + Warm Water
• Drain Cleaners	• Boiling Water + Baking Soda + Vinegar
• Upholstery Cleaners	• Dry Cornstarch
• Mothballs	• Cedar Chips or Lavender Flowers
• Window Cleaner	• White Vinegar + Water
• Oil-Based Paints and Stains	• Water-based Paints and Stains

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

6.6.4 Management Strategies for Controlling Fecal Coliform Bacteria

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

There are no monitored waterbodies in the Little Tennessee River basin where fecal coliform bacteria standards have been exceeded in at least 25% of the samples taken by DWQ. However, the Little Tennessee River at Prentiss and Cartoogechaye Creek have had a high percentage of samples greater than the standard of 200/100ml.

Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and pumping of the septic tank every three to five years.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Elimination of piped unpermitted discharges of home waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.13.

Table 6.13 Recommended Actions for Proper Maintenance of Septic Tanks

Homeowners	<u>Do not put harmful substances in your septic tank</u>. These substances include: cooking grease, oils, fats, pesticides, paints, solvents, disinfectants, and other household chemicals. These substances can kill the microorganisms that help purify the groundwater and can themselves pollute groundwater. <u>Know the location of your system and keep heavy vehicles and plant roots away from drain field pipes</u>. These things can compact soils and inhibit the proper functioning of the system. <u>Conserve water and stagger intensive uses</u>. Some intensive water uses include showers, laundry, dishwasher, etc. Look for ways to reduce (e.g.., full loads) and to not use all at once. <u>Have your septic tank pumped out every three to five years</u>. This is a small price to pay to ensure that your household has functioning wastewater treatment. <u>Look for "greener grass over the septic tank</u>." This could be a sign that the septic tank is failing. <u>Divert overland runoff from your property away from the drainfield area</u>. This will reduce the likelihood of saturating the soil and causing malfunctions.
County Health Departments	<u>Require regular inspections of septic systems.</u> <u>Enforce severe penalties for uncorrected septic system malfunctions.</u> <u>Ensure that citizens understand how to maintain their septic tank when they first obtain property in the county.</u>
NC Div. of Environmental Health	<u>Provide leadership to county health offices. Encourage county health offices to require regular inspections.</u> <u>Provide public education materials.</u>

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

References/Resources: Please contact the local county heath department for more specific advice.

6.6.5 Management Strategies For Controlling Toxic Substances

Toxic substances, or toxicants, routinely regulated by DWQ include metals, organics, chlorine, and ammonia, as described in Chapter 3.

The waters of the Little Tennessee River basin need to be protected from immediate acute effects and the residual chronic effects of toxic substances. Toxic limitations for point source discharges are based on the volume of the effluent released and the 7Q10 flow condition of the receiving stream. In the Little Tennessee River Basin, there are three facilities that have quarterly chronic toxicity test requirements: Franklin WWTP, Bryson City WWTP and Tuckaseigee WSA WWTP. None of these plants discharge to streams with HQW or ORW classifications. All three plants have consistently passed the toxicity tests. The Town of Highlands is not required to conduct toxicity testing because the town is a minor discharger (500,000 gallon per day flow limit) with 100 percent domestic waste. Minor dischargers with 100 percent domestic waste are given the option of ammonia limits (9 mg/l summer and 20 mg/l winter) or toxicity test requirements. The town of Highlands opted for ammonia limits, which they have consistently met.

Toxics from nonpoint sources of pollution typically enter streams during storm events through runoff from roads, parking lots, agricultural lands or golf courses. In the Little Tennessee River basin, low pH levels have been observed in many high elevation streams. These low pH levels have been attributed to chronic acid deposition and the low buffering capacity of high elevation streams in the basin. This issue is discussed further in Chapter 4. Continued research and monitoring will be important to fully understand the relationship between acid deposition and water quality and for furthering the development of policies to reduce impacts to surface waters from the chronic introduction of atmospheric pollution.

Refer to Section 6.5 for further strategies used to protect Highly Valued Resource Waters, such as HQWs and ORWs, in the basin.

6.6.6 Management Strategies For Oxygen-Consuming Wastes

Maintenance of dissolved oxygen (DO) is critical to the survival of aquatic life and to the general health of surface waters. The daily average dissolved oxygen standard for most waters in the state, except for waters classified as trout and swamp waters is 5.0 mg/l. The trout waters so prevalent in the Little Tennessee River basin have a daily average standard for dissolved oxygen of 6.0 mg/l. The major threat to oxygen levels is from point sources. Discharge permits must include limits that protect standards.

While the impact of point source discharges on dissolved oxygen is relatively low in this basin because of the naturally high reaeration rates of mountain streams, special precautions have been taken to protect HQW, ORW and trout waters from the potential impacts of point source discharges. Refer to Section 6.5 for strategies used to protect Highly Valued Resource Waters, such as HQWs and ORWs, in the basin.

6.6.7 Management Strategies for Controlling Nutrients

Control of nutrients is necessary to limit algal growth potential, to assure protection of the instream chlorophyll *a* standard and to avoid the development of nuisance conditions on the state's waterways. Point source controls are typically NPDES permit limitations on total phosphorous (TP) and total nitrogen (TN). Nonpoint controls of nutrients generally include best management practices (BMPs) to control nutrient loading from areas such as agricultural land and urban areas.

In the Little Tennessee River basin nutrient enrichment from point sources has been implicated as a potential source of water quality degradation on White Oak Creek, Cowee Creek, the West Buffalo Creek arm of Santeetlah Lake and in Sequoyah Lake near Highlands. These situations will continue to be monitored.

In addition, DWQ is aware of preliminary plans to site net pen trout farm operations in lakes in the Little Tennessee River basin. These net pen operations, if large enough in scale, can significantly increase phosphorous loading to lakes and result in local to lake-wide eutrophication. No net pen operations exist in North Carolina at present. DWQ envisions that requests for net pen production of trout be permitted only as pilot projects. Refer to Chapter 7, Section 7.3.6 for more details.

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CHAPTER 7

FUTURE INITIATIVES

7.1 OVERVIEW OF LITTLE TENNESSEE RIVER BASINWIDE GOALS AND OBJECTIVES

Near-term objectives, or those achievable at least in part during the next five years, include coordinating with various agencies to implement the control strategies outlined in Chapter 6. These strategies are aimed at reducing point and nonpoint source loadings of sedimentation, nutrients and other pollutants. These steps are necessary to progress towards restoring impaired waters, protecting threatened waters from further degradation, protecting high resource value and biologically sensitive waters and maintaining the quality of other waters currently supporting their uses.

The long-term goal of basinwide management is to protect the water quality standards and uses of the basin's surface waters while accommodating reasonable economic growth.

Attainment of these goals and objectives will require determined, widespread public support; the combined cooperation of state, local and federal agencies, agriculture, forestry, industry and development interests; and considerable financial expenditure on the parts of all involved. However, with the needed support and cooperation, DWQ believes that these goals are attainable through the basinwide water quality management approach.

7.2 FUTURE ACTIVITIES IN THE LITTLE TENNESSEE RIVER BASIN

7.2.1 Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts

Improving our knowledge of and controlling nonpoint source pollution will be a high priority over the next five years. Nonpoint source pollution is primarily responsible for the impaired and threatened waters in the Little Tennessee River Basin. The following initiatives (described in Section 7.2.2, 7.2.3 and 7.2.4) are underway to address the protection of surface waters from nonpoint sources of pollution.

7.2.2 The Little Tennessee River Basin Nonpoint Source (NPS) Team

In April 1996, DWQ contacted potential NPS Team Members in the Little Tennessee River basin. Potential NPS Team Members met to describe what is known about nonpoint sources in the basin and to obtain local input on issues and recommendations for addressing nonpoint source pollution. The team will work toward creating Action Plans consisting of voluntary commitments made by the various agencies to address nonpoint source pollution. A list of agencies which comprise the NPS Team is presented in Table 7.1.

The Action Plans will be evaluated and updated every five years as part of the basinwide planning process. A complete description of the NPS Team process can be found in Appendix VI. The responsibilities of the NPS Team members can be summarized as follows:

- Describe existing programs for nonpoint source pollutant control.
- Prioritize impaired waters for development and implementation of restoration strategies.

- Priortize NPS issues for remedial action.
- Develop five-year Action Plan for improving water quality in targeted watersheds.
- Determine what is needed to address the priority waters and NPS issues.
- Implement Action Plans.
- Monitor effectiveness of management strategies.

The team has submitted a proposal for Section 319 funding for their Action Plan for this funding cycle. The Team will focus on two projects. One project may include a plan and implementation measures to restore and protect Crawford Branch Watershed, an urban stream running through downtown Franklin. Issues that will be addressed with this project include controlling stormwater quality and quantity, eliminating illegal discharges, controlling sedimentation and erosion, restoring riparian zones to streambanks and educating citizens on water quality. The other project will be a widely focused basinwide education effort targeted at audiences of all ages. The Team hopes to hire an education coordinator to implement this project. The position will be funded with Section 319 funds and local contributions. A list of agencies which are currently active in the NPS Team is presented in Table 7.1.

Table 7.1 Current Little Tennessee River Basin NPS Team Members

Category	Agency/Group
Agriculture	USDA - Natural Resources Conservation Service NC Division of Soil and Water Conservation Southwestern NC RC&D Council Macon County Soil and Water Conservation District Swain County Soil and Water Conservation District Jackson County Soil and Water Conservation District
Construction/Mining	NC Division of Land Resources
Forestry	NC Division of Forest Resources US Forest Service
Surface water	NC Division of Water Quality NC Wildlife Resources Commission NC Division of Water Resources Tennessee Valley Authority
Urban	Division of Water Quality NC Department of Transportation
Local Government	Town of Franklin
Additional	Little Tennessee Watershed Association Streets of Franklin Heritage Association Land of Sky Regional Council Nantahala Power and Light Company Save Our Rivers, Inc.

7.2.3 Improved Monitoring Coverage and Coordination with Other Agencies

Monitoring of the chemical and biological status of receiving waters will provide critical feedback on the success of the basin management strategy. As discussed in Chapter 4, monitoring data will be collected from (1) ambient water chemistry, (2) sediment chemistry, (3) biological communities, (4) contaminant concentrations in fish and other biota, (5) ambient toxicity, and (6) facility self-monitoring data. The specific parameters measured will relate directly to the long-term water quality goals and objectives defined within the basinwide management strategy.

In addition to this, DWQ and other environmental agencies have been discussing the potential for coordination of field resources. If individuals from another environmental agency are visiting certain waterbodies to investigate fish populations or wetland areas, they could also collect water quality data from these areas. The coordination of these activities should help to better blend the activities of the various agencies.

7.2.4 Use Restoration Waters (URW) Strategy

Throughout North Carolina, there are waters that have pollution problems that prevent them from supporting their designated uses. Designated uses include aquatic life support, swimming and commercial shellfish harvest. These waters are often very difficult to restore due to the multitude of nonpoint sources contributing pollutants to the waterbody. Point source dischargers may also be a source of the impairment.

To address waters that have a persistent loss (full or partial) of designated uses, the Division of Water Quality is developing a Use Restoration Waters (URW) Program. If approved, this program would include voluntary and regulatory management strategies to control the specific parameters of concern in selected impaired watersheds. These voluntary and mandatory management strategies could include:

- site-specific best management practices for nonpoint sources,
- source reduction strategies such as education and land use planning,
- ecosystem restoration,
- wastewater treatment requirements, and
- other waste treatment management requirements.

The restoration strategies developed under the URW program would be site-specific to the watershed of the impaired waterbody. DWQ and stakeholders would coordinate each URW strategy with other agencies' programs to create a holistic approach to address the array of pollution problems in the watersheds

7.3 PROGRAMMATIC INITIATIVES

7.3.1 NPDES Program Initiatives

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes to municipal wastewater treatment plants so as to reduce the toxicity in effluent wastes;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or use of alternative disinfection methods;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for enlargement well before they reach capacity.

Longer-term objectives will include refining overall management strategies after obtaining feedback on current management efforts during the next round of water quality monitoring. Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling byproducts of the treatment process (including nonpotable reuse of treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

7.3.2 Use of Discharger Self-Monitoring Data

DWQ will continue to explore the possibilities of making greater use of discharger self-monitoring data to augment the data it collects through the programs described in Chapter 4. Quality assurance, timing and consistency of data from plant to plant would have to be addressed. Also, a system would need to be developed to enter the data into a computerized database for later analysis. One method of data collection that is currently being explored includes developing a comprehensive list of monitoring sites for the basin that would be monitored by an Association of NPDES dischargers with data input to STORET. A basinwide sampling program has been established for dischargers in the Neuse River Basin and to date appears to be successful.

7.3.3 Promotion of Non-Discharge Alternatives/Regionalization

DWQ requires all new and expanding dischargers to submit an alternatives analysis as part of its NPDES permit application. Non-discharge alternatives, including tying on to an existing WWTP or land-applying wastes are preferred from an environmental standpoint. If the Division determines that there is an economically reasonable alternative to a discharge, DWQ may recommend denial of the NPDES permit.

7.3.4 Coordinating Basinwide Management With the Construction Grants and Loans Program

The potential exists to use the basinwide planning process as a means of identifying and prioritizing wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. Completed basin documents are provided to this office for their use.

7.3.5 Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data including permitted dischargers, waste limits, compliance information, water quality data, stream classifications, and so on, will be put in a central data center which will then be made accessible to most staff at desktop computer stations. Much of this information is also being entered into the state's GIS computer system (Center for Geographic Information and Analysis or CGIA). As this and other information is made available to the GIS system, including land use data from satellite or air photo interpretation, and as the system becomes more user friendly, the potential to graphically display the results of water quality data analysis will be tremendous.

Research Triangle Institute performed a pilot study in the Tar-Pamlico River Basin in which high priority waterbodies for nonpoint source control programs were mapped. These maps were used by the various nonpoint source agencies for planning purposes. As resources become available, this tool will be developed for other basins.

7.3.6 Trout Farm Net Pen Operations in Lakes

DWQ has been made aware of preliminary plans to site trout farms in mountain lakes. Such "net pen" operations have the potential to produce tons of fish per year and can be large enough to have significant environmental consequences. Although there are no proposed major net pen operations at present, DWQ has reviewed several draft proposals to establish net pens in mountain lakes. The potential for phosphorus loading to lakes appears to be the most likely environmental threat from these operations. Phosphorus entering a lake from a net pen may cause both local and lake-wide euthrophication.

At present, there is not sufficient data available to accurately predict the short or long term effects of the proposed nets pens on water quality. Calibration of a water quality model to predict water quality impacts will require not only better information about the receiving waters, but better information about the operation of the net pens themselves. No large scale net pens are presently operated in North Carolina lakes or in similar lakes in other areas. Therefore, DWQ has recommended that any proposed net pen facilities be permitted only as a pilot project. Any such permitted pilot project would be required to conduct intensive water quality studies of the proposed site both before and during operation. Data will be required so that DWQ can make an accurate assessment of any local or lake-wide effects of net pen operation. Full scale net pen operations can not be permitted until data is available to demonstrate that water quality will not be significantly degraded by net pen operation.

In general North Carolina mountain lakes receive very low concentrations of phosphorus. This low phosphorus loading is a significant factor in maintaining the excellent water quality of many mountain lakes. Therefore, if appropriate pilot projects are proposed, DWQ will work carefully to ensure that both the phosphorus loading to the receiving waters does not cause water quality degradation and that sufficient data is collected to predict the environmental effects of other full scale net pen operations.

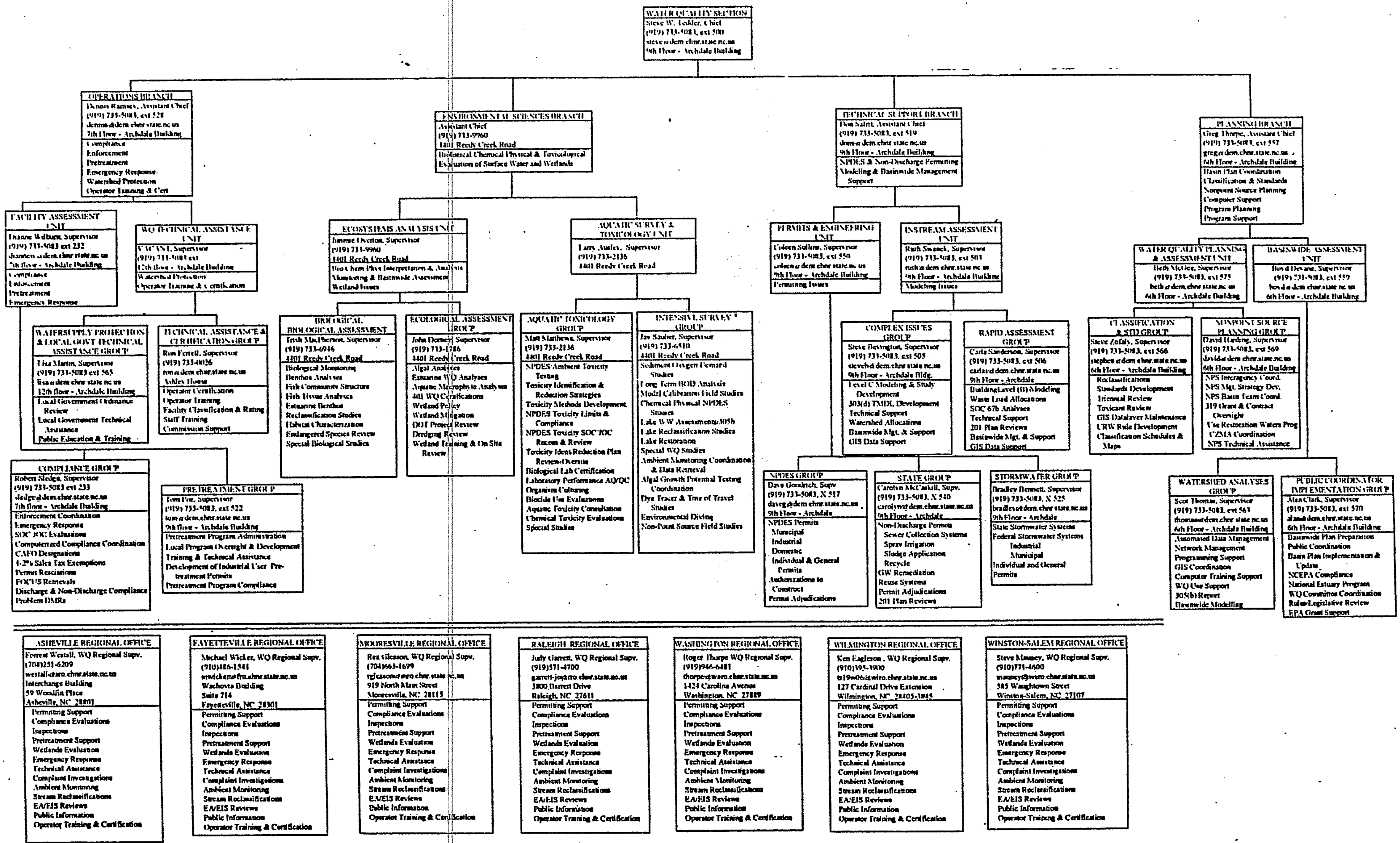
APPENDIX I

Division of Water Quality, Water Quality Section Organizational Duties Chart

WATER QUALITY SECTION

ORGANIZATIONAL DUTIES CHART

Date: December 27, 1995



APPENDIX II

- Summary of North Carolina's Water Quality Classifications and Standards
- Antidegradation Policy
- High Quality Waters
- Outstanding Resource Waters
- Classifications and Water Quality Standards Assigned to the Waters of the Little Tennessee River Basin

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS[1]	STORMWATER MANAGEMENT	OTHER REQUIREMENTS[2]
Freshwater:				
C (standards apply to all freshwaters, unless pre-empted by more stringent standard for more protective classification)	Secondary recreation (including swimming on an unorganized or infrequent basis); wildlife; fish and other aquatic life propagation and survival; agriculture and any other usage, except for primary recreation, water supply or other food-related ruses	Domestic and industrial wastewater dischargers allowed	Stormwater Management Rules apply in the 20 coastal counties as described in 15A NCAC 2H .1000	
B	Primary recreation (swimming on an organized or frequent basis) and all uses specified for Class C (and not water supply or other food-related uses)	Same as for Class C; wastewater treatment reliability requirements (dual train design; backup power capability) may apply to protect swimming uses (15A NCAC 2H .0124)	Same as for Class C	
WS-I Water Supply	Water supplies in natural and undeveloped watersheds	No point source discharges	Not applicable since watershed is undeveloped	No landfills; residual or petroleum contaminated soils application not allowed in the watershed
WS-II Water Supply	Water supplies in predominantly undeveloped watersheds	Only general permit wastewater discharges allowed in watershed	Local land management program required as per 15A NCAC 2B .0214; 6% built upon area in Critical Area; 12% built upon area in the Balance of the Watershed; up to 24% built upon area in the Critical Area and 30% in the Balance of the Watershed allowed with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area and no new discharging landfills outside of Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area
WS-III Water Supply	Water supplies in low to moderately developed watersheds	General permits allowed throughout watershed; domestic and non-process industrial discharges allowed outside of the Critical Area	Local land management program required as per 15A NCAC 2B .0215; 12% built upon area in Critical Area; 24% built upon area outside of Critical Area; up to 30% in Critical Area and 50% built upon area outside Critical Area allowed with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area and no new discharging landfills outside of the Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS[1]	STORMWATER MANAGEMENT	OTHER REQUIREMENTS[2]
WS-IV Water Supply	Water supplies in moderately to highly developed watersheds	General permits, domestic and industrial discharges allowed throughout watershed[4]	Local land management program required as per 15A NCAC 2B .0216: 24% built upon area in Critical Area and Protected Area [5,6]; up to 50% in Critical Area and 70% built upon area outside Critical Area with engineered stormwater controls for the 1" storm[3]	Buffers required along perennial waters; no new landfills allowed in the Critical Area; no new residual or petroleum contaminated soils application allowed in the Critical Area
WS-V Water Supply	Former or industrial use water supplies	No categorical restrictions on development or wastewater dischargers	Stormwater Management Rules apply in the 20 coastal counties as described in 15A NCAC 2H .1000	Instream water quality standards for water supply waters are applicable

NOTES: Please refer to 15A NCAC 2B .0101, .0104, .0202, .0211 and .0301 for more specific requirements for surface water supply protection.

1 Groundwater remediation discharges allowed when no alternative exists.
2 See attached tables: *Water Quality Standards for Freshwater Classes* and *Water Quality Standards for Saltwater Classes* for numeric standards associated with specific classes.
3 If the high density option is utilized engineered stormwater control systems must be designed for 85% TSS removal. Refer to Stormwater Management Rules (15 A NCAC 2H .1000) for specific design information.
4 New industrial process wastewater discharges in the Critical Area are allowed but must meet additional treatment requirements.
5 Applies to projects requiring an Erosion/Sedimentation Control Plan.
6 36% built-upon area is allowed for projects without a curb and gutter street system in the Protected Area.

- Critical area is 1/2 mile and draining to water supplies from normal pool elevation of reservoirs, or 1/2 mile and draining to a river intake.
- Protected Area is 5 miles and draining to water supplies from normal pool elevation of reservoirs, or 10 miles upstream of and draining to a river intake.
- Agricultural activities are subject to provisions of the Food Security Act of 1985 and the Food, Agriculture, Conservation and Trade Act of 1990. In WS-I watersheds and Critical Areas of WS-II, WS-III and WS-IV areas, agricultural activities must maintain a 10 foot vegetated buffer or equivalent control as determined by the Soil and Water Conservation Commission.
- Silviculture activities are subject to the provisions of the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0101-.0209).
- The Department of Transportation must use BMPs as described in their document, "Best Management Practices for Protection of Surface Waters".

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

PRIMARY CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
Saltwater:				
SC	Saltwaters protected for secondary recreation, aquatic life propagation and survival and other uses as described for Class C	Domestic and industrial wastewater discharges allowed	Stormwater Management Rules (15A NCAC 2H .1000) apply to all waters in the 20 coastal counties; low density option: 30% built upon area or structural stormwater controls with higher density, as specified	
SB	Saltwaters protected for primary recreation and all Class SC uses (similar to Class B)	Same as Class SC; wastewater treatment reliability requirements (dual train design; backup power capability) may apply to protect swimming uses (15A NCAC 2H .0124)	Same as for Class SC	
SA	Shellfishing and all Class SC and SB uses	No domestic discharges and only non-process industrial discharges such as seafood packing houses or cooling water discharges	Same as for Class SC except low density option is 25% built upon area	

Supplemental Classifications are added to the primary classifications as appropriate (Examples include Class C-NSW, Class SA-ORW, Class B-Trout, etc.) and impose additional requirements.

SUPPLEMENTAL CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
HQW High Quality Waters	Waters rated as Excellent by DEM; Primary Nursery Areas; Native or Special Native Trout Waters; WS-I, WS-II and SA waters are HQW by definition	For new or expanded discharges advanced treatment requirements are: BOD_5=5 mg/l; NH_3-N= 2 mg/l; DO=6 mg/l	For projects requiring Erosion/ Sedimentation Control Plan and that are within 1 mile and draining to HQW waters: 12% built upon area or higher density with engineered structural controls allowed; WS-I, WS-II and 20 coastal counties exempt since stormwater control requirements already apply	Other treatment requirements may apply, dependent upon type of discharge and characteristics of receiving waters (see Antidegradation Policy: Rule 15A: NCAC 2B .0201)

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (continued)

SUPPLEMENTAL CLASSIFICATIONS	BEST USAGE	DISCHARGE RESTRICTIONS	STORMWATER MANAGEMENT	OTHER REQUIREMENTS
ORW Outstanding Resource Waters	Unique and special waters having exceptional water quality and being of an exceptional state or national ecological or recreational significance; must meet other conditions and have 1 or more of 5 outstanding resource value criteria as described in Rule 15A NCAC 2B .0225	Water quality must clearly maintain and protect uses, including outstanding resource values; management strategies must include at a minimum: no new or expanded discharges to freshwater ORWs; some discharges may be allowed in coastal areas	Same as for High Quality Waters for Freshwater ORWs; for Saltwater ORWs, development activities within a 575' buffer must comply with the low density option of the Stormwater Management Rules (generally 25% built upon area around SA waters and 30% around other waters)	Other management strategy components as described in 15A NCAC 2B .0225
TR Trout Waters	Protected for natural trout propagation and survival of stocked trout	Domestic and industrial wastewater discharges allowed with stricter treatment requirements		More protective standards for cadmium, total residual chlorine, chlorophyll-a, dissolved oxygen, turbidity and toluene to protect these sensitive species
NSW Nutrient Sensitive Waters	Waters needing additional nutrient management due to their being subject to excessive growth of microscopic and macroscopic vegetation	No increase of nutrients over background levels permitted; domestic and industrial wastewater discharges allowed	Nutrient management strategies developed on a case-by-case basis	Nutrient management strategies developed on a case-by-case basis
SW Swamp Waters	Waters with low velocities and other characteristics different from other waterbodies (generally, low pH, DO, high organic content)			pH as low as 4.3 and DO less than 5 mg/l allowed if due to natural conditions
FWS Future Water Supply	Waters designated for future water supply use	Discharge restrictions will be reflective of those of primary water supply classification	Stormwater management options will be reflective of those of primary water supply classification; not required until after FWS supplemental classification is removed	Requirements for landfill permits, NPDES wastewater discharges, land application of residuals and road construction activities in Critical Area and Balance of Watershed or Protected Area as appropriate (15A NCAC 2H .0101)

Water Quality Standards For Freshwater Classifications

April 1, 1996

Parameters (ug/l unless noted)	Standards for All Freshwater *		Standards to Support Additional Uses			
	Aquatic Life	Human Health[1]	WS Classes[2]	Trout Waters	HQW	Swamp Waters
Arsenic	50					
Barium			1000			
Benzene		71.4	1.19			
Beryllium	6.5	0.117	0.0068			
Cadmium	2.0			0.4		
Carbon tetrachloride		4.42	0.254			
Chloride	230000 (AL)		250000			
Chlorinated benzenes			488 (N)			
Chlorine, total residual	17 (AL)			17		
Chlorophyll a, corrected	40 (N)			15 (N)		
Chromium, total	50					
Coliform, total (MFTCC/100ml)[3]			50 (N)[4]			
Coliform, fecal (MFFCC/100ml)[3]		200 (N)				
Copper, total	7 (AL)					
Cyanide	5.0					
Dioxin		0.000000014	0.000000013			
Dissolved gases	(N)					
Dissolved oxygen (mg/l)	5.0[5]			6.0		(N)[6]
Fluoride	1800					
Hardness, total (mg/l)			100			
Hexachlorobutadiene		49.7	0.445			
Iron (mg/l)	1 (AL)					
Lead	25 (N)					
Manganese			200			
MBAS (Methylene-Blue-Active-Substances)	500					
Mercury	0.012					
Nickel	88		25			
Nitrate nitrogen			10			
Pesticides						
Aldrin	0.002	0.000136	0.000127			
Chlordane	0.004	0.000588	0.000575			
DDT	0.001	0.000591	0.000588			
Demeton	0.1					
Dieldrin	0.002	0.000144	0.000135			
Endosulfan	0.05					
Endrin	0.002					
Guthion	0.01					
Heptachlor	0.004	0.000214	0.000208			
Lindane	0.01					
Methoxychlor	0.03					
Mirex	0.001					
Parathion	0.013					
Toxaphene	0.0002					
2,4-D			100			
2,4,5-TP (Silvex)			10			
pH (units)	6.0-9.0					(N)[6]
Phenolic coumpounds		(N)	1.0 (N)			
Polychlorinated biphenyls[7]	0.001	0.000079				
Polynuclear aromatic hydrocarbons[8]		0.0311	0.0028			
Radioactive substances		(N)				
Selenium	5					
Silver	0.06 (AL)					
Solids, total dissolved (mg/l)			500			
Solids, total suspended (mg/l)					10 Tr, 20 other	
Solids, settleable	(N)					
Sulfates			250000			
Temperature	(N)					
Tetrachloroethane (1,1,2,2)		10.8	0.172			
Tetrachlorethylene			0.8			
Toluene	11			0.36		
Toxic substances	(N)				(N)	
Trialkyltin	0.008					
Trichloroethylene		92.4	3.08			
Turbidity (NTU)	50; 25 (N)			10 (N)		
Vinyl chloride		525	2.0			
Zinc	50 (AL)					

* These standards apply to all freshwater classifications. For the protection of WS and supplemental classifications, standards listed under Standards to Support Additional Uses should be used unless standards for aquatic life or human health are listed and are more stringent.

(AL) Values represent action levels as specified in 2B .0211. WS Classes - Water Supply Classifications, same standards for all WS Classes,

(N) See 2B .0211 for narrative description of limits. HQW - High Quality Waters, standards for HQW areas only. Tr - Trout Waters.

1 Human health standards are based on consumption of fish only unless dermal contact studies available. See 2B .0208 for equation.

2 Water Supply standards are based on consumption of fish and water. See 2B .0208 for equation.

3 MFTCC/100ml means membrane filter total coliform count per 100 ml of sample. MFFCC/100ml means membrane filter fecal coliform count per 100 ml of sample.

4 Applies only to unfiltered water supplies.

5 An instantaneous reading may be as low as 4.0 mg/l, but the daily average must be 5.0 mg/l or more.

6 Designated swamp waters may have a dissolved oxygen less than 5.0 mg/l and a pH as low as 4.3, if due to natural conditions.

7 Applies to total PCBs present and includes PCB 1242, 1254, 1221, 1232, 1248, 1260, and 1016. See 2B .0208 & .0211.

8 Applies to total PAHs present and includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. See 2B .0208, .0212, .0214, .0215, .0216, & .0218.

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April 1, 1996

Water Quality Standards For Saltwater Classifications

Parameters (ug/l unless noted)	Standards for All Saltwater: Aquatic Life	Standards for All Saltwater: Human Health[1]	Standards to Support Additional Uses: Class SA	Standards to Support Additional Uses: HQW	Standards to Support Additional Uses: Swamp Waters
Arsenic	50				
Benzene		71.4			
Beryllium		0.117			
Cadmium	5.0				
Carbon tetrachloride		4.42			
Chlorophyll a	40 (N)				
Chromium, total	20				
Coliform, fecal (MFFCC/100ml)[2]		200 (N)	14 (N)		
Copper	3 (AL)				
Cyanide	1.0				
Dioxin		0.000000014			
Dissolved gases	(N)				
Dissolved oxygen (mg/l)	5.0			6.0	(N)[3]
Hexachlorobutadiene		49.7			
Lead	25 (N)				
Mercury	0.025				
Nickel	8.3				
Pesticides					
Aldrin	0.003	0.000136			
Chlordane	0.004	0.000588			
DDT	0.001	0.000591			
Demeton	0.1				
Dieldrin	0.0002	0.000144			
Endosulfan	0.009				
Endrin	0.002				
Guthion	0.01				
Heptachlor	0.004	0.000214			
Lindane	0.004				
Methoxychlor	0.03				
Mirex	0.001				
Parathion	0.178				
Toxaphene	0.0002				
pH (units)	6.8-8.5				(N)[3]
Phenolic compounds		(N)			
Polychlorinated biphenyls[4]	0.001	0.000079			
Polynuclear aromatic hydrocarbons[5]	0.0311				
Radioactive substances		(N)			
Salinity	(N)				
Selenium	71				
Silver	0.1 (AL)				
Solids, total suspended (mg/l)				10 PNA, 20 other	
Solids, settleable (mg/l)	(N)				
Temperature	(N)				
Tetrachloroethane (1,1,2,2)		10.8			
Toxic substances	(N)			(N)	
Trialkyltin	0.002				
Trichloroethylene		92.4			
Turbidity (NTU)	25 (N)				
Vinyl chloride		525			
Zinc	86 (AL)				

(AL) Values represent action levels as specified in 2B .0220.
(N) See 2B .0220 for narrative description of limits.
HQW - High Quality Waters, standards for HQW areas only.

Class SA - shellfishing waters see 2B .0101 for description.
PNA - Primary Nursery Areas

1 Human health standards are based on consumption of fish only unless dermal contact studies are available. See 2B .0208 for equation.
2 MFFCC/100ml means membrane filter fecal coliform count per 100 ml of sample.
3 Designated swamp waters may have a dissolved oxygen less than 5.0 mg/l and a pH as low as 4.3, if due to natural conditions.
4 Applies to total PCBs present and includes PCB 1242, 1254, 1221, 1232, 1248, 1260, and 1016. See 2B .0208 & .0220.
5 Applies to total PAHs present and includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. See 2B .0208.

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Classification		Dischargers	Allowable Development W/O Stormwater, Low Density Opt.	Allowable Development W/Stormwater, High Density Opt.	Required Control with High Density Opt.	10%/70% (5) Provision	Residuals Appl.	Landfills	Agriculture BMPs
WS-I	Watershed	None	None	None	None	None	None	None	(6) Required
WS-II	Critical Area	General Permits	(2) 1du/2ac or 6% built upon	6-24% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Watershed	General Permits	1du/ac or 12% built upon	12-30% built upon area	Control the 1" storm	Allowed	Allowed	No new discharging landfills	(6) Not Required
WS-III	Critical Area	General Permits	1du/ac or 12% built upon	12-30% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Watershed	Domestic & non-process industrial	2du/ac or 24% built upon	24-50% built upon area	Control the 1" storm	Allowed	Allowed	No new discharging landfills	(6) Not Required
WS-IV	Critical Area	Domestic & (1) industrial	(3) 2du/ac or 24% built upon	(3) 24-50% built upon area	Control the 1" storm	Not allowed	No new sites	No new landfills	(6) Required
	Protected Area	Domestic & industrial	(3,4) 2du/ac or 24% built upon	(3,4) 24-70% built upon area	Control the 1" storm	Allowed	Allowed	Allowed	(6) Not Required
WS-V	Watershed or River Segment	Domestic, Industrial	No categorical restrictions other than instream water quality standards applicable to all surface water supply waters.						

NOTE: Critical area is one-half mile and draining to water supplies from the normal pool elevation of reservoirs, or one-half mile and draining to a river intake.
Protected area is five miles and draining to water supplies from the normal pool elevation of reservoirs, or ten miles upstream of and draining to a river intake.
Municipal with pretreatment program (2H .0904) is considered industrial discharge.
Discharges qualifying for a General Permit pursuant to 2H .0127 will also be allowed in all areas of WS-III and WS-IV watersheds along with the allowed discharges noted in the table.
Buffers will be maintained around all perennial waters with a minimum width of thirty feet for low density development and a minimum one hundred foot buffer for high density development.
Groundwater remediation discharges may be allowed when no other practicable alternative exists.
Local governments will assume ultimate responsibility for operation and maintenance of stormwater controls.
(1) New industrial process wastewater discharges are allowed but will require additional treatment requirements.
(2) Residential development may apply dwelling units per acre or use percent built-upon surface area. Non-residential development must use percent built-upon surface area.
(3) Applies only to projects requiring a Sedimentation/Erosion Control Permit.
(4) One third acre lot or 36% built-upon area is allowed for projects without curb and gutter street systems.
(5) Allowed; can use 10% of jurisdiction for new development and expansions to existing development up to 70% built-upon area, without stormwater controls, if using low density option throughout remainder of water supply.
(6) In WS-I watersheds and critical areas of WS-II, WS-III and WS-IV watersheds, agricultural operations must maintain a 10 foot vegetated buffer, or equivalent control along all perennial streams. Animal operations deemed permitted and permitted are allowed in all water supply watersheds.

.0201 ANTIDEGRADATION POLICY

(a) It is the policy of the Environmental Management Commission to maintain, protect, and enhance water quality within the State of North Carolina. Pursuant to this policy, the requirements of 40 CFR 131.12 are hereby incorporated by reference including any subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Water Quality, Water Quality Section, 512 North Salisbury Street, Raleigh, North Carolina. Copies may be obtained from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9325 at a cost of thirteen dollars ($13.00). These requirements shall be implemented in North Carolina as set forth in Paragraphs (b), (c), (d), (e) and (f) of this Rule.

(b) Existing uses, as defined by Rule .0202 of this Section, and the water quality to protect such uses shall be protected by properly classifying surface waters and having standards sufficient to protect these uses. In cases where the Commission or its designee determines that an existing use is not included in the classification of waters, a project which shall affect these waters shall not be permitted unless the existing uses are protected.

(c) The Commission shall consider the present and anticipated usage of waters with quality higher than the standards, including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and shall not allow degradation of the quality of waters with quality higher than the standards below the water quality necessary to maintain existing and anticipated uses of those waters. Waters with quality higher than the standards are defined by Rule .0202 of this Section. The following procedures shall be implemented in order to meet these requirements:

(1) Each applicant for an NPDES permit or NPDES permit expansion to discharge treated waste shall document an effort to consider non-discharge alternatives pursuant to 15A NCAC 2H .0105(c)(2).

(2) Public Notices for NPDES permits shall list parameters that would be water quality limited and state whether or not the discharge shall use the entire available load capacity of the receiving waters and may cause more stringent water quality based effluent limitations to be established for dischargers downstream.

(3) The Division may require supplemental documentation from the affected local government that a proposed project or parts of the project are necessary for important economic and social development.

(4) The Commission and Division shall work with local governments on a voluntary basis to identify and develop appropriate management strategies or classifications for waters with unused pollutant loading capacity to accommodate future economic growth.

Waters with quality higher than the standards shall be identified by the Division on a case-by-case basis through the NPDES permitting and waste load allocation processes (pursuant to the provisions of 15A NCAC 2H .0100). Dischargers affected by the requirements of Paragraphs (c)(1) through (c)(4) of this Rule and the public at large shall be notified according to the provisions described herein, and all other appropriate provisions pursuant to 15A NCAC 2H .0109. If an applicant objects to the requirements to protect waters with quality higher than the standards and believes degradation is necessary to accommodate important social and economic development, the applicant may contest these requirements according to the provisions of General Statute 143-215.1(e) and 150B-23.

(d) The Commission shall consider the present and anticipated usage of High Quality Waters (HQW), including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and shall not allow degradation of the quality of High Quality Waters below the water quality necessary to maintain existing and anticipated uses of those waters. High Quality Waters are a subset of waters with quality higher than the standards and are as described by 15A NCAC 2B .0101(e)(5). The procedures described in Rule .0224 of this Section shall be implemented in order to meet the requirements of this part.

(e) Outstanding Resource Waters (ORW) are a special subset of High Quality Waters with unique and special characteristics as described in Rule .0225 of this Section. The water quality of waters classified as ORW shall be maintained such that existing uses, including the outstanding resource values of said Outstanding Resource Waters, shall be maintained and protected.

(f) Activities regulated under Section 404 of the Clean Water Act (33 U.S.C. 1344) which require a water quality certification as described in Section 401 of the Clean Water Act (33 U.S.C. 1341) shall be evaluated according to the procedures outlined in 15A NCAC 2H .0500. Activities which receive a water quality certification pursuant to these procedures shall not be considered to remove existing uses. The evaluation of permits issued pursuant to G.S. 143-215.1 that involve the assimilation of wastewater or stormwater by wetlands shall incorporate the criteria found in 15A NCAC 2H .0506(c) (1)-(5) in determining the potential impact of the proposed activity on the existing uses of the wetland per 15A NCAC 2H .0231.

History Note: *Authority G.S. 143-214.1; 143-215.1; 143-215.3(a)(1);*
Eff. February 1, 1976;

Amended Eff. October 1, 1995; February 1, 1993; April 1,1991; August 1, 1990;
RRC Objection Eff. July 18, 1996 due to lack of statutory authority and ambiguity;
Amended Eff. October 1, 1996.

.0223 NUTRIENT SENSITIVE WATERS

(a) In addition to existing classifications, the Commission may classify any surface waters of the state as nutrient sensitive waters (NSW) upon a finding that such waters are experiencing or are subject to excessive growths of microscopic or macroscopic vegetation. Excessive growths are growths which the Commission in its discretion finds to substantially impair the use of the water for its best usage as determined by the classification applied to such waters.

(b) NSW may include any or all waters within a particular river basin as the Commission deems necessary to effectively control excessive growths of microscopic or macroscopic vegetation.

(c) For the purpose of this Rule, the term "nutrients" shall mean phosphorous or nitrogen. When considering the assignment of this classification, the Commission may specify as a "nutrient" any other chemical parameter or combination of parameters which it determines to be essential for the growth of microscopic and macroscopic vegetation.

(d) Those waters additionally classified as nutrient sensitive shall be identified in the appropriate schedule of classifications as referenced in Section .0300 of this Subchapter.

(e) For the purpose of this Rule, the term "background levels" shall mean the concentration(s), taking into account seasonal variations, of the specific nutrient or nutrients upstream of a nutrient source.

(f) Quality standards applicable to NSW: no increase in nutrients over background levels unless it is shown to the satisfaction of the Director that the increase:

(1) is the result of natural variations; or
(2) will not endanger human health, safety or welfare and that preventing the increase would cause a serious economic hardship without equal or greater benefit to the public.

History Note: *Authority G.S. 143-214.1;*
Eff. October 1, 1995.

.0224 HIGH QUALITY WATERS

High Quality Waters (HQW) are a subset of waters with quality higher than the standards and are as described by 15A NCAC 2B .0101(e)(5). The following procedures shall be implemented in order to implement the requirements of Rule .0201(d) of this Section.

(1) New or expanded wastewater discharges in High Quality Waters shall comply with the following:
   (a) Discharges from new single family residences shall be prohibited. Those existing subsurface systems for single family residences which fail and must discharge shall install a septic tank, dual or recirculating sand filters, disinfection and step aeration.
   (b) All new NPDES wastewater discharges (except single family residences) shall be required to provide the treatment described below:
      (i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: $BOD_5 = 5$ mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. More stringent limitations shall be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen-consuming wastes shall not cause the DO of the receiving water to drop more than 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations shall assume a percent saturation determined by staff to be generally applicable to that hydroenvironment.
      (ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 10 mg/l for trout waters and PNA's, and to 20 mg/l for all other High Quality Waters.
      (iii) Disinfection: Alternative methods to chlorination shall be required for discharges to trout streams, except that single family residences may use chlorination if other options are not economically feasible. Domestic discharges are prohibited to SA waters.
      (iv) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or

equivalent failsafe treatment designs.

(v) Volume: The total volume of treated wastewater for all discharges combined shall not exceed 50 percent of the total instream flow under 7Q10 conditions.

(vi) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(vii) Toxic substances: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor shall be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent shall be allocated at one-half of the normal standard at design conditions. Whole effluent toxicity shall be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration of 90 percent. Ammonia toxicity shall be evaluated according to EPA guidelines promulgated in "Ambient Water Quality Criteria for Ammonia - 1984"; EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784) or "Ambient Water Quality Criteria for Ammonia (Saltwater) - 1989"; EPA document number 440/5-88-004; NTIS number PB89-169825. This material related to ammonia toxicity is hereby incorporated by reference including any subsequent amendments and editions and is available for inspection at the Department of Environment, Health, and Natural Resources Library, 512 North Salisbury Street, Raleigh, North Carolina. Copies may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 at a cost of forty-seven dollars ($47.00).

(c) All expanded NPDES wastewater discharges in High Quality Waters shall be required to provide the treatment described in Sub-Item (1)(b) of this Rule, except for those existing discharges which expand with no increase in permitted pollutant loading.

(2) Development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B .0218, and which drain to and are within one mile of High Quality Waters (HQW) shall be required to follow the stormwater management rules as specified in 15A NCAC 2H .1000. Stormwater management requirements specific to HQW are described in 15A NCAC 2H .1006.

If an applicant objects to the requirements to protect high quality waters and believes degradation is necessary to accommodate important social and economic development, the applicant may contest these requirements according to the provisions of G.S. 143-215.1(e) and 150B-23.

History Note: *Authority G.S. 143-214.1; 143-215.1; 143-215.3(a)(1);*
Eff. October 1, 1995;
Amended Eff. April 1, 1996.

.0225 OUTSTANDING RESOURCE WATERS

(a) General. In addition to the existing classifications, the Commission may classify certain unique and special surface waters of the state as outstanding resource waters (ORW) upon finding that such waters are of exceptional state or national recreational or ecological significance and that the waters have exceptional water quality while meeting the following conditions:

(1) there are no significant impacts from pollution with the water quality rated as excellent based on physical, chemical or biological information;

(2) the characteristics which make these waters unique and special may not be protected by the assigned narrative and numerical water quality standards.

(b) Outstanding Resource Values. In order to be classified as ORW, a water body must exhibit one or more of the following values or uses to demonstrate it is of exceptional state or national recreational or ecological significance:

(1) there are outstanding fish (or commercially important aquatic species) habitat and fisheries;

(2) there is an unusually high level of water-based recreation or the potential for such recreation;

(3) the waters have already received some special designation such as a North Carolina or National Wild and Scenic River, Native or Special Native Trout Waters, National Wildlife Refuge, etc, which do not provide any

water quality protection;

(4) the waters represent an important component of a state or national park or forest; or

(5) the waters are of special ecological or scientific significance such as habitat for rare or endangered species or as areas for research and education.

(c) Quality Standards for ORW.

(1) Freshwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values shall be developed on a site specific basis during the proceedings to classify waters as ORW. At a minimum, no new discharges or expansions of existing discharges shall be permitted, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an appropriate local erosion and sedimentation control program shall be required to follow the stormwater provisions as specified in 15A NCAC 2H .1000. Specific stormwater requirements for ORW areas are described in 15A NCAC 2H .1007.

(2) Saltwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values shall be developed on a site-specific basis during the proceedings to classify waters as ORW. At a minimum, new development shall comply with the stormwater provisions as specified in 15A NCAC 2H .1000. Specific stormwater management requirements for saltwater ORWs are described in 15A NCAC 2H .1007. New non-discharge permits shall meet reduced loading rates and increased buffer zones, to be determined on a case-by-case basis. No dredge or fill activities shall be allowed where significant shellfish or submerged aquatic vegetation bed resources occur, except for maintenance dredging, such as that required to maintain access to existing channels and facilities located within the designated areas or maintenance dredging for activities such as agriculture. A public hearing is mandatory for any proposed permits to discharge to waters classified as ORW.

Additional actions to protect resource values shall be considered on a site specific basis during the proceedings to classify waters as ORW and shall be specified in Paragraph (e) of this Rule. These actions may include anything within the powers of the commission. The commission shall also consider local actions which have been taken to protect a water body in determining the appropriate state protection options. Descriptions of boundaries of waters classified as ORW are included in Paragraph (e) of this Rule and in the Schedule of Classifications (15A NCAC 2B .0302 through .0317) as specified for the appropriate river basin and shall also be described on maps maintained by the Division of Environmental Management.

(d) Petition Process. Any person may petition the Commission to classify a surface water of the state as an ORW. The petition shall identify the exceptional resource value to be protected, address how the water body meets the general criteria in Paragraph (a) of this Rule, and the suggested actions to protect the resource values. The Commission may request additional supporting information from the petitioner. The Commission or its designee shall initiate public proceedings to classify waters as ORW or shall inform the petitioner that the waters do not meet the criteria for ORW with an explanation of the basis for this decision. The petition shall be sent to:

Director
DEHNR/Division of Environmental Management
~~P.O. Box 29535~~
Raleigh, North Carolina 27626-0535

The envelope containing the petition shall clearly bear the notation: RULE-MAKING PETITION FOR ORW CLASSIFICATION.

(e) Listing of Waters Classified ORW with Specific Actions. Waters classified as ORW with specific actions to protect exceptional resource values are listed as follows:

(1) Roosevelt Natural Area [White Oak River Basin, Index Nos. 20-36-9.5-(1) and 20-36-9.5-(2)] including all fresh and saline waters within the property boundaries of the natural area shall have only new development which complies with the low density option in the stormwater rules as specified in 15A NCAC 2H .1005(2)(a) within 575 feet of the Roosevelt Natural Area (if the development site naturally drains to the Roosevelt Natural Area).

(2) Chattooga River ORW Area (Little Tennessee River Basin and Savannah River Drainage Area): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section. However, expansions of existing discharges to these segments shall be allowed if there is no increase in pollutant loading:

(A) North and South Fowler Creeks,
(B) Green and Norton Mill Creeks,
(C) Cane Creek,
(D) Ammons Branch,
(E) Glade Creek, and
(F) Associated tributaries.

(3) Henry Fork ORW Area (Catawba River Basin): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section:
(A) Ivy Creek,
(B) Rock Creek, and
(C) Associated tributaries.

(4) South Fork New and New Rivers ORW Area [New River Basin (Index Nos. 10-1-33.5 and 10)]: the following management strategies, in addition to the discharge requirements specified in Subparagraph (c)(1) of this Rule, shall be applied to protect the designated ORW areas:
(A) Stormwater controls described in Subparagraph (c)(1) of this Rule shall apply within one mile and draining to the designated ORW areas;
(B) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW shall be permitted such that the following water quality standards are maintained in the ORW segment:
(i) the total volume of treated wastewater for all upstream discharges combined shall not exceed 50 percent of the total instream flow in the designated ORW under 7Q10 conditions;
(ii) a safety factor shall be applied to any chemical allocation such that the effluent limitation for a specific chemical constituent shall be the more stringent of either the limitation allocated under design conditions (pursuant to 15A NCAC 2B .0206) for the normal standard at the point of discharge, or the limitation allocated under design conditions for one-half the normal standard at the upstream border of the ORW segment;
(iii) a safety factor shall be applied to any discharge of complex wastewater (those containing or potentially containing toxicants) to protect for chronic toxicity in the ORW segment by setting the whole effluent toxicity limitation at the higher (more stringent) percentage effluent determined under design conditions (pursuant to 15A NCAC 2B .0206) for either the instream effluent concentration at the point of discharge or twice the effluent concentration calculated as if the discharge were at the upstream border of the ORW segment;
(C) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW shall comply with the following:
(i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: BOD = 5 mg/l, and NH3-N = 2 mg/l;
(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 10 mg/l for trout waters and to 20 mg/l for all other waters;
(iii) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs;
(iv) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(5) Old Field Creek (New River Basin): the undesignated portion of Old Field Creek (from its source to Call Creek) shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section.

(6) In the following designated waterbodies, no additional restrictions shall be placed on new or expanded marinas. The only new or expanded NPDES permitted discharges that shall be allowed shall be non-domestic, non-process industrial discharges. The Alligator River Area (Pasquotank River Basin) extending from the source of the Alligator River to the U.S. Highway 64 bridge including New Lake Fork, North West Fork Alligator River, Juniper Creek, Southwest Fork Alligator River, Scouts Bay, Gum Neck Creek, Georgia Bay, Winn Bay, Stumpy Creek Bay, Stumpy Creek, Swann Creek (Swann Creek Lake), Whipping Creek (Whipping Creek Lake), Grapevine Bay, Rattlesnake Bay, The Straits, The Frying Pan, Coopers Creek, Babbitt Bay, Goose Creek, Milltail Creek, Boat Bay, Sandy Ridge Gut (Sawyer Lake) and Second Creek, but excluding the Intracoastal Waterway (Pungo River-Alligator River Canal) and all other

tributary streams and canals.

(7) In the following designated waterbodies, the only type of new or expanded marina that shall be allowed shall be those marinas located in upland basin areas, or those with less than 30 slips, having no boats over 21 feet in length and no boats with heads. The only new or expanded NPDES permitted discharges that shall be allowed shall be non-domestic, non-process industrial discharges.

(A) The Northeast Swanquarter Bay Area including all waters northeast of a line from a point at Lat. 35° 23′ 51″ and Long. 76° 21′ 02″ thence southeast along the Swanquarter National Wildlife Refuge hunting closure boundary (as defined by the 1935 Presidential Proclamation) to Drum Point.

(B) The Neuse-Southeast Pamlico Sound Area (Southeast Pamlico Sound Section of the Southeast Pamlico, Core and Back Sound Area); (Neuse River Basin) including all waters within an area defined by a line extending from the southern shore of Ocracoke Inlet northwest to the Tar-Pamlico River and Neuse River basin boundary, then southwest to Ship Point.

(C) The Core Sound Section of the Southeast Pamlico, Core and Back Sound Area (White Oak River Basin), including all waters of Core Sound and its tributaries, but excluding Nelson Bay, Little Port Branch and Atlantic Harbor at its mouth, and those tributaries of Jarrett Bay that are closed to shellfishing.

(D) The Western Bogue Sound Section of the Western Bogue Sound and Bear Island Area (White Oak River Basin) including all waters within an area defined by a line from Bogue Inlet to the mainland at SR 1117 to a line across Bogue Sound from the southwest side of Gales Creek to Rock Point, including Taylor Bay and the Intracoastal Waterway.

(E) The Stump Sound Area (Cape Fear River Basin) including all waters of Stump Sound and Alligator Bay from marker Number 17 to the western end of Permuda Island, but excluding Rogers Bay, the Kings Creek Restricted Area and Mill Creek.

(F) The Topsail Sound and Middle Sound Area (Cape Fear River Basin) including all estuarine waters from New Topsail Inlet to Mason Inlet, including the Intracoastal Waterway and Howe Creek, but excluding Pages Creek and Futch Creek.

(8) In the following designated waterbodies, no new or expanded NPDES permitted discharges and only new or expanded marinas with less than 30 slips, having no boats over 21 feet in length and no boats with heads shall be allowed.

(A) The Swanquarter Bay and Juniper Bay Area (Tar-Pamlico River Basin) including all waters within a line beginning at Juniper Bay Point and running south and then west below Great Island, then northwest to Shell Point and including Shell Bay, Swanquarter and Juniper Bays and their tributaries, but excluding all waters northeast of a line from a point at Lat. 35° 23′ 51″ and Long. 76° 21′ 02″ thence southeast along the Swanquarter National Wildlife Refuge hunting closure boundary (as defined by the 1935 Presidential Proclamation) to Drum Point and also excluding the Blowout Canal, Hydeland Canal, Juniper Canal and Quarter Canal.

(B) The Back Sound Section of the Southeast Pamlico, Core and Back Sound Area (White Oak River Basin) including that area of Back Sound extending from Core Sound west along Shackleford Banks, then north to the western most point of Middle Marshes and along the northwest shore of Middle Marshes (to include all of Middle Marshes), then west to Rush Point on Harker's Island, and along the southern shore of Harker's Island back to Core Sound.

(C) The Bear Island Section of the Western Bogue Sound and Bear Island Area (White Oak River Basin) including all waters within an area defined by a line from the western most point on Bear Island to the northeast mouth of Goose Creek on the mainland, east to the southwest mouth of Queen Creek, then south to green marker No. 49, then northeast to the northern most point on Huggins Island, then southeast along the shoreline of Huggins Island to the southeastern most point of Huggins Island, then south to the northeastern most point on Dudley Island, then southwest along the shoreline of Dudley Island to the eastern tip of Bear Island.

(D) The Masonboro Sound Area (Cape Fear River Basin) including all waters between the Barrier Islands and the mainland from Carolina Beach Inlet to Masonboro Inlet.

(9) Black and South Rivers ORW Area (Cape Fear River Basin) [Index Nos. 18-68-(0.5), 18-68-(3.5), 18-68-(11.5), 18-68-12-(0.5), 18-68-12-(11.5), and 18-68-2]: the following management strategies, in addition to the discharge requirements specified in Subparagraph (c)(1) of this Rule, shall be applied to protect the designated ORW areas:

(A) Stormwater controls described in Subparagraph (c)(1) of this Rule shall apply within one mile and draining to the designated ORW areas;

(B) New or expanded NPDES permitted wastewater discharges located one mile upstream of the stream segments designated ORW (upstream on the designated mainstem and upstream into direct tributaries to the designated mainstem) shall comply with the following discharge restrictions:

(i) Oxygen Consuming Wastes: Effluent limitations shall be as follows: BOD = 5 mg/l and NH3-N = 2 mg/l;

(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) shall be limited to effluent concentrations of 20 mg/l;

(iii) Emergency Requirements: Failsafe treatment designs shall be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs;

(iv) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorus or nitrogen, or both.

(v) Toxic substances: In cases where complex discharges (those containing or potentially containing toxicants) may be currently present in the discharge, a safety factor shall be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent shall be allocated at one-half of the normal standard at design conditions. Whole effluent toxicity shall be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under flow design criteria (pursuant to 15A NCAC 2B .0206).

History Note: *Authority G.S. 143-214.1;*
Eff. October 1, 1995;
Amended Eff. April 1, 1996; January 1, 1996.

STATE OF NORTH CAROLINA
DEPARTMENT OF
ENVIRONMENT, HEALTH,
AND NATURAL RESOURCES

Classifications and Water Quality Standards Assigned to The Waters of the Little Tennessee River Basin & Savannah River Drainage Area

Division of Environmental Management
Raleigh, North Carolina

Reprint from North Carolina Administrative Code: 15A NCAC 2B .0303
Current through: February 1, 1993

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
LITTLE TENNESSEE RIVER (Including backwaters of Lake Emory and the back-waters of Fontana Lake at normal pool elevation 1708 feet MSL)	From North Carolina-Georgia State line to Nantahala River Arm of Fontana Lake	C	9/1/74	2-(1)
Betty Creek	From source to North Carolina-Georgia State Line	C Tr	7/1/73	2-2
Wildcat Branch	From source to Betty Creek	C	7/1/61	2-2-1
Rock Branch	From source to Betty Creek	C	7/1/61	2-2-2
Messer Creek	From source to North Carolina-Georgia State Line	C Tr	3/1/77	2-2-3
Barkers Creek	From source to North Carolina-Georgia State Line	C Tr	7/1/73	2-2-4
Falls Branch	From source to North Carolina-Georgia State Line	C	7/1/61	2-2-4-1
Commissioner Creek	From source to Little Tennessee River	C Tr	7/1/73	2-3
Waterloo Branch	From source to Little Tennessee River	C Tr	7/1/73	2-4
Mulberry Creek	From source to Little Tennessee River	C Tr	7/1/73	2-5
Norton Branch (East side of Little Tennessee River)	From source to Little Tennessee River	C	9/1/74	2-6
Norton Branch (West side of Little Tennessee River)	From source to Little Tennessee River	C	9/1/74	2-7
Bradley Branch	From source to Norton Branch	C	9/1/74	2-7-1
Middle Creek	From source to Little Tennessee River	C Tr	7/1/73	2-8
Watkins Creek	From source to Middle Creek	C Tr	7/1/73	2-8-1
Jake Branch	From source to Watkins Creek	C Tr	7/1/73	2-8-1-1
Shoal Creek	From source to Middle Creek	C Tr	7/1/73	2-8-2
Drymans Branch	From source to Middle Creek	C	9/1/74	2-8-3
Smart Branch	From source to Middle Creek	C	9/1/74	2-8-4
Tessentee Creek	From source to Little Tennessee River	C Tr	7/1/61	2-9
Cadon Branch	From source to Tessentee Creek	C	7/1/61	2-9-1
Nichols Branch	From source to Tessentee Creek	C	7/1/61	2-9-2
Whiterock Branch	From source to Tessentee Creek	C	7/1/61	2-9-3
Possum Branch	From source to Tessentee Creek	C	7/1/61	2-9-4
Stillhouse Branch	From source to Tessentee Creek	C	7/1/61	2-9-5
Wheatfield Branch	From source to Tessentee Creek	C	7/1/61	2-9-6
Buckeye Creek	From source to Tessentee Creek	C	7/1/61	2-9-7
Evans Branch	From source to Tessentee Creek	C	7/1/61	2-9-8
Coweeta Creek	From source to Little Tennessee River	B Tr	3/1/91	2-10
Shope Fork	From source to Coweeta Creek	B Tr	3/1/91	2-10-1
Pinnacle Branch	From source to Shope Fork	B	3/1/91	2-10-1-1
Camprock Branch	From source to Shope Fork	B	3/1/91	2-10-1-2
Cunningham Creek	From source to Shope Fork	B	3/1/91	2-10-1-3
Mill Branch	From source to Cunningham Creek	B	3/1/91	2-10-1-3-1
Ball Creek	From source to Coweeta Creek	B Tr	3/1/91	2-10-2
Henson Creek	From source to Ball Creek	B	3/1/91	2-10-2-1
Dryman Fork	From source to Coweeta Creek	C Tr	7/1/73	2-10-3

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Howard Branch	From source to Dryman Fork	C	7/1/61	2-10-3-1
North Fork Coweeta Creek	From source to Coweeta Creek	B	1/1/90	2-10-4
Falls Branch	From source to North Fork Coweeta Creek	B	1/1/90	2-10-4-1
Hickory Knoll Creek	From source to Little Tennessee River	C Tr	7/1/73	2-11
Doubletop Branch	From source to Hickory Knoll Creek	C	9/1/74	2-11-1
Possum Branch	From source to Hickory Knoll Creek	C	9/1/74	2-11-2
Bates Branch	From source to Little Tennessee River	C	9/1/74	2-12
Hoglot Branch	From source to Bates Branch	C	9/1/74	2-12-1
Skeenah Creek	From source to Little Tennessee River	C Tr	7/1/73	2-13
North Fork Skeenah Creek	From source to Skeenah Creek	C Tr	7/1/73	2-13-1
Shope Branch	From source to North Fork Skeenah Creek	C Tr	7/1/73	2-13-1-1
Battle Branch	From source to North Fork Skeenah Creek	C Tr	7/1/73	2-13-1-2
South Fork Skeenah Creek	From source to Skeenah Creek	C Tr	7/1/73	2-13-2
Black Mountain Branch	From source to South Fork Skeenah Creek	C Tr	7/1/73	2-13-2-1
Dowdle Branch	From source to Little Tennessee River	C	9/1/74	2-14
Fulcher Branch	From source to Little Tennessee River	C	9/1/74	2-15
McDowell Branch	From source to Little Tennessee River	C	9/1/74	2-16
Satser Branch	From source to McDowell Branch	C	9/1/74	2-16-1
Hayes Mill Creek	From source to Little Tennessee River	C	9/1/74	2-17
Owenby Branch	From source to Little Tennessee River	C	9/1/74	2-18
Gribble Branch	From source to Owenby Branch	C	9/1/74	2-18-1
Cartoogechaye Creek	From source to a point 0.5 mile downstream of Lenior Branch	WS-III Tr	8/3/92	2-19-(1)
Jones Creek	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-2
Lee Creek	From source to Jones Creek	WS-III Tr	8/3/92	2-19-2-1
Allison Creek	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-3
Cherry Cove Creek	From source to Allison Creek	WS-III Tr	8/3/92	2-19-3-1
Ash Flat Branch	From source to Allison Creek	WS-III Tr	8/3/92	2-19-3-2
Thompson Prong	From source to Ash Flat Branch	WS-III Tr	8/3/92	2-19-3-2-1
Carpenters Branch	From source to Allison Creek	WS-III Tr	8/3/92	2-19-3-3
Lowery Creek	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-4
Cloer Branch	From source to Lowery Creek	WS-III Tr	8/3/92	2-19-4-1
Anderson Branch	From source to Cloer Branch	WS-III Tr	8/3/92	2-19-4-1-1
Poplar Cove Creek	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-5
Broadtree Creek	From source to Poplar Cove Creek	WS-III Tr	8/3/92	2-19-5-1
Muskrat Creek	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-6
McKee Branch	From source to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-7
Wayah Creek	From source to porposed Town of Franklin Water Intake located 1,500 feet more or less upstream from Camp Branch	WS-III Tr	8/3/92	2-19-8-(1)
Shot Pouch Creek	From source to Wayah Creek	WS-III Tr	8/3/92	2-19-8-2
Wayah Creek	From proposed Town of Franklin Water Intake located 1,500 feet more or less	WS-III&B Tr	8/3/92	2-19-8-(3)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	upstream from Camp Branch to Arrowood Creek			
Camp Branch	From source to proposed Town of Franklin Water Intake located 1,000 feet more or less upstream from Wayah Creek	WS-III Tr	8/3/92	2-19-8-4-(1)
Camp Branch	From proposed Town of Franklin Water Intake located 1,000 feet more or less upstream from Wayah Creek to Wayah Creek	WS-III&B Tr	8/3/92	2-19-8-4-(2)
Rough Fork	From source to proposed Town of Franklin Water Intake located 1,200 feet more or less upstream from Wayah Creek	WS-III Tr	8/3/92	2-19-8-5-(1)
Right Prong Rough Fork	From source to Rough Fork	WS-III Tr	8/3/92	2-19-8-5-2
Left Prong Rough Fork	From source to Rough Fork	WS-III Tr	8/3/92	2-19-8-5-3
Grape Cove Branch	From source to Rough Fork	WS-III Tr	8/3/92	2-19-8-5-4
Rough Fork	From proposed Town of Franklin Water Intake located 1,200 feet more or less upstream from Wayah Creek to Wayah Creek	WS-III&B Tr	8/3/92	2-19-8-5-(5)
Brushy Branch	From source to Wayah Creek	WS-III&B Tr	8/3/92	2-19-8-6
Locust Tree Branch	From source to Wayah Creek	WS-III&B Tr	8/3/92	2-19-8-7
Wayah Creek	From Arrowood Creek to Cartoogechaye Creek	WS-III Tr	8/3/92	2-19-8-(8)
Arrowood Creek	From source to Wayah Creek	WS-III Tr	8/3/92	2-19-8-9
Shingletree Branch	From source to Wayah Creek	WS-III Tr	8/3/92	2-19-8-10
Mill Creek	From source to Cartoogechaye Creek	WS-III	8/3/92	2-19-9
Mint Branch	From source to Mill Creek	WS-III	8/3/92	2-19-9-1
Lenoir Branch	From source to Cartoogechaye Creek	WS-III	8/3/92	2-19-10
Cartoogechaye Creek	From a point 0.5 mile downstream of Lenior Branch to Town of Franklin water supply intake (located 0.5 mile upstream of mouth of Gibson Cove Creek)	WS-III Tr CA	8/3/92	2-19-(10.3)
Cartoogechaye Creek	From Town of Franklin water supply intake to Little Tennessee River	B Tr	8/3/92	2-19-(10.5)
Gibson Cove Branch	From source to Cartoogechaye Creek	C	8/3/92	2-19-11
Potts Creek	From source to Cartoogechaye Creek	C	8/3/92	2-19-12
Blaine Branch	From source to Cartoogechaye Creek	C	8/3/92	2-19-13
Dobson Branch	From source to Cartoogechaye Creek	C	8/3/92	2-19-14
Wallace Branch	From source to Cartoogechaye Creek	C	8/3/92	2-19-15
Trimont Branch	From source to Wallace Branch	C	8/3/92	2-19-15-1
Cullasaja River (Ravenel Lake)	From source to Macon County SR 1545	WS-III Tr	8/3/92	2-21-(0.5)
Saltrock Branch	From source to Cullasaja River	WS-III	8/3/92	2-21-1
Ammons Branch	From source to Cullasaja River	WS-III	8/3/92	2-21-2
Mill Creek	From source to Mirror Lake, Cullasaja River	WS-III Tr	8/3/92	2-21-3

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Satulah Branch (Harris Lake)	From source to Mill Creek	WS-III	8/3/92	2-21-3-1
Ravenel Lake	Entire Lake and connecting stream to Mill Creek	WS-III Tr	8/3/92	2-21-3-2
Cullasaja River (Mirror Lake, Lake Sequoyah)	From Macon County SR 1545 to dam at Lake Sequoyah	WS-III Tr CA	8/3/92	2-21-(3.5)
Monger Creek	From source to a point 0.5 mile upstream of U.S. Hwy. 64	WS-III	8/3/92	2-21-4-(1)
Monger Creek (Club Lake)	From a point 0.5 mile upstream of U.S. Hwy. 64 to Lake Sequoyah, Cullasaja River	WS-III CA	8/3/92	2-21-4-(2)
Big Creek Arm of Lake Sequoyah, Cullasaja River	From source to U.S. Hwy. 64 Bridge	WS-III Tr CA	8/3/92	2-21-5
Big Creek (Randall Lake)	From source to a point 0.7 mile upstream of mouth	WS-II Tr	8/3/92	2-21-5-1-(0.5)
Norton Prong	From source to Big Creek	WS-II Tr	8/3/92	2-21-5-1-1
Bad Branch	From source to Big Creek	WS-II Tr	8/3/92	2-21-5-1-2
Houston Branch (Highlands Reservoir)	From source to Dam at Highlands Reservoir	WS-I	8/3/92	2-21-5-1-3-(1)
Houston Branch	From Dam at Highlands Reservoir to Big Creek	WS-II	8/3/92	2-21-5-1-3-(2)
Big Creek	From a point 0.7 mile upstream of mouth to Lake Sequoyah, Cullasaja River	WS-II Tr CA	8/3/92	2-21-5-1-(4)
Cullasaja River	From dam at Lake Sequoyah to Little Tennessee River	B Tr	10/1/87	2-21-(5.5)
Skitty Creek (Cliffside Lake)	From source to Dam at Cliffside Lake	B Tr	7/1/73	2-21-6-(1)
South Skitty Branch	From source to Cliffside Lake, Skitty Creek	B Tr	7/1/73	2-21-6-2
Skitty Creek	From Dam at Cliffside Lake to Cullasaja River	C Tr	7/1/73	2-21-6-(3)
Long Branch	From source to Cullasaja River	C	7/1/61	2-21-7
Turtle Pond Creek	From source to Cullasaja River	C Tr	7/1/61	2-21-8
Piney Knob Fork	From source to Turtle Pond Creek	C Tr	7/1/61	2-21-8-1
~~Bennies Branch~~	~~From source to Turtle Pond Creek~~	~~C Tr~~	~~7/1/61~~	~~2-21-8-2~~
Laurel Branch	From source to Cullasaja River	C	7/1/61	2-21-9
Stephens Creek	From source to Cullasaja River	C	7/1/61	2-21-10
Short Creek	From source to Cullasaja River	C	7/1/61	2-21-11
Gold Mine Branch	From source to Cullasaja River	C	7/1/61	2-21-12
Brush Creek	From source to Cullasaja River	C Tr	7/1/73	2-21-13
Rattlesnake Branch (Highlands Reservoir)	From source to Dam at Highlands Reservoir	WS-I	8/3/92	2-21-13-1-(1)
Rattlesnake Branch	From Dam at Highlands Reservoir to Brush Creek	C	7/1/61	2-21-13-1-(2)
Crow Creek	From source to Cullasaja River	C	7/1/61	2-21-14
Buck Creek	From source to Cullasaja River	C Tr	7/1/73	2-21-15
Little Buck Creek	From source to Buck Creek	C Tr	7/1/73	2-21-15-1
Moss Branch	From source to Little Buck Creek	C	7/1/61	2-21-15-1-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Peeks Creek	From source to Cullasaja River	C Tr	7/1/73	2-21-16
Walnut Creek	From source to Cullasaja River	C Tr	7/1/73	2-21-17
Katie Creek	From source to Walnut Creek	C	7/1/61	2-21-17-1
Ledford Branch	From source to Walnut Creek	C	7/1/61	2-21-17-2
Crows Branch	From source to Cullasaja River	C	7/1/61	2-21-18
Lickskillet Branch	From source to Cullasaja River	C	7/1/61	2-21-19
Stansfield Branch	From source to Cullasaja River	C	7/1/61	2-21-20
Nickajack Creek	From source to Cullasaja River	C Tr	7/1/73	2-21-21
Bryson Branch	From source to Cullasaja River	C	7/1/61	2-21-22
Ellijay Creek	From source to Cullasaja River	C Tr	7/1/61	2-21-23
Indian Camp Branch	From source to Ellijay Creek	C	7/1/61	2-21-23-1
North Prong Ellijay Creek	From source to Ellijay Creek	C Tr	7/1/73	2-21-23-2
Wildcat Creek	From source to North Prong Ellijay Creek	C	7/1/61	2-21-23-2-1
Little Salt Rock Creek	From source to Wildcat Creek	C	7/1/61	2-21-23-2-1-1
Joe Creek	From source to Wildcat Creek	C	7/1/61	2-21-23-2-1-2
Bryson Branch	From source to Joe Creek	C	7/1/61	2-21-23-2-1-2-1
Falls Branch	From source to North Prong Ellijay Creek	C	7/1/61	2-21-23-2-2
Laurel Creek	From source to Ellijay Creek	C	7/1/61	2-21-23-3
Moses Branch	From source to Ellijay Creek	C	7/1/61	2-21-23-4
Battle Branch	From source to Ellijay Creek	C	7/1/61	2-21-23-5
Higdon Branch	From source to Ellijay Creek	C	7/1/61	2-21-23-6
Arnold Branch	From source to Cullasaja River	C	7/1/61	2-21-24
Scott Branch	From source to Cullasaja River	C	7/1/61	2-21-25
Marshburn Branch	From source to Cullasaja River	C	7/1/61	2-21-26
Crawford Branch	From source to Little Tennessee River	C	9/1/74	2-22
Rabbitt Creek	From source to Lake Emory, Little Tennessee River	C Tr	7/1/73	2-23
Corbin Creek	From source to Rabbit Creek	C	7/1/61	2-23-1
Berry Creek	From source to Corbin Creek	C	7/1/61	2-23-1-1
Ammons Branch	From source to Rabbit Creek	C	7/1/61	2-23-2
Elmore Branch	From source to Rabbit Creek	C	7/1/61	2-23-3
Cat Creek	From source to Rabbit Creek	C	7/1/61	2-23-4
Watauga Creek	From source to Little Tennessee River	C Tr	7/1/73	2-24
Hughs Branch	From source to Watauga Creek	C	7/1/61	2-24-1
Brown Creek	From source to Watauga Creek	C	7/1/61	2-24-2
Coon Creek	From source to Watauga Creek	C	7/1/61	2-24-3
Thompson Branch	From source to Watauga Creek	C	7/1/61	2-24-4
Tippet Branch	From source to Little Tennessee River	C	7/1/61	2-25
Rocky Branch	From source to Little Tennessee River	C	7/1/61	2-26
Jacob Branch	From source to Rocky Branch	C	7/1/61	2-26-1
Iotla Creek	From source to Little Tennessee River	C	7/1/61	2-27
Iotla Branch	From source to Iotla Creek	C	7/1/61	2-27-1
Poindexter Branch	From source to Iotla Creek	C	7/1/61	2-27-2
Mason Branch	From source to Little Tennessee River	C	7/1/61	2-28
Cowee Creek	From source to Little Tennessee River	C Tr	7/1/61	2-29
Mica City Creek	From source to Cowee Creek	C	7/1/61	2-29-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
Fall Branch	From source to Mica City Creek	C	7/1/61	2-29-1-1
Beasley Creek	From source to Cowee Creek	C Tr	7/1/73	2-29-2
Blazed Creek	From source to Beasley Creek	C	7/1/61	2-29-2-1
Huckleberry Creek	From source to Beasley Creek	C	7/1/61	2-29-2-2
Shepherd Creek	From source to Cowee Creek	C	7/1/61	2-29-3
Caler Fork Creek	From source to Cowee Creek	C	7/1/61	2-29-4
Tippet Creek	From source to Caler Fork Creek	C	7/1/61	2-29-4-1
Dalton Creek	From source to Caler Fork Creek	C	7/1/61	2-29-4-2
Matlock Creek	From source to Cowee Creek	C	7/1/61	2-29-5
Wests Branch	From source to Matlock Creek	C	7/1/61	2-29-5-1
Rickman Creek	From source to Matlock Creek	C	7/1/61	2-29-5-2
Carter Branch	From source to Little Tennessee River	C	7/1/61	2-30
Potts Branch	From source to Little Tennessee River	C	7/1/61	2-31
Rose Creek	From source to Little Tennessee River	C Tr	7/1/73	2-32
Stillhouse Branch	From source to Rose Creek	C	7/1/61	2-32-1
Bradley Creek	From source to Little Tennessee River	C Tr	7/1/73	2-33
Lakey Creek	From source to Little Tennessee River	C Tr	7/1/73	2-34
Long Branch	From source to Lakey Creek	C	7/1/61	2-34-1
Polecat Branch	From source to Lakey Creek	C	7/1/61	2-34-2
Caler Cove Branch	From source to Little Tennessee River	C	7/1/61	2-35
Long Branch	From source to Little Tennessee River	C	7/1/61	2-36
Queen Branch	From source to Little Tennessee River	C	7/1/61	2-37
Burningtown Creek	From source to Little Tennessee River	B Tr	1/1/90	2-38
Horse Cove Branch	From source to Burningtown Creek	C	7/1/61	2-38-1
Bridge Branch	From source to Burningtown Creek	C	7/1/61	2-38-2
Indian Camp Branch	From source to Burningtown Creek	C	7/1/61	2-38-3
Joe Dave Branch	From source to Indian Camp Creek	C	7/1/61	2-38-3-1
Left Prong Burnington Creek	From source to Burningtown Creek	C	7/1/61	2-38-4
Ray Branch	From source to Left Prong Burningtown Creek	C	7/1/61	2-38-4-1
Right Prong Ray Branch	From source to Ray Branch	C	7/1/61	2-38-4-1-1
Left Prong Ray Branch	From source to Ray Branch	C	7/1/61	2-38-4-1-2
DeWeese Branch	From source to Left Prong Burningtown Creek	C	7/1/61	2-38-4-2
~~Long Branch~~	~~From source to DeWeese Branch~~	~~C~~	~~7/1/61~~	~~2-38-4-2-1~~
Downes Branch	From source to Burningtown Creek	C	7/1/61	2-38-5
Fall Branch	From source to Downes Branch	C	7/1/61	2-38-5-1
Wildes Creek	From source to Burningtown Creek	C	7/1/61	2-38-6
Parrish Creek	From source to Burningtown Creek	C	7/1/61	2-38-7
Younce Creek	From source to Burningtown Creek	C	7/1/61	2-38-8
Daves Creek	From source to Younce Creek	C	7/1/61	2-38-8-1
Edwards Branch	From source to Daves Creek	C	7/1/61	2-38-8-1-1
Allen Branch	From source to Burningtown Creek	C	7/1/61	2-38-9
Bird Branch	From source to Little Tennessee River	C	7/1/61	2-39
Tellico Creek	From source to Little Tennessee River	C Tr	7/1/73	2-40
Indian Branch	From source to Tellico Creek	C Tr	7/1/73	2-40-1
Sugar Cove Creek	From source to Tellico Creek	C Tr	7/1/73	2-40-2
Laurel Branch	From source to Sugar Cove Creek	C	7/1/61	2-40-2-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Teague Branch	From source to Tellico Creek	C	7/1/61	2-40-3
Rhinehart Creek	From source to Tellico Creek	C	7/1/61	2-40-4
Gibby Branch	From source to Rhinehart Creek	C	7/1/61	2-40-4-1
Simon Branch	From source to Little Tennessee River	C	7/1/61	2-41
Ledbetter Branch	From source to Little Tennessee River	C	7/1/61	2-42
Loudermilk Creek	From source to Little Tennessee River	C	7/1/61	2-43
Rattlesnake Creek	From source to Little Tennessee River	C	7/1/61	2-44
Long Branch	From source to Little Tennessee River	C	7/1/61	2-45
Brush Creek	From source to Little Tennessee River	C	7/1/61	2-46
Wildcat Branch	From source to Brush Creek	C	7/1/61	2-46-1
Gibby Branch	From source to Brush Creek	C	7/1/61	2-46-2
Marr Branch	From source to Brush Creek	C	7/1/61	2-46-3
Dolph Branch	From source to Marr Branch	C	7/1/61	2-46-3-1
Licklog Creek	From source to Little Tennessee River	C	7/1/61	2-47
Wikle (Long) Branch	From source to Licklog Creek	C	7/1/61	2-47-1
DeHart Creek	From source to Little Tennessee River	C	7/1/61	2-48
Wiggins Creek	From source to Little Tennessee River	C	7/1/61	2-49
Monkey John Branch	From source to Wiggins Creek	C	7/1/61	2-49-1
Hurricane Branch	From source to Monkey John Branch	C	7/1/61	2-49-1-1
Charley Branch	From source to Wiggins Creek	C	7/1/61	2-49-2
Painter Branch	From source to Little Tennessee River	C	7/1/61	2-50
Tarkiln Branch	From source to Little Tennessee River	C	7/1/61	2-51
Cabe Branch	From source to Little Tennessee River	C	7/1/61	2-52
Sawmill Creek	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-53
Hurricane Branch	From source to Sawmill Creek	C	7/1/61	2-53-1
Thompson Branch	From source to Sawmill Creek	C	7/1/61	2-53-2
Davis Creek	From source to Sawmill Creek	C	7/1/61	2-53-3
Short Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-54
Pole Bridge Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-55
Nantahala River Arm of Fontana Lake, Little Tennessee River below elevation 1708 MSL	Entire Arm	B Tr	7/1/73	2-(56)
Nantahala River	From source to Roaring Fork	B Tr ORW	3/1/89	2-57-(0.5)
Kilby Creek	From source to Nantahala River	C ORW	3/1/89	2-57-1
Big Laurel Branch	From source to Kilby Creek	C ORW	3/1/89	2-57-1-1
Gulf Branch	From source to Big Laurel Branch	C ORW	3/1/89	2-57-1-1-1
Gulf Fork	From source to Big Laurel Branch	C ORW	3/1/89	2-57-1-1-2
Mooney Creek (Hemp Patch Branch)	From source to Nantahala River	C Tr ORW	3/1/89	2-57-2
Mooney Branch	From source to Mooney Creek	C ORW	3/1/89	2-57-2-1
Yellow Patch Branch	From source to Mooney Creek	C ORW	3/1/89	2-57-2-2
Mountainside Branch	From source to Mooney Creek	C ORW	3/1/89	2-57-2-3
Bearpen Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-3
Big Indian Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-4

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Big Shoal Branch	From source to Big Indian Creek	C ORW	3/1/89	2-57-4-1
Nichols Branch	From source to Nantahala River	C ORW	3/1/89	2-57-5
Thomas Branch	From source to Nantahala River	C ORW	3/1/89	2-57-6
Hurricane Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-7
Little Indian Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-8
John Branch	From source to Little Indian Creek	C ORW	3/1/89	2-57-8-1
Curtis Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-9
Kimsey Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-10
Little Lyman Prong	From source to Kimsey Creek	C ORW	3/1/89	2-57-10-1
Devils Prong	From source to Kimsey Creek	C ORW	3/1/89	2-57-10-2
Long Branch	From source to Nantahala River	C Tr ORW	3/1/89	2-57-11
Wyant Branch	From source to Long Branch	C ORW	3/1/89	2-57-11-1
Laurel Branch	From source to Nantahala River	C ORW	3/1/89	2-57-12
Little Rock Branch	From source to Nantahala River	C ORW	3/1/89	2-57-13
Park Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-14
Trough Branch	From source to Nantahala River	C ORW	3/1/89	2-57-15
Black Creek	From source to Nantahala River	C ORW	3/1/89	2-57-16
Pat Stable Branch	From source to Black Creek	C ORW	3/1/89	2-57-16-1
Moore Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-17
Bryson Branch	From source to Nantahala River	C Tr ORW	3/1/89	2-57-18
Siler Bald Branch	From source to Bryson Branch	C ORW	3/1/89	2-57-18-1
Nova Scotia Branch	From source to Nantahala River	C ORW	3/1/89	2-57-19
Factory Branch	From source to Nantahala River	C Tr ORW	3/1/89	2-57-20
Buck Creek	From source to Nantahala River	C Tr ORW	3/1/89	2-57-21
Little Buck Creek	From source to Buck Creek	C Tr ORW	3/1/89	2-57-21-1
Hogan Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-2
Black Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-3
Bullscrape Branch	From source to Black Branch	C ORW	3/1/89	2-57-21-3-1
Chestnut Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-4
Glade Branch	From source to Buck Creek	C Tr ORW	3/1/89	2-57-21-5
Davenport Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-6
Johnson Branch	From source to Davenport Branch	C ORW	3/1/89	2-57-21-6-1
Barnards Creek	From source to Buck Creek	C ORW	3/1/89	2-57-21-7
Chestnut Branch	From source to Barnards Creek	C ORW	3/1/89	2-57-21-7-1
Fishprong Branch	From source to Barnards Creek	C ORW	3/1/89	2-57-21-7-2
Clear Spring Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-8
Thunderstruck Branch	From source to Buck Creek	C ORW	3/1/89	2-57-21-9
Roaring Fork	From source to Nantahala River	C Tr ORW	3/1/89	2-57-22
Nantahala River [Nantahala Lake (Aquone Lake)]	From Roaring Fork to Nantahala River Arm of Fontana Lake, Little Tennessee R.	B Tr	7/1/73	2-57-(22.5)
Tate Branch	From source to Nantahala River	C	7/1/61	2-57-23
Tyler Branch	From source to Nantahala River	C	7/1/61	2-57-24
Tipton Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-25
Clear Creek	From source to Nantahala Lake, Nantahala River	C Tr	7/1/73	2-57-26
Camp Branch	From source to Clear Creek	C	7/1/61	2-57-26-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Stephens Branch	From source to Clear Creek	C	7/1/61	2-57-26-2
Jarrett Creek	From source to Nantahala Lake, Nantahala River	C Tr	7/1/61	2-57-27
Conley Camp Branch	From source to Jarrett Creek	C	7/1/61	2-57-27-1
Robin Branch	From source to Jarrett Creek	C	7/1/61	2-57-27-2
Dirty John Creek	From source to Jarrett Creek	C	7/1/61	2-57-27-3
Hurricane Creek	From source to Jarrett Creek	C	7/1/61	2-57-27-4
High Laurel Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-28
Arrowhead Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-29
Johnson Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-30
Joe Hicks Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-31
Big Choga Creek	From source to Nantahala Lake, Nantahala River	C Tr	7/1/61	2-57-32
Blockade Branch	From source to Big Choga Creek	C	7/1/61	2-57-32-1
Gibby Branch	From source to Big Choga Creek	C	7/1/61	2-57-32-2
Wolf Creek	From source to Big Choga Creek	C	7/1/61	2-57-32-3
Chestnut Orchard Branch	From source to Big Choga Creek	C	7/1/61	2-57-32-4
Little Tuni Creek	From source to Big Choga Creek	C	7/1/61	2-57-32-5
May Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-33
Ingram Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-34
Laurel Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-35
Little Choga Creek	From source to Nantahala Lake, Nantahala River	C Tr	7/1/73	2-57-36
Shop Branch	From source to Little Choga Creek	C	7/1/61	2-57-36-1
Garrison Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-37
Rocky Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-38
Wine Spring Creek	From source to Nantahala Lake, Nantahala River	C Tr	7/1/61	2-57-39
Bearpen Creek	From source to Wine Spring Creek	C	7/1/61	2-57-39-1
Indian Camp Branch	From source to Wine Spring Creek	C	7/1/61	2-57-39-2
Lee Branch	From source to Nantahala Lake, Nantahala River	C	7/1/61	2-57-40
Rowland Branch	From source to Nantahala River	C	7/1/61	2-57-41
Dicks Creek	From source to Nantahala River	C Tr	7/1/73	2-57-42
Pine Branch	From source to Dicks Creek	C	7/1/61	2-57-42-1
Matherson Branch	From source to Pine Branch	C	7/1/61	2-57-42-1-1
Hickory Branch	From source to Dicks Creek	C	7/1/61	2-57-42-2
Youngs Camp Branch	From source to Dicks Creek	C	7/1/61	2-57-42-3
Appletree Branch	From source to Nantahala River	C	7/1/61	2-57-43

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Beech Cove Branch	From source to Nantahala River	C	7/1/61	2-57-44
Whiteoak Creek	From source to Nantahala River	C Tr	7/1/61	2-57-45
Big Laurel Creek	From source to Whiteoak Creek	C	7/1/61	2-57-45-1
Little Laurel Creek	From source to Whiteoak Creek	C	7/1/61	2-57-45-2
Rocky Bald Branch	From source to Whiteoak Creek	C	7/1/61	2-57-45-3
Kit Spring Branch	From source to Whiteoak Creek	C	7/1/61	2-57-45-4
Split Whiteoak Branch	From source to Whiteoak Creek	C	7/1/61	2-57-45-5
Sassafras Branch	From source to Whiteoak Creek	C	7/1/61	2-57-45-6
Holloway Branch	From source to Whiteoak Creek	C	7/1/61	2-57-45-7
Cold Spring Creek	From source to Whiteoak Creek	C Tr	7/1/73	2-57-45-8
Big Branch	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-1
Dry Branch	From source to Big Branch	C	7/1/61	2-57-45-8-1-1
Middle Branch	From source to Cold Springs Creek	C	7/1/61	2-57-45-8-2
Burningtown Branch	From source to Middle Branch	C	7/1/61	2-57-45-8-2-1
Larry Brush Branch	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-3
Ben Creek	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-4
Batey Branch	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-5
Gold Pit Creek	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-6
Bateman Branch	From source to Cold Spring Creek	C	7/1/61	2-57-45-8-7
Long Branch	From source to Whiteoak Creek	C Tr	7/1/73	2-57-45-9
Otter Creek	From source to Whiteoak Creek	C Tr	7/1/73	2-57-45-10
Big Branch	From source to Otter Creek	C Tr	7/1/73	2-57-45-10-1
Sawmill Branch	From source to Otter Creek	C	7/1/61	2-57-45-10-2
Jane Otter Branch	From source to Otter Creek	C	7/1/61	2-57-45-10-3
Cherry Branch	From source to Otter Creek	C	7/1/61	2-57-45-10-4
Partridge Creek	From source to Whiteoak Creek	C Tr	7/1/73	2-57-45-11
Left Fork Partridge Creek	From source to Partridge Creek	C	7/1/61	2-57-45-11-1
Hampton Branch	From source to Partridge Creek	C	7/1/61	2-57-45-11-2
Camp Branch	From source to Nantahala River	C Tr	7/1/73	2-57-46
Piercy Creek	From source to Nantahala River	C Tr	7/1/73	2-57-47
Rowlin Creek	From source to Nantahala River	C	7/1/61	2-57-48
Laurel Branch	From source to Rowlin Creek	C	7/1/61	2-57-48-1
Handpole Branch	From source to Nantahala River	C	7/1/61	2-57-49
Ledbetter Creek	From source to Nantahala River	C	7/1/61	2-57-50
~~Queens Creek~~	~~From source to Nantahala River~~	~~C Tr~~	~~7/1/61~~	~~2-57-51~~
Appletree Branch	From source to Queens Creek	C	7/1/61	2-57-51-1
Grassy Branch	From source to Queens Creek	C	7/1/61	2-57-51-2
Clear Branch	From source to Queens Creek	C	7/1/61	2-57-51-3
Jarrett Camp Branch	From source to Queens Creek	C	7/1/61	2-57-51-4
Mudcut Branch	From source to Nantahala River	C	7/1/61	2-57-52
Talc Mountain Branch	From source to Nantahala River	C	7/1/61	2-57-53
Morris Branch	From source to Nantahala River	C	7/1/61	2-57-54
Silvermine Creek	From source to Nantahala River	C	7/1/61	2-57-55
Fall Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-1
Lettuce Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-2
Scald Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-3
Wildcat Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-4
Bee Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-5

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Grassy Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-6
Big Creek	From source to Silvermine Creek	C	7/1/61	2-57-55-7
Blacksnake Branch	From source to Silvermine Creek	C	7/1/61	2-57-55-8
Wesser Creek	From source to Nantahala River	C	7/1/61	2-57-56
Bald Branch	From source to Wesser Creek	C	7/1/61	2-57-56-1
DeHart Branch	From source to Wesser Creek	C	7/1/61	2-57-56-2
Right Fork Wesser Creek	From source to Wesser Creek	C	7/1/61	2-57-56-3
Totherow Branch	From source to Wesser Creek	C	7/1/61	2-57-56-4
Townhouse Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-58
Bird Falls Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-59
Euchulla Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-60
Watia Creek	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-61
Duck Branch	From source to Watia Creek	C	7/1/61	2-61-1
Buckner Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-62
Jake Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-63
Siles Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-64
Long Branch	From source to Siles Branch	C	7/1/61	2-64-1
Pump Branch	From source to Nantahala River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-65
LITTLE TENNESSEE RIVER (Fontana Lake below elevation 1708 MSL)	From Nantahala River Arm of Fontana Lake to the upstream side of mouth of Shoal Branch	B	8/3/92	2-(66)
Turkey Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-67
Ammons Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-68
Alarka Creek	From source to Alarka Falls (approximately 0.3 miles upstream of Cold Spring Branch)	C Tr HQW #	7/1/90	2-69-(0.4)
Alarka Creek	From Alarka Falls to Upper Long Creek	C Tr HQW	7/1/90	2-69-(0.5)
Cold Spring Branch	From source to Alarka Creek	C HQW	7/1/90	2-69-1
Upper Long Creek	From source to Alarka Creek	C HQW	7/1/90	2-69-2
Alarka Creek	From Upper Long Creek to Fontana Lake, Little Tennessee R.	C Tr	7/1/61	2-69-(2.5)
Bearmeat Branch	From source to Alarka Creek	C	7/1/61	2-69-3
Falls Branch	From source to Alarka Creek	C	7/1/61	2-69-4
Mason Branch	From source to Alarka Creek	C	7/1/61	2-69-5
Little Laurel Creek	From source to Alarka Creek	C	7/1/61	2-69-6
Una Creek	From source to Alarka Creek	C	7/1/61	2-69-7
Piney Wood Creek	From source to Una Creek	C	7/1/61	2-69-7-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Long Creek	From source to Una Creek	C	7/1/61	2-69-7-2
Hickorynut Branch	From source to Una Creek	C	7/1/61	2-69-7-3
Second Hurricane Branch	From source to Alarka Creek	C	7/1/61	2-69-8
First Hurricane Branch	From source to Alarka Creek	C	7/1/61	2-69-9
Pigeon Creek	From source to Alarka Creek	C	7/1/61	2-69-10
Bowers Creek	From source to Alarka Creek	C	7/1/61	2-69-11
Jones Creek	From source to Bowers Creek	C	7/1/61	2-69-11-1
Cullasaja Branch	From source to Bowers Creek	C	7/1/61	2-69-11-2
Battle Creek	From source to Alarka Creek	C	7/1/61	2-69-12
Little Alarka Creek	From source to Alarka Creek	C	7/1/61	2-69-13
DeHart Branch	From source to Alarka Creek	C	7/1/61	2-69-14
Frisbee Branch	From source to DeHart Branch	C	7/1/61	2-69-14-1
Robinson Gap Branch	From source to Alarka Creek	C	7/1/61	2-69-15
Welch Branch	From source to Alarka Creek	C	7/1/61	2-69-16
Davis Branch	From source to Alarka Creek	C	7/1/61	2-69-17
Dark Branch	From source to Alarka Creek	C	7/1/61	2-69-18
Grant Branch	From source to Alarka Creek	C	7/1/61	2-69-19
Grassy Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-70
Stevenson Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-71
Burnett Branch	From source to Stevenson Branch	C	7/1/61	2-71-1
Greasy Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-72
Lemmons Branch	From source to Fontana Lake, Little Tennessee River	B	7/1/61	2-73
Battles Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-74
Fishtrap Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-75
Watertank Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-76
Meadow Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-77
Tuckasegee River Arm of Fontana Lake, Little Tennessee River, below elevation 1708 MSL	That portion of the Tuckasegee River Arm of Fontana Lake above the upstream side of the mouth of Noland Creek	C	4/1/71	2-(78)
Tuckasegee River (East Fork Lake)	From source to Tennessee Creek	WS-III&B Tr ORW	2/1/93	2-79-(0.5)
Panthertown Creek	From source to Tuckasegee River	WS-III ORW	2/1/93	2-79-1
Frolictown Creek	From source to Panthertown Creek	WS-III ORW	2/1/93	2-79-1-1
Goldspring Branch	From source to Frolictown Creek	WS-III ORW	2/1/93	2-79-1-1-1
Greenland Creek	From source to Tuckasegee River	WS-III ORW	2/1/93	2-79-2
Little Green Creek	From source to Tuckasegee River	WS-III ORW	2/1/93	2-79-3
Honeycamp Branch	From source to Tuckasegee River	WS-III ORW	2/1/93	2-79-4
Bracken Creek	From source to Tuckasegee River	WS-III ORW	2/1/93	2-79-5
Tuckaseegee River (East	From Tennessee Creek to West Fork	WS-III&B Tr	8/3/92	2-79-(5.5)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
Fork Lake, Bear Creek Lake, Cedar Cliff Lake)	Tuckaseegee River			
Tennessee Creek (Tanasee)	From source to East Fork Lake, Tuckasegee River	WS-III Tr HQW	8/3/92	2-79-6
Sassafras Creek	From source to Tennessee Creek (Tanasee)	WS-III Tr HQW	8/3/92	2-79-6-1
Camp Creek	From source to Tennessee Creek (Tanasee)	WS-III Tr HQW	8/3/92	2-79-6-2
Pinhook Creek	From source to Tennessee Creek (Tanasee)	WS-III Tr HQW	8/3/92	2-79-6-3
Cold Creek	From source to Tennessee Creek (Tanasee)	WS-III HQW	8/3/92	2-79-6-4
Slickens Creek	From source to Tuckasegee River	WS-III	8/3/92	2-79-7
Doe Branch	From source to Tuckasegee River	WS-III	8/3/92	2-79-8
Wolf Creek (Wolf Creek Lake)	From source to Wolf Creek Dam	WS-III&B Tr HQW	8/3/92	2-79-9-(1)
Yellow Patch Branch	From source to Wolf Creek	WS-III HQW	8/3/92	2-79-9-2
Gage Creek	From source to Wolf Creek	WS-III HQW	8/3/92	2-79-9-3
Cold Creek	From source to Wolf Creek	WS-III HQW	8/3/92	2-79-9-4
Charley Creek	From source to Wolf Creek	WS-III HQW	8/3/92	2-79-9-5
Cub Branch	From source to Charley Creek	WS-III HQW	8/3/92	2-79-9-5-1
Long Branch	From source to Wolf Creek Lake, Wolf Creek	WS-III HQW	8/3/92	2-79-9-6
Wolf Creek	From Wolf Creek Dam to Bear Creek Lake, Tuckasegee River	WS-III Tr HQW	8/3/92	2-79-9-(7)
Neddie Creek	From source to Bear Creek Lake, Tuckasegee River	WS-III	8/3/92	2-79-10
Flat Creek	From source to Bear Creek Lake, Tuckasegee River	WS-III Tr HQW	8/3/92	2-79-11
Sols Creek	From source to Bear Creek Lake, Tuckasegee River	WS-III Tr	8/3/92	2-79-12
Jeff Creek	From source to Sols Creek	WS-III	8/3/92	2-79-12-1
Robinson Creek	From source to Bear Creek Lake, Tuckasegee River	WS-III Tr	8/3/92	2-79-13
Packs Creek	From source to Robinson Creek	WS-III	8/3/92	2-79-13-1
Mill Creek	From source to Robinson Creek	WS-III	8/3/92	2-79-13-2
Shelton Creek	From source to Mill Creek	WS-III	8/3/92	2-79-13-2-1
Cow Mountain Creek	From source to Mill Creek	WS-III	8/3/92	2-79-13-2-2
Ell Branch	From source to Robinson Creek	WS-III	8/3/92	2-79-13-3
Big Laurel Creek	From source to Robinson Creek	WS-III	8/3/92	2-79-13-4
Slatten Branch	From source to Robinson Creek	WS-III	8/3/92	2-79-13-5
Big Branch	From source to Bear Creek Lake, Tuckasegee River	WS-III	8/3/92	2-79-14
Em Branch	From source to Bear Creek Lake, Tuckasegee River	WS-III	8/3/92	2-79-15
Gladie Creek	From source to Bear Creek Lake, Tuckasegee River	WS-III Tr	8/3/92	2-79-16
Bear Creek	From source to Bear Creek Lake,	WS-III Tr	8/3/92	2-79-17

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	Tuckasegee River			
Bearpen Branch	From source to Bear Creek	WS-III	8/3/92	2-79-17-1
Turkey Branch	From source to Bear Creek Lake, Tuckasegee River	WS-III	8/3/92	2-79-18
Kiesee Creek	From source to Cedar Cliff Lake, Tuckasegee River	WS-III	8/3/92	2-79-19
Negroskull Creek	From source to Tuckasegee River	WS-III Tr	8/3/92	2-79-20
Canoe Creek	From source to Tuckasegee River	WS-III	8/3/92	2-79-21
Woods Branch	From source to Tuckasegee River	WS-III	8/3/92	2-79-22
West Fork Tuckasegee River (Thorpe Lake below elevation 3492 MSL)	From source in Thorpe Lake Backwater at Elevation 3492 MSL to Thorpe Dam	WS-III&B	8/3/92	2-79-23-(1)
Hurricane Creek (Hurricane Lake)	From source to Thorpe Lake, West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-2
Laurel Branch	From source to Hurricane Creek	WS-III	8/3/92	2-79-23-2-1
Cedar Creek (Webb Lake, Jenkins Lake)	From source to Thorpe Lake, West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-3
Glassyrock Creek	From source to Webb Lake, Cedar Creek	WS-III	8/3/92	2-79-23-3-1
Sheep Cliff Creek	From source to Webb Lake, Cedar Creek	WS-III	8/3/92	2-79-23-3-2
Beetree Creek	From source to Cedar Creek	WS-III	8/3/92	2-79-23-3-3
Norton Creek (Higgon Lake, Allison Lake)	From source to Thorpe Lake, West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-4
Grassy Camp Creek	From source to Norton Creek	WS-III	8/3/92	2-79-23-4-1
Shortoff Creek	From source to Grassy Camp Creek	WS-III	8/3/92	2-79-23-4-1-1
Knob Creek	From source to Norton Creek	WS-III Tr	8/3/92	2-79-23-4-2
Mill Creek	From source to Thorpe Lake, West Fork Tuckasagee River	WS-III Tr	8/3/92	2-79-23-5
Flat Creek	From source to Mill Creek	WS-III	8/3/92	2-79-23-5-1
Pine Creek	From source to Thorpe Lake, West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-6
Jackson Creek	From source to Pine Creek	WS-III	8/3/92	2-79-23-6-1
Taylor Creek	From source to Pine Creek	WS-III	8/3/92	2-79-23-6-2
Little Pine Creek	From source to Pine Creek	WS-III	8/3/92	2-79-23-6-3
Gem Creek	From source to Little Pine Creek	WS-III	8/3/92	2-79-23-6-3-1
~~West Fork Tuckasegee River~~ (Little Glenville Lake)	~~From Thorpe Dam to Tuckasegee River~~	~~WS-III&B Tr~~	~~8/3/92~~	~~2-79-23-(7)~~
Rough Run	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-8
Coggins Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-9
Shoal Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-10
Hunter Jim Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-11
Trout Creek	From source to West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-12
Fowler Branch	From source to Trout Creek	WS-III	8/3/92	2-79-23-12-1
Laurel Branch	From source to Trout Creek	WS-III Tr	8/3/92	2-79-23-12-2

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Raven Fork	From source to Trout Creek	WS-III	8/3/92	2-79-23-12-3
Little Trout Creek	From source to Trout Creek	WS-III	8/3/92	2-79-23-12-4
Bell Coney Branch	From source to Little Trout Creek	WS-III	8/3/92	2-79-23-12-4-1
Betsy Branch	From source to Trout Creek	WS-III	8/3/92	2-79-23-12-5
Grassy Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-13
Little Mill Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-14
Dickson Creek	From source to West Fork Tuckasegee River	WS-III	8/3/92	2-79-23-15
Mill Creek	From source to West Fork Tuckasegee River	WS-III Tr	8/3/92	2-79-23-16
Tuckasegee River	From West Fork Tuckasegee River to a point 0.6 mile upstream of Western Carolina University Power Dam	WS-III&B Tr	9/1/96	2-79-(24)
Mine Branch	From source to Tuckasegee River	WS-III	8/3/92	2-79-25
John Brown Branch	From source to Tuckasegee River	WS-III	8/3/92	2-79-26
Webster Creek	From source to Tuckasegee River	WS-III	8/3/92	2-79-27
Caney Fork	From source to Mull Creek	WS-III Tr HQW	8/3/92	2-79-28-(0.5)
Piney Mountain Creek	From source to Caney Fork	WS-III HQW	8/3/92	2-79-28-1
Bearwallow Creek	From source to Piney Mountain Creek	WS-III HQW	8/3/92	2-79-28-1-1
Chestnut Ridge Creek	From source to Bearwallow Creek	WS-III HQW	8/3/92	2-79-28-1-1-1
Birch Ridge Creek	From source to Bearwallow Creek	WS-III HQW	8/3/92	2-79-28-1-1-2
Rough Butt Creek	From source to Caney Fork	WS-III HQW	8/3/92	2-79-28-2
Caney Fork	From Mull Creek to Tuckaseegee River	WS-III Tr	8/3/92	2-79-28-(2.5)
Mull Creek	From source to Caney Fork	WS-III Tr	8/3/92	2-79-28-3
Coppermine Creek	From source to Mull Creek	WS-III	8/3/92	2-79-28-3-1
Beechflat Creek	From source to Mull Creek	WS-III	8/3/92	2-79-28-3-2
Sugar Creek	From source to Caney Fork	WS-III	8/3/92	2-79-28-4
Dryland Laurel Branch	From source to Sugar Creek	WS-III	8/3/92	2-79-28-4-1
Chastine Creek	From source to Caney Fork	WS-III	8/3/92	2-79-28-5
Craig Creek	From source to Chastine Creek	WS-III	8/3/92	2-79-28-5-1
Frady Creek	From source to Chastine Creek	WS-III	8/3/92	2-79-28-5-2
Abbs Creek	From source to Caney Fork	WS-III	8/3/92	2-79-28-6
Johns Creek	From source to Caney Fork	WS-III	8/3/92	2-79-28-7
Rich Mountain Branch	From source to Johns Creek	WS-III	8/3/92	2-79-28-7-1
Moses Creek	From source to Caney Fork	WS-III Tr	8/3/92	2-79-28-8
East Fork Moses Creek	From source to Moses Creek	WS-III	8/3/92	2-79-28-8-1
West Fork Moses Creek	From source to Moses Creek	WS-III	8/3/92	2-79-28-8-2
Indian Camp Branch	From source to West Fork Moses Creek	WS-III	8/3/92	2-79-28-8-2-1
Wayehutta Creek	From source to Tuckasegee River	WS-III	8/3/92	2-79-29
Rocky Face Branch	From source to Wayehutta Creek	WS-III	8/3/92	2-79-29-1
Tuckasegee River	From a point 0.6 mile upstream of Western Carolina University Power Dam to Western Carolina University Power Dam (Western Carolina University water supply intake)	WS-III&B Tr CA	9/1/96	2-79-(29.5)
Tuckasegee River	From Western Carolina University	B Tr	9/1/96	2-79-(30)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	Power Dam to Savannah Creek			
Cullowhee Creek	From source to Tuckasegee River	C Tr	7/1/61	2-79-31
Whiterock Creek	From source to proposed intake for Western Carolina Univ. Water Supply	C HQW	8/3/92	2-79-31-1-(1)
Whiterock Creek	From proposed intake for Western Carolina University Water Supply to Cullowhee Creek	C	7/1/61	2-79-31-1-(2)
Dodgen Creek	From source to Whiterock Creek	C	7/1/61	2-79-31-1-3
Bearpen Branch	From source to Dodgen Creek	C	7/1/61	2-79-31-1-3-1
Wilson Creek	From source to Cullowhee Creek	C Tr	7/1/73	2-79-31-2
Wolf Creek	From source to proposed intake for Western Carolina Univ. Water Supply	C HQW	8/3/92	2-79-31-3-(1)
Wolf Creek	From proposed intake for Western Carolina University Water Supply to Cullowhee Creek	C	7/1/61	2-79-31-3-(2)
Cherry Gap Branch (Chevy Gap Branch)	From source to Cullowhee Creek	C	7/1/61	2-79-31-4
Tilley Creek	From source to Cullowhee Creek	C Tr	7/1/73	2-79-31-5
Flat Branch	From source to Western Carolina University Water Supply Intake	C HQW	8/3/92	2-79-31-5-1-(1)
Flat Branch	From Western Carolina Univ. Water Supply Intake to Tilley Creek	C	7/1/61	2-79-31-5-1-(2)
Pressley Creek	From source to Tilley Creek	C	7/1/61	2-79-31-5-2
Parker Branch	From source to Pressley Creek	C	7/1/61	2-79-31-5-2-1
Bryson Branch	From source to Tilley Creek	C	7/1/61	2-79-31-5-3
Long Branch	From source to Western Carolina University Water Supply Intake	C HQW	8/3/92	2-79-31-6-(1)
Long Branch	From Western Carolina Univ. Water Supply Intake to Cullowhee Creek	C	7/1/61	2-79-31-6-(2)
Cane Creek	From source to Tuckasegee River	C Tr	7/1/73	2-79-32
Ash Branch	From source to Tuckasegee River	C	7/1/61	2-79-33
Locust Creek	From source to Tuckasegee River	C	7/1/61	2-79-34
Mill Creek	From source to Tuckasegee River	C	7/1/61	2-79-35
Bumgarner Branch	From source to Mill Creek	C	7/1/61	2-79-35-1
~~Tuckasegee River~~	~~From Savannah Creek to Dillsboro Dam~~	~~C Tr~~	~~4/1/71~~	~~2-79-(35.5)~~
Savannah Creek	From source to Tuckasegee River	C Tr	7/1/61	2-79-36
Shell Branch	From source to Savannah Creek	C	7/1/61	2-79-36-1
Long Branch	From source to Savannah Creek	C	7/1/61	2-79-36-2
Hornbuckle Branch	From source to Savannah Creek	C	7/1/61	2-79-36-3
Sassafras Branch	From source to Hornbuckle Branch	C	7/1/61	2-79-36-3-1
Sugar Branch	From source to Savannah Creek	C	7/1/61	2-79-36-4
Betty Branch	From source to Savannah Creek	C	7/1/61	2-79-36-5
Rhoda Branch	From source to Savannah Creek	C	7/1/61	2-79-36-6
Tatham Creek	From source to Savannah Creek	C	7/1/61	2-79-36-7
East Fork Savannah Creek	From source to Savannah Creek	C Tr	7/1/61	2-79-36-8
Reed Branch	From source to Savannah Creek	C	7/1/61	2-79-36-9
Deets Creek	From source to Savannah Creek	C	7/1/61	2-79-36-10
Greens Creek	From source to Savannah Creek	C Tr	7/1/61	2-79-36-11

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Sugar Fork	From source to Greens Creek	C	7/1/61	2-79-36-11-1
Peewee Branch	From source to Greens Creek	C	7/1/61	2-79-36-11-2
Brushy Fork	From source to Greens Creek	C	7/1/61	2-79-36-11-3
Brook Branch	From source to Greens Creek	C	7/1/61	2-79-36-11-4
Sutton Branch	From source to Savannah Creek	C	7/1/61	2-79-36-12
Cagle Branch	From source to Savannah Creek	C	7/1/61	2-79-36-13
Little Savannah Creek	From source to Savannah Creek	C	7/1/61	2-79-36-14
Blake Branch	From source to Little Savannah Creek	C	7/1/61	2-79-36-14-1
Yellow Bird Branch	From source to Tuckasegee River	C	7/1/61	2-79-37
Tuckasegee River	From Dillsboro Dam to Mack Town Branch	C	4/1/71	2-79-(38)
Scott Creek	From source to Tuckasegee River	C Tr	9/1/74	2-79-39
Woodfin Creek	From source to Scott Creek	C Tr	7/1/73	2-79-39-1
Carson Branch	From source to Scott Creek	C	7/1/61	2-79-39-2
Dark Ridge Creek	From source to Scott Creek	C Tr	7/1/73	2-79-39-3
Queen Camp Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-1
Flint Spring Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-2
Doubletop Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-3
Cabin Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-4
Jones Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-5
Licklog Creek	From source to Dark Ridge Creek	C	7/1/61	2-79-39-3-6
Cashie Branch	From source to Scott Creek	C	7/1/61	2-79-39-4
Soapstone Creek	From source to Scott Creek	C	7/1/61	2-79-39-5
Sugarloaf Creek	From source to Soapstone Creek	C	7/1/61	2-79-39-5-1
South Fork Sugarloaf Creek	From source to Sugarloaf Creek	C	7/1/61	2-79-39-5-1-1
North Fork Scott Creek	From source to Scott Creek	C Tr	7/1/73	2-79-39-6
Narrows Cove Branch	From source to North Fork Scott Creek	C Tr	7/1/73	2-79-39-6-1
Big Branch	From source to North Fork Scott Creek	C Tr	7/1/73	2-79-39-6-2
Buff Creek	From source to Scott Creek	C Tr	7/1/61	2-79-39-7
Henry Creek	From source to Buff Creek	C	7/1/61	2-79-39-7-1
Ochre Hill Creek	From source to Scott Creek	C	7/1/61	2-79-39-8
Parris Branch	From source to Scott Creek	C Tr	9/1/74	2-79-39-9
Blanton Branch	From source to Scott Creek	C	7/1/61	2-79-39-10
Fisher Creek	From source to Sylva Water Supply Intake	WS-I	8/3/92	2-79-39-11-(1)
Fisher Creek	From Sylva Water Supply Intake to Scott Creek	C Tr	7/1/73	2-79-39-11-(2)
Unnamed Tributary to Fisher Creek	From source to Sylva Water Supply Intake	WS-I	8/3/92	2-79-39-11-2.5-(1)
Unnamed Tributary to Fisher Creek	From Sylva Water Supply Intake to Fisher Creek	C Tr	7/1/73	2-79-39-11-2.5-(2)
Dills Creek	From source to Fisher Creek	C	8/3/92	2-79-39-11-3
Unnamed Tributary to Dills Creek	From source to Sylva Water Supply Intake	WS-I	8/3/92	2-79-39-11-3-1-(1)
Unnamed Tributary to Dills Creek	From Sylva Water Supply Intake to Dills Creek	C	8/3/92	2-79-39-11-3-1-(2)
Monteith Branch	From source to Scott Creek	C	7/1/61	2-79-39-12
Kitchin Branch	From source to Scott Creek	C	7/1/61	2-79-39-13

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Allens Branch	From source to Scott Creek	C	9/1/74	2-79-39-14
Cope Creek	From source to Scott Creek	C Tr	7/1/73	2-79-39-15
Dills Branch	From source to Scott Creek	C	9/1/74	2-79-39-16
Mack Town Branch	From source to Tuckasegee River	C	7/1/61	2-79-40
Tuckasegee River	From Mack Town Branch to Cochran Branch	B	9/1/96	2-79-(40.5)
Long Branch	From source to Tuckasegee River	C	7/1/61	2-79-41
Mince Branch	From source to Long Branch	C	7/1/61	2-79-41-1
Dicks Creek	From source to Tuckasegee River	C Tr	7/1/61	2-79-42
West Fork Dicks Creek	From source to Dicks Creek	C	7/1/61	2-79-42-1
Ned Branch	From source to West Fork Dicks Creek	C	7/1/61	2-79-42-1-1
Big Branch	From source to West Fork Dicks Creek	C	7/1/61	2-79-42-1-2
Buckeye Branch	From source to West Fork Dicks Creek	C	7/1/61	2-79-42-1-3
East Fork Dicks Creek	From source to Dicks Creek	C	7/1/61	2-79-42-2
Schoolhouse Branch	From source to Dicks Creek	C Tr	7/1/61	2-79-42-3
Laurel Branch	From source to Tuckasegee River	C	7/1/61	2-79-43
Barkers Creek	From source to Tuckasegee River	C Tr	7/1/61	2-79-44
West Fork Barkers Creek	From source to Barkers Creek	C	7/1/61	2-79-44-1
Middle Fork Barkers Creek	From source to Barkers Creek	C	7/1/61	2-79-44-2
East Fork Barkers Creek	From source to Barkers Creek	C	7/1/61	2-79-44-3
Jacks Creek	From source to Tuckasegee River	C	7/1/61	2-79-45
Cane Branch	From source to Tuckasegee River	C	7/1/61	2-79-46
Nations Creek	From source to Tuckasegee River	C	7/1/61	2-79-47
Joe Branch	From source to Nations Creek	C	7/1/61	2-79-47-1
Bumgarner Branch	From source to Tuckasegee River	C	4/1/71	2-79-48
Rocky Branch	From source to Bumgarner Branch	C	7/1/61	2-79-48-1
Camp Creek	From source to Tuckasegee River	C	7/1/61	2-79-49
Beck Branch	From source to Camp Creek	C	7/1/61	2-79-49-1
Crooked Creek	From source to Tuckasegee River	C	7/1/61	2-79-50
Lewis Creek	From source to Tuckasegee River	C	7/1/61	2-79-51
Conley Creek (Connelly Creek)	From source to Tuckasegee River	C Tr	7/1/73	2-79-52
Grassy Branch	From source to Conley Creek	C	7/1/61	2-79-52-1
Slipoff Branch	From source to Conely Creek	C	7/1/61	2-79-52-2
Camp Branch	From source to Conley Creek	C	7/1/61	2-79-52-3
~~Chestnut Cove Creek~~	~~From source to Conely Creek~~	~~C~~	~~7/1/61~~	~~2-79-52-4~~
Deep Gap Branch	From source to Chestnut Cove Creek	C	7/1/61	2-79-52-4-1
Right Fork Conley Creek	From source to Conley Creek	C Tr	7/1/73	2-79-52-5
Wesser Creek	From source to Right Fork Conley Creek	C	7/1/61	2-79-52-5-1
Williams Branch	From source to Right Fork Conely Creek	C	7/1/61	2-79-52-5-2
Improvement Creek	From source to Right Fork Conley Cr.	C	7/1/61	2-79-52-5-3
Moore Branch	From source to Conley Creek	C	7/1/61	2-79-52-6
Tuc-a-way Lake	Entire Lake and connecting stream to Tuckasegee River	C	7/1/61	2-79-53
Fishtrap Branch	From source to Tuckasegee River	C	7/1/61	2-79-54
Oconaluftee River	From source to Collins Creek	C Tr HQW	8/1/90	2-79-55-(1)
Beech Flats Prong	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-2

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Mine Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-1
Minnie Ball Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-2
Peruvian Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-3
Aden Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-4
Huskey Creek	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-5
Jack Bradley Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-6
Wild Cherry Branch	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-7
Kanati Fork	From source to Beech Flats Prong	C Tr HQW	8/1/90	2-79-55-2-8
Kephart Prong	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-3
Upper Grassy Branch	From source to Kephart Prong	C Tr HQW	8/1/90	2-79-55-3-1
Hunter Creek	From source to Upper Grassy Branch	C Tr HQW	8/1/90	2-79-55-3-1-1
Lower Grassy Branch	From source to Kephart Prong	C Tr HQW	8/1/90	2-79-55-3-2
Sweat Heifer Creek	From source to Kephart Prong	C Tr HQW	8/1/90	2-79-55-3-3
Coon Branch	From source to Kephart Prong	C Tr HQW	8/1/90	2-79-55-3-4
Smith Branch	From source to Oconaluftee River	C HQW	8/1/90	2-79-55-4
Jim Mac Branch	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-5
Cliff Branch	From source to Oconaluftee River	C HQW	8/1/90	2-79-55-6
Shell Bark (Hickory Flat) Branch	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-7
Will Branch	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-8
Oconaluftee River	From Collins Creek to Bradley Fork	B Tr HQW	8/1/90	2-79-55-(9)
Collins Creek	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-10
Newton Branch	From source to Collins Creek	C Tr HQW	8/1/90	2-79-55-10-1
Oconaluftee River	From Bradley Fork to Raven Fork	C Tr HQW	8/1/90	2-79-55-(11)
Bradley Fork	From source to Chasteen Creek	C Tr HQW	8/1/90	2-79-55-12-(1)
Chasm Prong	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-2
Gulf Prong	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-3
Frowning Rock Prong	From source to Gulf Prong	C Tr HQW	8/1/90	2-79-55-12-3-1
Pecks Corner Branch	From source to Gulf Prong	C Tr HQW	8/1/90	2-79-55-12-3-2
Washout Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-4
Bearwallow Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-5
Louie Camp Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-6
Cabin Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-7
Tennessee Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-8
Taywa Creek	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-9
Tabor Branch	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-10
Bradley Fork	From Chasteen Creek to Oconaluftee River	B Tr HQW	8/1/90	2-79-55-12-(11)
Chasteen Creek	From source to Bradley Fork	C Tr HQW	8/1/90	2-79-55-12-12
Becks Branch	From source to Cherokee Indian Reservation boundary (approximately 2.0 miles above mouth)	C Tr HQW	8/1/90	2-79-55-13-(1)
Becks Branch	From Cherokee Indian Reservation boundary (approximately 2.0 miles above mouth) to Cherokee Indian Reservation boundary (approximately 0.5 miles above mouth)	C Tr	7/1/61	2-79-55-13-(2)
Becks Branch	From Cherokee Indian Reservation	C Tr HQW	8/1/90	2-79-55-13-(3)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	boundary (approximately 0.5 miles above mouth) to Oconaluftee River			
Tow String Creek	From source to Cherokee Indian Reservation boundary (approximately 0.6 miles above mouth)	C Tr	7/1/61	2-79-55-14-(1)
Tow String Creek	From Cherokee Indian Reservation boundary (approximately 0.6 miles above mouth) to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-14-(2)
Couches Creek	From source to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-15
Mingus Creek	From source to Cherokee Water Supply Intake	WS-I Tr	8/3/92	2-79-55-16-(1)
Mingus Creek	From Cherokee Water Supply Intake to Oconaluftee River	C Tr HQW	8/1/90	2-79-55-16-(2)
Madcap Branch	From source to Mingus Creek	C Tr HQW	8/1/90	2-79-55-16-3
Oconaluftee River	From Raven Fork to Cherokee Indian Reservation boundary (approximately 0.4 miles downstream of Goose Creek)	C Tr	7/1/61	2-79-55-(16.5)
Raven Fork	From source to Jones Creek	C Tr HQW	8/1/90	2-79-55-17-(1)
Left Fork Raven Fork	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-2
Raven Creek	From source to Left Fork Raven Fork	C Tr HQW	8/1/90	2-79-55-17-2-1
Bills Creek	From source to Raven Creek	C Tr HQW	8/1/90	2-79-55-17-2-1-1
Little Niagara Creek	From source to Raven Creek	C Tr HQW	8/1/90	2-79-55-17-2-1-2
Middle Fork Raven Fork	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-3
Right Fork Raven Fork	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-4
Thicket Branch	From source to Right Fork Raven Fork	C Tr HQW	8/1/90	2-79-55-17-4-1
Rapid Creek	From source to Right Fork Raven Fork	C Tr HQW	8/1/90	2-79-55-17-4-2
Bulldie Creek	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-5
Breedlove Branch	From source to Bulldie Creek	C Tr HQW	8/1/90	2-79-55-17-5-1
Weaver Branch	From source to Breedlove Branch	C Tr HQW	8/1/90	2-79-55-17-5-1-1
Simmons Branch	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-6
Raven Fork	From Jones Creek to Cherokee Indian Reservation boundary (approximately 0.1 mile below Fountain Branch)	B Tr HQW	8/1/90	2-79-55-17-(7)
Jones Creek	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-8
Enloe Creek	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-9
Hideway Brook (Big Branch)	From source to Enloe Creek	C Tr HQW	8/1/90	2-79-55-17-9-1
Ramp Cove Branch	From source to Raven Fork	B Tr HQW	8/1/90	2-79-55-17-10
Batsaw (Balsam) Branch	From source to Raven Fork	C Tr HQW	8/1/90	2-79-55-17-11
Whitewater Branch	From source to Raven Fork	B Tr HQW	8/1/90	2-79-55-17-12
Fountain Branch	From source to Raven Fork	B Tr HQW	8/1/90	2-79-55-17-13
Raven Fork	From Cherokee Indian Reservation boundary (approximately 0.1 mile below Fountain Branch) to a point 0.5 miles above Straight Fork	B Tr	7/1/61	2-79-55-17-(13.5)
Ace Creek	From source to Cherokee Indian Reservation boundary (approximately 0.4 miles upstream of mouth)	B Tr HQW	8/1/90	2-79-55-17-14-(1)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Ace Creek	From Cherokee Indian Reservation boundary (approximately 0.4 miles upstream of mouth) to Raven Fork	B Tr	7/1/61	2-79-55-17-14-(2)
Raven Fork	From a point 0.5 mile above Straight Fork to Oconaluftee River	C Tr	7/1/61	2-79-55-17-(15)
Straight Fork	From source to Cherokee Indian Reservation boundary (approximately 0.8 miles upstream of Stillwell Creek)	C Tr HQW	8/1/90	2-79-55-17-16-(0.5)
Thermo (Teds) Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-1
Big Head Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-2
Dans Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-3
Roses Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-4
Miller Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-5
Manse Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-6
Balsam Corner Creek	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-7
Laurel Gap Branch	From source to Balsam Corner Creek	C Tr HQW	8/1/90	2-79-55-17-16-7-1
Turkey Pen Branch	From source to Balsam Corner Creek	C Tr HQW	8/1/90	2-79-55-17-16-7-2
Trap Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-8
Kahneska Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-9
Lynn Camp Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-10
Table Rock Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-11
Byrd Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-12
Thumper Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-13
Grass Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-14
Ledge Creek	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-15
Right Prong Ledge Creek	From source to Ledge Creek	C Tr HQW	8/1/90	2-79-55-17-16-15-1
Round Bottom Creek	From source to Straight Fork	B Tr HQW	8/1/90	2-79-55-17-16-16
Hyatt Creek	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-17
Rock Camp Run	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-18
Quillaree Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-19
Skidder Branch	From source to Straight Fork	C Tr HQW	8/1/90	2-79-55-17-16-20
Straight Fork	From Cherokee Indian Reservation boundary (located approximately 0.8 miles upstream of Stillwell Creek) to Raven Fork	C Tr	7/1/61	2-79-55-17-16-(20.5)
Stillwell Creek	From source to Cherokee Indian Reservation boundary (approximately 0.5 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-16-21-(1)
Stillwell Creek	From Cherokee Indian Reservation boundary (approximately 0.5 miles above mouth) to Straight Fork	C Tr	7/1/61	2-79-55-17-16-21-(2)
Bunches Creek	From source to Cherokee Indian Reservation boundary (approximately 0.1 mile downstream of Madcap Branch)	C Tr HQW	8/3/92	2-79-55-17-17-(1)
Flat Creek	From source to Bunches Creek	C Tr HQW	8/1/90	2-79-55-17-17-3
Black Camp Branch (Rock Camp Branch)	From source to Bunches Creek	C Tr HQW	8/1/90	2-79-55-17-17-4
John Henry Camp Creek	From source to Bunches Creek	C Tr HQW	8/1/90	2-79-55-17-17-5

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
Pleasant Branch	From source to Bunches Creek	C Tr HQW	8/1/90	2-79-55-17-17-6
Madcap Branch	From source to Cherokee Indian Reservation boundary (approximately 0.4 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-17-7-(1)
Madcap Branch	From Cherokee Indian Reservation boundary (approximately 0.4 miles above mouth) to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-7-(2)
Bunches Creek	From Cherokee Indian Reservation boundary (approximately 0.1 miles downstream of Madcap Branch) to Raven Fork	C Tr	7/1/61	2-79-55-17-17-(7.5)
Spread Branch	From source to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-8
Selma Creek	From source to Cherokee Indian Reservation boundary (approximately 0.2 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-17-9-(1)
Selma Creek	From Cherokee Indian Reservation boundary (approximately 0.2 miles above mouth) to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-9-(2)
Flat Bald Branch	From source to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-10
Heintooga Creek	From source to Cherokee Indian Reservation boundary (approximately 0.6 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-17-11-(1)
Heintooga Creek	From Cherokee Indian Reservation boundary (approximately 0.6 miles above mouth) to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-11-(2)
Moody Branch	From source to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-12
Board Cove Branch	From source to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-13
Redman Creek	From source to Bunches Creek	C Tr	7/1/61	2-79-55-17-17-14
Left Fork Redman Creek	From source to Cherokee Indian Reservation boundary (approximately 0.2 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-17-14-1-(1)
Left Fork Redman Creek	From Cherokee Indian Reservation boundary (approximately 0.2 miles above mouth) to Redman Creek	C Tr	7/1/61	2-79-55-17-17-14-1-(2)
Right Fork Redman Creek	From source to Cherokee Indian Reservation boundary (approximately 0.3 miles above mouth)	C Tr HQW	8/1/90	2-79-55-17-17-14-2-(1)
Right Fork Redman Creek	From Cherokee Indian Reservation boundary (approximately 0.3 miles above mouth) to Redman Creek	C Tr	7/1/61	2-79-55-17-17-14-2-(2)
Tooni Branch (Tunergh Creek)	From source to Bunches Creek	C	7/1/61	2-79-55-17-17-15
Galamore Branch	From source to Raven Fork	C	7/1/61	2-79-55-17-18
Soggy Hill Branch	From source to Raven Fork	C	7/1/61	2-79-55-17-19
Pigeon Creek	From source to Raven Fork	C	7/1/61	2-79-55-17-20
Mingo Creek	From source to Raven Fork	C Tr	7/1/73	2-79-55-17-21
Sherrill Cove Branch	From source to Raven Fork	C	7/1/61	2-79-55-17-22
Poplar Hollow Branch	From source to Raven Fork	C	7/1/61	2-79-55-17-23

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Grassy Branch	From source to Oconaluftee River	C	7/1/61	2-79-55-18
Lambert Branch	From source to Oconaluftee River	C	7/1/61	2-79-55-19
Owl Branch (East side of Oconaluftee River)	From source to Oconaluftee River	C	7/1/61	2-79-55-20
Soco Creek	From source to Oconaluftee River	C Tr	7/1/73	2-79-55-21
Rough Branch	From source to Soco Creek	C	7/1/61	2-79-55-21-1
Lost Cove Branch	From source to Soco Creek	C Tr	7/1/73	2-79-55-21-2
Hornbuckle Creek	From source to Soco Creek	C Tr	7/1/73	2-79-55-21-3
Open Branch	From source to Hornbuckle Creek	C	7/1/61	2-79-55-21-3-1
Cherry Orchard Branch	From source to Hornbuckle Creek	C	7/1/61	2-79-55-21-3-2
Cranberry Creek	From source to Hornbuckle Creek	C	7/1/61	2-79-55-21-3-3
Rough Branch	From source to Hornbuckle Creek	C	7/1/61	2-79-55-21-3-4
Polecat Branch	From source to Hornbuckle Creek	C	7/1/61	2-79-55-21-3-5
Blackrock Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-4
Shut-in Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-5
Jenkins Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-6
West Fork Jenkins Creek	From source to Jenkins Creek	C	7/1/61	2-79-55-21-6-1
East Fork Jenkins Creek	From source to Jenkins Creek	C	7/1/61	2-79-55-21-6-2
Indian Creek (Pheasant Creek)	From source a point 0.6 mile upstream of Cherokee Indian Reservation water supply intake	WS-II	8/3/92	2-79-55-21-7-(1)
Indian Creek (Pheasant Creek)	From a point 0.6 mile upstream of Cherokee Indian Reservaion water supply intake to Cherokee Reservation water supply intake	WS-II CA	8/3/92	2-79-55-21-7-(2)
Indian Creek (Pheasant Creek)	From Cherokee Indain Reservation water supply intake to Soco Creek	C	7/1/61	2-79-55-21-7-(3)
Washington Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-8
Long (Adams) Branch	From source to Soco Creek	C	7/1/61	2-79-55-21-9
Wrights Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-10
Mainey Branch	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-1
Bradley Branch	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-2
Big Witch Creek	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-3
Mink Branch	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-4
Swimmer Branch	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-5
Tooni Branch	From source to Wrights Creek	C	7/1/61	2-79-55-21-10-6
Stillwell Branch	From source to Soco Creek	C	7/1/61	2-79-55-21-11
Shoal Creek	From source to Soco Creek	C	7/1/61	2-79-55-21-12
Owl Branch (North side Oconaluftee River)	From source to Oconaluftee River	C Tr	7/1/61	2-79-55-22
Adams Creek	From source to Oconaluftee River	C	7/1/61	2-79-55-23
McCoy Branch	From source to Oconaluftee River	C Tr	7/1/61	2-79-55-24
Gibbs Branch	From source to Oconaluftee River	C	7/1/61	2-79-55-25
Goose Creek	From source to Oconaluftee River	C	7/1/61	2-79-55-26
Oconaluftee River	From Cherokee Indian Reservation boundary (approximately 0.4 miles downstream of Goose Creek) to Tuckaseegee River	C Tr HQW	8/1/90	2-79-55-(26.5)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
McHan Branch	From source to Oconaluftee River	C	7/1/61	2-79-55-27
Cooper Creek	From source to Tuckasegee River	C Tr	7/1/61	2-79-56
Little Creek	From source to Cooper Creek	C Tr	7/1/61	2-79-56-1
Wiggins Branch	From source to Cooper Creek	C	7/1/61	2-79-56-2
Galbraith Creek (Galbreath Creek)	From source to Tuckasegee River	C	7/1/61	2-79-57
Worley Branch	From source to Galbraith Creek	C	7/1/61	2-79-57-1
Falls Branch	From source to Tuckasegee River	C	7/1/61	2-79-58
Johnson Branch	From source to Tuckasegee River	C	7/1/61	2-79-59
Maple Branch	From source to Tuckasegee River	C	7/1/61	2-79-60
Kirkland (East Fork Kirkland) Creek	From source to Sitton Creek	C	7/1/61	2-79-61-(1)
Kirkland Creek	From Sitton Creek to Tuckasegee River	C Tr	7/1/61	2-79-61-(2)
Sitton (West Fork Kirkland) Creek	From source to Kirkland Creek	C	7/1/61	2-79-61-3
Shepherd Creek	From source to Kirkland Creek	C	7/1/61	2-79-61-4
Scarred Branch	From source to Tuckasegee River	C	7/1/61	2-79-62
Deep Creek	From source to Indian Creek	WS-II Tr	8/1/94	2-79-63-(1)
Sahlee Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-2
Rocky Fork	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-3
Cherry Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-4
Beetree Creek (Beartree Creek)	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-5
Nettle Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-6
Left Fork Deep Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-7
Keg Drive Branch	From source to Left Fork Deep Creek	WS-II Tr	8/1/94	2-79-63-7-1
Hermit Branch	From source to Left Fork Deep Creek	WS-II Tr	8/1/94	2-79-63-7-2
Bearpen Branch	From source to Left Fork Deep Creek	WS-II Tr	8/1/94	2-79-63-7-3
Pole Road Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-8
Elliott Cove Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-9
Nicks Nest Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-10
McCracken Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-11
Bridge Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-12
Cherry Cove Branch (Left Prong Bridge Creek)	From source to Bridge Creek	WS-II Tr	8/1/94	2-79-63-12-1
Dancing Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-13
Bumgardner Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-14
Hammer Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-15
Deep Creek	From Indian Creek to Juney Whank Branch	WS-II&B Tr	8/1/94	2-79-63-(16)
Indian Creek	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-17
Left Fork Indian Creek	From source to Indian Creek	WS-II Tr	8/1/94	2-79-63-17-1
Estes Branch	From source to Indian Creek	WS-II Tr	8/1/94	2-79-63-17-2
Georges Branch	From source to Indian Creek	WS-II Tr	8/1/94	2-79-63-17-3
Queen Branch	From source to Indian Creek	WS-II Tr	8/1/94	2-79-63-17-4
Tom Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-18
Deep Creek	From Juney Whank Branch to Town of Bryson City water supply intake (located just below Great Smoky	WS-II&B Tr CA	8/1/94	2-79-63-(18.5)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	Mountains National Park Boundary)			
Juney Whank Branch	From source to Deep Creek	WS-II Tr	8/1/94	2-79-63-19
Durham Branch	From source to point 0.5 mile upstream of mouth	WS-II	8/1/94	2-79-63-20-(1)
Durham Branch	From a point 0.5 mile upstream of mouth to Deep Creek	WS-II CA	8/1/94	2-79-63-20-(2)
Deep Creek	From Town of Bryson City water supply intake (located just below Great Smoky Mountains National Park Boundary) to Tuckasegee River	B Tr	9/1/96	2-79-63-(21)
Betts Branch	From source to Deep Creek	C	7/1/61	2-79-63-22
Toot Hollow Branch	From source to Tuckasegee River	C	9/1/74	2-79-64
Cripple Creek	From source to Tuckasegee River	C	9/1/74	2-79-65
Bryson Branch	From source to Tuckasegee River	C	9/1/74	2-79-66
Hughes Branch	From source to Tuckasegee River	C	9/1/74	2-79-67
Jenkins Branch	From source to Bryson City Water Supply Intake	C Tr HQW	8/3/92	2-79-68-(1)
Jenkins Branch	From Bryson City Water Supply Intake to Tuckasegee River	C	9/1/74	2-79-68-(2)
Tuckasegee River	From Cochran Branch to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	4/1/71	2-79-(68.5)
Cochran Branch	From source to Tuckasegee River	C	7/1/61	2-79-69
Lemmons Branch	From source to Tuckasegee River	C	4/1/71	2-79-70
Buckner Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-80
Gibby Branch	From source to Buckner Branch	C	7/1/61	2-80-1
Messer Branch	From source to Buckner Branch	C	7/1/61	2-80-2
Watkins Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-81
Mountain Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-82
Lands Creek	From source to Bryson City Water Supply Intake	WS-I	8/3/92	2-83-(1)
Long Branch	From source to Lands Creek	WS-I	8/3/92	2-83-2
Lands Creek	From Bryson City Water Supply Intake to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-83-(3)
Silvermine Branch	From source to Lands Creek	C	7/1/61	2-83-4
Laurel Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-84
Reeny Branch	From source to Laurel Branch	C	7/1/61	2-84-1
Peachtree Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee	C	7/1/61	2-85

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	River			
Middle Peachtree Creek	From source to Peachtree Creek	C	7/1/61	2-85-1
Little Peachtree Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-86
Canebrake Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-87
Hickory Flat Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C	7/1/61	2-88
Tuckasegee River Arm of Fontana Lake, Little Tennessee River, below elevation 1708 MSL	That portion of Tuckasegee River Arm of Fontana Lake below the upstream side of the mouth of Noland Creek	B	7/1/61	2-(89)
Noland Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-90
Clingmans Creek	From source to National Park Service Water Supply Intake	C Tr HQW	8/3/92	2-90-1-(1)
Clingmans Creek	From National Park Service Water Supply Intake to Noland Creek	C Tr	7/1/61	2-90-1-(2)
Salola Branch	From source to Noland Creek	C Tr	7/1/61	2-90-2
Bald Branch	From source to Noland Creek	C Tr	7/1/61	2-90-3
Sassafras Branch	From source to Noland Creek	C Tr	7/1/61	2-90-4
Upper Ripshin Branch	From source to Noland Creek	C Tr	7/1/61	2-90-5
Lower Ripshin Branch	From source to Noland Creek	C Tr	7/1/61	2-90-6
Jim Ute Branch	From source to Noland Creek	C Tr	7/1/61	2-90-7
Mill Creek	From source to Noland Creek	C Tr	7/1/61	2-90-8
Springhouse Branch	From source to Mill Creek	C Tr	7/1/61	2-90-8-1
Holder Cove Branch	From source to Noland Creek	C Tr	7/1/61	2-90-9
Drinklog Branch	From source to Noland Creek	C Tr	7/1/61	2-90-10
Andreas Branch	From source to Noland Creek	C Tr	7/1/61	2-90-11
Indian Creek	From source to Noland Creek	C Tr	7/1/61	2-90-12
Bearpen Branch	From source to Noland Creek	C Tr	7/1/61	2-90-13
Laurel Branch	From source to Noland Creek	C Tr	7/1/61	2-90-14
Jenkins Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	B	4/1/71	2-91
Flat Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-92
Goldmine Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-93
Hyatt Branch	From source to Goldmine Branch	C Tr	7/1/61	2-93-1
Tunnel Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee	C Tr	7/1/61	2-94

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	River			
Brewer Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-95
Gray Wolf Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	B	4/1/71	2-96
Forney Creek	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-97
Keeyuga Creek (Cherry Branch)	From source to Forney Creek	C Tr	7/1/61	2-97-1
Steeltrap Creek	From source to Forney Creek	C Tr	7/1/61	2-97-2
Little Steeltrap Creek	From source to Forney Creek	C Tr	7/1/61	2-97-3
Buckhorn Branch	From source to Forney Creek	C Tr	7/1/61	2-97-4
Christian Branch	From source to Forney Creek	C Tr	7/1/61	2-97-5
Huggins Creek	From source to Forney Creek	C Tr	7/1/61	2-97-6
Little Huggins Creek	From source to Huggins Creek	C Tr	7/1/61	2-97-6-1
Chokeberry Branch	From source to Forney Creek	C Tr	7/1/61	2-97-7
Board Camp Creek	From source to Forney Creek	C Tr	7/1/61	2-97-8
Noyah Branch	From source to Board Camp Creek	C Tr	7/1/61	2-97-8-1
Jonas Creek	From source to Forney Creek	C Tr	7/1/61	2-97-9
Little Jonas Creek	From source to Jonas Creek	C Tr	7/1/61	2-97-9-1
Yanu (Bearpen) Branch	From source to Little Jonas Creek	C Tr	7/1/61	2-97-9-1-1
Scarlet Ridge Creek	From source to Jonas Creek	C Tr	7/1/61	2-97-9-2
White Mans Glory Creek	From source to Forney Creek	C Tr	7/1/61	2-97-10
Locust Cove	From source to Forney Creek	C Tr	7/1/61	2-97-11
Slab Camp Branch	From source to Forney Creek	C Tr	7/1/61	2-97-12
Bee Gum Branch	From source to Forney Creek	C Tr	7/1/61	2-97-13
Advalorem Branch (Avakrem Branch)	From source to Forney Creek	C Tr	7/1/61	2-97-14
Whiteoak Branch	From source to Forney Creek	C Tr	7/1/61	2-97-15
Welch Branch	From source to Forney Creek	C Tr	7/1/61	2-97-16
Bear Creek	From source to Forney Creek	C Tr	7/1/61	2-97-17
Glady Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-98
Little Laurel Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-99
Jenny Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-100
Polecat Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-101
Gunter Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee	C Tr	7/1/61	2-102

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
	River			
Monteith Branch	From source to Tuckasegee River Arm of Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-103
Poundmill Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-105
Pole Bridge Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-106
Welch Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-107
Halfmile Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-108
Hogpen Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-109
Poplar Pole Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-110
Mouse Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-111
Murphy Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-112
Town Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-113
Little Horse Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-114
Panther Creek	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-115
Shell Stand Creek	From source to Panther Creek	C	7/1/61	2-115-1
Deep Gap Creek	From source to Shell Stand Creek	C	7/1/61	2-115-1-1
Whiteoak Creek	From source to Shell Stand Creek	C	7/1/61	2-115-1-2
Elbow Branch	From source to Shell Stand Creek	C	7/1/61	2-115-1-3
Little Coon Branch	From source to Shell Stand Creek	C	7/1/61	2-115-1-4
Coon Branch	From source to Shell Stand Creek	C	7/1/61	2-115-1-5
Reid Branch	From source to Shell Stand Creek	C	7/1/61	2-115-1-6
Whiteoak Branch	From source to Shell Stand Creek	C	7/1/61	2-115-1-7
Rock Creek	From source to Panther Creek	C	7/1/61	2-115-2
~~Cook Branch~~	~~From source to Rock Creek~~	~~C~~	~~7/1/61~~	~~2-115-2-1~~
Rough Branch	From source to Panther Creek	C	7/1/61	2-115-3
Horse Branch	From source to Panther Creek	C	7/1/61	2-115-4
Tobacco Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-116
Wolf Creek	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-117
Cody Branch	From source to Wolf Creek	C	7/1/61	2-117-1
Little Branch	From source to Wolf Creek	C	7/1/61	2-117-2
Laurel Branch	From source to Wolf Creek	C	7/1/61	2-117-3
Medlin Branch	From source to Wolf Creek	C	7/1/61	2-117-4
Big Branch	From source to Wolf Creek	C	7/1/61	2-117-5
Taylor Branch	From source to Fontana Lake, Little Tennessee River	B	7/1/61	2-118

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Proctor Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-119
Roaring Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-120
Loving Entry Branch	From source to Fontana Lake, Little Tennessee River	B	7/1/61	2-121
Buckeye Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-122
Chambers Creek	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-123
North Fork Chambers Creek	From source to Chambers Creek	C Tr	7/1/61	2-123-1
Hogpen Branch	From source to North Fork Chambers Creek	C Tr	7/1/61	2-123-1-1
Springhouse Branch	From source to North Fork Chambers Creek	C Tr	7/1/61	2-123-1-2
Cherry Branch	From source to North Fork Chambers Creek	C Tr	7/1/61	2-123-1-3
Big Branch	From source to North Fork Chambers Creek	C Tr	7/1/61	2-123-1-4
West Fork Chambers Creek	From source to Chambers Creek	C Tr	7/1/61	2-123-2
Kate Branch	From source to West Fork Chambers Creek	C Tr	7/1/61	2-123-2-1
Chambers Branch	From source to West Fork Chambers Creek	C Tr	7/1/61	2-123-2-2
Anthony Branch	From source to Chambers Creek	C Tr	7/1/61	2-123-3
Kirkland Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-124
Bluff Branch	From source to Fontana Lake, Little Tennessee River	B	7/1/61	2-125
Pendleton Creek	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-126
Meetinghouse Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-127
Little Laurel Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-128
Laurel Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-129
Stecoah Creek	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-130
Cody Branch	From source to Stecoah Creek	C	7/1/61	2-130-1
Dry Creek	From source to Stecoah Creek	C	7/1/61	2-130-2
Edwards Creek	From source to Stecoah Creek	C	7/1/61	2-130-3
Carver Branch	From source to Edwards Creek	C	7/1/61	2-130-3-1
Sawyer Creek	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-131
South Fork Sawyer Creek	From source to Sawyer Creek	C	7/1/61	2-131-1
Brown Fork	From source to South Fork Sawyer Creek	C	7/1/61	2-131-1-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Big Branch	From source to South Fork Sawyer Creek	C	7/1/61	2-131-1-2
Johnson Gap Branch	From source to Sawyer Creek	C	7/1/61	2-131-2
White Pine Branch	From source to Sawyer Creek	C Tr	7/1/61	2-131-3
Boelinger Branch	From source to Sawyer Creek	C Tr	7/1/61	2-131-4
Pilkey Creek	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-132
Clark Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-133
Owensby Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-134
Chesquaw Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-135
Tuskeegee Creek	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-136
South Fork Tuskeegee Creek	From source to Tuskeegee Creek	C	7/1/61	2-136-1
North Fork Tuskeegee Creek	From source to Tuskeegee Creek	C	7/1/61	2-136-2
Cindy (Sandy) Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-3
Apple Tree Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-4
Chestnut Log Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-5
Maple Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-6
Garland (Flat) Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-7
Bailey Branch	From source to Tuskeegee Creek	C	7/1/61	2-136-8
Hyde Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-137
Calhoun Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-138
Mill Branch	From source to Fontana Lake, Little Tennessee River	C Tr	7/1/61	2-139
Yellow Branch	From source to Fontana Lake, Little Tennessee River	C	7/1/61	2-140
LITTLE TENNESSEE RIVER (Fontana Lake below elev. 1708)	From the upstream side of Shoal Branch to Fontana Dam	WS-IV&B CA	8/3/92	2-(140.5)
Shoal Branch	From source to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-141
Whiteside Creek	From source to Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-142
Poison Cove Branch	From source to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-143
Powell Branch (Cable Cove Branch)	From source to Wagontree Branch	WS-IV	8/3/92	2-144-(0.3)
Powell Branch (Cable Cove Branch)	From Wagontree Branch to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-144-(0.7)
Wagontree Branch	From source to Powell Branch (Cable Cove Branch)	WS-IV	8/3/92	2-144-1
Barn Branch	From source to Powell Branch (Cable Cove Branch)	WS-IV CA	8/3/92	2-144-2
Indian Camp Branch	From source to Powell Branch (Cable	WS-IV CA	8/3/92	2-144-3

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
	Cove Branch)			
Hazel Creek Arm of Fontana Lake, Little Tennessee River, below elevation 1708 MSL	Entire Arm	WS-IV Tr CA	8/3/92	2-(145)
Hazel Creek	From source to a point 0.7 mile upstream of mouth	C Tr	7/1/61	2-146-(0.5)
Anthony Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-1
Slick Rock Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-2
Rough Arm Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-3
Proctor Creek	From source to Hazel Creek	C Tr	7/1/61	2-146-4
James Camp Branch	From source to Proctor Creek	C Tr	7/1/61	2-146-4-1
Holden Cove Branch	From source to Proctor Creek	C Tr	7/1/61	2-146-4-2
Boomer Branch	From source to Proctor Creek	C Tr	7/1/61	2-146-4-3
Long Cove Branch	From source to Proctor Creek	C Tr	7/1/61	2-146-4-4
Elbow Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-5
Walkers Creek	From source to Hazel Creek	C Tr	7/1/61	2-146-6
Sally Sam Branch	From source to Walkers Creek	C Tr	7/1/61	2-146-6-1
Brushy Branch	From source to Walkers Creek	C Tr	7/1/61	2-146-6-2
Hawk Ridge Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-7
Huggins Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-8
Little Huggins Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-9
Bee Gum Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-10
Sawbrier Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-11
Wildcat Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-12
Cold Spring Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-13
Right Fork Cold Spring Branch	From source to Cold Spring Branch	C Tr	7/1/61	2-146-13-1
Bone Valley Creek	From source to Hazel Creek	C Tr	7/1/61	2-146-14
Roaring Creek	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-1
Mineral Gap Branch	From source to Roaring Creek	C Tr	7/1/61	2-146-14-1-1
Rock Camp Branch	From source to Roaring Creek	C Tr	7/1/61	2-146-14-1-2
Desolation Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-2
Calhoun Branch	From source to Desolation Branch	C Tr	7/1/61	2-146-14-2-1
Defeat Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-3
Woolly (Woody) Ridge Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-4
Nunda Branch	From source to Wooly (Woody) Ridge Branch	C Tr	7/1/61	2-146-14-4-1
Big Flats Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-5
Mill Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-6
White Walnut Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-7
Old House Branch	From source to Bone Valley Creek	C Tr	7/1/61	2-146-14-8
Sugar Fork Creek	From source to Hazel Creek	C Tr	7/1/61	2-146-15
Little Fork	From source to Sugar Fork Creek	C Tr	7/1/61	2-146-15-1
Haw Gap Branch	From source to Sugar Fork Creek	C Tr	7/1/61	2-146-15-2
Cope Branch	From source to Haw Gap Branch	C Tr	7/1/61	2-146-15-2-1
Sandy Gap Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-16
Pine Gap Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-17

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Rowan Branch	From source to Hazel Creek	C Tr	7/1/61	2-146-18
Hazel Creek	From a point 0.7 mile upstream of mouth to Hazel Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-146-(19)
Shehan Branch (Possum Hollow Creek)	From source to Bearpen Branch	WS-IV Tr	8/3/92	2-147-(0.3)
Shehan Branch (Possum Hollow Creek)	From Bearpen Branch to Hazel Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-147-(0.7)
Bearpen Branch	From source to Shehan Branch	WS-IV Tr	8/3/92	2-147-1
Hickory Bottom Branch	From source to a point 0.4 mile upstream of mouth	WS-IV Tr	8/3/92	2-147-2-(1)
Hickory Bottom Branch	From a point 0.4 mile upstream of mouth to Shehan Branch	WS-IV Tr CA	8/3/92	2-147-2-(2)
Laurel Branch	From source to Hazel Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-148
Cable Branch	From source to Hazel Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-149
Matt Branch	From source to Hazel Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-150
Blaze Branch	From source to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-152
Rattlesnake Branch	From source to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-153
Slick Branch	From source to Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-154
Persimmon Branch	From source to Fontana Lake, Little Tennessee River	WS-IV CA	8/3/92	2-155
Johnny Branch	From source to Fontana Lake, Little Tennessee River	WS-IV&B CA	8/3/92	2-156
Myers Branch	From source to Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-157
Eagle Creek Arm of Fontana Lake, Little Tennessee River, below elevation 1708 MSL	Entire Arm	WS-IV Tr CA	8/3/92	2-(158)
Eagle Creek	~~From source to a point 0.7 mile up-~~ stream of mouth of Camp Ten Branch	~~C Tr~~	~~7/1/61~~	~~2-159-(0.5)~~
Gunna Creek	From source to Eagle Creek	C Tr	7/1/61	2-159-1
Spence Cabin Branch	From source to Gunna Creek	C Tr	7/1/61	2-159-1-1
Paw Paw Creek	From source to Gunna Creek	C Tr	7/1/61	2-159-1-2
Tub Mill Creek	From source to Eagle Creek	C Tr	7/1/61	2-159-2
Ivy Branch	From source to Tub Mill Creek	C Tr	7/1/61	2-159-2-1
Burnt Ridge Branch	From source to Tub Mill Creek	C Tr	7/1/61	2-159-2-2
Panther Branch	From source to Tub Mill Creek	C Tr	7/1/61	2-159-2-3
Asgini Branch	From source to Tub Mill Creek	C Tr	7/1/61	2-159-2-4
Lawson Gant Lot Branch	From source to Tub Mill Creek	C Tr	7/1/61	2-159-2-5
Eagle Creek	From a point 0.7 mile upstream of mouth of Camp Ten Branch to Pinnacle Creek	WS-IV Tr	8/3/92	2-159-(2.5)
Camp Ten Branch	From source to a point 0.4 mile up-	C Tr	7/1/61	2-159-3-(1)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	stream of mouth			
Camp Ten Branch	From a point 0.4 mile upstream of mouth to Eagle Creek	WS-IV Tr	8/3/92	2-159-3-(2)
Ekaneetlee Creek	From source to Eagle Creek	WS-IV Tr	8/3/92	2-159-4
Big Tommy Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-1
Thomas Cove Branch	From source to Big Tommy Branch	WS-IV Tr	8/3/92	2-159-4-1-1
Little Tommy Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-2
Proctor Sang Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-3
Hurricane Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-4
Shelter Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-5
Boulder Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-6
Round Mountain Branch	From source to Ekaneetlee Creek	WS-IV Tr	8/3/92	2-159-4-7
Pinnacle Creek	From source to a point 1.0 mile upstream of Lone Branch	C Tr	7/1/61	2-159-5-(0.3)
Pinnacle Creek	From a point 1.0 mile upstream of Lone Branch to Eagle Creek	WS-IV Tr	8/3/92	2-159-5-(0.7)
Lone Branch	From source to Pinnacle Creek	WS-IV Tr	8/3/92	2-159-5-1
Soapstone Branch	From source to Pinnacle Creek	WS-IV Tr	8/3/92	2-159-5-2
Eagle Creek	From Pinnacle Creek to Eagle Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-159-(6)
Lost Cove Creek	From source to a point 0.4 mile downstream of mouth of Coldspring Branch	WS-IV Tr	8/3/92	2-160-(0.5)
Coldspring Branch	From source to Lost Cove Creek	WS-IV Tr	8/3/92	2-160-1
Lost Cove Creek	From a point 0.4 mile downstream of mouth of Coldspring Branch to Eagle Creek Arm of Little Tennessee River	WS-IV Tr CA	8/3/92	2-160-(2)
Ecoah Branch	From source to Eagle Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-161
Birchfield Branch	From source to Eagle Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-162
Augerhole Branch	From source to Eagle Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-163
Licklog Branch	From source to Eagle Creek Arm of Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-164
Payne Branch	From source to Fontana Lake, Little Tennessee River	WS-IV Tr CA	8/3/92	2-166
LITTLE TENNESSEE RIVER (Cheoah Lake, Calderwood Lake)	From Fontana Dam to North Carolina-Tennessee State Line	C Tr	7/1/61	2-(167)
Walker Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-168
Gold Branch	From source to Walker Branch	C	7/1/61	2-168-1
Panel Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-169
Welch Cove Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-170
Lewellyn Branch	From source to Cheoah Lake, Little	C Tr	7/1/61	2-171

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Classification Date	Index No.
	Tennessee River			
Sweet Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-172
Fox (Fax) Branch (North Side of Cheoah Lake)	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-173
Fox (Fax) Branch (South Side of Cheoah Lake)	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-174
Jack Shute Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-175
Deaver Branch	From source to Cheoah Lake, Little Tennessee River	C	9/1/74	2-176
Dednan Branch	From source to Santeetlah Village Water Supply Intake	C Tr HQW	8/3/92	2-176-1-(1)
Dednan Branch	From Santeetlah Village Water Intake to Deaver Branch	C	9/1/74	2-176-1-(2)
Farley Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-177
Twentymile Creek	From source to Proctor Branch	C Tr	7/1/61	2-178-(1)
Rye Patch Branch	From source to Twentymile Creek	C Tr	7/1/61	2-178-2
Greer Branch (Creek)	From source to Twentymile Creek	C	7/1/61	2-178-3
Twentymile Creek	From Proctor Branch to Lake Cheoah, Little Tennessee River	C Tr HQW	8/3/92	2-178-(4)
Proctor Branch	From source to Twentymile Creek	C Tr	7/1/61	2-178-5
Moore Spring Branch	From source to Dalton Branch	C Tr	7/1/61	2-178-6-(1)
Moore Spring Branch	From Dalton Branch to Twentymile Creek	C Tr HQW	8/3/92	2-178-6-(2)
Dalton Branch	From source to Moore Spring Branch	C Tr	7/1/61	2-178-6-3
Judy Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-179
Rocky Point Ferry Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-180
Buggy Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-181
Fishtrap Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-182
Pole Bridge Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-183
Deals Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-184
Laurel Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-185
Aiken Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-186
Little Laurel Branch	From source to Cheoah Lake, Little Tennessee River	C	7/1/61	2-187
Stratton Branch	From source to Cheoah Lake, Little Tennessee River	C Tr	7/1/61	2-188
Clat Branch	From source to Cheoah Lake, Little	C	7/1/61	2-189

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	Tennessee River			
Cheoah River	From source to Town of Robbinsville's proposed Water Supply Intake, located 850 feet, more or less, downstream of the confluence of Sweetwater Creek and Tulula Creek	WS-III Tr CA	8/3/92	2-190-(1)
Tulula Creek	From source to a point 0.5 mile upstream of mouth	WS-III Tr	8/3/92	2-190-2-(0.5)
Bear Creek	From source to Tulula Creek	WS-III Tr	8/3/92	2-190-2-1
Cabin Branch	From source to Bear Creek	WS-III	8/3/92	2-190-2-1-1
Cherry Branch	From source to Bear Creek	WS-III	8/3/92	2-190-2-1-2
Sawmill Branch	From source to Bear Creek	WS-III	8/3/92	2-190-2-1-3
Dee Branch	From source to Bear Creek	WS-III	8/3/92	2-190-2-1-4
Jacks Branch	From source to Tulula Creek	WS-III	8/3/92	2-190-2-2
Juts Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-3
Auntney Branch	From source to Tulula Creek	WS-III	8/3/92	2-190-2-4
Campbell Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-5
Hares Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-6
Anderson Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-7
Millpond Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-8
Bert Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-9
Franks Creek	From source to Tulula Creek	WS-III Tr	8/3/92	2-190-2-10
Hyde Mill Creek	From source to Tulula Creek	WS-III	8/3/92	2-190-2-11
Carpenter Branch	From source to Hyde Mill Creek	WS-III	8/3/92	2-190-2-11-1
Riley Branch	From source to Tulula Creek	WS-III	8/3/92	2-190-2-12
Holly Cove Branch	From source to Riley Branch	WS-III	8/3/92	2-190-2-12-1
Wiggins Mill Branch	From source to Tulula Creek	WS-III	8/3/92	2-190-2-13
Tulula Creek	From a point 0.5 mile upstream of mouth to Cheoah River	WS-III Tr CA	8/3/92	2-190-2-(14)
Sweetwater Creek	From source to a point 0.5 mile upstream of mouth	WS-III Tr	8/3/92	2-190-3-(0.5)
Stillhouse Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-1
Orr Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-2
Beech Creek	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-3
North Fork Beech Creek	From source to Beech Creek	WS-III	8/3/92	2-190-3-3-1
Rines Creek	From source to Beech Creek	WS-III	8/3/92	2-190-3-3-2
South Fork Beech Creek	From source to Beech Creek	WS-III	8/3/92	2-190-3-3-3
Davis Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-4
Pinhook Branch	From source to Davis Branch	WS-III	8/3/92	2-190-3-4-1
Harwood Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-5
Pigpen Branch	From source to Harwood Branch	WS-III	8/3/92	2-190-3-5-1
Holloway Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-6
Slay Bacon Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-7
Long Branch	From source to Sweetwater Creek	WS-III	8/3/92	2-190-3-8
Stillhouse Branch	From source to Long Branch	WS-III	8/3/92	2-190-3-8-1
Sweetwater Creek	From a point 0.5 mile upstream of mouth to Cheoah River	WS-III Tr CA	8/3/92	2-190-3-(9)
Cheoah River	From the Town of Robbinsville's	C Tr	7/1/61	2-190-(3.5)

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	proposed water supply intake, to Mountain Creek			
Long Creek	From source to a point 0.2 mile downstream of Panther Creek	WS-I Tr	8/3/92	2-190-4-(1)
Panther Creek	From source to Long Creek	WS-I Tr	8/3/92	2-190-4-2
Long Creek	From a point 0.2 mile downstream of Panther Creek to Rock Creek	C Tr HQW	8/3/92	2-190-4-(2.5)
Burgan Creek	From source to a point 0.2 mile upstream of mouth	WS-I Tr	8/3/92	2-190-4-3-(1)
Burgan Creek	From a point 0.2 mile upstream of mouth to Long Creek	C Tr HQW	8/3/92	2-190-4-3-(2)
Rock Creek	From source to Robbinsville's water supply (located approximately 0.1 mile upstream of mouth)	WS-I Tr	8/3/92	2-190-4-4-(1)
Rock Creek	From Robbinsville's water supply intake to Long Creek	C Tr HQW	8/3/92	2-190-4-4-(2)
Long Creek	From Rock Creek to Cheoah River	C Tr	7/1/61	2-190-4-(5)
Poison Branch	From source to Long Creek	C Tr	7/1/61	2-190-4-6
Atoah Creek	From source to Long Creek	C	7/1/61	2-190-4-7
Jake Branch	From source to Atoah Creek	C	7/1/61	2-190-4-7-1
Tahquette Branch	From source to Atoah Creek	C	7/1/61	2-190-4-7-2
Moose Branch	From source to Long Creek	C	7/1/61	2-190-4-8
Mauney Branch	From source to Long Creek	C	7/1/61	2-190-4-9
Cheoah River, Santeetlah Lake below elevation 1940 MSL	From Mountain Creek to Santeetlah Dam	B Tr	7/1/73	2-190-(5)
Mountain Creek	From source to Santeetlah Lake, Cheoah River	C Tr	7/1/61	2-190-6
Basin Branch	From source to Mountain Creek	C	7/1/61	2-190-6-1
Green Creek	From source to Mountain Creek	C	7/1/61	2-190-6-2
Shepherd Creek	From source to Mountain Creek	C	7/1/61	2-190-6-3
Pinhook Branch	From source to Mountain Creek	C	7/1/61	2-190-6-4
Massey Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-7
Cooloska Branch	From source to Santeetlah Lake, Cheoah River	B Tr	7/1/73	2-190-8
Snowbird Creek	From source to Polecat Branch	C Tr HQW	8/1/90	2-190-9-(0.5)
Bearpen Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-1
Rockbar Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-2
Meadow Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-3
Pantherflat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-4
Flat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-5
Littleflat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-6
Mouse Knob Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-7
Sassafras Creek	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-8
Fall Branch	From source to Sassafras Creek	C HQW	8/1/90	2-190-9-8-1
Indian Camp Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-9
Owlcamp Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-10

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Belding House Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-11
Wildcat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-12
Deerlick Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-13
Chestnut Flat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-14
Polecat Branch	From source to Snowbird Creek	C HQW	8/1/90	2-190-9-15
Snowbird Creek	From Polecat Branch to Santeetlah Lake, Cheoah River	C Tr	7/1/61	2-190-9-(15.5)
Lovin Branch	From source to Snowbird Creek	C	7/1/61	2-190-9-16
Little Snowbird Creek	From source to Snowbird Creek	C Tr	7/1/73	2-190-9-17
Newman Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-1
Hornet Nest Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-2
Mulky Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-3
Tom Taylor Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-4
Lucy Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-5
Birchspring Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-6
Plankroad Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-7
Gunstock Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-8
Coldspring Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-9
Wolfpen Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-10
Juanita Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-11
Rocky Spring Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-12
Sunday Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-13
Allmon Camp Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-14
Broadcamp Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-15
Axefield Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-16
Bear Creek	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-17
Birch Spring Branch	From source to Bear Creek	C	7/1/61	2-190-9-17-17-1
Flat Branch	From source to Bear Creek	C	7/1/61	2-190-9-17-17-2
Eller Mill Creek	From source to Little SnowBird Creek	C	7/1/61	2-190-9-17-18
Fox Squirrell Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-19
Lige Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-20
Hunting Boy Branch	From source to Little Snowbird Creek	C	7/1/61	2-190-9-17-21
Dick Branch	From source to Snowbird Creek	C	7/1/61	2-190-9-18
Long Branch	From source to Snowbird Creek	C	7/1/61	2-190-9-19
Cornsilk Branch	From source to Long Branch	C	7/1/61	2-190-9-19-1
Hooper Branch	From source to Snowbird Creek	C	7/1/61	2-190-9-20
Barker Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-10
Long Hungry Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-11
West Buffalo Creek	From source to Santeetlah Lake, Cheoah River	C Tr	7/1/61	2-190-12
Squally Creek	From source to West Buffalo Creek	C Tr	7/1/61	2-190-12-1
South Fork Squally Creek	From source to Squally Creek	C	7/1/61	2-190-12-1-1
Little Buffalo Creek	From source to West Buffalo Creek	C Tr	7/1/61	2-190-12-2
Hooper Mill Creek	From source to West Buffalo Creek	C	7/1/61	2-190-12-3
Dogfall Branch	From source to Hooper Mill Creek	C	7/1/61	2-190-12-3-1
Seven Springs Branch	From source to Hooper Mill Creek	C	7/1/61	2-190-12-3-2

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Bearden Branch	From source to Hooper Mill Creek	C	7/1/61	2-190-12-3-3
Little (Obadiah) Creek	From source to Hooper Mill Creek	C	7/1/61	2-190-12-3-4
Cedar Creek	From source to West Buffalo Creek	C	7/1/61	2-190-12-4
Teeoatlah Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-13
Duncan Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-14
Ground Squirrel Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-15
East Buffalo Creek	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-16
Ollie Branch	From source to East Buffalo Creek	C	7/1/61	2-190-16-1
Ryefield Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-17
Charikus Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-18
Santeetlah Creek	From source to Santeetlah Lake, Cheoah River	B Tr	7/1/73	2-190-19
Whigg Branch	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-1
Johns Branch	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-2
Cold Branch	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-3
Bob Branch	From source to Cold Branch	C Tr	7/1/73	2-190-19-3-1
Sand Creek	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-4
Wolf Laurel Branch (West Laurel Branch)	From source to Sand Creek	C Tr	7/1/73	2-190-19-4-1
Indian Creek	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-5
Wright Creek	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-6
Little Santeetlah Creek	From source to Santeetlah Creek	C Tr	7/1/73	2-190-19-7
Groundhog Branch	From source to Little Santeetlah Creek	C	7/1/61	2-190-19-7-1
Adamcamp Branch	From source to Little Santeetlah Creek	C	7/1/61	2-190-19-7-2
Daviscamp Branch	From source to Little Santeetlah Creek	C	7/1/61	2-190-19-7-3
Grassy Branch	From source to Little Santeetlah Creek	C	7/1/61	2-190-19-7-4
Indian Spring Branch	From source to Little Santeetlah Creek	C	7/1/61	2-190-19-7-5
Horsecove Branch	From source to Santeetlah Creek	B Tr	7/1/73	2-190-19-8
Avey Creek	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-20
Attooga Branch	From source to Santeetlah Lake, Cheoah River	C	7/1/61	2-190-21
Cheoah River	From Santeetlah Dam to Calderwood Lake, Little Tennessee River	C Tr	7/1/61	2-190-(22)
Gladdens Creek	From source to Cheoah River	C	7/1/61	2-190-23
Cochran Creek	From source to Cheoah River	C	7/1/61	2-190-24
Colvin Branch	From source to Cochran Creek	C	7/1/61	2-190-24-1

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
Orr (Almond) Branch	From source to Cochran Creek	C	7/1/61	2-190-24-2
Gold Mine Branch	From source to Cheoah River	C	7/1/61	2-190-25
Rock Creek	From source to Cheoah River	C	7/1/61	2-190-26
Cochran Creek	From source to Cheoah River	C	7/1/61	2-190-27
Laurel Branch	From source to Cheoah River	C	7/1/61	2-190-28
Yellow Creek	From source to Cheoah River	C Tr	7/1/61	2-190-29
Cody Branch	From source to Yellow Creek	C	7/1/61	2-190-29-1
Big Branch	From source to Yellow Creek	C	7/1/61	2-190-29-2
Dummy Branch	From source to Yellow Creek	C	7/1/61	2-190-29-3
Bee Creek	From source to Yellow Creek	C	7/1/61	2-190-29-4
Williams Branch	From source to Bee Creek	C	7/1/61	2-190-29-4-1
Garrison (Higlon) Branch	From source to Yellow Creek	C	7/1/61	2-190-29-5
Dee (Pounding Mill) Branch	From source to Yellow Creek	C	7/1/61	2-190-29-6
Turpin Branch	From source to Yellow Creek	C	7/1/61	2-190-29-7
Shuler (Rickman) Branch	From source to Yellow Creek	C	7/1/61	2-190-29-8
Rickman (Sawmill) Branch	From source to Yellow Creek	C	7/1/61	2-190-29-9
Peterson Branch	From source to Yellow Creek	C Tr	7/1/61	2-190-29-10
Lifting Rock Branch	From source to Yellow Creek	C	7/1/61	2-190-29-11
Persimmon Tree Branch	From source to Cheoah River	C	7/1/61	2-190-30
Puncheon Camp Branch	From source to Cheoah River	C	7/1/61	2-190-31
Falls Branch	From source to Cheoah River	C	7/1/61	2-190-32
Deep Creek	From source to Cheoah River	C Tr	7/1/73	2-190-33
Hudson Deaden Branch	From source to Deep Creek	C	7/1/61	2-190-33-1
Rockwall Branch	From source to Deep Creek	C	7/1/61	2-190-33-2
Blackgum Branch	From source to Deep Creek	C	7/1/61	2-190-33-3
Rough Branch	From source to Deep Creek	C	7/1/61	2-190-33-4
Indian Grave Branch	From source to Deep Creek	C	7/1/61	2-190-33-5
Frisby Branch	From source to Cheoah River	C	7/1/61	2-190-34
Halfmile Branch	From source to Cheoah River	C	7/1/61	2-190-35
Barker Creek	From source to Cheoah River	C Tr	7/1/73	2-190-36
Cooper Camp Branch	From source to Barker Creek	C	7/1/61	2-190-36-1
Bear Creek	From source to Cheoah River	C Tr	7/1/73	2-190-37
Beach Creek	From source to Bear Creek	C	7/1/61	2-190-37-1
Middle Creek	From source to Beach Creek	C	7/1/61	2-190-37-1-1
Sugar Cove Branch	From source to Beach Creek	C	7/1/61	2-190-37-1-2
Jane Branch	From source to Beach Creek	C	7/1/61	2-190-37-1-3
Grassy Branch	From source to Bear Creek	C	7/1/61	2-190-37-2
Caney Branch	From source to Bear Creek	C	7/1/61	2-190-37-3
Little Blackgum Branch	From source to Caney Branch	C	7/1/61	2-190-37-3-1
Otter Rock Branch	From source to Cheoah River	C	7/1/61	2-190-38
Meadow Branch	From source to Cheoah River	C	7/1/61	2-190-39
Yellowhammer Branch	From source to Tapoco Inc. Water Supply Intake	WS-I	8/3/92	2-190-40-(1)
Yellowhammer Branch	From Tapoco Inc. Water Supply Intake to Cheoah River	C	9/1/74	2-190-40-(2)
Magazine Branch	From source to Calderwood Lake, Little Tennessee River	C	7/1/61	2-191
Ike Branch	From source to Calderwood Lake,	C	7/1/61	2-192

.0303 LITTLE TENNESSEE RIVER BASIN AND SAVANNAH RIVER DRAINAGE AREA

Name of Stream	Description	Class	Date	Classification Index No.
	Little Tennessee River			
Stillhouse Branch	From source to Calderwood Lake, Little Tennessee River	C	7/1/61	2-193
Slickrock Creek	From source to Calderwood Lake, Little Tennessee River	C Tr HQW	8/1/90	2-194
Naked Ground Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-1
Glen Gap Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-2
Rust Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-3
Hangover Creek	From source to Slickrock Creek	C HQW	8/1/90	2-194-4
Grapevine Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-5
Buckeye Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-6
Big Flat Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-7
Nichols Cove Branch	From source to Slickrock Creek	C HQW	8/1/90	2-194-8
Tellico River	From source to North Carolina-Tennessee State Line	C Tr	7/1/73	2-195
Round Mountain Branch	From source to Tellico River	C Tr	7/1/73	2-195-1
Bob Creek	From source to Tellico River	C Tr	7/1/73	2-195-2
Mistletoe Creek	From source to Tellico River	C Tr	7/1/73	2-195-3
Peckerwood Creek	From source to Tellico River	C Tr	7/1/73	2-195-4
Tipton Creek	From source to Tellico River	C Tr	7/1/73	2-195-5
Bearpen Branch	From source to Tipton Creek	C Tr	7/1/73	2-195-5-1
Jenks Branch	From source to Tipton Creek	C Tr	7/1/73	2-195-5-2

Point source discharges are prohibited to segments classified HQW with a pound sign according to the provisions of 15A NCAC 2B .0201 in order to protect the existing and anticipated usage of those waters.

APPENDIX III

DWQ Water Quality Monitoring Programs in the Little Tennessee River Basin

- Benthic Macroinvertebrate Sampling
- Fisheries Studies
- Lakes Assessment Program
- Aquatic Toxicity Monitoring

A - III.I BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since many taxa in a community have life cycles of six months to one year, the effects of short term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures. Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT S). Likewise, ratings can be assigned with a Biotic Index. This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal) within North Carolina.

<u>Classification Criteria by Ecoregion*</u>

A. EPT taxa richness values

	10-sample Qualitative Samples			4-sample EPT Samples		
	Mountains	Piedmont	Coastal	Mountains	Piedmont	Coastal
Excellent	>41	>31	>27	>35	>27	>23
Good	32-41	24-31	21-27	28-35	21-27	18-23
Good-Fair	22-31	16-23	14-20	19-27	14-20	12-17
Fair	12-21	8-15	7-13	11-18	7-13	6-11
Poor	0-11	0-7	0-6	0-10	0-6	0-5

B. Biotic Index Values (Range = 0-10)

	Mountains	Piedmont	Coastal A
Excellent	<4.05	<5.19	<5.47
Good	4.06-4.88	5.19-5.78	5.47-6.05
Good-Fair	4.89-5.74	5.79-6.48	6.06-6.72
Fair	5.75-7.00	6.49-7.48	6.73-7.73
Poor	>7.00	>7.48	>7.73

*These criteria apply to flowing water systems only. Biotic index criteria are only used for full-scale (10-sample) qualitative samples.

Table A - III.1 lists all the benthic macroinvertebrate collections in the Little Tennessee River basin between 1983 and 1994, giving site location, DEM classification schedule index number, collection date, taxa richness and biotic index values, and bioclassifications. Final bioclassifications assigned may take into account seasonal correction of both EPT taxa richness and Biotic Index value if the sample was collected outside of summer. Bioclassifications listed in this report may differ from older reports because evaluation criteria have changed since 1983. Originally, total taxa richness and EPT taxa richness criteria were used to assign rating, then just EPT taxa richness. Currently BI as well as EPT taxa richness criteria are used to assign bioclassification. Refinements of the criteria continue to occur as more data is gathered.

Benthos data were collected at 30 basin assessment sites during 1994, and a total of 81 sites have been rated using benthic macroinvertebrate data since 1983. Looking at bioclassifications assigned with the most recent data, 47% were Excellent, 35% were Good, 13% were Good-Fair,

Table A - III.1 Benthic Macroinvertebrate Data Collected from 1983 through 1994 in the Little Tennessee Subbasin 02.

LTN 02

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Little Tennessee R nr Needmore, Swain	/B-1	2-(1)	07/94	83/40	4.47/3.92	Good
			06/94	79/32	4.40/3.73	Good
Tellico Cr, SR 1367, Macon	/B-2	2-40	07/94	84/43	3.26/2.45	Excellent
Alarka Cr, SR 1140, Swain	5/B-3	2-69-(0.4)	11/88	59/37	2.31/1.65	Excellent*
Alarka Cr, SR 1185, Swain	/B-4	2-69-(2.5)	07/94	91/48	3.50/2.75	Excellent
Bearmeat Br, nr SR 1140, Swain	6/B-5	2-69-3	11/88	-/24	-/1.71	Good
Tuckasegee R, be Greenland, Jackson	29/B-6	2-79-(0.5)	06/88	99/51	3.81/2.68	Excellent
Tuckasegee R, SR 1140, Jackson	30/B-7	2-79-(0.5)	09/94	-/39	-/2.19	Excellent
			09/89	101/47	3.40/1.79	Excellent
Hurricane Cr, SR 1145, Jackson	32/B-8	2-79-23-2	12/91	-/45	-/1.66	Excellent
		09/89	-/39	-/2.06	Excellent	
Cedar Cr, SR 1120, Jackson	31/B9	2-79-23-3	09/89	89/40	4.18/2.69	Good
Grassy Camp Cr, SR 1145, Jackson	33/B-10	2-79-23-4-1	09/89	-/28	-/2.01	Good
			08/84	52/21	4.27/2.31	Good-Fair
UT Shortoff Cr, NC 64, Jackson	2/B-11	2-79-23-4-1-1-?	08/84	54/27	2.49/1.33	Excellent*
Mill Cr, SR 1145, Jackson	34/B-12	2-79-23-5	09/89	-/29	-/2.08	Good
Pine Cr, SR 1145, Jackson	35/B-13	2-79-23-6	09/89	87/36	4.20/2.79	Good**
Caney Fk, SR 1740, Jackson	/B-14	2-79-28-(2.5)	07/94	93/56	3.04/2.46	Excellent
Mull Cr, SR 1740, Jackson	/B-15	2-79-28-3	07/94	-/29	-/1.45	Good**
Moses Cr, SR 1737, Jackson	/B-16	2-79-28-8	07/94	-/33	-/2.25	Good
Cullowhee Cr, SR 1001, Jackson	/B-17	2-79-31	07/94	-/32	-/2.35	Good**
Whiterock Cr, nr school, Jackson	/B-18	2-79-31-1-(1)	12/91	-/31	-/1.64	Excellent*
Savannah Cr, SR 1367, Jackson	/B-19	2-79-36	07/94	77/40	3.63/2.99	Excellent**
Tuckasegee R, SR 1137 (Dillsboro), Jackson	C/B-20	2-79-(38)	07/94	100/47	4.29/3.27	Excellent**
			08/90	86/43	3.96/3.07	Excellent**
			08/88	83/39	3.81/2.68	Excellent**
			07/86	68/32	4.72/3.51	Good
			08/84	66/25	4.49/3.53	Good
Scott Cr, SR 1556, Jackson	/B-21	2-79-39	07/94	69/29	4.88/3.16	Good-Fair
Fisher Cr, SR 1447 ab WTP, Jackson	3/B-22	2-79-39-11-(1)	04/87	-/24	-/2.50	Good*
Fisher Cr, SR 1447 be WTP, Jackson	4/B-23	2-79-39-11-(2)	04/87	-/24	-/2.49	Good*
Connelly Cr, SR 1177, Swain	/B-24	2-79-52	07/94	94/42	3.42/2.87	Excellent**
Oconaluftee R, NC 441, be Bradley Fk, Swain	44/B-25	2-79-55-(1)	03/89	86/48	2.23/1.64	Excellent
Beech Flats Prong, US 441, Swain	/B-26	2-79-55-2	09/94	-/22	-/1.35	Good-Fair*
Bradley Fk, Off US 441 (Smokemont), Swain	/B-27	2-79-55-12-(11)	09/94	-/31	-/1.36	Good
			03/89	-/45	-/1.79	Excellent
Mingus Cr, NC 441, Swain	38/B-28	2-79-55-16-(2)	03/89	-/41	-/2.06	Excellent**
Oconaluftee R, NC 441, be Raven Fk, Swain	46/B-29	2-79-55-(16.5)	03/89	-/42	-/2.29	Excellent
Oconaluftee R, SR 1359, Birdtown, Swain	D/B-30	2-79-55-(16.5)	07/94	87/47	3.84/2.82	Excellent
			07/89	88/47	4.13/3.07	Excellent
			03/89	93/50	3.53/2.70	Excellent
			08/87	103/45	4.13/2.85	Excellent
			08/85	94/41	4.05/2.82	Good
Raven Fk, FS Rd ab trout farm, Swain	40/B-31	2-79-55-17-(13.5)	03/89	-/43	-/1.46	Excellent
Raven Fk, be Cherokee trout farm, Swain	41/B-32	2-79-55-17-(15)	03/89	-/43	-/2.49	Excellent
Raven Fk, be Straight Fk, Swain	42/B-33	2-79-55-17-(15)	03/89	-/43	-/2.44	Excellent
Raven Fk, Sequoyah CH, Swain	43/B-34	2-79-55-17-(15)	03/89	-/41	-/2.40	Good
Straight Fk, be hatchery, Swain	39/B-35	2-79-55-17-16-(20.5)	03/89	-/47	-/1.92	Excellent
Socco Cr, old NC 441 nr mouth, Swain	45/B-36	2-79-55-21	03/89	83/41	3.25/2.58	Excellent

LTN 02

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Deep Cr, ab campground, Swain	/B-37	2-79-63-(16)	07/94	-/41	-/2.07	Excellent
Deep Cr, SR 1340, Swain	/B-38	2-79-63-(21)	07/94	88/50	2.91/2.26	Excellent
Forney Cr, nr mouth, Swain	/B-39	2-97	07/94	79/46	2.30/1.40	Excellent
Bear Cr, nr mouth, Swain	/B-40	2-97-17	07/94	71/44	2.10/1.41	Excellent
Panther Cr, SR 1233, Graham	/B-41	2-115	07/94	-/37	-/1.86	Excellent
Stecoah Cr, SR 1237, Graham	/B-42	2-130	07/94	-/29	-/3.24	Good
Hazel Cr, nr mouth, Swain	/B-43	2-146-(0.5)	07/94	96/47	2.67/1.77	Excellent

*Small stream criteria
**Sediment-affected streams which may have a lower rating if evaluated with information on the fish community.

4% were Fair and 1% (1 site) was Poor (the Cullasaja River above Lake Sequoyah in 1991).

A - III.II FISHERIES

Fish Community Structure Assessment
The fish communities of the Little Tennessee River Basin were sampled using methods that were developed for the application of the North Carolina Index of Biotic Integrity (NCIBI) (NCDEHNR 1995). At each sample site, a representative section of stream (600 feet), was selected and the fish in the stream were collected with two backpack electrofishing units. After collection, all fish were examined for sores, lesions, fin damage, and skeletal anomalies, identified, measured (total length to the nearest 1 mm), and released. Fish that could not be identified were preserved in 10% formalin and returned to the laboratory for identification and total length measurement. The resulting data were then analyzed with the NCIBI (Appendix FC-1).

The NCIBI is a modification of the Index of Biotic Integrity initially proposed by Karr (1981) and Karr et al. (1986). The method was developed for assessing a stream's biological integrity by examining the structure and health of its fish community. The scores derived from this index are a measure of the ecological health of the waterbody and may not necessarily directly correlate to water quality. A stream with excellent water quality, but poor to fair habitat would not rate excellent in this index. However, a stream which rates excellent on the NCIBI would be expected to have excellent water quality. The NCIBI is not applicable to high elevation trout streams or lakes. Trout streams often have too few fish species for the metrics to work well.

The Index incorporates information about species richness and composition, trophic composition, abundance, and fish condition. The NCIBI summarizes the effects factors which must influence aquatic faunal communities, including water quality, energy source, habitat quality, flow regime, and biotic interactions. While any change in a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effect of biotic interactions and energy supply. Changes in fish abundance and condition information may indicate additional water quality effects. It should be noted, however, that these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality.

The assessment of biological integrity using the NCIBI is provided by the cumulative assessment of 12 parameters or metrics . The values provided by the metrics are converted into scores on a 1, 3, or 5 scale (Appendix FC-2). A score of 5 represents conditions which would be expected for undisturbed streams in the specific river basin or ecoregion, while a score of 1 indicates that the conditions vary greatly from those expected in undisturbed streams of the region. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall IBI score. Finally, the NCIBI scores are then used to determine the integrity class of the stream from which the sample was collected:

NCIBI Scores	Integrity Class
58-60	Excellent
53-57	Good-Excellent
48-52	Good
45-47	Fair-Good
40-44	Fair
35-39	Poor-Fair
28-34	Poor
23-27	Very Poor-Poor
12-22	Very Poor
------	No Fish collected

Little Tennessee River Fish Community Structure Overview

Approximately 61 species have been collected from the Little Tennessee River basin in North Carolina (Menhinick 1991; 1995 (pers. comm.) Eight of these species have been given special protection status by the North Carolina Wildlife Resources Commission or the North Carolina Natural Heritage Program under the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337) (LeGrand and Hall 1995). The stonecat, Noturus flavus, is listed as "Endangered" in North Carolina and with only 1-5 extant populations, the species is considered as critically impaired because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. The spotfin chub, Cyprinella monacha, and the logperch, Percina caprodes, are both considered as "Threatened" and also have only 1-5 extant populations within the state. The rosyside dace, Clinostomus funduloides (a subspecies within the Little Tennessee River drainage), the yellowfin shiner, Notropis lutipinnis, the wounded darter, Etheostoma vulneratum, and the olive darter, Percina squamata, are all listed as "Special Concern". The rosyside dace and the wounded darter are considered to have only 6-20 extant populations in North Carolina and are considered as imperiled in the state because of rarity or because of some factor(s) making them vulnerable to extirpation from the state. The yellowfin shiner and the olive darter are listed as having 21-100 extant populations in the state and are considered rare or uncommon within the state. The tangerine darter, Percina aurantiaca, is considered significantly rare (any species which has not been listed by the North Carolina Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species but which exists in the state in small numbers as determined by the North Carolina Natural Heritage Program) and is in need of monitoring.

Seventeen individuals of Notropis lutipinnis were collected during 1995 by NCDEM from the Little Tennessee River and from Coweeta and Tessentee Creeks. Forty-eight individuals of Clinostomus funduloides were collected during 1995 by NCDEM from Coweeta, Middle, Cartoogechaye and Tessentee creeks.

Fish Tissue

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species, have been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be available for bioaccumulation either directly or through aquatic food webs and may accumulate in fish and shellfish tissues. Results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water.

Fish tissue analysis results are used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels, U. S. Environmental Protection Agency (EPA) recommended screening values, and criteria adopted by the North Carolina Health Department.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs and thus employ a "safe level" approach to fish tissue consumption. A list of fish tissue analytes accompanied by their FDA criteria are presented below. At present, the FDA has only developed metals criteria for mercury. Individual parameters which appear to be of potential human health concern are evaluated by the N.C. Division of Epidemiology by request of the Water Quality Section.

Food and Drug Administration (FDA) Action Levels			
Metals			
Mercury	1.0 ppm		
Organics			
Aldrin	0.3 ppm	o,p DDD	5.0 ppm
Dieldrin	0.3 ppm	p,p DDD	5.0 ppm
Endrin	0.3 ppm	o,p DDE	5.0 ppm
Methoxychlor	None	p,p DDE	5.0 ppm
Alpha BHC	None	o,p DDT	5.0 ppm
Gamma BHC	None	p,p DDT	5.0 ppm
PCB-1254	2.0 ppm	cis-chlordane	0.3 ppm
Endosulfan I	None	trans-chlordane	0.3 ppm
Endosulfan II	None	Hexachlorobenzene	None

In the guidance document, Fish Sampling and Analysis: Volume 1 (EPA823-R-93-002), EPA has recommended screening values for target analytes which are formulated from a risk assessment procedure. These are the concentrations of analytes in edible fish tissue that are of potential public health concern. The DEM compares fish tissue results with EPA screening values to evaluate the need for further intensive site specific monitoring. A list of target analytes and EPA recommended screening values for the general adult population is presented below.

The North Carolina Health Department has adopted a selenium limit of 5 ppm for issuing fish consumption advisories. Total DDT includes the sum of all its isomers and metabolites (i.e. p,p DDT, o,p DDT, DDE, and DDD). Total chlordane includes the sum of cis-and trans- isomers as well as nonachlor and oxychlordane. Although the EPA has suggested a screening value of 7.0×10^{-7} ppm for dioxins, the State of North Carolina currently uses a value of 3.0 ppt in issuing fish consumption advisories.

Environmental Protection Agency (EPA) Screening Values			
Metals			
Cadmium	10.0 ppm		
Mercury	0.6 ppm		
Selenium	50.0 ppm		
Organics			
Chlorpyrifos	30.0 ppm	Heptachlor epoxide	0.01 ppm
Total chlordane	0.08 ppm	Hexachlorobenzene	0.07 ppm
Total DDT	0.3 ppm	Lindane	0.08ppm
Dieldrin	0.007 ppm	Mirex	2.0 ppm
Dioxins	7.0×10^{-7} ppm	Total PCB's	0.01 ppm
Endosulfan (I and II)	20.0 ppm	Toxaphene	0.1 ppm
Endrin	3.0 ppm		

A - III.III LAKES ASSESSMENT PROGRAM

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lake Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the trophic state of each lake, a relative measure of nutrient enrichment and productivity, and whether the designated uses of the lake have been threatened or impaired by pollution.

Tables presented in each subbasin summarize data used to determine the trophic state and use support status of each lake. These determinations are based on information from the most recent summertime sampling (date listed). The most recent North Carolina Trophic State Index (NCTSI) value is shown, followed by the descriptive trophic state classification (O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic, D=dystrophic).

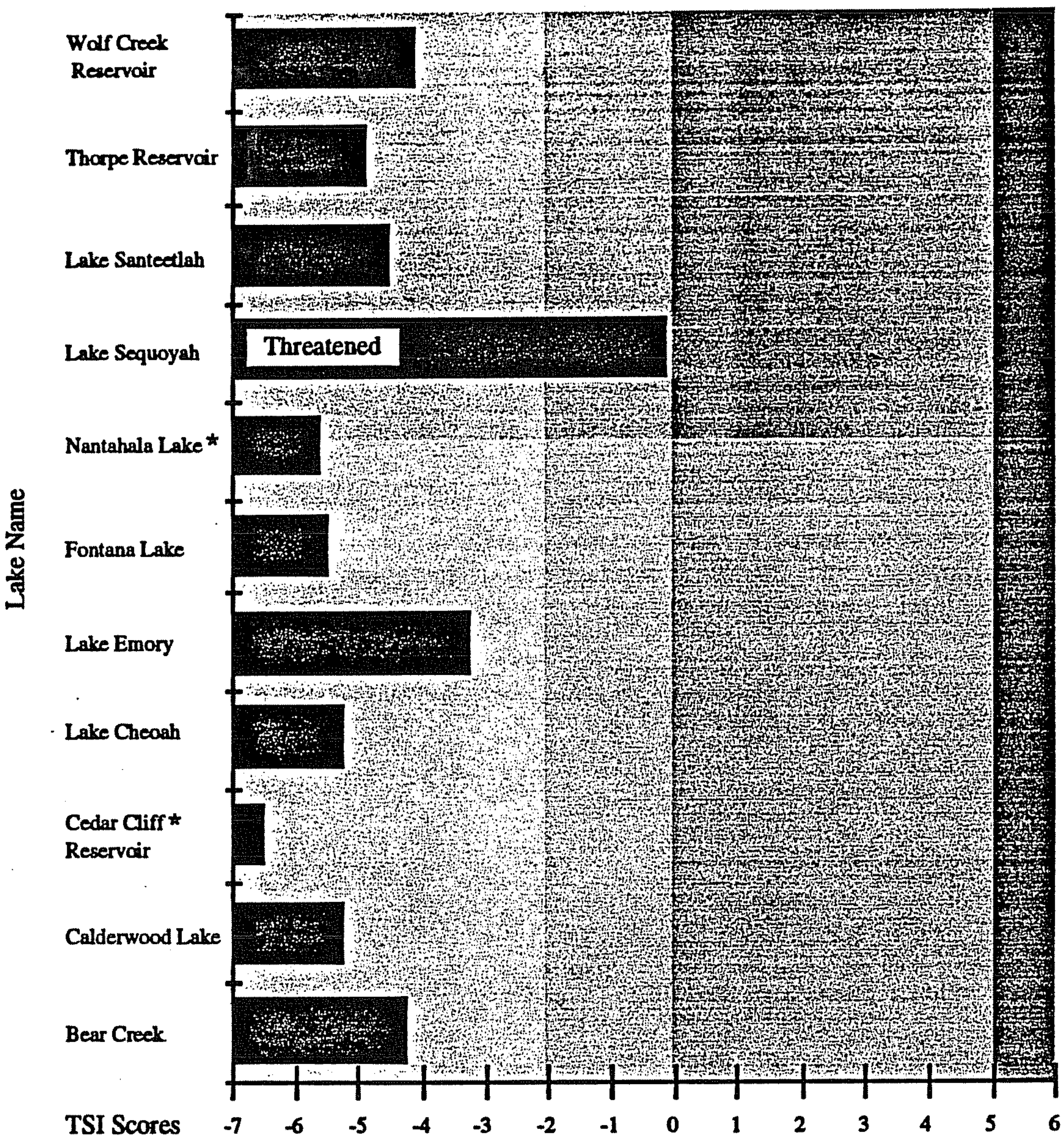
Numerical indices are often used to evaluate the trophic state of lakes. An index was developed specifically for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NCDNRCD 1982). The North Carolina Trophic State Index (NCTSI) is based on total phosphorus (TP in mg/l), total organic nitrogen (TON in mg/l), Secchi depth (SD in inches), and chlorophyll-a (CHL in µg/l). Lakewide means for these parameters are manipulated to produce a NCTSI score for each lake, using the following equations:

Lakes designated as oligotrophic include Bear Creek Reservoir, Calderwood Lake, Cedar Cliff Lake, Lake Emory, Fontana Lake, Lake Cheoah, Nantahala Lake, Santeetlah Lake, Thorpe Reservoir and Wolf Creek Reservoir. Lake Sequoyah is considered mesotrophic.

Notable lakes:
Lake Emory - This run-of-the-river impoundment was most recently monitored in 1994. The lake was found to be oligotrophic despite the muddy appearance of the water and low Secchi depth measurements. Ammonia was elevated at one sampling site (0.06 mg/l), total phosphorus was elevated for a mountain lake (range = 0.04 mg/l to 0.05 mg/l), and nitrite plus nitrate was extremely elevated at all of the sampling sites (0.13 mg/l). Sandbars with established vegetation were observed in the lake, especially near the dam. Although there was an improvement in chlorophyll *a* values and in total phosphorus in 1994 as compared with 1988, the change in trophic stautus from eutrophic in 1988 to oligotrophic in 1994 is ambiguous in light of the lack of a satisfactory explanation for this drastic change in trophic status.

Lake Sequoyah - Based on collections in 1988, this small reservoir was identified as Threatened in the 1992-1993 305(b) Report due to high levels of nutrients, turbidity and chlorophyll *a* values that exceeded the state water quality standard for Trout Waters (Tr). Values for turbidity and chlorophyll *a* were not in violation of state water quality standards in 1984, but the lake did appear muddy and Secchi depth measurements were low (one meter at the three sampling sites). Total phosphorus values were elevated for a mountain lake (mean value = 0.05 mg/l, range = 0.04 mg/l to 0.06 mg/l) and lakewide mean nitrite plus nitrate was also elevated (range = 0.04 mg/l to 0.12 mg/l). Because of the elevated nutrients, poor water clarity, and elevated density of phytoplankton, the designated uses of Lake Sequoyah remain threatened.

Figure A - III.1 Little Tennessee Basin - TSI Scores (Last Assessment Date)



All lakes were sampled in 1994, except for Cedar Cliff Reservoir which was last sampled in August, 1992 and Wolf Creek Reservoir, which was sampled in 1988.

* Reference Lake

A - III.IV AQUATIC TOXICITY MONITORING

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, Ceriodaphnia dubia). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DEM's Aquatic Toxicology Laboratory. The Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

APPENDIX IV

NPDES Permit Requirements for Trout Farms

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT

GENERAL PERMIT NO. NCG0000

TO DISCHARGE SEAFOOD PACKING AND RINSING, FISH FARMS AND SIMILIAR WASTEWATERS UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provision of North Carolina General Statute 143-215.1, other lawful standards and regulations promulgated and adopted by the North Carolina Environmental Management Commission, and the Federal Water Pollution Control Act, as amended, this permit is hereby issued to all owners or operators, hereafter permittees, which are covered by this permit as evidenced by receipt of a Certificate of Coverage by the Environmental Management Commission to allow the discharge of treated wastewater in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in Parts I, II, III and IV hereof.

This permit shall become effective August 1, 1992

This permit shall expire at midnight on July 31, 1997

Date: 7-31-92

A. Preston Howard, Jr., P.E., Acting Director
Division of Environmental Management
By Authority of the Environmental Management Commission

PART I

A. Effluent Limitations and Monitoring Requirements Final

NPDES Permit No. NCG 0000

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge from outfall(s) serial number 001. Such discharges shall be limited and monitored by the Permittee as specified below:

Effluent Characteristics	Discharge Limitation		Monitoring Requirements		
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow			Annually	Estimate	Effluent
Total Suspended Solids	30.0 mg/l	60.0 mg/l	Annually	Grab	Effluent
Settleable Solids	5.0 ml/l	10.0 ml/l	Annually	Grab	Effluent
Dissolved Oxygen	*	*	Annually	Grab	Effluent

* The daily average dissolved oxygen effluent concentration shall not be less than 6.0 mg/l.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units for fresh surface water classifications.
The pH shall not be less than 6.8 standard units nor greater than 8.5 standard units for tidal salt water classifications.

There shall be no discharge of fish parts, floating solids, or visible foam except in other than trace amounts.

PART I

SECTION B. SCHEDULE OF COMPLIANCE

1. The permittee shall comply with Final Effluent Limitations specified for discharges in accordance with the following schedule:

   Permittee shall comply with Final Effluent Limitations by the effective date of the permit unless specified below.

2. Permittee shall at all times provide the operation and maintenance necessary to operate the existing facilities at optimum efficiency.

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3. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next schedule requirements.

SECTION A. DEFINITIONS

1. Permit Issuing Authority

   The Director of the Division of Environmental Management.

2. DEM or Division

   Means the Division of Environmental Management, Department of Environment, Health and Natural Resources.

3. EMC

   Used herein means the North Carolina Environmental Management Commission.

4. Permittee

   Used herein means the entity who obtains coverage under this general permit by subsequent issuance of a "Certificate of Coverage" by the Division of Environmental Management.

5. Act or "the Act"

   The Federal Water Pollution Control Act, also known as the Clean Water Act, as amended, 33 USC 1251, et. seq.

6. Mass/Day Measurements

   a. The "monthly average discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month. It is therefore, an arithmetic mean found by adding the weights of the pollutant found each day of the month and then dividing this sum by the number of days the tests were reported. The limitation is identified as "Monthly Average" in Part I of the permit.

   b. The "weekly average discharge" is defined as the total mass of all daily discharges sampled and/or measured during the calendar week (Sunday - Saturday) on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such week. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the week and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Weekly Average" in Part I of the permit.

   c. The "maximum daily discharge" is the total mass (weight) of a pollutant discharged during a calendar day. If only one sample is taken during any calendar day the weight of pollutant calculated from it is the "maximum daily discharge." This limitation is identified as "Daily Maximum," in Part I of the permit.

d. The "average annual discharge" is defined as the total mass of all daily discharges sampled and/or measured during the calendar year on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such year. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the year and then dividing this sum by the number of days the tests were reported. This limitation is defined as "Annual Average" in Part I of the permit.

7. Concentration Measurement

a. The "average monthly concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average monthly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar month. This limitation is identified as "Monthly Average" under "Other Units" in Part I of the permit.

b. The "average weekly concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar week (Sunday/Saturday) on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such week (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average weekly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar week. This limitation is identified as "Weekly Average" under "Other Units" in Part I of the permit.

c. The "maximum daily concentration" is the concentration of a pollutant discharge during a calendar day. If only one sample is taken during any calendar day the concentration of pollutant calculated from it is the "Maximum Daily Concentration". It is identified as "Daily Maximum" under "Other Units" in Part I of the permit.

d. The "average annual concentration," other than for fecal coliform bacteria, is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar year on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such year (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day . The average yearly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar year.

e. The "daily average concentration" (for dissolved oxygen) is the minimum allowable amount of dissolved oxygen required to be available in the effluent prior to discharge averaged over a calendar day. If only one dissolved oxygen sample is taken over a calendar day, the sample is considered to be the "daily average concentration" for the discharge. It is identified as "daily average" in the text of Part I.

f. The "quarterly average concentration" is the average of all samples taken over a calendar quarter. It is identified as "Quarterly Average Limitation" in the text of Part I of the permit.

g. A calendar quarter is defined as one of the following distinct periods: January through March, April through June, July through September, and October through December.

8. Other Measurements

a. Flow, (MGD): The flow limit expressed in this permit is the 24 hours average flow, averaged monthly. It is determined as the arithmetic mean of the total daily flows recorded during the calendar month.

b. An "instantaneous flow measurement" is a measure of flow taken at the time of sampling, when both the sample and flow will be representative of the total discharge.

c. A "continuous flow measurement" is a measure of discharge flow from the facility which occurs continually without interruption throughout the operating hours of the facility. Flow shall be monitored continually except for the infrequent times when there may be no flow or for infrequent maintenance activities on the flow device.

9. Types of Samples

a. Composite Sample: A composite sample shall consist of:

(1) a series of grab samples collected at equal time intervals over a 24 hour period of discharge and combined proportional to the rate of flow measured at the time of individual sample collection, or

(2) a series of grab samples of equal volume collected over a 24 hour period with the time intervals between samples determined by a preset number of gallons passing the sampling point. Flow measurement between sample intervals shall be determined by use of a flow recorder and totalizer, and the present gallon interval between sample collection fixed at no greater than 1/24 of the expected total daily flow at the treatment system, or

(3) a single, continuous sample collected over a 24 hour period proportional to the rate of flow.

In accordance with (1) above, the time interval between influent grab samples shall be no greater than once per hour, and the time interval between effluent grab samples shall be no greater than once per hour except at wastewater treatment systems having a detention time of greater than 24 hours. In such cases, effluent grab samples may be collected at time intervals evenly spaced over the 24 hour period which are equal in number of hours to the detention time of the system in number of days. However, in no case may the time interval between effluent grab samples be greater than six (6) hours nor the number of samples less than four (4) during a 24 hour sampling period.

b. Grab Sample: Grab samples are individual samples collected over a period of time not exceeding 15 minutes; the grab sample can be taken manually.

10. Calculation of Means

a Arithmetic Mean: The arithmetic mean of any set of values is the summation of the individual values divided by the number of individual values.

b. Geometric Mean: The geometric mean of any set of values is the Nth root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

c. Weighted by Flow Value: Weighted by flow value means the summation of each concentration times its respective flow divided by the summation of the respective flows.

11. Calendar Day

A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

11. Hazardous Substance

A hazardous substance means any substance designated under 40 CFR Part 116 pursuant to Section 311 of the Clean Water Act.

13. Toxic Pollutant

A toxic pollutant is any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act.

SECTION B. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

a. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

b. The Clean Water Act provides that any person who violates a permit condition is subject to a civil penalty not to exceed $25,000 per day for each violation. Any person who negligently violates any permit condition is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment for not more than 1 year, or both. Any person who knowingly violates permit conditions is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than 3 years, or both. Also, any person who violates a permit condition may be assessed an administrative penalty not to exceed $10,000 per violation with the maximum amount not to exceed $125,000. [Ref: Section 309 of the Federal Act 33 U.S.C. 1319 and 40 CFR 122.41 (a)].

c. Under state law, a daily civil penalty of not more than ten thousand dollars ($10,000) per violation may be assessed against any person who violates or fails to act in accordance with the terms, conditions, or requirements of a permit. [Ref: North Carolina General Statutes § 143-215.6 (A)].

2. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, C.4.) and "Power Failures" (Part II, C.7.), nothing in this permit shall be construed to relieve the permittee from any responsibilities, liabilities, or penalties for noncompliance pursuant to NCGS 143-215.3, 143-215.6 or Section 309 of the Federal Act, 33 USC 1319. Furthermore, the permittee is responsible for consequential damages, such as fish kills, even though the responsibility for effective compliance may be temporarily suspended.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under NCGS 143-215.75 et seq. or Section 311 of the Federal Act, 33 USG 1321. Furthermore, the permittee is responsible for consequential damages, such as fish kills, even though the responsibility for effective compliance may be temporarily suspended.

5. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

6. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

7. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

8. Duty to Provide Information

The permittee shall furnish to the Permit Issuing Authority, within a reasonable time, any information which the Permit Issuing Authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Permit Issuing Authority upon request, copies of records required to be kept by this permit.

9. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

10. Permit Termination

After public notice and opportunity for a hearing, the general permit and Certificates of Coverage issued under this general permit may be terminated for cause.

11. When an Individual Permit may be Required

The Division may require any owner authorized to discharge under this permit to apply for and obtain an individual permit. Cases where an individual permit may be required include, but are not limited to, the following:

(a) The discharger is a significant contributor of pollution.

(b) Conditions at the operating facility change altering the constituents and/or characteristics of the discharge such that the discharge no longer qualifies for a General Permit.

(c) The discharge violates the terms or conditions of this permit.

(d) A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source.

(e) Effluent limitation guidelines are promulgated for the point sources covered by this permit.

(f) A water quality management plan containing requirements applicable to such point sources is approved after the issuance of this permit.

This permit may be terminated as to an individual owner for any of the reasons set forth above after appropriate notice in accordance with N.C.G.S. 143-215.1.

12. When an Individual Permit may be Requested

Any permittee operating under this permit may request to be excluded from the coverage of this permit by applying for an individual permit. When an individual permit is issued to an owner the applicability of this general permit is automatically terminated on the effective date of the individual permit. When a General Permit is issued which applies to an owner already covered by an individual permit, such permittee may request exclusion from the provisions of the General Permit and subsequent coverage under an individual permit.

13. Signatory Requirements

All applications, reports, or information submitted to the Permit Issuing Authority shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or (b) the manager of one or more manufacturing production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding 25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Permit Issuing Authority shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above;

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or well field, superintendent, a position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized

representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Permit Issuing Authority.

c. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

14. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

15. Permit Modification, Revocation and Reissuance, or Termination

The issuance of this permit does not prohibit the permit issuing authority from reopening and modifying the permit, revoking and reissuing the permit, or terminating the permit as allowed by the laws, rules, and regulations contained in Title 40, Code of Federal Regulations, Parts 122 and 123; Title 15A of the North Carolina Administrative Code, Subchapter 2H .0100; and North Carolina General Statute 143-215.1 et. al.

SECTION C. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Certified Operator

Pursuant to Chapter 90A-44 of North Carolina General Statutes, the permittee shall employ a certified wastewater treatment plant operator in responsible charge (ORC) of the wastewater treatment facilities. Such operator must hold a certification of the grade equivalent to or greater than the classification assigned to the wastewater treatment facilities. The permittee shall notify the Division's Operator Training and Certification Unit within thirty days of any change in the ORC status.

2. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit.

Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

3. Need to Halt or Reduce not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the condition of this permit.

4. Bypassing of Treatment Facilities

a. Definitions

(1) "Bypass" means the known diversion of waste streams from any portion of a treatment facility including the collection system, which is not a designed or established or operating mode for the facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations.

The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Paragraphs c. and d. of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass; including an evaluation of the anticipated quality and affect of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II, E. 6. of this permit. (24-hour notice).

d. Prohibition of Bypass

(1) Bypass is prohibited and the Permit Issuing Authority may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under Paragraph c. of this section.

(2) The Permit Issuing Authority may approve an anticipated bypass, after considering its adverse affects, if the Permit Issuing Authority determines that it will meet the three conditions listed above in Paragraph d. (1) of this section.

5. Upsets

a. Definition.

"Upset " means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph c. of this condition are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset.

A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Part II, E. 6. (b) (B) of this permit.

(4) The permittee complied with any remedial measures required under Part II, B. 2. of this permit.

d. Burden of proof.

In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in accordance with NCGS 143-215.1 and in a manner such as to prevent any pollutant from such materials from entering waters of the State or navigable waters of the United States. The permittee shall comply with all existing federal regulations governing the disposal of sewage sludge. Upon promulgation of 40 CFR Part 503, any permit issued by the Permit Issuing Authority for the disposal of sludge may be reopened and modified, or revoked and reissued, to incorporate applicable requirements at 40 CFR Part 503. The permittee shall comply with applicable 40 CFR Part 503 Standards for the Use and Disposal of Sewage Sludge (when promulgated) within the time provided in the regulation, even if the permit is not modified to incorporate the requirement. The permittee shall notify the Permit Issuing Authority of any significant change in its sludge use or disposal practices.

7. Power Failures

The permittee is responsible for maintaining adequate safeguards as required by DEM Regulation, Title 15A, North Carolina Administrative Code, Subchapter 2H, .0124 Reliability, to prevent the discharge of untreated or inadequately treated wastes during electrical power failures either by means of alternate power sources, standby generators or retention of inadequately treated effluent.

SECTION D. MONITORING AND RECORDS

1. Representative Sampling

Samples collected and measurements taken, as required herein, shall be characteristic of the volume and nature of the permitted discharge. Samples collected at a frequency less than daily shall be taken on a day and time that is characteristic of the discharge over the entire period which the sample represents. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Permit Issuing Authority.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than 10% from the true discharge rates throughout the range of expected discharge volumes. Once-through condenser cooling water flow which is monitored by pump logs, or pump hour meters as specified in Part I of this permit and based on the manufacturer's pump curves shall not be subject to this requirement.

3. Test Procedures

Test procedures for the analysis of pollutants shall conform to the EMC regulations published pursuant to NCGS 143-215.63 et. seq., the Water and Air Quality Reporting Acts, and to regulations published pursuant to Section 304(g), 33 USC 1314, of the Federal Water Pollution Control Act, as Amended, and Regulation 40 CFR 136. To meet the intent of the monitoring required by this permit, all test procedures must produce minimum detection and reporting levels that are below

the permit discharge requirements and all data generated must be reported down to
the minimum detection or lower reporting level of the procedure. If no approved
methods are determined capable of achieving minimum detection and reporting
levels below permit discharge requirements, then the most sensitive (method with
the lowest possible detection and reporting level) approved method must be used.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or
knowingly renders inaccurate, any monitoring device or method required to be
maintained under this permit shall, upon conviction, be punished by a fine of not
more than $10,000 per violation, or by imprisonment for not more than two years per
violation, or by both.

5. Records Retention

The permittee shall retain records of all monitoring information, including all
calibration and maintenance records and all original strip chart recordings for
continuous monitoring instrumentation, copies of all reports required by this
permit, for a period of at least 3 years from the date of the sample, measurement,
report or application. This period may be extended by request of the Director at any
time.

6. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit,
the permittee shall record the following information:

a. The date, exact place, and time of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

7. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the
presentation of credentials and other documents as may be required by law, to;

a. Enter upon the permittee's premises where a regulated facility or activity is located
or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under
the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

SECTION E. REPORTING REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

2. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR Part 122.29 (b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR Part 122.42 (a) (l).

3. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

4. Transfers

This permit is not transferable to any person except after notice to and approval by the Director. The Director may require modification or revocation and reissuance of the permit and incorporating such other requirements as may be necessary under the Clean Water Act.

5. Twenty-four Hour Reporting

a. The permittee shall report to the central office or the appropriate regional office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee became aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances.

The written submission shall contain a description of the noncompliance, and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

b. The following shall be included as information which must be reported within 24 hours under this paragraph.

(A) Any unanticipated bypass which exceeds any effluent limitation in the permit.

(B) Any upset which exceeds any effluent limitation in the permit.

(C) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in the permit to be reported within 24 hours.

c. The Director may waive the written report on a case-by-case basis for reports under paragraph b. above of this condition if the oral report has been received within 24 hours.

6. Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

7. Noncompliance Notification

The permittee shall report by telephone to either the central office or the appropriate regional office of the Division as soon as possible, but in no case more than 24 hours or on the next working day following the occurrence or first knowledge of the occurrence of any of the following:

a. Any occurrence at the water pollution control facility which results in the discharge of significant amounts of wastes which are abnormal in quantity or characteristic, such as the dumping of the contents of a sludge digester; the known passage of a slug of hazardous substance through the facility; or any other unusual circumstances.

b. Any process unit failure, due to known or unknown reasons, that render the facility incapable of adequate wastewater treatment such as mechanical or electrical failures of pumps, aerators, compressors, etc.

c. Any failure of a pumping station, sewer line, or treatment facility resulting in a by-pass directly to receiving waters without treatment of all or any portion of the influent to such station or facility.

Persons reporting such occurrences by telephone shall also file a written report in letter form within 5 days following first knowledge of the occurrence.

8. Availability of Reports

Except for data determined to be confidential under NCGS 143-215.3(a)(2) or Section 308 of the Federal Act, 33 USC 1318, all reports prepared in accordance with the terms shall be made available for public inspection at the offices of the Division of Environmental Management or at the site of the discharge within a reasonable time period, not to exceed five (5) days. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such
report may result in the imposition of criminal penalties as provided for in NCGS 143-215.1(b)(2) or in Section 309 of the Federal Act.

9. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both.

PART III
OTHER REQUIREMENTS

1. Previous Permits

All previous State water quality permits issued to this facility for this particular discharge, whether for construction or operation or discharge, are hereby revoked by issuance of this permit and subsequent issuance of a Certificate of Coverage. The conditions, requirements, terms, and provisions of this permit authorizing discharge under the National Pollutant Discharge Elimination System govern discharges from this facility.

2. Construction

No construction of wastewater treatment facilities or additions thereto shall be begun until Final Plans and Specifications have been submitted to the Division of Environmental Management and approval has been granted by the Division. Design and operation of facilities and/or treatment works shall be in accordance with the application and supporting information. If facility deficiencies, design and/or operational, are identified in the future which could affect the facility performance or reliability, it is the responsibility of the permittee to correct such deficiencies.

3. Certified Operator

Pursuant to Chapter 90A-44 of North Carolina General Statutes, the permittee shall employ a certified wastewater treatment plant operator in responsible charge (ORC) of the wastewater treatment facilities. Such operator must hold a certification of the grade equivalent to or greater than the classification assigned to the wastewater treatment facilities. The permittee shall notify the Division's Operator Training and Certification Unit within five days of any change in the ORC status.

4. Groundwater Monitoring

The permittee shall, upon written notice from the Director of the Division of Environmental Management, conduct groundwater monitoring as may be required to determine the compliance of this NPDES permitted facility with the current groundwater standards.

5. Limitations Reopener

This permit shall be modified or alternatively, revoked and reissued, to comply with any applicable effluent guideline or water quality standard issued or approved under Sections 302(b) (2) (c), and (d), 304(b) (2), and 307(a) (2) of the Clean Water Act, if the effluent guideline or water quality standard so issued or approved:

a. contains different conditions or is otherwise more stringent than any effluent limitation in the permit; except for, if a water quality standard for Dioxin is modified and approved, this permit will be reopened or modified to reflect such changes as provided by 40 CFR 122.62 (c) (3)(i)(B); or

b. controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements in the Act then applicable.

PART IV
ANNUAL ADMINISTERING AND COMPLIANCE MONITORING FEE REQUIREMENTS

1. The permittee must pay the annual administering and compliance monitoring fee within 30 (thirty) days after being billed by the Division. Failure to pay the fee in a timely manner in accordance with 15A NCAC 2H .0105(b)(4) may cause this Division to initiate action to revoke the Certificate of Coverage.

APPENDIX V

Lists of Best Management Practices (BMPs) For:

- Agriculture
- Urban Runoff
- Erosion and Sedimentation Control
- Onsite Wastewater Disposal
- Solid Waste Disposal
- Forestry
- Mining
  - Hydrologic Modifications

BMPs FOR AGRICULTURE

Detailed Implementation Plan*
September 1996 (Revised)

Definition of Practices

(1) An agrichemical handling facility means a permanent structure that provides an environmentally safe means of mixing agrichemicals and filling tanks with agrichemicals for the application and storage of agrichemicals to prevent accidental degradation of surface and ground water.

(2) A conservation tillage system means any tillage and planting system in which at least (30) thirty percent of the soil surface is covered by plant residue to reduce soil erosion and improve the quality of surface water.

(3) A critical area planting means an area of highly erodible land which can not be stabilized by ordinary conservation treatment on which permanent perennial vegetative cover is established and protected to reduce soil erosion and sedimentation and to improve the quality of surface water.

(4) A cropland conversion practice means to establish and maintain a conservation cover of grasses, trees, or wildlife plantings on fields previously used for crop production to reduce soil erosion and sedimentation and to improve the quality of surface water.

(5) A diversion means a channel constructed across a slope with a supporting ridge on the lower side to control drainage by diverting excess water from an area to reduce soil erosion and sedimentation and to improve the quality of surface water.

(6) A field border means a strip of perennial vegetation established at the edge of the field that provides a stabilized outlet for row water to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(7) A filter strip means an area of permanent perennial vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(8) A grade stabilization structure means a structure (earth embankment, mechanical spillway, detention-type, etc.) used to control the grade and head cutting in natural or artificial channels to reduce erosion and sedimentation and to improve the quality of surface water.

(9) A grassed waterway means a natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff to reduce erosion and sedimentation and to improve the quality of surface water.

(10) A heavy use protection area means an area used frequently and intensively by animals which must be stabilized by surfacing with suitable materials to reduce erosion, sedimentation and nutrient pollution to improve the quality of surface water.

(11) A livestock exclusion system means a system of permanent fencing (board, barbed, high tensile or electric wire) installed to exclude livestock from streams and critical areas not intended for grazing to reduce erosion, sedimentation and to improve the quality of surface water.

(12) A long term no-till practice means planting all crops for five consecutive years in at least 80 percent plant residue from preceding crops to reduce soil erosion and sedimentation and improve the quality of surface water.

(13) A pastureland conversion practice means establishing trees or perennial wildlife plantings on excessively eroding Class VII land being used for pasture that is too steep to mow or maintain with conventional equipment to reduce soil erosion and sedimentation and to improve the quality of surface water.

(14) A nutrient management practice means a definitive plan to manage the amount, form, placement, and timing of applications nutrients to minimize entry of nutrient to surface and groundwater and to improve water quality.

(15) A rock-lined outlet means a waterway having an erosionresistant lining of concrete, stone or other permanent material where an unlined or grassed waterways would be inadequate to provide safe disposal of runoff, reduce erosion and sedimentation and to improve the quality of surface water.

(16) A sediment basin means a basin constructed to trap and store waterborne sediment where physical conditions or land ownership preclude treatment of a sediment source by the installation of other erosion control measures to improve the quality of surface water.

(17) A sod-based rotation practice means an adapted sequence of crops and grasses established and maintained for a definite number of years which is designed to provide adequate organic residue for maintenance or improvement of soil filth to help reduce erosion and improve surface water quality.

(18) A stock trail or walkway means to provide a stable area used frequently and intensively for livestock movement by surfacing with suitable material to reduce erosion sedimentation and nutrient pollution to improve the quality of surface water.

(19) A stream protection system means a planned system for protecting streams and streambanks which eliminates the need for livestock to be in streams by providing an alternative watering source for livestock to reduce erosion and sedimentation and to improve the quality of surface water. System components may include:

- (A) A spring development means improving springs and seeps by excavating, cleaning, capping or providing collection and storage facilities.
- (B) A trough or tank means devices installed to provide drinking water for livestock at a stabilized location.
- (C) A well means constructing a drilled, driven or dug well to supply water from an underground source.
- (D) A windmill means erecting or constructing a mill operated by the wind's rotation of large vanes and is used as a source of power for pumping water.

(E) A stream crossing means a trail constructed across a stream to allow livestock to cross without disturbing the bottom or causing erosion on the banks.

(20) A stripcropping practice means to grow crops and sod in a systematic arrangement of alternating strips on the contour to reduce soil erosion and sedimentation and to improve the quality of surface water.

(21) A terrace means an earth embankment, a channel, or a combination ridge and channel constructed across the slope to reduce erosion, reduce sediment content in runoff water, and to improve the quality of surface water.

(22) A waste management system means a planned system in which all necessary components are installed for managing liquid and solid waste to prevent or minimize degradation of soil and water resources. System components may include:

(A) A waste storage pond means an impoundment made by excavation or earthfill for temporary storage of animal waste, waste water and polluted runoff.

(B) A drystack means a fabricated structure for temporary storage of animal waste.

(C) A composter/storage structure means a facility for the biological treatment, stabilization and environmentally safe storage of organic waste material (such as livestock and poultry manure and dead animal carcasses) to produce a material that can be recycled as a soil amendment and fertilizer substitute.

(D) A waste treatment lagoon means an impoundment made by excavation or earthfill for biological treatment and storage of animal waste.

(E) A waste application system means an environmentally safe system (such as solid set, dry hydrant, mobile irrigation equipment, etc.) for the conveyance and distribution of animal wastes from waste treatment and storage structures to agricultural field as part of an irrigation and nutrient management plan.

(F) A constructed wetlands for land application practice means an artificial wetland area into which liquid animal waste from a waste storage pond or lagoon is dispersed over time to lower the nutrient content of the liquid animal waste.

(G) A controlled livestock lounging area means a planned, stabilized and vegetated area in which livestock are kept for a short duration.

(H) A closure of abandoned waste treatment lagoons and waste storage ponds practice means the safe removal of existing waste and waste water and the application of this waste on land in an environmentally safe manner.

(I) A storm water management system means a system of collection and diversion practices (buttering, collection boxes, diversions, etc.) to prevent unpolluted storm water from flowing across concentrated waste area on animal operations.

(23) A water control structure means to provide control of surface and subsurface water through the use of permanent structures which increase infiltration and reduce runoff to improve the quality of surface and ground water.

(24) A waste utilization plan means a plan of using animal waste on land in an environmentally acceptable manner while maintaining or improving soil and plant resources to safeguard water resources.

(25) An insect control practice means an method of pest management used in an integrated pest management program to control target organisms and minimize contamination of soil, water, and

air, and minimize impacts to non-target organisms through cultural, biological and physical practices including safe and prudent use of pesticides.

(26) A riparian buffer means an area adjacent to solid blue line streams as shown on 7.5 minute USGS maps where a permanent, long-lived vegetative cover (sod, shrubs, trees, or a combination of vegetation types) is established to reduce soil erosion, sedimentation, nutrient and pesticide pollution, and to improve the quality of surface water and shallow ground water.

(27) An odor control management system means a practice or combination of practices (planting windbreaks, precharging structures, incorporation of waste into soil, etc.) which manages or controls odors from confined animal operations, waste treatment and storage structures and waste applied to agricultural land.

*To be used in conjunction with the most recent version of the APA Rules for the North Carolina Agriculture Cost Share Program for Nonpoint Source Pollution Control and the NCACSP Manual.

<u>Best Management Practices Eligible for Cost Share Payments</u>

Best Management Practices eligible for cost sharing include the following practices and any approved District BMPs. District BMPs shall be reviewed by the Division for technical merit in achieving the goals of this program. Upon approval by the Division, the District BMPs will be eligible to receive cost share funding.

The minimum life expectancy of the BMPs is listed below. Practices designated by a District shall meet the life expectancy requirement established by the Division for that District BMP. The list of BMPs eligible for cost sharing may be revised by the Commission as deemed appropriate in order to meet program purpose and goals.

Practice	Minimum Life Expectancy (years)
Agrichemical Handling Facility	10
Conservation Tillage System	10
Critical Area Planting	10
Cropland Conversion	10
Diversion	10
Field Border	10
Filter Strip	10
Grade Stabilization Structure	10
Grassed Waterway	10
Heavy Use Area Protection	10
Insect Control	5
Livestock Exclusion	10
Long Term No-Till	5
Mobile Irrigation Equipment	10
Pastureland Conversion	10
Nutrient Reduction Management System	3
Rock-lined Waterway or Outlet	10
Sediment Control Structure	10
Sod-based Rotation	4 or 5
Stock Trail and Walkway	10
Stream Protection System	
Spring Development	10
Trough or Tank	10
Well	10
Windmills	10
Stream Crossing	10
Stripcropping	5
Riparian Buffer	10
Terrace	10

Best Management Practices Eligible for Cost Share Payments (continued)

Waste Management System	
Waste Storage Pond	10
Waste Storage Structure	10
Waste Treatment Lagoon	10
System for Land Application of Animal Waste	10
Wetlands Development for Land Application	10
Controlled Livestock Lounging Area	10
To-Be-Abandoned or Abandoned Confined	
Animal Operation (CAO)	5
Odor Control	1 to 10
Water Control Structure	10

Agricultural Best Management Practices

I. Crop and Pasture Lands

A. BMPs for Sediment Control
- Conservation Tillage System
- Critical Area Planting
- Cropland Conversion
- Diversion
- Field Border
- Filter Strip
- Grade Stabilization Structure
- Grassed Waterway
- Rock-lined Waterways or Outlets
- Sediment Control Structure
- Sod-based Rotation
- Stripcropping
- Terrace
- Water Control Structure
- Pastureland Conversion

B. BMPs for Nutrient Control
- Legumes in Rotation
- Soil Testing
- Liming
- Setting Realistic Crop Yield Goals (determines fertilization rates)
- Fertilizer Waste Application (method, rate, and timing)
- Sediment Control BMPs

C. BMPs for pesticide control
- Alternative Pesticides
- Optimize Pesticide Formulation, Amount, Placement Timing, Frequency
- Crop Rotation
- Resistant Crop Varieties
- Other Cultural or Biological Controls
- Optimize Crop Planting Time
- Plant Pest Quarantines
- Proper Disposal of Obsolete Pesticides and Containers
- Certification of Applicators
- ~~Sediment Control BMP's~~

II. Animal Production (esp. Confined Animal Operations)

BMPs for bacteria and nutrient control
- Grade Stabilization Structures
- Heavy Use Area Protection
- Livestock Exclusion
- Spring Development
- Stock Trails and Walkways
- Trough or Tank
- Waste Management System
- Waste Storage Pond
- Waste Storage Structure
- Waste Treatment Lagoon
- Land Application of Waste
- Water Control Structure

BMPs FOR URBAN STORMWATER

Structural Best Management Practices for urban runoff control are typically designed to reduce sediment, its attached pollutants, and nutrients. In addition, other BMPs protect the riparian ecosystem, provide streambank stabilization, provide shade to water bodies and reduce the likelihood of excessive water temperatures. Non-structural BMPs, such as a design manual or a public education program, encourage the comprehensive and effective implementation of structural BMPs. The table below contains a list of both structural and non-structural BMPs. This list is taken from the *Stormwater Management Guidance Manual*, published by DWQ's Water Quality Planning Branch in 1995. The *Manual* provides a detailed discussion of each of the BMPs, including its characteristics, pollutant-specific effectiveness, reliability, feasibility, costs, unknown use factors, design considerations, and references for further information.

STRUCTURAL BMPs
I. Wet Detention Basin
II. Constructed Wetlands
• Wet Retention Basin
• Dry Detention Basin
• Infiltration Basin
• Vegetative Practices
◊ Filter Strips
◊ Grassed Swales with Check Dams
• Sand Filter
• Oil and Grease Separator
• Rollover-Type Curbing
NON-STRUCTURAL BMPs
I. Preventive Measures
II. Pollutant Minimization
• Exposure Reduction (proper scheduling, etc. - see Manual)
• Landscaping and Lawn Maintenance Controls
• Animal Waste Collection
• Curb Elimination
• Parking Lot and Street Cleaning
• Road Salt Application Control
• Catch Basin Cleaning
III. Riparian area protection
IV. Design Manual for Urban BMPs
V. Public Education
VI. Identification and Enforcement of Illegal Discharges
VII. Land-Use Control
• Low-Density Development
• Comprehensive Site Planning
• Buffer Zone
• Sanitary Waste Management
VIII. Conservation Easement

Structural BMPs may affect groundwater quality in certain situations. Devices that recharge groundwater pose the risk of passing soluble pollutants into groundwater systems. It is not currently known whether pollutant concentrations in recharged groundwater areas pose a significant environmental or health risk. USGS is presently studying groundwater quality effects of urban BMPs. In addition, if funds are made available, DWQ may conduct a similar study in North Carolina.

BMPs FOR EROSION AND SEDIMENTATION CONTROL

Best Management Practices suggested pursuant to the NC Sedimentation Pollution Control Act of 1973 are selected on the basis of performance in providing protection from the maximum peak rate of runoff from a 10-year storm. This allows the developer/designer of the control measures, structures, or devices to determine and submit for approval the most economical and effective means of controlling erosion and preventing sedimentation damage. Practices are therefore reviewed for acceptability based upon the characteristics of each individual site and its erosion potential. Ideally, the erosion control plan will employ both practices and construction management techniques which will provide the most effective and reasonable means of controlling erosion while considering the uniqueness of each site. The following table provides a list of practices commonly used in sedimentation and erosion control plans across North Carolina.

Check Dam	Sand Fence (Wind Fence)
Construction Road Stabilization	Sediment Basin
Dust Control	Sediment Fence
Grade Stabilization Structure	Sod Drop Inlet Protection
Grass-lined Channels	Sodding
Grass Channels with Liner	Structural Streambank Stabilization
Land Grading	Subsurface Drain
Level Spreader	Surface Roughening
Mulching	Temporary Block & Gravel Inlet Protection
Outlet Stabilization Structure	Temporary Diversions
Paved Channels	Temporary Excavated Drop Inlet Protection Fabric Drop Inlet Protection
Paved Flume (Chutes)	Temporary Gravel Construction Entrance/Exit
Perimeter Dike	Temporary Sediment Trap
Permanent Diversions	Temporary Seeding
Permanent Seeding	Temporary Slope Drains
Permanent Stream Crossing	Temporary Stream Crossing
Right-Of-Way Diversions	Topsoiling
Riprap	Tree Preservation & Protection
Riprap-lined Channels	Trees, Shrubs, Vines & Ground Covers
Rock Dam	Vegetative Dune Stabilization
	Vegetative Streambank Stabilization

BMPs FOR ON-SITE WASTEWATER DISPOSAL

To protect public health and water quality, best management practices (BMPs) need to be implemented throughout the life cycle of an on-site wastewater disposal system. Life-cycle management problems can be addressed in three phases (Steinbeck, 1984). The first phase includes system siting, design, and installation. The second phase involves the operation of the system and phase three involves maintenance and repair when the system malfunctions or fails. As BMPs are applied in each life-cycle phase, the primary factor the success of the system is the participation of the local influencing health department and the cooperation of the developer, owner, design engineer, system operator, and the state. The table that follows gives a summary of the current life-cycle management practices and penalties utilized in North Carolina to implement the on-site sewage systems program (Steinbeck, 1984).

1. Application -- The developer or property owner meets with the staff of the local health department to review the project proposal and submits an application to the local health department that contains information regarding ownership, plat of property, site plan, type of facility, estimated sewage flow, and proposed method of sewage collection, treatment, and disposal.
2. Site Evaluation -- The local health department, with technical assistance from the state, evaluates the proposed sewage effluent disposal site for several factors, including slope, landscape position, soil morphology, soil drainage, soil depth, and space requirements. Next, the local health department will assign a site suitability classification, establish the design sewage flow, and the design loading rate for the soil disposal system.
3. Design Review --The applicant is required to submit plans and specifications for the sewage collection, treatment, and disposal system prepared by a professional engineer, for complex systems, or for systems exceeding 3,000 gal/day. Reviews are made by both state and local health departments. The designer must also include in the plans and specifications, installation procedures, phasing schedules, operation and maintenance procedures, monitoring requirements, and designate the responsible agents for operation and maintenance.
4. Legal Document Review -- For systems with multiple ownership or off-site disposal, the applicant must prepare and submit to state and local health departments for their legal review documents applicable to the project.
5. Improvement Permit -- Issued only after a successful review of the proposed project, including each of the items discussed above and allows construction to begin for the on-site sewage system. The improvement permit must be issued prior to other construction permits and allows only temporary electrical power to the site. This permit contains the necessary conditions for construction of the projects with the plans, specifications, and legal documentation appended to it.
6. Operation Permit -- Issued to the owner of the on-site sewage system by the local health department when it determines that all the requirements in the rules, plans and specifications are met; all conditions on the improvement permit are met; and the design engineer for the sewage collection, treatment, and disposal system certifies in writing to the local health department that the on-site system has been installed in accordance with the approved plans and specifications. The operation permit is also conditioned to establish performance requirements and may be issued for a specific period of time. It allows the on-site sewage system to be placed into use, prevents permanent electrical service to the project and prevents occupancy of the facilities until issued. The operation permit applies to systems larger than 480 gallons per day. A certificate of completion is required for conventional septic tank systems when the design sewage flow is less than 480 gal/day.

On-Site Wastewater Disposal BMPs (continued)

7.	Surveillance -- Once an on-site sewage system is placed into operation the local health department must make routine inspections at least annually for large systems to determine that the system is performing satisfactorily and not creating a public health nuisance or hazard. Additionally, required monitoring reports are routinely submitted to the local health department as required in the permits. The state provides technical assistance to the local health department and the system operator in assuring adequate performance. While annual inspections are required, frequent performance checks must be made by the local health department.
8.	Remedies -- When voluntary compliance with the performance requirements for the on-site system is unsuccessful, the General Statutes (1983) provide for the following remedies:
a)	Right of Entry -- Allows the state or local health department to enter the premises to determine compliance with the laws and rules and provides for an administrative search and inspection warrant when entry is denied.
b)	Injunction -- The state or local health department may institute an action for injunctive relief against the owner to bring the on-site sewage system into compliance.
c)	Order of Abatement -- The state or local health department is empowered to issue an order of abatement directing the owner to take any necessary action to bring the system into compliance. However, if the on-site system is determined to be creating an imminent health hazard, the state or local health department may, after previous unsuccessful attempts at correction, take the necessary action to correct the problem and recover any costs for abatement from the owner. This is the least frequently applied remedy.
d)	Administrative Penalties -- The state may impose administrative penalties up to $300 per day for violation of the laws, rules, or any permit condition for on-site sewage systems serving multi-family residences with a flow greater than 480 gal/day. A penalty of up to $50 per day can be assessed for malfunctioning systems where the flow is less than or equal to 480 gal/day.
e)	Suspension and Revocation of Permits -- The state may suspend or revoke a permit for violations of the laws, rules, or permit conditions upon a finding that a violation has occurred.
f)	Misdemeanor -- The owner who violates the sewage laws or rules shall be guilty of a misdemeanor and punishable by a fine or imprisonment as determined by the courts. This is the most frequently used remedy.

BMPs FOR SOLID WASTE MANAGEMENT

Best Management Practices for solid waste management address the water quality impacts of leachate migration and surface erosion. A list of BMPs for controlling solid waste impacts on water quality can be found in the table below.

The BMPs offer significant benefits for groundwater quality. Landfill liners will prohibit or greatly decrease the volume of leachate entering groundwater. In turn, leachate collection systems capture leachate for subsequent treatment rather than groundwater disposal. For even greater protection, groundwater and surface water monitoring should detect failures in the liner or collection system.

Reduce, Recover, and Recycle Solid Waste to Maximum Extent
Incineration with Energy Recovery
North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities, 1987
Liners (Clay or Synthetic) for All New Landfills
Leachate Collection Systems
Erosion Control Plan
Operation and Maintenance Plan
Buffers Between Landfill and Streams, Property Lines and Dwellings
Groundwater Quality Monitoring
Surface Water Quality Monitoring
Public Education
Stormwater Runoff Control
Sedimentation Control

BMPs FOR FORESTRY

A. General BMPs for Forestry Operations in North Carolina

Forest Practices Guidelines Related to Water Quality (15A NCAC 1I.0101-.0209) have been adopted as published in the NCR, Volume 4, Issue 11, pages 601-604, and were effective January 1, 1990. These guidelines are summarized below.

Streamside Management Zone(SMZ)
• Must establish SMZ along natural, intermittent and perennial streams and water bodies. (Not required along man-made ditches and canals, although erosion protection is needed).
• Must have sufficient width and adequate ground cover to confine visible sediment (usually best to protect existing ground cover).
• Place roads, trails and decks outside of SMZ.
• Limited cutting(harvesting) is permitted within the SMZ.
Prohibition of Debris Entering Streams
• Prevent debris(logging slash, soil) of all types that can cause stream flow impediment or water quality degradation from entering intermittent and perennial streams and water bodies.
• Remove debris that accidentally enters streams.
Access Road and Skid Trail Stream Crossing
• Avoid crossing streams where possible.
• Avoid using stream channels as roads or trails.
• Construct crossings to minimize sediment entering streams.
• Protect stream banks and channels from damage.
• Provide water control devices and/or structures and, within 10 working days of initial disturbance provide ground cover sufficient to restrain accelerated erosion and prevent stream sedimentation.
Access Road Entrance
• Prevent soil and debris from being deposited on public highways which may result in stream sedimentation.
Keep Waste from Entering Streams, Water bodies and Groundwater
• Prevent oil, fuels, fertilizer and other chemical waste from entering streams, water bodies and groundwater.
Pesticide Application
• Application must follow labeling and N.C. Pesticides Board rules. Includes insecticides, fungicides, herbicides, and rodenticides.
Fertilizer Application
• Apply in a manner to prevent adverse impacts on water quality.
Stream Temperature
• Retain shade sufficient to prevent temperature fluctuations which result in a violation.
Rehabilitation of Project Site
• Within 30 working days after ceasing operations, provide sedimentation control measures to prevent water quality damage.
• Permanently stabilize SMZ areas and other areas that may directly contribute visible sediment to streams.

B. BMPs for Forestry Operations in Wetlands

The Division of Forest Resources is in the process of developing BMPs for forested wetlands. Economic pressure to expand forestry activities in wetlands continues to increase. This expansion will require a sound strategy to protect these environmentally sensitive areas.

A Forested Wetlands BMP Committee was established in the winter of 1987. Committee members represent federal and state agencies, industry, education, and environmental groups who have a role in the fate of wetlands.

In the absence of state standards, federal BMPs for forested wetlands are implemented. The table below identifies these federally mandated BMPs for Waters of the United States and wetlands adjacent to such Waters (Fed. Register 53(108): 207775, June 6, 1988). The Clean Water Act Section 404 Permit Exemption for forest roads applies only where the following BMP standards are fully met.

• Permanent roads (for forestry), temporary access roads (for forestry), and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with silvicultural and local topographic and climatic conditions;
• All roads shall be located sufficiently far from streams or other water bodies (except for portions of such roads that must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;
• Road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;
• Fill shall be properly stabilized and maintained to prevent erosion during and following construction;
• Discharges of dredged or fill material into waters of the U.S. to construct road fills shall be made in a manner that minimizes encroachment of trucks, tractors, bulldozers, and other heavy equipment into waters of the U.S. (including adjacent wetlands that lie outside the lateral boundaries of the fill itself);
• In designing, constructing, an maintaining roads, vegetative disturbance in waters of the U.S. shall be kept to a minimum;
• Design, construction and maintenance of road crossings shall not disrupt the migration or other movement of those aquatic species inhabiting the water body;
• Borrow material shall be taken from upland sources whenever feasible;
• The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;
• Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;
• Discharge shall not be located in proximity to a public water supply intake;
• The discharge shall not occur in areas of concentrated shellfish production;
• Discharge shall not occur in a designated National Wild and Scenic River;
• Discharge shall be of suitable material free from toxic pollutants in toxic amounts; and
• All temporary fills shall be removed in their entirety and the area restored to its original elevation.

BMPs FOR MINING OPERATIONS

Significant environmental damage can and often times does occur during land-disturbing activities of mining operations, especially during the initial stages. The potential for such damage can be substantially reduced with the installation of BMPs. Once the mining has terminated, BMPs are used to reclaim or reasonably rehabilitate the site (for mined lands after June 11, 1971). The basic objective of the reclamation is to establish on a continuing basis the vegetative cover, soil stability, and water and safety conditions appropriate to the area. The BMPs are performance-oriented, allowing a mining permit applicant to design and propose the most economical and effective means of a) controlling erosion and preventing off-site sedimentation damage; b) preventing contamination of surface waters and groundwater; and, c) preventing any condition that will have unduly adverse effects on wildlife or freshwater, estuarine, or marine fisheries. BMP selection is site-specific and controlled in part by the pre- and post-mining land use(s). The acceptability of a BMP is therefore based upon the characteristics of the individual site and its potential for off-site damage.

The table which follows provides a list of BMPs used for activities associated with mining activities in North Carolina. This list is essentially the same as that provided for Sedimentation and Erosion Control, due to the similar nature of activities in both programs.

Check Dam	Sediment Basin
Construction Road Stabilization	Sediment Fence
Dust Control	Sod Drop Inlet Protection
Grade Stabilization Structure	Sodding
Grass-lined Channel	Structural Streambank Stabilization
Grass Channels with Liner	Subsurface Drain
Groundwater Monitoring Wells	Surface Roughening
Land Grading	Temporary Block and Gravel Inlet Protection
Level Spreader	Temporary Diversions
Mulching	Temporary Excavated Drop Inlet Protection
Outlet Stabilization Structure	Temporary Fabric Drop Inlet Protection
Paved Flume (Chutes)	Temporary Gravel Construction Entrance/Exit
Perimeter Dike	Temporary Sediment Trap
Permanent Diversions	Temporary Seeding
Permanent Seeding	Temporary Slope Drains
Permanent Stream Crossing	Temporary Stream Crossing
Right-of-Way Diversions	Topsoiling
Riprap	Tree Preservation and Protection
Riprap-lined Channels	Trees, Shrubs, Vines & Ground Covers
Rock Dam	Vegetative Dune Stabilization
Sand Fence (Wind Fence)	Vegetative Streambank Stabilization

BMPs FOR HYDROLOGIC MODIFICATION (related to mining operations)

BMPs for Discharges of Dredged or Fill Material (Adapted from 40 CFR 230 - Guidelines for Specification of Disposal Sites for Dredged or Fill Material)

1. Actions concerning the location of the discharge.
a) Minimize smothering of organisms;
b) Avoid disruption of periodic water inundation patterns;
c) Select a previously used disposal site;
d) Select a disposal site with substrate similar in composition to the material being disposed;
e) Minimize extent of any plume; and
f) Minimize or prevent creation of standing bodies of waters in areas of normally fluctuating water levels.
2. Actions concerning the material to be discharged.
a) Maintain physiochemical conditions and reduce potency and availability of pollutants;
b) Limit solid, liquid and gaseous components;
c) Add treatment substances; and
d) Utilize chemical flocculants in diked disposal areas.
3. Actions controlling the materials after discharge.
a) Reduce potential for erosion, slumping or leaching by
i) using containment levees, sediment basins and cover crops to reduce erosion; and
ii) using lined containment areas to reduce leaching.
b) Cap in-place contaminated material with clean material;
c) Prevent point and nonpoint sources of pollution; and
d) Time the discharge to minimize impact, especially during unusual high water flows, wind, wave and tidal actions.
4. Actions affecting the method of dispersion.
a) Maintain natural substrate contours and elevation;
b) Minimize undesirable obstruction to the water current or circulation pattern;
c) Confine suspended particulate/turbidity to a small area where settling can occur;
d) Mix, dilute and disperse the discharge;
e) Minimize water column turbidity;
f) Maintain light penetration for organisms; and
g) Set limitations on the amount of material to be discharged per unit of time or volume of receiving water.
5. Actions related to technology.
a) Use appropriate equipment and machinery, including protective devices;
b) Employ appropriate operation and maintenance of machinery, including training, staffing and working procedures;
c) Use machinery and techniques designed to reduce damage to wetlands, including devices that scatter rather than mound excavated materials, machines with specially designed wheels or tracks, and the use of mats under heavy machinery to reduce compaction and rutting; and
d) Design access roads and channel spanning structures to accommodate fluctuating water levels and circulation patterns.

BMPs for Hydrologic Modification (continued)

6. Actions affecting plant and animal populations.
a) Avoid changes in water current and circulation patterns;
b) Prevent or avoid creating habitat conducive to the development of undesirable predators or species;
c) Avoid sites having unique habitat or other value, including endangered or threatened species;
d) Institute habitat development and restoration;
e) Avoid spawning or migration seasons and other biologically critical time periods; and
f) Avoid destruction of remnant natural sites within areas already affected by development.
7. Actions affecting human use.
a) Prevent or minimize damage to the aesthetically pleasing features of an aquatic site, including water quality;
b) Avoid disposal sites valuable as natural aquatic areas;
c) Avoid seasons or periods when human recreational activity associated with the aquatic site is most important;
d) Avoid sites which will increase incompatible human activity or require frequent dredge or fill maintenance in remote fish and wildlife areas; and
e) Locate disposal site outside of the vicinity of a public water supply intake.

APPENDIX VI

Existing Point And Nonpoint Source Water Quality Programs

APPENDIX VI

EXISTING POINT AND NONPOINT SOURCE POLLUTION CONTROL PROGRAMS

NORTH CAROLINA'S POINT SOURCE CONTROL PROGRAMS

Discharge permits are issued under the authority of North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination System (NPDES) program. NPDES permits establish effluent limitations on the maximum level of wastes or pollutants, that may be discharged into surface waters. North Carolina has a very comprehensive NPDES program that includes the following major components:

1. NPDES Permit Review and Processing,
2. Wasteload Allocation Modeling,
3. Compliance Monitoring and Enforcement,
4. Aquatic Toxicity Testing,
5. Pretreatment,
6. Operator Certification and Training and
7. Nondischarge and Regional Wastewater Treatment Alternatives.

Below is a brief summary of key components of North Carolina's NPDES program

NPDES Permit Review and Processing

In North Carolina, the issuance of discharge permits is coordinated with the basinwide planning process. Thus, DWQ issues all discharge permits within a given basin at approximately the same time. These permits are valid for five years. New discharge permits issued during an interim period between cycles will have a shorter expiration period in order to coincide with the next basin permitting cycle. Thus, DWQ can more effectively monitor and modify its permitting system consistently across the river basins.

DWQ will not process a permit application until the application is complete. The requirements for discharge permit application and processing are outlined in Administrative Code Section: 15A NCAC 2H .0100 - Wastewater Discharges to Surface Waters. Under this rule, all applications must include a feasibility analysis on alternative disposal options, such as spray irrigation, and justification for the selection of the discharge option.

Applications for new discharges greater than 500,000 gallons per day of wastewater, 10 million gallons per day (MGD) of cooling water, or 1 MGD of any other type of effluent must include an *assessment* report in addition to the normal permit application. The assessment is to provide sufficient information to describe the impact of the proposed action on the waters in the area. DWQ may also require an Environmental Impact Statement or Environmental Assessment, under the NC Environmental Policy Act for certain publicly funded projects.

DWQ staff establish waste limits for permit applications based on a wasteload allocation process (described in the following section). The staff review also includes a site inspection (for existing facilities up for renewal, the inspection may be conducted prior to submittal of a complete application). If DWQ finds the application acceptable, it will issue a public notice (called a Notice of Intent to Issue) in newspapers having wide circulation in the local area. The Notice of Intent includes all of the permit applications for a particular subbasin (or subbasins) that will be issued within a given month. The public then has a 30-day period to comment on the proposed permit. If the public expresses sufficient interest in one or more of the applications, DWQ may hold a public hearing.

DWQ also sends copies of the Notice of Intent to a number of state and federal agencies for comment. For example, the Division of Environmental Health reviews the applications for their potential impact on surface water sources of drinking water. Once DWQ received and evaluates the comments, the Director of DWQ decides whether to issue or deny the permit. The final permit will include recommended waste limits and other special conditions that may be necessary to ensure protection of water quality standards.

Establishing Discharge Permit Effluent Limitations/Wasteload Allocations

Effluent limitations, also called waste limits, dictate the amounts of wastes (pollutants), that the permittee is allowed to discharge into surface waters under an NPDES permit. Before DWQ issues a discharge permit, it evaluates the projected impact of the discharge on the receiving waters. This determination, called a wasteload allocation (WLA), is usually based on a computer model which considers many factors, including the characteristics of the waste (e.g., flow and type) and the characteristics of the receiving waters (e.g., flow, waste assimilative capacity, channel configuration, rate of reaeration, water quality classification). DWQ determines permit limits using models called water quality-based limits. DWQ also bases some permit limits based on federal effluent guidelines established by the USEPA.

DWQ performs wasteload allocations by using various models, depending on the parameter (type of pollutant) of interest and the characteristics of the receiving waters. Model frameworks (discussed in more detail in Appendix IV) can range from simple mass balance analyses to 3-dimensional dynamic water quality models. Modeling fits into the basin plan by drawing on the current conditions within the basin and evaluating the effects of various management strategies. DWQ uses models for a number of objectives, including determining the fate and transport of pollutants, setting reduction goals for point and nonpoint sources, and to derive effluent limits for NPDES permits. For example, models can be used to predict concentrations of a parameter at a given site, such as instream DO or chlorophyll *a* in a lake.

Models can also be a tool for determining the level of pollutant reductions needed to protect instream standards. In addition, DWQ performs uncertainty analyses of water quality models to expand their predictive capabilities and increase confidence in results. Waste limits may vary from summer to winter for some parameters, such as nutrients and ammonia, with winter limits being somewhat less stringent than summer limits due to higher instream flows during the winter months.

When point sources are responsible for water quality problems, WLAs can yield appropriate permit limits that offer adequate water quality protection. Where a sole discharge is responsible for the water quality impacts, DWQ can perform a simple WLA without considering other discharges. In this case, DWQ will establish limits in accordance with the state's Standard Operating Procedures (SOP) for Wasteload Allocations manual. The SOP manual has been developed to support State and Federal regulations and guidelines and has been approved by the EPA.

A critical factor in determining the wasteload for an individual discharge is whether the receiving waters have a flow during 7Q10 or 30Q2 conditions. DWQ's policy prohibits new or expanded discharges into "no flow" streams that have a 7Q10 and a 30Q2 equal to zero. In addition, DWQ will look for ways to remove existing discharges on such streams unless it is determined that there are no reasonable alternatives. If it is not feasible to remove the discharge, then the facility will be required to meet limits of 5 mg/l BOD_5 and 2 mg/l NH_3N in summer (and 10 mg/l BOD_5 and 4 mg/l NH_3N in winter).

When numerous discharges affect water quality, the Environmental Management Commission is required to consider the cumulative impacts of all of the permitted discharges to a water body (pursuant to NCGS 143-215.1(b)(2)). Such areas are identified and discussed in Chapter 6. Generally, these are areas where the SOP alone does not provide adequate guidance. Since the SOP addresses mostly single discharge or relatively simple interaction of multiple discharges, WLA procedures outside the realm of the SOP represent the larger, basinwide strategy that DWQ is implementing.

Compliance Monitoring and Enforcement

Most dischargers are required to periodically sample the treated effluent from their discharge pipes. Also, many larger and more complex dischargers are required to sample points in the receiving waters both up and downstream from the discharge point. This process is called self-monitoring and it is typically required five days a week for some parameters (Monday through Friday) for major facilities. The sampling results (contained in a daily monitoring report or DMR) are then submitted each month to DWQ for compliance evaluations.

If a plant does not meet its permitted limits, DWQ may take one or more of the following actions: issue a notice of violation, initiate enforcement action, place the facility on moratorium, and/or enter into a Special Order by Consent (SOC). An SOC is a legal commitment entered into by the state and the discharger that establishes a time schedule for bringing the wastewater treatment plant back into compliance. During this time period, interim waste limits may be assigned to the facility until the improvements can be made. These interim limits may be less stringent than those in the permit although they are still required to protect water quality in the receiving waters.

In addition to the DMR data, illegal or improperly treated discharges may be identified in other ways including through third party reports, routine DWQ site inspections, and water quality monitoring conducted by DWQ staff.

Aquatic Toxicity Testing

There are thousands of chemicals and compounds that can enter wastewater systems and potentially be discharged to surface waters. Treatment plants are unable to monitor each of these chemicals individually due to limited funds and time, and limits in the ability of current analytical techniques to detect some pollutants. Even if the existence and potential effects of every constituent of a wastewater were known, the combined effects of these constituents could not be predicted.

North Carolina uses an integrated approach to aquatic toxicity testing that includes monitoring specific chemicals, assessing resident aquatic populations, and analyzing whole effluent toxicity (WET). Whole effluent toxicity limits predict the impacts of toxicants by measuring those impacts in a laboratory setting. It is from this same foundation of aquatic toxicity laboratory tests that chemical specific limits and criteria are derived for the majority of chemical toxicants.

In February 1987, North Carolina implemented a policy to incorporate WET limits for all major and complex minor permits. As of June 1996, 567 permitted NPDES discharges were required to perform WET monitoring, and over 15,000 individual toxicity analyses had been performed for plants across the state. WET limits were developed to protect aquatic life from the discharge of substances in toxic amounts as prescribed by 15 NCAC 2B. 0208 (i.e. so as not to result in chronic toxicity at permitted discharge flow and 7Q10 receiving flow volumes). Since the inception of the program, a change in WET limitations has been observed. Previously, DWQ had predicted that approximately 25% of the facilities tested to be acutely toxic instream; however, DWQ has lowered that prediction to ten percent.

Aquatic toxicity testing, like other complex analytical techniques, requires a great deal of quality assurance and control to achieve reliable results. In 1988, North Carolina initiated a program that requires all laboratories performing NPDES analyses in North Carolina to be certified by the state as a biological laboratory. As of June 1996, 22 commercial, municipal, and industrial laboratories had achieved this certification in either aquatic toxicity analyses and/or aquatic population survey. The NC Biological Laboratory Certification Program, much like WET permitting in North Carolina, is looked at as a national leader in its field.

Pretreatment Program

The goal of pretreatment program is to protect municipal treatment plants or publicly-owned treatment works (POTWs) as well as the environment from the discharge of hazardous or toxic wastes into a public sewage system. The pretreatment program regulates non-domestic (e.g., industrial) users of POTWs that discharge toxic wastes under the Domestic Sewage Exclusion of the Resource Conservation and Recovery Act (RCRA). In essence, the program requires that businesses and other entities that use or produce toxic wastes pretreat their wastes prior to discharging their wastewater into the sewage collection system of POTW. State-approved pretreatment programs are typically administered by local governments that operate POTWs.

Local pretreatment program address four areas of concern: (1) interference with POTW operations, (2) pass-through of pollutants to a receiving stream, (3) municipal sludge contamination, and (4) exposure of workers to chemical hazards. Interference refers to any problem with plant operation, including physical obstruction and inhibition of biological activity. DWQ and the local government develop local pretreatment limits by determining the maximum amount of each pollutant the plant can accept at the influent (or headworks) and still protect the receiving water, the POTW itself, and the POTW's sludge disposal options.

Operator Certification and Training Program

Water pollution control systems must be operated by individuals certified by the North Carolina Water Pollution Control System Operators Certification Commission (WPCSOCC). The level of training and certification that the operator must have is based on the type and complexity of the wastewater treatment system. These systems include: wastewater treatment plants, wastewater collection systems and "non-discharge" ground absorption systems, such as alternative on-site disposal technologies and spray irrigation facilities. The Commission currently certifies operators in four grades of wastewater treatment, four grades of collection system operation, subsurface operation, spray irrigation operation, animal waste management and a variety of specialized conditional exams for specific technologies (e.g. oil/water separators).

The Technical Assistance and Certification Group of the North Carolina Division of Water Quality provides staff support for the Commission and assists in organizing training for operators in cooperation with the North Carolina University System, the North Carolina Community College System and through the professional associations for operators and pollution control professionals. Specialty courses and seminars for operators are also offered by the North Carolina combined Section Of The Water Environment Association/American Water Works Association (WEA/AWWA).

Training and certification of operators is essential to the proper operation and maintenance of pollution control systems. Without proper operation and maintenance, even the most effectively designed treatment system will not function efficiently. The goal of the WPCSOCC is to train competent and conscientious professionals that will provide the best wastewater treatment and thus protect the environment and public health.

Nondischarge and Regional Wastewater Treatment Alternatives

DWQ requires NPDES permit applicants to consider alternatives for disposal of wastewater effluent other than discharge to a stream. For some, there may be no other economically feasible alternatives. However, for others, particularly smaller dischargers, there are a number of potentially cost-effective and environmentally sound alternatives. There are several types of non-discharging wastewater treatment systems including spray irrigation, rapid infiltration, trickling systems and underground injection. Researchers in North Carolina are evaluating artificial wetlands as wastewater treatment systems. Permit requirements for nondischarging systems are listed in Administrative Code Section 15 NCAC 2H .0200 - Waste Not Discharged to Surface Waters.

Another alternative to a surface water discharge is to tie into an existing wastewater treatment system. Where possible, DWQ is encouraging smaller dischargers to connect to large established municipal systems. Regionalization, as this is called, has several advantages. Large municipal facilities, unlike smaller package-type plants, have a larger and better-trained staff, thereby reducing the potential for plant malfunctions. When malfunctions do occur in a large plant, they can be caught and remedied more quickly than in a small plant. Larger facilities provide a higher level of treatment more economically and more consistently than can smaller plants. Larger plants are monitored daily. Additionally, centralizing the discharges reduces the number of streams receiving effluent. As DWQ evaluates future permit expansion requests from regional facilities, it will look favorably upon plants that accept flows from smaller discharges.

Nondischarge permits are required for alternative methods of wastewater treatment. Nondischarge permits are also issued for the land application of residual solids (sludge) from wastewater treatment processes.

NONPOINT SOURCE CONTROL PROGRAMS

Agricultural Nonpoint Source (NPS) Control Programs

Agricultural BMPs have been developed largely to control the five major agriculturally-related causes of pollution: nutrients, sediment, pesticides, oxygen-demanding substances and bacteria. BMPs vary from site to site and are dependent upon a particular pollutant but include practices such as grassed waterways and vegetated buffers, nondischarging animal waste lagoons, integrated crop and pest management and soil testing. BMPs may be administered through one or more of the agricultural programs described below. Common agricultural BMPs are listed in Appendix VI.

- **North Carolina Agriculture Cost Share Program**
  In 1984, the North Carolina General Assembly budgeted approximately $2 million to assist landowners in 16 counties within the "Nutrient Sensitive Water" (NSW) watersheds including the Upper Neuse River (Falls Lake) and the New River in Onslow County to implement BMPs for agricultural and silvicultural activities. These funds were increased in May 1987 to include 17 additional coastal counties by the passage of a General Statute formally creating the *Agriculture Cost Share Program for Nonpoint Source Pollution Control (NCACSP)*. In 1989 the NCACSP became a statewide program. The NCACSP will pay a farmer 75 percent of the average cost of implementing approved BMPs and offer technical assistance to the landowners or users which would provide the greatest benefit for water quality protection. The primary purpose of this voluntary program is water quality protection.

The local Soil and Water Conservation District Boards under the administration of the North Carolina Soil and Water Conservation Commission (SWCC) are responsible for identifying treatment areas, allocating resources, signing contractual agreements with landowners, providing technical assistance for the planning and implementation of BMPs and generally encouraging the use of appropriate BMPs to protect water quality. The criteria for allocating funds to the District is "based on the identified level of agricultural related nonpoint source pollution problems and the respective District's BMP installation goals and available technical services as demonstrated in the Districts annual strategy plan" (NC Administrative Code, Title 15, Chapter 6, Section 6E). This local participation is crucial to the success of the program.

The DEHNR-Division of Soil and Water Conservation (DSWC) provides staff, administrative and technical support to the SWCC. The DSWC also coordinates the efforts of various associated Program committees and acts as the clearinghouse for District strategy plans, contracts, etc. A legislated Technical Review Committee meets quarterly "to review the progress of the Program" (G.S. 143-215.74B) and to make technical recommendations to the Commission.

Technical assistance for the implementation of approved BMPs is provided to the Districts through a 50:50 cost share provision for technical positions to be filled at the District level. The USDA-Natural Resources Conservation Service also provides technical assistance.

- **North Carolina Pesticide Law of 1971**

  In 1971 the General Assembly created and authorized the North Carolina Pesticide Board to regulate the use, application, sale, disposal and registration of pesticides for the protection of the health, safety, and welfare of the people and for the promotion of a healthy and safe environment. Some of the responsibilities of the Pesticide Board and the North Carolina Department of Agriculture include registering all pesticides prior to distribution and sale in North Carolina, sampling pesticides to insure that all products are up to guaranteed analysis and unadulterated by any other pesticide, sampling pesticides at time of application to insure that the applicator is following label instructions, and certifying the competency of applicators and dealers of restricted use pesticides.

  The Pesticide Section of the North Carolina Department of Agriculture conducts mandatory annual inspections of all aircraft used in pesticide application and conducts random inspections of ground application equipment and chemigation systems (application of pesticides through irrigation systems). These inspections are intended to encourage proper calibration and use of equipment in order to avoid excessive application rates and accidental spills from faulty systems. Stop use orders are issued for noncompliance with the regulations.

Inspections are also required for bulk storage tanks prior to filling. All commercial pesticide storage facilities are required to have an approved Pre-fire Plan. In addition, each large commercial storage facility is required to develop and maintain an Emergency Contingency Plan. This plan describes the actions facility personnel shall take to respond to fires, explosions, spills, or any other sudden or gradual release of pesticides or pesticide contaminated materials to air, soil, or surface waters. The Contingency Plan is designed to minimize hazards to human health and the environment.

Penalties are assessed to careless pesticide applicators. Enforcement of the law is based on where the pesticide is deposited rather than just where it is applied. For example, if a pesticide is found in a stream as a result of wind drift, the applicator is subject to legal action. The Raleigh Office staff of the NCDA Pesticide Section is comprised of 20 employees. There are 10 Inspectors who conduct field-level compliance monitoring and investigation services. The annual budget for pesticide control and analytical work is $1.4 million.

- **NCDA Pesticide Disposal Program**

In 1976, the North Carolina Pesticide Board adopted regulations governing the disposal of pesticides. These regulations make it illegal in North Carolina to dispose of hazardous waste (which includes certain pesticides) in sanitary landfills. While households and farms which generate less than 220 pounds of hazardous waste and less than 2 pounds of acutely hazardous waste are exempt from federal disposal requirements, the regulations prohibiting the disposal of these wastes in sanitary landfills still applies to them. The option to use commercial hazardous waste disposal companies is too expensive and most companies will not pickup small quantities. As a result of this dilemma, the NCDA created the Pesticide Disposal Program in 1980 through appropriations from the General Assembly.

The goal of the Program is to provide an available, affordable and environmentally acceptable mechanism in which any homeowner, farmer, or institution can dispose of unwanted or unusable pesticides. It is mandatory, however, that all pesticide products are labeled correctly before NCDA will pick them up. An EPA permitted hazardous waste treatment or disposal facility (TSD) requires proper identification before the products can be disposed.

The Food and Drug Division of the North Carolina Department of Agriculture administers the Pesticide Disposal Program. The same staff used for enforcing the North Carolina Pesticide Law of 1971 are used in the Disposal Program.

- **Animal Waste Management**

Regulations

On December 10, 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H .0217) to establish procedures for properly managing and reusing animal wastes from intensive livestock operations. The goal of the rule is for intensive animal operations to operate so that animal waste is not discharged to waters of the state. This means that if criteria are met and no waste is discharged to surface waters, then an individual permit from DWQ is not required. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds with a liquid waste system. These operations are deemed permitted if a signed registration and an approved waste management plan certification are submitted to DWQ by the appropriate deadlines.

The deadline for submittal of registrations to DWQ for existing facilities was December 31, 1993. Animal waste management plans for existing facilities must be certified by a technical specialist designated by the Soil and Water Conservation Commission and submitted to DWQ by December 31, 1997. The standards and specifications of the USDA Natural Resources Conservation Service are the minimum criteria used for plan approval by the local Soil and Water Conservation Districts.

Operator Training and Certification

The North Carolina General Assembly ratified Senate Bill 974 (NCGS 143-215.74C - E) on July 29, 1995, which requires that the Department of Environment, Health and Natural Resources, in cooperation with the Cooperative Extension Service, develop and administer a training and certification program for operators of swine facilities with more than 250 swine that land apply animal waste. The Department assigned the task of developing and administering this program to the Technical Assistance and Certification Group of the Water Quality Section. The purpose of this program is to reduce nonpoint source pollution associated with the operation of animal waste management systems. Animal waste management systems are defined as a combination of structural and non-structural practices that collect, treat, store, or apply animal waste to the land. All animal operations with 250 or more swine (Sus scrofa) are required to designate an Operator in Charge who has primary responsibility for the operation of the animal waste management system. There are approximately 4,000 animal operations in the state that are required to designate an Operator in Charge.

A steering committee was established that includes representatives from the animal agriculture industry, environmental groups, North Carolina Department of Agriculture, Natural Resources Conservation Service, Division of Soil and Water Conservation, North Carolina Cooperative Extension Service and the Division of Environmental Management. The primary purpose of this committee was to develop the instructional manual and exam questions for the training and certification program. The manual has been completed and is being used in the training sessions that are primarily being conducted by the Cooperative Extensive Service in each county. Also involved in the training will be personnel from the NC Department of Agriculture, Natural Resources Conservation Service and pork producers. The training sessions for the operators began in April 1996. The examinations will be administered by the Technical Assistance and Certification Group in eighteen locations throughout the state beginning in May, 1996.

Persons who wish to be certified as operators of animal waste management systems must attend a minimum of six hours of training and demonstrate competence in the operation of animal waste management systems by passing an examination. The training and certification requirements must be completed once every five years. Participants in the training program will receive instruction in the following areas: 1) proper operation of animal waste management system components such as lagoons and irrigation systems; 2) waste utilization plans and proper waste, soil and tissue sampling techniques; 3) proper application of waste including calculation of application rates and calibration of equipment; and 4) consequences of improper management and environmental stewardship.

Inspection and Enforcement
Prior to July, 1995, DWQ's limited compliance resources were mostly directed toward getting existing facilities registered, insuring that new and existing facilities had approved waste management plans and responding to citizen complaints.

Following major lagoon dike breaks in late June and July, 1995, DWQ and the Department's natural resources divisions made a major commitment to inspecting all animal operations. As of December 1, 1995, over 4,000 operations were inspected.

These inspections have found a very high percentage of these facilities with problems. DWQ is currently working with these problem facilities to get them into compliance. These efforts include technical assistance, Notices of Violations, notification of loss of deemed permitted status and other appropriate enforcement actions. Approximately 1,800 out of the 3,922 reports entered in the Division's database indicate a compliance problem. As of May 13, 1996, approximately 200 facilities were found to have a discharge during an inspection.

As of May 13, 1996, 40 civil penalty cases were assessed and 8 court injunctions have been filed. Eighty-five facilities have lost their deemed permitted status and are required to obtain a certified waste management plan prior to the December 31, 1997 deadline.

Animal Inspection Database
May 13, 1996

Inspections	Total	Swine	Cattle	Poultry
Reports Entered	3922	3,012	803	107
Inadequate Freeboard	579	449	87	43
Seepage observed from lagoon	118	85	26	7
Erosion observed	426	376	32	18
Inadequate acreage available for spray	112	96	3	13
Cover crop inadequate	225	206	4	15
Man made conveyance of wastes	154	99	52	3
Inadequate Records	1,078	868	162	48
Non-Man made conveyance of wastes	59	43	8	8

This is preliminary information based on only the inspection reports entered as of the date of the report. These numbers are not considered accurate until a quality assurance procedure is in place. These numbers will change daily based on the entry of new reports and quality assurance checks of the information in the data base.

Swine Farm Siting Act
The Swine Farm Siting Act, SB 1080, was adopted on July 11, 1995 to minimize adverse impacts on property adjoining concentrated animal operations. The Act specifies that a swine house or lagoon of a new farm sited on or after October 1, 1995 is required to be at least 1,500 feet from any occupied residence; at least 2,500 feet from any school, hospital, or church; and at least 100 feet from any property boundary. The Act restricts the application of lagoon effluent to land at least 50 feet from a residential property line and from any perennial stream or river, excluding irrigation ditches and canals. If written permission is given by the property owner and recorded with the Register of Deeds, a swine house or lagoon may locate closer to a residence, school, hospital, church, or property boundary.

- **NC Cooperative Extension Service and Agricultural Research Service**
Crop and animal production programs are administered under the research and education activities of the NC Agricultural Research Service (ARS) and the NC Cooperative Extension Service (CES). The research and education efforts are broad and include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development and irrigation. Guidelines for most agricultural enterprises have been developed and made available to farmers. A more intensified water quality emphasis is being incorporated in these areas and many other projects undertaken by ARS and CES. The local contact that county CES agents have with farmers and homeowners provides an excellent opportunity for dialogue and education in nonpoint source pollution control. This network of contacts can be used to inform people about BMPs and to provide some structure for a general NPS education program.

The NC Agricultural Research Service and the NC Cooperative Extension Service conduct broad research and education efforts that include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development, and irrigation. County Cooperative Extension agents work closely with farmers and homeowners, providing an excellent opportunity for dialogue and education in nonpoint source pollution control. In addition, CES has begun assisting DWQ in holding a series of public workshops in each river basin prior to DWQ's preparation of the draft basin plan.

- **Soil, Plant Tissue, and Animal Waste Testing Program**
These services provide farmers with information necessary to improve crop production efficiency, to manage the soil properly and to protect environmental quality. The Soil, Plant

Tissue and Animal Waste Testing Program is administered by the Agronomic Division of the North Carolina Department of Agriculture. Water and wastewater from lagoons is also tested for irrigation and fertilizer use.

- **Watershed Protection and Flood Prevention Program (PL 83-566)**
The purpose of the Watershed Protection and Flood Prevention Program is to provide technical and financial assistance in planning, designing, and installing improvement projects for protection and development of small watersheds. The Program is administered by the USDA-Natural Resources Conservation Service in cooperation with the NC Division of Soil and Water Conservation, the State Soil and Water Conservation Commission, the U.S. Forest Service, Soil and Water Conservation Districts, and other project sponsors.

The emphasis of the Program over the past three decades has been to provide flood control. However, legislation has shifted emphasis of PL-566 land treatment projects so that a project proposal must demonstrate off-site water quality benefits in order to have any chance of funding.

- **Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA)**
There are several provisions authorized by the federal Food Security Act of 1985 (FSA) and re-authorized by the Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) which offer excellent opportunities for the abatement of agricultural nonpoint source pollution. The FSA and FACTA make the goals of the USDA farm and conservation programs more consistent by encouraging the reduction of soil erosion and production of surplus commodities and the retention of wetlands. At the same time, the provisions can serve as tools to remove from production those areas which critically degrade water quality by contributing to sedimentation. Important water quality-related provisions are known as the Conservation Reserve, Conservation Compliance, Sodbuster, Swampbuster, and Conservation Easement, Wetland Reserve, and Water Quality Incentive Program. These provisions are administered by the USDA.

Conservation Reserve Program
The Conservation Reserve Program (CRP) is administered by the USDA Agricultural Stabilization and Conservation Service (ASCS) and the USDA Natural Resources Conservation Service (NRCS). Other cooperating agencies include the NC CES, NC Division of Forest Resources and local Soil and Water Conservation Districts. The CRP was established to encourage removing highly erodible land from crop production and to promote planting long-term permanent grasses and tree cover. The ASCS will share up to half of the cost of establishing this protective cover. The intention of the program is to protect the long term ability of the US to produce food and fiber by reducing soil erosion, improving water quality and improving habitat for fish and wildlife. Additional objectives are to curb the production of surplus commodities and to provide farmers with income supports through rental payments over a 10 year contract period for land entered under the CRP.

Conservation Compliance
The Conservation Compliance provision of the FSA and FACTA discourages the production of crops on highly erodible cropland where the land is not carefully protected from erosion. Highly erodible land is defined as land where the potential erosion (erodibility index) is equal to eight times or greater than the rate at which the soil can maintain continued productivity. This rate is determined by the Natural Resources Conservation Service.

A farmer had until January 1, 1990 to develop and begin applying a conservation plan on highly erodible land. Plans were required to be operational by January 1, 1995. If a conservation plan is not developed and implemented, the farmer loses eligibility in price and income supports, crop insurance, FHA loans, Commodity Credit Corporation storage payments, farm storage facility loans, Conservation Reserve Program annual payments, and other programs under which USDA makes commodity-related payments. In other words, Conservation Compliance is an economic disincentive, quasi-regulatory program.

Sodbuster
The Sodbuster provision of the FSA and FACTA is aimed at discouraging the conversion of highly erodible land for agricultural production. It applies to highly erodible land that was not planted in annually tilled crops during the period 1981-85. As with the other provisions of the FSA, the Natural Resources Conservation Service determines if a field is highly erodible. If a highly erodible field is planted in an agricultural commodity without an approved conservation system, the landowner (or farmer) becomes ineligible for certain USDA program benefits.

Swampbuster
The purpose of Swampbuster is to discourage the conversion of wetlands to cropland use. Wetlands are defined as areas that have a predominance of hydric soils that are inundated or saturated by surface water or groundwater at a frequency or duration sufficient to support a prevalence of hydrophytic (water loving) vegetation. It is the responsibility of the Natural Resources Conservation Service to determine if an area is a wetland. Like the other provisions of the FSA and FACTA, a farmer will lose eligibility for certain USDA program benefits on all the land which is farmed if a wetland area is converted to cropland.

Conservation Easement
The Conservation Easement provision encourages producers whose FHA loans are in or near default to place their wetland, highly erodible land, and fragile land in conservation, recreation, or wildlife uses for periods of at least 50 years. The producer benefits by having the FHA loan partially canceled. The environment benefits by reducing the level of soil disturbing activities and the threat of agricultural pollutants.

Wetland Reserve
FACTA established a voluntary program for farmers to grant the federal government a 30-year or perpetual easement to wetlands. Eligible land includes farmed or converted wetlands which could be restored to their highest wetland function and value. The goal is to enroll one million acres by the end of 1995.

Water Quality Incentive Program
FACTA established this cost sharing program to help farmers control pollution problems associated with agricultural activities. A producer could receive up to $3,500 in cost share assistance to implement approved BMPs. The goal is to enroll 10 million acres by 1995.

Nonpoint Source Programs for Urban and Developed Lands

- **Federal Urban Stormwater Discharge Program / NC NPDES Stormwater Program**

  In 1987, Congress passed the Water Quality Act Amendments to the Clean Water Act requiring the U.S. Environmental Protection Agency (EPA) to develop regulations on permit application requirements for stormwater discharges associated with industrial activities as well as those associated with large and medium municipal separate storm sewer systems (population greater than 100,000). These regulations became effective in December 1990.

  The goal of the stormwater discharge permitting regulations in North Carolina is to prevent stormwater runoff pollution by controlling the source(s) of pollutants. Defining the potential pollutant sources and establishing controls of the sources that will reduce and minimize pollutant availability will result in an improvement to the water quality of the receiving streams, consistent with the overall goal of the water quality program. Authority to administer these

regulations has been delegated to the North Carolina Division of Water Quality (DWQ). The NPDES stormwater regulations require that facilities with stormwater point source discharges associated with industrial activity and municipalities defined as either large or medium municipal separate storm sewer systems be permitted.
The municipal permitting requirements are designed to lead to the formation of site-specific stormwater management programs for a municipal area. Therefore, the permits issued to municipalities for their municipal separate storm sewer systems will be explicitly written for each individual municipality. Municipal permits of this type in North Carolina are currently required for Charlotte, Durham, Greensboro, Raleigh, Winston-Salem and Fayetteville/Cumberland County. The municipalities will develop and implement comprehensive stormwater quality management programs to reduce the discharge of pollutants in stormwater to the maximum extent practicable (MEP). MEP will be defined separately for each municipality required to be permitted. Industrial facilities discharging through a municipal separate storm sewer system are required to submit a permit application to the state and receive their own NPDES stormwater permit.

Industrial activities which require permitting are defined in eleven categories in the federal regulations ranging from sawmills and landfills to phosphate manufacturing plants and hazardous waste treatment, storage or disposal facilities. The regulations cover point source discharges that are related to manufacturing, processing, or material storage areas at an industrial facility. Stormwater discharges associated with industrial activities are required to be covered by permits which contain technology based controls based on Best Available Technology (BAT)/Best Conventional Pollutant Control Technology (BCT) considerations or water quality controls, if necessary. Through monitoring and regulating stormwater discharge quality, the goal of the NPDES stormwater program is to reduce the pollutant load in stormwater runoff.

The permitting requirements described here represent Phase I of the stormwater program. EPA and Congress are currently involved in studies to determine the scope of additional stormwater coverage under Phase II of the stormwater program. Further stormwater NPDES coverage could include additional industrial activities or additional municipal areas. If additional areas of coverage are added under the federal stormwater programs, DWQ will be responsible for the appropriate permitting of these areas within North Carolina.

- **Water Supply Watershed Protection Program**
  Approximately 50 percent of North Carolina's population depends on surface water supplies for drinking, commercial, and industrial uses. Water supplies have become more important in recent years because of increased demand for water, concern over potential contamination by toxic substances, and protection of human health. As a result, the General Assembly passed the Water Supply Watershed Protection Act of 1989 (NCGS 143-214.5). This Act requires all local governments that have land-use jurisdiction within surface water supply watersheds, or a portion thereof, to be responsible for implementation and enforcement of nonpoint source management requirements related to urban development, according to minimum standards adopted by the state. NPS control strategies are included in the rules for urban, agricultural, silvicultural, and Department of Transportation activities. The Water Supply Watershed Protection Rules were adopted by the Environmental Management Commission on February 13, 1992 and became effective on August 3, 1992. These rules were recently revised (effective August 1, 1995) to give local governments more flexibility in the implementation of water supply protection programs.

  The purpose of the Water Supply Watershed Protection Program is to encourage communities to work with the state to provide enhanced protection for their water supply from nonpoint pollution sources. There are five water supply classes that are defined according to existing land use and the amount and types of permitted wastewater discharges. (See Appendix I for a summary of the management requirements for the five water supply classifications.) By classifying a watershed as a water supply watershed, local governments with land use jurisdiction within the watershed will take steps to control nonpoint sources of pollution and thereby reduce the potential of pollutants contaminating drinking water supplies. In turn, the state limits the point source discharges that can locate within the watershed which reduces the potential of contamination of the water supply.

This dual approach of state and local government action to preclude potential impacts from stormwater runoff and wastewater discharges is important since only a small fraction of the pollutants that enter water supplies from nonpoint sources have water quality standards. As more is learned about the types and effects of pollutants in our drinking waters, the state will be forced to adopt additional water quality standards. If these additional standards are imposed, one effect may be that water treatment facilities will be required to apply additional technology and possibly more expensive treatment facilities or operation to ensure safe drinking water. It is, therefore, very important for the state and local governments to consider alternative means of preventing nonpoint source pollution from entering drinking water supplies in the first place. The land-use requirements, including density controls, buffers along perennial streams and stormwater control requirements for high density developments are but a few ways to accomplish this.

The Water Supply Protection Program is administered by staff in the Operations Branch of the DWQ. These staff coordinate with the Division of Community Assistance (NCDCA) which helps local governments develop land-use ordinances, the Division of Environmental Health, which certifies that a proposed water supply is suitable for drinking water, and DWQ staff in NCDEHNR regional offices who are responsible for water quality sampling. Statewide, the compliance rate for submittals is 100%.

- **Coastal Stormwater Management**
  In November 1986, the EMC adopted rules which required new development in a limited zone (575 feet) around Class SA (shellfish) waters to control stormwater either by limiting density or completely controlling a 4.5 inch, 24-hour storm with the use of a stormwater treatment system. The regulations applied to development activities which required either a CAMA major permit or a Sediment/Erosion Control Plan (generally development disturbing more than one acre). The design storm, low density limits, and aerial coverage were all quite controversial and the adopted rules represented a compromise by all parties. A sunset provision was added to the rules to force the staff and Commission to reconsider the rules after a year. These rules expired December 31, 1987, but new stormwater regulations were adopted having an effective date of January 1, 1988. These regulations are administered by the DWQ. Approximately five man-years are allocated to implementing this program. Planning Branch staff are responsible for providing guidance and interpretation to promote consistent implementation of the rules. DWQ regional staff review and approve plans and enforce the requirements of the regulations.

  Perhaps the most important measure accomplished with the regulations has been the applicability of stormwater controls to development activities within the 20 CAMA coastal counties. Certainly the near-water impact of stormwater as addressed in the original rules is important, but the staff believed the cumulative impact of stormwater runoff throughout the coastal zone also needed to be addressed. Therefore, the expanded area of coverage helps provide better protection of both shellfish waters and coastal water quality in general.

  Other major items specified in the rules address the sizing of stormwater treatment systems. For developments adjacent to SA waters, infiltration systems must be able to retain 1.5 inches of rainfall, whereas development in other areas must control one inch of rainfall. Wet detention ponds are not allowed for stormwater control near SA waters and must be sized for 85 percent TSS removal in other areas. In addition, porous pavement is considered an innovative infiltration system (only five are allowed until they are proven to work) as evidence has not been provided regarding its effectiveness in coastal areas. A low density option of the new regulations applies a built-upon limit of 25 percent for SA areas and 30 percent for other coastal areas rather than a limit on effective impervious cover. Development exceeding these levels is required to have a engineered stormwater system as indicated.

In summary, the regulations, which have an expanded aerial coverage increases the annual number of projects affected from approximately 50 (original rules) to 500. This increase is coincident with a reduction in design storm that is comparable to requirements in other states. In addition, the low density option, retained from the original regulations, is encouraged as operation and maintenance concerns associated with stormwater controls are not applicable.

- **Coastal Nonpoint Pollution Control Programs**
  As part of the Coastal Zone Act Reauthorization Amendments of 1990, Congress enacted a new section 6217 entitled "Protecting Coastal Waters". This provision requires states with coastal zone management programs (which includes North Carolina) that have received Federal approval under section 306 of the Coastal Zone Management Act (CZMA) to develop and implement Coastal Nonpoint Pollution Control Programs. The coastal nonpoint programs will provide additional control for sources of nonpoint pollution that impair coastal water quality. Sources subject to the 6217 Coastal NPS Program include: agriculture, forestry operations, urban and developing areas, marinas, hydromodification projects, and wetlands and riparian areas.

  Section 6217 requires coastal states to submit their coastal nonpoint control programs to the National Oceanic and Atmospheric Administration (NOAA) and the U.S. EPA for approval by July 1995. The programs are to be implemented by January, 1999. Failure to submit an approvable program by July 1995 will result in a state losing substantial portions of its Federal funding under section 306 of the CZMA and section 319 of the Clean Water Act. The coastal nonpoint program will be developed and administered jointly by the NC Division of Coastal Management and DWQ.

Summary of Changes Since 1989

- The N.C. DWQ has developed programs for the administration of NPDES stormwater permits for industries and municipalities.
- The N.C. DWQ has developed and issued eighteen general permits to cover a variety of facilities that discharge stormwater associated with industrial activity.
- Water Supply Protection Legislation was passed in N.C. which has resulted in the development and implementation of statewide water supply watershed protection requirements. This program is described in detail in the previous section.
- The stormwater management rules governing coastal areas, High Quality Waters and Outstanding Resource Waters have been modified. These rules were finalized and effective on September 1, 1995. These programs are described in more detail in the previous section.
- Educational Efforts: The N.C. DWQ has instituted a number of educational efforts related to stormwater management across the state. These efforts have included:

\- Guidance Manuals:
1 *Stormwater Management Guidance Manual*
2 *Stormwater Management In North Carolina: A Guide For Local Officials*
\- Fact Sheets on Stormwater Management
1 *Stormwater Problems and Impacts*
2 *Stormwater Control Principles and Practices*
3 *Stormwater Management Roles and Regulations*
4 *Local Stormwater Program Elements and Funding Alternatives*
\- Statewide Stormwater Conference - (1994)

- Statewide Workshops on The Water Supply Protection Program (1994 & 95)
- Statewide Workshops on Stormwater Management (1995)

- **ORW and HQW Stream Classifications**
  Outstanding Resource Waters (ORW) and High Quality Waters (HQW) have management strategies that address handling of urban stormwater. Controls for urban stormwater, either through development density limitations or stormwater treatment systems, are required by DWQ. Other NPS management agencies are expected to place priority on protecting these waters as well. For example, the NC Department of Transportation and the NC Division of Land Resources require more stringent sediment control on construction sites in ORW and HQW areas.

- **CAMA Land Use Plans**
  The Coastal Area Management Act (CAMA), passed in 1974, requires the development of land use plans by each of the 20 coastal counties that fall within the coastal area. These plans must be consistent with state guidelines and address a wide range of issues, including resource protection and conservation, hazards mitigation, economic development and public participation. Land use plans must be updated every five years. 1995 revisions to the land use planning guidelines strengthened the connection between land use planning and surface water quality. Future land use plan updates must consider water quality use classifications, watershed planning and problems identified in basinwide plans. There are 91 jurisdictions that have prepared and adopted CAMA land use plans.

  A land use plan is a "blueprint" used by local leaders to help guide the decisions that affect their community. Through land use planning, local jurisdictions can influence how growth will affect surface water quality by adopting policies supported by local ordinances, promoting better sedimentation and erosion control standards, stream buffers and lower levels of impervious surface cover. Although land use plans are required only in the state's coastal area, these land use planning tools for the protection of water quality are available to any jurisdiction which chooses to implement them.

Construction - Sedimentation and Erosion Control Nonpoint Source Program

In 1973, the North Carolina General Assembly enacted the Sedimentation Pollution Control Act (SPCA). The Act authorized the establishment of a sediment control program to prevent accelerated erosion and off-site sedimentation caused by land-disturbing activities other than agriculture, forestry, and mining. The Land Quality Section of the Division of Land Resources is responsible for administration and enforcement of the requirements of the Act under the authority of the NC Sedimentation Control Commission.

The sediment control program requires, prior to construction, the submission and approval of erosion control plans on all projects disturbing one or more acres. On-site inspections are conducted to determine compliance with the plan and to evaluate the effectiveness of the BMPs which are used. The intent is to offer permanent downstream protection for stream banks and channels from damages caused by increased runoff velocities. If voluntary compliance with the approved plan is not achieved and violations occur, the Land Quality Section will pursue enforcement through civil penalties and injunctive relief. House Bill 448, passed in 1991, authorized the issuance of stop-work orders for violations of the SPCA. This additional enforcement mechanism will help improve the overall performance of the program.

Sedimentation control rules are more stringent for areas draining to waters supplementally classified as Trout or High Quality Waters.

Local programs are reviewed annually for compliance with the requirements of the Sedimentation Pollution Control Act. The Land Quality Section also conducts educational programs directed toward state and local government officials in order to strengthen the local programs. Persons engaged in land-disturbing activities and interested citizen groups are included in the educational effort.

The Sedimentation Control Commission has delegated to the Division of Highways of the North Carolina Department of Transportation (DOT) the authority to approve erosion and sedimentation control plans for land-disturbing activity conducted by that agency or by other persons under highway contracts with that agency. The DOT sedimentation control program has been reviewed by the Division of Land Resources under the authority of the Sedimentation Control Commission. DOT uses more stringent sedimentation controls in areas adjacent to High Quality Waters and Outstanding Resource Waters. The NC Department of Environment, Health, and Natural Resources (NCDEHNR) has established a position to evaluate environmental aspects of DOT highway projects and programs. DOT, in cooperation with DWQ, has developed and adopted formal BMPs for protection of surface waters. These BMPs and other efforts are significant improvements in developing a proactive system at DOT toward environmental issues.

On-Site Wastewater Disposal - Sanitary Sewage Systems Nonpoint Source Program

Septic tank soil absorption systems are the most widely used method of on-site domestic wastewater disposal in North Carolina. More than 52 percent of all housing units in the state are served by septic tank systems or other systems besides public or community sewage systems. A conventional septic system consists of a septic tank, a distribution box or equivalent branching lines, and a series of subsurface absorption lines consisting of tile or perforated pipes laid in a bed of gravel. All subsurface sanitary sewage systems are under the jurisdiction of the Commission for Health Services (CHS) of the Department of Environment, Health, and Natural Resources. The CHS establishes the rules for on-site sewage systems which are administered by the Division to Environmental Health. BMPs for onsite sewage systems are listed in Appendix VI.

According to GS 130A-335(e) and (f), the rules of the CHS and the rules of the local board of health shall address at least the following: sewage characteristics; design unit; design capacity; design volume; criteria for the design, installation, operation, maintenance, and performance of sanitary sewage collection, treatment, and disposal systems; soil morphology and drainage; topography and landscape position; depth to seasonally high water table, rock, and water impeding formations; proximity to water supply wells, shellfish waters, estuaries, marshes, wetlands, areas subject to frequent flooding, streams, lakes, swamps, and other bodies of surface or groundwaters; density of sanitary sewage collection, treatment, and disposal systems in a geographical area; requirements for issuance, suspension, and revocation of permits; and other factors which affect the effective operation in performance of sanitary sewage collection treatment and disposal systems.

The rules also must provide construction requirements, standards for operation, and ownership requirements for each classification of sanitary systems of sewage collection, treatment, and disposal in order to prevent, as far as reasonably possible, any contamination of the land, groundwater, and surface waters. There exists a strict permitting procedure which regulates site selection, system design, and installation of on-site sewage systems. Privately owned subsurface sewage discharging systems are governed by NCDEHNR through local county health departments. Authorized local sanitariums serve as agents of NCDEHNR and assist in implementing the state sewage rules. Local boards of health may adopt by reference the state rules and append to those rules more stringent laws and local criteria which they desire. These amendments, however, must be approved by the state. Only nine counties in the state currently operate under local rules. The 1983 amendments of the state public health laws eliminated the co-mingling of state rules with local rules except by state approval.

The Straight Pipe Elimination Amnesty Program was established in 1996 for the purpose of eliminating domestic sewage or wastewater discharges, from both straight pipes and overland flow of failing septic systems. The program contains three components: identification and elimination of domestic sewage discharges into streams currently or proposed to be used for public water supplies; an amnesty period to end on December 31, 1997 during which time violations of State rules and laws on domestic sewage and wastewater discharges identified as a result of this program will not result in legal consequences; and a public education effort on the program and the amnesty period.

Solid Waste Disposal NPS Programs

- **Federal Program**
  The major federal legislation in the area of solid waste management is the Resource Conservation and Recovery Act (RCRA) administered by the U.S. Environmental Protection Agency (EPA). RCRA deals almost entirely with hazardous waste management but it does require that states meet minimum standards for solid waste facilities. EPA does not have permitting authority over solid waste management facilities.

- **State Program**
  States are accorded a major role in solid waste management by RCRA. North Carolina now operates under revisions by the General Assembly to Chapter 130A of the General Statutes. The Division of Solid Waste Management (DSWM) in the Department of Environment Health and Natural Resources is authorized as the single state agency for the management of solid waste. DSWM is responsible for the development of the state's solid waste management plan, has permitting authority over all solid waste management facility siting and operation, inspects permitted facilities, provides technical assistance, investigates complaints, responds to emergencies, monitors ground water quality at facilities, promotes the state's recycling effort, and closes non-conforming sites.

  The Solid Waste Management Act of 1989 established the policies and goals of the state to recycle at least 25 percent of the total waste stream by January 1, 1993. This Act created a Solid Waste Management Trust Fund to promote waste reduction and fund research and demonstration projects to manage solid waste. In 1991, the Solid Waste Management Act of 1989 was amended to broaden the goal to reduce the solid waste stream by 40 percent through source reduction, reuse, recycling, and composting by June 30, 2001.

  The state adopted solid waste management rules, effective February 1, 1991, requiring liner, leachate collection, and final cover systems at all new landfills, lateral expansions of existing landfills, and at all active landfills by January 1, 1998. Septage rules and regulations also have been adopted and are administered through a permit program.

- **Local Program**
  Solid waste collection and disposal has long been a municipal function. The operation of solid waste collection and disposal facilities is among the enterprises which municipalities are expressly authorized by statute to operate (G.S. 160A-311 through 160A-321). Municipalities are also authorized to regulate the disposal of solid waste within their corporate limits. Such regulations may specify the location and type of receptacles to be used for collection (G.S. 160A-192).

  Outside municipal limits, counties are authorized to operate solid waste collection and disposal facilities either as a function of county government or through establishment of a special service district (G.S. 153A-292 and 301). Since 1970, county governments have increasingly accepted responsibility for solid waste disposal activities and most disposal facilities in the state are now operated by counties or with county financial assistance.

Forestry NPS Programs

- **Forest Practice Guidelines Related to Water Quality**
  In 1989 the Sedimentation Pollution Control Act (SPCA) was amended to limit the forestry exemption to those operations that adhere to forest practice guidelines. The forestry amendment to the SPCA required the Division of Forest Resources to develop performance standards known as the Forest Practices Guidelines Related to Water Quality.

  Guidelines consist of nine performance standards for activities such as maintaining streamside management zones and applying fertilizer and pesticide applications. These Guidelines are used to determine if a forestry operation will fall under the jurisdiction of the Division of Land Resources which enforces the SPCA. The Guidelines were developed in October 1989 and were put into effect on January 1, 1990. A Memorandum of Agreement was also signed between the Division of Forest Resources and the Division of Land Resources to coordinate their respective activities in the sedimentation control program. DLR has also signed an MOA with DWQ.

  Site-disturbing forestry activities are being inspected by local DFR personnel as part of a training, mitigation, and monitoring program. Site inspections are conducted when a problem or potential problem is suspected to exist. Sites not brought into compliance within a reasonable time schedule are referred by DFR to DLR or DWQ for appropriate enforcement action. Commonly used forestry BMPs are listed in Appendix VI.

- **National Forest Management Act (NFMA)**
  The National Forest Management Act was passed in 1976 and applies to all lands owned or administered by the National Forest System. The Act stipulates that land management plans be prepared which consider economic and environmental aspects of forest resources. The Act further states that timber will be harvested from National Forest lands only where soil, slope, or other watershed conditions will not be irreversibly damaged; and where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of watercourses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat.

- **Forest Stewardship Program**
  The Division of Forest Resources initiated the Forest Stewardship Program in 1991 along with the cooperation and support of several other natural resource and conservation agencies. This program encourages landowners with ten or more acres of forestland to become involved and committed to the wise development, protection and use of all natural forest resources they own or control.

Mining NPS Program

In 1971 the North Carolina General Assembly passed the Mining Act to ensure that the usefulness, productivity, and scenic values of all land and waters involved in mining will receive the greatest practical degree of protection and restoration. The Mining Commission is the rule-making body for the Act and has designated authority to administer and enforce the rules and regulations of the Act to the Mining Program within the Land Quality Section of the NCDEHNR Division of Land Resources.

The Mining program has four major areas of responsibility. First, the Program requires submission and approval of a mining permit application prior to initiating land disturbing activity if the mining operation is one (1) or more acres in surface area. The mining permit application must have a reclamation plan for these operations. Second, the Program conducts on-site inspections to determine compliance with the approved application and whether or not the plan is effective in protecting land and water quality. Third, the program pursues enforcement action through civil penalties, injunctive relief, and/or bond forfeiture to gain compliance when voluntary compliance is not achieved. Finally, the Mining Program conducts educational efforts for mine operators.

Wetlands Regulatory NPS Programs

There are numerous reasons for preserving wetlands, but of special interest within the context of basinwide planning is their role in protecting water quality. Because of their intrinsic characteristics and location within the landscape, wetlands function to protect water quality in a number of ways. These functions include the retention and removal of pollutants, stabilization of shorelines, and storage of flood waters.

Numerous authors have studied the effectiveness of riparian wetland forests for nutrient retention and transformation (Jones et al. 1976; Yates and Sheridan 1983; Brinson et al. 1984; Lowrance et al. 1984; Peterjohn and Correll 1984; Jacobs and Gilliam 1985; Budd et al. 1987; and Groffman et al. 1991). The location of riparian wetlands allows them the opportunity to receive nutrients from the surrounding landscape as well as through overbank flooding. In addition to the storage of nutrients in wetland vegetation, the microbial and chemical processes within wetland soils may function to completely remove nutrients from the system.

Headwater riparian wetlands are extremely important and effective in terms of sediment and associated nutrient and toxicant retention and transformation. Since small streams comprise most of the total stream length within a watershed (Leopold 1974), these areas intercept the greatest proportion of eroded sediments and associated substances from uplands before these pollutant reach waters downstream. Novitzki (1978) found that approximately 80% of the sediments entering a stream were retained in headwater wetlands.

Wetlands adjacent to streams, rivers and lakes stabilize shorelines and help protect these bodies of water from erosive forces. This function is particularly important in urbanized watersheds where the prevalence of impervious surfaces contributes to greater peak storm flows. Wetland vegetation serves to dissipate erosive forces and anchors the shoreline in place preventing sediments and associated pollutants from entering waterways. Wetlands by their very nature of being "wet" are also vital for water storage. Those wetlands adjacent to surface waters, that have the opportunity to receive flood waters and surface runoff, are most important to water storage. Wetlands located in headwaters generally minimize peak flood waters in tributaries and main channels. Lakes and wetlands with restricted outlets hold back flood waters and attenuate flood peaks (Carter et al. 1978).

Several important state and federal wetland protection programs are described below. In addition to the following wetlands programs, provisions of the 1985 and 1990 Farm Bills, discussed in Section 5.3.1, should also help reduce wetlands impacts. Agriculture conversions should be reduced by the "swampbuster" provision of the 1985 Farm Bill, which encourages farmers not to convert wetlands for agriculture to prevent the loss of their USDA subsidies, loans, and price supports. Silviculture is exempted from the swampbuster provision and therefore, conversion of wetlands for intensive or managed forestry is not affected by this provision. A Wetland Reserve Program was established by the 1990 Farm Bill with the goal of allowing one million acres of prior-converted wetlands to revert back to wetlands by 1995.

- **Section 10 of the Rivers and Harbors Act of 1899**
This act, administered by the US Army Corps of Engineers, provides the basis for regulating dredge and fill activities in navigable waters of the United States. Originally, this Act was administered to protect navigation and the navigation capacity of the nation's waters. In 1968, due to growing environmental concerns, the review of permit applications was changed to include factors other than navigation including fish and wildlife conservation, pollution, aesthetics, ecology, and general public interest. Activities which may be covered under the Act include dredging and filling, piers, dams, dikes, marinas, bulkheads, bank stabilization and others.

- **Section 404 of the Clean Water Act**
The U.S. Army Corps of Engineers administers a national regulatory program under Section 404 of the Clean Water Act aimed at controlling the discharge of dredged or fill material into waters of the United States. Section 404 applies to the discharge of dredged or fill materials into waters of the United States including dredging. Waters of the United States refers to navigable waters, their tributaries, and adjacent wetlands. Activities covered under Section 404 include dams, dikes, marinas, bulkheads, utility and power transmission lines and bank stabilization. Although the 404 program does not fully protect wetlands, it is nonetheless the only existing federal tool for regulating wetland development statewide. State legislation has not been adopted to protect inland freshwater wetlands in North Carolina, as has been done for coastal wetlands, but the EMC in March of 1996 adopted rules which will formalize the wetlands protection measures associated with the 401 Water Quality Certification review process.

- **Section 401 Water Quality Certification (from CWA)**
The Division of Water Quality is responsible for the issuance of 401 Water Quality Certifications. Section 401 of the federal Clean Water Act provides that no federal agency can issue any license or permit to conduct any activity that may result in a discharge to navigable waters unless the state in which the discharge may occur certifies that the discharge will not result in a violation of any state water quality or related standards. Thus, a 401 certification is required for, among other things, a discharge into surface waters or wetlands for projects that require a section 404 permit. A federal permit cannot be issued if a 401 certification is denied. Any conditions added to the 401 certification become conditions of the 404 permit. The 401 certification process is coordinated with the 404 and CAMA processes in the 20 counties of CAMA jurisdiction.

- **North Carolina Dredge and Fill Act (1969)**
This act requires permits for "excavation or filling begun in any estuarine waters, tidelands, marshlands, or state-owned lake". This law is currently administered with North Carolina's Coastal Area Management Act (CAMA) (1974).

- **Wetlands Restoration Program/Funds**
The Wetlands Restoration Program was established in 1996 as a nonregulatory program "...for the acquisition, maintenance, restoration, enhancement, and creation of wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, wildlife habitat, and recreational opportunities". The purposes of the program include: the restoration of wetlands function and values; to provide a consistent and simplified approach to mitigation requirements associated with permits or Corps of Engineers authorizations; to streamline the permitting process; to increase the ecological effectiveness of mitigation efforts; to achieve a net increase in wetlands acres, functions and values for each major river basin; to promote a comprehensive approach to environmental protection.

Through the Wetlands Restoration Program, basinwide plans for wetlands and riparian area restoration will be developed. The goals of the plans are to protect and enhance "...water quality, flood prevention, fisheries, wildlife habitat, and recreational opportunities..." These plans will be developed for each of the seventeen major river basins in the state beginning in July 1997. Compensatory mitigation (a required condition of section 404 permits issued by the U.S. Corps of Engineers) options will be addressed within the plans.

A Wetlands Restoration Fund has been established under the program. The Fund is a trust fund designed as a repository for monetary contributions and dedication of interest to real property under the compensatory mitigation options. These funds will primarily be used to restore, enhance, preserve or create wetlands and riparian areas in accordance with the basinwide plan.

Hydrologic Modification

Hydrologic modification is defined as channelization, dredging, dam construction, flow regulation and modification, bridge construction, removal of riparian vegetation, streambank modification/destabilization, and dam collapse. By its very nature hydrologic modification is closely tied to wetland issues. It is not surprising then that the U.S. Army Corps of Engineers (Corps) is the agency most involved in issuing permits for land-disturbing activities in wetlands. These permits are issued through Section 404 and the Rivers and Harbors Act discussed above.

In addition to wetland issues, dam construction and the lack of low flow releases into streams can severely impact downstream aquatic resources. Dam construction, repair, modification, and removal are regulated by the NC Division of Land Resources under the Dam Safety Law of 1967. A dam safety permit is required for any dam which is 15 feet or greater in height (from top of dam to lowest point on downstream toe) and the impoundment capacity is 10-acre-feet or greater at the top of the dam. Low-flow release requirements to maintain adequate instream flows are established in permits where appropriate. Instream flows are recommended by the NC Division of Water Resources.

There are several other programs which can affect hydrologic modification. The Forest Practice Guidelines Related to Water Quality requires streamside management zones to be maintained during logging operations. The Water Supply Watershed Protection Program also has requirements to maintain buffers for certain activities. The Conservation Reserve Program encourages the establishment of vegetative filter strips (66-99 feet wide) for farming operations. A significant number of local governments have established greenway programs within urban settings in order to maintain and protect riparian areas.

Water Supply Legislation in North Carolina

- **Water Supply Planning Law**
  The Water Supply Planning law (G.S. 143-355 (l) and (m)) was adopted in 1989 and amended in 1993. It requires all local governments that supply or plan to supply water to prepare a local water supply plan. In their plans, local governments are to include present and projected population, industrial development and water use within the service area, present and future water supplies, an estimate of technical assistance needs and other information that may be required by the Department. All local plans are to be approved and submitted to DWR by January 1, 1995. Information in those local plans is to be included in a State Water Supply Plan. The State Plan will also investigate the extent to which the various local plans are compatible.

- **Registration of Water Withdrawals and Transfers Law**
  The Registration of Water Withdrawals and Transfers law (G.S. 143-215.22H) requires any person who withdraws or transfers 1 MGD or more of surface water or groundwater to register the average daily and maximum daily withdrawal or transfer with the Environmental

Management Commission (EMC). The law also provides that if a local government has an approved local water supply plan on file with DWR, it does not have to register that withdrawal, thereby reducing duplication of effort by local governments that otherwise would be subject to both laws. In addition, the law includes a 5-year renewal requirement, which will ensure that the data is regularly updated.

- **Regulation of Surface Water Transfers Act**
  In 1993, the legislature adopted the Regulation of Surface Water Transfers Act (G.S. 143-215.22I et seq.). This law was designed to regulate large surface water transfers by requiring a certificate from the EMC and by repealing several other laws that had previously affected interbasin transfers. The law applies to anyone initiating a transfer of 2 MGD from one river basin to another and to anyone increasing an existing transfer by 25 percent or more if the total transfer is 2 MGD or more. Applicants for certificates must petition the EMC and include a description of the transfer facilities, the proposed water uses, water conservation measures to assure efficient use and any other information desired by the EMC. A certificate will be granted for the transfer if the Commission concludes that the overall benefits of the transfer outweigh its detriments. The Commission may grant the petition in whole or in part, or deny it, and it may require mitigation measures to minimize detrimental effects. The law also provides for a $10,000 civil penalty for violating various statutes.

- **Capacity Use Act**
  DWR administers the Capacity Use Act (G.S. 143-215.11 et seq.), which allows the EMC to establish a Capacity Use Area where it finds that the use of ground water, surface water or both requires coordination and limited regulation. If after an investigation and public hearings a Capacity Use Area is designated, the EMC may adopt regulations within the area, including issuance of permits for water users. In the near future, DWR plans to review the rules for implementation of the Capacity Use statute and develop a model of the aquifer system, in coordination with the Groundwater Section of DWQ, for Capacity Use Area 1, which was created to regulate surface water and ground water withdrawals in an area surrounding Texasgulf, Inc. in Aurora, N.C. A new ground water flow model will be used to simulate Capacity Use Area 1 as a basis for permitting withdrawals.

- **Dam Safety law**
  The Dam Safety law (G.S. 143-215.24) was amended in 1993, and rules are being developed for implementation of these amendments. Among the changes, the amendment defines "minimum stream flow" as a quantity and quality sufficient in the judgment of the Department of Environment, Health and Natural Resources (DEHNR) to meet and maintain stream classifications and water quality standards established by DEHNR and to maintain aquatic habitat in the affected stream length.

  The Dam Safety Law applies to dams that are 15 feet or more high or with impoundment capacity of 10 acre feet or more. The law requires that the EMC adopt rules specifying minimum stream flow in the length of the stream affected by a dam and sets specific parameters for minimum stream flow for dams operated by small power producers that divert water from 4,000 feet or less of a natural stream bed and return the water to the same stream.

Section 319 Nonpoint Source Management and Other Programs

- **Section 319**
  Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer

establishment, and others. North Carolina DWQ established a Workgroup process in 1995 for prioritizing and selecting projects from the pool of cost-share proposals for inclusion in its annual application to EPA. DWQ staff first reviews proposals for minimum 319 eligibility criteria such as:

- support state Program milestones;
- address targeted, high priority watersheds;
- provide sufficient cost-share match (40% of project costs);
- propose adequate time periods;
- identify measurable outputs;
- use compatible GIS products with those of the state; and
- make commitment for educational activities and a final report.

Workgroup members separately review and rank each proposal which meets the minimum 319 eligibility criteria. The Workgroup consists of representatives from the state and federal agencies that deal with NPS issues, including agricultural, silvicultural, on-site wastewater, mining, solid waste and resource protection. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; degree of balance lent to the state Program in terms of project type; and competence/reliability of contracting agency. They then convene to discuss individual projects' merits, to pool all rankings and to arrive at final rankings for the projects. All proposals that rank above the funding target are included in the annual grant application to EPA, with DWQ reserving the right to make final changes to the list. Actual funding depends on approval from EPA and yearly Congressional appropriations.

- **Use Restoration Waters**
  The North Carolina Division of Water Quality is currently developing the Use Restoration Waters (URW) program to restore surface waters to their designated uses. If adopted, this program will allow the state to work with local governments, businesses, and residents to develop management strategies appropriate for the area. In order to be effective, the URW program will include a mix of mandatory and voluntary programs. The voluntary and mandatory programs will be coordinated on a site-specific basis by DWQ and a group of stakeholders who have an interest in the impaired water body and associated watershed. In addition, the URW program will attempt to develop cooperative relationships among these agencies so that overlapping efforts can be consolidated and targeted to restore designated water body uses.

The URW Program will apply to polluted surface waters where the following conditions apply:

- Biological, physical and/or chemical data indicate the specific sources of pollution.
- A use attainment study indicates that the sources of pollution are not transitory.
- It is possible to control the sources of pollution by implementing appropriate management strategies under the existing authority of the North Carolina Environmental Management Commission (EMC), other state commissions, and local agencies or voluntary actions implemented by citizens and other groups.

Based on current water quality data, there are approximately 4,300 miles of freshwater streams (or about 1.4 percent of total miles) and about 40,000 saltwater acres (or about 2 percent of total saltwater acres) that would be potential candidates for URW consideration.

The restoration strategies developed under the URW Program will be site-specific to the watershed of the nonsupporting or impaired water body. DWQ and the stakeholders will coordinate each URW strategy with other agencies' programs to create a holistic approach to address the array of pollution problems in the watershed.

- **The Nonpoint Source (NPS) Team Process**

Successfully managing NPS pollution requires not only a knowledge of science and technology, but also an understanding of the local resources and economy. Although there are some general management guidelines, there is no single technique for controlling NPS pollution. The most efficient and effective NPS solutions will be site-specific. Formulating NPS solutions often requires cooperation between different interested parties. Each group that contributes to the NPS problem must be part of the solution.

DWQ will coordinate the Watauga NPS Team to include a wide variety of stakeholders interested in the basin. This team will take the lead in identifying NPS problems and implementing solutions. The NPS Team process is discussed below and in Chapter 7.

1. Coordinate the NPS Team.
DWQ's goal in forming the Watauga NPS Team is to choose predominantly locally-based members that represent the federal, local, and state agencies, local governments, industries, and citizens' groups that have interests and responsibilities pertaining to NPS pollution. DWQ will consult local groups to determine which interests should be represented on the team.

Once the NPS Team is formed, DWQ and the team will work as partners to identify, prioritize, and address the NPS problems in the basin. DWQ will offer information from the state's water quality monitoring program and its staffs' knowledge of technical and financial resources. The NPS Team will describe current NPS initiatives, identify priority NPS-impaired waterbodies, and analyze NPS issues and needs. One of the most important missions of the DWQ-NPS Team partnership is to foster coordination and cooperation between the basin's diverse interest groups and agencies. The eventual goal of the NPS Team is to create and implement Action Plans that will address priority *NPS-impaired waterbodies* and *NPS issues* as part of the basinwide planning process. The implementation schedule will be determined as the plans are developed.

2. Take inventory of the initiatives and programs in place to address NPS pollution.
Each member of the NPS Team will describe the existing initiatives and programs of the agency or group he/she represents. A list of these initiatives is included in the basinwide plan to show readers some of the potential resources for addressing their NPS problems (see Chapter 5). This effort will provide an opportunity for mutual education, understanding and coordination with other stakeholders. An important responsibility of the NPS Teams will be to assess whether existing initiatives and programs in the basin are successfully improving water quality.

3. Choosing the priority NPS-impaired waterbodies and NPS issues.
Since the NPS Team will not be able to address all of the *NPS-impaired waterbodies* and *NPS issues* in the basin, it will have to follow a system for prioritization. The NPS Team will use the following process to target NPS-impaired waterbodies and select NPS issues.

Selecting the Priority NPS-impaired Waterbodies

Within the guidelines described below, the NPS Team will select at least one NPS-impaired waterbody for which an Action Plan will be developed. More than one waterbody may be selected if time and resources allow. The goal of the Action Plan will be to restore the designated use of the selected waterbody using a comprehensive, site-specific, and coordinated approach. The Actions Plans will be a prime candidate for funding under the federal Section 319(h) program.

The NPS Team will use both primary and secondary criteria to select the *priority NPS-impaired waterbodies*. The primary criteria are (in order of importance):

- Highly-valued resource waters, such as High Quality Waters and Water Supplies I-IV, that have a demonstrated pollution problem.
- Monitored waters that have an overall use support rating of non-supporting.
- Monitored waters that have a use support rating of partially supporting but have a high predicted loading for one or more pollutants.
- Highly valued resource waters, such as High Quality Waters and Water Supplies I-IV, that are in need of protection.
- Monitored waters that have an overall use support rating of partially supporting.

DWQ will provide a list of waterbodies that meet the primary criteria to the NPS Team.

The secondary criteria for selecting the priority *NPS-impaired waterbodies* are:

- Waters that pose a potential threat to human health,
- Waters that are important for ecological reasons not reflected in their classification and use support ratings (such as endangered species, unique habitats, or significant biological resources),
- Waters that are highly eroded or have other evidence of serious erosion problems that are not reflected in the use support ratings,
- Waters that have experienced a recent, rapid decline in water quality, and
- Waters that have identifiable pollution sources and a high likelihood of successful restoration.

An NPS-impaired waterbody that meets the primary criteria as well as one or more of the secondary criteria listed above is a good candidate for prioritization by the NPS Team. However, the NPS Team may select a priority NPS-impaired waterbody that does not meet the primary criteria but meets *several* of the secondary criteria. This allows the team to select waters that DWQ did not monitor or waters for which the use support rating failed to describe the extent of the NPS problem.

Selecting the Priority NPS Issues

In order to address problems in the remaining NPS-impaired or threatened waterbodies (ones not prioritized for specific Action Plans), the follwing criteria will be used to target NPS issues throughout the basin:

- Issues that apply throughout a significant portion of the basin or address one or more impaired waters that were not selected as a *priority NPS-impaired waterbody,*
- Issues that have a clearly defined "problem" and "solution," and
- Issues that are within the team's ability to address through educational efforts, improved coordination between stakeholders, focused new initiatives, or involvement of additional stakeholders.

4. Determine what is needed to address the priority NPS-impaired waterbody and the NPS issues the team selects.

The NPS Team will decide which actions are likely to restore the priority NPS-impaired waterbodies and address the NPS issues. Some of the possible needs include:

- Public education. When water quality problems result from citizens' lack of knowledge about how their local actions affect water quality or from land use decisions, public education is a key component of the solution.

- Implementation of best management practices (BMPs). BMPs are structural or nonstructural management practices used to reduce nonpoint source inputs to receiving waterbodies in order to achieve water quality protection goals. Often higher levels of pollutant removal can be achieved by using a combination of different BMPs.
  * Structural BMPs generally work by capturing, retaining, and treating runoff before it leaves an area. Some examples of structural BMPs include constructed wetlands and wet detention ponds in urban settings and controlled drainage on agricultural lands. Structural BMPs require regular maintenance.
  * There are a variety of nonstructural BMPs. One nonstructural BMP is source reduction, which reduces the amount of pollutants that are introduced into the environment. Some types of source reduction are nutrient management plans for crop production and hazardous waste collection sites in urban areas. Another nonstructural BMP is maintaining natural drainageways to allow the vegetation and soil to cleanse runoff before it enters a waterbody.
- Ecosystem restoration and management. If a stream's ecosystem is badly damaged, removing pollutants alone will not always restore the water's uses. In cases like these, it will be necessary to restore the ecosystem through measures such as riparian revegetation and streambank stabilization.
- Local water quality planning. Development sites can be planned in order to reduce their risk of harming water quality. Some planning techniques include steering development towards less environmentally sensitive areas, using natural drainage systems rather than curb and gutter, and planning for development densities that allow for open space, greenways, and wildlife corridors.

5. Develop comprehensive Action Plans consisting of management strategies to address the priority NPS-impaired waterbody and the NPS issues.

The NPS Team members will work together to develop "Action Plans." These Action Plans will consist of a list of Action Items that form a coordinated, comprehensive effort to address each priority NPS-impaired waterbody and NPS issue. Each Action Item will include lead contacts, goals, and a schedule for completion and may utilize one or more of the following vehicles for implementation:

- Efforts by NPS Team members: The NPS Team members can make commitments to target their agency's/group's existing resources to address the priority NPS-impaired waterbody or NPS issues. Team members can also agree to share their expertise on a volunteer basis.
- Section 319: Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects that have been funded in the past include BMP demonstrations, watershed water quality improvement projects, data management, educational activities, modeling, stream restoration efforts, riparian buffer establishment, and others. Refer to Section 5.7 for a complete program description.
- Agriculture Cost Share Program: Provides a number of cost-share practices designed to solve soil, water, and related environmental problems in agricultural areas including forested buffer strips.
- Wetlands Restoration Program. A bill recently ratified by the NC General Assembly establishes a statewide Wetland Restoration Program that will provide a leadership role in targeting and consolidating all wetland and riparian area restoration initiatives in NC.
- Proposed Use Restoration Waters (URW) Program. DWQ is currently developing the URW program to restore surface waterbodies to their designated uses. If adopted, this program would allow the state to work with local governments, businesses, and residents to develop

focused management strategies appropriate for the area. Those affected by the URW program will be requested to meet well-defined milestones and goals for water quality improvement. If these milestones are not met on a voluntary basis within an established schedule, mandatory controls may be considered by the Environmental Management Commission.

- Federal Initiatives: There are a number of federal programs and resources that may be available to address the Priority NPS-impaired waterbody and NPS issues. These include US Fish and Wildlife Service funds, the USDA-NRCS Wetland Reserve Program, and the Environmental Quality Initiative Program (EQIP) provisions of the Farm Bill.
- Other Programs: There are numerous other programs sponsored by private and state agencies that could be initiated to address the NPS Team's priority waterbodies and issues. Some of these programs include corporate funding for educational programs, the Small Watershed Program, and US Fish and Wildlife Grants. A complete list of funding sources for NPS pollution is listed in Appendix VIII.

6. Implement Action Plans.
Implementation is the most important part of the state's NPS program since it is the only way to restore the priority NPS-impaired waterbody and address NPS issues. Most, if not all, members of the NPS Team will be involved with the implementation of one or more of the Action Items. During the implementation phase, the NPS Team will continue to meet on a regular basis. The purpose of these meetings will be for the team to update each other on their progress toward completing the Action Items and provide a forum for continuing the coordination between team members. When some of the team members experience setbacks in implementing an Action Item, the rest of the team can advise and/or provide additional help so that the item can be completed successfully.

7. Monitor to evaluate the effectiveness of management strategies.
The NPS Team will identify where additional water quality monitoring sites may be needed to document the effectiveness of its Action Plans. DWQ and the NPS Team will cooperate to assure that pre- and post-monitoring is in place before a new program, initiative or BMP is implemented. In order to supplement DWQ's monitoring programs, the team may seek the involvement of citizens' groups. Any agencies that receive 319 grants will be required to conduct pre- and post-evaluations as a part of their project.

8. Consider additional management strategies if the voluntary approaches do not result in an improvement in water quality.
If the NPS Team's management strategies do not show progress in improving water quality according to the designated schedule, DWQ and the team will work together to identify the reason for the lack of progress. Some of the potential courses of action are:

- Reevaluate the source of impairment.
- Increase and/or redirect voluntary measures.
- Consider additional measures.

APPENDIX VII

USDA Forest Service Transportation System Management Guidelines

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES	GENERAL DIRECTION	STANDARDS
Transportation System Management	1. Manage roads. trails and other travelways consistent with Management Area direction. Designate roads as open to motorized public use by: -Signing for specific uses; or -Surfacing with stone, shale, pavement or other hard surface material and not closing by gate, natural barricade, sign, or other visible closure method or device.	
	2. Manage closed forest development roads for a wide range of non-motorized uses. Minimize conflicting uses (example bicycle use vs. linear wildlife opening). Resolve conflicts using an ID team approach and coordinate with other federal, state, and county agencies and user groups.	a. Assure drainage structures will accommodate mowing with motorized equipment without resource damage when areas are converted to permanent wildlife openings.
	3. Identify temporary roads currently used as linear strip openings. Determine whether to incorporate them into the Forest Development Road system and continue to use them as wildlife opening if water quality standards can be met, or convert to permanent wildlife openings, or restore to forest conditions. Coordinate the decision about long term uses with the North Carolina Wildlife Resources Commission.	
	4. Allow non-motorized bicycle and horse travel on Forest development roads unless signed as closed to that use.	
	5. Limit opportunities outside of established ORV areas for primitive roads suitable for travel only be off-road	

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES		GENERAL DIRECTION		STANDARDS
Transportation System Management		vehicles. Inventory forest roads currently used by such vehicles. Determine whether to incorporate these roads into the Forest Development Road System (traffic service level D) as designated four-wheel drive ways open for public use or permanently close and restore to forest conditions. Include designated roads in calculations of open road densities specified for different management areas. Identify where existing road conditions do not meet water quality standards and develop strategies to bring them into compliance, except where physical conditions preclude complete correction and the road can not be legally closed. Schedule implementation consistent with funding availability. Newly constructed roads designed as four-wheel drive ways will comply with water quality standards. Four-wheel drive ways are exempted from the Highway Standards Act.		
Road Planning Construction and Maintenance	1.	Insure road stability and protection of the environment, except; existing four-wheel drive ways may not be in full compliance with water quality standards. Develop strategies to bring these roads into compliance unless physical conditions preclude complete correction and the road can not be legally closed. Schedule implementation consistent with funding.	a.	During transportation planning and road location, incorporate historic, geologic, physiographic, and soils information to locate potential problem areas and to select road locations least <u>likely to cause damage to National Forest Resources.</u>
			b.	Design broad-based dips and ditch outlets so that runoff water will infiltrate soils and erosion will be deposited before reaching stream channels.
			<u>c.</u>	<u>Design and construct access road and skid trail crossings of intermittent streams so as to: not obstruct or impede stream flow; provide crossings with effective structures or ground</u>

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES		GENERAL DIRECTION		STANDARDS
				<u>cover to protect the banks and channel from accelerated erosion. Provide crossings with sufficient water control devices to collect and divert surface flow from the access road or skid trail into undisturbed areas or other control structures to restrain accelerated erosion and prevent visible sediment from entering intermittent streams; and provide crossings with ground cover or other means sufficient to prevent visible sediment from entering intermittent streams within 10 working days of initial disturbance and maintain such cover or structures until the site is permanently stabilized. (NC PPGRWQ Regulations)</u>
Road Planning Construction and Maintenance (continued)	2.	Use Traffic Service Level C or higher construction standards where roads are open to public travel with conventional vehicles or where specialized needs exceed Traffic Service Level D capabilities (Traffic Service Levels are described in Appendix G). <u>In all cases, road grades will not exceed that which, through proper design and maintenance, can not prevent erosion and damage to resources adjacent to the roadbed.</u>	a.	Use the following standards for Traffic Service Level C roads: Design speed: 5-25 mph Width: 12-14 ft. with turnouts. Surface: Gravel as needed to support traffic. Max. sustained grade: <u>10%</u> Lanes: 1 Min. curve radius: 50 feet Drainage: Outslope or ditch. Max. pitch: <u>12%</u> for 200 feet.
	3.	Use Traffic Service Level D construction standards where this standard will accommodate the intended use. Except for existing designated four-wheel drive ways, road grades will not exceed that which, through proper design and maintenance, can not prevent erosion and		

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Table III-1. Forest-wide Direction. (continued)

ACTIVITIES	GENERAL DIRECTION	STANDARDS
Road Planning Construction and Maintenance (continued)	damage to resources adjacent to the roadbed. Develop strategies to correct resource damage adjacent to the roadbed on designated four-wheel driveways. Schedule implementation consistent with funding availability.	a. Use the following standards for Traffic Service Level D roads: Design speed: 5-10 mph Width: 12-14 feet Surface: Native or gravel as needed to support traffic. Max. sustained grade: 12% Lanes: 1 Min. curve radius: 50 feet Drainage: Outslope or ditch. Max. pitch: 14% for 200 feet.
		b. Use the following standards for Traffic Service Level D, four-wheel drive ways: Design speed: 2-10 mph Width: 6-10 feet Surface: Native rough, irregular, large rocks or boulders, mud, sand, loose materials, obstacles such as logs, some winching may be required. Max. sustained grade: 20-30% for 200-300 feet. Max pitch: 20-40% up to 100 feet Lanes: 1 Template: Existing
	4. Construct temporary roads only for non-recurrent use. Do not plan or permit purchasers to construct temporary roads in lieu of building specified roads needed for future recurrent management of the area.	a. Use the following standards for temporary roads: Width: 12-14 feet Surface: Native or spot surfacing. Max. sustained grade: 12% Lanes: 1 Drainage: Outslope or ditch.

Table III-1. Forest-wide Direction. (continued)

ACTIVITIES	GENERAL DIRECTION	STANDARDS
Road Planning Construction and Maintenance (continued)		Max. pitch 15% for 200 feet. Revegatation of Roadbed: Establish vegetative cover in first seeding season after road closure. b. For temporary stream crossings, minimize soil movement through the use of temporary bridges or fords.
	5. Approve temporary road and skid road locations prior to construction.	

APPENDIX VIII

Potential Sources of Funding for Projects to Address Point Sources

Appendix VIII
Potential Sources of Funding for Projects to Address Point Sources

Funding Program	Application	Contact
U.S. Rural Utilities Service: Water and Wastewater Loan and Grant Program	For rural areas and towns up to 10,000 in population who wish to construct, enlarge, extend, or otherwise improve water or waste disposal facilities providing essential service primarily to rural residents and businesses. Applicants must provide evidence that they cannot finance desired facilities at reasonable rates and terms.	Jeff Duval Jefferson, NC (910) 246-2885
Rural Business and Cooperative Service: Rural Business Enterprise Grants	For rural areas and towns up to 50,000 in population to facilitate and support the development of small and emerging private business enterprises. This includes the construction and development of water and sewer facilities. Grants must either create or save jobs.	One of the RECD Rural Development Managers listed under "Rural Utilities Service" serving the area where the project is located.
Appalachian Regional Commission: Supplements to Other Federal Grants in Aid	For public bodies and nonprofit groups located in wester North Carolina to assist in the improvement of water and sewer facilities which will facilitate the creation or retention of industrial and commercial jobs.	Sara Stuckey NC Department of Administration 116 West Jones Street Raleigh, NC 27603-8003 (919) 733-7232
U.S. Economic Development Administration: Public Works and Development Facilities Grant Program	For any public or nonprofit agency to assist communities with funding public works and development facilities that contribute to the creation or retention of primarily private sector jobs and alleviation of unemployment and underemployment.	Dale L. Jones Economic Development Representative P.O. Box 2522 Raleigh, NC 27601 (919) 856-4570
NC Division of Water Quality: Construction Grants and Loans Program	Provides grants and loans to local government agencies for the construction, upgrade, and expansion of wastewater collection and treatment systems.	Bobby Blowe Construction Grants/Loans Section Division of Water Quality P.O. Box 29579 Raleigh, NC 27626-0579 (919) 733-6900
NC Division of Community Assistance: Small Cities Community Development Block Grant	For municipalities and counties (except for 22 entitlement cities and Wake and Cumberland Counties, which receive money directly from U.S. Dept. of Housing and Urban Development) to develop viable communities by providing decent suitable living environments and to expand economic opportunities mainly for persons of low to moderate income. Funds may be used for public water/wastewater activities.	Liz Wolfe or Phyllis Denmark Division of Community Assistance P.O. Box 12600 Raleigh, NC 27605-2600 (919) 733-2850

Appendix VIII
Potential Sources of Funding for Projects to Address Point Sources, continued

Funding Program	Application	Contact
NC Commerce Finance Center: Industrial Development Fund	For counties and their local units of government (with the same exceptions as above) which access the fund on behalf of new or existing manufacturing firms to provide a financing incentive for jobs creation in the state's most economically distressed counties. Funds may be used for a wide variety of repair, renovation, and modification type projects including sewer infrastructure.	Charles Johnson Industrial Finance Specialist 301 N. Wilmington St. P.O. Box 29571 Raleigh, NC 27626-0571 (919) 715-6558
Rural Economic Development Center, Inc.: Supplemental and Capacity Grants Program	*Supplemental Grants* - Provide funds to match federal and other grants that support necessary economic development projects in economically distressed areas. *Capacity Grants* - Enable local governments to acquire short-term capacity for the planning and writing of federal grants that address immediate economic needs.	Johnnie Southerland Senior Associate Wastewater Grants Rural Economic Development Ctr. 1200 St. Mary's Street Raleigh, NC 27605 (919) 715-2725

APPENDIX IX

Potential Sources Of Funding For Projects To Address Nonpoint Sources

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
NC Agriculture Cost Share Program for NPS Pollution Control (NCACSP)	**Agriculture:** Provides up to 75% cost-share, as well as technical assistance, for practices that protect water quality in agricultural areas.	Donna Moffit NC Division of Soil and Water Conservation (919) 715-6107
Environmental Quality Incentives Program (EQIP)	**Agriculture:** Establishes conservation priority areas -- agricultural lands with significant water, soil, and related natural resource problems. Provides 5 to 10 year contracts to pay up to 75% of the cost of conservation practices such as manure management systems, IPM, and erosion control. USDA also provides technical assistance.	Tim Jones USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Conservation Reserve Program (CRP)	**Agriculture:** Payments to farmers who voluntarily take highly erodible land out of production for at least ten years. Annual rental payments along with 50% cost-share for establishment of permanent cover (grass, trees).	Tim Jones USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Emergency Conservation Program	**Agriculture:** Provides technical assistance and direct cost-share payments for agricultural producers who, without federal assistance, cannot rehabilitate their private farm land after a natural disaster. Payments are limited to 64% of the first $62,400, 40% of the second $62,400, and 20% of the cost above $125,000.	Tim Jones USDA - Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-2867
Farm Debt Cancellation-Conservation Easement Program	**Agriculture:** Farm Service Agency credit borrowers who have loans secured by real estate and have qualifying land may be given debt cancellation on outstanding loan balances in exchange for conservation easements. The cancellation may not exceed 33% of the principal for current borrowers, or the fair market value of the easement for delinquent borrowers.	Mickey Cochran USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-3057

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Interest Assistance Program	**Agriculture:** Provides guaranteed loans to, among other things, enhance and protect land and water resources -- including pollution abatement and control. Eligible recipients include farm owners/operators who are unable to obtain financing at reasonable rates or rates that allow them to maintain a positive cash flow.	Mickey Cochran USDA, Farm Service Agency 4407 Bland Road Suite 175 Raleigh, NC 27609 (919) 790-3057
Wetland Reserve Program (WRP)	**Agriculture:** Allows farmers to sell permanent wetland easements to USDA. Also cost-share to restore altered wetlands to natural condition. Eligible land includes prior converted cropland, farmed wetlands, riparian areas along streams or water courses that link protected wetlands.	USDA - Natural Resources Conservation Service Contact your local conservationist.
Small Watershed Program, PL-566	**Agriculture:** Technical and financial assistance for projects protecting and developing small watersheds. Historic emphasis on flood control, program now requires off-site water quality benefits.	Carroll Pierce NC Division of Soil and Water Conservation (919) 715-6110
GTE Foundation	**Education:** Supports projects improving math and science for underrepresented groups.	GTE Foundation GTE Corporate Communications One Stamford Forum Stamford, CT 06904 (203) 965-3620
Toyota TAPESTRY Grants	**Education:** Supports innovative science education by teachers in environmental education and physical science.	Eric Crossley National Science Teachers Assoc. Toyota Tapestry 1840 Wilson Blvd. Arlington, VA 22201-3000 (703) 312-9258
Toshiba America Foundation	**Education:** Supports secondary school science and math education.	John Sumansky Toshiba America Foundation 1251 Avenue of the Americas Suite 4100 New York, NY 10020 (212) 596-0600
Digital Equipment Corporation	**Education:** Supports science and math education through school-based and community-linked organizations.	Programs Manager Corporate Contributions Programs Digital Equipment Corp. 110 Powder Mill Rd. MSO 1/L14 Maynard, MA 01754-1418 (508) 493-6550

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
National Environmental Education and Training Foundation (NEETF)	**Education:** Provides funds for environmental education projects that foster informed decision-making, target adults and adolescents in informal educational settings, and address environmental issues affecting health. Require at least a 50% cash match provided by a non-federal source other than the award recipient.	NEETF 915 Fifteenth St. NW Suite 200 Washington, D.C. 20005 (202) 628-8200
National Research Initiative Competitive Grants Program	**Research:** Supports research on key problems of national and regional importance in biological, environmental, physical, and social science relevant to agriculture, food, and the environment, including assessment and protection of water resources. Scientists at public and private agencies and universities are eligible.	USDA - CSREES National Research Initiative Competitive Grants Program Room 323, Aerospace Center AG Box 2241 Washington, DC 20250-22441 (202) 401-5022 (Request for proposals published annually in the *Federal Register*.)
Environmental Contaminants - Identification and Assessment	**Research:** Provides short and medium duration studies/investigations of contaminant exposure and effect to individuals and organizations with a need for such information. Applicants must provide matching funds or in-kind services	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520
Environmental Contaminants - Prevention	**Research:** Provides technical and engineering support to prevent contaminant problems. No direct financial assistance is provided.	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520
Environmental Geochemistry and Biogeochemistry Research Program	**Research:** Supports interdisciplinary research on how chemical and biological processes in nature alter water quality. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Division of Earth Sciences Director, Environmental Chemistry and Geochemistry Program 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1554
Hydrologic Science Research Program	**Research:** Supports research in hydrologic science on the quality of waters in streams and aquifers. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Division of Earth Sciences Director, Hydrologic Sciences Program 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1549

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Water and Watersheds Research Program	Research: A joint NSF/EPA special awards program to support interdiciplinary teams joining the physical, biological, and socioeconomic sciences and engineering in research on water quality issues. A minimum 1% cost-share is required. Eligible recipients are scientists, engineers, and educators at universities and other not-for-profit institutions.	National Science Foundation Directorate for Biological Sciences Executive Officer 4201 Wilson Blvd. Arlington, VA 22230 (703) 306-1400
Flood Plain Management Services	Water Quality Planning: Provides invormation and data on floods and actions to reduce flood damage to local governments.	U.S. Army Corps of Engineers, Planning Division Directorate of Civil Works, Chief Flood Plain Management Services 20 Massachusetts Ave., NW Washington, D.C. 20314-1000 (202) 761-0169
Resource Conservation and Development Program	Water Quality Planning: Provides funds and technical assistance to local governments and nonprofits to plan, develop, and implement programs for resource conservation and community sustainability.	Stan Steury RC&D Executive Director Blue Ridge RC&D Council, Inc. P.O. Box 2 Boone, NC 28607 (704) 265-4005
River Basin Surveys and Investigations	Water Quality Planning: Provides planning assistance to local agencies to develop coordinated water and relanted land resource programs, with priority given to solving upstream flooding of rural communityies, improving water quality from agricultural nonpoint sources, abd wetland preservation, etc.	USDA, Natural Resources Conservation Service Director, Watersheds and Wetlands Division P.O. Box 2890 Washington, D.C. 20013 (202) 720-3534
Soil and Water Conservation Program	Water Quality Planning: Provides technical assistance to local governments for resource planning and management to improve water quality and reduce pollution.	USDA, Natural Resources Conservation Service Contact your local conservationist
Watershed Protection and Flood Preventions (Small Watershed Program)	Water Quality Planning: Provides monitoring, loans, cost-share, and technical assitance for the installation of land treatment measures. Provides up to 100% of the cost of structural flood prevention measures. Eligible agencies include local government, nonprofits, and SWCDs.	USDA, Natural Resources Conservation Service Contact your local conservationist.

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
Rivers, Trails, and Conservation Assistance Program	**Water Quality Planning:** Provides technical assistance for assessing resources, identifying land protection strategies, and developing organizations to address environmental concerns.	Mary Rountree Great Smokey Mountains Nat. Park 107 Park Headquarters Gatlinburg, TN 37738-4102 (423) 436-1246
Section 205(j) Water Quality Planning Grants	**Water Quality Planning:** Provides funds for planning activities such as developing plans for meeting and maintaining local water quality standards, implementing such plans, and determining the nature, extent, and causes of water quality problems.	Alan Clark Division of Water Quality Planning Branch P.O. 29535 Raleigh, NC 27607 (919) 733-5083 ext. 570
NC Division of Water Resources Stream Repair Funding	**Stream Restoration:** Provides cost-share funds and technical assistance in stream restoration projects to local governments.	Jeff Bruton Division of Water Resources P.O. Box 27687 Raleigh, NC 27611-7687 (919) 733-4064
Forestry Stewardship Incentive Program	**Forestry:** Up to 75% cost-share (max $10,000/person-yr) to enhance management of nonindustrial private forest lands to increase timber supply and improve fish and wildlife habitat and recreation.	Larry Such NC Division of Forest Resources P.O. Box 29581 Raleigh, NC 27626 (919) 733-2162 ext. 241
Forestry Incentives Program	**Forestry:** Up to 65% funding for tree planting and stand improvement to increase supplies from nonindustrial private forest lands.	Larry Such NC Division of Forest Resources P.O. Box 29581 Raleigh, NC 27626 (919) 733-2162 ext. 241
Rural Abandoned Mine Program	**Reclamation:** Direct payments of up to 100% in cost-share funds for conservation practices determined to be needed for reclamation, conservation, and development of up to 320 acres per owner of rural abandoned coal mine land or lands and waters affected by coal mining.	USDA, Natural Resources Conservation Service Contact your local conservationist.
Environmental Contaminants -- Natural Resource Damage Assessment	**Reclamation:** Provides funding for the assessment of damage to water quality and Trust resources from oil spills and/or other hazardous substance releases for individuals or organizations interested in the restoration of fish and wildlife, including aquatic habitat and water quality.	Tom Ausperger US Fish and Wildlife Service P.O. Box 33726 Raleigh, NC 27636-3627 (919) 856-4520

Appendix IX
Potential Sources of Funding for Projects to Address Nonpoint Sources

Funding Program	Application	Contact
NC Conservation Tax Credit Program	**Land Conservation:** Allows credit against individual and corporate income taxes when real property is donated for conservation purposes. Interests in property that promote fish, wildlife, etc. conservation purposes may be donated to a qualified recipient for a substantial tax credit (currently 25% of the value of the gift up to $25,000).	Bill Flournoy NC DEHNR (919) 715-4191

APPENDICE X

Section 303(d) of the Clean Water Act

APPENDIX X

List of 303(d) Waters in the Little Tennessee River Basin

What is the 303(d) list?

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses. Waters may be excluded from the list if existing control strategies for point and nonpoint source pollution will achieve the standards or uses. Waterbodies which are listed must be prioritized, and a management strategy or total maximum daily load (TMDL) must subsequently be developed for all listed waters.

303(d) List Development

The 305(b) report was used as a basis for developing the 303(d) list. Section 305(b) of the CWA requires states to report biennially to the U.S. Environmental Protection Agency (EPA) on the quality of waters in their state. In general, the report describes the quality of the state's surface waters, groundwaters, and wetlands, and existing programs to protect water quality. Information on use support, likely causes (e.g., sediment, nutrients, etc.) and sources (point sources, agriculture, etc.) of impairment are also presented in the report.

Many types of information were used to make use support assessments and to determine causes and sources of use support impairment. Chemical, physical, and biological data were the primary sources of information used to make use support assessments. North Carolina has an extensive ambient and biological monitoring network throughout the state. Benthic macroinvertebrate data which indicate taxa richness of pollution intolerant groups are an important data source. North Carolina also collects fish tissue and fish community structure data and phytoplankton bloom data that are used in the assessments. In addition, fish consumption advisories, information from other agencies, workshops, and reports, predictive modeling results, toxicity data, and self monitoring data is considered when making final use support determinations. Data from all readily available sources are used when the Division's standard operating procedures are followed when collecting and analyzing data. In the Little Tennessee River Basin, the Tennessee Valley Authority (TVA) has collected data. Their data collection and analysis methods differ from DWQ's, and therefore their data were not used to determine final use support. However, the results of their sampling are summarized in Section 4.2.6. DWQ will use their data to help determine future sampling sites. For example, if TVA data show impairment, DWQ will try to monitor that waterbody to see if our data also indicate impairment. DWQ will also work with TVA to choose reference sites that both agencies believe have high quality. These sites will then be sampled to determine if similar results are obtained from each agency. Overlap sampling may also occur at other sites throughout the basin.

The list also includes probable problem parameters. Where the list has no problem parameter listed, the use support rating was based on biological data, and available chemical data showed no impairment. It should be noted that where a problem parameter has been identified, the water quality standard for that parameter was exceeded. This parameter is a potential cause of the impairment, but there may be other unidentified causes contributing to the impairment as well.

Only those waterbodies whose use support rating were not supporting (NS) or partially supporting (PS) in the 305(b) report were considered as candidates for the 303(d) list. Of those waterbodies that showed impairment (PS or NS rating) only those waterbodies that had a use support rating based on monitoring data collected in the last five years were included on the 303(d) list. Since many changes can occur within a watershed in a five year period, conclusive information about a waterbody's use support cannot be made with older data. However, North Carolina will be collecting information on as many of these evaluated waterbodies as staffing and time permit for subsequent updates of the basin plan and 303(d) list. As more conclusive information on streams rated using older data or best professional judgment is obtained, evaluated waterbodies will be added to the list if the data indicate impairment. Finally, those waterbodies which were rated as NS or PS were then examined to determine if there were management strategies in place. If so, the streams were eliminated from the list. Management strategies that were considered included the following:

1. Miscellaneous nonpoint programs - Any waterbodies where DWQ was aware of nonpoint management studies (e.g. 319 or similar program) were eliminated if nonpoint sources were the only problem.

2. Point sources - All waters where point sources were the only problem were eliminated if the facility was under SOC, under schedule for removal, recently upgraded, or some other strategy was in place.

One waterbody, Whiteoak Creek, was dropped from the Little Tennessee River Basin 303(d) list because a trout farm believed to be the source of impairment has implemented best management practices. Mill Creek was included on the list even though the Town of Highlands has developed local water quality protection ordinances since these ordinances address new development, and existing development may contribute to the impairment.

Changes in the Little Tennessee River Basin's 303(d) list from earlier lists are based on updated chemical and biological monitoring results. If updated information indicated no impairment, a previously listed waterbody was removed. This is why the Little Tennessee River, Savannah Creek, and Scott Creek were removed from the list. If previously supporting waterbodies had new data that indicated impairment, these waterbodies were added to the list. In addition, if no new data were collected on a given waterbody, and all available data were greater than 5 years old, the waterbody was excluded from the list. The remaining streams that were listed on the previous 303(d) list for the Little Tennessee River Basin were included on the old list due to information collected at a workshop in Asheville in the 1980s. No new monitoring data were collected on these waterbodies, but evaluation criteria indicate they may be fully supporting their uses. If future data indicate impairment, the streams will be added to the list.

This listing process resulted in two waterbodies on the Little Tennessee River Basin 303(d) list, and they are shown on Table A - X.1. Any stream included on the list must be prioritized for management strategy or total maximum daily load (TMDL) development. In part, the prioritization must be based on the degree of impairment and the uses of the waterbodies. Both waterbodies are rated as partially supporting; thus they have fairly equivalent degrees of impairment. Both have identical stream classifications, and therefore similar uses. Therefore both waterbodies were given an equivalent priority of medium. No waterbodies were given a high priority due to higher priority waters in need of management in other areas of the state.

In addition, monitored streams that are fully supporting their uses but may be threatened were examined, but none of these waters were added to the list at this time.

Additional Guidance on Using the 303(d) List

The column headings in the 303(d) list refer to the following:

Class - The information in this column indicates the classification assigned to the particular waterbody. Stream classifications are based on the existing and anticipated best usage of the stream as determined through studies and information obtained at public hearings. The stream classifications are described in 15A NCAC 2B .0300, and a copy of the pertinent pages of these regulations is attached in Appendix II. (Note: The abbreviation Tr refers to trout water).

Wtrbdy - This is the North Carolina subbasin in which the waterbody is located. The NRCS 14 digit hydrologic units nest within the DWQ subbasins.

Problem Parameter - These are the causes of impairment as identified in the 305(b) report. No streams had an identified problem parameter in the Little Tennessee River Basin as the ratings were based on benthic data, and available chemical data showed no impairment.

Rating - This column lists the overall use support rating. These values may be NS (not supporting), PS (partially supporting), and ST (supporting but threatened). The 305(b) report describes these use support ratings further.

Major (P,NP) - This column indicates whether point (P) or nonpoint (NP) sources are the major sources of impairment.

Subcategory - This column breaks the point and nonpoint sources down further. A summary of the subcategory codes is provided in the attachment at the end of this appendix.

Priority - This column indicates the priority the waterbody is given for TMDL development.

Table A - X.1 303(d) LIST FOR THE LITTLE TENNESSEE RIVER BASIN

Name of Stream	Description	Class	Wtrbdy	Problem Paremeter	Overall Rating	Major Sources (P,NP)	Subcategory	Priority
Cullasaja River	Source to Macon Co SR 1545	WS-III Tr	40401		NS	NP,P	90, 08	Med
Mill Creek	From source to Mirror Lake	WS-III Tr	40401		PS			Med

APPENDICE XI

List of NPDES Wastewater Dischargers by Subbasin

SUBBASIN: 40401

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
1	Bates Ready Mixed Concrete Company NC0047775	Little Tennessee River (Macon)	35°01'52"	83°22'55"	Y
2	Cullasaja School NC0067326	Cullasaga River (Macon)	35°09'40"	83°18'53"	
3	Macon County Middle School NC0067300	Cullasaga River (Macon)	35°09'51"	83°21'37"	
4	Franklin Mineral Products Company NC0027243	Little Tennessee River (Macon)	35°10'48"	83°22'13"	
5	Evans / Kirkland Sand Dredge NCG520024	Little Tennessee River (Macon)	35°10'30"	83°22'14"	
6	Franklin WWTP NC0021547	Little Tennessee River (Macon)	35°12'03"	83°23'05"	
6	Harold Clark SFR (Lake Emory Sand Dredge) NCG520039	Little Tennessee River (Macon)	35°12'11"	83°23'03"	
7	Blue Bell, Inc. NC0000418	Cartoogechaye Creek (Macon)	35°09'30"	83°23'27"	Y
8	Franklin Plaza Shopping Center NC0039616	Cartoogechaye Creek (Macon)	35°09'31"	83°23'31"	Y
9	Anthony J. Fiorillo Residence NCG550299	Little Tennessee River (Macon)	35°12'30"	83°22'45"	
9	Rodney W. Goehman Residence NCG550300	Little Tennessee River (Macon)	35°12'30"	83°22'45"	
10	Pinaud Gem Mine NCG520016	Mason Branch (Macon)	35°14'43"	83°23'28"	
11	Richard E. Bradley Sand Dredge NC0077402	Little Tennessee River (Macon)	35°03'07"	83°22'28"	Y
12	James Jacobs Residence NCG550392	Middle Creek (Macon)	35°03'11"	83°21'52"	
13	Joseph A. Palmisano Development NC0073946	Little Tennessee River (Macon)	35°04'32"	83°23'01"	Y

SUBBASIN: 40401

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
14	Raven Watch Development NC0064807	Tessentee Creek (Macon)	35°04'36"	83°20'06"	Y
15	Bert Raby Sand Dredge NC0075442	Little Tennessee River (Macon)	35°02'35"	83°23'06"	Y
16	Pinnacle Point Homeowners Association, Inc. NC0072401	Lake Sequoyah (Macon)	35°03'33"	83°13'17"	Y
16	On the Verandah, Inc. NC0061221	Lake Sequoyah (Macon)	35°03'49"	83°13'12"	
17	Highlands WTP NC0032778	Big Creek (Macon)	35°04'11"	83°13'03"	
18	Highlands WWTP NC0021407	Cullasaja River (Macon)	35°04'03"	83°13'31"	
19	Highlands Assembly of God NCG550000	Mill Creek (Macon)	35°03'04"	83°11'38"	
20	Skyline Lodge & Village NC0036692	Big Creek (Macon)	35°04'27"	83°12'56"	
21	Highlands Mountain Club NC0037991	UT Cullasaja River (Macon)	35°02'48"	83°13'37"	
22	S. B. Association, Inc. NC0058262	Lake Sequoyah (Macon)	35°03'13"	83°13'20"	
23	LBJ Civilian Conservation Center NC0020524	Wayah Creek (Macon)	35°09'54"	83°30'28"	
24	Bert Raby (Sand Dredging) NC0048259	Little Tennessee River (Macon)	35°06'47"	83°22'42"	Y
25	Caler Creek Ruby Mine NC0028266	Caler Fork Creek (Macon)	35°16'06"	83°22'35"	Y
26	Gibson Ruby Mine NC0006998	Caler Fork Creek (Macon)	35°16'08"	83°22'01"	Y
27.	Holbrook Ruby Mine NC0065536	Caler Fork Creek (Macon)	35°16'12"	83°21'42"	Y

SUBBASIN: 40401

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
27	Jones Ruby Mine NCG520018	Caler Fork Creek (Macon)	35°16'18"	83°21'38"	
28	Shuler Ruby Mine NCG520019	Caler Fork Creek (Macon)	35°16'22"	83°21'29"	
28	Shuler Ruby Mine NC0065412	Caler Fork Creek (Macon)	35°16'22"	83°21'29"	
29	Cherokee Ruby Mine NCG520017	Caler Fork Creek (Macon)	35°16'22"	83°21'02"	
30	Gregory Ruby Mine NC0006963	Caler Fork Creek (Macon)	35°16'25"	83°20'45"	Y
31	Paul Gerisch Irish Imports NC0076953	Coweeta Creek (Macon)	35°04'58"	83°23'01"	Y
32	Sherwood Forest Division NC0068934	Cullasaja River (Macon)	35°04'10"	83°11'17"	Y
32	Highlands-Cashiers Animal Clinic NCG550658	UT Cullasaja River (Macon)	35°04'11"	83°11'18"	
33	Tom Earley Residence NCG550518	Coweeta Creek (Macon)	35°04'15"	83°23'41"	
33	Frank Fargo Residence NCG550364	Coweeta Creek (Macon)	35°04'29"	83°23'40"	
34	Highlands Falls Country Club NC0059552	UT Cullasaja River (Macon)	35°04'47"	83°11'20"	
35	David L. Kussow Property NC0061476	Coweeta Creek (Macon)	35°03'50"	83°25'01"	Y
36	Highlands Falls Country Club NC0051381	Saltrock Branch (Macon)	35°03'53"	83°10'44"	
37	Schnaak Lodge & Restaurant NC0061166	UT Middle Creek (Macon)	35°00'00"	83°19'40"	Y
38	Mann Brothers NC0069078	Little Tennessee River (Macon)	35°05'36"	83°22'57"	

SUBBASIN: 40401

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
38	Walter L. Propst Property NC0073261	Little Tennessee River (Macon)	35°05'37"	83°22'58"	
39	Barbara Service Residence NCG550482	Skeenah Creek (Macon)	35°06'39"	83°24'16"	
39	Russell Hart Residence NC0064033	Skeenah Creek (Macon)	35°06'39"	83°24'16"	Y
40	John Glattli Property NC0070441	UT Cullasaja River (Macon)	35°04'29"	83°11'23"	Y
41	Laurel Hills Townhouses NC0060844	UT Little Tennessee River (Macon)	35°07'45"	83°22'23"	
42	Willow Brook Park NC0070394	Coweeta Creek (Macon)	35°05'04"	83°23'12"	
43	Holly Springs Golf Village NC0058386	Cat Creek (Macon)	35°12'01	83°20'29"	Y
44	Wendel Nixon Residence NCG550170	Buck Creek (Macon)	35°07'30"	83°15'28"	
45	Sky Valley Resort / Alpine Lodge NC0060682	UT Mud Creek (Macon)	34°59'59"	83°20'10"	
46	Lonnie Barnes Residence NCG550389	Little Buck Creek (Macon)	35°08'22"	83°13'57"	
47	Gerald A. Wolfe Residence NCG550396	Little Buck Creek (Macon)	35°08'46"	83°13'19"	
48	Doris Moyer Residence NC0064114	Nickajack Creek (Macon)	35°07'40"	83°19'20"	Y
49	Harold Clark Sand Dredge NC0079413	Little Tennessee River (Macon)	35°04'52"	83°22'57"	Y
50	I.A. Tingloff Residence NC0061361	UT Cullasaja River (Macon)	35°05'04"	83°08'55"	Y
50	John Six Residence NC0063339	UT Cullasaja River (Macon)	35°05'05"	83°09'03"	Y

SUBBASIN: 40401

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
50	Wildcat Cliffs Country Club NC0075612	UT Ravenel Lake (Macon)	35°05'05"	83°09'17"	
51	Bertlyn Enterprises, Inc. NC0062871	Commissioner Creek (Macon)	34°59'59"	83°23'00"	Y
52	J. Edward Gay Residence NCG550444	Buck Creek (Macon)	35°07'44"	83°16'45"	
52	Arthur E. Gamache Residence NCG550162	Buck Creek (Macon)	35°07'43"	83°16'40"	
53	Bert Raby Sand Dredge NCG520031	Little Tennessee River (Macon)	35°03'39"	83°23'09"	

SUBBASIN: 40402

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
1	Peppertree Fontana Village WWTP NC0023086 - 001	Little Tennessee River (Graham)	35°26'48"	83°49'04"	
2	Peppertree Fontana Village WWTP NC0023086 - 002	UT Gold Branch (Graham)	35°26'30"	83°47'55"	
3	TVA / Fontana Hydro Plant NCG500187	Little Tennessee River (Graham)	35°27'05"	83°48'16"	
4	Fontana Village WTP NC0051349	Little Tennessee River (Graham)	35°26'36"	83°48'35"	
5	Bryson City WWTP NC0026557	Tuckasegee River (Swain)	35°25'21"	83°27'49"	
6	Yogi in the Smokies NC0036382 - 001	Raven Fork Creek (Swain)	35°32'55"	83°15'47"	Y
6	Yogi in the Smokies NC0036382 - 002	Raven Fork Creek (Swain)	35°32'58"	83°16'00"	Y
7	Swain County Jail & Sheriff's Department NCG500261	Tuckasegee River (Swain)	35°25'43"	83°26'45"	
8	Cherokee WWTP NC0052469	Oconaluftee River (Swain)	35°28'02"	83°21'10"	
9	Deep Creek Campground NC0025119	Deep Creek (Swain)	35°27'30"	83°26'17"	Y
10	US Dept of Interior/Smokemont Campground NC0025101	Oconaluftee River (Swain)	35°32'57"	83°18'32"	
11	Jay Vee Apartments NC0032379	Tuckasegee River (Jackson)	35°19'35"	83°10'30"	
12	Nantahala Village NC0037737	UT Nantahala River Arm of Fontana Lake (Swain)	35°21'17"	83°33'30"	
13	Neighbors Drive In NC0040631	Tuckasegee River (Swain)	35°24'58"	83°25'55"	Y
14	Glen Lake Development Corporation NC0071510	Thorpe Lake, West Fork Tuckasegee River (Jackson)	35°09'47"	83°08'27"	

SUBBASIN : 40402

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
14	Old Glenville School Bed & Breakfast, Inc NC0075981	Glenville Lake (Jackson)	35°10'05"	83°08'10"	Y
15	Lewis Ellsworth Residence NCG550351	Dicks Creek (Jackson)	35°23'41"	83°15'45"	
15	Louis Racy Residence NC0065315	Dicks Creek (Jackson)	35°23'53"	83°15'45"	
16	Whittier Elementary School NC0034291	Tuckasegee River (Swain)	35°26'12"	83°21'29"	Y
17	Drexel Heritage Furnishings, Inc NC0000264	Tuckasegee River (Jackson)	35°25'41"	83°21'24"	
18	Golden Eagle Motel NC0034720	Shoal Creek (Jackson)	35°27'32"	83°18'48"	Y
19	KOA Kamping Resort NC0029921	Raven Fork Creek (Swain)	35°31'45"	83°16'55"	Y
20	Blue Ridge School NC0066958	Hurricane Creek (Jackson)	35°07'40"	83°07'20"	
21	Singing Waters Camping Resort NC0038687	Trout Creek (Jackson)	35°13'07"	83°07'30"	
22	Woody's Trout Farm NC0074357	Cooper Creek (Swain)	35°29'33"	83°22'15"	
23	Sylva WWTP NC0020214	Scotts Creek (Jackson)	35°22'26"	83°14'30"	
24	Jackson County Sanitary District WWTP NC0039578	Tuckasegee River (Jackson)	35°20'59"	83°14'22"	
25	Dillsboro WWTP NC0025747	Tuckasegee River (Jackson)	35°22'01"	83°15'16"	
26	Ensley Rest Home NC0032808	Blanton Branch (Jackson)	35°23'32"	83°09'54"	
27	Scotts Creek Elementary School NC0066940	Scott Creek (Jackson)	35°24'07"	83°09'56"	

SUBBASIN : 40402

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
28	Sylva WTP NC0032638	UT Fisher Creek (Jackson)	35°24'25"	83°11'54"	
29	Lewis Oil Company, Inc. NCG080056	Scott Creek (Jackson)	35°23'11"	83°12'35"	
30	Western Carolina University Water Plant NC0074624	Tucksegee River (Jackson)	35°18'55"	83°10'38"	
31	Tapoco, Inc / Cheoah Powerhouse NCG500049	Little Tennessee River (Graham)	35°26'54"	83°56'19"	
31	Tapoco, Inc / Lodge & Village WWTP NC0023281	Little Tennessee River (Graham)	35°27'00"	83°56'36"	
32	Mr. Warner Bradley / Pioneer MHP NC0079154	Barkers Creek (Jackson)	35°22'58"	83°17'50"	
33	Carolina Investment Group NC0059200	UT Thorpe Lake (Jackson)	35°08'47"	83°07'59"	
34	Nantahala Outdoor Center NC0057193	Nantahala River (Swain)	35°20'02"	83°35'30"	
35	Tapoco, Inc / Santeetlah Powerhouse NCG500050	Little Tennessee River (Graham)	35°26'52"	83°51'52"	
36	Rough Butt Trout Farm NCG530086	Rough Butt Creek (Jackson)	35°19'31"	83°02'21"	
37	Eastern Band of Cherokee Ind/Rough Br WWTP NC0048089	Rough Branch (Jackson)	35°29'41"	83°10'24"	
38	Hideaway Campground NC0061620	Tuckasegee River (Swain)	35°27'09"	83°23'55"	
39	William Arnold Price Residence NCG550375	West Fork Dicks Creek (Jackson)	35°25'37"	83°15'14"	
40	Seico Carolina Corporation NC0066214	Buff Creek (Jackson)	35°25'29"	83°09'41"	Y
41	Cullowhee Valley Baptist Church NCG550374	Tilley Creek (Jackson)	35°16'56"	83°11'20"	

SUBBASIN : 40402

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
42	Cashiers Mountain Utilities, Inc. NC0065820	Raven Fork of Trout Creek (Jackson)	35°12'13"	83°07'01"	Y
43	Jackson Paper Manufacturing Company NC0065293	Scotts Creek (Jackson)	35°22'33"	83°12'56"	
44	Church of God Assembly Grounds NC0073563	Crooked Creek (Jackson)	35°25'22"	83°20'15"	
45	Milton J. Barber Residence NCG550575	Tucksegee River (Jackson)	35°22'44"	83°16'48"	
45	Jimmie Moore Trailer Park NC0073865	Tucksegee River (Jackson)	35°23'09"	83°16'32"	Y
46	Whiteside Estates, Inc. NC0075736	Grassy Camp Creek (Jackson)	35°06'47"	83°09'13"	
47	Gateway Chevron, Inc. NC0074250	Camp Creek (Jackson)	35°25'15"	83°19'59"	
48	Highlands Towne & Golf Club NC0074802	Shortoff Creek (Jackson)	35°07'00"	83°09'36"	Y
49	Tellico Trout Farm NCG530071	Tellico Creek (Macon)	35°16'35"	83°31'27"	

SUBBASIN : 40403

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
1	Nantahala School NC0067318	Partridge Creek (Macon)	35°15'10"	83°38'06"	
2	Royal M. Rowland Residence NC0068136	Lee Branch (Macon)	35°12'08"	83°38'02"	Y
3	Whiteoak Trout Farm NCG530062	Whiteoak Creek (Macon)	35°13'17"	83°36'52"	
4	Cold Springs Trout Farm NCG530072	Whiteoak Creek (Macon)	35°13'37"	83°37'10"	

SUBBASIN: 40404

Map	Facility NPDES #	Receiving Stream County	Latitude	Longitude	CD
1	Robbinsville WWTP NC0025879	Cheoah River (Graham)	35°19'43"	83°48'40"	
2	Hemac, Inc. NCG530076	Little Snowbird Creek (Graham)	35°13'32"	83°57'50"	
3	Bear Creek Junction NC0055581	Bear Creek (Graham)	35°16'20"	83°43'23"	
4	Coldwater Trout Farm, Inc. NCG530077	Snowbird Creek (Graham)	35°18'57"	83°51'50"	
5	Riverbend Trout Farm NC0078719	West Buffalo Creek (Graham)	35°17'43"	83°55'33"	
5	Glennwood Trout Farm NC0078638	West Buffalo Creek (Graham)	35°17'43"	83°55'28"	
6	Hemlock Trout Farm NC0081035	West Buffalo Creek (Graham)	35°18'07"	83°54'50"	
7	Veach-Wilson Oil Company NCG080055	Tulula Creek (Graham)	35°18'48"	83°47'40"	

APPENDICE XII

Little Tennessee River Basin Workshop Comments

Issues of Interest as Expressed by River Basin Workshop Attendees for the Little Tennessee River Basin
July 25, 1995

- Sedimentation
- Cooperation between states [Georgia in particular]
- Protecting existing uses
- Shoreline development
- Communication and Education
- Excellent cooperation between various groups
- Population growth impacts (over-all)
- Protecting critical habitats - biodiversity
- Aesthetics
- Land use planning
- Cooperation and appropriate incentives for farmers
- Recreational uses
- Highway construction
- Forestry - clearcutting - silt fences - roadway (driveway) - management - replacement
- Sharing of water resources (private v. public recreation)
- Data information sharing
- Science and planning integration
- Floodplain management
- Urban runoff and development
- Wetland definition and property rights
- Powerline location
- Improvement of greenways through town
- Industry water use
- Sand dredging
- Wastewater, sewage, industrial effluent
- Livestock access
- Enforcement of existing regulations
- Ability of municipalities to operate State-approved wastewater treatment plants per NPDES permits

<u>Solutions and Actions Suggested by Workshop Attendees</u>

- Alternative sewage treatment
- Finish Highway 441
- Don't start NC 28 N
- Implement land use planning
- Education activities: erosion control (including homeowner practices) , cooperation between groups, water quality conditions, water supplies, and biodiversity
- Enlist local leadership
- Compensation to farmers, developers, etc.
- Relating economic value of waterbodies to environmental values
- Better communication
- Sustain family farm
- Mechanism to document problems
- Publicizing good examples : Environmental Stewardship Award
- Development of Conservation Trust for easements
- Tax the rafters - they have an interest as much as the land owners- needs to remain local
- Governor's Year of the Mountain Program

Little Tennessee Workshop
Bryson City, NC
April 9, 1996

PRIORITY ISSUES

-Development
-Consistent Monitoring/Data
-Protect existing uses
-Water Supply
-Tax base
-Short vs. long-range planning
-Use Conleys Cr. as model
-Individual responsibility
-Streambank Buffers

RECOMMENDED ACTIONS

-Local responsibility
-Education of Citizens
    -High Schools
    -4-HR's
    -Colleges
-Educate Small Contractors
-River Clean up
-Agriculture Cost-Share
-Citizen Monitoring
-Community Voices

9 April, 1996

Little Tennessee River Basin Meeting (Cherokee)

Alan Clark
Darlene Kucken
Farrell Keough
Greg Jennings
refer to list of other attendees

Opening:

Clark : Basin Talk - refer hand-out materials

Kucken : Little Tennessee Talk - refer hand-out materials

Jennings : Facilitator

Problems

- Sedimentation : buffers and streambank stabilization (no cost-share available)
- Agriculture not only cause of sedimentation - % numbers need to reflect this better, (maybe a more specific breakdown of activities)
- How will implementation of Basin Plan take place? will local authorities be responsible, (i.e. beyond the permitting of point sources)
- wants a distinction made between natural and manmade problems, (spoken of in terms of organic v. non-organic)
- lacrosse encephalitis - mosquito carrying disease which ha been documented in this area and has affected children
- need local governments to adopt more stringent development controls - State will provide help to local gov'ts that want help in developing local ordinances
- strictly pine reforestation will have problematic long-term effects - need mixed types v. these people are planting trees for economic reasons
- 1985 Farm Act called for buffers as part of BMP's which seems to have had good effects
- virtually all participants had problems with agri being the number one cause - strongly felt that urban and construction was the dominant problem
- 'user fee' for salaries of local ordinance administrators - possible idea, need mechanisms to get moneys for enforcement and help with these
- 0200's regulations will put many dairy farmers out-of-business and these lands will switch over to development
- science over emotion
- Education : buffers, where does water go?, pesticides, fertilizers, farmers want to do the right thing if they knew how and what and that it would inevitably save them money...
- monitoring to better understand sources of pollutants
- historical perspective of regulations needs to be kept in perspective - at one time farmers were told to practice various farming activities which are now known to be environmentally problematic
- fencing and buffering along stream banks for animal control(Soil & Water Conservation District help and land owner buys seed and fence in agri cost-share program)
- Property Rights v Public Good "Don't make criminals out of private citizens..."
- person up here makes money off waste from trout farm - sells it as fish food
- establish cost-efficient and extensive monitoring system to prevent expensive remediation of problems in future
- acid rain (are streams monitored during rain events)
- trash, tires, appliances, etc in waters - any before and after studies and what are effects?

*Note: nonpoint source meeting taking place in Bryson City while this meeting was going on...