2012

SOUTH CHICKAMAUGA CREEK HEADWATERS MANAGEMENT PLAN

A local stakeholder and Georgia EPD approved Watershed Management Plan that outlines the framework for improving water quality in South Chickamauga Headwater Streams

Acknowledgements

The Limestone Valley Resource Conservation and Development Council, Inc., would like to express its appreciation to the many organizations and individuals that assisted with the research and compilation of information presented in this plan. First and foremost, Limestone Valley wishes to thank the Environmental Protection Agency and the Georgia Environmental Protection Division for funding the preparation of this document. Additionally, the council would like to thank the many individuals associated with the Natural Resources Conservation Service and the Tennessee Valley Authority that contributed many hours by providing resource information and guidance. Other organizations that contributed to this plan include the Catoosa County Commission, Catoosa County Environmental Health Department, Catoosa County Stormwater Department, Catoosa Soil and Water Conservation District, City of Ringgold, City of Tunnel Hill, City of Varnell, Envision Ecology, South Chickamauga Creek Greenway Alliance, Tennessee Valley Canoe and Kayak Club, and the University of Georgia Cooperative Extension. It is the hope of Limestone Valley RC & D that the information presented here, as well as the cooperative partnerships formed during this process, will work to improve the water quality in South Chickamauga Creek headwaters.

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Executive Summary

The South Chickamauga Creek Headwaters encompass several streams that fail to meet criteria set by the State of Georgia for pathogens and impacted biota, which respectively tend to be the result of excessive fecal contamination and sediment loading. Due to these impairments, load reductions of these nonpoint source pollutants are necessary in many areas within the watershed. The need for a further effort to identify consistent sources of these pollutants and work towards addressing the load reductions led to the creation of this Watershed Management Plan. The plan includes the Nine Key Elements as recommended by the Environmental Protection Agency, and outlines a process for implementing the load reductions necessary for watershed restoration. Development of the plan also featured a stakeholder-driven process to build momentum and partnerships with the local community that will assist in its implementation. The plan has been written by Limestone Valley Resource Conservation and Development Council as a deliverable associated with a Environmental Protection Agency Clean Water Act (§319) grant administered by the State of Georgia. Assuming 319 funding is available, Limestone Valley intends on later leading the collaborative restoration effort to help achieve the necessary load reductions to improve the watershed.

In order to focus on load reductions of fecal coliform bacteria and sediment from agricultural and residential sources, Limestone Valley has proposed a multi-faceted South Chickamauga Headwaters Restoration Program, which was conceptualized in an effort to play on the strengths of project partners. This program will complement existing conservation programs (e.g., Environmental Quality Incentives Program). As part of this program, agricultural lands are identified for targeting load reductions through cost-shares with landowners for the installation of Best Management Practices. The practices implemented will vary according to the interests of the farmers, but will likely include heavy use area protection, streambank stabilization, stream access control for cattle coupled with alternative watering systems, stream buffer enhancement, and nutrient management. It is anticipated that the Natural Resource Conservation Service will be a key contributor to the success of this program component. Residential lands will also be targeted to reduce the contributions of fecal coliform bacteria from human sources by addressing septic system issues. This will include cost-shares on septic system repairs near streams, workshops designed for system installers and homeowners, and the development of a septic tank pump-out cost-share program. For this program component, it is anticipated that North Georgia Health District will play a key role. In addition to actual "on-the-ground" projects, this document outlines education and outreach activities that were identified by the stakeholder group as having the potential to contribute toward the reduction of pollutant loads and/or further educate the community about soil and

water conservation. The success of outreach and education efforts will be maximized through effective partnerships with several groups. Collectively, these educational and "on-the-ground" management measures will be implemented across several grants, with each grant also involving monitoring to reevaluate watershed conditions.

During the development of this management plan, estimates were prepared to consider the time and funding from 319 sources likely needed to accomplish restoration goals. Other sources of funding (mainly anticipated in the form of in-kind donations from stakeholders, agencies, and non-governmental organizations) were not estimated, but were assumed to contribute significantly to the program. In order to come up with a financial estimate, the extent of work within the watershed needed for complete watershed treatment was first conceptualized using Geographic Information Systems analysis and visual inspection of aerial photography. Next, the extent of the total watershed treatment that would likely be necessary to result in the de-listing of several impaired stream segments was estimated. Finally, the projects that these funds would finance were arranged in an implementation schedule that spans 13 years (including grant proposal submission periods), accounting for a phased approach that will better allow for acceptance of conservation practices. The proposed implementation schedule includes all grant activities including water quality monitoring, education and outreach activities, and project activities (e.g., agricultural Best Management Practices and septic system repairs). Each of these activities will continue through each grant implementation period. Currently, it is anticipated that four grant implementation periods may allow for significant improvements within the watershed. After this period of time, it is expected that some streams will have been de-listed and others will at least be improved and approaching compliance with state criteria. Success in this endeavor will depend on a number of variables, and priorities will be evaluated and altered throughout the 13 year period to maximize results. It is possible that the initial timeline may need to be extended to accommodate the goals of de-listing the majority segments.

1. Plan Preparation and Implementation

The following section will serve as a brief overview of the purpose of the Watershed Management Plan, the objectives it aims to accomplish, some of the details of the plan development and stakeholder process, and ultimately how the plan will be implemented.

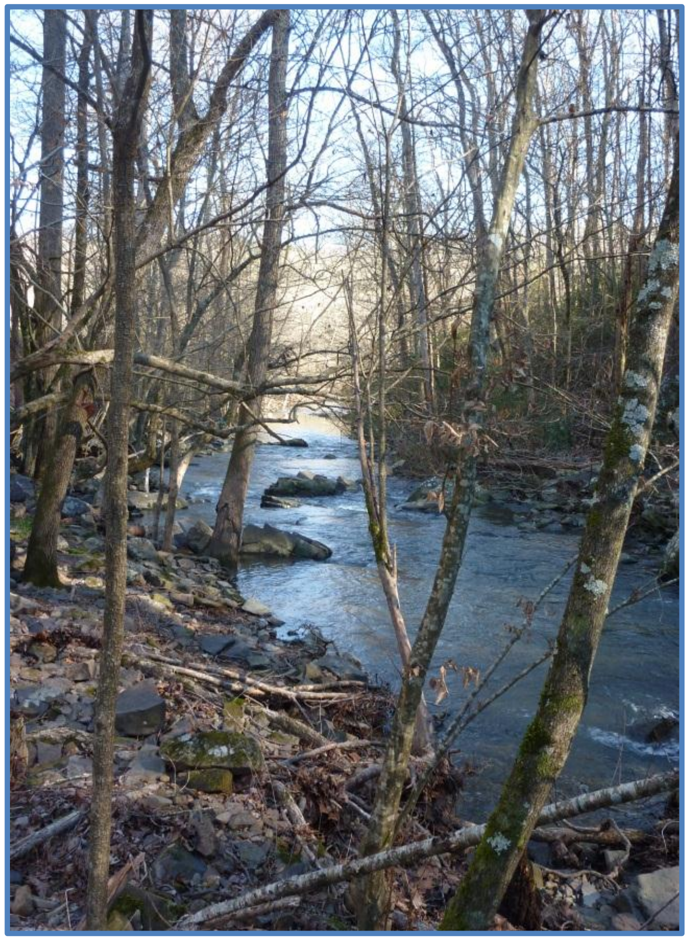


Figure 1.1.a. Dry Creek in the upper reaches of the SCC Headwaters.

The purpose of this Watershed Management Plan (WMP) is to outline a feasible prescription and timeline on which to implement the restoration of the South Chickamauga Creek (SCC) Headwaters. The document is not regulatory in nature, but the preparation process calls on stakeholders to recognize its issues and provide feedback on how to deal with them, as well as to develop momentum and contribute to the restoration effort if possible. The ultimate goals of the planning and restoration process are for impaired segments to be (and remain) de-listed and for the integrity of other segments to be maintained so that they continue to meet criteria for each designated use. Ultimately, a broader goal is to make stakeholders and landowners in the watershed more knowledgeable concerning watershed issues and how to go about managing the landscape to minimize water and soil resource concerns.

The development of this WMP coincides with a state-wide effort by Georgia Environmental Protection Division (EPD) to update all Total Maximum Daily Load (TMDL) Implementation Plans to include the nine key elements (described below) as recommended by the US Environmental Protection Agency (EPA). The nine key elements are a recommended new addition to these documents to help ensure that stakeholder involvement and approval lead to an explicit prescription to eventually meet watershed restoration objectives. Specifically, the nine key elements are as follows:

1. An identification of the sources or groups of similar sources contributing to nonpoint source (NPS) pollution to be controlled to implement load allocations or achieve water quality standards.

2. An estimate of the load reductions needed to de-list impaired stream segments;

3. A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

4. An estimate of the sources of funding needed, and/or authorities that will be relied upon, to implement the plan;

5. An information/education component that will be used to enhance public understanding of and participation in implementing the plan;

6. A schedule for implementing the management measures that is reasonably expeditious;

7. A description of interim, measurable milestones (e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

8. A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

9. A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8) above.

Limestone Valley Resource Conservation and Development Council (RC&D) opted to develop a more comprehensive WMP that also includes each of the key elements rather than more simply update the TMDL Implementation Plan, as part of an EPA Clean Water Act (§319) grant. The more extensive WMP differs from a TMDL implementation plan in that it focuses more effort on specific watershed details, as well as a more comprehensive Geographic Information Systems (GIS) analysis that investigates several factors that exert an influence on NPS pollution loads. More focus on these details should lead to more specific WMPs that are founded on a greater understanding of the local physical and social environment. Compiling more extensive data should help us better determine priorities in the watershed for targeting Best Management Practice (BMP) installations, allow for better long term land use and riparian comparisons, and assist in the development of more discreet objectives and milestones.

The process used to construct this document was fairly complex and utilized extensive research on the watershed, including water quality monitoring and GIS analysis. Data regarding water quality, fish and macroinvertebrate assemblages, geology, soils, and land use were considered when conducting research on the watershed. The GIS component focused on analyzing riparian buffers, land use percentages, and housing densities. GIS and water quality monitoring were also tools to identify broad areas of likely NPS pollution sources and priority areas for installation of BMPs.

The development of the plan also relied upon the participation of a stakeholder group (Table 1.1.a.), which consisted of members from local, state, and Federal government agencies, nonprofit groups, and the private sector. Three public meetings (conducted in June and December of 2011 and April of 2012) were held with the stakeholder group to engage the public in the process of designing an implementation plan. Most members were invited to take part in the process due to their professional interests and familiarity with previous stakeholder efforts. Local governments were also made aware of the stakeholder process and given the opportunity to participate in the stakeholder group. All members were informed of what was expected of them throughout the stakeholder process, and those that wished to contribute more were allowed to do so. A few stakeholders were consulted more regularly due to their expertise and willingness to provide additional support. It was also anticipated that some stakeholders may contribute significantly in the restoration process. Meetings focused on gathering input about potential problems and solutions, developing priorities, evaluating what BMPs might be met with the best public reception, and obtaining insight on the document. Finally, approval was sought for the document to serve as the plan on which implementation efforts will follow to restore and maintain the watershed.

Table 1.1.a. Stakeholder committee members that participated in the WMP development.

WATERSHED ADVISORY COMMITTEE MEMBERS		
Name	**Main Affiliation**	**Email Address**
Mark Fletcher	Catoosa County Commission	NA
John Klepper	Catoosa Environmental Health Dept.	jrklepper@dhr.state.ga.us
Ellis Walters	Catoosa Environmental Health Dept.	rewalters@dhr.state.ga.us
James Davis	Catoosa County Stormwater Dept.	james.davis@catoosa.com
Roger Bowman	Catoosa Soil and Water Conservation District	rbowman@catt.com
Blake Griffin	City of Tunnel Hill	lbgriffin@cityoftunnelhill.com
Jason Hall	City of Varnell	jhall@cityofvarnell.com
Bill Phillips	Envision Ecology	bphillips@envisionecology.com
Larry Carter	Envision Ecology	lcarter@envisionecology.com
Doug Cabe	Limestone Valley RC&D Council	dcabe4@gmail.com
Cindy Askew	Natural Resource Conservation Service	cindy.askew@ga.usda.gov
Nick Mooneyham	Natural Resource Conservation Service	nicholas.mooneyham@ga.usda.gov
Bill Henderson	Natural Resource Conservation Service	bill.henderson@ga.usda.gov
Sandy Kurtz	South Chickamauga Creek Greenway Alliance	sandykurtz@comcast.net
Linda Harris	Tennessee Valley Authority	lbharris@tva.gov
Jim Ledbetter	Tennessee Valley Canoe and Kayak Club	1jimled@gmail.com
John Hubbard	Tennessee Valley Canoe and Kayak Club	johnhubbard43@yahoo.com
Charles Lancaster	University of Georgia Cooperative Extension	clancast@uga.edu

Plan implementation will focus to improve the watershed through several specific project components. These include reducing NPS pollution from septic systems and agricultural lands in the watershed, as well as educating the public about these sources and watershed processes in general. Stakeholder assistance in some aspects of the implementation effort will be key to the process. Plan implementation will occur with respect to private property rights and rely on voluntary conservation, which involves participation from landowners in cost-shares to reduce NPS pollution on their properties. Although management of individual parcels is key to watershed restoration, a discussion regarding individual parcels in this plan has been avoided so as to not discourage participation, which could occur if criticisms over the management of private lands were included. Instead, the general NPS issues associated with specific land uses which predominate within the watershed are discussed.

Achieving the objectives of the plan through voluntary conservation will be a difficult endeavor. However, by building momentum through a phased approach, and developing relationships in the community, the process should cumulatively achieve significant NPS pollution reduction. To increase the chance of successful watershed restoration, a reassessment of this plan is scheduled every five years, just after an extensive assessment of the local water quality. This iterative process will allow a chance for stakeholders and citizens to analyze project successes and failures, and provide opportunities for changes in restoration priorities.

2. South Chickamauga Headwaters Description

Extensive knowledge regarding the watershed is paramount in making effective watershed planning decisions. This section will focus on providing an extensive background to the watershed as it relates to the development of a WMP for the SCC Headwaters. The section is organized into three parts. First, a description of landscape features is given that includes the local watershed geography, geology, and the climate in the area. The second part focuses on the important local flora and fauna. The last describes anthropogenic features in the watershed (e.g., resource uses, political boundaries, etc.). Much of the following information regarding the SCC Headwaters was written with the assistance of the historical TMDL Implementation Plans and the Soil Survey of Catoosa County, Georgia. Additional sources are referenced within the text.

2.1 Landscape Features

Watershed Geography

The SCC Headwaters drain approximately 106,000 acres of land primarily located in Northwest Georgia, and is classified by drainage area as a "HUC 10" watershed (specifically Hydrologic Unit Code #0602000109; Figure 2.1.a). The watershed is located within the Ridge and Valley Physiographic Province and, while predominantly forested (55% land use), it contains significant agricultural activity (27%) in addition to moderate levels of urban development (10%) due to the increasing population of nearby Chattanooga, Tennessee. The majority of the watershed in Georgia lies within Catoosa County, but it also includes relatively small areas within Whitfield and Walker Counties. A portion of the upper watershed also extends into Tennessee to the north, where it drains areas of Hamilton and Bradley Counties.

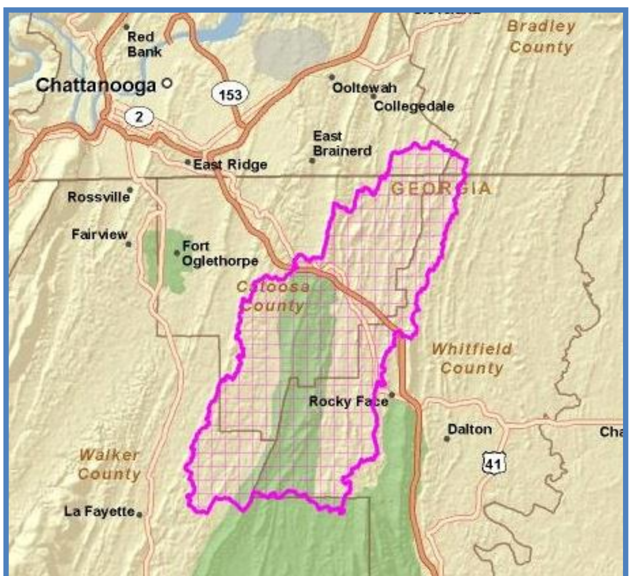


Figure 2.1.a. Location of the SCC Headwaters area as it relates to Northwest Georgia and Southeastern Tennessee.

The mainstem creek flowing from the HUC 10 watershed is South Chickamauga Creek, which eventually drains into the Tennessee River in upper Nickajack Lake Reservoir, four miles north of Chattanooga, Tennessee. Four main tributaries in the watershed contribute to the flows of South Chickamauga Creek. These include Tiger Creek, Little Chickamauga Creek, East Chickamauga Creek, and Dry Creek. Their subwatersheds are depicted in Figure 2.1.b. Dry Creek is a tributary to East Chickamauga Creek. Downstream of this confluence, East Chickamauga Creek and Tiger Creek come together to form South Chickamauga Creek. At the lowest extent of the watershed, Little Chickamauga Creek enters South Chickamauga Creek.

Dry Creek drains the east side of Taylor's Ridge and flows northeast, eventually into East Chickamauga Creek. The subwatershed area accounts for approximately 7,680 acres. The majority of the subwatershed lies within the Chattahoochee National Forest Proclamation Boundary although few parcels are actually owned by the Federal Government. Despite this, land use in the area is still dominated by forest (although private) at 80.8%. Agriculture is the second highest land use with 15.8%. The majority of agriculture in the subwatershed occurs in the middle and lower reaches along Dry Creek.

East Chickamauga Creek originates on the eastern slopes of Taylor's Ridge south of Dry Creek and flows in the direction of northeast, prior to accepting Tanyard Creek. From there, East Chickamauga Creek collects Dry Creek and meanders through the floodplain between Dick Ridge to the west and various smaller ridges to the east. It comes together with Tiger Creek and becomes known as South Chickamauga Creek just west of Ringgold Road. Excluding the Dry Creek Subwatershed which has been evaluated separately, the East Chickamauga Creek Subwatershed drains approximately 34,777 acres. Land use in the subwatershed includes mainly forest (73.4%), pasture/hay (19.2%), and row crops (2.5%).

Little Chickamauga Creek begins southwest of the town of Catlett, in Walker County and eventually drains approximately 32,861 acres. The creek flows north by northeast through Catoosa County where it collects the drainage from the western side of Taylor's Ridge. Little Chickamauga Creek eventually comes together with South Chickamauga Creek north of I-75 in Ringgold. The land use in this subwatershed is primarily forest (80.8%) and agriculture (15.8%).

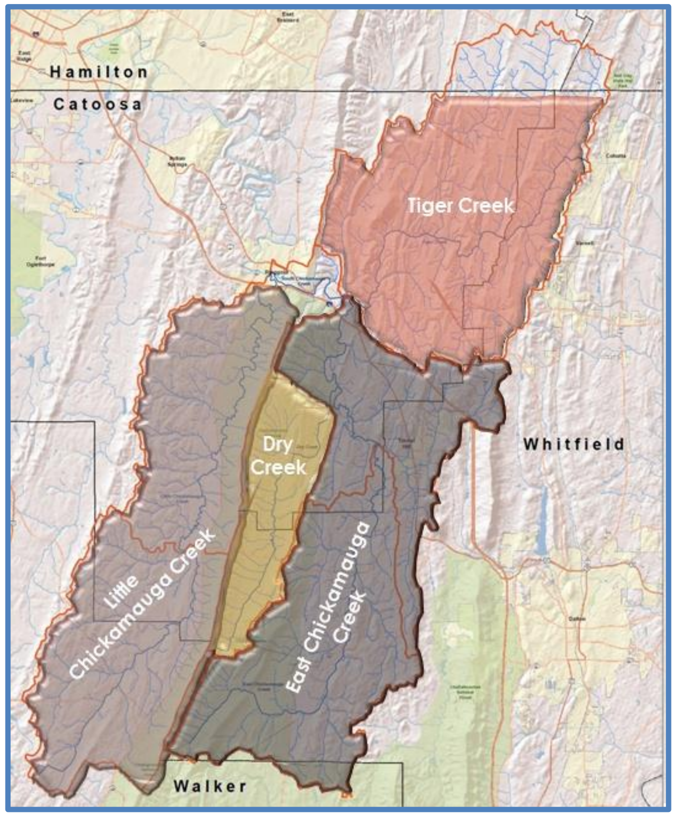


Figure 2.1.b. A map displaying the subwatersheds of the SCC Headwaters as they are found in Georgia.

Tiger Creek originates just northwest of Cohutta in Whitfield County as underground springs and eventually drains 30,508 acres (including the portion in Tennessee) before its confluence with East Chickamauga Creek. The creek flows south and southwest through heavily forested terrain into Catoosa County just north of Varnell, Georgia. It flows west across Catoosa County, dipping south, collecting the drainage from the eastern slopes of Sand Mountain and ultimately joins with East Chickamauga Creek upstream of Ringgold, forming South Chickamauga Creek. The subwatershed is known to have very tight subsoils that will not percolate. At the time of the last TMDL Implementation Plan, land use in the Tiger Creek Subwatershed was made up of forest (72.5%), pasture/hay (20.8%), and row crops (3.2%). A significant portion of the subwatershed is also owned and managed by the U.S. Military as the Catoosa Volunteer Training Site.

<u>Watershed Geology and Soils</u>

The SCC Headwaters are located within the Ridge and Valley physiographic region, which is dominated by northward-trending valleys separated by low, rounded ridges and by high, steep-sided ridges. The locations of these streams and high level of meander likely follow the more soluble carbonate formations in between more resistant rock types. Flowing over beds of exposed limestone, the streams have been found to have relatively high natural conductivity levels.

Rocks in the Ridge and Valley physiographic region range from early Cambrian to Mississippian age. The ridges in this area are typically composed of chert and capped sandstone, while the valleys are most often limestone or shale. The most common underlying rocks here are shale, slate, dolomite, limestone, and sandstone. Dolomite and limestone are porous rocks that can be found in aquifer forming layers that have cracked and faulted in the mountain building process. Sinkholes and springs are present as a result of the limestone and dolomite (karst) topography.

Soils within the SCC Headwaters are described in detail in the Catoosa County Soil Survey. The thicker, more fertile soils typically form in the valleys from erosion of soil at higher elevations and the weathering of parent material. The weathering of sandstone and chert on ridges help form the acidic soils which maintain the forested areas of this region. In Catoosa County (where the majority of the watershed is located), most soils are on very gentle to steep uplands and nearly level flood plains and stream terraces. Upland soils are generally well-drained and have a loamy surface layer and a loamy or clayey subsoil. These soils tend to be underlain by limestone, shale, or sandstone bedrock at depths of more than 20 inches. Flood plain and stream terrace soils vary between somewhat drained and poorly drained. These are commonly flooded. These soils are generally loamy throughout or clayey beneath a loamy surface layer. The poor draining soils of many areas within the watershed are important when considering septic system failures and their contribution of fecal coliform to the local streams (discussed later).

The local soil composition in Catoosa County has resulted in characterization of about 16,000 (16%) acres as prime farmland. Prime farmland is land with soils that produce the highest crop yields with minimal energy expenditure, economic resources, and environmental damage. Another 43,000 acres is additional farmland of statewide importance. This land is important for agriculture in the County, yet is less productive, more difficult to cultivate, seasonally wet, and more erodible.

Climate/Precipitation

The climate of Catoosa County is characterized by cool winters and hot summers with a relatively lengthy growing season. According to the Soil Survey for Murray and Whitfield Counties, Georgia, the average and maximum temperatures per day for the summer season are relatively warm (77.1º and 87.9º, respectively), and the sun shines much of the daylight hours (approximately 64% of the time). The winter is less sunny (44% of the daylight hours), and the average and minimum temperatures per day are relative cool (41.8º and 31.5º, respectively).

Precipitation is plentiful in the area and in comparison to other areas of the country is spread somewhat evenly throughout the seasons. Winter and Spring, however, tend to be the wettest seasons of the year, and more precipitation in these seasons results in a higher water table. Annual precipitation averages approximately 56 inches, yet snow is rare, averaging about 2 inches per season.

Local stream flows reflect seasonal precipitation, which is an important a factor when considering water quality concerns. Stream flow data has been recorded at a USGS stream gauge site along South Chickamauga Creek since 1985. Although the site is located downstream, the SCC Headwaters drainage area makes up around 40% of the drainage area contributing to the stream at the location of the USGS stream gauge. Average annual flows from mid-February through mid-September in South Chickamauga Creek (1985 – 2007) are displayed in Figure 2.1.c. Average weekly flows in South Chickamauga Creek from mid-February through mid-September (2003 – 2007) are displayed in Figure 2.1.d. Both figures were incorporated into a "Water Quality Survey Report for South Chickamauga Creek Watershed" (created by Tennessee Valley Authority after an extensive study of the region) and reveal some of the temporal variation in stream flows that occurs in the larger South Chickamauga Creek system.

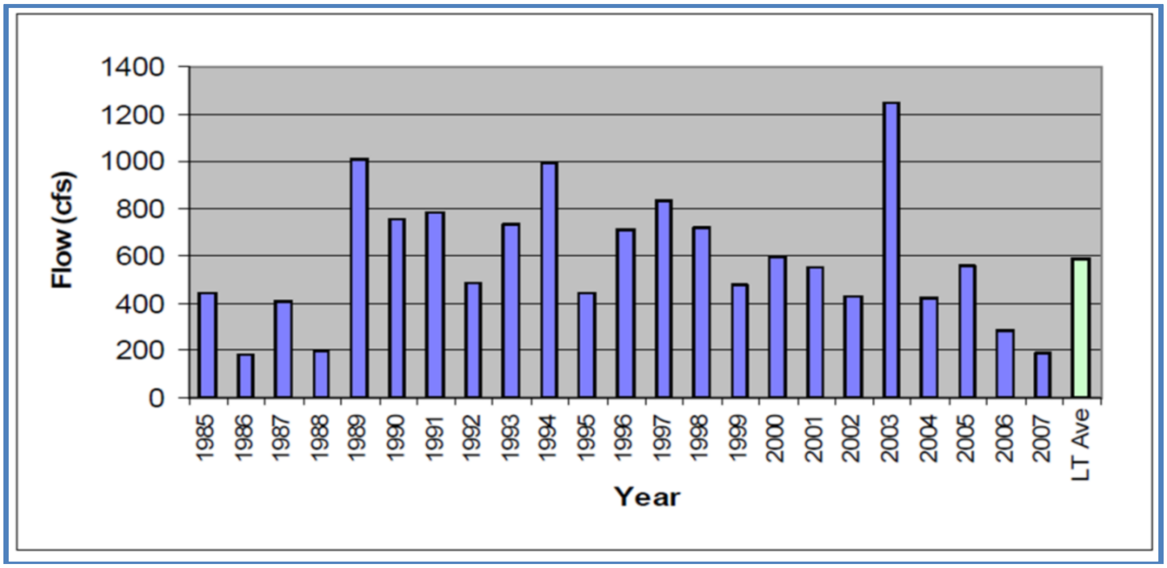


Figure 2.1.c. A display of the average annual flows in South Chickamauga Creek during mid-February through mid-September, 1985 -2007. Source: TVA.

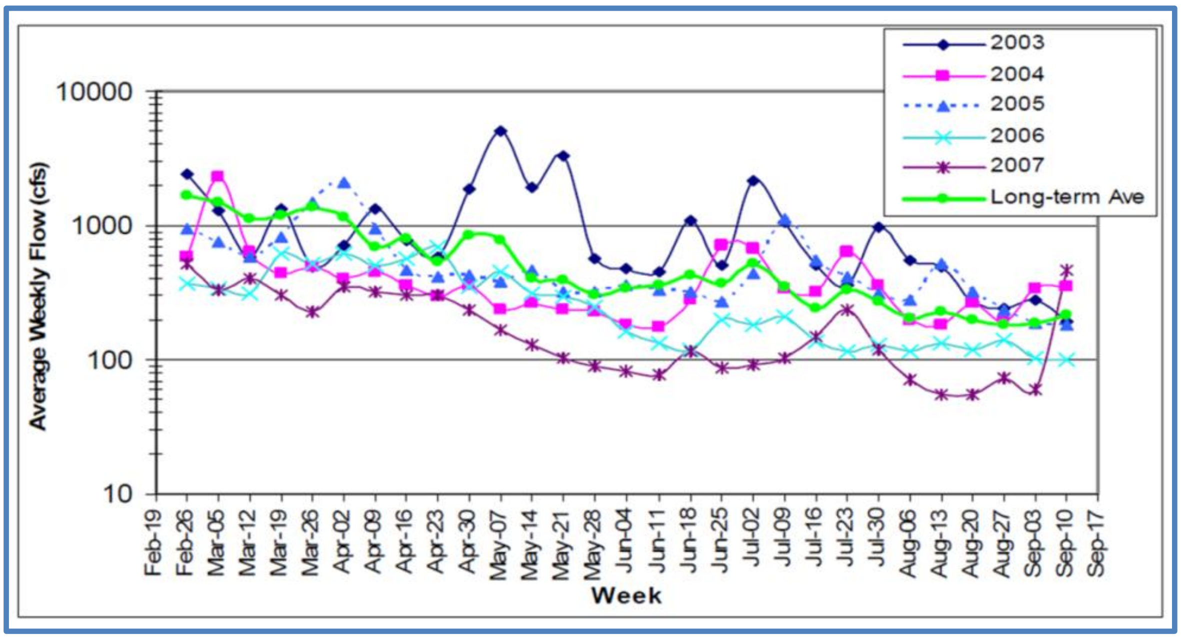


Figure 2.1.d. A display of the average weekly flow in South Chickamauga Creek for the periods of mid-February through mid-September, 2003 – 2007. Source: TVA

2.2 Important Flora and Fauna

Forest Ecosystems

The dominant land use in the SCC Headwaters drainage area is forest, most of which occurs on private lands in small holdings. The majority of forest in the watershed appears to be located on steeper slopes or other areas, such as bottomlands, that were historically unsuitable for agriculture. Several forest types exist including predominantly oak-hickory and oak-pine forests, and to a lesser extent elm-ash-cottonwood and loblolly-shortleaf pine forests. Within mixed oak and oak-hickory forests, the species composition depends on several factors including slope, slope aspect, and soil moisture. According to an Environmental Assessment for the Catoosa Volunteer Training Site, white oaks (*Quercus alba*), black oaks (*Q. velutina*), chestnut oaks (*Q. montana*), and eastern red cedars (*Juniperus virginiana*) have been described to dominate the overstory higher up on slopes, with yellow poplar (*Liriodendron tulipifera*) co-dominant with the same oak species on lower slopes. Bottomland hardwoods were described to be dominated by green ash (*Fraxinus pennsylvanica*), while other species tolerant of inundation and high moisture throughout the year are also present. Loblolly and shortleaf pines (*Pinus taeda* and *P. echinata*) as well as pine plantations dominated by loblolly pine are also present within the Catoosa Volunteer Training Site properties as well as the remainder of the watershed.

Wildlife and Habitat

Local wildlife populations exert effects on water quality within the watershed. The watershed is primarily a rural environment with an abundance of pasture and forest that provide fairly good habitat for wildlife. The Soil Survey of Catoosa County, Georgia, describes the local wildlife and their habitats in great detail. Wildlife in woodland habitats can include wild turkey (*Meleagris gallopavo*), American woodcock (*Scolopax minor*), thrushes *(Turdidae* family*)*, woodpecker (*Picidae* family), and American black bear (*Ursus americanus)*. Pine and hardwood forests surrounding pasture make good habitat for white-tailed deer (*Odocoileus virginianus*), mourning dove (*Zenaida macroura*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), opossum (*Didelphis virginiana*), and fox (*Vulpes sp.*) Cropland, pasture, meadows, and other open areas with suitable food and cover are inhabited by Eastern cottontail rabbit (*Sylvilagus floridanus*), bobwhite quail (*Colinus virginianus*), meadowlark (*Sturnella magna*), field sparrow (*Spizella pusilla*) , and red fox (*Vulpes vulpes*). Deer, rabbit, fox, quail, and other wildlife gain food and cover in the abundant native woody and herbaceous plants that occur in unmanaged pasture, old fields, young pine plantations, and thin woodland tracts. Waterfowl, otter (*Lontra canadensis*), beaver (*Castor canadensis*), bobcat (*Lynx rufus*), and raccoon inhabit

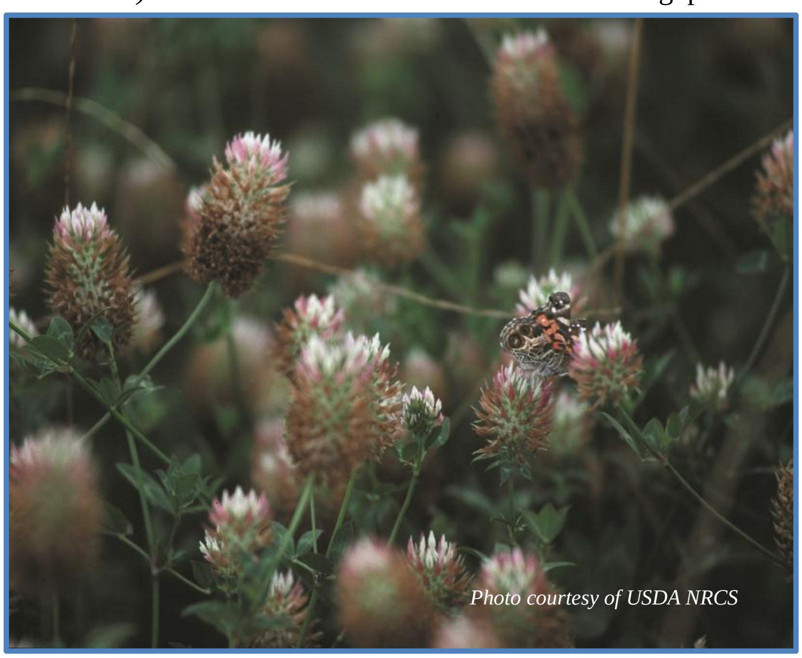


Figure 2.2.a. Buttonbush is a common plant found in the area, and is an important source of nectar for butterflies, and seeds for ducks and deer.

forested wetlands, which occur mostly along streams. More open wetlands attract ducks and geese *Anatidae* family), herons (*Ardeidae* family), shorebirds, and beaver.

Listed and Sensitive Species

The SCC Headwaters are also home to a few federally listed species and several state listed species, some of which may be influenced by changes in the watershed. Federally listed species within the watershed include the endangered gray bat (*Myotis grisescens*) and the large flowered skullcap (*Scutellaria montana*), according to the Environmental Assessment for the Catoosa Volunteer Training Site. No obligate aquatic species present in the watershed have been federally listed; however, the federally threatened snail darter (*Percina tanasi*) is known to occur farther downstream in the South Chickamauga Creek Watershed. Another fish species, the federally threatened spotfin chub (*Erimorax monacha*), was likely in the system at one time but has probably been extirpated.

Figure 2.2.b. The Eastern Hellbender is a species of giant salamander known to occur, among other places, in the Tiger Creek drainage within the SCC Headwaters. This species has been given "Threatened" status by the State of Georgia.

According to the Environmental Assessment for the Catoosa Volunteer Training Site, several state species of special concern that occur within the SCC Headwaters include the blueside darter (*Etheostoma jessaie*), redline darter (*Etheostoma rufilineatum*), and banded darter (*Etheostoma zonale*). According to Georgia DNR, other aquatic species protected by the State of Georgia considered present in Catoosa County include the state endangered popeye shiner (*Notropis arriomus*) and mountain madtom (*Noturus eleutherus*), the state threatened Chickamauga crayfish (*Cambarus extraneus*), Eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), and stargazing minnow (*Phenacobius uranops*) and the rare black darter (*Etheostoma duryi*), Ohio lamprey (*Ichthyomyzon bdellium*), and dusky darter (*Percina sciera*). Some of these species are likely present in the headwaters and downstream in the larger South Chickamauga Creek Watershed.

State listed plant species known in Catoosa County include the state endangered goldenseal (*Hydrastis canadensis*), Great Plains ladies' tresses *(Spiranthes magnicamporum)*, Glade meadowparsnip (*Thaspium pinnatifidum*), and the state threatened Tennessee gladecress (*Leavenworthia exigua var. exigua*). The proximity of these plants to the riparian zones and floodplains in the watershed has not been investigated for the purposes of this document.

Fisheries

Streams of the SCC Headwaters are also important waters for fishing. Several creeks in the watershed are characterized by Georgia Department of Natural Resources (DNR) as Secondary Trout Streams. This designation is for streams having no evidence of natural trout reproduction, yet, due to cool instream temperatures and other factors can support year-round populations of trout. Specifically, segments of Dry

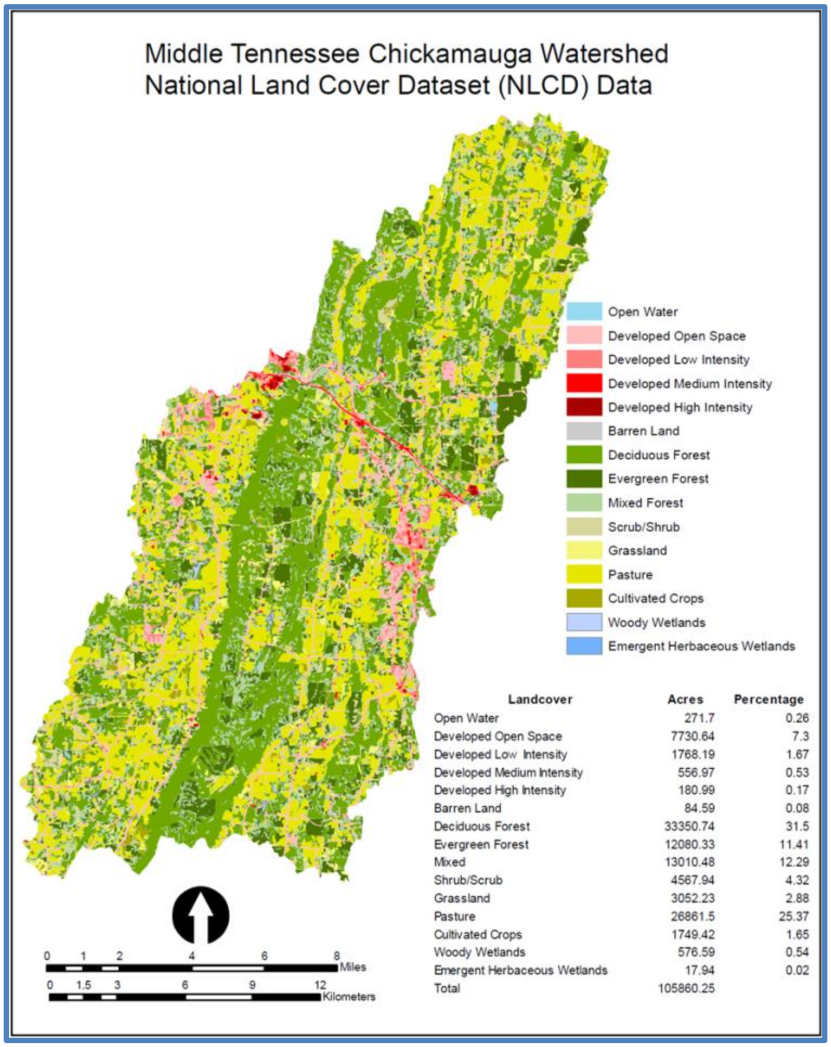
Creek, Little Chickamauga Creek, and Tiger Creek, are designated and stocked by the Georgia DNR twice per month (12 times total) between March and Labor Day each year. Such designations result in more strict regulations intended to minimize sedimentation and maintain forest buffers for temperature control. Current state regulations require the maintenance of a 50 foot vegetated buffer on either side of a trout stream with permits required for modifications within the buffer areas.

Other important freshwater sport fishes in the Tennessee River drainage streams of Catoosa County are largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* sp.), channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), striped bass (*Morone saxatilis*), and brook trout (*Salvelinus fontinalis*). With the exception of brook trout, most of these species are also commonly caught downstream of the headwaters in South Chickamauga Creek and Nickajack Reservoir of the Tennessee River system.

2.3 Anthropogenic Features

Land and Resource Uses

Land uses within the SCC Headwaters are variable (and revealed in Figure 2.3.a.), yet primarily reflect its rural nature. Parcels managed as forest are common in the watershed, although a large percentage of land and its resources in the watershed are also devoted to agricultural production. Most agricultural lands are used for cattle grazing, however, crop and poultry production are also relatively common within the drainage. Industrial and other urban lands, while small in comparison to other land uses, are mostly found in the lowest portion of the watershed near the City of Ringgold, Georgia. In addition, Interstate 75, a six lane highway connecting Chattanooga and Atlanta runs through the watershed from the Ringgold area through that of Tunnel Hill. Much of the more densely populated areas in the watershed are located in close proximity to I-75. All of the land use types outlined likely exert some contribution to the current water quality conditions in the watershed, although significant variation in NPS contributions per land use exists from parcel to parcel depending on management.



Landcover	Acres	Percentage
Open Water	271.7	0.26
Developed Open Space	7730.64	7.3
Developed Low Intensity	1768.19	1.67
Developed Medium Intensity	556.97	0.53
Developed High Intensity	180.99	0.17
Barren Land	84.59	0.08
Deciduous Forest	33350.74	31.5
Evergreen Forest	12080.33	11.41
Mixed	13010.48	12.29
Shrub/Scrub	4567.94	4.32
Grassland	3052.23	2.88
Pasture	26861.5	25.37
Cultivated Crops	1749.42	1.65
Woody Wetlands	576.59	0.54
Emergent Herbaceous Wetlands	17.94	0.02
Total	105860.25	

Figure 2.3.a. A map displaying the SCC Headwaters' more prominent land uses and their percentages within the watershed.

Figure 2.3.b. Grazing lands with cattle are a common sight in Northwest Georgia. Pasture accounts for the majority of agricultural lands in the SCC Headwaters.

Several sources of drinking water exist in the watershed, including surface water from Yates Springs in the headwaters of Little Chickamauga Creek. The area is also supplemented with water from the Tennessee River collected in Chattanooga. South Chickamauga Creek is utilized as the main water source in Ringgold. Some areas in Catoosa County also rely on wells, which are generally less than 100 feet deep. Wells are used for both domestic and livestock purposes. Livestock water sources also include local streams and small ponds, which is a topic of discussion found later in this document.

Downstream in Nickajack Reservoir, one of the designated uses is "domestic water supply". The Tennessee American Water Company pumps water directly from the reservoir for treatment. Their location is approximately 1 mile downstream of the South Chickamauga Creek confluence with the Tennessee River. Water quality problems within the SCC Headwaters may be of concern to Chattanooga residents since higher treatment costs are commonly attributed to water quality issues within the reservoir.

Political Boundaries

The SCC Headwaters drain portions of three counties in Georgia, as well as two in Tennessee (Figure 2.3.c.). The majority of the Georgia portion of the watershed is in Catoosa County; however, portions of Whitfield and Walker Counties are also in the watershed. Headwaters of the Tiger Creek Subwatershed also extend into Hamilton and Bradley Counties of Tennessee. However, this section of the watershed is not considered in this management plan since its development was funded through the State of Georgia.

Low density development is relatively consistent across the landscape, although three small urban areas contribute to the streams of the watershed. Ringgold, Georgia, is located entirely within the catchment along South Chickamauga Creek. According to City-Data.com, Ringgold has a population of 2,850 people and includes a sewer system and a storm sewer system that operates under the general stormwater permit for small municipal separate storm sewer systems.

Portions of two other small urban areas (both in Georgia) are also located within the watershed. Tunnel Hill is located just northwest of Dalton, Georgia, along I-75, and has a population of 1,237 individuals. Much of the Tunnel Hill area contributes to Tanyard Creek of the East Chickamauga Subwatershed. Varnell is located east of Ringgold, and has a population of 1,605 individuals. The area immediately west of Varnell contributes to the Tiger Creek system. Each of these towns lacks a sewer system, and residents rely on septic systems for waste management.

Downstream of the headwaters, South Chickamauga Creek continues to flow through Catoosa County while picking up other tributaries that drain large and mostly rural portions of Catoosa and Walker Counties. South Chickamauga Creek ultimately enters the state of Tennessee and drains into the Tennessee River System in Chattanooga. Specifically, the stream drains into the Nickajack Reservoir portion of the Tennessee system, which is used heavily for the purpose of recreation. Since this confluence is just upstream of the intake for a water treatment plant, the activities within the watershed are also of great concern to Chattanooga and Hamilton County residents.

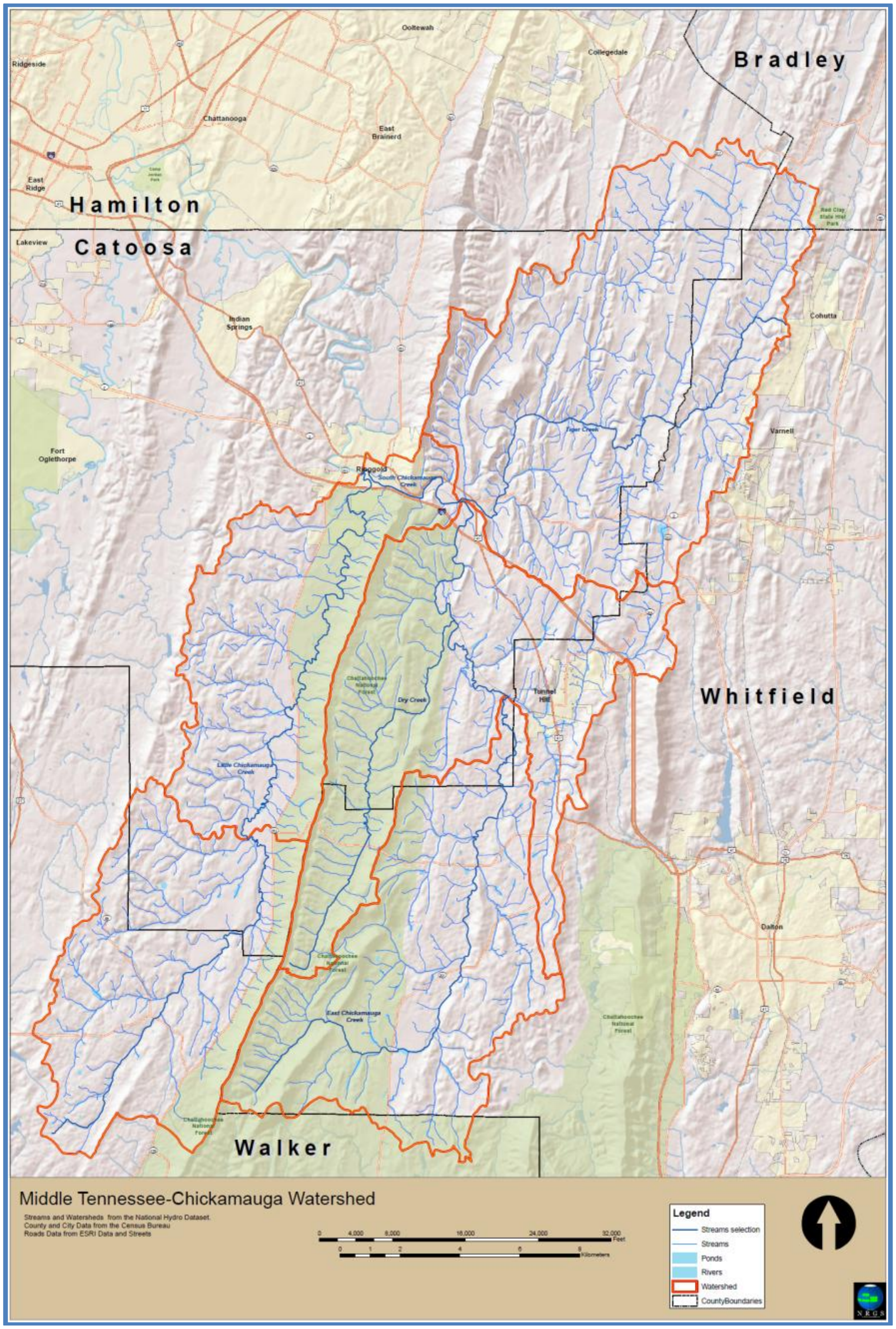


Figure 2.3.c. A map displaying the SCC Headwaters' political boundaries.

Active Groups Within the Watershed

A few groups with a local presence are relevant to the conservation of the SCC Headwaters and/or the larger South Chickamauga Watershed. Federal entities relevant to the WMP development process and/or conservation efforts in the area include the EPA, the Farm Services Agency (FSA), the Natural Resource Conservation Service (NRCS), the Tennessee Valley Authority (TVA), and the United States Forest Service (USFS). State entities relevant to the conservation efforts in the area include the Georgia Association of Regional Commissions, Georgia Department of Natural Resources (DNR), Georgia Department of Public Health, the Georgia Environmental Protection Division (EPD), the Georgia Soil and Water Conservation Commission (GSWCC), and the Tennessee Department of Environment and Conservation (TDEC). In addition, non-governmental organizations that contribute to local watershed conservation include the Chattanooga Zoo, Envision Ecology, Limestone Valley RC&D, The Nature Conservancy (TNC), the South Chickamauga Creek Greenway Alliance (SCCGA), Tennessee Aquarium Conservation Institute, the Tennessee River Rescue group, and the Tennessee Valley Canoe and Kayak Club (TVCC). Most of these groups have already conducted actions relevant to conservation within the greater South Chickamauga Creek Watershed, and others have improved local education regarding watershed science and water pollution. Groups conducting long-term programs, conducting monitoring, installing "on-the-ground" projects, implementing nonstructural practices, or those predicted to play a significant role in the implementation of this WMP are discussed further within the document.

3. Watershed Conditions

The following section will focus on introducing the state water quality standards and their importance, as well as impairments in the SCC Headwaters, and sampling data from past and current monitoring endeavors. Assessments representative of current watershed conditions are also included.

3.1 Water Quality Standards and Impairments within the SCC Headwaters

Georgia Water Quality Criteria

Georgia's water quality standards are made up of two different groups of criteria. The general criteria apply to all waters, and certain specific criteria exist for each of six designated uses. The general criteria are more qualitative in nature, and include:

- Waters shall be free of materials, oils, and scum associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits, produce turbidity, color, or odor, or that may otherwise interfere with legitimate water uses.

- Waters shall be free from toxic, corrosive, acidic, and caustic substances in amounts which are harmful to humans, animals, or aquatic life.

The six designated uses in Georgia, which vary in strictness of standards, are:

- Drinking Water Supply
- Fishing
- Wild River
- Recreation
- Coastal Fishing
- Scenic River

Each of the four main tributaries located in the watershed are designated for Fishing. The numeric criteria associated with this designated use is found in Table 3.1.a. These water quality parameters are important for several reasons including minimization of human health risk and protection of aquatic fauna. When streams fail to meet water quality criteria for a given designated use, they are listed as impaired on the Georgia Integrated 303(d)/305(b) List.

Table 3.1.a. A description of the quantitative water quality criteria for waters designated for the use of fishing.

GEORGIA'S WATER QUALITY CRITERIA FOR FISHING WATERS				
Designated Use	**Fecal Coliform Bacteria**	**Dissolved Oxygen**	**pH**	**Temperature**
Fishing	May – Oct < 200 colonies/100 ml as geometric mean* Nov – April < 1000 colonies/100 ml as geometric mean < 4,000 as instantaneous max	< 5 mg/l daily average Not < 4 mg/l at all times	Between 6.0 and 8.5	< 90° F

Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 mL (geometric mean) occasionally, then the allowable geometric mean of fecal coliform shall not exceed 300/100 mL in lakes and reservoirs and 500/100 mL in free-flowing freshwater streams.

Impairments in the SCC Headwaters

Sampling of water quality and biota (fish and macroinvertebrate assemblages) in the watershed has resulted in the placement of seventeen stream segments on the Georgia Integrated 303(d)/305(b) List for failure to meet state criteria. These impaired stream segments account for approximately 74 miles of streams in the watershed. Each of the four major tributaries have impaired segments due to fecal coliform violations (Figure 3.1.a.; Table 3.1.b.). Additionally, many smaller tributaries have segments characterized as impaired due to impacted biota violations.

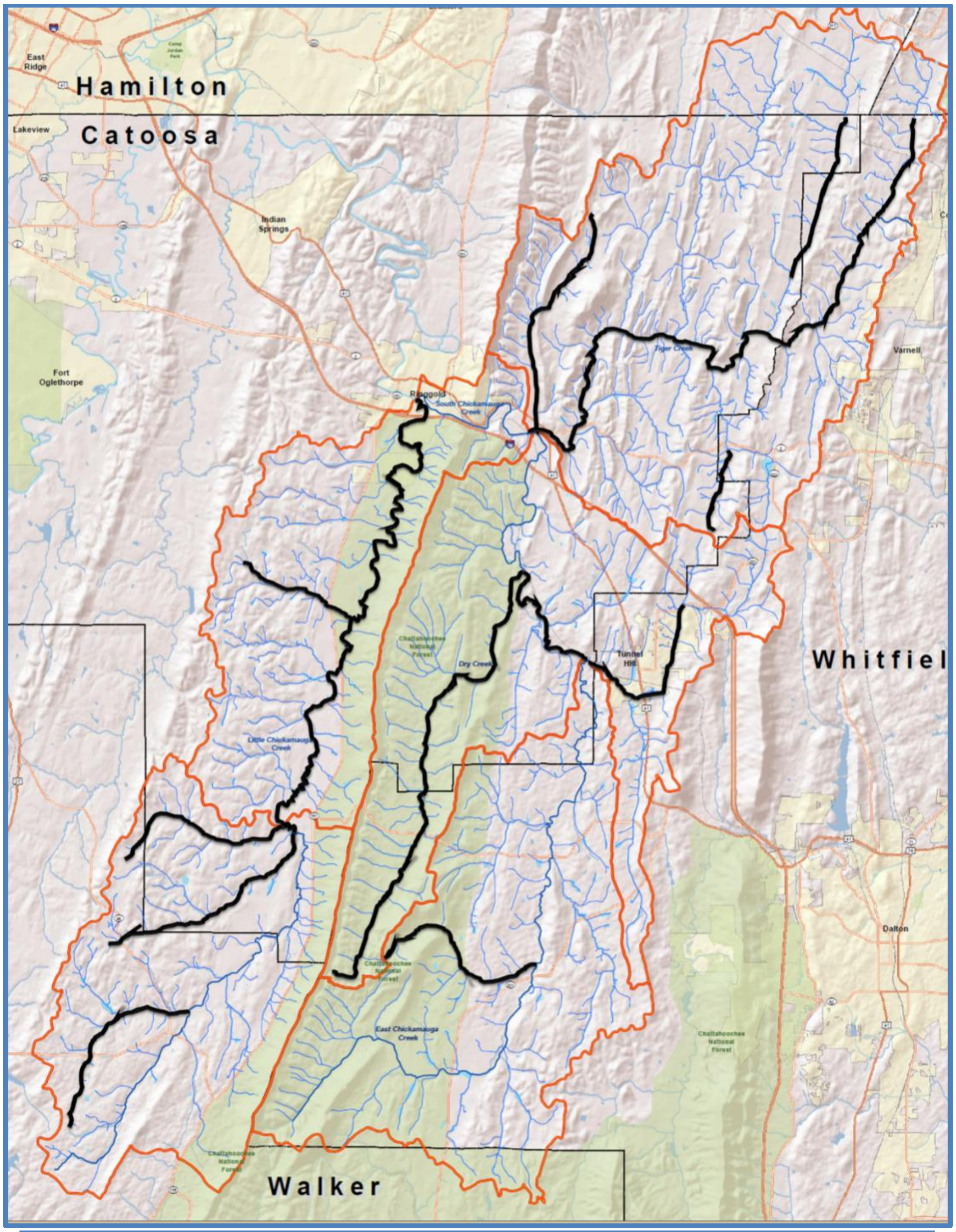


Figure 3.1.a. A map displaying all impaired segments found within the SCC headwaters drainage.

Table 3.1.b. A table displaying the location and criterion violated for each impaired segment found within the SCC Headwaters drainage.

SCC HEADWATERS IMPAIRED SEGMENTS		
Waterbody (Impaired Miles)	**County**	**Criterion Violated***
Dry Creek Subwatershed		
Dry Creek (10 miles)	Catoosa, Whitfield	Fecal Coliform/ Bio (F)
East Chickamauga Creek Subwatershed		
Cove Branch (4 miles)	Whitfield	Bio (F)
East Chickamauga Creek (14 miles)	Whitfield, Catoosa	Fecal Coliform
East Chickamauga Creek (3 miles)	Catoosa	Fecal Coliform
Tanyard Creek (5 miles)	Catoosa, Whitfield	Bio (F)
Little Chickamauga Creek Subwatershed		
Coulter Creek (4 miles)	Catoosa	Bio (F)
Little Chickamauga Creek (9 miles)	Catoosa, Walker	Bio (F)
Little Chickamauga Creek (11 miles)	Catoosa, Walker	Fecal Coliform
Little Chickamauga Trib. #1 (3 miles)	Catoosa	Bio (F)
Little Chickamauga Trib. #2 (5 miles)	Catoosa	Bio (F)
Little Chickamauga Trib. #3 (3 miles)	Catoosa	Bio (F)
Tiger Creek Subwatershed		
Cat Creek (4 miles)	Catoosa, Whitfield	Bio (F)
Cherokee Creek (4 miles)	Catoosa	Bio (F)
Dry Branch (3 miles)	Whitfield	Bio (F)
Little Tiger Creek (1 mile)	Catoosa	Bio (F)
Sugar Creek (trib. to Tiger Cr.; 5 miles)	Catoosa	Bio (M)
Tiger Creek (8 miles)	Catoosa, Whitfield	Fecal Coliform
Tiger Creek Tributary (3 miles)	Catoosa	Bio (M)

Bio (F) = Impacted biota characterization resulting from fish sampling.
Bio (M) = Impacted biota characterization resulting from macroinvertebrate sampling.

Fecal Coliform Impairments

Each of the main four tributaries in the watershed has failed to meet state criteria due to having high concentrations of fecal coliform bacteria. Downstream of the watershed the same issues persist, as South Chickamauga Creek is also impaired for high fecal coliform counts. Although generally present in the environment and not alarming at low levels, high fecal coliform bacteria (and *Escherichia coli*) concentrations in streams are used as an indicator for significant fecal contamination and more importantly the human health risks and pathogens that often coincide with fecal contamination. For this reason, impairments are often described as pathogen impairments even though they result from high bacteria counts.

Fecal coliform bacteria include the species *Escherichia coli* (*E. coli*), which makes up between 60 and 80% of fecal coliform bacteria in streams according to Georgia EPD. The U.S. EPA and many states have switched to *E. coli* as the indicator of fecal contamination and potential pathogen presence due to its correlation with gastrointestinal illnesses associated with swimming. The EPA views human health risk to pathogens associated with fecal contamination at an acceptable risk level if fewer than 9 people out of 1,000 get sick from using the resource. Generally, at higher levels of indicator bacteria (fecal coliform and *E. coli*), the risks of gastroenteritis, as well as respiratory, eye, ear, nose, throat, and skin infections become more prevalent. Higher levels of indicator bacteria also suggest the potential presence of more harmful bacteria [e.g., *E. coli* 0157, *Salmonella*, *Shigella* (which often causes gastrointestinal illnesses), and *Pseudomonas aeruginosa* (which can cause swimmer's ear or dermatitis)]. In addition to harmful bacteria, waters with high fecal coliform counts can harbor protozoans (e.g., *Crytosporidium* and *Giardia*) and viruses (e.g., hepatitis A).

Although high fecal coliform bacteria concentrations can indicate a human health hazard, they are unlikely to exert negative effects on aquatic species. However, the nutrient enrichment that coincides with fecal contamination may result in indirect effects leading toward eutrophication of streams. Nutrient enrichment can result in heavy algal growth that can alter aquatic habitats and cause harmful dissolved oxygen fluctuations.

Sources of fecal coliform bacteria in streams include contamination from humans, pets, livestock, and wildlife. More specifically, common causes of elevated fecal coliform counts in impaired watersheds include failing septic systems, livestock with direct stream access, applied manure, and natural areas with abundant wildlife. Relative proportions of contributors are watershed specific and difficult (as well as expensive) to determine.

Fecal coliform concentrations are variable, difficult to predict, and depend on a number of complex factors. According to Georgia EPD, fecal coliform counts can often be higher in the summer as a result of higher temperatures that increase bacteria survivorship. Fecal coliform concentrations are also affected by precipitation and the amount of time between rain events. Heavy precipitation after a dry period can result in very high concentrations of fecal coliform as a result of runoff delivering an abundance of previously deposited fecal contamination

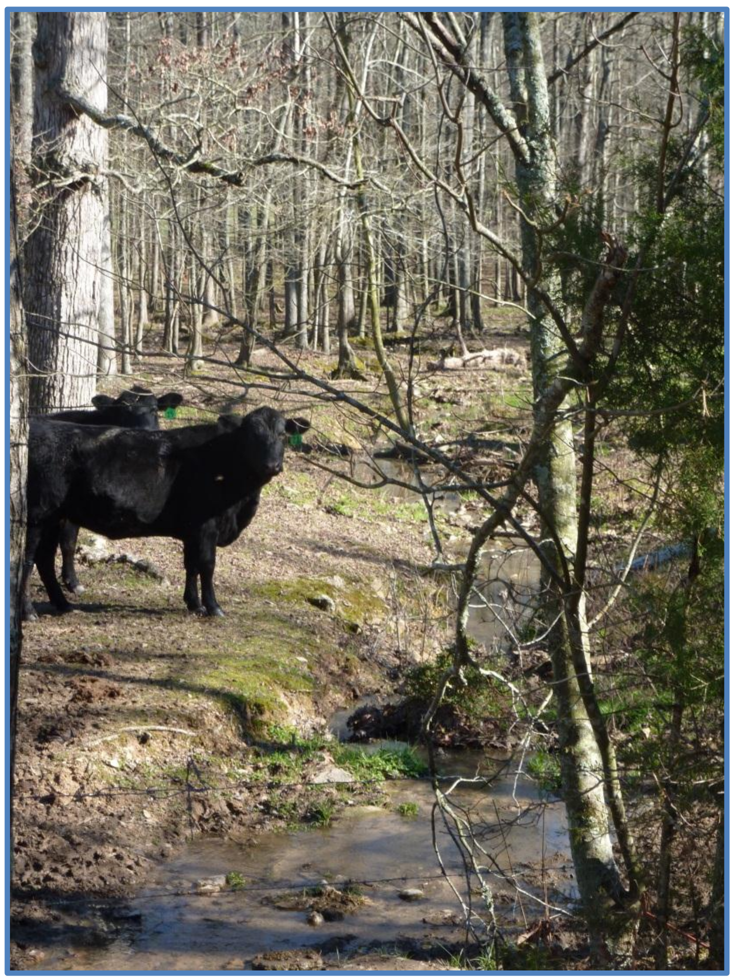


Figure 3.1.b. Cattle with direct access to streams can contribute to a stream's fecal coliform load.

from the landscape into waterways. Runoff events (especially after dry periods) have a tendency to reflect fecal coliform sources conveyed from the landscape, and fecal coliform concentrations during dry periods tend to represent the direct introduction of fecal contamination into tributaries higher in the watershed. Other factors that affect fecal coliform concentrations include sediment pollution, riparian composition, and source proximity to waters.

Impacted Biota Impairments

Within the SCC Headwaters, thirteen segments (most of which are found in the headwaters of the watershed) are designated as impaired due to impacted biota. A stream is considered impaired for impacted biota when sampling of fish or macroinvertebrates reveals poor or very poor biotic integrity. Various sampling efforts (many of which occurred in 2002 and 2003) by Georgia DNR and TVA have resulted in the impaired segments for impacted biota. In general, sediment pollution is identified as the cause of the impacted biota characterization in Georgia. Although there are qualitative descriptions in Georgia's water quality criteria that address restrictions on turbidity (a measurement of water clarity), there is no numeric criterion to identify discrete thresholds beyond which violations can be determined for sediment loading. Instead, indices of biotic integrity are used to represent stream health or various levels of degradation (generally from sedimentation).

Sediment pollution can originate from many sources including, but not limited to: eroding streambanks, construction sites, heavy use areas, and cropland. Negative implications for aquatic fauna that often result from erosion include the deposition of fine sediment, which contributes to a loss of habitat diversity as well as other issues. The deposition of fine sediment on the stream-bottom can result in a change in interstitial spaces (areas between substrate particles), which can have a negative effect on aquatic insect communities and thus the fish species which feed upon them. Fine sediments also tend to cover up gravels which are critical areas for fish to spawn. Altogether, significant increases in sediment loads adversely impact the biotic community.

In addition to wildlife concerns, sedimentation can cause other issues more relevant to local communities and other people living downstream. First, at the source of the erosion, soil loss can result in reduced productivity of the land. Additionally, increased sediment results in higher fecal coliform retention rates and serves as a source for increased bacteria in the water column during runoff events. Lastly, with increased sediment pollution in waterways, the need to dredge navigable waterways (and the cost to do so) is increased.

3.2 Available Monitoring/Resource Data from Recent Years

During the formation of this WMP, a significant effort was undertaken to acquire any recent data collected in the watershed. To our knowledge, two agencies, Georgia EPD and TVA, have recently conducted monitoring within the watershed. These data were made available for the purposes of this document, and a small, relevant subset is presented in this section.

Georgia EPD periodically monitors water quality in this watershed to determine whether statewide criteria are being met. Data collected as part of this effort in 2001 resulted in the placement of several stream segments on the 303(d)/305(b) list of impaired waters for fecal coliform violations (displayed previously in Table 3.1.b.). These data that resulted in impairments are displayed below in Table 3.2.a. The data are somewhat outdated, but the streams have yet to be delisted, which occurs when water quality criteria are shown to be met.

TVA is another agency that periodically samples streams in the SCC Headwaters as part of its monitoring rotation. TVA also conducted a more extensive local study (from 2003 – 2007) designed to monitor any changes in conditions resulting from ongoing NRCS restoration efforts. This monitoring effort was fairly comprehensive, including both chemical analysis (e.g., dissolved oxygen, conductivity, etc.) and biological sampling (e.g., bacteria, fish). TVA analyzed fecal coliform (Georgia's state standard) concentrations for only 2003, and used *E. coli* for the remainder of the study, which makes comparisons difficult. Overall, the local study appeared to indicate water quality improvements, but correlations were not found to be statistically significant. Additional water quality improvement projects have been conducted since, so additional study may reveal whether positive changes in the community indices have occurred since the previous sampling events.

Table 3.2.a. A display of geometric means of fecal coliform counts calculated from samples collected by Georgia EPD.

FECAL COLIFORM GEOMETRIC MEANS (2001)				
Site (code)	**Winter**	**Spring**	**Summer**	**Fall**
Dry Creek (DC-1)	205	67	1447	46
East Chickamauga Creek (EC-2)	930	331	845	65
Little Chickamauga Creek (LC-1)	421	105	847	159
Tiger Creek (TC-1)	1131	124	565	144

3.3 Monitoring/Resource Data Collected for the WMP

Efforts were also made to collect water quality data during the development of this plan in order to determine more current watershed conditions. These contemporary data allow comparisons with previous efforts and state criteria and may help determine areas most in need of BMP treatments. Two separate sampling regimes were developed and incorporated into a *Targeted Water Quality Monitoring Plan* for general sampling purposes, and a *Sampling Quality Assurance Plan* for de-listing purposes.

The *Targeted Water Quality Monitoring Plan* was developed and utilized primarily to provide stakeholders with current water quality data and assist with the decision-making process (e.g., determining priority areas). This sampling focused on collection of fecal coliform count and turbidity data. Fecal coliform counts were determined to represent amounts of fecal contamination upstream of each site, and turbidity was used to represent potential erosional/sediment issues upstream of each site. Samples were taken from nine sample sites (Figure 3.3.a.) to allow comparisons within the watershed. Samples were collected from these sites during both wet and dry periods of the summer and winter. This was orchestrated because wet weather samples better represent the NPS pollution flushed from the landscape during runoff events (and potentially when floodplains are inundated); whereas samples collected during dry events better reveal instream sources of NPS pollutants. Summer and winter samples were collected because state criteria change seasonally. The majority of the dataset obtained through these efforts is displayed in Appendix A.

Sampling the nine sites revealed less information about sediment than fecal coliform sources. The turbidity data revealed good water clarity in the watershed, and therefore significant sources of sediment in the watershed were not apparent. The fecal coliform sampling revealed a few potential trends. Both wet and dry weather data appear to reveal slightly greater fecal coliform counts in the upper areas of the watershed than in lower. Wet weather sampling appeared to demonstrate extensive sources of fecal coliform from the landscape with many samples well above the criteria. In comparison to the other main tributaries, it appeared less fecal coliform was derived from the landscape in Dry Creek than the other subwatersheds. Dry weather sampling also indicated fecal coliform counts were generally higher than the criteria, but by a smaller margin. Overall, the data indicates significant pathogenic issues remain in the watershed.

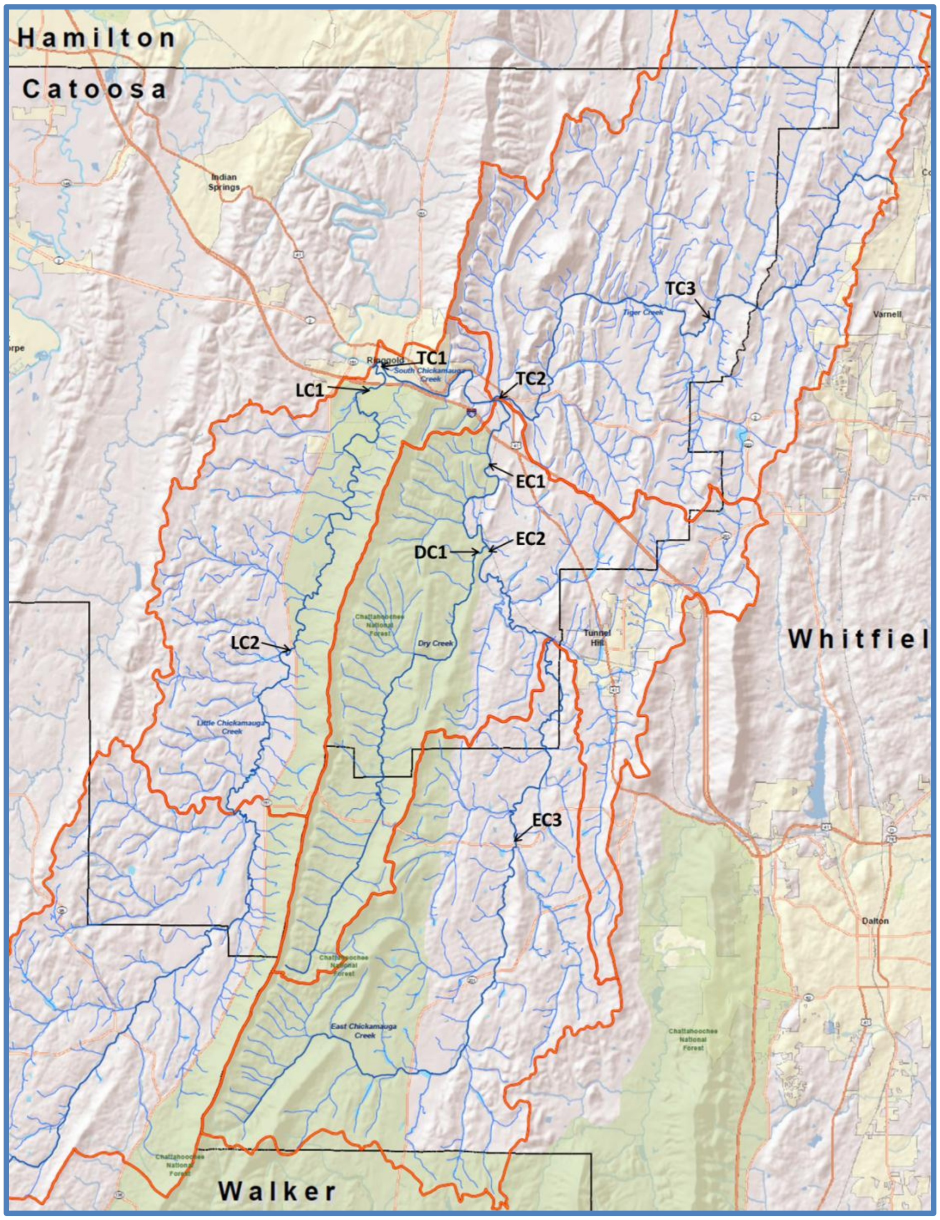


Figure 3.3.a. A display of the locations of the nine sample sites used during targeted monitoring in the SCC Headwaters.

The *Sampling and Quality Assurance Plan* (SQAP) was developed and utilized primarily to assess whether or not watershed conditions have improved since the initial violations were discovered by Georgia EPD in 2001. This fecal coliform sampling (for the purposes of de-listing) was conducted in streams at the lower end of the four major reaches with pathogen impairments using a specific protocol. Georgia EPD used the same protocol when collecting the data that resulted in these fecal coliform impairments, displayed in Table 3.2.a. The present sampling will not be completed until after the finalization of this document, however, the data collected thus far is displayed below in Table 3.3.a. These data indicate conditions may have improved since 2001, although de-listing of any of the streams impaired for fecal coliform violations is an impossibility due to violations of statewide criterion at each site (geometric mean >200 Colonies).

Table 3.3.a. A display of fecal coliform geometric means calculated from each of four samples taken by Limestone Valley RC & D in the summer and fall of 2011 and winter of 2012.

FECAL COLIFORM COUNT GEOMETRIC MEANS (2011-12)				
Site (code)	**Summer**	**Fall**	**Winter**	**Spring**
Dry Creek (DC-1)	390	158	85	185
East Chickamauga Creek (EC-2)	334	257	296	185
Little Chickamauga Creek (LC-1)	360	234	290	110
Tiger Creek (TC-1)	368	305	226	80

Biotic sampling was not conducted for the purpose of the planning process for several reasons. First of all, it is anticipated that sediment load reductions (where required) are the first objective in the process that is targeted for the eventual recovery of aquatic assemblages. Even after load reductions are accomplished, the recovery of stream habitats and aquatic assemblages may require a significant amount of time. In addition, the majority of impairments in the watershed for impacted biota resulted from fish sampling, which requires costly equipment and significant time and labor. Furthermore, sampling biota by a non-government organization cannot result in the de-listing of an impaired segment, which reduces the value of a hypothetical effort by such a group. Sampling by Georgia EPD and TVA as part of their rotations may be frequent enough that changes in aquatic biota are revealed in sufficient intervals without the need to duplicate their efforts.

3.4 Buffer Analysis

As part of the development of the WMP, a stream buffer analysis was also completed for the SCC Headwaters due to the importance of vegetative buffer zones (i.e., riparian zones) on stream and water quality conditions. As the name indicates, these zones literally serve as a buffer between activities that occur on the landscape and the contents of the water in the stream by physically catching pollutants (e.g., sediment, nutrients, bacteria) from runoff during rain events.

Buffers, in addition, serve many other functions that are important to the health of the stream. One of the functions of sufficiently intact buffers is the mitigation of stream bank erosion, which is a common contributor of sediment to streams. The roots of the vegetation help to hold the sediment in place during high flows, making the banks more stable. The vegetation also provides shade for the stream, which aids in keeping the temperatures low (and dissolved oxygen high). Dense vegetation in the riparian zone also contributes falling dead and dying vegetation into the stream channel, providing diverse habitat for aquatic life.

Conducting an analysis of buffers within an impaired watershed has become an acceptable way to assess areas in need of restoration. Insufficient riparian buffers often indicate sources of NPS pollution. These areas could simply be a place where pollutants enter the stream through runoff, or even a place where livestock enters the stream (heavy use inhibits vegetative growth) thereby allowing direct introduction of NPS pollutants.

The stream buffer analysis was conducted using GIS software and recent aerial imagery. The purpose of this analysis was to identify areas of inadequate vegetation within a 100 foot buffer of all streams. Every tributary was analyzed with the software and aerial imagery (viewed with the naked eye), to confirm insufficient buffers. The areas having insufficient riparian zones are depicted in pink in Figure 3.4.a. A percentage of inadequate buffer was also calculated for the watershed, as well as the four main subwatersheds (Table 3.4.a). It appears that Dry Creek has the highest proportion of intact riparian zones within the watershed. The other drainages were found to have similar proportions of inadequate buffers. This information was used for estimating the technical and financial assistance needed to de-list the impaired segments (discussed later).

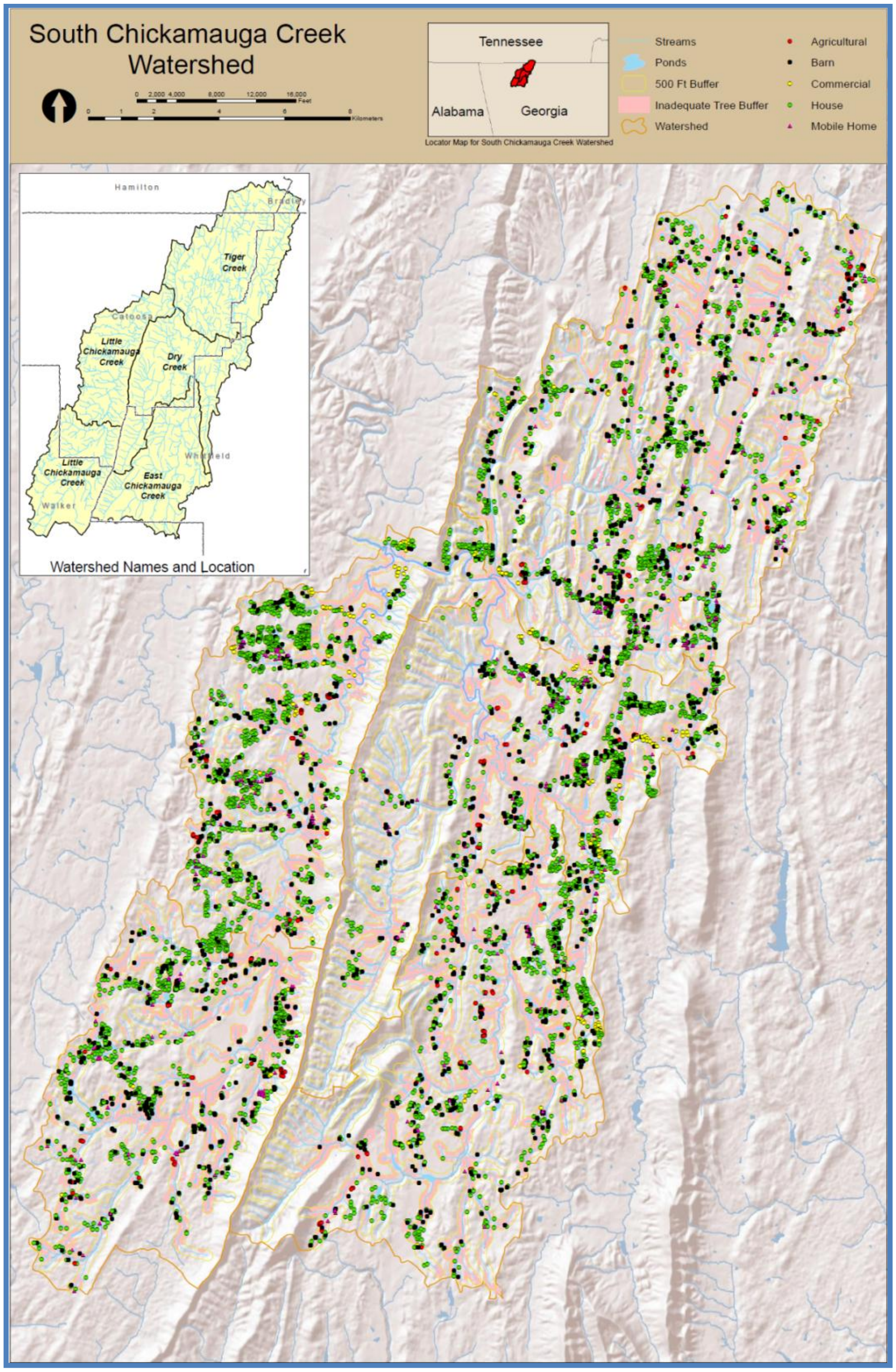


Figure 3.4.a. An image depicting insufficient buffers (in pink) and structures within the 500 foot buffer.

Table 3.4.a. The following table displays the inadequate vegetative buffers in acreage in each subwatershed and the percentages that are inadequate.

INADEQUATE BUFFER ANALYSIS			
Drainage Name	**Inadequate Buffer (Ac)**	**W'shed Area (Ac)**	**% Inadequate Buffer**
Dry Creek	3506	21833	16
East Chickamauga Creek	4166	20654	20
Little Chickamauga Creek (Upper)	3774	17154	22
Little Chickamauga Creek (Lower)	3221	15709	21
Tiger Creek	6823	30508	22
Total SCC Headwaters	**21489**	**105858**	**20**

Additional GIS analysis was conducted to investigate the number of dwellings that occur within a 500 foot buffer of streams within the watershed. This analysis generated the map in Figure 3.4.a., and the information in Table 3.4.b. Specific types of dwellings were quantified and houses and trailers can be used to represent the likelihood of septic system presence and ultimately fecal coliform contributions from failed septic systems. The figure and the data in the associated table were utilized to evaluate where sources of fecal coliform contributions from septic systems are likely significant. These data indicate that septic systems may be significant issues on the outskirts of the City of Ringgold and the City of Tunnel Hill.

Table 3.4.b A display of the number of residential and agricultural structures found within a 500 foot buffer per subwatershed within the SCC Headwaters.

STRUCTURES WITHIN SUBWATERSHED BUFFERS			
Subwatershed Name	**Subwatershed Area (acres)**	**Number of Dwellings**	**Number of Ag. Structures**
Dry Creek	21833	1130	362
East Chickamauga Creek	20654	655	318
Little Chickamauga Creek (Upper)	17154	751	324
Little Chickamauga Creek (Lower)	15709	1359	280
Tiger Creek	30508	1509	583

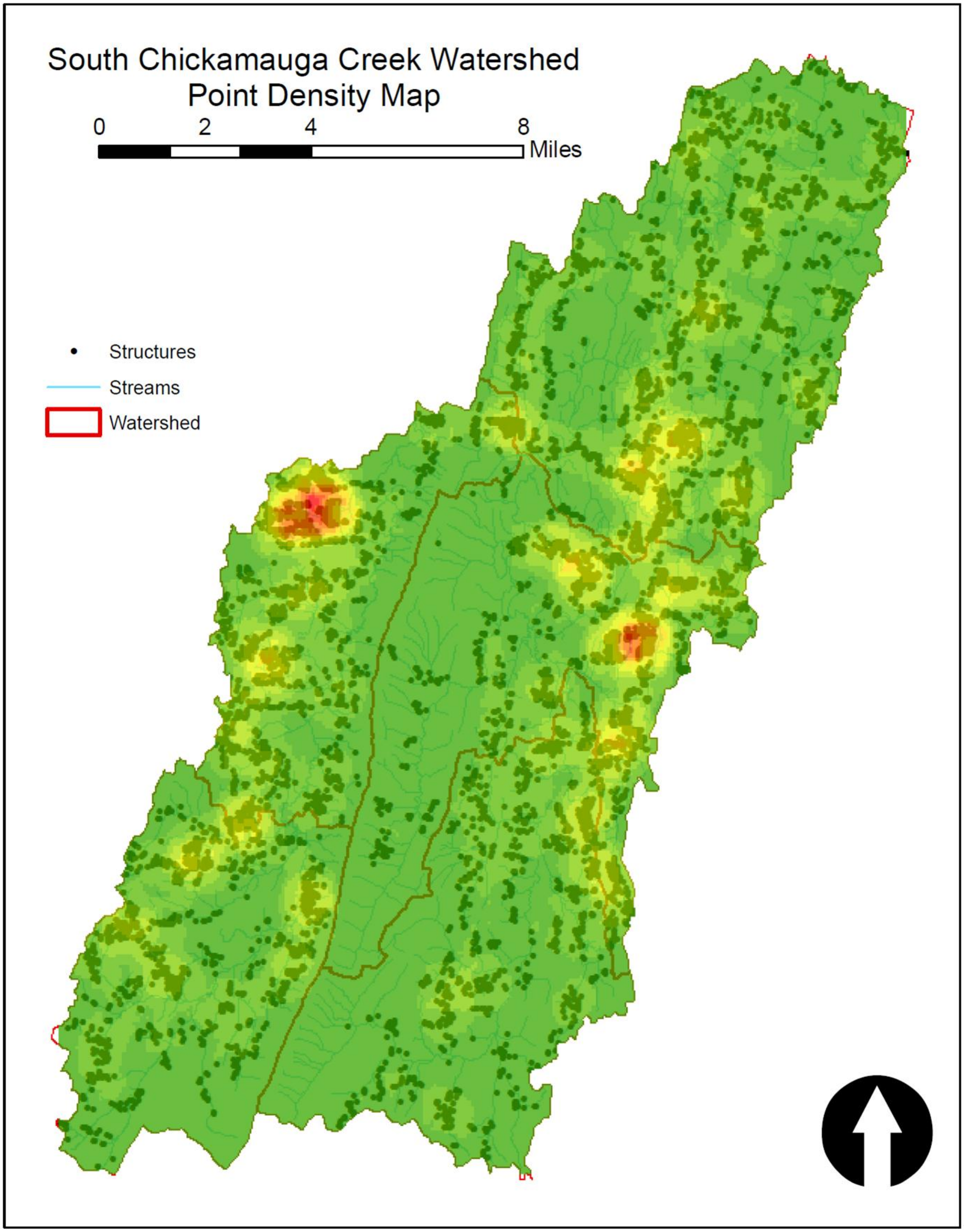


Figure 3.4.b. An image depicting the location of structures found within a 500 foot buffer of all streams in the SCC Headwaters drainage. Red depicts a high density area, whereas green reflects low density areas.

4. Pollutant Source Assessment

This section of the WMP outlines the sources of significant impairing pollutants within the watershed. The major issues in the watershed stem from excessive fecal coliform loads, and presumably sediment (which has likely led to impaired biota). The two major categories of pollutants addressed in this section are point and nonpoint sources. The quantity and type of pollutants found in a waterbody are directly related to the land uses within the watershed. See Figure 2.3.a. for a map depicting the distribution of land uses throughout the watershed. The following information was gathered through both research and stakeholder input during WMP formation.

4.1 Nonpoint Sources

This category of sources encompasses a wide range of pollutants distributed across the landscape and washed into our streams during rain events, as well as those NPS pollutants deposited directly into streams from unregulated sources. These pollutant sources are difficult to identify and regulate since they are typically ubiquitous and originate from multiple land parcels with different owners. NPS pollution can also be quite variable over time due to grazing rotations, runoff events, and other factors. It is assumed that NPS pollution makes up a significant portion of the pollutant load in this watershed due to the scarcity of point sources permitted under the NPDES program.

Figure 4.1.a. Cropland is a common contributor of nonpoint source pollution in the U.S.; however, it only accounts for a small percentage of land use within the SCC Headwaters' drainage area.

<u>Agriculture</u>

Agriculture makes up approximately 27% of the land use within this watershed. Activities range from livestock grazing and hay production (pasture = 25.4%) to cultivation of crops (1.4%). Many poultry operations are also located in the watershed. Agriculture, with the exception of forest, is the most dominant land use type; hence it likely plays a significant role in impairment issues. Many stakeholders postulated that agriculture may be a significant contributor to observed fecal coliform bacteria and sediment loads within the watershed.

Because pastures encompass approximately 25% of the land use in the watershed, livestock has the potential to be a significant contributor to both fecal coliform and sediment loads in the form of NPS pollution. Although dairy cattle, hogs, and poultry spend a large portion of their time confined (see CAFOs in 5.2), beef cattle spend the vast majority of their time in pastureland. This means that they consistently deposit their feces on pastureland can contribute to erosion especially when grazed to the extent that they destroy vegetative cover. When significant feces builds up and erosion becomes more prevalent on the landscape, fecal coliform bacteria and eroded soil become more frequently captured by rainwater runoff and delivered into nearby waterways.

In addition to NPS sources derived from the landscape, beef cattle often have access to streams that run through pastureland, giving them the opportunity to deposit feces directly into the waterways. This stream access can also contribute to the sediment load through streambank erosion. Cattle can destroy the vegetation in the riparian zone, which may result in streambank collapse into the waterway, increasing the sediment load.

Poultry operations are also fairly common throughout the watershed. Depending on the number of animals present, these operations can be classified as potential nonpoint sources (<125,000 animals) or potential point sources (>125,000 animals; see CAFOs in 5.2). There are 24 poultry operations in the watershed that are classified as potential NPS. Since these operations produce large quantities of animal waste (depending on their management), they may contribute to NPS issues as manure from poultry operations is often applied to agricultural lands. According to Wang et. al. (2004), fecal coliform can survive for several months after animal waste excretion. This indicates that even aged manure could be a significant contributor to the fecal coliform bacteria load when applied to the landscape. Due to this likely contribution, nutrient management practices are anticipated to be a component of restoration efforts in the watershed. Table 4.1.a. displays a list of poultry operations (per subwatershed) that can found in the SCC Headwaters drainage area.

Table 4.1.a. A display of the approximate locations and capacities of poultry operations within the SCC Headwaters drainage area. These operations are not characterized as point sources (CAFOs) and therefore do not require NPDES permits.

POULTRY OPERATIONS IN THE SCC HEADWATERS		
Subwatershed	**Number of Operations**	**Average Capacity**
Dry Creek	2	42,000
East Chickamauga Creek	7	81,857
Little Chickamauga Creek	8	79,625
Tiger Creek	4	85,000

Table 4.1.b. below displays the estimated agricultural livestock population in Catoosa County. The SCC Headwaters encompass about half of the county, and also includes much smaller portions of Whitfield and Walker Counties. Despite the incongruence, the area of Catoosa County is similar in size to the SCC Headwaters drainage area, and thus the information can be used to estimate the relative proportions of livestock types occurring within the watershed.

Table 4.1.b. Estimated Livestock Populations in Catoosa County (provided by NRCS, 2008).

Livestock Populations								
County	**Beef Cattle**	**Dairy Cattle**	**Swine**	**Sheep**	**Horses**	**Goats**	**Chicken Layers**	**Chickens-Broilers Sold**
Catoosa	3,000	-	-	25	300	40	60,000	15,158,000

Cropland encompasses approximately 1.4% of the land use within the watershed. Although this is not a large percentage, croplands could still contribute significant amounts of pollutants (e.g., fecal coliform after manure application) into nearby waterways. According to the National Research Council (1989), surface water sediment deposition is significantly related to cropland erosion within basins.

Wildlife

Wildlife contributions of fecal coliform and sediment to streams vary considerably, depending on the animals present within the watershed (see 3.2). Based on the TMDL written for this section of Georgia and information provided by the Wildlife Resources Division of Georgia DNR, the animals that spend the majority of their time in and around aquatic habitats are the most important wildlife sources of fecal coliform bacteria. Waterfowl are considered to be significant contributors since they spend a large portion of their time on surface waters and deposit feces directly into the waterway. Other significant contributors include aquatic mammals such as beaver, muskrat, and river otters. Rapidly expanding feral pig populations (*Sus scrofa*), known to exist along the floodplains of every major river in Georgia, may also be an issue according to stakeholders, some of which have sighted them within the watershed. According to Kaller et. al. (2007), these animals can contribute both fecal coliform and sediment to our waterways due to their numbers and behavior. Despite feral pigs and other animals that may be viewed as pests in the area, wildlife populations are mostly naturally occurring and an indicator of the relative health of the environment. For this reason, minimization of fecal coliform contributions from wildlife will not be a major focus of the plan. Instead the plan will emphasize the reduction of anthropogenic sources of fecal coliform bacteria.

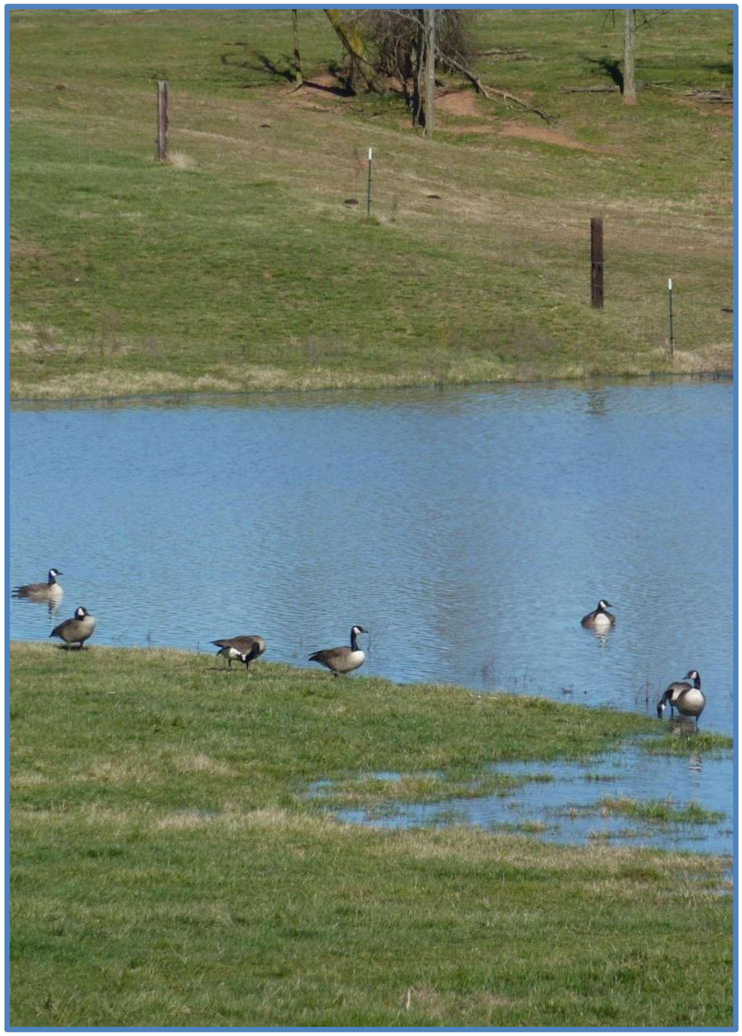


Figure 4.1.b. Wildlife can also contribute to a stream's fecal coliform load. Waterfowl can especially be problematic due to direct deposition of waste.

Urban/Suburban Runoff

Sediment pollution can originate from many sources in an urban or suburban area. Land-disturbing activities are a consistent contributor of sediment to streams nationwide. These activities include clearing, grading, excavating, or filling of land. Disturbance of land typically removes the vegetation, which exposes the surface sediment to rain events resulting in erosion and sedimentation processes in streams. For example, conversion of forests to developed land (clearing) is often associated with water quality degradation.

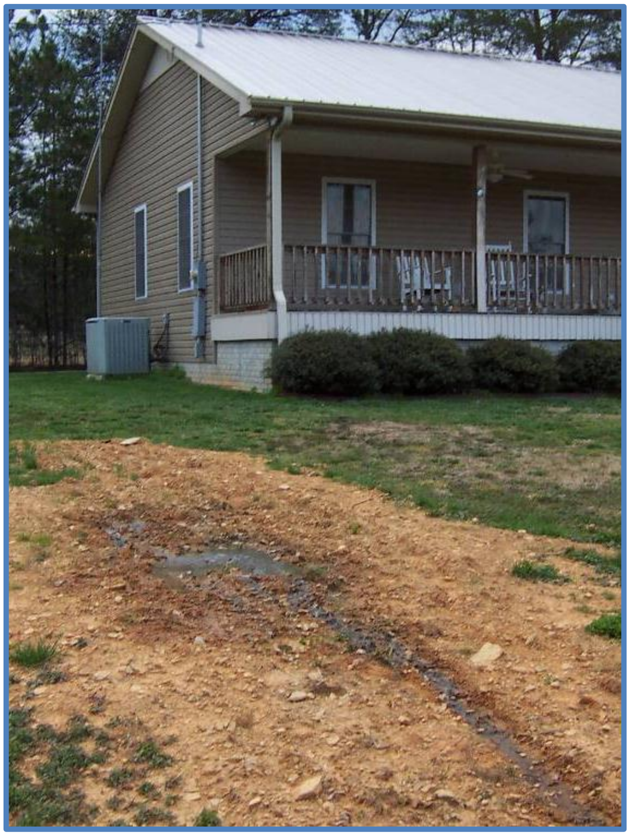


Figure 4.1.c. A failing septic system can introduce pathogens into nearby streams. This system has effluent surfacing in the yard, and drains into a nearby tributary.

With the recent tornado damage in the lower watershed around Ringgold and in the Tiger Creek subwatershed, erosion and sedimentation issues have potential to be more significant than under normal conditions. The damage contributed to widespread forest damage including uprooted trees and likely instability to stream channels and hillslopes. Unfortunately, damage to homes and properties was also widespread within the watershed, and additional soil loss and sediment pollution has likely occurred with the clearing damaged parcels and houses and reconstruction activities.

Stormwater runoff can also contribute to erosion issues in streams. This type of runoff originates from developed land that contains higher proportions of impervious surface cover (rooftops, parking lots, roads, etc.). These surfaces concentrate large quantities of water into the stream quickly, resulting in stream bank erosion and incision or gully-scour.

Stormwater runoff not only contributes sediment, but also fecal coliform. Domestic and urban animals contribute fecal coliform to the landscape, which is washed into the streams during rain events. Similar contributions in urban environments often originate from leaks and overflows from sanitary sewer systems, illicit discharges, and leaking septic systems.

Leaking septic systems have been identified as a significant contributor to the fecal coliform load detected in the watershed. Even though this watershed is not entirely located in Catoosa County, it is useful to analyze urban expansion in this area. The rate of urban and suburban expansion in Catoosa County has been high during the past decade, creating more potential sources of fecal coliform pollution. According to U.S. Census data, the population of Catoosa County has increased by 20% during 2000 – 2010. Within the same period there were 4,795 households built in the county, many of which were complemented with septic systems. Table 4.1.c. displays information regarding septic systems in Catoosa County.

Table 4.1.c. A display of septic system installation and repair information compiled from 2001 – 2006.

Septic System Statistics				
County	**Existing Systems (2001)**	**Existing Systems (2006)**	**Number of Systems Installed (2001 to 2006)**	**Number of Systems Repaired (2001 – 2006)**
Catoosa	16,375	17,571	1,196	598

Stakeholders considered septic systems to be another significant source of fecal coliform bacteria loads in the watershed. It was decided by the stakeholder group that landowners experiencing septic system failures would likely be motivated to fix the issues, especially if cost-share assistance is available.

Silviculture

Forestry practices have the potential to contribute sediment to local stream systems, especially when harvesting takes place near waterways. Approximately 68% of land use in Georgia is dedicated to forestry. The SCC Headwaters have approximately 55% forested land use, much of which is likely dedicated to silviculture. Table 4.1.d. displays information regarding timberland and percent harvested per year for Catoosa County. Although this information is somewhat outdated; it is still useful in understanding contributions of silviculture to sediment load within this watershed. Most activities occur on relatively small, privately-owned parcels with harvest occurring many years after one another. Unfortunately, the annual removal percentage (0.79%) and infrequent harvest per parcel make it difficult to implement projects that focus on load reductions from silvicultural activities without a long-term program.

Table 4.1.d. A display of statistics associated with forestry practices in Catoosa County, Georgia (1997).

Silviculture Statistics						
County	**Total Area**	**Timberland**	**Percent Timberland**	**Growing Stock (million ft^3)[a]**	**Annual Removal (million ft^3)**	**Annual Removal (%)**
Catoosa	103,800	46,500	44.80%	88.6	0.7	0.79%

4.2 Point Sources

Point sources of pollution are those which are delivered to a waterbody via "discrete conveyances". These sources are regulated through the NPDES permitting system. Point sources typically include industrial sites, municipal separate storm sewer systems, and confined animal feeding operations (CAFOs). There are few permitted point sources in the watershed, but it is assumed that the majority of impairing pollutants result from NPS pollution.

Industrial Sites

Many industries are required to apply for an NPDES permit when discharging industrial storm water to a nearby waterbody. There are six permits of this type located within the watershed. All of these sites are located in the lower portion of the watershed. Since the vast majority of impaired segments are located higher in the watershed, this indicates that industrial stormwater's contribution to stream impairment is minimal. Table 4.2.a below lists the industrial NPDES permits found within the watershed.

Table 4.2.a: A display of the locations of facilities that hold NPDES permits within the SCC Headwaters drainagearea.

ACTIVE NPDES PERMITS IN THE SCC HEADWATERS' DRAINAGE AREA		
Facility	**Address**	**County**
Babb Lumber Company	6652 Hwy. 41, Ringgold GA 30736	Catoosa
Candlewick Yarns	716 Industrial Blvd., Ringgold GA 30736	Catoosa
Penn Color	540 Hackett Mill Road, Ringgold GA 30736	Catoosa
Propex, Inc.	428 Rollins Industrial Blvd., Ringgold GA 30736	Catoosa
Shaw Industries, Inc.	716 Industrial Blvd., Ringgold GA 30736	Catoosa
Transfer Station	755 Shope Ridge Road, Ringgold GA 30736	Catoosa

Stormwater Systems

Runoff from rain events in urbanized areas is typically managed through the use of a municipal separate storm sewer system (MS4). This runoff captures pollutants as it travels across the urban landscape, and enters local waterways via stormwater conveyances without being treated. These conveyances are considered point source discharges, and operators are required to obtain an NPDES permit and develop a stormwater management program in order to mitigate any conveyed pollution.

According to the EPA (2011) Stormwater Phase I regulations (1990) require *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II (1999) requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

There are no areas within the SCC Headwaters that fall under phase I regulations; however, there are three urbanized areas that are regulated by phase II. The city of Ringgold, GA is located lower in the watershed, and is considered to be in the urbanized area of Chattanooga, Tennessee. The cities of Varnell and Tunnel Hill are higher in the watershed, and are considered to be in the urbanized area associated with Dalton, Georgia. These cities are potential sources of the impairing pollutants identified in the watershed.

CAFO Permits

Confined animal feeding operations (CAFOs) are considered a point source of pollution by Georgia EPD. These operations must therefore obtain an NPDES permit. There are no CAFOs located in this watershed. There are no dairy or swine operations within the watershed. Although there are many poultry operations, none are large enough to be considered a CAFO (>125,000 animals). CAFOs are therefore not considered to be a source of impairment in the watershed.

Figure 4.2.a. The Historic District of Ringgold encompasses the largest urban area within the watershed. Stormwater discharges are often considered point-sources.

5. Watershed Improvement Goals

This section of the WMP outlines the overall goals for the watershed improvement process in SCC headwater streams. In addition, the minimum NPS load reduction objectives for each segment (as written in TMDLs) are included and describe the estimated necessary load reductions for streams to meet water quality criteria.

5.1 Overall Objectives

<u>Restoration</u>

The main objective of this WMP is to define a route that will lead to the restoration of the watershed to the degree that compliance with state standards is achieved and maintained. Seventeen segments have been placed on Georgia's 303 (d)/305 (b) list, totaling over sixty miles of impairments. By implementing cost-share programs that incentivize landowners to address pollution sources on their privately-owned lands, reductions in relevant pollutants are likely to eventually be evident through water quality analysis and in fish and macroinvertebrate sampling. State-designated water quality collection and analysis protocols will be followed during periodic sampling events in an effort to de-list stream segments impaired for high fecal coliform bacteria counts. In addition, sampling rotations by monitoring groups (from Georgia EPD and TVA) should help indicate improvements in biotic integrity as they occur within the streams of the watershed. The ultimate objective of this plan is the de-listing of the streams of the watershed and ensuring afterwards that they continue to meet state criteria.

Figure 5.1.a. Streambank stabilization is an important restoration technique where eroding banks contribute to the stream's sediment load.

This is consistent with the desires of the local stakeholder group. The underlying concerns for these water quality issues within the group were variable; however, a general consensus was identified. The main concern of the stakeholder group appears to be the health hazard that fecal coliform contamination poses. In addition, the cost associated with extra water treatment due to the pollutant load is a concern for the group. Finally, the stakeholders expressed the need for sedimentation issues that negatively affect aquatic organisms to be reduced to preserve the biodiversity present within the watershed.

<u>Anti-degradation</u>

Another major restoration objective is to prevent further degradation in the streams within the watershed. Future activities that introduce pollutants to streams in the watershed will hopefully be accompanied by

BMPs that mitigate the contribution. Although this document is not regulatory in nature, it aims to outline a path to prevent further degradation of stream segments by raising awareness of existing programs that make these practices more affordable to private landowners. Given the current growth trends in the area (e.g. conversion of farmland to suburban uses), one of the biggest threats to anti-degradation goals may be stormwater pollution that negatively affects water quantity and water quality.

Education

The final primary goal of this plan is to improve local citizens' knowledge of general watershed and NPS pollution processes. Education and outreach efforts are paramount if watershed goals and objectives are to be reached. Involving local communities in the watershed improvement process is a key to success, and providing an opportunity for locals to gain an understanding of the importance of watershed restoration needs to be a priority program component to supplement BMP installation efforts.

Presentations at local events were suggested by the stakeholder group as a means to reach a broad audience in the community. Creation of events with the sole purpose of gaining support was also suggested. Specific examples include stream cleanups, homeowner workshops (focused on septic system maintenance), and canoe floats down local waterways. Although streams in the SCC Headwaters may not be large enough for canoe floats, the objectives may still be accomplished by floating other nearby streams within the larger South Chickamauga Watershed.

5.2 Load Reduction Targets

Four impaired segments within the watershed are due to exceeding state standards with regards to fecal coliform concentration. These segments have had TMDLs created either in 2004 or 2009. Based on these TMDLs, percent reductions of fecal coliform loadings were calculated. These load reductions attempt to calculate how much the pollutant load must be reduced from the watershed for a stream to meet state criteria for a particular pollutant. The results from these calculations are listed below for each segment in Table 5.2.a.

The other 13 listed segments resulted from impaired biota. It is assumed that sediment load was the main contributor to the state of the biotic assemblages. Sediment loads were assessed for each of the impaired segments, and sediment load targets were established. Total Allowable Loads were calculated from this information. If the observed loads were less than the target, then the total allowable loads were identical to the observed load. No load reductions are given for these streams. When no load reductions were called for, impairments are likely to stem from historical loading rather than current issues within watersheds. Overall, these calculations allowed percent reduction estimates needed to de-list problem segments to be obtained. The results from these calculations are listed below for each segment in Table 5.2.b.

Table 5.2.a: Fecal Coliform Loads and Required Fecal Coliform Load Reductions.

FECAL COLIFORM LOAD REDUCTIONS NEEDED PER SEGMENT			
Impaired Stream Segment	**Observed Load (counts/30 days)**	**TMDL (counts/30 days)**	**Percent Reduction**
Dry Creek	4.89 E+12	6.75 E+11	86
East Chickamauga Creek	1.74 E+13	4.11 E+12	76
Little Chickamauga Creek	1.40 E+13	3.30 E+12	76
Tiger Creek	7.05 E+12	2.50 E+12	65

Table 5.2.b: Total Annual Sediment Loads and Required Sediment Load Reductions from TMDLs that have been completed.

SEDIMENT LOAD REDUCTIONS NEEDED PER SEGMENT			
Impaired Stream Segment	**Observed Load (tons/yr.)**	**Total Allowable Load (tons/yr.)**	**Percent Reduction**
Dry Creek Subwatershed			
Dry Creek	4,742	613	0*
East Chickamauga Creek Subwatershed			
Cove Branch	194	194	0*
Tanyard Creek	2,300	1,177	49
Little Chickamauga Creek Subwatershed			
Coulter Creek	25	25	0*
Little Chickamauga Creek	3,858	2,497	35
Little Chickamauga Creek Tributary #1	1,048	510	51
Little Chickamauga Creek Tributary #2	688	510	26
Little Chickamauga Creek Tributary #3	277	277	0*
Tiger Creek Subwatershed			
Cat Creek	346	346	0*
Cherokee Creek	318	318	0*
Little Tiger Creek	191	191	0*

GA DNR determined that these sediment issues were historical in nature, and no reduction is required.

6. Pollution Reduction

This section explores management programs and strategies that exist within the SCC Headwaters that are designed to reduce fecal coliform and/or sediment pollution. Many of these programs have been put in place by organizations both large and small, and most are meant to be mutually beneficial to multiple groups of people and the environment. More importantly for the purposes of this document, this section also explores a proposed program needed in the watershed in order for the previously identified restoration goals and objectives to be accomplished. This program is intended to be led by Limestone Valley RC&D Council.

In the following sections, each program and the structural and non-structural practices they provide are discussed. Structural practices are those that are engineered, and result in a physical structure that is designed to reduce a specific type(s) of pollution. Non-structural practices are those that do not result in an engineered structure. Instead, these measures typically work to change the attitude or behavior of individuals.

6.1 Existing Conservation Programs

There are several existing conservation programs implemented within the SCC Headwaters; however, none are unique to the area. Most programs that encourage water quality improvements are ubiquitous across Georgia, if not the nation. Only those that specifically relate to sediment and/or fecal coliform pollution reduction are discussed here.

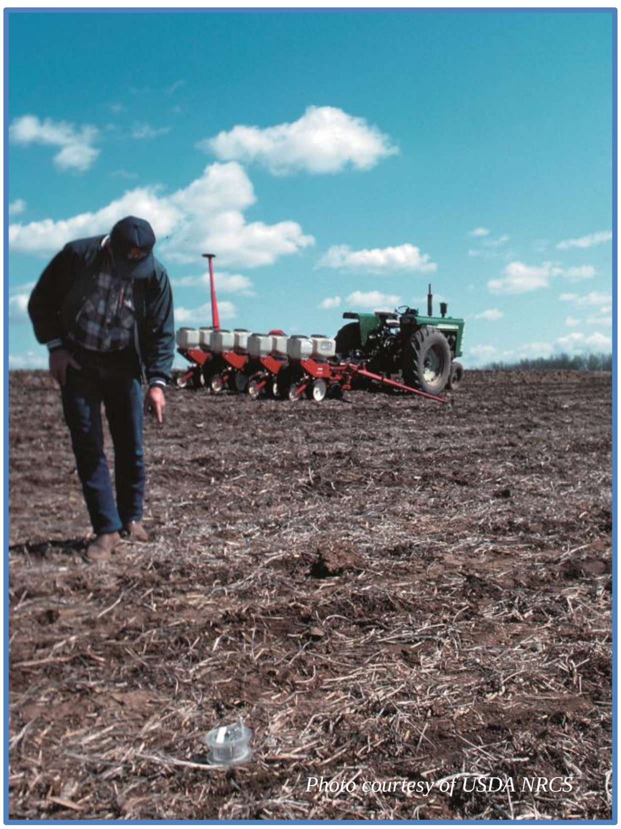


Figure 6.1.a. In front of No-Till equipment, a farmer observes the crop residues left from previous seasons for soil protection.

Existing Structural Programs and Practices

Several programs aim to implement structural practices to address significant resource concerns when possible. Since agriculture and forest encompass a large portion of the land use within the watershed, opportunities for conservation on farms and forest parcels are integral to improving water quality in the area. The practices conducted by these agricultural and forestry programs generally rely on voluntary conservation, yet the programs are included in this section since they still work effectively towards water quality improvement. In addition, programs in existence to ensure sound onsite waste management design and construction, as well as stormwater conveyance are relevant to sediment and/or fecal coliform reduction within the watershed.

A conservation tillage program, relevant to sediment pollution reduction on agricultural lands, is currently run by Limestone Valley RC&D Council. The program makes various conservation tillage equipment available for rent within the watershed. Equipment provided includes seed drills, aerators, and chemical sprayers. Conservation tillage is an excellent way for producers to plant their crops with minimal disturbance to the soil.

This technique significantly reduces erosion from cropland, but also has other benefits such as increasing water retention and nutrients in the soil.

The Environmental Quality Incentives Program (EQIP), implemented by NRCS, is another program that works to address resource concerns (including sediment and fecal coliform sources) on agricultural and forest lands. EQIP is a cost-share program for voluntary landowners seeking conservation practices and is open to any producer engaged in livestock, forestry, or crop production on eligible land. If a producer within the watershed is interested in implementing BMPs on their property, they currently could receive 75% of the costs associated with installation. However, the funds are limited, and many applicants across Northwest Georgia are not accepted due to this factor. Examples of practices provided by EQIP that reduce sedimentation include heavy use area stabilization, streambank stabilization, and riparian enhancement, among others. Practices that reduce fecal coliform contamination include animal waste storage facilities and livestock exclusion coupled with alternative livestock watering facilities.

The Conservation Reserve Program (CRP), administered by the USDA Farm Service Agency, also puts conservation practices "on-the-ground" on agricultural and forest lands. One of the nation's oldest conservation programs, the CRP helps provide technical and financial assistance to qualifying farmers that want to address soil and water quality concerns on their property. It is designed to help farmers make decisions about their property that are not only environmentally desirable, but also cost effective. In addition, the program can help farming operations become or remain compliant with federal, state, and local laws. Common practices used through the CRP are designed to address problem areas on farmland, such as eroding cropland. This can be accomplished by conversion of sensitive acreage to vegetative cover such as planting grasses, trees, or establishing vegetative buffers along waterways. These types of practices not only help continue the production of food through conserving our soil resources, but also help enhance forest and wetland resources while providing clean water to our local streams.

Another program is implemented by the North Georgia Health District (a division of Public Health in Georgia) that addresses human health concerns on residential lands by using a permitting method for septic system repairs and installations. The State of Georgia has existing regulations that require that each dwelling have a functioning system, and this system is designed to uphold that requirement. The permitting process includes the design of specific prescriptions (e.g., field line length, location, and placement, determination of special needs, etc.) that may be necessary for a system to work on a given parcel. The program helps ensure that when new systems are constructed, or old systems are re-assessed due to failure, they follow specifications approved by the district. The system also involves licensing contractors to make them fully aware of the expectations associated with septic system projects. The importance of this program cannot be understated, since onsite waste management systems

Figure 6.1.b. Septic system field lines are being repaired for this household. There are permitting requirements for repairs in the watershed.

are ubiquitous in the watershed due to limitations of sewer lines in this mostly rural area. The program and management strategy is effective in the area; however, poor soils and poverty in areas of the watershed present significant challenges.

Stormwater management programs are also implemented by the cities of Ringgold, Tunnel Hill, and Varnell as required in order to maintain compliance with regulations. These programs are in place to help mitigate pollution entering the local waterways from their municipal separate storm sewer systems with various practices, including certain minimum control measures. These measures include certain structural practices, such as controlling runoff from construction sites. Other measures are non-structural in nature, and are discussed in the next section.

Existing Non-Structural Programs and Practices

Many programs also provide non-structural practices in the SCC Headwaters, and most are not unique to the area. These practices, although not physically reducing pollution, can arguably improve water quality as much or more than structural practices themselves. Changing behaviors and/or attitudes can be contagious, making a real difference in both the cultural and natural landscape over time.

The NRCS provides technical assistance to farmers across the nation, including helping create management plans for their lands. Conservation Plans, as well as Comprehensive Nutrient Management Plans (CNMPs), are designed to help producers better manage the natural resources on their lands, in addition to the runoff leaving them. Implementing these plans may involve the installation of structural practices, which help to protect the environment on and off the farm.

The NRCS Farm and Ranch Lands Protection Program and the Georgia Forestry Commission's Forest Legacy Program work to prevent non-agricultural/silvicultural activities from ever occurring on the property (e.g., development). Land preservation, whether protecting farm lands or forests, is an important non-structural control throughout the nation. Several other preservation programs and incentives exist to maximize preservation of land, although many easements are more restrictive. These strict preservation covenants can be obtained through a land trust. Federal tax deductions and state tax credits (GA) exist to help incentivize property owners to enter properties in these restrictive covenants.

Figure 6.1.c. Forested lands are common in the SCC Headwaters. Some parcels are protected through management by the U.S. Forest Service.

The cities of Ringgold, Tunnel Hill, and Varnell stormwater management programs, mentioned previously, each also contain non-structural components. There are several measures that comprise a successful program; however, there are certain minimum measures that must be included in order to meet federal regulations. These include ensuring public education, public involvement, and illicit discharge detection. Pollution prevention, or "good housekeeping", is also an important part of any stormwater management program.

Georgia's Erosion and Sedimentation Act prevents buffers on state waters from being mechanically altered without a permit. On standard streams, the buffer requirement is 25 feet of undisturbed vegetation in the riparian zone. Primary and secondary trout streams have further restrictions, designating 50 feet of vegetation in the riparian zone. These practices work to reduce both fecal coliform contamination and sediment pollution within the watershed.

Additional non-structural practices accompany the agricultural BMP installations by NRCS programs that garner local attention for voluntary conservation projects. To explain, along with the actual BMP installation, programs set out to submit press releases that educate the public regarding soil and water resource concerns. Local newspaper articles derived from the press releases, farm days, and banquets all spotlight the agricultural BMPs and their benefits to producers and the environment.

6.2 Proposed Conservation Program for the SCC Headwaters

The number of impaired stream segments within the watershed indicate that a new collaborative program (in addition to those already in existence) is needed to approach compliance with state water quality standards. The following proposed program, the *South Chickamauga Headwaters Restoration Program* (SCHRP), would be an endeavor partially funded by Clean Water Act (§319) grants (and assisted by in-kind donations of certain stakeholders, agencies, and non-governmental organizations) that would provide cost-shares on practices that have been deemed by the stakeholder group as a means to address the water quality issues specifically related to the local watershed. In addition, this program would attempt to raise awareness of the issues in the area, as well as educate citizens about potential solutions to these local problems. It is intended, although left up to the discretion of Georgia EPD, that Limestone Valley RC&D Council receive funding to lead this collaborative program in the future.

Proposed Structural Practices of the SCH Restoration Program

Since agricultural activity encompasses a large proportion of land use within the watershed, the SCHRP will include a cost-share program that will help local farmers afford conservation practices that reduce fecal coliform and/or sediment contributions to receiving waters. Many of these practices are also beneficial to landowners which will serve as additional motivation for participation in the program. Most of the agricultural lands within the watershed are used for grazing, so funds need to be available to assist farmers with an interest in voluntary conservation to restrict livestock stream access and provide alternative watering sources. This would reduce the fecal coliform load from direct sources and agricultural runoff in the watershed. Projects that address erosion issues will likely include streambank and heavy use area stabilization. In addition, funds are needed to establish riparian buffers where they are absent. GIS analysis indicated that approximately 20% of the watershed has inadequate riparian buffers. Projects to improve riparian buffers would help reduce both fecal coliform and sediment pollution by acting as a physical barrier to runoff during rain events.

Altogether, many types of agricultural BMPs may be installed as a part of the watershed improvement process. In general, however, projects that only marginally address the resource concerns will be avoided. A variable cost-share rate model will be implemented to offer higher rates on projects that significantly reduce pollutant loads. A suite of agricultural BMPs may be installed as part of the restoration process assuming they assist in sediment and/or fecal coliform load reductions. Each BMP type has been described in detail at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/alphabetical/ncps.

Since failing septic systems were determined by the stakeholder group to be a significant contributor to the fecal coliform bacteria load in the watershed, the SCHRP will include a cost-share program to address this issue. High failure rates are said to occur for several reasons, including poor percolating soils, outdated systems, and the low-income financial condition of a portion of the local population. A cost-share program in the area would help to incentivize system fixes. A variable cost-share rate model will be implemented to offer higher rates on projects that significantly reduce pollutant loads. Inclusion of other property owners to be eligible for lower cost-share rates, however, will maximize program participation while building important momentum within communities.

Proposed Non-Structural Practices of the South Chickamauga Headwaters Restoration Program

Non-structural practices that educate and inform the public will accompany the cost-share programs funded through the SCHRP by seeking local attention for the voluntary conservation projects. The idea is to invest in conservation practices while demonstrating their effectiveness to other landowners, with hopes that voluntary conservation and modern land management practices that address resource concerns become contagious in the community. At the least, the concepts and practices will be slowly become more accepted over a period of time as they become more commonplace. Local newspaper articles derived from the press releases, farm days, and banquets are all acceptable ways to spotlight the benefits of agricultural BMPs. According to stakeholder comments, several BMP demonstration projects have already been completed by NRCS within the SCC Headwaters. These projects were well accepted, which indicates the potential to develop local momentum for the proposed BMP cost-share program.

Figure 6.2.a. Community canoe floats are a great way to connect citizens with their local waterways. South Chickamauga Creek (just downstream) is large enough to provide this non-structural conservation measure.

Stakeholders brought to our attention that additional nutrient management strategies are needed to reduce fecal coliform bacteria by ensuring landowners apply poultry manure according to prescriptions. Many poultry operations in the watershed have developed CNMPs as a prerequisite to attain NRCS funds, however, these producers are often not the final recipient of the manure. Producers who purchase and apply manure in the watershed (and water quality) could benefit from an incentivized program to develop and follow nutrient management prescriptions for their own properties based on local site conditions. The details of this proposed effort are anticipated to be included in the first grant proposal of the restoration process. Despite being non-structural in nature, this project component is discussed for the duration of the document under agricultural BMPs (Nutrient Management; code 590).

Another non-structural element of the proposed program will seek to educate the local community about septic system maintenance. Local contractors and Environmental Health Inspectors have indicated that many septic system failures are due to a lack of maintenance, which suggests that an educational strategy designed to inform homeowners of proper septic system care has the potential to make a long-term impact on the fecal coliform load in local streams. Funds from the SCHRP should be used to provide workshops that inform homeowners of proper maintenance. These "pump-out" workshops should have an incentive for participation such as a discount on septic system maintenance through local contractors. In addition, educational material should be produced and distributed with all system installations and repairs.

As a part of the SCHRP, Limestone Valley RC&D should also create annual or semi-annual events that encourage public participation in the watershed improvement process. This plan could include canoe floats, stream cleanups, rainbarrel workshops, and the establishment of viable Adopt-A-Stream groups. Although many of the streams within this watershed may be too small for floats or effective cleanups, the South Chickamauga Creek Watershed as a whole offers ample opportunity to make significant connections between citizens and their waterways.

In addition, the new program should include promotion of the watershed improvement process to local stakeholders to further develop and maintain program momentum. Press releases should be periodically issued to local newspapers highlighting program details, and the watershed issues it attempts to resolve. Promotions should also include occasional local presentations to stakeholder groups. These promotions would serve to maintain community interest in the restoration effort by reminding local groups of the benefits the implementation effort is seeking to provide (e.g., reduced human health risk and water treatment costs and increased financial assistance within the community). These stakeholders should be also updated as significant progress is made toward water quality goals in order to show them that the goals of the restoration efforts are attainable.

7. Implementation Program Design

The objective of this WMP is to outline implementation efforts needed to result in the long-term goal of de-listing the vast majority impaired stream segments. This section of the WMP outlines specific restoration activities, how they relate to implementation milestones, and estimated dates of completion. In addition, costs associated with the measures needed for watershed restoration are estimated.

7.1 Management Strategies

The basic strategy for implementation of this WMP is to create and manage a program that features both structural and non-structural controls within the watershed to address the fecal coliform and sediment issues. It is the intent of this program to restore the watershed to the extent that impaired segments are eventually de-listed. We aim to accomplish this by increasing the available agricultural BMP cost-share opportunities, creating a septic system repair cost-share program, and making available educational opportunities to encourage public participation in the watershed improvement process. Septic system failures will be identified and addressed with the technical assistance provided by the North Georgia Health District. The NRCS will assist with technical advisement with respect to agricultural projects. Other stakeholders, agencies, and non-governmental organizations will make key contributions to other facets of the program. All participation in grant programs will be voluntary in nature, and great care will be taken to respect private property rights.

In order to de-list several stream segments through implementation of a number of small projects, it is likely a long-term investment of time and significant funding will be necessary. Assuming the behaviors and land management practices improve over time, the benefits of clean water can last generations. It has been estimated that approximately 30% of the critical areas within the watershed can be treated with BMP installations to reduce NPS pollution through the implementation of four separate Clean Water Act §319 grants. The proposed grants would cumulatively fund over $700,000 worth of projects and be implemented over the course of thirteen years (including grant proposal submission periods). This proposed allocation of funds is similar to other restoration efforts that have been funded in the state, yet is to be focused on a smaller geographic scale, which should lead to more pronounced improvements. It is believed that several stream segments (and potentially the majority of impairments) could be de-listed as a result of this effort, although it is possible more funding could be necessary to accomplish that feat.

7.2 Management Priorities

<u>Project Fund Allocation</u>

We intend on developing cost-share programs for both agricultural BMP installations and septic repairs and solicited the stakeholders as to how to allocate the funds between these projects within the watershed. Stakeholder opinions were variable, but analysis of responses resulted in 50% of the potential funds being allocated to each component. Stakeholders suggested that many homeowners with chronic and relatively new septic system issues will likely be inclined to fix them for sanitary purposes, and thus garnering support for this program facet may be accomplished more swiftly than for the agricultural component. Acceptance of agricultural BMPs in the watershed, and thus program participation, may take more time since there is a lack of urgency when compared to households experiencing septic system failure. Considering these factors, planning has resulted in more funds being allocated towards septic system repairs during the first grant period (of four) in order to develop momentum in the watershed through widespread participation. The funds from the second and third grants are planned to be split more evenly between septic and agricultural projects. During the fourth grant period, the focus will be more on agricultural projects since septic system issues in the watershed should be less prevalent as a result of previous restoration efforts.

Initial Load Reduction Focus

Fecal coliform bacteria, as opposed to sediment, was the most concerning NPS pollutant to the stakeholders. For this reason, reduction of fecal contamination will be the primary focus during the first phase of the implementation process. This is supported by the plan to allocate more funds toward septic system projects during the first grant period. Projects to reduce significant sources of sediment will still be considered and completed when appropriate, but not as heavily marketed in outreach efforts. Many agricultural BMPs address both pollutants of concern simultaneously, and many farmers will seek a suite of BMP installations that will address multiple resource concerns. Projects such as these will likely be more prominent during the later phases of implementation.

Variable Cost-Share Rates to Focus on Priorities

Ideal projects for restoration of the watershed will be those significantly addressing the pollutants in close proximity to streams within or just upstream of impaired reaches. However, inclusion of landowners from the entire SCC Headwaters area to be eligible for program cost-shares is necessary to maximize program participation by building important momentum within the local community. In addition, since the problem areas are often in the downstream reaches, all areas of the SCC Headwaters likely contribute to the impaired status of local stream segments, albeit to varying degrees.

Since certain projects may address resource concerns more than others, variable cost-share rates will be utilized to reflect the anticipated water quality improvement. For example, a septic system within 100 feet of an impaired stream will receive a higher cost-share rate than one located much farther away. This method of incentivizing participation will bring about the greatest load reductions while maximizing the overall number of participants.

Priority Areas

Priority areas have been established by the stakeholder group for areas expected to have higher impacts on water quality within the SCC Headwaters area. Stakeholder opinions were variable, but a general consensus (based on water quality data and personal watershed knowledge) was reached that the headwaters of streams should be given priority status. The general headwaters of the main tributaries, as defined upstream of our upstream-most sampling points are shown in Figure 7.2.a. In addition to projects in close proximity to state waters, landowners in these areas will be given higher cost-shares on certain projects. Landowners within close proximity to streams and within priority areas are also likely to be solicited first when we are seeking to consider projects.

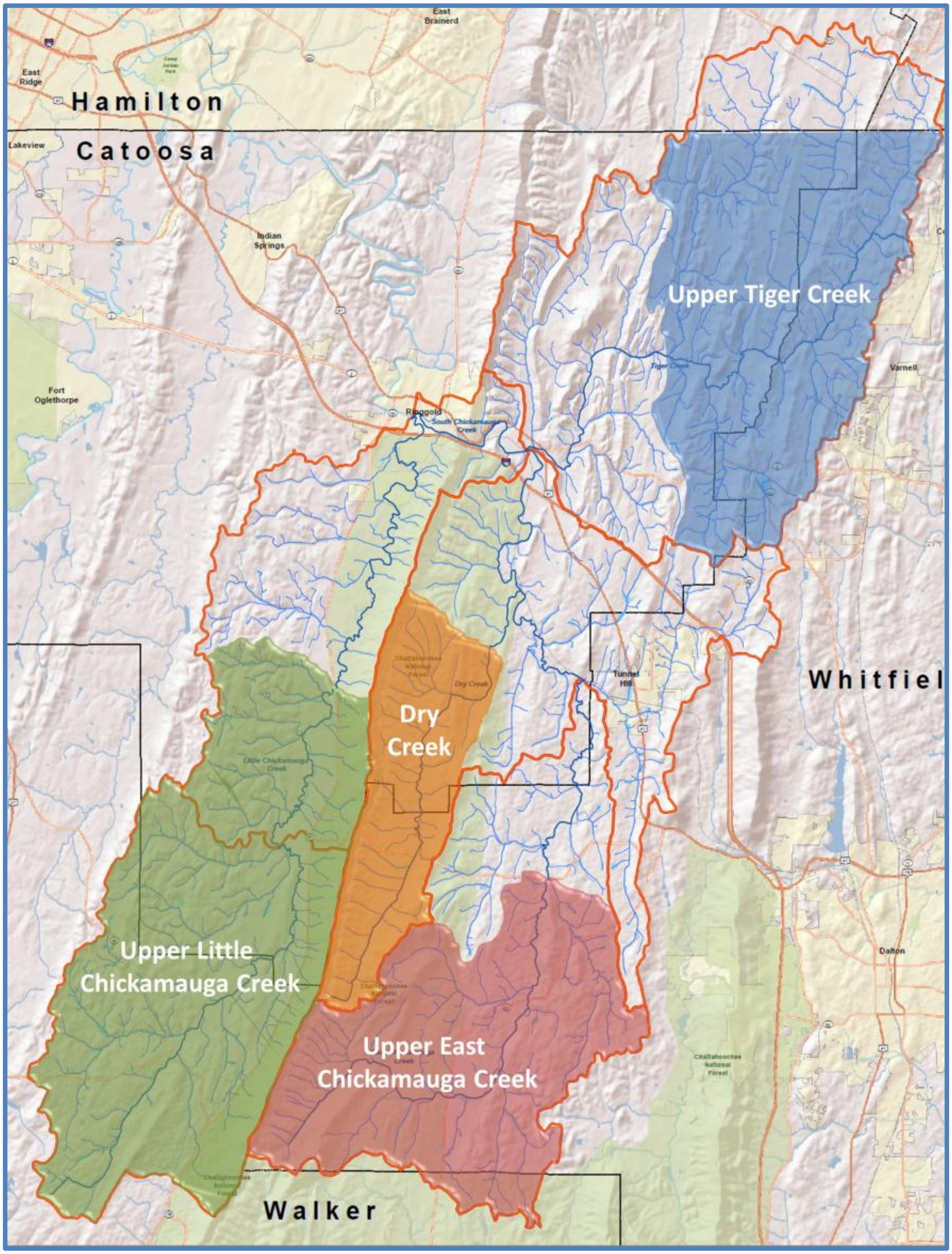


Figure 7.1.a. A map highlighting the priority areas of the watershed, as selected by the stakeholder group. These areas may receive higher project cost-share rates.

7.2 Interim Milestones

This WMP will be implemented for multiple years over several grants, each of which may have its own updated objectives and milestones according to changes in watershed conditions and/or management strategies. This section, however, seeks to outline objectives that should apply across the entire implementation process and some measurable milestones that should reveal significant progress. An update or addendum to this plan is scheduled for 2017 and again in 2022.

OBJECTIVE #1: Create a septic system repair cost-share program in the watershed.

MILESTONES:

- Identify local certified septic system contractors interested in participating in the program.
- Hold meetings with NGAHD representatives to design program.
- Establish cost-share criteria based on proximity to priority subwatersheds and distance of system to state waters.
- Hold a septic system installer's workshop to explain program details, and ensure standards for participation are understood.
- Maintain the septic repair program throughout the implementation process.

The repair process will involve the submission of bids from locally-owned businesses. These businesses must attend an installer's workshop to participate in grant projects. Bids will be requested from a maximum of five contractors for each repair, and the specific businesses that receive the opportunity to bid will be determined by using a rotating list of approved contractors. The homeowner will be allowed to choose which bid to accept. The rate of cost-share will be on a sliding scale that will result in offering more assistance to projects that will likely result in the greatest load reductions.

OBJECTIVE #2: Create an agricultural BMP cost-share program in the watershed.

MILESTONES:

- Hold meetings with the NRCS to determine appropriate BMPs and cost-share rates.
- Advertise the available grant money through local media.
- Issue press releases for successful BMP installations.
- Maintain the agricultural BMP program throughout the implementation process.

Agricultural BMP installation will be on a strictly voluntary basis, and "on-the-ground" efforts will be initiated with a phased approach. Landowner confidence and satisfaction will be a primary focus. This will allow us to develop a positive reputation in the area, which is hoped to eventually garner more interest in the watershed. The subsequent years are estimated to have more projects completed annually.

OBJECTIVE #3: Implement BMPs to achieve load reductions specified in the TMDL.

MILESTONES:

- Identify farmers willing to cost-share on agricultural BMP projects.
- Identify property owners willing to address inadequate riparian zones.
- Identify homeowners within targeted subwatersheds with failed or missing septic systems.

- Implement septic repairs and pump-outs in the watershed anticipated for each grant period as shown in Table 7.5.b. in Section 7.5.
- Implement agricultural BMPs in the watershed anticipated for each grant period as shown in Table 7.5.b. in Section 7.5.
- Estimate load reductions from projects when possible.

BMPs that specifically address fecal coliform will be emphasized on agricultural lands. These include activities that restrict cattle access to the stream while providing alternative water sources, and enhancement of riparian zones that may prevent animal waste and sediment from entering the stream during runoff events. Failing septic systems and "straight-pipes" will be identified and repaired to reduce the contribution of fecal coliform originating from residential areas.

OBJECTIVE #4: Reduce pollution inputs from suburban and rural areas through education and outreach (Section 8 for more detail).

MILESTONES:

- Hold a homeowner's septic system pump-out workshop designed to educate local citizens on proper septic system maintenance.
- Provide opportunities for the public to assist with stream cleanup efforts.
- Provide opportunities for the public to participate in Rainbarrel Workshops and ripairian tree plantings
- Provide opportunities for the public to participate in Georgia's Adopt-A-Stream Program.
- Conduct presentations discussing watershed restoration efforts at local events.
- Submit press releases to inform the public of the restoration process and NPS pollution issues and solutions.

A key component of the education and outreach portion of this WMP is designed to raise the awareness of citizens in the area through local media and "hands-on" events. Stream cleanups, creek walks/floats, and rainbarrel workshops are planned to be offered to interested citizens in the area throughout this plan's implementation. This ensures that the general public is provided the opportunity to not only learn about the watershed, but also participate in restoration events.

Education regarding septic system issues is also a primary focus of restoration efforts within the watershed. Local installers will be given the opportunity to participate in the cost-share program by attending a workshop where local environmental health officials will discuss regulations and proper procedures with respect to system repair and installation. Homeowners will be given the opportunity to receive discounts on septic system maintenance by attending a workshop where they will be educated by local officials about importance of functioning systems. In addition, educational materials will be made available at pertinent locations around the area to maximize the outreach efforts.

OBJECTIVE #5: Document changes in water quality throughout WMP implementation.

MILESTONES:

- Submit a targeted water quality monitoring plan for each grant received.
- Monitor sites at locations previously chosen by Georgia EPD.
- Conduct Pre- and Post-BMP monitoring for large agricultural BMP projects near significant streams.
- Sample to potentially de-list streams impaired for fecal coliform violations.
- Initiate WMP revisions.

Baseline data will be collected from available sources to determine the average concentrations of pollutants found at various locations within the watershed. This will allow for future comparisons when data is gathered to determine if improvements are measurable. Targeted monitoring (accompanied by a Targeted Water Quality Monitoring Plan) will occur once for each grant that is received. This type of monitoring will be used to determine if any improvements have been made and also to shift priority areas based on results.

When large agricultural BMP projects are implemented near significant streams, an effort will be made to sample for the pollutants of concern before and after project completion. This may allow inferences to be made about what projects are most beneficial, as well as build local confidence on finding solutions to water quality issues.

A SQAP will be also written for each grant that is received. This will guide efforts to sample according the procedure necessary to "de-list" stream segments if conditions have improved enough for standards to be met. The sites that are sampled for this purpose will be the same as those initially used to designate the segments as impaired.

Biological monitoring will also be conducted as part of regular Georgia EPD and TVA rotations and will provide insight on whether the local biotic integrity in impaired stream is improving as watershed restoration activities take place in the watershed.

OBJECTIVE #6: Provide local community leaders with the knowledge to consider the effects management decisions may have on stream health in the watershed.

MILESTONES:

- Establish connections with local community leaders.
- Conduct presentations to community leaders discussing water quality issues and the solutions that BMPs can provide.
- Share water quality data and interpret the results with local community leaders for discussion purposes.

City and county personnel will be updated regularly through presentations at local meetings to keep up involvement and/or awareness during the restoration process

7.3 Schedule of Activities

The following schedule provides the anticipated years for various objectives and milestones to be addressed in the WMP implementation process, assuming funding needs are met.

Table 7.3.a. A display of milestone activities and a timeline in which they will each be addressed throughout the implementation of the SCHRP.

IMPLEMENTATION SCHEDULE														
MILESTONE ACTIVITY	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Submit §319 Proposal to GA EPD	X			X			X			X				
Create septic cost-share program		X												
Create an agricultural BMP cost-share program		X												
Conduct Homeowner's Pumpout Workshop			X		X		X		X		X		X	
Install Agricultural BMPs			X	X	X	X	X	X	X	X	X	X	X	X
Install Septic System BMPs			X	X	X	X	X	X	X	X	X	X	X	X
Establish AAS Monitoring Group			X		X		X		X		X		X	
Update County Commission/Press Releases			X		X		X		X		X		X	
Conduct Education/Outreach Events		X	X	X	X	X	X	X	X	X	X	X	X	X
Conduct WQ Monitoring (Targeted)			X			X			X			X		
Conduct WQ Monitoring (De-listing)				X			X			X			X	
Reevaluate Milestones				X		X	X			X	X			X
Initiate Reassessment of WMP						X					X			

7.4 Indicators to Measure Progress

For more finite objectives, the numbers of agricultural and septic system projects and outreach events will reveal progress that the implementation program is gaining momentum. Section 7.5 outlines the goals with respect to each BMP type throughout the anticipated implementation effort. Some may be ambitious due to differences in palatability among BMPs to farmers; however, comparisons of completed "on-the-ground" projects with those anticipated within the watershed should indicate progress. Referencing these should also allow inference of specific BMPs needing more focus, as will areas in the watershed where more projects are necessary.

Landowner participation rates will be another useful tool in determining the success of grant implementation. It is hoped that the rate will increase through subsequent years of watershed restoration due to education and outreach efforts, as well as the gradual acceptance of BMPs within the watershed. Education and outreach participation rates will also be analyzed to help measure our progress. It is anticipated that these rates will also increase through subsequent years as the events gain notoriety within the watershed.

Of more importance in the long run will be to measure how these projects have translated toward the goals of accomplishing the necessary load reductions and eventually de-listing the impaired segments within the watershed. For the stream segments impaired for high fecal coliform bacteria counts, tracking water quality improvements will best indicate progress toward reducing fecal contamination and eventually de-listing streams. Water quality improvements will be revealed using two water quality sampling regimes intermittently throughout the implementation process. Both types of water quality monitoring (first introduced in Section 3.3) will be used to measure progress towards de-listing of segments impaired for exceeding fecal coliform standards.

First, targeted water quality monitoring (after submitting a targeted water quality monitoring plan) will take place at the beginning of each respective grant period. Targeted water quality monitoring will focus on sampling at nine sites within the watershed in an effort to evaluate improvements at sites in comparison to one another. Tracking project locations over time should complement this effort to evaluate improvements with respect to location. This monitoring is important to repeat throughout the implementation of this WMP since conditions should change as land management issues are attenuated.

The second type of water quality monitoring will be conducted according to the de-listing protocol (after submitting a SQAP) to attempt to de-list segments. This sampling will be completed at the end of each grant period to determine if state standards have been met or ensure they are at least improving. Additionally, the rate of water quality improvements resulting from the "on-the-ground" projects should be revealed, which should assist in adapting the timelines and management strategies accordingly. Eventually, if de-listing of a particular segment occurs prior to others, then priority areas may be shifted to incentivize more rapid improvements in other segments. Obviously, the delisting of any stream segment will be an excellent measure of success.

For stream segments impaired for poor biotic diversity, progress may be more difficult to indicate. Targeted water quality monitoring may potentially reveal turbidity changes over time (revealing less sediment in the water column), but Georgia EPD and TVA will be relied upon to sample fish and macroinvertebrates according to their scheduled rotations in order to determine whether biotic integrity has improved and to potentially de-list streams. Because many of these impairments occur in headwater streams, improvements may rely on where particular projects are located. It is anticipated that load reductions may be accomplished for some segments (or historical sediment may be attenuated).

However, whether sufficient increases in biodiversity lead to de-listing after load reductions are accomplished depends on several variables (e.g., habitat complexity, connectivity, etc.) for each segment.

7.5 Technical Assistance and Roles of Contributing Organizations

This section will focus on the roles of various groups anticipated to contribute to make the restoration effort a success. Specifically, the SCHRP will rely on technical expertise from the NRCS with respect to agricultural BMP implementation, and the Northwest Georgia Public Health with respect to septic system BMPs. The program also relies on assistance with education and outreach activities from groups such as the South Chickamauga Creek Greenway Alliance, Tennessee River Rescue, and the Tennessee Valley Canoe Club. The development of these partnerships has begun during the formation of this plan. The roles of the various groups providing assistance in the restoration process are outlined in detail in Table 7.5.a. below.

Table 7.5.a. The following groups are anticipated to contribute to SCHRP implementation by taking on the roles described below. While working towards accomplishing conservation goals, many of these activities will count towards non-federal match contributions associated with any funded 319 projects.

Organization Roles and Responsibilities		
Organization Name	**Organization Type**	**Description of Role in SCHRP**
Analytical Industrial Research Laboratories	Private Company	Provide discounted services in order to aid the restoration efforts. Analyze water samples for fecal coliform concentrations, which will be collected by project partners throughout implementation of this plan.
Catoosa Soil and Water Conservation District	State Agency	Assist with marketing for agricultural BMPs in the watershed. Potentially help identify willing landowners in the watershed that are interested in the program.
Georgia Department of Natural Resources	State Agency	Conduct monitoring rotations to sample sites in the watershed for fecal coliform bacteria and biota that can reveal improvements or aid de-listing efforts.
Georgia Environmental Protection Division	State Agency	Adminster Clean Water Act Section 319 Grants to provide funding for this restoration program.
Environmental Protection Agency	Federal Agency	Provide EPA Clean Water Act Section 319 funds to Georgia EPD to adminster through the state 319 grant program.
Envision Ecology	Private Company	Provide technical expertise on stream restoration projects. Potentially help identify critical sites within the watershed.
Limestone Valley RC & D Council	Quasi-Governmental Organization	Lead implementation efforts including submitting grant applications, serving as grantee fulfilling reporting obligations, marketing program components, spearheading outreach efforts, managing finances, conducting monitoring, and managing projects

Natural Resource Conservation Service	Federal Agency	Provide technical expertise for agricultural BMPs. This process will include multiple farm visits, the development of a conservation plan for the landowner, project supervision and project inspection. All projects will be installed according to NRCS specifications and standards.
Northwest Georgia Public Health	State Agency	Provide technical expertise for septic system repairs. This process will include assessing, planning, permittig, and inspection of installed or repaired septic system components. Help may also be provided through identification of potential septic system repair projects. Assistance may also be provided during workshop preparation if applicable.
South Chickamauga Greenway Alliance	Community Organization	Serve as a vehicle to promote the South Chickamauga Headwater Restoration Program and assist in marketing its outreach efforts.
Tennessee River Rescue	Community Organization	Assist in marketing efforts of the program to provide stream cleanup opportunities.
Tennessee Valley Canoe Club	Community Organization	Assist in marketing the outreach efforts of the program. Provide guidance on the development of paddling events within the watershed.
Tennessee Valley Authority	Federal Agency	Conduct monitoring rotations to sample sites in the watershed for fecal coliform bacteria and biota that can reveal improvements and potentially lead to de-listing
University of Georgia Cooperative Extension	State Agency	Assist in marketing efforts for program components and outreach events.

7.6 Estimates of Funding

As discussed in Section 6, many programs are already offered within the SCC Headwaters that work to reduce NPS pollution. Despite the existence of these endeavors, impairments persist in the area. The estimates for implementing the SCHRP in this section are reliant on the 319 program as the main source of funding (despite key contributions from various groups as discussed above), and assume continuous consistent effort from the other programs previously mentioned in order for water quality improvements to occur. In order to estimate the cost associated with the de-listing of impaired segments within the watershed, an estimate of total watershed treatment was first calculated (Table 7.6.a.). The Total Watershed Treatment Table is an estimate of the cost of a hypothetical instantaneous treatment for fecal coliform and sediment reduction at all critical sites (estimated through statistics, or identified remotely). These calculations assume 100% landowner participation in the watershed, and landowner contributions (generally averaging 40%) to project costs are included in each itemized line; however, these contributions have been removed in the last line of the table. **The high cost associated with total watershed treatment may be alarming at first glance, however, it is not anticipated that total watershed treatment is necessary in order to de-list the majority of impaired segments.** Despite this fact, it is important to estimate the maximum restoration effort in the watershed based on actual watershed conditions and the amount of money needed to accomplish such an effort, so that work towards total watershed treatment can proceed until eventual de-listing occurs.

Many of the BMPs needed to de-list the stream were chosen by the Watershed Advisory Committee based on their expertise and knowledge of the area. The quantities of BMPs estimated in the Total Watershed Treatment Table were calculated using a variety of techniques. The septic system BMP needs were estimated based on information obtained from Catoosa County and failure statistics provided by the U.S.

EPA. Information originating from local knowledge of repair costs in the area was also utilized. Agricultural BMP quantities were largely estimated through Geographic Information Systems analysis. Each tributary in the watershed was studied to determine the location of grazing lands and cropland. This information was coupled with an insufficient riparian buffer analysis to determine likely areas in need of BMPs. Many BMPs are often coupled with others, and the frequencies of these associations were calculated using conservative estimates.

Efforts to begin working towards the de-listing of impaired stream segments are planned to begin immediately with the approval of this WMP. **A goal of approximately 30% of total watershed treatment has been set to be accomplished by 2025, which is believed to potentially be enough to de-list several segments. In order to lay the framework to accomplish this, Table 7.6.b. was created to represent approximately 30% of the total watershed treatment costs excluding landowner contributions.** A phased implementation approach was designed to allow for slower progress during initial development of partnerships and community momentum, while accounting for the expected acceleration during subsequent years. Based on this approach, goals were established for each BMP type to be accomplished by the years of 2016, 2019, 2022, and 2025. These years coordinate with the completion of each of the four planned §319 grant cycles (FY12, FY15, FY18, and FY21). **Again, the costs associated with this table do not include landowner contributions to the project, and are displayed at 60% of the total cost in order to better describe federal funding needs. It is anticipated that requests in future §319 proposals will reflect similar amounts with respect to BMP project funds (excluding personnel, travel, etc.).**

Table 7.6.a. An estimate of the cost associated with a hypothetical instantaneous watershed-wide treatment for fecal coliform and sediment reduction at all critical sites.

TOTAL WATERSHED TREATMENT TABLE			
Agricultural BMPs (Name - Code)	**Quantity**	**Cost/Unit**	**Cost Estimate**
Fence - 382	357,500 lin.ft.	$1.88/lin.ft.	$672,100
Heavy use area (pad - concrete; w/ 614 below) - 561	1620	6.00/sqft	$9,720
Heavy use area (pad - geotextile) - 561	13,600	$1.28/sqft	$17,408
Nutrient Management – 590	3,000	$53/ac	$159,000
Pipeline - 516	67,500	$2.25/lin.ft.	$151,875
Pumping plant -533	135	$1875 ea.	$253,125
Riparian forest buffer -391	220	$135.00/ac	$29,700
Riparian herbaceous cover - 390	220	$201/ac	$44,220
Field borders - 386:	5	$221/ac	$1,105
Spring development - 574	15	$1500 each	$22,500
Streambank and Shoreline Stabilization	35,750	$15/lin.ft.	$536,250
Water well - 642	45	$4500 each	$202,500
Watering facility (3’x4’ pad) - 614	135	$487.50 each	$65,813
Septic System BMPs (Name - Code)	**Quantity**	**Cost/Unit**	**Cost Estimate**
Conventional system repair	500	$4000 each	$2,000,000
Experimental system Installation	50	$7000 each	$350,000
Septic Tank Pumpout	1100	$300	$330,000
Educational Event	**Quantity**	**Cost/Unit**	**Cost Estimate**
Septic installer workshop	1	$1,500	$1,500
Homeowner workshops (septic maintenance)	5	$1,500	$7,500
Ag-field days	5	$1,500	$7,500
TOTAL WATERSHED TREATMENT COST			**$4,861,816**
TOTAL TREATMENT COST EXCLUDING LANDOWNER CONTRIBUTIONS			**$2,917,089***

60% of Total Watershed Treatment Cost

Table 7.6.b. A display of goals set to measure progress towards watershed restoration. All SCHRP funds will be sought from the 319 program to complement other existing programs.

WMP Implementation Budget and Goals Table					
***Management Measure – BMP code**	**Est. Cost/unit**	**Goals by Year (Cost**)**			
		2016	**2019**	**2022**	**2025**
Fence - 382	$1.88/lin.ft.	15,000 ($16,920)	25,000 ($28,200)	25,000 ($28,200)	35,000 ($39,480)
Heavy use area (pad - concrete; w/ 614 below) - 561	6.00/sqft	72 ($260)	120 ($432)	120 ($432)	168 ($605)
Heavy use area (pad - geotextile) - 561	$1.28/sqft	400 ($307)	800 ($614)	800 ($614)	1200 ($922)
Nutrient Management	$53/ac	150 ($7,950)	172 ($9,116)	172 ($9,116)	194 ($10,282)
Pipeline - 516	$2.25/lin.ft.	3000 ($4,050)	5000 ($6,750)	5000 ($6,750)	7000 ($9,450)
Pumping plant -533	$1875 ea.	6 ($6,750)	10 ($11,250)	10 ($11,250)	14 ($15,750)
Riparian forest buffer -391	$135.00/ac	9 ($729)	15 ($1,215)	15 ($1,215)	21 ($1,701)
Riparian herbaceous cover - 390	$201/ac	9 ($1,085)	15 ($1,809)	15 ($1,809)	21 ($2,533)
Field borders - 386:	$221/ac	0 ($0)	1 ($121)	1 ($121)	2 ($241)
Spring development - 574	$1500 each	0 ($0)	1 ($900)	1 ($900)	2 ($1,800)
Streambank and Shoreline Stabilization	$15/lin.ft.	1000 ($9,000)	2500 ($22,500)	2500 ($22,500)	4000 ($36,000)
Water well - 642	$4500 each	2 ($5,400)	3 ($8,100)	3 ($8,100)	4 ($10,800)
Watering facility (3'x4' pad) - 614	$487.50 each	6 ($1,755)	10 ($2,925)	10 ($2,925)	14 ($4,095)
Conventional system repair – N/A	$4000 each	40 ($96,000)	40 ($72,000)	40 ($72,000)	30 ($54,000)
Experimental system Installation – N/A	$7000 each	5 ($21,000)	4 ($14,400)	4 ($14,400)	3 ($10,800)
Septic Tank Pumpout – N/A	$300	50 ($9,000)	75 ($13,500)	75 ($13,500)	100 ($18,000)
TOTAL EXPENDITURES		**$180,206**	**$193,832**	**$193,832**	**$216,459**
CUMULATIVE EXPENDITURES		**$180,206**	**$374,038**	**$567,870**	**$784,329**

****Cost is displayed at 60% of the total cost to better estimate needs from federal funding sources.**

The BMPs listed in the last few tables are not the only techniques that may be used to reduce polluted runoff during watershed restoration. These goals were derived from GIS analysis, and not all resource concerns can be identified using aerial imagery (ex. Stream Crossings, Cover Crops, Waste Storage Facilities, etc.). In addition to agricultural BMPs, stormwater BMPs may be needed, despite the small percentage of urban land in the watershed. The local stakeholder group made it clear that the BMP list above will likely be the most frequently used, however, any type of project that reduces the pollutants of concern should be considered.

7.7 Getting Started

A goal of approximately 30% watershed treatment has been set to be accomplished by 2025 (assuming funding needs are met). This treatment prescription is believed to potentially be enough to de-list several segments, although it is possible more funding may be necessary to de-list all impaired streams. Efforts to begin working towards the de-listing of impaired stream segments will begin immediately with the approval of this WMP. First, a few agricultural BMPs and septic system repairs will be implemented (using FY10 funds already awarded) in 2011 and 2012 to serve specifically as BMP demonstrations to build momentum in the watershed.

In late 2012, Limestone Valley RC & D plans to apply for the first grant dedicated to the SCHRP which, if funded, would begin in 2013/2014. This first grant period will highlight activities identified in Table 7.3.a., and focus on accomplishing the projects described in Table 7.5.b. by 2016. The goals assume landowner interest to be adequate. Some goals for specific BMPs may be easier to accomplish than others due to differences in palatability to landowners. Some may be reconsidered when the document is reassessed or updated in an addendum for the first time in 2017. Limestone Valley RC&D plans to continue the activities as described in Section 7.4. until the goals are achieved.

8. Education and Outreach Strategy

The outreach associated with watershed restoration efforts will seek to put volunteers to work in ways that assist with cleaning up South Chickamauga Creek, enhancing the riparian buffer, reducing non-point source pollution, and sampling water quality parameters. These events have been designed to aid in raising awareness of local nonpoint source issues, and lay the groundwork for implementation through the establishment of partnerships and identification of potential BMP projects. This idea is based on the Council's past experience with implementing 319 grant projects, which revealed that the general public is one of the most valuable sources of information with respect to identifying both general and specific sources of pollutants, as well as generating unique ways to address watershed issues. With each commitment from a citizen to volunteer their time, the likelihood of successful watershed restoration increases. The following descriptions are tentative events that are planned to be held in and adjacent to the watershed, and a map is included to identify their locations. A value will be placed on these events through calculating volunteer labor, supplies, or other in-kind donation. This value, with all supporting documentation, will be reported as match to the federal funds distributed through any applicable 319 grant.

Riparian Tree Plantings

Limestone Valley RC & D aims to hold riparian tree planting events with volunteers on the banks of streams and creeks in the South Chickamauga Headwaters. It is anticipated that trees and the tools with which to plant them will be obtained through donations from various non-federal sources. The volunteers to plant the trees will be acquired through newspaper articles and word-of-mouth. The primary purpose is to utilize volunteer labor to plant trees in an effort to increase the riparian buffer within the watershed. Another purpose of this event is to identify potential BMP projects through personal interaction with volunteers that encourage them to assist in "spreading the word" about grant funds and opportunities. These events will include a presentation about the Watershed Management Plan and the non-point source pollution issues that face the South Chickamauga Creek and its headwaters. Other educational materials on septic system repairs and maintenance, and stormwater practices (rainbarrels, raingardens) will be made available. Donated materials and labor will be reported as match for any applicable 319 grant.

Rainbarrel Workshops

During past 319(h) grant implementation projects in Northwest Georgia, rainbarrel workshops have proven to be one of the more useful tools to garner public support for watershed restoration efforts. Through these past projects, the Council has been able to not only develop a relationship with the local Coca-Cola plant that provides the barrels, but also assess the level of interest from the public. The Council quickly determined that this event generates an overwhelming interest from local communities, and attracts the most enthusiastic volunteers. Furthermore, rainbarrels are desired by a diverse array of citizens including both farmers and homeowners, which is the exact demographic that is needed to implement BMPs that address resource concerns on residential and agricultural lands.

There are several reasons why rainbarrel workshops generate such a positive response for the area of Northwest Georgia. For many homeowners, these rainbarrels provide an economic benefit since they do not pay for the water use and it can also help them avoid any watering restrictions during drought years. Many farmers claim that this technique was used on the farm when their parents and grandparents were running the operation, and thus have a nostalgic connection with the method. While these benefits work well for attracting volunteers to construct rainbarrels, the most significant benefit of the practice is the improvement in stormwater runoff that results from rainbarrel use. By functioning similar to a retention pond, these barrels can reduce the quantity of runoff leaving properties during storm events which can reduce the excessive flows that contribute to streambank erosion in our smaller tributaries and streams. Sediment originating from erosion is a significant threat to the outstanding aquatic biodiversity found in the freshwater streams of our region, and many local volunteer citizens are enthusiastically searching for ways that they can work to accomplish conservation through management of their own properties.

For the purposes of the current 319(h) grant project, this outreach activity will have the primary objective of incentivizing rainbarrel construction and installation to reduce NPS pollution, but will also serve as the sounding board from which we can advertise available BMP funds. At these events, citizens will receive specific information about cost-share funds for projects that benefit both landowners and our natural resources, information about South Chickamauga Creek's water quality issues (with watershed map visual aids), and the opportunity to work to construct and take home a free rainbarrel to affix to the guttering system of their home. Volunteers from these events will be encouraged to participate further in identifying potential BMP sites and assisting with other outreach events. Follow-up communications will be initiated by the Council to keep these interested citizens engaged throughout the implementation process. The barrels donated from Coca Cola, the parts used to retrofit them, and the homeowners' labor and time spent constructing rainbarrels are all values that will be calculated and compiled for matching purposes for any applicable 319 grant.

Adopt-A-Stream Workshops

These events are designed to train volunteers in Catoosa, Walker, and Whitfield Counties on how to use AAS monitoring equipment to sample water quality parameters and inform them of non-point source pollution issues. At these workshops, volunteers will be informed of the basics of water quality sampling and watershed science, as well as how to use the AAS website to enter all collected data from the stream that they choose to adopt. The hours that volunteers spend in the training workshop, along with subsequent hours of actual sampling, will be used to calculate a match value that will be reported with supporting documentation to Georgia EPD. In addition, volunteers will be given information advertising potential available cost-share funds for both agricultural projects and septic system repairs that reduce non-point source pollution. Some workshop components may be featured in events that fall under a different category (e.g. Educational Canoe Float).

South Chickamauga Creek Cleanup

As part of the process to gain stakeholders from the local population (the Chattanooga area) that ultimately receives the waters from South Chickamauga Creek, partnerships were formed with the Tennessee Valley Canoe Club, the South Chickamauga Creek Greenway Alliance, and the Tennessee River Rescue. Through these partnerships with stakeholders, Limestone Valley, and TVCC has been assigned a leadership role in organizing a stream cleanup for volunteers in the greater South Chickamauga Creek Watershed. It is planned that this cleanup event will occur annually, and (since many volunteers are from the watershed) will be used as sounding board for advertising available BMP project funds while providing opportunities for NPS education. Volunteer labor and donated material values will be recorded and reported for matching purposes.

Water Quality Monitoring and Stream Cleanup Canoe Floats

These events are designed to attract members of the local community to volunteer to clean up our local waterways from a canoe and/or sample water quality during a training session on how to use Adopt-A-Stream equipment for water quality sampling. These volunteers will paddle while picking up all accessible trash within the stream and on the banks, and/or sample water quality at several sites, while learning about the importance of varying water quality parameters, agricultural and residential runoff issues and how they pertain to South Chickamauga Creek. Maps and handouts will be distributed at stops along the way to discuss pollution sources, BMPs, and steps they can take on their own property to reduce pollution. In addition, local aquatic fauna will be a topic of discussion in order to convey what could be at stake should pollution problems continue. Volunteer labor and donated material values will be recorded and reported as matching funds for any applicable 319 grant.

Summary of Nine Key Elements

The following is a summary of the Nine Key Elements addressed in the South Chickamauga Creek Headwaters (SCH) Watershed as identified in the Watershed Management Plan (WMP).

1. An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load reductions or achieve water quality standards.

The SCC Headwaters have a number of streams that fail to meet the criteria within the State of Georgia for pathogens and impacted biota, which respectively result from fecal contamination and excessive sediment loads. Load reductions of these pollutants are necessary in many stream segments, so the WMP focuses on fecal coliform bacteria and sediment as the nonpoint source (NPS) pollutants of concern and identifies several consistent sources for these pollutants (discussed in detail in Section 4), each of which relates to land use. This WMP identifies agricultural lands for targeting load reductions of both fecal coliform bacteria and sediment pollution through the installation of Best Management Practices (BMPs; e.g., controlling livestock access to water sources, installing alternative watering sources, protecting heavy use areas, etc.). In addition, residences will be targeted for septic system repairs to reduce the contributions of fecal coliform bacteria from failing septic systems.

2. An estimate of the load reductions expected for the management measures described under number 3 (below);

The load reductions recommended in Total Maximum Daily Load (TMDL) documents are featured in Section 5. Management measures that will be implemented to achieve load reductions include both agricultural projects and septic system repairs. Agricultural BMPs will vary according to the interests of the farmers, and it is difficult to predict the frequency that each practice will be used during implementation, as well as where projects will be located, the current onsite conditions, and the significance of the NPS pollution at each site to be ameliorated. Septic system repairs will also be conducted as part of the WMP implementation process, especially in close proximity to blueline streams. However, the type of repairs, the proximity to streams, and the contributions to instream fecal coliform counts may vary for each septic repair project. Complicating matters further, conditions within the watershed will change over time. Due to the complexity involved in predicting the load reductions from the broad management measures provided below, the WMP instead seeks to focus on the completion of multiple projects and intermittently evaluating where the watershed is within the restoration process. Eventually, the management measures implemented should result in restoration to the extent that the necessary load reductions will be met and the impaired segments will be able to remain delisted.

3. A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

A number of management measures including both structural and non-structural practices have already accomplished and will continue to accomplish various objectives. These practices are highlighted within Section 6. WMP implementation will also aim to execute additional structural controls to include some combination of the agricultural practices and a number of septic system repairs directed toward NPS load reductions (discussed in Chapters 6 and 7). The management measures will be implemented across several grants with each involving monitoring to update us on current watershed conditions and completing projects potentially according to changing priorities. In conjunction with these efforts, we plan to implement non-structural controls geared towards promoting watershed improvements with educational involvement within the community (also described in Chapters 6 and 7).

4. An estimate of the amounts of technical and financial assistance needed, and/or the authorities that will be relied upon to implement the plan;

The groups responsible for each existing and new management measure are described within the WMP. The WMP implementation effort will most likely be organized by Limestone Valley RC&D Council, yet assisted by a number of other groups as described in Section 7. Estimates of funding needs are indicated only for activities conducted exclusively for WMP implementation. In order to come up with an estimate, we first conceptualized the extent of work within the watershed potentially needed for complete watershed treatment. Next, we estimated the extent of that treatment that would likely result in the de-listing of the majority of impaired streams. We assumed completion of approximately 30% of total watershed treatment may suffice to meet this objective, and each series of projects and monitoring events may allow for a better estimate. The process used to estimate the financial resources utilized is described in greater detailed in Section 7, and was chosen due to the complexities of implementing load reductions "on the ground" through voluntary conservation practices. The anticipated sources of funding to achieve restoration goals are several Environmental Protection Agency (EPA) Section 319 grants administered by the Georgia Environmental Protection Division (EPD).

5. An informational/educational component that will be used to enhance public understanding of and participation in implementing the plan;

Public education and outreach recommendations are initially identified in Section 6 and 7, but most explicitly stated in Section 8. The more successful programs will likely remain standard practices for the duration of the implementation process. The recommended educational programs focus on water quality monitoring, septic system maintenance, rainbarrel workshops, and stream cleanups (among others). Additional programs will be designed and implemented as necessary for successful implementation.

6. A schedule for implementing the management measures that is reasonably expeditious;

The implementation schedule is found in Section 7 and initially estimates implementation activities to occur through 2025. This includes water quality monitoring and implementation activities (e.g., agricultural BMPs and septic system repairs), in addition to education and outreach. Each of these activities will continue through each grant implementation period, although priorities may be reevaluated and subsequently altered with each grant period. Currently, we anticipate that three grant implementation periods may allow for the goals of the WMP to be accomplished.

7. A description of interim, measurable milestones (e.g., e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

A number of goals and objectives are recommended as interim milestones proposed to implement the management measures of this watershed improvement plan. These are included in Section 7. The initial goals of the WMP include developing a septic system cost-share program, building momentum toward implementation of agricultural management practices, completing both septic and agricultural projects that reduce pollutant loads, carrying out educational activities, and monitoring to observe where extra focus is necessary and maintain that load reductions are occurring as a result of implementation. Over the course of implementation, each grant will include interim milestones with more finite objectives for each of the overall goals (i.e., number of agricultural and septic projects, number of newspaper articles, number of Adopt-A-Stream (AAS) programs initiated, multiple years of water quality monitoring data, etc.).

8. A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

Several sources of the pollutants of concern will be addressed by WMP implementation. Water quality data collection is ongoing to determine priorities and current conditions and will continue intermittently to indicate how projects on the landscape are translating into water quality changes. Yet, it may be a few years before enough projects are completed in each subwatershed to significantly affect water quality. Therefore, throughout the implementation process, project types and locations will be documented to get an idea of the extent of water quality improvements as projects become more prevalent within each subwatershed and the SCC Headwaters area. This will allow management measures to be adapted to effectively address concerns that may arise with improvements in the implementation strategy. In the interim, continued monitoring of water quality and determination of the success of completed projects is necessary to determine if revisions are needed. At the least, revisions should be submitted in an addendum to this document in 2017 to evaluate successes and adaptations to the initial management measures recommended in this WMP. Section 7 includes how progress will be indicated and considers documenting the details of each project, load reductions per project when applicable, increased public interest, and changes in water quality that indicate progress toward the overall goal of de-listing all or the majority of segments within the watershed.

9. A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8).

In Section 7, the WMP recommends that two different monitoring protocols continue to be conducted within the watershed as the new management measures (and the ongoing programs discussed in Section 6) are implemented. One type of monitoring is identified as “Targeted Monitoring”, and involves sampling at specific sites in both wet and dry periods to help establish baseline conditions and monitor for improvements. The second type of monitoring is for “de-listing” purposes, and follows a strict procedure (regardless of weather) in an attempt to show that restoration has been achieved.

Glossary of Acronyms

AAS - Adopt-A-Streams

BMP - Best Management Practice

CNMP - Comprehensive Nutrient Management Plan

DNR - Department of Natural Resources

EPA - Environmental Protection Agency

EPD - Environmental Protection Division

GIS - Geographic Information Systems

IBI - Index of Biotic Integrity

SCC – South Chickamauga Creek

NPS - Nonpoint Source

NRCS - Natural Resource Conservation Service

RC&D - Resource Conservation and Development Council

SCHRP - South Chickamauga Headwaters Restoration Program

SQAP - Sampling and Quality Assurance Plan

TMDL - Total Maximum Daily Loads

WMP - Watershed Management Plan

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Appendix A:

2011-2012

Targeted Water Quality

Monitoring Data

Appendix A.1.: Fecal Coliform Bacteria Counts from Targeted Water Quality Monitoring. Sites are shown on the map in Figure 3.3.a.

South Chickamauga Creek Headwaters Fecal Coliform Counts								
	Sampling Dates							
Site	**8/24/11**	**9/2/11**	**9/6/11****	**10/11/11***	**2/17/12**	**2/24/12**	**3/9/12***	**3/23/12***
Dry Creek 1	320	530	4,100	390	40	44	1,160	420
East Chickamauga Creek 1	550	90	31,000	610	120	129	7,100	460
East Chickamauga Creek 2	235	180	67,000	750	90	171	8,000	620
East Chickamauga Creek 3	380	550	73,000	3,150	90	159	4,000	580
Little Chickamauga Creek 1	280	320	63,000	2,900	80	142	2,400	820
Little Chickamauga Creek 2	230	510	69,000	1,240	30	141	5,700	1,420
Tiger Creek 1	31	90	42,000	2,220	108	150	3,900	1,160
Tiger Creek 2	140	290	55,000	920	100	162	7,000	1,120
Tiger Creek 3	330	360	69,000	760	160	281	5,800	330

**** indicates wet weather events.***
*****indicates an exceptional wet weather event***

Appendix A.2.: Turbidity Measurements (NTUs) from Targeted Water Quality Monitoring. Sites are shown on the map in Figure 3.3.a.

South Chickamauga Creek Headwaters Turbidity Measurements (NTU)								
	Sampling Dates							
Site	**8/24/11**	**9/2/11**	**9/6/11****	**10/11/11***	**2/17/12**	**2/24/12**	**3/9/12***	**3/23/12***
Dry Creek 1	1.87	2.12	60.5	2.14	5.24	7.71	40.9	16.9
East Chickamauga Creek 1	8.37	6.59	58.1	5.17	9.56	14.8	100	13.4
East Chickamauga Creek 2	10.1	9.51	64.9	11.6	10.1	18.7	106	16.8
East Chickamauga Creek 3	4.69	6.49	56.5	4.82	5.78	7.74	57.2	7.7
Little Chickamauga Creek 1	10.2	10.9	39.9	18.9	9.19	17.3	87.4	21.7
Little Chickamauga Creek 2	5.62	4.56	49.2	5.86	6.11	11.3	86.7	24.2
Tiger Creek 1	4.12	4.15	34.57	14.4	8.35	12.9	96.7	13.9
Tiger Creek 2	4.5	4.59	44.4	4.4	5.36	6.72	62.9	14.6
Tiger Creek 3	3.58	3.82	43.1	2.58	4.44	5.74	41.9	8.4

**** indicates wet weather events.***
*****indicates an exceptional wet weather event***

Appendix B:

Notes from Stakeholder Meetings

Appendix B. Stakeholder Meeting Notes, Recommendations, and Worksheets

Notes from the June 9th, 2011 Watershed Advisory Committee

At the Old Nutrition Center in Ringgold, Georgia

- The purpose of the stakeholder committee was identified as "to create opportunity for community leaders to provide input into Watershed Management Plan formation, and help identify potential BMP projects".
- Stakeholder roles were identified as "Sharing issues that concern you and your organization, Providing insight into possible solutions for stream quality issues, provide access to data, volunteers, outreach networks, or other assets that can be used to enhance the watershed plan, and to provide technical expertise needed for planning initiatives
- The watershed was presumed to be mostly forested with significant agriculture and residential development. Two small cities are located within the watershed also.
- Stream issues were identified as, fecal coliform, sediment pollution, and trash.
- Many stakeholders were aware that impairments existed in the watershed.
- Sources of fecal coliform were identified as failing septic systems, cattle in the streams, and wildlife from forested areas. Sources of sediment were identified as heavy use areas, streambank erosion, and stormwater pollution.
- No clear ranking of sources were established
- There are ongoing management efforts within the watershed that address these pollutants. EQUIP is active in the area, and a joint study between the NRCS and TVA occurred within the last decade. Northwest Georgia Public Health has a permitting program for septic system repairs and installations.
- Development has been rapid in the area until the economic collapse of 2007/2008, so stormwater and septic system issues have likely gotten worse in the past decade. The economic downturn has also likely resulted in fewer households keeping up with their septic system maintenance.
- Catoosa County likely has office space that could be donated to Limestone Valley RC & D for work associated with the development of this plan.
- The NRCS has access to GIS software if needed.
- Catoosa Utilities may be able to help with fecal coliform sampling

Discussion items from the June 9th, 2011 Watershed Advisory Committee Meeting

At the Old Nutrition Center in Ringgold, Georgia

Findings:

- The upper portions of the watershed seem to have higher negative impacts on water quality with respect to fecal coliform and sediment pollution.
- Both failing septic systems and agriculture are likely contributing to the impaired designation of streams in the watershed.
- Many Septic system failures can be attributed to the poor percolating soils in the area, lack of education about system maintenance.
- NRCS efforts in the watershed have been substantial in the past, which may indicate that acceptance of BMP projects may already be occurring.
- Wildlife may be a significant contributor in the Dry Creek subwatershed since it is largely forested, and also because NRCS efforts have been concentrated there in the past.
- Canoe floats for educational activities may be difficult within the watershed due to the size of streams, and it may be necessary to go farther downstream (but stay in the South Chickamauga Watershed) to conduct such events.

Recommendations:

- Although responses were variable, the watershed advisory committee averages resulted in approximately 50% of any awarded funds to address each of septic system issues and agricultural sources of fecal coliform and sediment.
- The committee felt that fecal coliform pollution was a larger threat to public health, and thus projects that address this issue should have priority over projects that address sediment pollution.
- When ranking preferred septic system activities, septic system repairs were identified as the highest priority, followed by the production and distribution of educational materials and septic system pump-out workshops.
- The headwaters of each of the four major tributaries were identified as the priority areas within the watershed.
- When ranking outreach activities, the stakeholders generally agreed that stream cleanups and canoe floats were the most likely to garner a positive response from the community. Rainbarrel workshops, adopt a stream groups, and pump-out workshops were identified as potential outreach activities that might garner less support, although the group wanted to try an “all of the above” strategy.

Stakeholder Meeting #1 Worksheet
What Do We Already Know?

Please Answer the following questions is possible.

1. What are the known or perceived stream impairments and problems in the watershed?

2. Do we already know the sources of any water quality problems or impairments in the watershed? If so, what are they?

3. If you are aware of multiple sources of a problem, please rank the relative contributions.

4. Are there any historical or ongoing management efforts aimed at controlling the problem pollutants or stressors?

5. Are you aware of any threats to future conditions, such as accelerated development patterns?

6. Are you aware of any historical water quality datasets or ongoing water quality sampling that is occurring in the watershed? Do you have contacts with a water quality lab that may be willing to help with this project?

Please discuss any additional concerns or goals you can identify on back.

Stakeholder Committee Questions

1. Are you aware of any gaps in stakeholder representation today?

2. Are there certain days/times of the week that are more convenient for meeting than Thursday mornings?

Stakeholder Meeting #1 Worksheet
Identifying Stakeholder Skills and Resources

Name/Org: ____

Phone: ____

Email: ____

Skills/resources	If you possess these skills or have access to these resources	Comments
Skills in Stakeholder Group		
Accounting		
Graphic Design		
Geographic information Systems		
Water Sampling		
Facilitation		
Other		
Resources Available		
Potential Donated Office Space		
Contacts with media		
Access to volunteers		
Access to water quality datasets		
Access to meeting facilities		
Access to relevant equipment		
Access to local Water Laboratory		
Other		
Other		

Additional skills, resources, or comments:

South Chickamauga Headwaters
Management Plan Development
Stakeholder Meeting #2 – Establishing Priorities

Please give your opinion regarding watershed restoration priorities below. If your opinion is not listed, please write it in under the appropriate number. Additional details explaining the basis of your opinion are appreciated.

1. What proportion of funds should be spent on agricultural versus septic system projects in the watershed? Please circle an answer, or fill in your own below.

   Agricultural:Septic

   a. 60:40

   b. 50:50

   c. 40:60

   d. other____________________

Comments:

2. Which pollutant would you like agricultural BMP projects to address the most? Please place an X in the appropriate space.

   _______________Fecal Coliform _______________________Sediment

Comments:

3. In your opinion, please rank the following septic system activities in the order of importance (1-3).

_____System Fixes

_____Pumpout assistance (maintaining functioning systems)

_____Educational Materials

_____Other____

Comments:

4. Please identify priority areas within the watershed. Write the name of any watershed (e.g. Little Chick. Creek Watershed) or sub-watershed (e.g. Upper Little Chick. Creek Watershed).

Comments:

5. Please rank the outreach activities below that you think would be most likely to attract home/land owners in the area (1-5).

_______Stream Cleanups

_______Canoe Floats

_______Adopt-A-Stream Program

_______Rainbarrel Workshop

_______Pumpout Workshops

_______Other____

Comments: