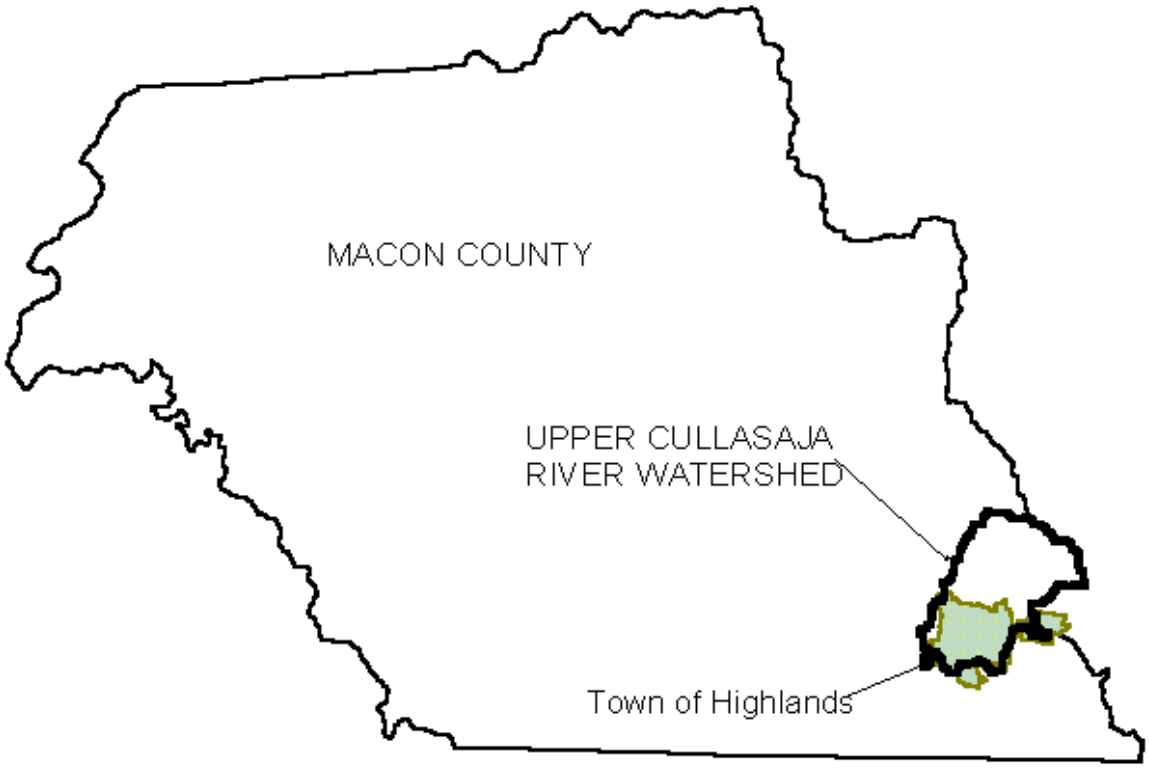
Upper Cullasaja River Watershed Strategy and Action Plan



Upper Cullasaja Watershed Association

Final 2004

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Executive Summary

As part of a Regional Geographic Initiative grant from the U. S. Environmental Protection Agency (EPA), the Upper Cullasaja Watershed Association (UCWA) of Highlands, NC, has been contacting citizens, businesses, and organizations to determine the stakeholder concerns and issues in the watershed and to define possible solutions. The result is this watershed strategy and action plan.

The upper Cullasaja River watershed is a headwaters watershed in the Blue Ridge Mountains of western North Carolina. The watershed is part of the Little Tennessee River Basin and is located in Macon County. The 14.4 square mile watershed crowns a high elevation area defined by the Tennessee Valley Divide on three sides. This area is identified as the "Highlands Plateau", an area with unique climate, ecosystems, geology, and geography that sets it apart from other areas in the Southern Appalachians. The watershed has highly erodable soils, and sand is a dominant substrate in many streams on the plateau. The steep slopes common throughout the watershed exacerbate the erosive characteristics of the local soils.

The watershed is approximately 50% forested or undeveloped and 50% residential, commercial or industrial. Much of the land adjacent to the Cullasaja River and it tributaries has been cleared of riparian vegetation by development in the watershed. The watershed continues to experience rapid growth and development due to increasing popularity as a retirement and vacation community. Only 13% of the watershed is in the National Forest. The majority of the acreage in the watershed is privately owned, and 40% of the watershed is located within the town limits of Highlands, NC.

The watershed begins at the headwaters of four main streams – the Cullasaja River, Mill Creek, Big Creek and Monger Creek - and ends at the dam on Lake Sequoyah. The Cullasaja River and Mill Creek are included on the North Carolina 303(d) List of impaired streams. Although small in total acreage, the watershed has different issues on several of the stream basins, making it difficult to generalize the watershed conditions and solutions to problems. To deal with this factor, the ***Upper Cullasaja River Watershed Strategy and Action Plan*** divides the watershed into four subbasins based on the four main tributaries and their drainage areas.

Subbasin Name	**Drainage Area**	**Stream Miles**
Upper Cullasaja River	5.4 sq. miles	10.3
Mill Creek	1.7 sq. miles	3.0
Monger Creek	2.0 sq. miles	3.7
Big Creek	5.3 sq. miles	10.0
Total	**14.4 sq. miles**	**27.0**

Although all of the streams in the upper Cullasaja River watershed are classified as "Trout Waters" by the state, there are few supporting populations of native trout in the watershed today.

The Town of Highlands uses Big Creek as a drinking water source. The remainder of the watershed is served by groundwater sources supporting private and community well systems.

A recent water quality assessment by the NC Department of Environment and Natural Resources (DENR) Division of Water Quality (DWQ) focused on benthic studies and the biological health of macroinvertebrate populations in the two impaired streams, Cullasaja River and Mill Creek. While this study and its recommendations are viewed as important inputs to the stakeholders, it is clear that other issues of vital importance to the stakeholders were not completely addressed by this report. Examples of other stakeholder issues include preventative sediment trapping and remediation of watershed lakes damaged by legacy sediments accumulation.

A comprehensive watershed strategy for the upper Cullasaja River watershed takes into account the unique environment and topography of this mountain headwaters watershed which makes it both an attractive location for retirees and seasonal residents and a place worth our efforts to preserve for future generations. This watershed strategy defines the local water quality issues and priorities established by UCWA and other watershed stakeholders.

The goals of this strategy and action plan are:

- Improvement of water quality in all impacted streams and lakes in the watershed
- Removal of the Cullasaja River and Mill Creek from the 303(d) list of impaired streams
- Protection of the streams where the water quality is still excellent
- Restoration of the historical boating, fishing, and recreational uses of our public lakes
- Restoration of the trout fisheries

Potential water quality improvements will be addressed with waterfront property owners to seek cost-sharing commitments for project definition and implementation at specific sites. Measurement and monitoring systems will be established and maintained. Specific sites for bank-side habitat restoration, improved riparian buffers, in-stream structure and riffle-pool frequency, stormwater velocity control and diffusion, stormwater pretreatment to remove runoff pollutants, and elimination of deteriorated and leaking sewer lines will be investigated. With the property owner's agreement, feasible sites will be selected and recommended for project implementation.

Stakeholders have defined the priorities of watershed issues to be:

- Prevention of Erosion and Sedimentation Pollution
- Remediation of Area Lakes to restore their historical uses
- Management of Stormwater Runoff and Nonpoint Source Pollution
- Development of Improved Nutrients Management Practices
- Restoration of Stream and Streamside Habitat
- Detection and Elimination of Sewer System Leaks and Infiltrations
- Detection and Elimination of Chemical and Hydrocarbon Pollution Sources

The strategies for resolving these issues include new and expanded biological and chemical monitoring systems, development of more effective Best Management Practices (BMPs) for mountainside slopes and small streams, innovative regulations and incentives for water quality improvements, and measurable criteria for project improvement.

The steps required to implement the watershed strategy are organized in the plan into general (i.e., pertaining to the entire watershed) and sub-basin specific initiatives. Public education and awareness of water quality concerns, improved practices, habitat restoration and preservation are key elements of the strategy and the recommended solutions.

The database that supports the recommended initiatives is summarized in Appendix A. Local and State water quality initiatives and organizations active in the watershed are described in Appendix B. Building on past projects and relationships, these groups are positioned to continue their efforts towards protecting and restoring the environment in the watershed. A steering committee comprised of representatives from these local, state and federal organizations will assist UCWA in locating, developing and monitoring the projects that are selected for implementation. Major achieveable initiatives that are proposed are listed in the table in Appendix C.

As this strategy and action plan was being finalized, UCWA received funding administered by the NC DENR Division of Water Quality from the Section 104 (b) grant to support stakeholder development through 2004 to define specific projects in the watershed. During the remainder of 2003 and all of 2004, UCWA will promote water quality through public education initiatives and direct interface with stakeholder groups and individual property owners. UCWA's stakeholder involvement process will survey specific properties and stream locations to determine feasibility and property owner interest in implementing specific water quality projects. Recognized agency, industry, and university expertise will be brought in to assist in project definition in accordance with EPA's 9-Points of a Watershed Plan. Federal and State grants, matching funds, and property owner cost sharing will be pursued for implementation of the water quality improvement projects to which the property owners have agreed.

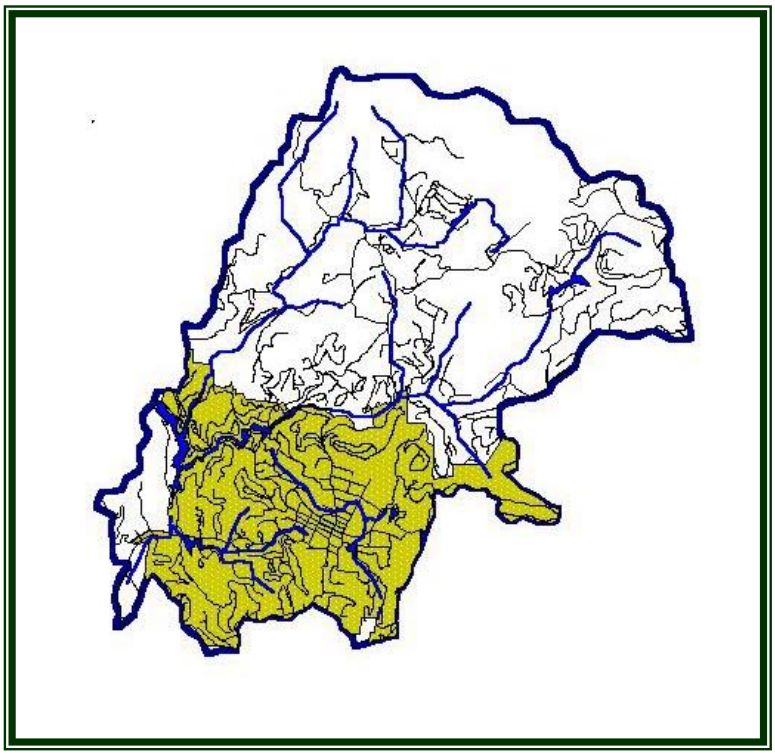
This document defines UCWA's strategy and five-year action plan for improvement of water quality throughout the upper Cullasaja River watershed.

1.0 Introduction to the Upper Cullasaja River Watershed

The upper Cullasaja River watershed is a headwaters watershed in the Blue Ridge Mountains of western North Carolina. Stream habitats here were once natural trout streams having high-gradient flows over natural gravel streambeds through old growth hardwood forests. Aquatic biological diversity was significant and numerous rare or unique species were naturally occurring in this watershed. The streams, rivers and lakes in the upper Cullasaja River watershed are highly valued environmental amenities, from the aesthetics of numerous waterfalls to the popularity of trout fishing and recreational uses.

The watershed of the upper Cullasaja River has experienced degradation of the streams in the watershed from forestry clear-cutting, road construction and urban development since the early 1900's. This area (Figure 1) is continuing to experience development of forested land and steep slopes for use as seasonal and permanent residences. Approximately fifty per cent of the watershed has been converted to residential homes, commercial buildings and golf courses. Water quality problems associated with growth and development are evident in the streams in the upper Cullasaja River watershed. Two of the watershed streams, the Cullasaja River and Mill Creek, have been on the state's 303 (d) List of Impaired Waterbodies since the early 1990's.

Figure 1. Upper Cullasaja River Watershed Basin



In addition to current landscape changes and uses, historic practices such as draining and filling wetlands, straightening or ditching (channelizing) streams, constructing lakes and ponds, and clearing streamside vegetation further compromise the integrity of these natural systems. These practices exacerbate the effects of growth and development on stream health.

In late 2002, EPA Region IV awarded Upper Cullasaja Watershed Association a Regional Geographic Initiative grant to work with local stakeholders to develop a plan for addressing water quality problems in the upper Cullasaja River watershed. This document represents the culmination of efforts undertaken by UCWA and community partners to evaluate the principal sources and causes of water quality degradation and recommend a comprehensive set of strategies for addressing these problems.

2.0 Watershed Characterization

2.1 Hydrology

The upper Cullasaja River Watershed in the Little Tennessee River Basin is located in Macon County and contains the Town of Highlands and surrounding lands. The 14.4 square mile watershed is located on the Highlands Plateau in western North Carolina, a high elevation area contained by the Blue Ridge Mountains on all sides. Bounded to the southwest, south and east by the Tennessee Valley Divide, water flows generally east to west from elevations near 5,000 feet to 3,600 feet at the dam on the Cullasaja River forming Lake Sequoyah. The drainage for this watershed is shown on Figure 2.

The watershed begins at the headwaters of four main streams – the Cullasaja River, Mill Creek, Big Creek and Monger Creek – and ends at the dam on Lake Sequoyah. The USGS hydrologic Unit for this area is No. 06010202 and the NC DWQ Subbasin Code is 04-04-01. The streams flow through the Town of Highlands and then north-northwest to the Little Tennessee River confluence in Franklin, NC. Because of the location of the upper Cullasaja River, 65% of all streams on the plateau are first-order, or headwaters. All streams, except the Cullasaja River, begin and end in the watershed by flowing into the Cullasaja River.

Low flow estimates from US Geological Survey for this area predict a 7Q10 (7 days lowest flow average in 10 years) of 2.2 cubic feet per second (cfs) for the upper Cullasaja River at US 64 with approximately 3.9 sq. mile (mi^2) drainage and 2.9 cfs at Lake Sequoyah (5.4 mi^2). The 7Q10 flow for Mill Creek is approximately 0.8 cfs at Brookside Lane (1.5 mi^2) and 0.9 cfs at confluence with Cullasaja River (1.7 mi^2). The flow on Big Creek is 2.8 cfs (5.3 mi^2) at US 64 and the Monger Creek flow is estimated at 1.1 cfs (2.0 mi^2) at confluence with Cullasaja River in Lake Sequoyah (includes Monger Creek arm). These estimates give a comparison of the different sizes of the main tributaries in the watershed. These estimates are more accurate for size comparisons than width of streams which are showing impacts from development stresses. There have been numerous lakes and ponds built in the watershed over the years, for both private and public uses, which impact the amount of flow in the streams.

2.2 Geography

The Highlands, North Carolina area is a location known to tourists and to seasonal residents as a beautiful mountain community, with clean flowing streams, abundant wildlife, gorgeous scenery, and a quality of life second to none. The Forest Service has identified this area as "Highlands Upland", an area with unique climate, geology, and geography that sets it apart from other areas in the Southern Appalachians. The area includes prominent granite/gneiss rock outcrops, high elevation 'domed' landscapes perched above steep escarpments and very high rainfall. It is classified as the only temperate deciduous rainforest in the continental United States outside of the Pacific Northwest. The forest consists of oak-hickory and oak-heath complexes (heath included rhododendrons, mountain laurel and galax). The rich understory of herbs and shrubs includes an abundance of rare plant species. Valuable ecological habitats in the area include Southern Appalachian bogs, spray cliffs, old-growth forest patches, seeps and Carolina Hemlock bluffs. The elevation of the Highlands Upland ranges from 3600 feet at Lake Sequoyah to 5000

feet on Shortoff and Whiteside Mountains. Nearly one-third of the plateau has a slope of 30-50%, with some areas exceeding 60% slope. Another 40% of the plateau is graded between 15-30% (CAP Report, 2001).

2.3 Meteorology/Weather

The area is often characterized as a high elevation rain forest, and heavy rainfall is a signature characteristic of the area. The rainfall averages 81.9 inches/year, with a range of 58.37 to 116.30 inches/year recorded during the period 1931-2002. The National Weather Service 30-year average rainfall for the period 1970-1999 is 88.5 inches. The average rainfall per month is 4"-6", but 8"-10" is common and over 16" was experienced in October 2002, with most of the amount due to one rain event. The streams in the watershed have had to accommodate everything from flooding to multiple years of drought.

Drought has periodically lowered water levels in streams, as well as in drinking water wells and reservoirs, causing concern to area residents. A four-year rainfall decline has been documented for the watershed area beginning in July 1999. Until recently, the State of North Carolina's Drought Monitoring Council has classified the western mountains region to be in a moderate to severe drought. The rainfall at Highlands has been 92%, 68%, 68% and 73% of the annual average for the years 1999-2002 respectively.

2.4 Soils

The Highlands Plateau is underlain by gneiss bedrock covered with schist. The prominent granite/gneiss rock outcrops distinguish the Highlands area. These outcrops are examples of granite plutons, which intruded through the crust between 390-460 million years ago (USDA Forest Service, 1995). Granite/gneiss consequently makes up 60% of the primary bedrock composition, with greywacke-shist-amphibolite making up 20% and graywacke-shist another 19%.

The main soils in the Highlands area include Cullasaja-Tuckasegee Complex (stony, 15%-90%, most at 15-30% slopes); Edneyville-Chestnut Complex (stony, most at 15%-50% slope); Fannin Fine Sandy Loam (most at 15-50% slope); Chandler Gravelly Fine Sandy Loam (most at 15-50% slope) (USDA, 1996). The remaining soil types include fine sandy loams, high percent slopes, stony or bouldery and windswept. These soils in the watershed are typically well drained and susceptible to erosion. This creates additional management needs for erosion control during construction of buildings or land clearings. Sand has been noted as a dominant substrate in many of the streams on the plateau (NCDENR, 2002).

Disturbance of the natural vegetative cover during construction leads to high rates of erosion and sedimentation unless control measures (Best Management Practices or BMPs) are installed on site prior to the initiation of construction activities. The steep slopes common in the watershed exacerbate the erosive characteristics of the local soils.

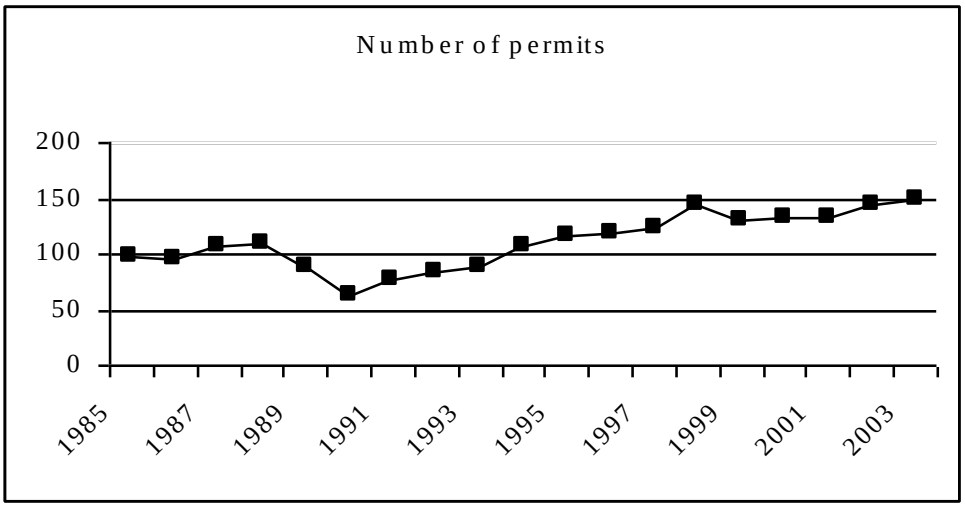
2.5 Land Use

Much of the Highlands Plateau was logged in the 1870s and then divided into parcels for family farms or became National Forest. The Town of Highlands was incorporated in 1879 as a resort town. The town promoted the area as a destination for part-time residents seeking their health or pleasure in its restorative climate, rather than a passing attraction for day travelers. The limitation on growth in the area initially was lack of adequate roadways. In the 1920s, many roads were built and subsequent economic growth occurred. Several dams on streams in the watershed, including two Ravenel Lakes and Lake Sequoyah were built by 1925. Hydroelectric power was first supplied to the plateau in 1927 from the Lake Sequoyah dam. Highlands Country Club was sited on Lake Sequoyah and Monger Creek in 1928, the first golf course community in the area and the beginning of widespread popularity for Highlands as a summer retreat. Much of the upper Cullasaja River watershed was cleared for proposed development in 1940's. A large parcel (2-3,000 acres) was clear-cut by Champion Lumber in what is now the Cullasaja Club and Wildcat Cliffs Country Club area. In 1960s, Wildcat Cliffs Country Club was constructed upstream of Ravenel Lake (associated with Cullasaja Club). The lake itself was drained and a new dam built in this same time period. Highlands Falls Country Club golf course and residential community began construction in 1978. The rest of the land between Highlands Falls Country Club and Wildcat Cliffs Country Club was sold in 1987 and became the Cullasaja Club golf course community. Numerous impoundments were built on the streams in the watershed during this period, both for golf course and for residential and recreational uses.

Land use patterns can have a profound effect on water quality and stream hydrology. Based on information from Macon County and the Town of Highlands, the watershed is approximately 50% forested or undeveloped and 50% residential, commercial or industrial. 40% of the watershed is located within the town limits.

The commercial uses are clustered in the downtown area and along US 64 road corridor. No agricultural uses are found in the watershed. The watershed is experiencing rapid growth and development due to increasing popularity as a retirement and vacation community. Growth in the area has continued through the present as shown by increasing number of building permits annually for the Highland area (Figure 3). A 2002-2003 land use planning effort in Highlands revealed approximately 800 undeveloped land parcels of varying size remain in the town limits. The Town of Highlands found this to be 70% of the parcels within the town boundary have been developed, with only 30% left undeveloped (Betz, Highlands GIS).

Figure 2. Number of Building Permits For New Construction Issued by the Town of Highlands, 1985-2002 with 2003 Estimated.



More than half of the watershed of the Cullasaja River upstream of Mirror Lake is in three golf course communities, with combined golf course and residential uses. The golf courses are predominantly in the river valleys, and many home sites and roads are located on the steep ridges, which are largely wooded. Much of the Cullasaja River and it tributaries have been cleared of riparian vegetation by these uses. Most of the golf course residential parcels have been sold and construction is complete on 70-90% of the area. Subdividing of existing lots is occurring but to a smaller degree because of limitations under current environmental health, planning and zoning regulations.

Mill Creek's watershed is residential above and below the town center and heavily urbanized within the town center. A fourth golf course community is located in the Monger Creek watershed. Big Creek watershed is the least developed of the four stream areas.

Although the town provides water to all commercial and residential users within the town limits, sewer hookups are not as extensive and are estimated to serve less than 25% of the existing houses. The town sewer system only has 700-800 hookups and these include the majority of downtown commercial buildings (Nix, 2003). The main limitations to serving more individual residences are the financial cost of installing collection lines and the cost of sewer hookup to residents. Currently the plant is reaching the 80% maximum flow that the state permit allows before it requires planning and funding for expansion of the facility. A town wastewater treatment facility expansion is currently being designed. The planned expansion will triple the existing capacity. Outside of the town limits, there are community systems that provide sewer service to some but not all of the residences in the golf course communities. The lots in the Big Creek watershed outside of the town limits are generally served by individual septic systems. There is one permitted wastewater system in the Big Creek subbasin.

There are National Forest lands within the watershed in the Big Creek Basin and the Cullasaja River Basin. These amount to only 7.4% of the Cullasaja River and 27.9% of the Big Creek basins, and 13% of the full watershed. The rest of the acreage in the watershed is privately owned.

2.6 Population

The area's population is difficult to estimate, due to the majority of houses serving as seasonal residences and vacation homes. Population of the larger Highlands community is estimated to be 990 (Census 2000) in the winter with an increase of 4 to 5 times that amount in the summer, depending on rental patterns and vacation schedules of seasonal residents. The local Chamber of Commerce often uses an informal estimate of watershed summer residency of up to 30,000; however, this number cannot be substantiated by hard data. Two-thirds of the property tax bills for Highlands are mailed to addresses outside Macon County. Macon County sends 50% of its property tax bills to owners outside the county. This means most of the population in the watershed are not full-time residents. Remote ownership of property adds to the complexity of working jointly with property owners on watershed issues.

2.7 Water Supply

Rainfall and base flow from the groundwater system are the only sources of water to the streams in the watershed. Groundwater in the watershed supports private and community well systems throughout the Highlands Plateau except for the Town of Highlands, which uses Big Creek (surface water) as a drinking water source. The source of water in this area is fractured bedrock groundwater systems. There are no underground reservoirs like that found in coastal areas of North Carolina . Instead, ground water supplies depend upon flow through fractured bedrock structures and are highly sensitive to drilling locations. It is common to drill more than one well before striking a high yield water supply.

Recent studies have shown that the wide spread groundwater levels have not decreased significantly during the period 1988 to 2002. Groundwater levels within the Town show modest increases in water levels during this period. Other wells in the area that have gone dry in recent years reflect localized conditions and the effect of the drought. The identification of groundwater recharge areas in or near the watershed remains lacking. An UCWA study (Wright, 2003) revealed that all known wells in the watershed have high artesian pressure characteristics indicating that the groundwater recharge areas are at higher elevations then the watershed communities. Without the information on the groundwater recharge areas, the full impact of increasing impervious surface areas (development) on the groundwater and base flow and the resulting impact on the streams in the area cannot be predicted.

The main source of stream flow is precipitation according to the Wright report. The report did confirm that discharge in the stream is increasing at a greater rate than rainfall, with an increase in rainfall annual rate of 5.4% in million gallons per day (mgd) and a stream flow of 6.8% in mgd. This finding may reflect the impact of development on increasing impervious areas that used to absorb rainfall. The surface water flows show a higher flow per inch of rain during the winter months and the reverse in the summer. During the winter, the evapotranspiration is low

and the ground may be frozen, thus enhancing runoff and preventing infiltration. In the summer, the evaporation and plant transpiration are at a peak and greater infiltration of rain through the soils may be occurring.

2.8 Watershed and Stream Background

The water quality of the streams has been documented in several reports, with most of the recent data coming from the North Carolina Division of Water Quality (DWQ). DWQ performs monitoring every five years for the basinwide assessment report. In 2000, DWQ initiated a comprehensive study of two streams in the upper Cullasaja River watershed as part of the Watershed Assessment and Restoration Projects (WARP). Results from these studies are documented in Appendix A and referenced in this report. Information on stream and lake water quality from UCWA and other sources are also presented in Appendix A.

The upper Cullasaja River watershed is fortunate to have many local and state organizations and agencies cooperating on initiatives and projects addressing water quality in the watershed (Appendix B). These groups include the Upper Cullasaja Watershed Association, USGS (stream gauging and the Blue Ridge-Piedmont Groundwater Research Project), Tennessee Valley Authority (TVA), North Carolina State Department of Environment and Natural Resources (NCDENR – for rules and regulations on stream classifications, discharge permits, non-discharge permits, land use, stormwater, and water supply), the Little Tennessee Non-Point Source Team (formed by NCDWQ), Macon County and the Town of Highlands (planning, zoning, and watershed protection), Macon County Watershed Council (MCWC), NASA and the North Carolina Center For Geographic Information and Analysis (North Carolina Impervious Surface Research Project– satellite imagery project), the Highlands Land Trust (watershed awareness and land conservation), the Highlands Biological Station, and the Little Tennessee Watershed Association. The initiatives are summarized in Appendix B and referenced where appropriate in this report. North Carolina State University Agriculture Extension Service will be involved in the design and construction of projects pertaining to stormwater and stream restoration. Building on past projects and relationships, these groups are positioned to continue their efforts towards protecting and restoring the water quality in the watershed.

The watershed, although small, has different issues on several of the stream basins, making it difficult to generalize the watershed conditions and solutions to problems. To deal with this factor, the watershed was divided into four subbasins based on the four main tributaries and land-use considerations. The subwatershed boundaries are shown on Figure 4.

Figure 3. Upper Cullasaja River Sub-Watersheds

The drainage area and the total miles of streams involved in each subwatershed and for the full watershed are listed in Table 1. Details on the subwatershed basins are described for each stream basin.

Table 1. Summary of drainage area and total stream miles by subwatershed

Subwatershed Name	Drainage Area	Stream Miles
Upper Cullasaja River	5.4 sq. miles	10.3
Mill Creek	1.7 sq. miles	3.0
Monger Creek	2.0 sq. miles	3.7
Big Creek	5.3 sq. miles	10.0
Total	**14.4 sq. miles**	**27.0**

2.8.1 Upper Cullasaja River

UCWA delineates the upper Cullasaja River subbasin as beginning at the headwaters of the Cullasaja River near Whiteside Mountain and ending at the dam on Lake Sequoyah. The subwatershed contains 5.4 sq. miles in drainage area and a total of 10.3 miles of stream and is the largest subbasin of the watershed. The main stem of the upper Cullasaja River includes the most length of stream (6.0 miles), but the tributaries of Ammons Branch (0.9 miles), Salt Rock Branch (1.0 miles) and three unnamed tributaries (0.6, 0.6 and1.2 miles) contribute to the total stream miles in the subbasin and can be the sources of significant water quality problems. The USGS topographic map for the area shows at least 14+ ponds or small lakes within Wildcat Cliffs Country Club property and another 9 ponds/reservoirs located downstream of Ravenel Lake.

This watershed includes the named lakes of Ravenel Lake (at Cullasaja Club), Highlands Falls Country Club Lake, Apple Lake, Mirror Lake, and Lake Sequoyah. The map does not include the frequent low head dams on many of the tributaries that occur in resident's backyards or along streams in commercial developments.

2.8.2 Mill Creek

Mill Creek watershed begins at the headwaters at Satulah Mountain, Sunset Rock and the Bearpen Mountains and ends at the junction with the upper Cullasaja River in Mirror Lake. This watershed includes over half of the downtown drainage of the Town of Highlands. It has 1.7 square miles of drainage. Most of the length of streams (3.0 miles) is in the main stem of Mill Creek (2.0 miles) with the remaining stream length in Satulah Branch (1.0 miles). The USGS topographic map for the area shows at least 4 reservoirs in the watershed. This includes the named lakes of Ravenel Lake (at Highlands Biological Station or HBS) and Harris Lake. Most of the Mill Creek watershed is either urbanized or residential in the downtown area and preserved in land trust on the ridgelines. The majority of the building growth in the Town of Highlands has occurred in this watershed. The Town's jurisdiction covers the whole watershed of Mill Creek.

2.8.3 Monger Creek

Monger Creek watershed begins at the headwaters near Sassafras Knob and Little Yellow Mountain and ends at the confluence with the Cullasaja River in Lake Sequoyah. This subbasin includes the Monger Creek arm of Lake Sequoyah. It contains 2.0 sq. miles of drainage area. The stream lengths of 3.7 miles includes Monger Creek arm of Lake Sequoyah and Club Lake (at Highlands Country Club). The main stem includes most of the stream length (1.7 miles) but there are three tributaries with 0.9, 0.4 and 0.7 miles in length respectively. The USGS topographic map for the area shows at least 6 additional reservoirs in the watershed. The entire watershed is within the Town of Highlands jurisdiction.

2.8.4 Big Creek

Big Creek watershed is 5.3 sq. miles in drainage area. This watershed begins at the headwaters along the Cowee and Shortoff Mountains and ends downstream at the US 64W bridge crossing on Lake Sequoyah. The subbasin includes the Big Creek arm of Lake Sequoyah. The headwaters of several of Big Creek tributaries start in the National Forest, while the main stem begins close to US 64 road at the eastern end of the watershed. The total subbasin length of streams is 10.0 miles and includes the Big Creek Arm of Lake Sequoyah and Randall Lake. The main stem of Big Creek includes most of the stream length (4.8 miles), with the rest in Houston Branch (1.6 miles), Bad Branch (0.7 miles), and Big Norton Prong (1.3 miles) and three unnamed tributaries with 0.4, 0.5 and 0.7 miles in length respectively. 10 reservoirs are found in this watershed, including the Randall Lake, Highlands Reservoir and Cold Springs Lake. This subbasin of the watershed is the least developed of the four subbasins and will be experiencing the greatest development pressures in the future.

2.9 Fisheries

North Carolina classifies the waters in the Highlands area for use as trout streams, and certain of the tributaries are well known for their population of fish. Although all of the streams in the upper Cullasaja River watershed are classified as "Trout Waters" by the state, there are few supporting populations of native trout in the watershed today. Using an Index of Biological Integrity (IBI) modified for high elevation streams, ratings for two stream sites were determined in 1999. Fish sampling in the upper Cullasaja River showed only one, tolerant, non-native species, the redbreast sunfish (McLarney, 2000). This scored a rating of Poor-Fair. The fish community on Mill Creek was scored as Poor and consisted of redbreast sunfish, creek chub, and bluehead. The McLarney report noted that lack of recruitment sources due to impoundments was a persistent problem for fish communities in the watershed. The general community has noted the decline in native trout population. Assumptions for the decrease in the IBI included temperature changes, siltation of stream and lake bottoms, drought-caused low stream water levels, and blockage of fish movements by man-made dams.

Stocked trout fisheries are common in the watershed for the pleasure of the sporting community, particularly in the community-based lakes and ponds. These stocked trout are generally only available during the cooler weather months (Fall, Winter and Spring) as the summer temperatures in the lakes are too high to support trout. The manmade waterbodies are not suitable for native trout and populations of warmer water fish (bass, bluegill, catfish, shiners, carp, dace, etc.) can be found in the environments around the impoundments.

3.0 Watershed Strategy

3.1 Overview

A comprehensive watershed strategy for the upper Cullasaja River watershed must recognize the unique environment and topography of this mountain headwaters watershed that makes it both an attractive location for retirees and seasonal residents and a place worth our efforts to preserve for future generations. The mild temperatures, beautiful scenery, lush forests, and distinct seasons offer a welcome retreat to visitors, tourists, and "refugees" from the more hectic, urban lifestyles of the major cities of the southeastern United States. One only need be informed of the weekly distribution of the small town local newspaper to every state in the union and several foreign countries to understand the appeal of this plateau to residents and nonresidents alike.

Classified as a high elevation rain forest, the watershed evolved a unique ecosystem. So rare were so many of its animal, plant, and aquatic species that The Highlands Biological Station has been a center of biological research and education in the Southern Appalachians since 1927. The world renown Coweeta Hydrologic Laboratory is located nearby in Macon County, North Carolina. Equally important, and oftentimes in competition for these resources, the local economy has drawn summer visitors and retirees to the area since the founding of the Town of Highlands in 1875. Today the watershed is home to a thriving tourist and second home economy, four beautiful golf course communities, and scenic forests, streams and lakes with nearby waterfalls and numerous outdoor recreational activities.

Although a number of water quality studies and assessments have been conducted in the impaired streams of the watershed, UCWA believes none have identified the one specific cause of impairment. From the assessment studies, UCWA considers that the impairments are the "probable result" of the cumulative impact from various nonpoint sources of stress in the watershed. Although not given the same technical assessments, UCWA concludes that similar water quality problems exist in other named streams and tributaries in the watershed upstream of Lake Sequoyah because similar conditions exist surrounding these streams.

These facts provide the framework and boundaries of UCWA's watershed strategy. Any successful project initiative designed to improve water quality and other environmental factors must achieve a practical balance between the environmental objectives and the real needs of the local economy. For example, any proposal to severely limit further growth and development in the watershed will impact the local economy and, therefore, is unlikely to be accepted by local governments or the business community. Removal of the golf course impoundments (water hazards) in order to return the Cullasaja River to its original, free flowing condition is not a realistic goal in the local economy either. On the other hand, incremental changes to improve water quality and habitat can, and will, succeed with education and cooperative stakeholder support. The residents of the watershed community, both full time and seasonal, have a strong commitment to their environmental heritage and to preserving the quality of life in the watershed for their heirs. This watershed strategy defines the local water quality issues and priorities established by UCWA and other watershed stakeholders.

3.2 The Water Quality Goal

The goal of this strategy and action plan is improvement of water quality in the impacted streams and lakes in the watershed and protection of the streams where the water quality is still excellent.

Restoration of the historical boating, fishing, and recreational uses of our public lakes by installation of upstream preventative sedimentation trapping and control measures and removal of legacy sediment bedload accumulations is a priority to watershed stakeholders. A vision for the longer term is the restoration of the trout fisheries to achieve the State classification of our waterways as trout streams in fact and not just on paper only.

For the Cullasaja River and Mill Creek, the goal is removal of these streams from the 303(d) list of impaired streams. The plan will address the problems identified by the Division of Water Quality's Watershed Assessment and Restoration Project Team in *Biological Impairment in the Upper Cullasaja River Watershed* (2002) (WARP report).

Potential water quality improvements will be addressed with waterfront property owners to seek cost-sharing commitments for project definition and implementation at specific sites. Measurement and monitoring systems will be established and maintained. Specific sites for bank-side habitat restoration, improved riparian buffers, in-stream structure and riffle-pool frequency, stormwater velocity control and diffusion, stormwater pretreatment to remove runoff pollutants, and elimination of deteriorated and leaking sewer lines will be investigated. With the

property owner's agreement, feasible sites will be selected and recommended for project implementation.

The focus of this strategy is not the impaired streams alone. The stakeholders and residents of the watershed have issues and concerns in areas other than the 303(d)-listed impaired waters. Similar water quality improvement projects are envisioned for the other streams and lakes throughout the watershed, and the goal are prevention of further degradation of water quality and steady improvement in measurable parameters and habitat.

3.3 The Strategic Plan

The stakeholders have defined the priorities of current watershed issues to be:

- Prevention of Erosion and Sedimentation Pollution
- Remediation of Area Lakes to restore their historical uses
- Management of Stormwater Runoff and Nonpoint Source Pollution
- Development of Improved Nutrients Management Practices
- Restoration of Stream and Streamside Habitat
- Detection and Elimination of Sewer System Leaks and Infiltrations
- Detection and Elimination of Chemical and Hydrocarbon Pollution Sources

The strategies for resolving these issues include new and expanded biological and chemical monitoring systems, study of more effective Best Management Practices (BMPs) for mountainside slopes and small streams, innovative regulations and incentives for water quality improvements, and measurable criteria for project improvement. UCWA will involve other organizations and resources to bring recognized expertise to bear on specific problems and challenges in this watershed including the use of consultants and university researchers, increased cooperation from the NC Department of Transportation, the USDA Forest Service, and municipal utility and public works crews, and creative use of GIS services available in Macon County. North Carolina State University staff will be involved in the design and construction of projects pertaining to stormwater and stream restoration. Outreach efforts will include direct project planning involvement and commitment by watershed property owners and local government, public awareness and education initiatives, and volunteer efforts by interested citizens, homeowners, and UCWA.

Watershed land ownership is comprised of several large forest service tracts, a small number of large homesteaded tracts, four golf course community developments, a commercially developed urban area in the center of the Town of Highlands, and a large number of individually owned parcels averaging one-acre or less. The Macon County GIS department reports over 5,180 property parcels in the watershed. Of these, approximately 400 border on named streams. Coupled with the steep mountainous terrain common to this watershed, the opportunity for large-scale stream restoration and stormwater retrofit projects is virtually nonexistent. The watershed strategy envisions a number of smaller projects on limited acreage sites. This specific knowledge of the watershed forecasts a labor-intensive approach that involves a large number of stakeholder contacts and planning sessions to identify project sites. Increased public awareness of the importance of the biological impairment indicators is the key to success of the strategy.

The strategy requires that improved erosion and sedimentation controls, stormwater management initiatives, and stream habitat improvements be made in the upper reaches of the headwater streams in order to support and protect significant restoration efforts required in the downstream public impoundments. Successful implementation of the total strategy will provide measurable improvements in water quality and healthy macroinvertebrate communities as well as restoration of historical recreation, boating, and fishing uses for the public in Harris Lake, Mirror Lake and Lake Sequoyah.

To be effective in promoting water quality within the golf course communities, UCWA will work directly with the club managers and their boards to increase water quality awareness amongst their homeowners. Any attempt to "report on the club's performance" to their homeowners or to the public without the club's prior understanding and agreement will result in alienating these key stakeholder organizations and is not a part of UCWA's approach.

Projects selected for implementation will be funded by individual businesses or by state and federal grants with cost-sharing commitments by local property owners, civic organizations, and local governments. Matching funds will be supplied by in-kind services and direct contributions. Property owners that wish to implement water quality projects at their own cost to avoid long-term restrictions placed on the use of funds by the granting agencies can participate in the overall project by offering their projects as matching funds efforts.

UCWA will serve the watershed community as overall project manager to apply for project grants, serve as the primary point of contact and communications with stakeholders, university experts, and the agencies, and coordinate the overall watershed strategy and action plan.

4.0 Strategy Implementation

The steps required to implement the watershed strategy are organized into general (i.e., pertaining to the entire watershed) and sub-basin specific initiatives. The latter groups address issues specific, and sometimes unique, to each drainage basin within the upper Cullasaja River watershed.

The database that supports these initiatives are the UCWA's local knowledge and observations, the Watershed Assessment and Restoration Project (WARP) water quality monitoring and biological impairment assessments, the Little Tennessee Watershed Association and TVA's fish sampling, NC Division of Water Quality's (DWQ) Basinwide Assessment Report, and other recognized studies (Appendix A). The Upper Cullasaja Watershed Association (UCWA) has combined the recommendations of the various DWQ reports with the concerns and issues of the watershed stakeholders and cooperating organizations and agencies.

4.1 Watershed-Wide Initiatives

The following initiatives will be addressed during the development of stakeholder commitments and specific water quality projects.

4.1.1 Erosion and Sedimentation Control

Sediment pollution from construction activities, unpaved roads, forestry, and land development has been and remains today a significant water quality problem in the Upper Cullasaja River Watershed. Sediment pollution impacts stream habitat by smothering benthic organisms and filling fish spawning areas. Phosphorus, metals, pesticides and other pollutants readily adsorb to sediment particles and are carried into streams from upland sources during storm events. Sediment can also fill local ponds and lakes, reducing storage capacity and increasing aquatic plant blooms. As noted in Appendix B, the state, county and Town of Highlands have enacted ordinances and regulations addressing the control of erosion and sedimentation.

The WARP assessment, with its focus on the benthic communities, indicated sedimentation is not currently the primary stressor in the two impaired streams of the watershed. However, the WARP data was acquired during low rainfall years and included little stormwater data on sediment loads. The sedimentation that occurs from erosion on construction sties in the watershed has been lessened in the past few years because of the drought. In 2003, with average to above average rainfalls, the streams have been again noted as carrying excessive sediment loads again. This has not been quantified through stormwater monitoring but has been observed through field surveys. The WARP conclusion suggests that existing regulations designed to minimize sediment pollution are adequate to protect water quality. Sedimentation and removal of sediment accumulations in the lakes and streams, however, remain the highest priority water quality issues with the local watershed stakeholders. Sediment accumulations in local lakes prohibit the traditional uses of the waterbodies in several communities.

Figure 4. Sediment Plume from Lambert Creek in Mirror Lake, June 2003.

In the Upper Cullasaja River Watershed, new residential and commercial construction, unpaved roads and driveways, road maintenance, and eroding slopes are potential sources of sediment pollution. Near-level, undeveloped properties in the watershed are largely non-existent today. There are no large commercial development projects (e.g. a Wal-Mart shopping center and parking lot) in this watershed. Home construction continues at a significant pace, and it often occurs on steep slopes prone to erosion and sediment flow during rain events. Other western North Carolina watersheds (Mud Creek and Pigeon River) have reported that models of sediment loading, which estimate the amount of sediment pollution from various land uses in the

watershed, suggests that residential development and unpaved roads account for a significant amount of the upland sources of sediment pollution.

The majority of the sedimentation damage to area streams and lakes was done in the years before current local regulations came into effect. The watershed is now suffering under the legacy of past practices and lack of understanding of the effects of natural habitat loss caused by the accumulation of silt. UCWA believes most of this "legacy" sediment is still present in the streams in the upper Cullasaja River watershed and as it moves downstream in the watershed, it will continue to impact the biological potential of the streams to provide high quality fisheries and aquatic habitat unless removed.

Although sediment loads should be considered in determining which strategies will be most effective in reducing sediment pollution, the loading rate should also be considered. As shown in other watersheds (Mud Creek Watershed Report), residential development may account for the greatest sediment loads in the watershed, but the loading per acre is much greater from construction sites and eroding roads. Management strategies to address sediment pollution should target not only the greatest sources, but also the sources with the greatest loading rates.

Until the public awareness of erosion and sedimentation control issues reaches the level where new property buyers understand the importance of requiring their contractor to install and maintain good erosion control measures, more laws, regulations, and enforcement can accomplish little improvement. The key to further reduction, or elimination, of sedimentation pollution damage to streams in this watershed is the individual property owner – residential and commercial. **UCWA, in partnership with other Highlands' nonprofits and local governments, should continue an aggressive public education initiative to inform the public – especially newcomers to the area – about the importance of effective erosion and sedimentation control in the mountains.**

Stakeholders should continue to work with the NC Department of Transportation (DOT), municipalities, and property owner associations to reduce the sediment pollution from unpaved roads, eroding road banks, and roadside ditches. Many of these unpaved roads are directly adjacent to streams or cross over streams and provide a direct pathway for sediment pollution to enter streams during storm events. To address this problem, UCWA and the local governments should prioritize unpaved roads in the upper Cullasaja River watershed to determine which roads pose the greatest risk to water quality and continue to request DOT to pave these roads. Proximity to water, slope, and length are all factors that should be considered in determining which roads pose the greatest potential threat to water quality.

NC Department of Transportation should acknowledge that local mountain and watershed conditions require flexibility and innovative approaches to road improvements. Past efforts by local governments and citizens to have eroding state-maintained roads paved have been stymied by DOT's stringent adherence to one set of standards for all roads in the state. In the watershed, unpaved road runoff carries large amounts of sediment directly into area streams and lakes. However, DOT's insistence upon widening and straightening unpaved roads that have existed and carried local traffic safely for many years before paving have made it impossible for local governments and property owners to agree to the DOT right-of-way requirements. The

inflexible and singular, state-wide standards, when applied to most unpaved roads in the watershed, result in significant loss of private property and higher driving speeds that are considered unsafe in the mountains. Local road safety and water quality concerns will not be fully addressed until NC DOT is authorized to develop alternate standards for small mountain community roads or to waive the state road standards for paving based on study and analysis of local terrain, geology, and hydrogeological conditions.

To reduce sediment pollution from future roads, more stringent design standards and local regulations for unpaved, private roads requiring builders to pave all roads within 100 feet of a stream or water body are recommended. UCWA recommends improving new road construction guidelines to address these impacts and to pave existing gravel roads wherever impacts are occurring.

In addition to unpaved roads, eroding road banks are also a source of sediment pollution. Eroding road banks often result from roads cut into steep slopes. **Bare and eroded banks should be inspected twice a year and re-vegetated any time the bare earth has been exposed.**

Recommendations should be made on NC DOT ditch maintenance procedures. NC DOT's standard practice of cleaning out roadside drainage ditches with heavy machinery too often exacerbates the problems of high stormwater velocities, erosion, and sedimentation in a mountain watershed. Emphasis is placed on getting the water off the road surface and not on the potential erosion damage that is done to local drainage systems, streams and lakes as a result of the ditch cleanout practice. NC DOT should also install and maintain sediment catch basins to reduce ditch erosion and sediment runoff from roads and eroding road banks. Rock check dams should be installed in ditches with slopes greater than twenty degrees to slow and diffuse stormwater velocities. Outfall erosion protection should be installed and maintained on all road culvert discharges downstream of long, sloping ditch runs according to state design standards and enforced in all situations.

UCWA recommends consolidation of jurisdictional responsibility for sediment control. UCWA believes the jurisdictional exemptions in the state and local erosion control laws are their principal weakness. The public, when reporting an obvious erosion and sedimentation problem to Macon County or the Town of Highlands, frequently has to be told that there is nothing local officials can do because the project is not within their jurisdiction. Best Management Practices, standards for performance, and enforcement effectiveness varies widely amongst the state, local, DOT, and U.S. Forestry Service entities. It is difficult at best for the average person to find their way through the bureaucratic morass to locate the one person or organization responsible for a specific project in their neighborhood. The very real danger in this distributed and divided set of regulations in the same watershed is a total loss of public support. This loss of public confidence can be prevented by the consolidation of erosion and sedimentation regulations under a single authority. The decision is a political one at the state level. **Consolidation of jurisdictional responsibility would be the greatest single improvement in the state law and regulations for erosion and sedimentation pollution control since 1973.**

4.1.2 Stormwater

The conversion of farmland, forests and wetlands to rooftops, roads, and parking lots creates a layer of impervious cover in the watershed that prevents precipitation from infiltrating the soil and recharging the groundwater. In natural systems, less than a third of rainfall runs off of the landscape. Most of the rainfall is absorbed by wetlands or percolates to ground water aquifers and is slowly released to streams and lakes. In watersheds with a large amount of impervious cover, much of the rainfall is converted to stormwater runoff and is diverted quickly to streams via stormwater systems, including ditches. Stormwater runoff from roads and commercial and residential development impacts stream habitat by scouring the streambed and banks. Over time, these high velocity streamflows destabilize the streambanks causing them to collapse depositing large amounts of sediment into the stream channel. In addition, stormwater runoff also carries toxins, such as metals and organic pollutants, from parking lots and other paved surfaces directly to the streams.

Stormwater BMPs should be installed throughout the watershed. Although stormwater is associated with high density/urban development, the effectiveness of site-specific stormwater controls cannot be minimized and should be encouraged throughout the watershed. These can also be used as examples and educational resources for demonstrating the size, capacity and maintenance of the systems in the watershed. Stormwater BMPs should be installed in as many areas as retrofits as possible, and in all new construction. Although each individual project will not be the solution, each additional control will add up to prevent additional damage and will eventually reduce the impact of stormwater over time. More specific recommendations will be presented in the urban subbasins recommendations. UCWA will pursue funding from sources like EPA 319, and the Clean Water Management Trust Fund to install stormwater BMPs throughout the watershed as projects are identified through stakeholder contacts and agreed with the property owners.

4.1.3 Stream Habitat

An important component of the viability of aquatic organisms is the stream habitat. While the water quality is a critical baseline, without appropriate habitat there will be no or little aquatic organisms (fish, insects) living in the streams. This is particularly of concern in the upper Cullasaja River watershed in areas where the water quality sampling indicates good water quality but the lack of trout and aquatic insects. Stream habitat includes structure for insects to live on and around (gravel, boulders, logs, roots); food sources internal and external to the streams (vegetation above the stream, insects within the stream and airborne); and temperature control from shading of the streams.

This Action plan will protect and improve the aquatic habitat for insects. The watershed would also be improving the habitat for other aquatic species (trout) and terrestrial species in the riparian buffer (birds, mammals, etc.). Specific project sites will need to be identified and evaluated through stakeholder development efforts. In general, the following strategies are recommended to address this problem:

UCWA should continue to educate landowners about the importance of riparian buffers for streambank stabilization, water quality and habitat. Changing public perception about riparian buffers is a critical objective for the UCWA. To accomplish this goal, UCWA needs to identify key target groups including garden groups, civic groups, golf courses, local government maintenance workers, utilities, and homeowners groups and develop a communications strategy for these audiences. Outreach materials might include a PowerPoint presentation, website, or fact sheet.

UCWA should work with landowners to restore native woody vegetation along streams to stabilize streambanks and improve habitat. Few opportunities for largescale stream restoration sites exist in this watershed. Additionally, largescale stream restoration is not always a cost-effective solution to addressing site-specific streambank erosion problems. In many cases, these site-specific problems can be managed by stabilizing streambanks with vegetation to reduce sedimentation. Buffer restoration costs on average $650-900 per acre and there are a number of programs in place such as EQIP and Ag Cost Share that provide funding to help landowners address this problem. UCWA will pursue other sources of funding for vegetation including TVA, Trout Unlimited, CWMTF and EPA 319. This strategy will depend on identifying interested landowners and feasible projects for implementation. This will occur during the Stakeholder Development Project that is being funded by the NCDWQ 104 (b) grant to UCWA for 2003-2004.

4.1.4 Biological and Chemical Monitoring

It is important to have a method of determining the water quality of the streams in the watershed. In the past century, visual observations of clear water and living organisms were adequate for this determination. Unfortunately, visual observations by themselves cannot always see degradation of the water quality or impacts to aquatic organisms until the condition of the stream is almost past recovery. We live in an environment full of chemicals that have never been released to streams in the past. If we are to protect our streams and catch problems early, we need to be constantly aware of what is occurring in the water. This requires some type of sampling or monitoring program that can inform both the citizen and the scientist of changes or impacts that are occurring in the watershed.

In order to monitor and assess the condition of the streams in the upper Cullasaja River watershed, water quality and biological sampling has been used in the past, mainly by state agenices. The upper Cullasaja River watershed has been monitored every three to five years by the NC Division of Water Quality (DWQ) at one to two sites (Appendix A). The Biological Assessment Unit monitored the upper Cullasaja River at US 64 for biological and chemical data in 1990, 1991, 1996, and 1999. Mill Creek was sampled above and below the old WWTP site in 1990 and 1991 before the new WWTP began operation (1994) and in 1999 below the old WWTP site. No other sites in the upper Cullasaja River watershed have been sampled on a regular basis. During the special sampling for the WARP report, the two existing sites were joined by four sampling sites on the upper Cullasaja River and one additional site on Mill Creek (Appendix A). Two reference sites were also sampled for biological data in the Big Creek watershed. Most of the sites were sampled once, with the two Cullasaja River sites, one Mill Creek site and one Big Creek reference site sampled twice. The information provided by this sampling provided some

additional insight into the condition of the watershed, but lacked the long term perspective for the new sites, and all of the sites were under the influence of a region wide drought. There were also no permanent sites established on the other impacted streams in the Upper Cullasaja River Watershed – Monger Creek and lower Big Creek.

McLarney has performed two fish surveys in the upper Cullasaja River watershed in 2000 for the Little Tennessee Watershed Association and TVA. These surveys were at the NCDWQ sites on upper Cullasaja River and Mill Creek. No long-term fishery information is available from scientific studies but many locals can relate memories of a healthy or existing trout population not very long ago. Other species inhabiting stream environments have not been studied or enumerated (salamanders, mussels, etc.). Surveys for threatened and endangered species have not been performed on a basinwide basis (site by site surveys prior to development if an Environmental Assessment required is the only data available).

The monitoring program will develop around the projects that are implemented as a result of the Watershed Strategy and Action Plan, but there are some general recommendations that can be made now to provide background information and to expand the existing database.

With environmental and developmental conditions changing constantly, **UCWA needs to build a better monitoring database for the Upper Cullasaja River Watershed to more accurately determine where, when and what pollution impacts are being felt in the watershed.** Future monitoring data will also be needed to track the success of water quality projects that are installed in the watershed. All four of the primary streams and selected tributaries in the watershed will need to be monitored. Lake sampling for chemical and physical and depth profiles are needed to develop a baseline of the current conditions of the lakes and to track improvements in the future. Stormwater sampling is needed to confirm where and what kind of stormwater pollutants the watershed is experiencing, to design and install the appropriate Best Management Practices for the pollutants and to track improvements as BMPs are installed throughout the watershed. An annual review of stream habitat throughout the watershed is needed. This will provide additional baseline information on the streams and tributaries and will track improvements or degradation in the future.

Continue biological sampling on an annual basis and expand the biological program to include all four primary streams. Continue to document the benthic population and the changes that may have occurred with the recent return to normal rainfalls. Other tributaries should be surveyed to document existing habitat and recolonization sources. Funding should be found to support this sampling. Possible sampling entities include volunteers, university students or UCWA. Determine the locations of populations that are available for recolonization.

Chemical and physical sampling: Establish a monitoring program on the four primary streams and the public lakes for chemical and physical monitoring. The database needs seasonal data and annual data that are not available from current state monitoring programs, which were cut back in the 1990s. Funding for a long term monitoring program should be found. Possible monitoring programs could include VWIN using volunteers, UCWA, university sources, or NCDWQ.

Stormwater sampling: Establish at least 4 stormwater monitoring sites on the primary streams for baseline and annual sampling. Standard stormwater components will be evaluated and based on the type of land use and pollutant sources in the subwatersheds. In addition, single stage sediment traps will quantify the amount of sediment that is currently being eroded in the watershed and deposited into the streams. This information will determine whether sediments are under control with the current regulations.

Develop a program to determine legacy loading of sediment to the streams in the Cullasaja River watershed. Consultation with experts in water quality and watersheds/forestry will be necessary to develop a method of determining what sediment is from past erosion events, what is currently occurring and how sediment is moving through the system. Bed load measurements, sediment traps, embeddedness, photographs, lake sediment deposits, etc. will be the types of techniques that will be considered in order to determine if and where sediments are impacting the stream habitats. This information will be used to develop future projects to remove legacy sediments in lakes and streams, modify stream channels to promote the movement of sediments naturally downstream, and to concentrate the efforts of the community on problem areas.

Fish Studies – fish collection surveys on all four streams and key tributaries are needed. Baseline sampling is only available for Cullasaja River and Mill Creek. Big Creek and Monger Creek need to be documented. Other watershed tributaries may be surveyed to determine if they will act as recruitment or breeding areas for fish upstream.

UCWA and the Highlands Biological Station should develop an integrated biological monitoring plan that coordinates the local nonprofit stream monitoring with local university research. Every year the Highlands Biological hosts a number of undergraduate and graduate research programs which perform studies in the Highlands Plateau ecosystems. These programs represent a significant resource and database for improving the overall understanding of the interrelated effects of water quality and the presence and behavior of aquatic and amphibian species in the local environment. UCWA and the Highlands Biological Station already have an existing working relationship. By working on a jointly developed monitoring and research plan, the local stakeholder groups can summarize prior efforts and focus future research and volunteer monitoring in areas that will provide a more complete understanding of the effectiveness of riparian buffer areas, habitat requirements, water quality, and the urban grown stressors that impact all of these characteristics.

Provide the monitoring data to the public on a regular basis. The general public needs to know what conditions are in the streams and how they are changing before they are ready to accept changes that they need to make. Monthly reports and information in the newspaper will prepare and inform the public on management techniques that will be required and which ones are working.

4.1.5 Nutrients Management Plan

In natural forests and grasslands, nutrient cycling through the environment is managed through checks and balances. When man impacts this natural cycle, it can lead to upsets and degradation of the environment, especially of water bodies. Man brings additional nutrients into the

environment through direct application of fertilizers, leaks from sewers or septic systems, and increased concentrations of animals (feedlots are the extreme example, but a neighbor's yard with several large dogs can also lead to a local impact). Excessive nutrients in the aquatic environment produce excessive growth of aquatic plants, both rooted (macrophytes) and single celled (algae). With extreme growth, these in turn can create localized areas of low oxygen and death of aquatic organisms.

The streams of the watershed, like many high elevation trout streams, are relatively low in nutrients and do not show a visible impact from any of the additions of nutrients from the development of the watershed. However, it is a different matter altogether when one reviews the conditions of the lakes and ponds in the watershed. From some sampling data and information on aquatic plant management by lake owners, it is fairly clear that the nutrients in the watershed are making excessive aquatic plant growth a common problem that is being dealt with on a regular basis, at least in localized areas. The symptoms of the problems are being addressed (excessive growth) by using chemicals or plant removal. The sources of the problems (nutrient enrichment) have not been specifically identified or addressed.

The object of this project is to develop nutrients application and management recommendations for local property owners. When excess nutrient levels are detected by monitoring or experienced as algae blooms in the lakes, they are often blamed on the golf courses because of their size and use of turf management chemicals. However, with the fact of many smaller parcels bordering streams and the high number of seasonal residents in the watershed, it is very likely that significant nutrient loading is added to the streams by careless or unknowing, private lawn care practices.

In 2002, UCWA initiated an effort to form a proactive working relationship with the four local golf course communities. It is known that the clubs hire technically trained and experienced golf course superintendents and turf managers. Their specialized training and knowledge of soils, grasses, fertilizers and insect control chemicals are a resource in the watershed. UCWA has proposed to work with the clubs on water quality initiatives. In the nutrients management project, **UCWA will utilize the golf course superintendents as consultants to provide input, review, and approve specific guidelines for homeowner use of fertilizers and lawn care chemicals.** This plan will provide recommendations specific to the watershed soil types and promote soils testing on specific owner parcels. Lawn care tips related to the use of riparian buffer strips rather than manicured lawns at the water's edge, mowing heights, use of slow release and organic fertilizers, use of natural weed and insect controls, and other pertinent recommendations will be included in the plan in simple words the average home owner can understand and use.

The effectiveness of the nutrients management plan will be measured by establishing a system of monitoring and sampling locations in each primary watershed stream. Volunteer stakeholders or contract technicians will conduct both random and seasonal sampling for nutrients. During the peak spring fertilization season, analysis of the water samples taken downstream of the major turf areas (subdivisions, golf courses) will be performed by a certified laboratory.

4.1.6 Local Regulations and Enforcement

Local ordinances for erosion and sediment control are in place and are more stringent than the State law requirements (Appendix B). The town requires an erosion control plan for any land disturbance 3,000 square feet and larger. Macon County requires a plan for land disturbing activity great than one-half acre. The county ordinance also contains incentives that relax the formal erosion control plan requirements for contractors than complete eight hours of state or local erosion control training. Both town and county ordinances have special provisions for enhanced erosion control measures on steep slopes. Approved Macon County contractors that receive a Notice of Violation on their job site are subject to revocation of their approved status. Macon County has revoked the approved status of 3 contractors during the first year the ordinance has been in effect.

Public awareness and consistent enforcement on projects of all sizes are supported by local initiatives by UCWA and active support of the local governments.

The Town of Highlands, after experiencing a major sedimentation event in a section of Big Creek, implemented a local Impoundment Ordinance that regulates man-made releases of water from area impoundments and requires professional engineer certification on larger impoundments. The town's impoundment ordinance is also enforced in the Macon County portions of the Upper Cullasaja River Watershed by the Town through an interlocal agreement. The local ordinance is thought to be the only one of its kind in the state regulating the release of water behind non-jurisdictional dams less than fifteen feet in height.

The entire watershed is protected by town and county Public Water Supply Watershed Protection Ordinances that limit development density and require stream buffers/setbacks. The town's ordinance is more stringent than the State law. In 2002, the Town Board approved a policy statement opposing any stream diversion or rerouting by developers seeking to create the required watershed protection buffers in new property developments.

Current state law and local Public Water Supply Watershed Protection Ordinances allow properties greater than one acre in size to be exempt from the watershed built upon requirements. **Local governments, the Macon County Watershed Council, the Little Tennessee River Watershed Association, UCWA, and other interested stakeholder groups should work together to review the wording of the ordinances and to modify the existing ordinances, as required, to clarify and extend the built upon requirements to properties of all sizes.**

4.1.7 Public Education Initiatives

The watershed has a high percentage of seasonal residents and second-home property owners. Because these owners live a substantial part of each year in other locations and not in the mountains, the key initiative has been and remains public education and awareness of water quality issues in this watershed.

Contact all landowners adjacent to the watershed streams. With funding from Section 104(b) through NCDWQ program, UCWA will direct mailings to the 400+ owners of property

parcels on or near watershed streams. UCWA will distribute water quality brochures and locally- prepared recommendations to those owners having the greatest probability of affecting improvements. In partnership with the Highlands Land Trust, UCWA will also distribute information about conservation easements and gifts, or sales, to land trusts as important methods of preserving water quality. Meetings at homes and yards will be arranged to further educate landowners on methods for protecting water quality in the watershed.

Public information meetings with water quality experts to discuss statewide and local issues will be held. A minimum of two public meetings will be held each year to bring recognized experts in water quality to discuss statewide and local issues. Funding and speakers will be sought from private industry, universities, and state organizations.

Raise the visibility of water quality issues in the watershed to the community. UCWA has been, and will continue to be, active in making local presentations of water quality awareness issues to local garden clubs, Leadership Highlands, the Rotary Clubs, and other civic and nonprofit organizations. UCWA has written a public education "Know Your Watershed" in the local newspaper, The Highlander, since 1999. Having generated a core following of local and nonresident readers, this initiative will be continued with a frequency of one or two articles a month. Additionally, UCWA will continue to present papers at state and regional conferences when the conference objectives are consistent with the local issues and objectives.

UCWA will educate business and citizens about stormwater management issues and action they can take to reduce these impacts. The concept of stormwater impacts to the streams in the watershed is new to many individuals in the community. Through presentations, newspaper articles, brochures and newsletters, UCWA will educate the community and promote practices that reduce the impact of stormwater runoff to the streams and lakes of the watershed.

UCWA's public education initiative will communicate the recommendations, testing results, and resultant water quality results to the golf course managers, their boards, and to the public, with the clubs concurrence. Local media and public meetings will be used as forums to increase local awareness of the benefits of nutrients management and riparian buffers. The support of the community for UCWA efforts on protecting the water quality in the watershed will be backed up by scientific data that provides the information needed for good management decisions. An informed community will recognize trends, high values, and consistent data points and will be more likely to support any changes in the watershed strategy that is required to address any negative direction of water quality.

4.1.8 Preservation

UCWA will work with the Highlands Land Trust and the Highlands Biological Station to identify and permanently protect high priority streams, wetlands and riparian buffers in the watershed. Although many streams, riparian areas and upland areas in the Upper Cullasaja River Watershed have been degraded by development, there are still many high quality streams and wetland areas worthy of long-term protection. The land under US Forest Service control is a small percentage of the land in the watershed and cannot provide a lot of protection beyond what currently exists. Much of the land even in the Big Creek watershed is on ridge tops and does not

protect the stream corridors. In partnership, UCWA and the Highlands Land Trust can work with landowners in the upper Cullasaja River watershed to protect stream and wetland areas by negotiating permanent conservation easements and fee simple acquisition on these properties. The Clean Water Management Trust Fund and the Natural Heritage Trust Fund are two potential sources of funding for this purpose. The state also offers Conservation Tax Credits to encourage landowners to donate conservation easements to land trusts and state programs. The Highlands Land Trust is in the process of identifying priority areas for protection in the Upper Cullasaja River Watershed and elsewhere throughout Macon and Jackson Counties.

4.2 Sub-Watershed Recommendations

4.2.1 Cullasaja River

As noted in the reports summarized in Appendix A, the upper section of the Cullasaja River has been documented as having water quality impacts and a loss of aquatic organisms. This sub-watershed is the longest of the four main tributaries and has the largest drainage area (both slightly larger than Big Creek watershed). The subwatershed has some Forest Service lands but mostly a mixture of private and commercial lands. Three of the four golf courses in the whole watershed are located in this sub-watershed. Much of the land along the main stem of the Cullasaja River is in private ownership and most of the main stem has been developed. The main strategy for this sub-watershed is for protection of undeveloped lands, prevention of further water quality pollution, increased natural stream habitats and community education and involvement in restoring the river for trout populations.

Habitat Restoration will be proposed for appropriate sites and where landowners will agree to projects. This will create additional habitat and refuges for aquatic organisms, which are currently under stressed conditions. Specific habitat restoration sites will be identified, and the landowners involved to develop voluntary stream buffers, streamside planting of woody plants and trees for shade and cover, conservation easements or purchases of linear sites. UCWA will work cooperatively with the golf course communities to identify feasible sites and to develop habit restoration projects at agreed sites. Education and publicity about sites will be provided to the community in order to expand the number of landowners considering this type of project.

Evaluate bypass or minimum flow opportunities for the impoundments in upper Cullasaja River. Many of the lakes in the upper Cullasaja River were constructed with no consideration of minimum flow release or for the biological community connection between upstream and downstream reaches. Opportunities for retrofits may be limited, but other techniques may be appropriate. During periods of drought like the past 5 years, techniques and guidelines should be developed to minimize the impacts of the impoundments and the irrigation uses. Options to be investigated will include minimum flow releases using siphons during low water level periods; creating stream bypasses to the ponds with side intakes for the ponds; creating side channel inflows to ponds from the main stream; and developing optional irrigation water sources (e.g., WWTP treated effluent). Many NC and southeast U.S. communities have experienced water shortages and water restrictions that have been well documented in newspapers and on

television. UCWA will build upon the public's knowledge of water quality and quantity and direct interest towards providing and protecting water resources in the watershed.

Pursue preservation opportunities on Ammons Branch and Unnamed Tributary to Cullasaja River. These streams have shown healthy communities of aquatic organisms. Develop contacts with landowners and encourage protection of stream lengths though conservation easements, deed restrictions, fee simple purchases, etc. A combination of preservation techniques will be necessary to reach consensus with a significant number of owners. This will ensure a population of healthy benthic organisms is available for recolonization of downstream reaches, through water transport or adult flying stages.

Seasonal Monitoring of chemical applications in golf course environments. To be effective in promoting water quality within the golf course communities UCWA will work directly with the club managers and their boards to increase water quality awareness amongst their homeowners. Any attempt to "report on the club's performance" to their homeowners or to the public without the club's prior understanding and agreement will result in alienating these key stakeholder organizations and is not a part of UCWA's approach. Monitoring will correspond with the time of applications of chemicals, both in the golf courses and in the seasonal residential communities. This would be coordinated with the golf courses to monitor for those chemicals that are being used and the information provided to the golf courses for feedback as to the effectiveness of the application's ability to stay on the turf where it is applied. Stormwater sampling should also be timed to catch the first major rain event after applications, when that is possible for the three golf courses.

Stormwater management opportunities (BMPs) will be pursued at all community areas with large parking lots – hospital, town and county government buildings, commercial stores, gas stations, tennis courts, etc. There are opportunities in the upper Cullasaja River watershed that can be pursued for stormwater treatment on a small but effective scale. New techniques are available which are less intrusive and even an amenity for the properties where they are installed. These include rain gardens, pervious pavements, bioretention ponds, wetlands, and grass swales. More technical and engineered structures are available for more concentrated sources of pollution if those are detected.

Public education directed to homeowners within the golf course communities. The golf course management staffs from the three golf courses have indicated a desire to participate in the efforts by UCWA to restore and protect the streams and lakes in the watershed, but are sometimes limited in their efforts by perceptions of homeowners and members in what they are allowed. Education provided to the golf courses, their boards and committees, or directly to landowners by UCWA will explain and support the environmental activities that are being pursued by the course managers. UCWA will also become a resource or referral agency that the golf course managers can use for homeowners who need or want more information about what they can do as individuals to improve local water quality.

Survey stretch of upper Cullasaja River between Highland Falls and upper Mirror Lake. This section has not been surveyed and no information exists about water quality, habitat quality, habitat or stream restoration potential, sediment load, development impact, etc. This needs to be

determined, along with survey of residents, to see if there is any interest in participating in the watershed protection plan.

Address sediments in the Cullasaja River upstream of Mirror Lake Bridge. This section of river is impacted by impounded water levels from Mirror Lake and is no longer free flowing in nature. There are excessive sediment deposits in the area, and the stream is no longer functioning well (profile and dimension changes). This area needs restoration to improve the function of the stream. Wetland enhancement and preservation on some small areas may be possible. Innovative and effective sediment collection, deposition and removal systems will be considered and used where appropriate.

Address water quality problems and opportunities at Mirror Lake. Mirror Lake has long been one of the most sediment impacted water bodies in the basin, with over 7 acres of lake lost to open water recreation. There is a combination of opportunities around the lake and its environment. Areas that have been "lost" to wetlands can be preserved, enhanced and possibly developed to create a wetland that can absorb stormwater events and improve the water quality of the river before it enters Mirror Lake. This innovative use and preservation of the wetlands will also increase the wildlife component in the area, increasing habitat and diversity for terrestrial animals and birds. The emerging wetlands area at the confluence of Mill Creek and the Cullasaja River is a prime candidate site because it exists and is the first place downstream of the Town of Highlands storm drain discharge point that flattens and disperses the town's stormwater flows. Since most of the urban town area stormwater runoff flows in Mill Creek to this site, natural treatment processes using the wetlands area formed by legacy siltation at the discharge of Mill Creek will improve water quality in Mirror Lake and Lake Sequoyah regardless of other upstream initiatives.

Restore Mirror Lake to depths that allow recreational use of the lake. One of the first principles of watersheds is that they are controlled by nature and recognize no artificial or political boundaries, such as the town limits. NC DENR has defined the boundary between Mirror Lake and its streams to be the Mirror Lake Road bridge. Because of this definition, the waters upstream of the bridge are classified as being a stream and impaired; and the water downstream of the bridge is the lake and has not been evaluated for lake impairment (different criteria). Watershed stakeholders and local residents believe this distinction is neither logical nor correct.

The problem of water quality and past sedimentation damage in Mirror Lake needs to be addressed with the same priority as the streams across the bridge, legacy sediment accumulation needs to be removed, and the open water restored to recreational uses. Because of the stringent erosion control and watershed protection ordinances now in effect throughout the watershed, future sediment loads in this watershed can be predicted to be significantly less than those of the prior years. Lake remediation will also serve to protect downstream reaches of the river and Lake Sequoyah from watershed pollutants, as an improved Mirror Lake will provide greater efficiency as a regional sediment/water treatment basin for the lower sections. Minimum discharges and other techniques to minimize the impoundment impact will be considered.

Develop Lake Monitoring program. Mirror Lake has several stressors that are impacting the water quality of the lake. Sedimentation accumulation has resulted in shallow water conditions which leaves the lake susceptible to many problems including excessive macrophyte growth, algae blooms, nutrient concentration, fish community impacts (habitat modifications, population, invasive species and kills) and further loss of recreational usage associated with open water. Lake monitoring will document impacts from the lake's populations of geese and migratory waterfowl on nutrients and bacteria levels and will provide information necessary to determine whether or not a waterfowl control program is needed.

Create a public education program of water supply protection for Lake Sequoyah that includes water quality and quantity aspects. Everyone in the upper Cullasaja River sub-watershed should be made aware that their activities on their property and in and on the streams and lakes can impact the water supply in Lake Sequoyah. Even those who obtain their household water from wells impact the streams and lakes through outside activities like driving on roads, washing cars, lawn and garden maintenance, etc. Additionally, runoff from their roofs and driveways provide sources for pollutants to be washed into nearby streams. This public education initiative is needed in addition to the town and county Public Water Supply rules and regulations that are detailed in Appendix B.

Remove sediments from the Big Creek Arm of Lake Sequoyah and other potential sites within the lake (Monger Creek arm, Cullasaja River arm, etc.). With the protection in place upstream on Cullasaja River throughout the watershed and within Mirror Lake, Lake Sequoyah should be better protected from most sediment impacts in the future. Past sediment deposits should be evaluated (depth, age, etc.) and removed before it reaches a level where removal becomes even more expensive, inappropriate (wetlands creation), and impacts the cost of water treatment for the Town of Highlands.

The whole lake should be monitored for sediment deposits, and long term plans and financing arranged to address capital needs such as dredging of sediments. However, the highest priorities will be given to the three shallow areas of the lake where loss of water depths already restrict the traditional uses of the waters.

4.2.2 Mill Creek

This sub-watershed is the smallest in drainage area (1.7 square miles) and the shortest in length (3.0 miles). More sections of this creek or its tributaries are culverted than the other streams in the watershed due to its location running through downtown Highlands. Mill Creek was noted in the reports in Appendix A as having water quality impacts. Most of the impacts in this sub-watershed were due to the high density, urban development that covers most of the area. Very little acreage is undeveloped or available for protection efforts. Stormwater impacts, pollutant sources and stream habitat degradation are all major concerns. The recommendations for this sub-watershed address these concerns.

Survey habitat above Ravenel Lake (HBS). The stream habitats upstream of the lake at the Highlands Biological Station have not been surveyed by the state, although some research has been conducted by students in residence at HBS. The initial approach will be to learn what

relevant research already exists in the possession of HBS and to summarize these findings to better understand the stream habit and biological species of the area. Once this data picture is compiled, cooperative efforts between HBS and UCWA will be able to focus on new initiatives to evaluate the water quality and habitat issues in this important headwaters of Mill Creek. HBS has graduate research programs every summer and the University of North Carolina's Carolina Environmental Program (CEP) is in the third year of sponsoring resident undergraduate student research at HBS each fall quarter. These university programs significantly increase the talent and resources available for refining the evaluations of water quality and environmental studies throughout the watershed. The cooperative efforts between HBS, UCWA, and other Highlands-based nonprofit organizations provide the student with mentors and the opportunity to address real and current environmental issues while furthering their education and experience.

Collect water quality data on Ravenel Lake and Harris Lake headwater streams. No information is readily available nor is it available over time for evaluation of watershed changes in the headwaters of Mill Creek. Physical and chemical analyses as recommended in the watershed-wide sections would be necessary to track environmental impacts from upstream sources to the lakes in this basin. Satulah Branch upstream of Harris Lake has often been reported as one of the last havens of native trout, yet no fish or benthic surveys have been conducted in this headwaters tributary of Harris Lake and Mill Creek. Prevention of lake degradation is of prime importance in this watershed where many lakes are impaired for recreational uses and Mill Creek itself is on the 303(d) list of impaired streams

UCWA, HBS, and the HLT should initiate a project to identify, catalog, and map (GIS) the remaining, undeveloped wetlands and Appalachian mountain bog sites for public awareness and to coordinate this information with the permitting agencies.

Recently, the U.S. Corps of Engineers and NC DENR as the permitting agency has approved 401/404 permits for several new development projects in this watershed. **UCWA-led stakeholder efforts should be initiated to advise the permitting agencies and local governments of the existence of these important environmental areas and to make it known that many citizens and stakeholders believe it extremely important to preserve the remaining sites rather than to approve mitigation efforts in this, or another watershed.**

The last known, undeveloped Appalachian mountain bog in the watershed is located on private properties in the vicinity of 6th Street and Smallwood Avenue. Development of these properties will be very costly and require complex U. S. Corps of Engineers permitting with wetlands mitigation. Local stakeholders will promote public awareness and preservation of this important mountain bog and its ecosystem. The creation of non-invasive walkways and interpretative signage to teach school children and the general public about the ecological role of mountain bogs would add a unique feature to the biological gardens and trails of the Highlands Nature Center nearby. **A cooperative partnership of The Highlands Land Trust, UCWA, and The Highlands Nature Center should contact the property owners to encourage the donation of the property to a land trust or the execution of a conservation easement allowing the preservation of the bog area and the development of public access and educational facilities.**

Stormwater BMPs should be installed where appropriate in the downtown area. To address the high scour of rain events that was observed in studies and the general knowledge of urban rain pollutants, stormwater BMPs should be installed in as many areas as retrofits or in new construction as possible. Because of the steepness of the terrain, there are few locations where area or regional BMPs can be installed and UCWA needs to emphasize the need for on-site controls wherever possible. During expansions, new construction, or as retrofits, there are multiple techniques available for on-site treatment and retention of stormwater. Although each individual project will not be the solution, each additional control will add up to prevent additional damage and will eventually reduce the impact of stormwater over time. There are potential sites within the Town of Highlands that may be suitable for small to medium scale (more than one building) projects. NCSU staff with experience in stormwater and stream techniques will be utilized in the design, planning, construction and evaluation of these structures. These structures within the town will improve the water quality of both Mill Creek and Monger Creek.

Address pollution concerns identified in the WARP report in the two tributaries to Mill Creek in town. Both of these tributaries were found to have low levels of volatile organic contamination (benzene, toluene, xylene, etc.) and the source has not been confirmed or corrected. One possibility mentioned by the WARP report is a town maintenance facility where leaking fuel tanks were removed many years ago under State and EPA cleanup activities. Due to lack of resources and a change in state groundwater priority lists (no drinking water sources impacted), the contaminated soil was left in place. WARP noted suspicions that this soil/facility site may be the source of the pollutants, but no data has confirmed the source. The Town of Highlands re-started periodic testing at this site subsequent to the WARP recommendations. Further sampling is needed and needs to be correlated with groundwater levels to locate the source and to see that the problem is addressed.

Develop a Voluntary Program for the Detection and Elimination of Illicit and Unknown Storm Sewer Connections. Studies, observations and smells have all indicated that a sewage leak exists in the vicinity of Main Street and is detected periodically in the small, unnamed tributary between the Episcopal Church and the Hudson Library. Additional efforts need to be made to determine the source of this problem. There has been a partial determination that the source is not a city line, but is a private line that is no longer maintained. Die tests conducted by the Town, however, have been inconclusive. In a volunteer effort modeled after the NPDES Phase II illicit storm sewer connections elimination program, UCWA needs to develop a proactive approach for working with the Town and local businesses for addressing this, and similar situations, so that problems are positively identified or eliminated from further consideration, confirmed problems are fixed and future problems are prevented. Other communities have had similar situations and examples of resolutions or private/public agreements are available to utilize when sources of sewage leaks are positively identified.

Address residents concerns about possible, but unconfirmed illegal discharges in the storm drains of Highlands. Residents in the watershed are observant and do take note of strange substances in the drainage systems on occasion. There are town and UCWA staff available to respond and help to follow up on determining the source of the problem. State agencies can also be contacted for an investigation. Education and information made available to the community

about what problems may look like and who to contact would address resident's concern. This would be a part of the education component of the watershed action plan.

Determine source of high conductivity readings in the tributaries to Mill Creek. High conductivities were documented in the tributaries to Mill Creek by the WARP team. The sources of these high conductivity measurements need to be better understood As some of the measurements were taken in the winter; it appears that the use of road salt for snow and ice by NC DOT, the Town of Highlands, and local businesses may be a problem. Monitoring of the streams and tributaries will detect this impact only during the winter months if it is the source. Alternatives to road salt or the application procedure can be considered if this is the case.

Develop wetlands at the downstream end of Mill Creek at the junction with Mirror Lake. Mirror Lake has lost surface water area to wetlands from past sediment deposits. These wetland areas may be incorporated into a natural facility for treatment of storm flows using the natural water quality treatment processes for solids and nutrients that occurs in wetlands. Evaluation of the site and available land will determine if the wetlands can be enhanced through better flow patterns, connection to the stream high waters, and plantings of wetland vegetation. Evaluation of non-wetland areas adjacent to the wetlands can determine whether creating additional wetlands or riparian buffers are possible. UCWA and the Highlands Land Trust will jointly pursue the means of preserving the wetlands through easements or land trust ownership.

Remove sediments from Mirror Lake. With the protection in place upstream on Mill Creek and the Cullasaja River, the lake should be buffered from most sediment impacts in the future. Past deposits should be evaluated (depth, age, etc.) and removed before it reaches a level where sediment removal becomes more expensive or inappropriate (additional wetlands creation). This is the same recommendation as the Cullasaja River junction in Mirror Lake and should be addressed jointly.

4.2.3 Monger Creek

Monger Creek does not have the same scientific database as Cullasaja River and Mill Creek to help develop a strategy and plan. Monger Creek does, however, receive drainage from the downtown area of Highlands (adjacent watershed to Mill Creek); has similar development patterns to Mill Creek; has been noted to have the same problems as Mill Creek by the WARP staff (Leslie, personal communication); and is similar in size and stream length to Mill Creek. All of the general recommendations that were made for Mill Creek are proposed for Monger Creek. The recommendations in the upper Cullasaja River watershed that were made for golf courses can be applied to Monger Creek and the Highlands Country Club.

Determine the sediment loads from Monger Creek headwater areas. Sediment has been noted as an ongoing problem in the Highlands Country Club Lake from sources upstream. Home sites and roads on surrounding mountain terrain have continued to be constructed and may be contributing to excessive sediment. Information on where the sediment is originating and what strategy is needed to reduce this loading is needed.

Seasonal Monitoring of chemical/fertilizer applications in the golf course environment. As recommended in the upper Cullasaja River sub-watershed, monitoring will correspond with the time of applications of chemicals, both in the golf course and in the seasonal residential communities. This would be coordinated with the golf course to monitor only those chemicals that are being used and the information provided to the golf courses for feedback as to the effectiveness of the application's ability to stay on the turf where it is applied. Stormwater sampling should also be timed to catch the first major rain event after applications.

Stormwater monitoring to verify pollutants near Spring Street. Baseline data is needed to determine what specific problems Monger Creek is experiencing, how similar or different to Mill Creek are the problems, what strategy will be required to address the problems, and if the same techniques can be used in both Monger Creek and Mill Creek sub-watersheds.

Stormwater BMPs should be installed throughout the center of Town. As recommended in the Mill Creek sub-watershed, stormwater BMPs should be installed in as many areas as retrofits or in new construction projects as possible. During expansions, new construction, or as retrofits, there are multiple techniques available for on-site treatment and retention of stormwater. There are potential sites within the south and west part of downtown that may be suitable for small to medium scale (more than one building) projects. Most of the properties are privately owned and there will be limited usage of public properties, unlike the Mill Creek watershed. NCSU extension staff with experience in stormwater and stream techniques will be utilized in the design, planning, construction and evaluation of these structures. These structures within the town will improve the water quality of Monger Creek.

Promote stormwater BMP at Highlands Plaza (Bryson's shopping center) during the parking lot retrofit. The parking lot at Highlands Plaza is one of the largest in town. Areas surrounding the paved parking area will be surveyed for potential sites to develop retrofit stormwater control projects such as berms, retention ponds, and small wetlands areas. In addition, a new area is being filled adjacent on Third & US64 for business expansion. UCWA will pursue the opportunity for installation of BMPS during this expansion.

Develop wetlands at the downstream end of Monger Creek at the junction with Lake Sequoyah. The Monger Creek Arm of Lake Sequoyah has lost surface water area to wetlands from past sediment deposits. Similar to the Mill Creek wetland area in Mirror Lake, these wetland areas may be incorporated into a treatment of the stormwater runoff during flood events for natural water quality treatment of solids and nutrients that occurs in wetlands. Evaluation of the site and available land will determine if the wetlands can be enhanced through better flow patterns, connection to the stream high waters, and plantings of wetland vegetation. Evaluation of non-wetland areas adjacent to the wetlands can determine whether creating additional wetlands is possible. UCWA and Highlands Land Trust will pursue the means of preserving the wetlands through easements or land trust ownership.

Remove sediments from the Monger Creek Arm of Lake Sequoyah. With the protection in place upstream on Monger Creek throughout the watershed, Lake Sequoyah should be buffered from most sediment impacts in the future. Past deposits should be evaluated (depth, age, etc.) and removed before it reaches a level where sediment removal becomes more expensive or

inappropriate (additional wetlands creation). This is the same recommendation as the Big Creek Arm and the Cullasaja River junction in Lake Sequoyah and should be addressed jointly.

Pursue opportunities throughout the watershed for preservation and protection. Most of the properties along the streams in this watershed are privately owned. Landowners will be educated through UCWA efforts on the need for stream and habitat protection. Landowners will be encouraged to change practices that impact the water quality, exposed to new techniques that help protect the streams and encouraged to participate in preservation opportunities such as easements or land trust donations.

4.2.4 Big Creek

The Big Creek sub-watershed currently contains the best quality water and stream habitat and the least development. It is almost 30% Forest Service land on the ridgelines. Much of the properties along the streams in the watershed are in private ownership, however. This area also contains some of the least expensive land in the upper Cullasaja River watershed and is positioned for growth in the future. As noted in UCWA assessment of the watershed (Appendix A), Big Creek has experienced some water quality problems in the past with sediment. The main strategy for this sub-watershed is for protection and preservation of the current high quality water and stream habitat.

UCWA and Highlands Land Trust will pursue opportunities for land trust acquisitions or easements. The best opportunity for preservation exists in the mid-section below Chestnut Hill Retirement Development to the Flat Mountain Road Bridge over Big Creek. This area is known for a privately owned well-established and preserved wetlands site for Chestnut Hill residents at Buck Creek Rd & Shortoff Road. Another small wetlands area exists on private property adjacent to the new Macon County facilities and soccer fields on Buck Creek Road.

Establish water quality monitoring site on Big Creek. Little baseline data is known for the water quality on Big Creek (WARP biological monitoring in 2001-2002, DWQ biological monitoring 1999 & 2000). Current state biological assessments show Good to Excellent rating for the creek. Monitoring data will provide information on whether Big Creek is maintaining, improving or degrading water quality in the future. This will allow UCWA and the community to adjust the strategy for protecting Big Creek watershed if necessary in the future. As sediment loading has been a problem in the past and development pressures will exist in the future, stormwater sampling site(s) should be established as appropriate to monitor any increasing impact from sediment during erosion from rain events.

Fishery baseline sampling recommended for Big Creek. Of all the sub-watersheds of the Cullasaja River, the Big Creek watershed should have the best fish habitat of all the streams. The natural limitation on Big Creek is the size of the creek and the population may show less variety of species in the headwaters. Lakes in the upper stretches of the watershed (Wildwood and Cold Springs developments) are stocked lakes. The lower sections should have healthy populations of native fish species based on WARP's water quality assessment. Once a baseline data is established, the community will be informed and encouraged to protect this natural habitat and fisheries through UCWA efforts.

Remove sediments from the Big Creek Arm of Lake Sequoyah. As noted in the UCWA Assessment of Big Creek (Appendix A), the Randall Lake event impacted the Big Creek Arm of the lake with sediment deposits. Past deposits should be evaluated (depth, age, etc.) and removed before it reaches a level where sediment removal becomes expensive or inappropriate (wetland creation). This is particularly important at this location as the intake for the Highlands water treatment plant is in this arm and not in the lake itself. Excessive sediment deposits can impact the quality of the water source for drinking water. This is the same recommendation as the Big Creek Arm and the Cullasaja River junction in Lake Sequoyah and should be addressed together.

5.0 Future Goals and Milestones

In order to accomplish many of the recommendations that have been proposed, UCWA needs to develop local residents' acceptance of the plan and participation in the implementation of the projects. UCWA first milestone will be to contact property owners in the watershed. In 2003, UCWA received funding from NCDWQ from the Section 104 (b) grant to support stakeholder development through 2004 to define specific projects in the watershed. During the remainder of 2003 and all of 2004, UCWA will promote water quality through public education initiatives and direct interface with stakeholder groups and individual property owners. UCWA's process will survey specific properties and stream locations to determine feasibility and property owner interest implementing specific water quality projects. Recognized agency, industry, and university expertise will be brought in to assist in project definition in accordance with EPA's 9-Points of a Watershed Plan. Funding applications for projects that have been identified as feasible will be submitted to appropriate agencies and grant organizations for implementation.

UCWA plans for implementation of projects to begin in late 2004 for design, and for construction, acquisition or landscaping to occur during the years 2005-2007 and beyond. As projects are installed and established, education and promotion of the practices in the community will continue and additional willing partners will be recruited. UCWA foresees that this process will be ongoing for many years as the acceptance of these techniques becomes established in the community. Monitoring of the streams and lakes in the watershed will provide feedback on the success or lack of success of the various projects. Additional goals and recommendations will be included in future revisions of the plan.

UCWA will work with partners in local governments and organizations to achieve these goals. Many past projects and initiatives that are listed in Appendix B are examples of what has been accomplished in the watershed. Building on past projects and relationships, these groups are positioned to continue their efforts towards protecting and restoring the environment in the watershed. These organizations will be involved with the upper Cullasaja River watershed steering committee and participate in locating, developing and monitoring the projects that are selected. UCWA will build upon these past relationships with many of the organizations and groups in the watershed on initiatives that are being actively pursued as detailed in this report.

Grant funding, local matching funds, and property owner cost sharing will be pursued for the water quality improvement projects that the owners and stakeholders have agreed to implement.

Preservation of special wetlands areas and stretches of excellent water quality will be pursued through land acquisition initiatives by the Highlands Land Trust, an UCWA partner in the watershed.

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APPENDIX A
Water Quality, Lake and Stream Health

Water Quality, Lake and Stream Health

Appendix A summarizes current watershed conditions in the upper Cullasaja River watershed, including land use, water quality, stream channel, riparian buffer condition, habitat and wetlands. This Appendix summarizes reports and data that characterize existing watershed conditions and identify existing and potential sources of water quality degradation. Sources of information for this section included NC DWQ Assessment Report: Biological Impairment in the Upper Cullasaja River Watershed (WARP Report, 2002), NC DWQ Little Tennessee River Basinwide Management Report (2002), NC DWQ Little Tennessee River Basinwide Assessment Report (2000), Carolina Environmental Program Reports on Land Use and Biodiversity on the Highlands Plateau, 2000 and 2001; Sediment Report on Randall Lake Dam discharge, (Miller, 2001); and Upper Cullasaja River Watershed Water Resources Study (Wright, 2003).

UCWA has four main streams or tributaries in the watershed – upper Cullasaja River, Mill Creek, Monger Creek and Big Creek. Each of these streams has different watershed characteristics and problems. Two of the streams – upper Cullasaja River and Mill Creek – have been monitored and assessed by the North Carolina Division of Water Quality to be impaired due to non-point source pollution. Big Creek has been biologically sampled in 1999-2002 and was classified as Good to Excellent, but is not proposed for future monitoring efforts. Monger Creek has not been formally assessed but local stakeholders have noted similar problems on this stream as in the Cullasaja River.

There are three reservoirs in the watershed that traditionally have full public access and use, Lake Sequoyah, Mirror Lake, and Harris Lake. All are surrounded by privately owned properties, and all provide public access. The Big Creek arm of Lake Sequoyah provides the Town of Highlands drinking water supply. Lake Sequoyah is designated a Class II Public Water Supply Reservoir. Mirror Lake is a shallow, run-of-the river impoundment that has experienced excessive sediment accumulation from both Mill Creek and upper Cullasaja River in the past. Harris Lake is a small lake in the Mill Creek watershed that is currently experiencing heavy sediment accumulations.

DWQ Use Support Ratings

Most of the long term data available for water resources in the watershed are found in monitoring data from North Carolina Division of Water Quality Ambient Monitoring Program, a state wide program for sampling and analyzing data. Based on the data collected for chemical, physical and biological analyses, the streams are assessed to whether they are meeting their use classification. The use classifications for streams in the upper Cullasaja River watershed are Class C, WS-II and WS-III and Tr (Trout). The explanation of classifications can be found in Appendix B under state regulations.

To determine the biological health of streams, DWQ evaluates the composition and diversity of stream benthic macroinvertebrate communities every five years. These communities can provide important information about water quality stressors such as excessive nutrients, toxicants, and sediment pollution. In addition, macroinvertebrates and fish communities respond to the quality of in-stream habitat, which is influenced by factors such as sedimentation.

Thus, biological communities are reflections of stream integrity as a whole. Chemical and physical data are collected from the streams at the same time as the biological.

As part of this ambient monitoring program, the Biological Assessment Unit monitored the Cullasaja River at US 64 for biological and chemical data in 1990, 1991, 1996, and 1999. Mill Creek was sampled above and below the old WWTP site in 1990 and 1991 before the new WWTP began operation (1994) and in 1999 below the old WWTP site. In 1997 and 2002, DWQ assessed streams in the upper Cullasaja River watershed as part of the basinwide planning process for the Little Tennessee River Basin and determined that upper Cullasaja River and Mill Creek do not support their use classifications for Class C waters. Figure x shows the use-support rating assigned by DWQ for streams in the upper Cullasaja River watershed and the location of the two biological monitoring sites that DWQ sampled in 2000. Streams rated as either Not Supporting or Partially Supporting are considered impaired by the DWQ. Upper Cullasaja River and Mill Creek are listed on the state's 303(d) List of Impaired Waterbodies as Biologically Impaired Waters. The state is in the process of updating the use support ratings for the 303(d) list for the Upper Cullasaja River and Mill Creek. A complete summary of the DWQ Use Support Ratings and Stream Use Classifications for the Little Tennessee River Basin, including the upper Cullasaja River watershed is available at http://h2o.enr.state.nc.us/basinwide/Little_Tennessee/2002/2002_plan.htm. The state 2002 303(d) list can be accessed at http://h2o.enr.state.nc.us/tmdl/General_303d.htm).

NC Division of Water Quality Watershed Assessment and Restoration Project (WARP)

In 1999, North Carolina Division of Water Quality (DWQ) received a grant from the Clean Water Management Trust Fund (CWMTF) to identify causes and sources of stream impairment through intensive monitoring and analysis and to develop watershed management strategies for eleven impaired watersheds across the state. Each of the watersheds in this study contains streams considered impaired because they are unable to support healthy aquatic communities. The upper Cullasaja River watershed was selected as one of the eleven watersheds in the Watershed Assessment and Restoration Project (WARP).

In 2000, the NC Division of Water Quality (DWQ) initiated a comprehensive study of two streams in the upper Cullasaja River watershed. The local study focused on two impaired streams- the Cullasaja River above Mirror Lake and Mill Creek. The overall goal of the project was to provide the foundation for future water quality restoration activities by: 1) identifying the most likely causes of biological impairment (such as degraded habitat or specific pollutants); 2) identifying the major watershed activities and sources of pollution contributing to those causes (such as stormwater runoff from particular urban or rural areas, streambank erosion, or hydrologic modification); 3) outlining ~~a~~ recommendations for restoration activities and best management practices (BMPs) to address these problems and improve the biological condition of the impaired streams.

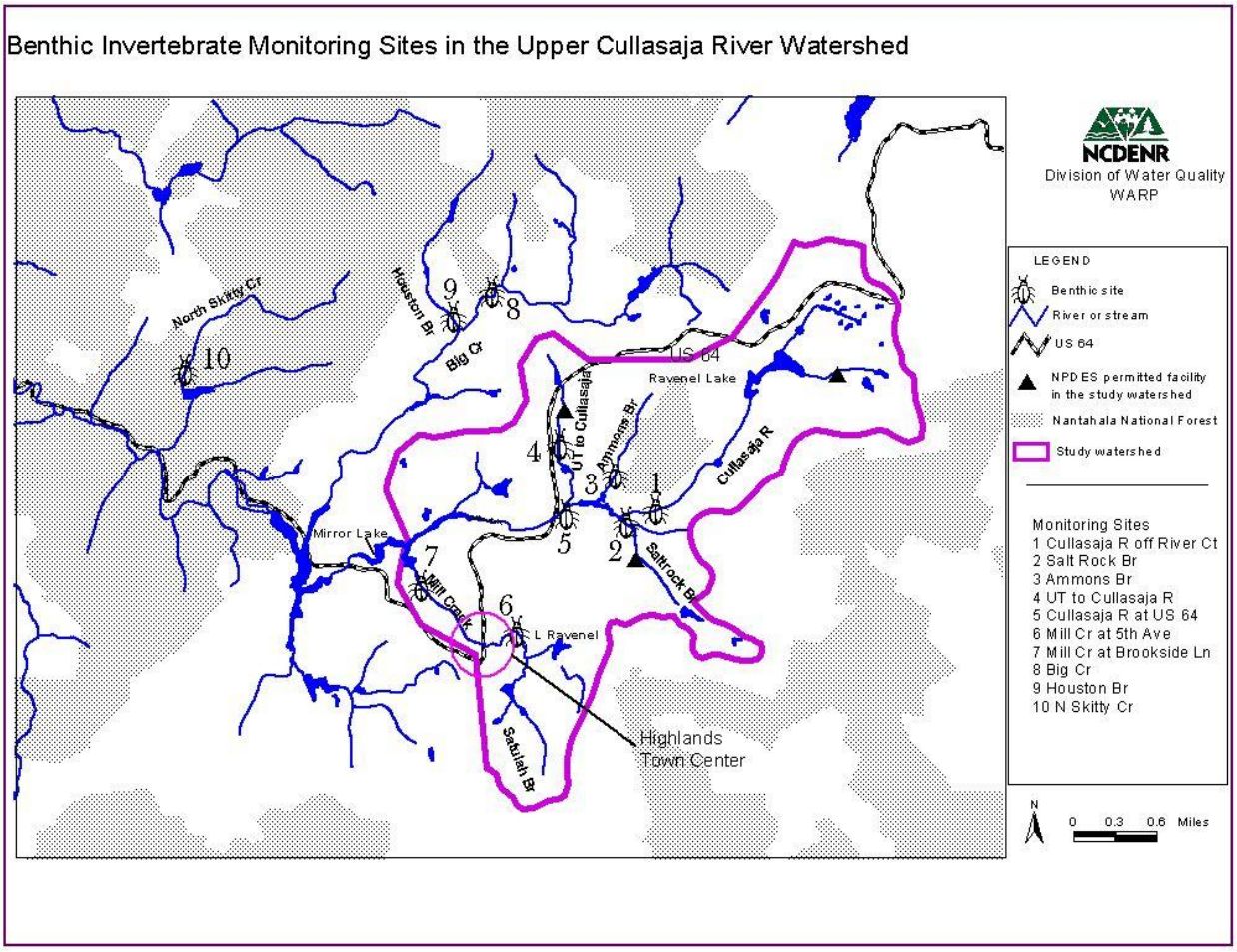
As part of this study, DWQ conducted biological assessments, sampled ambient and storm water quality, and walked many miles of streams in the watershed to assess stream habitat, morphology, and riparian zone condition. The study also evaluated watershed hydrologic conditions, land use, land management activities, and potential pollution sources. WARP only

looked at the portion of the watershed that contained the impaired bodies of water. WARP did use Big Creek sampling points for reference sampling of biological communities but not for other monitoring. The study did include data collection on other streams in the watershed, including Ammons Branch, Saltrock Branch, Houston Branch, and UT to Cullasaja River. Monger Creek and other small tributaries within the watershed were not monitored. A detailed description of all their data collection methods as well as an analysis of their findings is presented in the report titled Assessment Report: Biological Impairment in the Upper Cullasaja River Watershed (DWQ, 2002).

WARP Assessment and Sampling

WARP focused on the two 303(d) listed streams (upper Cullasaja River and Mill Creek) and some tributaries to the main streams in the watershed. However, the issues identified are likely important for many streams in the upper Cullasaja River watershed with similar development patterns and stresses.

Biological Sampling: WARP conducted one to two biological sampling efforts at 7 sites in the upper Cullasaja River watershed and three reference sites outside the watershed between May 2000 and July 2001.



WARP used benthic macroinvertebrate communities to characterize steam health. WARP

evaluated a number of community characteristics, including diversity, pollution tolerance of the community as a whole, and species composition, to determine community health and the types of pollution impacting the streams. In addition to gathering data at known problem sites in the watershed, WARP also collected samples at reference sites to establish benchmarks for healthy biological communities and conducted habitat assessments at all sites to determine if the lack of habitat might also be a potential source of stress for these communities.

Habitat scores considered channel modifications, in-stream habitat (such as leafpacks, sticks, large woody debris and rocks), sedimentation, riparian zone integrity, and riffle and pool frequency. Habitat scores and benthic community scores can be found summarized in Table 2.

WARP found that the healthiest communities are in headwater streams with adequate habitat that drain forested, undeveloped areas of the watershed—North Skitty Creek, Ammons Branch and Houston Branch. Other healthy communities were found in watersheds with less developed land uses including Big Creek and an Unnamed Tributary to upper Cullasaja River. Degraded benthic communities were found at almost all other sample sites.

Degraded biological communities were reported from the urban portions of the watershed in Mill Creek at both the Brookside Lane and the 5th Street sites. Habitat scores were very low in this urban area and likely contributed to the poor biological communities. In addition, the WARP study suggested that the high velocity and volume of stormwater runoff generated by urban development scours the stream channels, removing key habitat such as leafpacks and woody debris.

The upper Cullasaja River biological sampling site at River Court showed variable results, with one not impaired and one impaired result. This site was healthier than the downstream Cullasaja River site. The downstream site at US 64, which is the site that has been monitored over time by DWQ, hosted severely impacted benthic communities. The Salt Rock Branch hosted a community that is very tolerant to stress.

The Mill Creek biological sampling site showed biological communities exposed to periodic organic stress. Suspecting an leaking underground storage tank (LUST) at a old city maintenance garage was the source of this pollution, WARP sampled below the site of the LUST and also requested the NC Groundwater Department to reopen the files on the site. WARP data show continuing pollution, but the groundwater data did not show any impact from the site to the stream. A hypothesis was proposed that the site only contributes groundwater contamination to the stream during high groundwater periods (wetter weather) and that the drought conditions in 2001-2 during the sampling may not have caught the groundwater exporting to the stream.

A number of impacts other than toxicity likely influence the benthic communities at some sites. Sampling of the stormwater system for Mill Creek showed signs of semi-volatile organic contaminants and unauthorized discharges. WARP also determined that in upper Cullasaja River and in many areas throughout the watershed, excess sedimentation exacerbates many of the primary causes of impairment.

Selected Benthic Community and Habitat Characteristics at Study Sites in the Upper Cullasaja River Watershed

Site	Date	Stream Width (m) [1]	Avg. Depth (m)	Substrate % sand and silt [2]	In-stream Structure Score (of 20) [3]	Embedded-ness Score (of 15) [4]	Habitat Score Total (of 100) [5]	EPT Richness [6]	EPT Biotic Index [6]	Bioclassification [6]
Cullasaja R. off River Ct.	5/16/00	3	0.1	30	10	11	38	25	3.72	Not Impaired (at least Good-Fair)
	7/26/01	3	0.2	40	14	6	60	16	4.63	Not Rated**
Salt Rock Br. at Falls Dr. E	7/26/01	1	0.3	85	10	4	37	5	5.52	Not Rated**
Unnamed tributary off US 64	7/25/01	3	0.2	20	16	13	87	23	2.38	Not Rated**
Cullasaja R. at US 64	8/28/00	5	0.3	55	14	8	69	18	5.12	Fair
	7/25/01	5	0.6	55	14	10	69	10	5.92	Fair
Mill Cr. at 5th Ave.	5/17/00	3	0.3	45	9	8	70	13	4.51	Not Rated*
	8/29/00	2	0.1	60	10	5	49	11	5.36	Not Rated*
Mill Cr. at Brookside Ln.	8/28/00	3	0.2	20	14	12	76	17	4.51	Not Rated*
Reference Streams										
Ammons Br. off Spruce Ln.	7/25/01	2	0.1	30	13	15	93	20	1.15	Not Rated**
Big Cr. at Buck Cr. Rd.	8/29/00	4	0.1	80	16	8	83	41	2.48	Excellent
	7/25/01	3.5	0.5	25	17	13	89	29	2.22	Not Rated**
Houston Br. at Simon Speed Rd.	8/29/00	1	0.1	50	14	9	82	25	1.97	Excellent
North Skitty Cr. at Cliffside	8/29/00	2	0.1	30	16	12	92	28	1.61	Excellent

[1] **Wetted channel width at times of sampling.**
[2] **Based on visual estimate of substrate size distribution.**
[3] **Visual quantification of the of in-stream structures present, including leafpacks and sticks, large wood, rocks, macrophytes, and undercut banks/root mats.**
[4] **Estimation of riffle embeddedness.**
[5] **See text for a list of component factors.**
[6] **See text for description.**
* Sampled with Qual 4 method. Impacted, but too small to rate.
** Sampled with Qual 5 method, which currently has no rating method.

NCDENR
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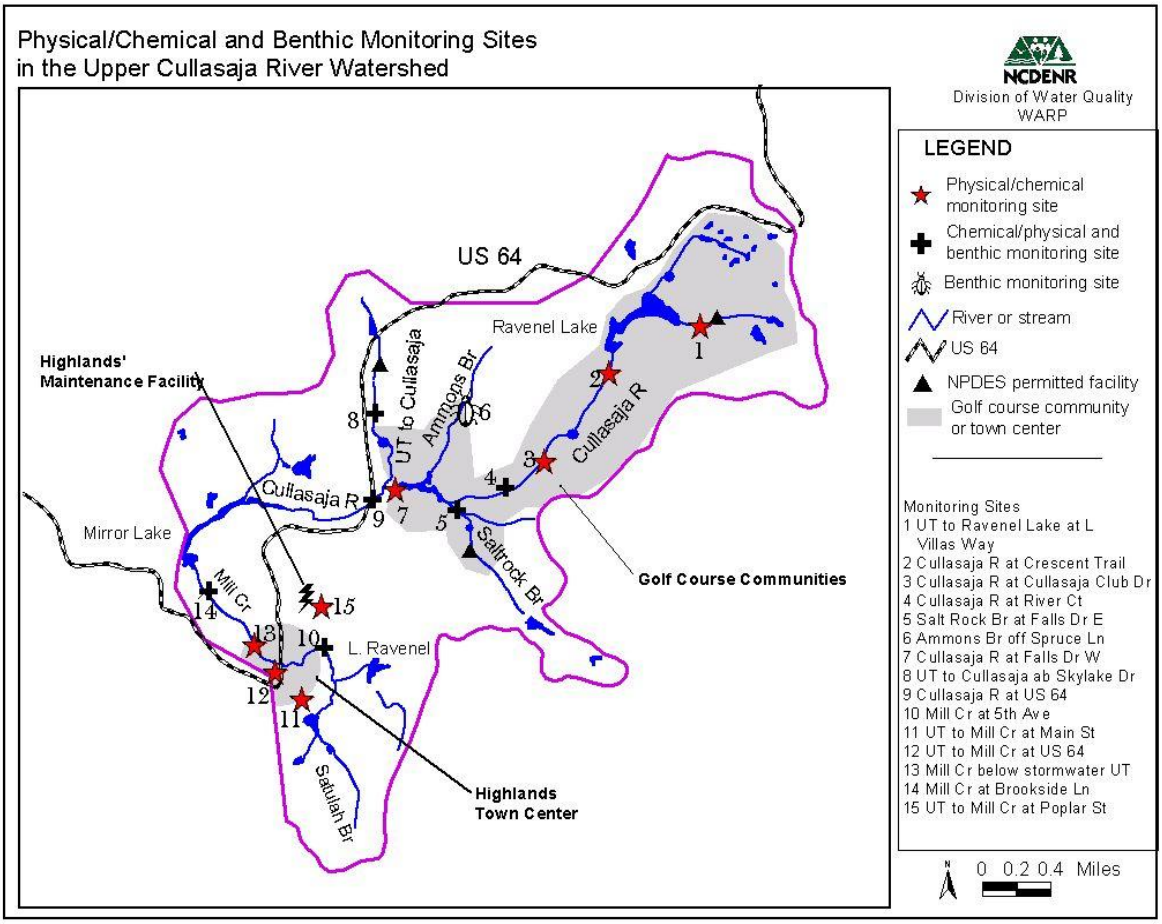
Chemical Water Quality Sampling: In addition to biological sampling, WARP also conducted extensive chemical water quality sampling to characterize water quality conditions in the watershed and to evaluate whether chemical and physical conditions might be negatively affecting benthic communities. WARP established seven sampling stations throughout the watershed and evaluated these sites during an 18 month period for a standard set of parameters including pH, dissolved oxygen, conductivity, temperature, metals, turbidity, solids, fecal coliform and nutrients. Samples were collected during baseflow for all sites and stormflow for Mill Creek at Brookside Lane and upper Cullasaja River at US 64. WARP also collected grab samples at a number of sites in the watershed with known biological impairment. The purpose of the grab samples was to assess potential chemical stressors such as pesticides, hydrocarbons and volatile organic pollutants. The location of WARP water quality sampling sites in the upper Cullasaja River watershed are shown in the attached figure.



WARP chemical water quality monitoring data indicated that the upper Cullasaja River and Mill Creek had normal range of results for nutrients and fecal coliform. Dissolved oxygen levels in these streams were adequate for aquatic life.

Water samples taken during baseflow in the upper Cullasaja River watershed had no levels of insecticides that were above ecological screening benchmarks. Bed sediment samples collected

from upper Cullasaja River revealed high levels of metals and chlorinated pesticides (historic applications, currently banned), but no evidence of current pesticide application impacts. WARP indicated concern about pesticide applications in the watershed as a contributing factor to the impaired conditions.

Water samples were tested semi-volatile organic contaminants on two sites in the Mill Creek watershed. Two tributaries to Mill Creek did show detection of compounds, including naphthalene, p-xylene, m-xylene, toluene and benzene. Most were below screening levels for causing impairment on their own, but accumulative effects may be of concern.

WARP also evaluated selected metals concentrations in the watershed including cadmium, copper, lead, and zinc. Median metal values for baseflow samples collected by WARP were generally below NC's standards or benchmark levels. However, the stormflow sample exceeded the benchmark levels for cadmium and copper. Bioassay results from these samples indicated that these metal levels were not acutely toxic. For a more detailed discussion of the WARP monitoring protocol, sampling results and analysis, see the report titled Assessment Report: Biological Impairment in the Upper Cullasaja River Watershed, 2002.

Other problems noted in the watershed including elevated conductivity readings, especially on tributaries to Mill Creek associated with the Volatile Organic Contaminants (VOC). During snowmelt, high conductivity was measured in several storm drains and ditches in the Mill Creek drainage. A sample for chloride was taken and showed 94 mg/l, evidence of road salt impact. Another site on Main Street was sampled for fecal coliform and showed evidence of raw sewage in the storm drain. The WARP report noted that residents have observed periodic occurrences of suspicious substances in the stormwater drainage network of Highlands. Soapy substances, milky white discharges and petroleum smells have been noted. None of the potential sources of these discharges were verified or located.

General Conclusions of WARP Assessment

WARP used the data summarized to determine causes and sources of biological impairment for upper Cullasaja River and Mill Creek. WARP study did not determine any one factor that was causing the biological impairment in the watershed, rather that the restoration of water quality will require broad based, watershed-wide solutions. WARP concluded that a number of factors impact water quality and stream health in the upper Cullasaja River watershed and would need to be addressed by any watershed restoration. They include dams on the streams; natural stream channel alteration; stream habitat; scour from stormwater; and organic pollutants.

Dam Impacts: Man-made dams creating lakes and ponds throughout the watershed have altered the natural flow and blocked colonization of fish and aquatic organisms from above and below dams. The total number of dams, of all sizes in the watershed is of concern. If the impacts of the dams are not reduced, WARP concludes that the recovery of the Cullasaja River will be limited.

Stream Channel Alteration: Extensive stream channel alterations have occurred in the watershed over the years. Stream channelization has resulted in straightened and unstable stream banks, eroding banks or artificially hardened stream banks (rocks, walls) that have reduced the

natural riparian habitat. Often the channel alterations are associated with the removal of riparian vegetation, wetland drainage or filling and the replacement of canopy (trees and shrubs) with grass/low growing turf. This reduces the natural filtration of stormwater and increases the temperature impacts to the cold-water streams.

Habitat Degradation: Poor in-stream habitat for biological communities was a widespread problem in the watershed, but most notable in upper Cullasaja River and Mill Creek. Lack of woody riparian vegetation, leafpacks, and large wood has reduced the organic microhabitat.

Stormwater: In urban streams, the combined factors of toxicants (e.g., metals, organic pollutants, and pesticides) and scouring energy from high stormflow volumes severely limit biological communities. BMPs for developers should be encouraged and the municipality and the county should continue to support policies that protect the streams and lakes from erosion and sedimentation.

Organic pollutants: Sources of high levels of organic contaminants should be located and steps taken to remove the discharge. Unauthorized discharges to the stormwater system should be found and stopped.

Combined impacts of toxicants from urban sources, scour from high stormflow volumes, poor in-stream habitat, and a lack of access (colonization) to tributaries with healthy biological communities due to dams are thought to be responsible for chronically impaired biological communities in upper Cullasaja River and Mill Creek.

UCWA Stream Assessment

Mill Creek sediment plume in Mirror Lake, June 2003

UCWA, Highlands community and the regional environmental agencies have observed that historic practices from logging, construction, road building and general earth moving activities have resulted in many years of erosion and sediment impacts to the streams in the watershed. Combined with the practice of removing or filling in wetlands which removes a natural control for filtering sediment from the streams, the sediment loads have been excessive in the past. Gravel roads are common throughout the watershed and are a possible source of sediments to mountain streams (Pigeon River Watershed Plan, 2003; Mud Creek Watershed Report, 2003). UCWA and the community have worked with the local governments in addressing the sources of sediment and have made progress to ensuring less erosion in the future. However, several streams and tributaries during rainfalls show excessive sediment which is impacting the water

quality of the affected streams. The streams themselves have been noted to contain deposits of the sandy soil so common in the region. The historic bedload of sediments from past erosion may be slow to be flushed from the system. The sediment may not be the current reason for the impairment as noted in the WARP study, but it is considered by stakeholders to be a significant component of a cumulative effect that results in the loss of stream bottom habitat and impairment of the streams.

Monger Creek, a stream flowing through urban Highlands and the Highlands Country Club was not assessed by DWQ, but has many of the same characteristics of Mill Creek in the downtown area and similar to upper Cullasaja River in the golf course area. The DWQ staff performing the WARP assessment did note that Monger Creek was experiencing the same degradation and impacts that were observed in Mill Creek and that this stream would need actions taken to prevent further degradation. Monger Creek and its northern tributaries drain approximately one-half of the Town of Highlands' stormwater flow to Lake Sequoyah via a system of open ditches and small streams. UCWA has observed sediment, stream bank erosion and stream habitat modifications that would impair the water quality in Monger Creek. The Monger Creek arm of Lake Sequoyah is experiencing sedimentation, a loss of water depth, and emerging wetlands vegetation. It is a high priority for UCWA to address the water quality problems in Monger Creek along with Mill Creek and upper Cullasaja River.

Big Creek is the least impacted and the least developed of the four watersheds. The headwaters of the creek and several of its tributaries start in the Nantahala National Forest. Those reaches of stream drain forested watershed and old growth forest and have little impacts from any developments. The rest of the watershed is in residential use or undeveloped parcels. Development density is light relative to the rest of the Cullasaja River watershed. The stream is considered unimpaired and in good to excellent condition. However, even in this watershed impacts from development can be observed with erosion impacts from residential construction sites. One major source of water quality impacts that concerns the Town of Highlands and UCWA is the dam at Randall Lake. Privately owned, the lake is located on Flat Mountain Road just below the junction of Big Creek and Houston Branch. In 2001, the owner breached the dam without taking into consideration any environmental impact. The release of lake water had several impacts:

1) The volume of the discharge was large enough to create scour as it discharged down the creek;
2) Sediment was released from behind the dam and deposited throughout Big Creek in pools and eddies;
3) The dam was not correctly removed and as a result, catches woody debris at the dam face until a semi-solid structure forms, refills with water until the water pressure and/or rainfall breaks through and discharges a flood event again.

Waterfront residents along the Big Creek arm of the lake have long been distressed by the loss of recreational waterway use and concerns about decreasing property values resulting from the heavy sediment accumulations. Water long used for boating and fishing are today only inches deep. A sediment study conducted in the summer of 2001 by Dr. Jerry Miller of WNCU measured sediment profiles in the Big Creek arm of Lake Sequoyah to determine the impact of

the Randall Lake event. The study found determined that the recent sand sediment accumulation in the Big Creek Arm of Lake Sequoyia and the change in sediment character within Big Creek came from the sediment deposits that collected behind the Lake Randall dam. There was no other significant sources of the sandy sediments between Lake Randall and Lake Sequoyia that would accounted for the amount (75 cm or 30 inches) of sediment deposited in the lake. The Miller report was commissioned by the property owners along the lakefront.

Big Creek had not been historically evaluated by the state because it was not on the 303(d) list of impaired waters of NC. DWQ did biological monitoring below the Randall Lake dam in 1999 and 2000 and the benthic community was rated Excellent and Good respectively. In 2001-2002, WARP did use two sites in the Big Creek watershed as reference sites for biological monitoring. The biological monitoring results could not be rated due to the size of the stream, but the study showed Big Creek in unimpacted conditions with similar community structure to other mountain streams rated as Excellent. The impacts from any existing or past sedimentation at these Big Creek sites have had short term or limited impact so far on the biological community. The WARP biological monitoring sites were above the Randall Lake and thus do not show the impacts from the reoccurring environmental events below Randall Lake.

The area immediately around Skyline Lodge and Randall Lake is currently experiencing the highest rate of development in the Big Creek watershed. Big Creek's pristine condition may not last with increasing development pressures in the watershed.

UCWA Lake Assessment

Two public lakes in the watershed, Mirror Lake and Lake Sequoyah, have experienced many years of water quality impacts. Mirror Lake, a small impoundment on the lower end of the upper Cullasaja River watershed, has experienced extremely high sediment accumulation. It has currently lost over 7-9 acres of lake surface area to sediment deposits which have created wetlands and dry land. The rest of the lake has become so shallow (ave 3.0 feet depth) that it is in grave danger of losing all lake attributes. Mirror Lake Improvement Association (MLIA), the local lake community, has made efforts for over a decade to control the amount of sediment entering the lake locally through working with NCDOT on sediment basins, educating property owners on the lake and investigating methods to remove enough sediments to restore the lake for recreational use. UCWA realized that unless the sediment problem throughout the watershed was resolved and the historic sediment load addressed, any project to restore the depth of the lake would be temporary in nature. UCWA and MLIA now believe effective local regulations and controls are in place and that a lake restoration project is practical.

Lake Sequoyah has not experienced widespread sediment damage to the extent of Mirror Lake; however, the Big Creek arm of Lake Sequoyah has experienced sediment accumulations very similar to Mirror Lake. Mirror Lake is currently acting as a sediment catch basin for the upper Cullasaja River and settling most of the sediment out before it reaches the main body of Lake Sequoyah. This benefit is no longer functioning as well as in the past as sediment deposits in the Cullasaja River arm of Lake Sequoyah have been noted. The Monger Creek arm of the lake has also shown increasing loss of depth in the stream channel and formation of wetlands. Other

lakes in the watershed have noted sediment loads, and many of the golf course community lakes are dredged annually.

Because sediment and erosion control issues are being addressed and controlled in the watershed, it is a high priority to UCWA to restore the remaining open water of Mirror Lake and the impacted arms of Lake Sequoyah to original or useable depths. This will enable recreational uses to resume and continue into the foreseeable future. It will also provided another level of protection for the lakes and the Cullasaja River in the case that an unforeseen incident occurs and a sediment load enters the lakes, the deposition will not have as great an impact. They will continue to act as a natural settling basin to protect the lower Cullasaja River and Little Tennessee River downstream.

SEWER SYSTEM INFILTRATION

A recently completed Inflow and Infiltration (INI) Study conducted for the Town of Highlands reported significant storm water flows into the town's sewer system. Treatment of high stormwater flows in inefficient and uneconomical for the operations of the Highlands wastewater treatment plant. The Town is taking remedial action based on the INI study. Like many other municipalities, treatment of stormwater flows is inefficient and uneconomical for the operations of the Highlands wastewater treatment plant. During the study, the testing methods showed no discharge of sewer to the surface waters, either into storm drains or into the creeks. Although not a replacement for techniques to determine sewer leaks out of the system, this recent study provided data that indicates sewer leaks are not a major concern at this time in the city system.

Appendix B
Local And State Water Quality Initiatives and Organizations

Local And State Water Quality Initiatives and Organizations

Upper Cullasaja Watershed Association (UCWA)

UCWA is a citizen-based, nonprofit watershed protection organization dedicated to the preservation of water quantities and water quality in the watershed. Since 1999, UCWA has led local efforts to restore scientific measurement systems through partnering with local governments, state and federal agencies, and local and regional environmental groups. UCWA's key values are based on a non-adversarial approach and the demonstrated ability to form effective working relationships with any interested group. Land developers, contractors, and area golf clubs are considered important stakeholders in the watershed, along with concerned citizens, property owners, environmental groups, and government agencies.

UCWA has been instrumental in obtaining the installation of a USGS stream gage on the Cullasaja River at Turtle Pond Road bridge and implementation of a ten-gauge rainfall measurement system using UCWA-operated gauges and partnering measurements from the TVA, local golf clubs, and the highlands Biological Station. Additionally, two professional hydrogeological studies of watershed surface and ground water resources have been completed since 2000.

There are many local regulations that are currently in effect in the watershed that help to protect and prevent degradation of the water quality of the streams in the area. These include permitted discharges, erosion and sediment control, trout water protections, illegal discharges, etc. Due to previous efforts of the Town of Highlands, Macon County and UCWA, the watershed of the upper Cullasaja River is protected by some of the best regulations in the state for preventing water quality problems. Erosion and sediment control is one of the strongest in the state – requiring permits for land disturbances of one-half acre or grater in Macon County and 3,000 square feet or more in the town of Highlands, local Watershed Protection Ordinances, promotion of Clean Water Contractors with special training and experience in erosion control, special steep slope regulations, and other state of the art techniques have been implemented in recent years. Through education of the local governments, landowners and the contractors, the UCWA is creating an atmosphere where the best is the expected result. People are becoming more willing to ask contractors for replacement or repairs on erosion control methods that have failed, to fully fund a project to ensure correct erosion control, or to report poor construction techniques to the appropriate authority. Contractors are becoming more educated about proper design and installation of Best Management Practices (BMPs). UCWA through newspaper articles and education, has provided citizens with the knowledge of what is expected and to whom to report non-compliance projects. UCWA is also willing and able to work as a reporting entity for those complaints that come to their attention.

In 2000-2001, Tennessee Valley Authority (TVA) provided funding to the Upper Cullasaja Watershed Association (UCWA) to support organizational capacity growth and UCWA's efforts to restore scientific measurement systems to the watershed. In 2000, the North Carolina Rural Center funded a Macon County grant to develop an inventory of water resources in the watershed and to develop a water management plan for groundwater and surface waters. UCWA defined and managed these studies for the Macon County grant. TVA's annual funding support

to UCWA continues as this local stakeholder organization transitions its watershed improvement efforts from studies of water resources availability to water quality improvement and other emerging issues.

In 2002, the Environmental Protection Agency (EPA) Region IV in Atlanta, GA awarded the UCWA a Regional Geographic Initiative grant to develop a watershed strategy and action plan for addressing the water quality problems in the upper Cullasaja River watershed. This initial plan will document the existing conditions in the watershed, identify known pollution sources, propose projects that will address the problems and suggest possible funding sources for the solutions. The Plan will not be a static document and will be expected to adapt to the changing conditions in the watershed area, whether it be improved or degraded conditions. The Plan will provide UCWA and the community at large with goals and measurable ways to track the progress towards improved water quality in the watershed.

As part of the Regional Geographic Initiative grant, UCWA has been contacting citizens, businesses, and organizations to determine the stakeholder concerns and issues in the watershed and possible solutions. Four stakeholder meetings have been held to gather issues and input for the watershed strategy. These meetings included local environmental groups, agencies and local government, representatives of the four area golf courses, and individual citizens. UCWA has met with the town of Highlands Town Engineer to tour existing stormwater system and the site of the town's previous waste water treatment plant to investigate its potential for use as a stormwater retrofit project site. UCWA has additionally met with the Town Board and requested discussions with the appropriate committee to present UCWA's concepts for cooperative and voluntary stormwater control initiatives.

In 2003, UCWA received funding from NCDWQ from the Section 104 (b) grant to support stakeholder development for specific projects in the watershed through 2004. During the remainder of 2003 and all of 2004, UCWA will promote water quality through public education initiatives and direct interface with stakeholder groups and individual property owners. UCWA's process will survey specific properties and stream locations to determine feasibility and property owner interest implementing specific water quality projects. Recognized agency, industry, and university expertise will be brought in to assist in project definition in accordance with EPA's 9-Points of a Watershed Plan.

Upper Cullasaja River Watershed Steering Committee

In order to develop the Watershed Strategy and Action Plan, the Upper Cullasaja Watershed Association has taken the leadership role in the community. UCWA, local stakeholders, state and federal resource managers have been working together as an informal steering committee to develop the priorities for restoring and protecting upper Cullasaja River watershed. Beginning in the first quarter 2003, the UCWA brought together these interested parties in planning meetings to participate in the development of the Upper Cullasaja River Watershed Strategy and Action Plan. The members included local government officials from Macon County and the Town of Highlands, state and federal agency officials, business, environmental and community group representatives. A formalization of the Steering Committee is planned and additional quarterly meetings are planned during stakeholder development and subsequent project implementations.

The Steering Committee will meet periodically to review and provide guidance on UCWA's strategy, progress in implementing the action plan, development of projects and landowner commitments, public education, and funding sources. The Plan developed documents the efforts undertaken to date by these partners to evaluate all possible sources and causes of water quality degradation and recommends a comprehensive set of strategies for addressing these problems.

NASA Satellite Research Project

The State of North Carolina has obtained NASA funding to participate in a research project using remote sensing imagery from NASA and commercial satellites. Initially, four pilot research sites have been selected.

UCWA's executive director met NASA's principal investigator, Mr. William Graham, of the Earth Science Applications Directorate, Stennis Spaceflight Center, MS, at the Southeast Watershed Forum in 2002. In discussions with Mr. Graham, the NC Center For Geographic Information Analysis, and Region A Economic Development Council of western North Carolina, UCWA and the LTWA recommended Macon County for the mountains pilot research site for this satellite technology project.

Recently Macon County has been selected to be one of the four sites for this important project. The research will investigate several different types of remote sensing imagery, data analysis methods, and the accuracy with which impervious surface coverage can be calculated using satellite imagery. UCWA and LTWA will be working with the project team to make specific recommendations relative to the Little Tennessee River and Cullasaja River basins, specific focus on the two specific areas in Macon County (the towns of Franklin and Highlands) to produce impervious surface ratios for the highly urbanized areas, and providing volunteers as requested to assist in ground truth data gathering in the watersheds.

The North Carolina Impervious Surface Research Project will likely be conducted over a period of three to five years. The technical results of this research will be used in the watershed to educate local governments and the public about impervious surface coverage and its relationship to stormwater runoff and control.

USGS Groundwater Study

A joint groundwater research project of the U.S. Geological Survey (USGS) and the NC Department of Water Resources (DENR) was initiated in 2000. Named the Blue Ridge-Piedmont Groundwater Research Project, this first-of-a kind research into groundwater supplies in the western mountain region is comparing groundwater characteristics in two mountain watersheds. Drilling is nearly complete in the Bent Creek watershed in Buncombe County. The project plan calls for drilling of monitoring wells to begin in the upper Cullasaja River watershed within the next two years. Local residents are very interested in this project that will significantly increase the understanding of the local groundwater systems.

Little Tennessee Watershed Association (LTWA)

The Little Tennessee Watershed Association, Inc. (LTWA) is a citizen-based organization of Macon County actively engaged in public education, public service and in studying, monitoring, and improving the Little Tennessee River watershed from its headwaters to Lake Fontana. The LTWA has been very effective in working with local landowners to achieve miles of stream bank restoration along the Little Tennessee River in recent years.

LTWA monitored total suspended sediment in the Cullasaja River watershed for one year with four stations on the Highlands Plateau. Fish and benthic macroinvertebrate communities in the Cullasaja River watershed are monitored for LTWA and the Tennessee Valley Authority. Fish data for the upper Cullasaja River watershed are available for two sites. LTWA and UCWA are also part of the Macon County Watershed Council, which advised the Macon County Board of Commissioners and the county's municipal governments on watershed protection and water resource management planning.

The LTWA and Macon County are currently completing an extensive greenway project and public trails along the banks of the Little Tennessee River in Franklin, NC.

Macon County Watershed Council (MCWC)

In 2000, the UCWA and the LTWA were asked by the Macon County Board of Commissioners to form a citizen council to advise the commissioners on issues dealing with water resources and water quality. The MCWC is comprised of four members appointed by the LTWA and four members appointed by UCWA. MCWC works closely with the Macon County Planner and the Manager of Projects, as well as the County Manager and the Board of Commissioners to address issues brought to the MCWC by the commissioners.

The MCWC performed the lead role in drafting and promoting the Macon County's Erosion and Sedimentation Control Ordinance, and in leading the community efforts to revise the county's Watershed Protection Ordinance to include special protection for the pristine section of the Little Tennessee River downstream of Lake Emory. Public education of the water-related issues important to Macon County is an important role of the MCWC.

Little Tennessee Non-Point Source Team

The Little Tennessee Non-Point Source Team was formed by the NCDWQ to address the problems and concerns that were documented in the Basinwide Management Reports. The team is led by state watershed planning group and consists of government, agencies, local community organizations and individuals who have a stake in the water quality of the watershed. This group has led efforts to identify problems and find solutions in the Little Tennessee River Watershed.

North Carolina State Government

The watershed is within the governmental jurisdiction of the State of North Carolina, Macon County and the Town of Highlands. The governmental units have regulations and laws

concerning various activities under governmental oversight that can impact water quality in the watersheds. The state regulations in many cases are locally enforced after the local program is approved by the state. State programs that are currently regulated or enforced by the state are listed below.

Stream Classification System

The State of North Carolina assigns a classification based on usage to every stream in the state. The classifications that are found in the Cullasaja River watershed are as follows:
Class C waters are protected for secondary recreation, fishing, and aquatic life. Class C is the minimum protection class for freshwaters.

Class B waters are protected for primary recreation including frequent, organized swimming. Water quality standards applicable to Class C apply to Class B waters in addition to more stringent standards for bacterial pollution.

"Tr" is a supplemental classification designed to protect freshwaters for natural trout propagation and the survival of stocked trout, it does not denote the presence of trout in a stream. Trout water (Tr) sections of Class B and C waters retain all respective water quality standards with the addition of more stringent standards for dissolved oxygen, temperature, turbidity and chlorine.

The state classification of trout waters requires protection from excessive turbidity and temperature changes, more so than Piedmont and coastal plain waters. Enforcement of these rules is through the state and regional offices of the Department of Environment and Natural Resources, Division of Water Quality. NPDES permitted discharges (wastewater effluent) in Trout waters have stricter requirements for solids and temperatures than discharges into other waters.

The state classifies the Cullasaja River and its tributaries in the Highlands area as Water Supply II and III due to the Town of Highlands intake on the Big Creek Arm of Lake Sequoyah and as supplemental classification to C or B as Trout waters. The water supply regulations require riparian buffers along the streams and lakes, reduced density development or stormwater controls on higher density development; restrictions on the type of developments next to the streams and lakes (no industrial or chemical facilities, etc.) and other land use restrictions in order to protect the water quality of the drinking water source. These regulations are detailed and put into approved ordinances by the local governments in the area of the drinking water supply. In the upper Cullasaja River and Lake Sequoyah area, The Town of Highlands and Macon County administer and enforce the regulations for water supply protection.

State Point Source Discharge Permits

Discharging to the watershed streams are four wastewater treatment plants (WWTP) and one water treatment facility that are permitted by the National Pollutant Discharge Elimination System (NPDES). A fifth site on Monger Creek, the S&B Associates plant, was recently taken out of operation (Fall 2002) and the users connected to the town sewer system. The currently permitted facilities are as follows from headwaters of the Cullasaja River going downstream:

Wildcat Cliffs Country Club at the headwaters of the upper Cullasaja River, above Ravenel Lake. It is permitted to discharge 0.05 million gallons per day (MGD or 50,000 gallons per day) and has recently expanded the facility capacity (2002).

Highland Falls Country Club (permit NC0075612), a residential golf community, is permitted to discharge 0.135 MGD (135,000 gpd) to Salt Rock Branch.

Highland Falls Community Association (permit NC0059552) is permitted to discharge 0.003 MGD (3,000 gpd) to an unnamed tributary to the Cullasaja River. This facility is a small sandfilter system plus ultraviolet treatment that rarely discharges to the stream due to the low volume of flow and the high hydraulic potential of soils beneath the system.

Skyline Lodge (permit NC0036692) is permitted to discharge 0.01 MGD (10,000 gpd) to Big Creek.

Highlands Water Treatment Plant (permit NC0032778) is permitted for an unlimited volume of discharge to Big Creek. This is treated backwash discharge from the water treatment process and the treatment consists of settling solids and removing disinfection byproducts before discharge. No sewage is involved.

There are three other facilities that are located in or serve developments (collection system) in the watershed, but discharge to the adjacent watershed basin. Cullasaja Club, VZ Top Homeowners Association and Mountain Laurel Homeowner's Association all discharge to tributaries to the adjacent Savannah River Basin.

State Non-Discharge Permits

There is one non-discharge system currently permitted by the North Carolina State Division of Water Quality for facilities treating wastewater with no discharge (ND) to the surface waters of the state in the watershed. The Cottages at Lake Osseroga (permit WQ0015869) is permitted to operate a spray irrigation system with a capacity of 2,400 gallons per day of domestic wastewater. This is a new community development and the system was not in operation as of June 2002. Another non-discharge system (golf course spray irrigation) at the Cullasaja Club was allowed to lapse and has not been renewed. The facility was permitted for irrigation use until mid-1990s when the permit was not renewed due to wet weather conditions in the area. The Cullasaja Club is pursuing the option of renewing the ND permit because of the drought conditions of the past several years.

State Land Use Regulations

The state regulates land-disturbing activities that can result in erosion of sediments to the surface waters of the state. In 1973, the state adopted the NC Sedimentation Pollution Control Act to control erosion and sedimentation from road building and development activities. Most of the development regulations are delegated to local authority, but some restrictions remain with the state. In accordance with the Act, public projects (i.e., NC DOT, Natural Gas Pipelines, Water

and Sewer Utility Lines, etc.), timber or lumber projects, and agricultural projects are excluded from the local jurisdictions. Forestry operations are required to meet performance standards and implement best management practices to control sediment pollution. Many of the recent sedimentation problems in the watershed have been attributed to DOT and public projects. The state enforces the sediment regulations through Regional Offices across the state. Macon County and the Town of Highland are covered by field staff out of the Asheville Regional Water Quality Office.

State Stormwater Regulations

The upper Cullasaja River watershed is not currently subject to any federal or state stormwater regulations. EPA has developed a Phase II stormwater program mandating that small communities not previously subject to federal stormwater requirements apply for permit coverage. Under the new Phase II stormwater program, local towns and governments must develop and implement a comprehensive stormwater management program. This program must include six minimum measures: (1) public education and outreach on stormwater impacts; (2) public involvement/participation; (3) unauthorized discharge detection and elimination; (4) construction site stormwater runoff control; (5) post-construction stormwater management for new development and re-development; and (6) pollution prevention/good housekeeping for municipal operations.

Though the upper Cullasaja watershed is not included in Phase II stormwater rules automatically, there is an option under North Carolina rules that allows the State (DWQ) to recommend for inclusion in these rules other areas that are not meeting their use standards (impaired bodies). This recommendation can occur during the basinwide planning process, which has just been completed in 2002 and will be up for review in 2007 for the watershed. If the upper Cullasaja River and Mill Creek have not shown improvements in water quality by that time and the technical staff feels that stormwater is contributing to the impairment, the state does have the ability to recommend that this area come under Phase II stormwater controls.

Town of Highlands Regulations

Watershed Protection Ordinances

The Town of Highlands adopted a local Watershed Protection Ordinance and enforces it through the town zoning ordinance. The entire watershed is classified as a public water supply watershed with WS-II, WS-III, and WS-III CA (critical area) classifications in the sub-watersheds. The classifications in Town are WS-II-CA (a very limited area near the Water Treatment Plant), WS-III-CA, and WS-III-BW. The ordinance limits development density using the state's built-upon restrictions and a 30-ft construction buffer. No "development" is permitted in the natural vegetative buffer at all; enforcement would not be limited to construction, but would also apply to any development after a Certificate of Compliance/Watershed Occupancy Permit is issued, as violations are reported. The buffer in the entire Critical Area (WS-II-CA & WA-III-CA) is 50-foot and the WS-III-BW buffer requirement is 30 foot, both in the Town and the County Ordinance.

A watershed protection Permit is required along with a Zoning certificate. To obtain the permit, development plans are reviewed by the Town Watershed Administrator, and commercial projects are reviewed by an Appearance Commission and the Zoning Board. The Zoning Board would consider watershed issues under its obligation to ensure that a project "meets all required conditions and specifications." The Ordinance limits development density through a combination of lot size and "built-upon" limits; that is, pre-existing lots smaller than the minimum lot size are not simply "grandfathered," but regulated by built-upon limits. This approach is unique among NC local governments, and The Town of Highlands is not aware of any other local jurisdictions taking this approach.

One weakness noted in the current watershed protection ordinance is a loophole inherent in the state law that drops or waives the built-upon limits for properties greater than 1-acre in size. The "loophole inherent in State law" does not prohibit the Town from strictly enforcing the natural vegetative buffer, regardless of the lot size or a lot's existence at the time of adoption of the Ordinance; however, many property owners view this as an area where both the state law and the local ordinances can and should be improved by extending the built-upon limits in each WS-classification to all properties, regardless of size.

Highlands has various zoning rules and classifications that protect and preserve the natural environment of the watershed. The Town has more restrictions and less leeway for high density development than the County. Highlands uses three broad zoning classifications – residential, commercial and government and limits the areas that the different development may occur. In the commercial zones, a high density option (70% built-upon) is permitted in 5% of the watershed. The town's assessment of the total developed area in the SIA category is about 2% of the watershed - well below the 5% allowed by the town's ordinance or the 10% allowed by the state's high-density option.

Erosion and Sedimentation Control

In the upper Cullasaja River watershed, years of unregulated development activity have been replaced by proactive local regulations, enforcement, and local concern. The Town of Highlands implemented local erosion and sedimentation ordinances in 1993. Macon County implemented its local ordinance in April 2000. Both ordinances require permits and are more stringent than the NC state law, and both contain special provisions for steep slopes. The entire watershed is now covered by locally enforced erosion control ordinances (excluding the national forest lands and publicly-funded projects).

The town has a series of stiffening plan requirements as the slope increases in several ranges. The town ordinance requires an approved erosion control plan for projects disturbing more than 3,000 square feet.

Town of Highlands Impoundment Ordinance

Following the 2001 sediment release from Randall Lake into Big Creek above the Town's drinking water supply intake and from there into Lake Sequoyah, The Town of Highlands passed an impoundment ordinance regulating dam removal activities on man-made ponds and lakes.

For impoundments either less than or equal to one-half acre in surface area at full pool, or receiving the surface water runoff from less than or equal to seventy-five (75) acres of contributing drainage area, or both (i.e., meeting both of the two foregoing criteria), the applicant shall submit a plan indicating the method to be used in draining the lake and the measures to be taken to prevent the release of sediment from the impoundment. For impoundments either more than one-half acre in surface area at full pool, or receiving the surface water runoff from more than seventy-five (75) acres of contributing drainage area, or both (i.e., meeting both of the two foregoing criteria), the applicant shall submit a plan prepared by a N. C. Professional Engineer, indicating the method to be used in draining the lake and the measures to be taken to prevent the release of sediment from the impoundment. This ordinance applies to all man-made dams. The town's impoundment ordinance controlling water and sedimentation releases from area lakes is the only one of its kind in the state.

Through an interlocal agreement approved in 2002, the Town of Highlands administers and enforces its impoundment ordinance in the Macon County portion of the entire watershed that drains to Lake Sequoyah.

Water Supply Lake and Shoreline Regulations

Because Lake Sequoyah is classified as a public water supply reservoir, the town is required by the state to enforce special restrictions on the lake. These include no commercial or multifamily development of lakefront properties; minimum 1 acre lot size on lake front and 2 acres above the lake (water intake); grandfathered lots under this size are limited to 12% or 6% impervious cover; 50 foot buffer, boat docks and other structures are limited in size and materials; boating requires a permit and boating speed limit is 5 mph with electric motors recommended; and prohibited conduct that might impact the purity of lake water including livestock within 50 feet of shoreline, littering, liquid discharges, and using the lake as a bathroom.

Land Use Planning

Highlands has one of the most rigid land use policies of any municipality in the state. The town has attempted to shape future development with the goal of preserving the founders' goals of a residential mountain community. The town passed strict regulations through the zoning ordinances to review and control development so as to "preserve, protect and enhance those gifts of nature which make up the unique quality of our Town and its environs".

Macon County Regulations

Erosion and Sedimentation Control

In the upper Cullasaja River watershed, years of unregulated development activity have been replaced by proactive local regulations, enforcement, and local concern. Macon County implemented its local ordinance in April 2000. This ordinance requires permits and is more stringent than the NC state law, and it contains special provisions for steep slopes. The entire watershed is now covered by locally enforced erosion control ordinances (excluding the national forest lands and publicly-funded projects).

Macon County requires a soil erosion control plan for land disturbances greater than one-half acre, and projects of any size when the slope exceeds 1:1 (45deg). The county ordinance requires erosion control plan approval for several other conditions of steep road & driveway grades, and cut and fill excavation slopes, regardless of project size (disturbed area). The county requires a plan for projects disturbing 1/2 acre or more, with a contractor training incentive that relaxes the disturbed area requirement to1-acre (state requirements) if the owner employs an approved contractor. An approved contractor is one who has voluntarily taken 8- hrs of erosion control training in the county or from one of the state training seminars. An approved contractor may have this approval revoked if he operates a site that receives a Notice of Violation. In the first year, the county has registered over 120 approved contractors, and has revoked three contractor's approved status.

Volunteer Water Information Network (VWIN)

VWIN is a water quality monitoring program run by citizens and the Environmental Quality Institute (EQI) at the University of North Carolina at Asheville. Local volunteers collect samples at specified sites on a given day each month, and samples are delivered to EQI for analysis. Samples are analyzed for twelve parameters, including nutrients, metals, and turbidity. VWIN monitors over 200 stream and lake sites monthly throughout Western North Carolina. VWIN prepares an annual report for each area at the end of the monitoring year. The annual report includes comparisons of each site and each area with all sites analyzed in the mountain region. Local governments and organizations can use this information to compare similar situations and better recognize regional issues and develop regional solutions. Trend analysis is also carried out on sites that have been monitored over a period of years. This provides information on changing water quality over time and season. Currently no organizations are utilizing the VWIN program in the upper Cullasaja River watershed, but interest has been expressed by several community groups in starting the program on local streams and lakes in the area.

Highlands Land Trust

Initially formed in 1883 as the Highlands Improvement Association, the organization has evolved through the years and became the Highlands Land Trust in 1990. The earliest years the organization concentrated on public green spaces and town parks, but did purchase the summit of Satulah Mountain in 1909 ($500). In 1914, Sunset Rocks was donated to the Town of Highlands by another organization which joined with the Improvement Society to form the Land Trust. Land trust efforts in the 1990s have built partnerships with landowners, developers, realtors, and communities and conserved land. Areas such as Shortoff Mountain and the Fodderstacks have been protected through these efforts. The land trust is trustee for 225 acres of land that is permanently protected from development. The Highlands Land Trust is in the process of developing a database in Geographic Information Systems (GIS) for identifying and prioritizing lands that are available for conservation. The Highlands Land Trust and UCWA were awarded a joint grant from the Community Foundation of NC to promote SE Fresh Water Streams awareness. Watershed signs have been purchased and installed on 6 highways in the watershed. Public awareness mailings are also planned.

Highlands Biological Station

The Highlands Biological Station (HBS) is a year-round field station for biological research and education related to the diverse flora and fauna of the Southern Appalachian Mountains. Founded in 1927 through the combined efforts of prominent local residents and a group of biologists from leading universities in the Southeast, HBS built its first laboratory in 1930. Today, the Station is an interinstitutional center of the University of North Carolina. Its facilities are available for year-round use by students and faculty engaged in biodiversity studies (ecology, systematics, evolution, and conservation). The programs in research and graduate training are devised by a 34-member Board of Scientific Advisors, drawn from colleges and universities from throughout the Southeast. The work of the Station is further supported by the Highlands Biological Foundation, Inc., a 501(c)(3) nonprofit organization that promotes and encourages research, education, and conservation in the region.

The Highlands Biological Station supports university research in the ecosystem of the watershed through the use of the Carolina Environmental Program (CEP), an interdisciplinary initiative of the University of North Carolina at Chapel Hill. Dedicated to addressing the factors that will build a sustainable society, the CEP crosses the traditional boundaries between Academic and Health Affairs to involve faculty, students, and staff from more than two dozen participating units. As part of their training, students in the CEP spend a semester in residence at a field site immersing themselves in the local community and working as a team to address the ecological basis of some environmental problem. Field sites are being established overseas in places such as Salzburg, Austria (focus on risk assessment), Burgundy, France (historical land use/climate interactions), and Bangkok, Thailand (air quality). In addition, field sites are being established in North Carolina on the Coastal Plain (Manteo and Morehead City), Piedmont (Research Triangle), and Mountains (Highlands). HBS is the mountain field site for the CEP, and its theme is biodiversity and land preservation, a topic that has occupied center stage in the mission of the Station since its founding.

UCWA has been involved with the CEP since 2001, its first year in Highlands, as a mentoring organization and as a member of the local CEP advisory committee. Through its students, the CEP program has helped UCWA in studying and collecting information on the environment and influences of development on the streams in the watershed. Past and future projects include water quality and water resource issues. A wetlands project is proposed for the fall of 2003.

Appendix C
319 Initiatives

Upper Cullasaja River and Tributaries

Sediment Control

causes and sources	Residential development; road construction; stream bank erosion	
load reductions expected	reduce sediments in runoff by 20%	
management measures	educate landowners and contractors to clearing techniques, erosion control, stream bank stabilization, riparian buffer	
amounts of technical and financial assistance needed	local UCWA staff, NCSU and NRCS will provide training and education; projects to stabilize stream banks and plant vegetation; Funding will be dependant on stakeholder development – estimate of $5,000-$25,000 per site; will be sought under EPA 319 and CWMTF funding.	
information/education component	UCWA staff, contractors, NCSU staff, NRCS, and Extension will meet with landowners for individual consultations on their property. Training courses for contractors will be held	
schedule	Begins in Summer of 2005 and concludes Fall of 2008	
interim, measurable milestones	Expected 10% reduction of sediments in 2006 and the goal of 20% reduction in 2008	
criteria to determine loading reductions are being achieved	Instream stormwater measures of water quality to meet state standards	
monitoring evaluate effectiveness	5 permanent water quality stations will be established in along the Cullasaja River. They will be monitored during four runoff events for the first year and twice a year for subsequent years.	

Stormwater Pollution (Other than sediment)

causes and sources	Increased impervious area; NPS from commercial, golf course and residential development uses.	
load reductions expected	reduce volume of runoff by 20% ; reduce pollutant loads by 20%.	
management measures	educate property owners of impacts due to land use; promote site specific BMPs, LID techniques and retrofit large impervious areas with controls.	
amounts of technical and financial assistance needed	UCWA staff and NCSU will provide training, education and site design and construction; projects to install stormwater BMPs; install flow monitoring sites; Initial funding of $225,000 will be needed; will be sought under EPA 319 and CWMTF funding.	
information/education component	UCWA staff and NCSU staff will meet with property owners for individual consultations on their property. UCWA will present information to garden clubs, Kiwanis, community groups, etc during regular meetings.	
schedule	Begins in Summer of 2005 and ongoing (Dependent on stakeholder development).	
interim, measurable milestones	Expected 10% reduction of volume in 2006 and the goal of 20% reduction in 2008 (Dependent on stakeholder development)	
criteria to determine loading reductions are being achieved	Instream stormwater measures of water quality to meet state standards; % volume increase from rain events to be reduced to control watershed levels.	
monitoring evaluate effectiveness	8 flow gauging sites will be established in the watershed. Four will be monitored during four runoff events for the first year and twice a year for subsequent years; others sites before and after BMP installation for 4 post construction.	

Illegal Discharges

causes and sources	Sewer lines; groundwater or USTs	
load reductions expected	Remove source of fecal coliform; eliminate volatile organic contamination	
management measures		
amounts of technical and financial assistance needed		
information/education component		
schedule		
interim, measurable milestones	Expected 100% reduction of bacteria in 2005; the goal of 100% volatile organic contamination reduction in 2008	
criteria to determine loading reductions are being achieved	Instream bacteria and volatile organic parameters of water quality to meet state standards	
monitoring evaluate effectiveness	2 permanent water quality stations will be established in the two tributaries in the watershed. They will be monitored monthly during the first year and quarterly for subsequent years until the pollutants are removed..	