2011

Pennahatchee Creek TMDL Watershed Improvement Plan Revision

Developed by:

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1.0 SUMMARY

This document describes an interim framework for the implementation of Total Maximum Daily Loads (TMDLs). This interim framework is intended to guide and document the evolving local policies and procedures for advancing consistency with water quality standards. This documentation will promote internal coordination among local, state, and federal agencies and help inform the general public and commercial interests.

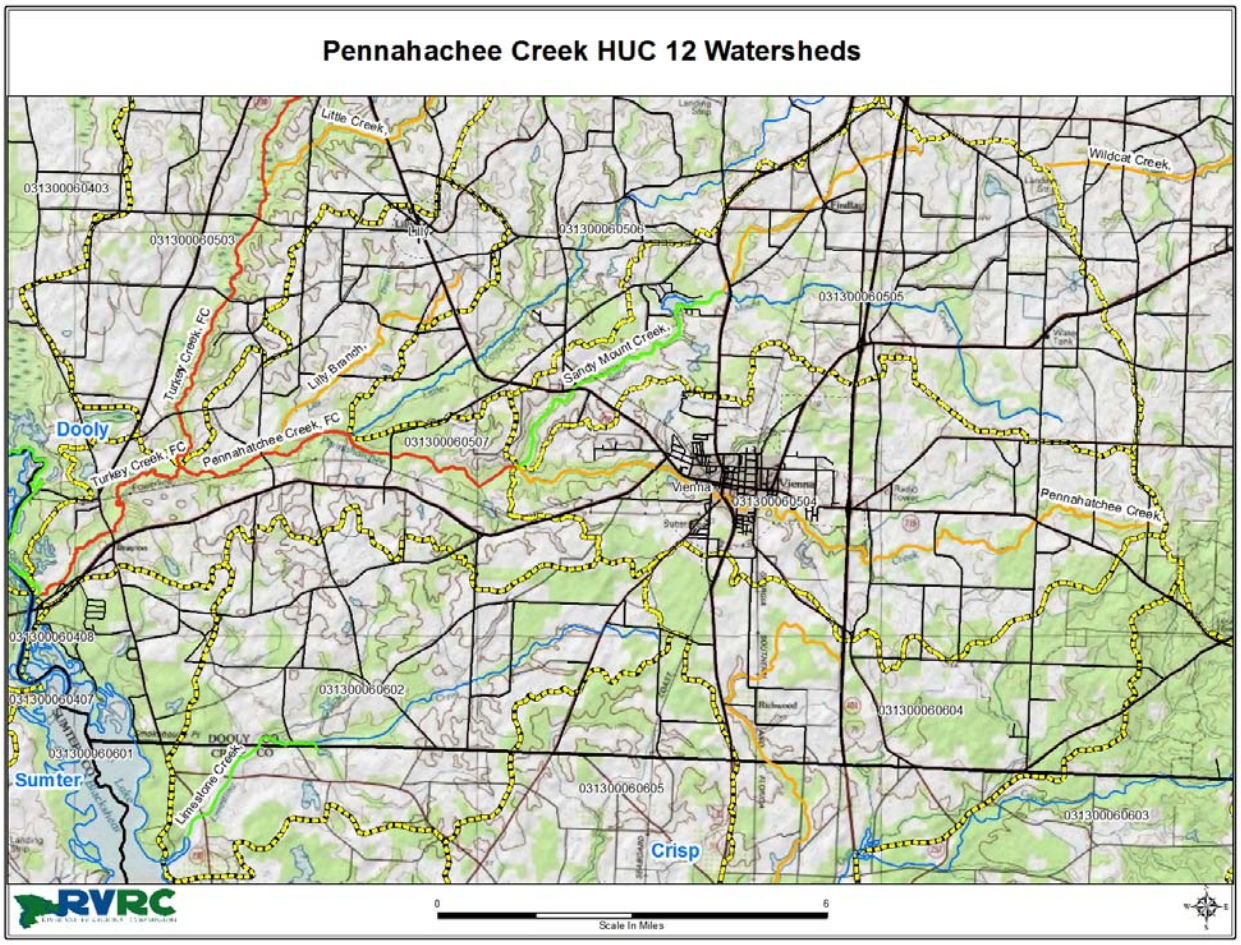
2.0 INTRODUCTION

The Federal Clean Water Act (33 U.S.C. §§ 1251-1387) allows the U.S. Environmental Protection Agency (EPA) to delegate authority to states to implement a technical and administrative framework for managing water quality. Those assigned responsibilities include setting water quality standards, assessing water quality, identifying waters that do not meet standards, establishing limits on impairing substances, and issuing permits to ensure consistency with those pollutant limits.

For waters that do not meet water quality standards due to an excessive pollutant load, the State must conduct a scientific study to determine the maximum amount of the pollutant that can be introduced to a waterbody and still meet standards. That maximum amount of pollutant is called a Total Maximum Daily Load (TMDL). A TMDL is a means for recommending controls needed to meet water quality standards, which are set by the state and determines how much of a pollutant can be present in a waterbody. If the pollutant is over the set limit, a water quality violation has occurred. If a stream is polluted to the extent that there is a water quality standard violation, there cannot be any new additions (or "loadings") of the pollutant into the stream until a TMDL is developed. Pollutants can come from point source and non-point source pollution. Examples of "pollutants" include, but are not limited to: Point Source Pollution – wastewater treatment plant discharges and Non-point Source Pollution – runoff from urban, agricultural, and forested areas – such as animal waste, litter, antifreeze, gasoline, motor oil, pesticides, metals, and sediment. The purpose of developing a Watershed Improvement Plan (WIP) for Pennahatchee Creek is to provide a tool that demonstrates a holistic approach to water quality management. The TMDL report is reviewed by the public, revised, and then submitted to the EPA to be considered for approval.

The Pennahatchee Creek Total Maximum Daily Load (TMDL) Watershed Improvement Plan defines the approach to planning, implementing, and evaluating the effectiveness of Best Management Practices (BMPs) with the goal to achieve the wasteload allocations (WLAs) for fecal coliform (FC) and restore the beneficial uses of the Pennahatchee Creek Watershed (Figure 1).

FIGURE 1. PENNAHATCHEE CREEK HUC 12 WATERSHEDS.



Watershed Improvement Plans require the development of a process to develop and implement a plan document for the purpose of: 1) creating the local network of partners; 2) identifying and securing the resources needed to fund and install the management practices and activities that would best achieve the pollutant load reductions needed to meet the TMDL and restore water quality; 3) verifying major sources or impairment; 4) developing a TMDL Implementation Plan that would address USEPA's 9-Key Elements of Watershed Planning; and 5) providing the information needed to support applications for funding (such as EQIP, Section 319(h), GEFA, or others), or identifying existing funding sources such as utility fees, SPLOST, or others.

3.0 SEGMENT AND WATERSHED DESCRIPTION

One of the first steps in understanding a watershed is through the discovery of its general and natural history. This section presents an overview and characterization of the Pennahatchee Creek Watershed. The successful application of BMPs in the Pennahatchee Creek Watershed will depend on the TMDL components, the physical characteristics of the watershed, and the regulatory requirements. By having a general knowledge of the creek's history and natural resources, this can establish an understanding and appreciation of its existence.

The referenced hydrologic unit code (HUC 10) covers roughly 110,000 acres, the vast majority of which is used for agriculture, specifically row crops. The limited development which has occurred over the past decade consists almost entirely of rural (single-family) housing. Based on the limited information provided by the *Greater Dooly County Comprehensive Plan* of 2008, it is assumed that this land use distribution was derived from Landsat Thematic Mapper digital images developed in 1995. Development in this sub-basin over the past ten years has been primarily residential in nature. Overall, any acreage distribution differences from those presented in the accompanying table are insignificant. Table 1 describes the land use within the Pennahatchee Creek Watershed. Figure 2 shows Pennahatchee Creek's Watershed Land Use Trends of 2008 prescribed by the Natural Resources Spatial Analysis Laboratory. This map demonstrates the characteristics of the land use cover within the Pennahatchee Creek watershed. Figure 3 shows the Pennahatchee Creek Watershed Future Land Use.

TABLE 1. PENNAHATCHEE CREEK LAND USE DISTRIBUTION.

Forest	Row Crop Agriculture	Pasture/Hay	Residential/Developed	Other
18.5%	50.6%	11.2%	3.1%	16.6%

FIGURE 2. PENNAHATCHEE CREEK WATERSHED LAND USE TRENDS.

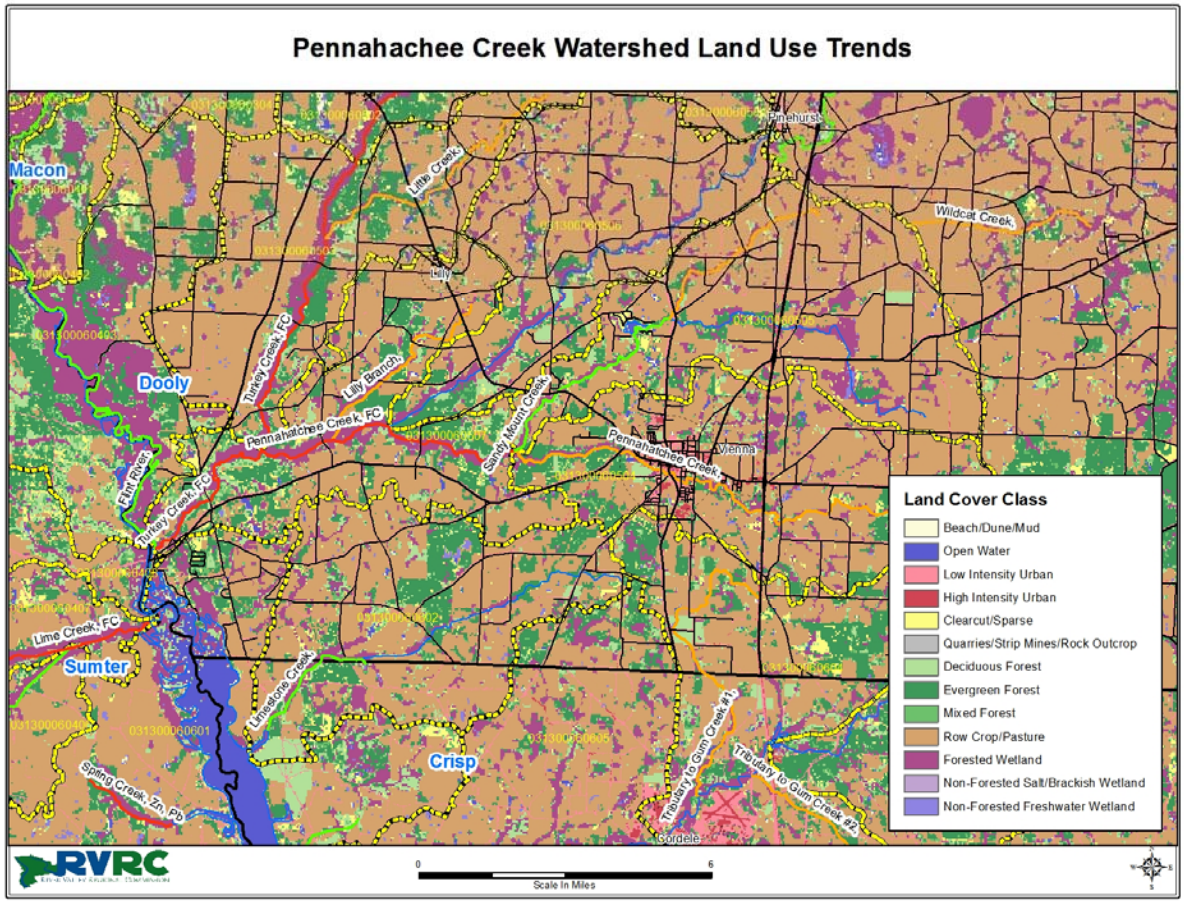
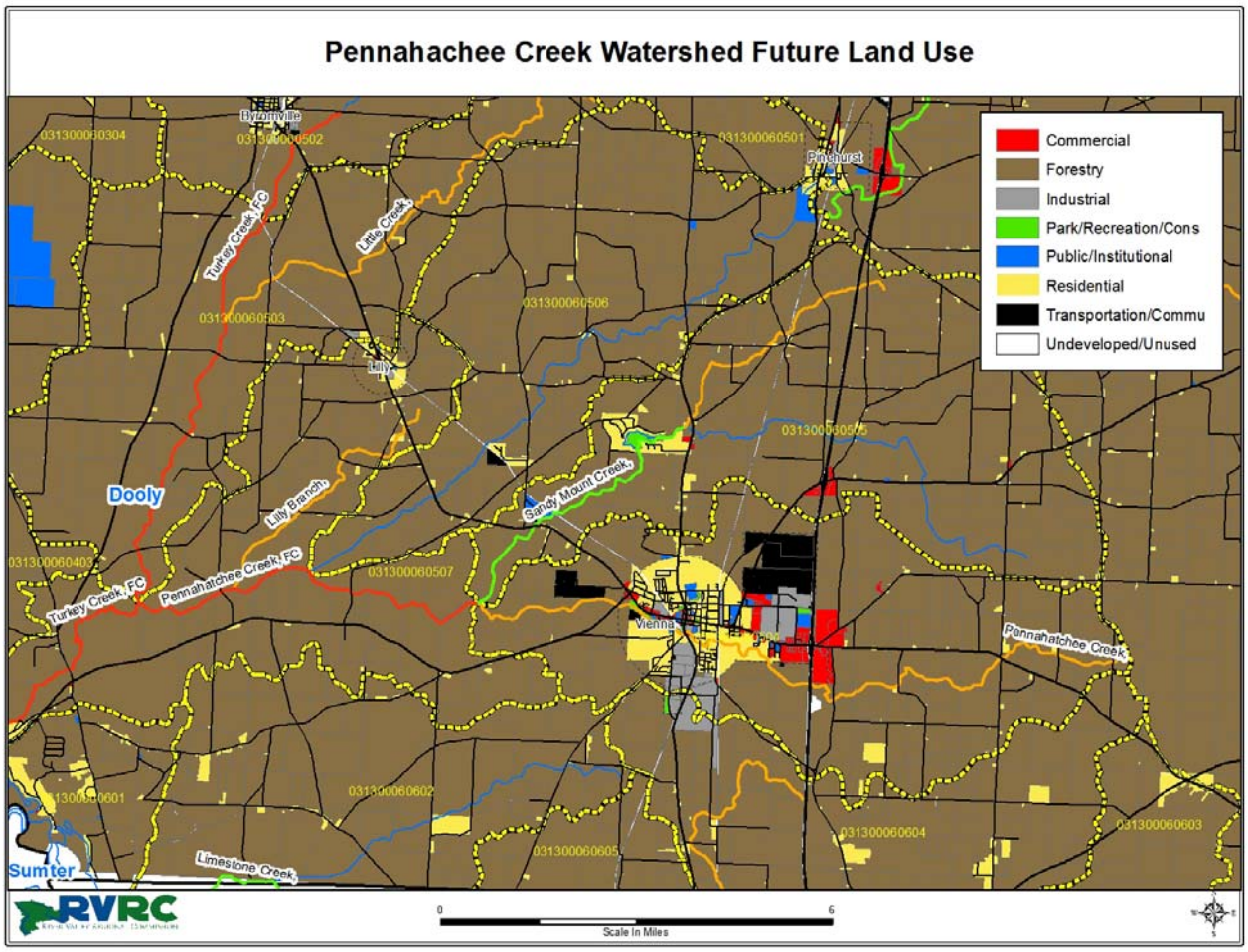


FIGURE 3. PENNAHATCHEE CREEK WATERSHED FUTURE LAND USE.



Dooly County is located in south-central Georgia and has a land area of approximately 252,480 acres, or about 395 square miles. Most of the land is well-drained and most of the county is well-suited for agriculture. The physical landscape is fairly homogenous with no outstanding physical features. Much of the land is used for agricultural purposes, including commercial timber production.

Dooly County is located within the Southern Coastal Plain physiographic province. The county's land surface is nearly level to gently sloping and is dissected by numerous shallow rivers and streams which generally flow east and west, although the overall drainage pattern is from north to south. The largest of these is the Flint River which forms the southern half of the western county boundary with neighboring Sumter County.

Dooly County's lowest elevations are at about 240 feet along the county's southwestern border, where the Flint River flows southward into Lake Blackshear, and also a little less than 250 feet near the northeastern corner of the county where Big Creek flows eastward into Pulaski County. The highest elevations are greater than 450 feet on broad hilltops in the northern third of the county, as well as in portions of the southeastern quadrant of the county where the highest elevations reach more than 490 feet in some places. In Byromville, the lowest elevations are

about 300 feet along Turkey Creek in the southeastern part of the town, while the downtown area is about 360 feet, and the highest elevations are near 390 feet in the western portions of town. In Dooling, the central area of town is about 370 feet while the highest elevation is a small hilltop at 400 feet in the northwestern portion. Lilly is a little more flat with elevations ranging from 340 to 360 feet throughout, with the downtown area at about 350 feet. Pinehurst is also relatively flat with a benchmark elevation in the downtown area of 378 feet. Elevations in Vienna range from a lowest point of near 300 feet along the Pennahatchee Creek in the southwestern part of the city, to more than 350 feet in many other areas of the city. The downtown area has a benchmark elevation of 338 feet and the city's highest areas include 360 feet at the Dooly County High School and 370 feet at the Dooly County Fairgrounds. The downtown area of Unadilla is near 395 feet with some parts of the city ranging over 400 feet. The highest elevation is a benchmark near the Exit #122 interchange along I-75 at 433 feet. Elevations in the outlying rural communities include Drayton at 298 feet, Findlay at 372 feet, Richwood at 340 feet, Snow Spring at 461 feet, and Tippettville at 351 feet.

The county's topography is such that notable views and vistas are not present. There are no steep slopes or mountainous areas and there are no coastal resources. The Flint River consists of a broad floodplain with dense tree canopy, and is considered scenic by some. The river flows into Lake Blackshear, whose beginnings are at the southwestern corner of Dooly County. This would perhaps be the most scenic view in Dooly County and it would be noteworthy if it were accessible by a means other than from the lake itself. However, there are multitudes of scenic vistas across agricultural areas that some would consider aesthetically pleasing, but these are not of any significant scale nor do any exhibit unique qualities that are not found in other counties of south-central Georgia.

Dooly County's climate is classified as humid-mesothermal (Cfa) according to the Köppen climate classification system. Winters are short and mildly cool with periodic cold spells moderating in 1-2 days. Summers are hot and humid. Annual precipitation typically ranges from 45 to 50 inches and is spread evenly throughout the year (2-5 inches each month). Measurable snowfalls are very rare with a less than 5% probability each year. When they occur, snowfall amounts are most always less than one inch and melt quickly. In winter, the average minimum daily temperature is 38 degrees. In summer, the average maximum daily temperature is 92 degrees. Dooly County's growing season ranges from 8-9 months with an average of 260 days that have daily minimum temperatures greater than 32 degrees. The first winter freeze typically occurs in early November and the last freeze typically occurs in mid-March.

Annual precipitation runoff for Dooly County is about 10-11 inches, which equals approximately 9.62 billion cubic feet (71.98 billion gallons) of water. This represents the volume of water directly entering the county's rivers and streams each year. The remaining water either evaporates or is absorbed by the ground. Surface drainage within Dooly County is directed by a dendritic (branching tree-like) pattern which flows generally southward but with most streams exiting the county along the eastern and western borders. The county can be divided into 3 major drainage basins for major rivers in south Georgia: Alapaha, Flint, and Ocmulgee. The Flint River forms part of Dooly County's western border and it drains the western two-thirds of the land area. The Flint River flows southward through Lake Blackshear and eventually to Lake Seminole where the water enters the Apalachicola River in Florida and empties into the Gulf of

Mexico. Major tributaries of the Flint River in Dooly County include Hogcrawl Creek, Turkey Creek, and Pennahatchee Creek. Most of the eastern third of Dooly County drains eastward into Pulaski and Wilcox counties through various streams to the Ocmulgee River which flows southeastward and eventually into the Atlantic Ocean. The larger of these Ocmulgee tributaries include Big Creek, South Prong Creek, and Cedar Creek. The remaining major river basin is that of the Alapaha River whose headwaters are actually in the southeastern portion of Dooly County. The Alapaha flows southward into Florida where it empties into the Suwannee River and eventually into the Gulf of Mexico. It is interesting to note that one of the main drainage divides in the United States (dividing the river basins for the Atlantic Ocean and Gulf of Mexico) runs through the middle of Dooly County.

Typical of coastal plain areas, most of Dooly County's consumer water comes from underground aquifers which are porous underground rock layers containing water. The main aquifers beneath Dooly County are the Floridan and Claiborne aquifer systems which consist of confined limestone, dolostone, and calcarious sand. These aquifers serve as the water supply watershed for all of Dooly County's municipal water systems as well as many agricultural irrigation systems. There are no surface water supply watersheds within Dooly County. The Floridan aquifer is principally recharged immediately south of the Fall Line which stretches across central Georgia from Columbus to Macon to Augusta. This is the point at which streams from harder rock formations of the Piedmont cross into softer rock formations of the Coastal Plain. Most sedimentary rock formations of the Coastal Plain begin at the ground surface just south of the Fall Line, therefore this is where most aquifer water originates. Recharge can also occur at other points where the aquifer up dips to become closer to the surface allowing water from streams, sink holes, and ponds to permeate through more shallow ground into the aquifer. Approximately 85% of Dooly County overlies recharge areas of these aquifer systems, and most of the county is considered susceptible to groundwater pollution. Compared with other counties in central and southern Georgia, Dooly County has a particularly large percentage of recharge area. Unfortunately, there have not been any additional protection measures (local ordinances) for groundwater recharge areas adopted by any of the local governments in Greater Dooly.

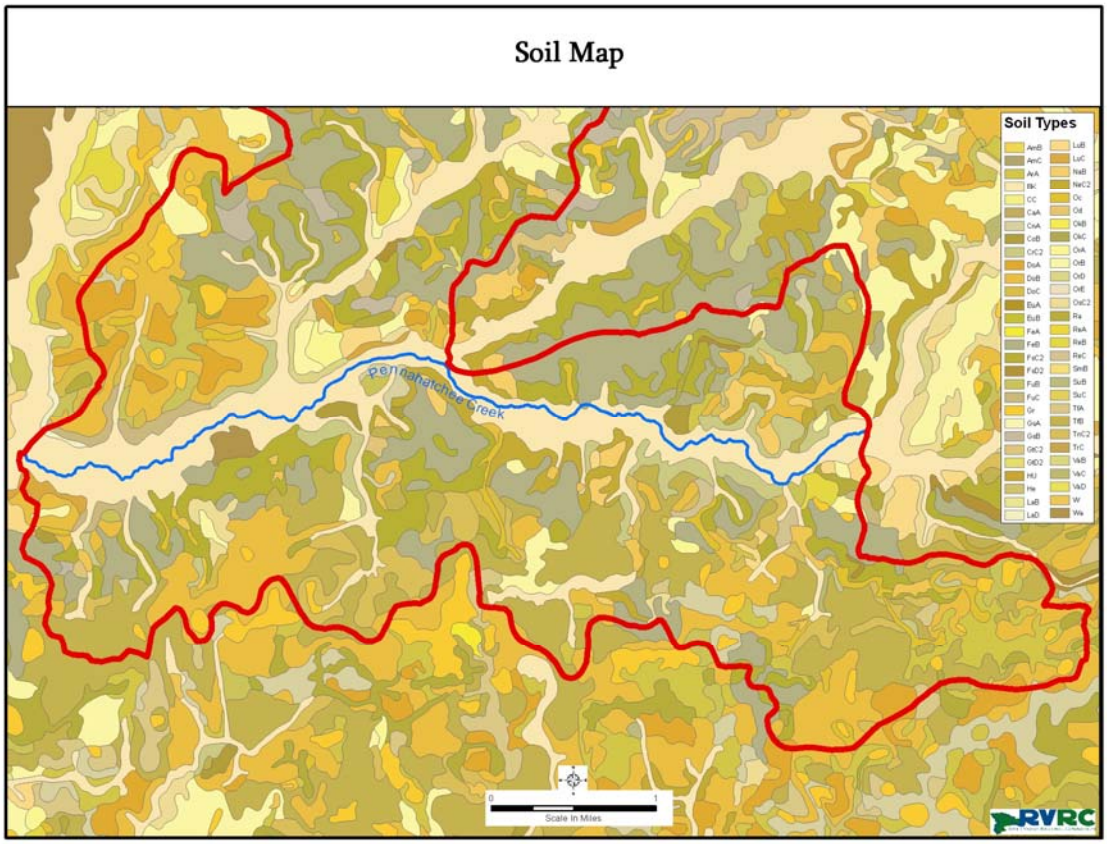
Dooly County's bedrock is composed of Pliocene-Miocene-Oligocene sedimentary rocks which were formed mostly during the Cenozoic Era (up to 70 million years ago). Below this, the rocks are Eocene and Paleocene sedimentary rocks. The sediments which formed these rocks originated in the "ancient" Appalachian Mountains which have been eroded to form the present day Piedmont and remnant mountains.

The USDA Soil Survey for Dooly County contains mapping and information for 30 different soil series. The most prevalent of these are: Dothan (43,665 acres), Tifton (42,560 acres), Faceville (27,690 acres), Bibb and Kinston (21,465 acres), and Nankin (19,100 acres). These five soil series comprise a total of 154,480 acres, or about 61% of the county's total land area. Perhaps more importantly, these are predominantly loamy soils accounting for 116,200 acres, or about 78% of the county's prime farmland. Also, with the exception of Bibb and Kinston, these have only slight to moderate limitations for physical, non-agricultural development. Table 2 shows the soil associations of Dooly County. Figure 4 depicts the *Pennahatchee Creek Watershed Soils*.

TABLE 2. SOIL ASSOCIATIONS OF DOOLY COUNTY.

Soil Association	Soil Description
Dothan	Very deep, well drained, moderately slowly to slowly permeable soils on broad uplands. They formed in thick beds of unconsolidated, medium to fine-textured marine sediments of the Coastal Plain. Slopes range from 0 to 12 percent.
Tifton	Very deep, well drained, moderately slowly permeable soils that formed in loamy marine sediments. These soils are on nearly level to gently sloping uplands and have slopes that range from 0 to 8 percent.
Faceville	Very deep, well drained, moderately permeable soils that formed in red clayey Coastal Plain sediments. These soils are on Coastal Plain uplands and have slopes ranging from 0 to 15 percent.
Bibb and Kinston	Very deep, poorly drained, moderately permeable soils that formed in stratified loamy and sandy alluvium. These soils are on flood plains of streams in the Coastal Plain. They are commonly flooded and water runs off the surface very slowly. Slopes range from 0 to 2 percent.
Nankin	Very deep, well drained, moderately slowly permeable soils on uplands of the Coastal Plain. They formed in stratified loamy and clayey marine sediments. Slopes range from 0 to 60 percent.

FIGURE 4. PENNAHATCHEE CREEK WATERSHED SOILS.



4.0 WATER QUALITY IMPAIRMENTS AND TOTAL MAXIMUM DAILY LOADS (TMDLS)

Water quality standards address the federal requirement "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Federal Clean Water Act §101). The broad term "water quality standards" encompasses the adoption of "designated uses" and specific "criteria" that indicate whether or not the uses are being achieved.

The Georgia 2010 305(b)/303(d) draft list of waters was prepared as a part of the Georgia assessment of water quality prepared in accordance with Sections 305(b) and 303(d) of the Federal Clean Water Act and guidance from the U.S. Environmental Protection Agency. Assessed water bodies are classified according to a comparison of water quality monitoring results to water quality standards and other pertinent information. Table 3 depicts the 2010 list of supporting streams within the Pennahatchee Creek watershed. Table 4 depicts the 2010 list of impaired streams located within the Pennahatchee Creek watershed and their impairment.

TABLE 3. PENNAHATCHEE CREEK WATERSHED 2010 305(B) LIST.

Waterbody Name	Location	County(s)	Impairment	Miles Impacted	Category
Sandy Mount Creek	U.S. 41 to Pennahatchee Creek	Dooly	N/A	5	1
South Prong Creek	Headwaters to Big (Tucsawhatchee) Creek	Dooly, Pulaski	N/A	12	1

Source: Georgia Department of Natural Resources, Environmental Protection Division, 2010

TABLE 4. PENNAHATCHEE CREEK WATERSHED 2010 303(D) LIST.

Waterbody Name	Location	County(s)	Impairment	Miles Impacted	Category
Pennahatchee Creek	Sandy Mount Creek to Turkey Creek	Dooly	Fecal Coliform	6	4a
Turkey Creek	Rogers Branch to Pennahatchee Creek	Dooly	Fecal Coliform	9	4a

Source: Georgia Department of Natural Resources, Environmental Protection Division, 2010

Pennahatchee Creek (6 miles) was placed on the Section 303(d) list by the GA EPD for violating the state standards for fecal coliform (FC). Based off of information provided in GA EPDs 2008 *Total Maximum Daily Load Evaluation for Six Stream Segments in the Flint River Basin for Fecal Coliform*, a TMDL called for a 70.2% reduction in fecal coliform for Pennahatchee Creek. The GA EPD Sampling Station #1106050701, located at Slosheye Trail Road (32.095431, -83.883763), is where GA EPD monitors this creek. Georgia's instantaneous standard specifies that fecal coliform concentration in the stream water shall not exceed the 30 – day geometric mean of 200 cfu/100 ml for the months of May through October, and 1,000 cfu/100 ml for the months of November through April.

This TMDL has an implicit margin of safety embodied in the endpoint identification. By defining the endpoint in the same units as the impairment, concentration in mg/L, at a geographic point within the drinking water source, the TMDL assures that successfully meeting the endpoint will also eliminate the impairment. Units of percent can be used to quantify the standard TMDL equation: LA + WLA = TMDL. This equation describes both the allocation of allowable loading and the allocation of responsibility for reducing loading to the extent necessary to achieve the endpoint. There is minimal utility in attempting to define a precise target for loading when concentration is the important and controlling factor. However, using the data set resulting in the violation, suggests that a load reduction of approximately 70.2 percent would result in attainment of the standard.

As a result of the water quality impairment, Pennahatchee Creek was assessed as "not supporting" the Federal Clean Water Act's fishing use support goal. In order to remedy the water quality impairment pertaining to fecal coliform, a TMDL has been developed, taking into account all sources of fecal coliform. Upon implementation, the TMDL for Pennahatchee Creek shall ensure that the water quality standard relating to fecal coliform will be in compliance with the geometric mean standard.

5.0 VISUAL FIELD SURVEYS AND TARGETED WATERSHED MONITORING

A visual survey of Pennahatchee Creek is very important. The purpose of a visual survey is to determine if there are observable problems on the river and to characterize the environment the river flows through. The visual survey helps pinpoint areas that may be the source of water quality problems and helps to identify the overall condition of the river. See Appendix D for field notes and pictures of the visual field survey that was conducted on September 17, 2009.

Monitoring for *Escherichia coliform* (commonly known as *E. coli*) was scheduled to be conducted for Pennahatchee Creek during Year 3, or the Revision, of the Watershed Improvement Plan. Monitoring was conducted to geographically isolate the major sources of impairments for the Pennahatchee Creek Watershed. *E. coli* is not a water quality criteria that can cause a stream to be listed on the impaired streams list, but its concentrations can be used as an indicator of the water quality criteria fecal coliform. Therefore, this data was not submitted to the Environmental Protection Division for purposes of delisting the stream segment, but rather to determine sources of impairment within the watershed. Results of the targeted watershed monitoring may be obtained in Appendix H of this report.

6.0 RANKING AND PRIORITIZING OF SIGNIFICANT SOURCES OF IMPAIRMENTS

In the 2009 Pennahatchee Creek Tier 2 Implementation Plan, several sources of impairment were identified and the Advisors/Stakeholders have provided input on these potential sources. Table 5 addresses the sources of impairment and their contribution (1 being little or no contribution and 5 being great contribution).

TABLE 5. SOURCES OF CONTAMINATION FOR PENNAHATCHEE CREEK.

Source	Extent (Miles, acres, etc.)	Permitted (Y/N)	Estimated Contribution (Rank 1 – 5)	Stakeholder Opinion (1 – 5)	Comments
Invasive hogs	6	N/A	5	5	There is a significant population of invasive feral hogs that contribute fecal coliform in the streams
Wildlife/ waterfowl	6	N/A	2	2	Wildlife such as deer, raccoons, squirrels, ducks, geese, and the Sand Hill Crane all contribute to the impairment
Wastewater treatment facility/ LAS	6	Y	2	1	The LAS may have runoff during events of heavy precipitation
Slaughtered animals in creek	6	N/A	2	2	Sometimes hunters neglect to properly dispose of their kill and leave carcasses and body parts behind in the stream or watershed
Septic Systems	1	Y	1	1	There are about 135 properties with septic systems in the area. No major malfunctions have been reported according to the Dooly County Health Department
Livestock Farms	6	Y	3	3	Beef cattle on pastures, hog farm

There are many invasive feral hogs within this watershed. Little has been done to quantify their abundance. However, farmers in the area can ascertain this abundance by the amount of damage that is done on their crops by the invasive hogs. Since these hogs have no natural predators and they can produce litters of 12 or more two to three times per year, they can thrive and destroy

without any opposition. These hogs also degregate the quality of water by wading directly into streams, especially during the hot months of the summer.

Wildlife and waterfowl within the watershed include deer, armadillos, raccoons, varmints, ducks, cranes, and geese and do contribute to fecal coliform contamination of Pennahatchee Creek. However, these animals are native to the watershed and their waste should be considered natural. The deer density within Dooly County is approximately 17.3 deer per square mile.

The Land Application System of the City of Vienna operates under an NPDES permit. The spray fields may contribute to contamination during heavy rain events. However, the most impaired Site 5 has approximately 4 miles of stream between it and the LAS. Due to the proximity of the site and that high sample counts were taken during dry periods, there is a low probability that this site is a significant source of impairment.

Improper disposal of hunted animal carcasses can contribute to a fecal coliform impairment. Sometimes hunters neglect to dispose of the carcass in a landfill and leave it on the ground or in a creek. Although this happens in nearly every watershed, there is no evidence to suggest that this is the major pollutant source within the Pennahatchee Creek watershed.

Septic systems can certainly cause an impairment to underground aquifers and thus, to streams. However, according to the Dooly County Health Department, there have not been any reported failing septic systems in the area. Furthermore, there are too few septic systems in the area to even cause an impairment.

Livestock farms can cause pollution problems within a watershed. According to stakeholders, there are three livestock farms within the watershed. The hog operation, located at 32.114100, -83.854082, contains approximately 100 domestic hogs. One cattle operation, located at 32.088723, -83913063, contains approximately 100 cattle and the other, located at 32.112620, -83.904993, contains approximately 150 cattle. These sources of fecal coliform may be significant enough to contribute to the impairment.

7.0 Identification of Applicable Existing Management Measures

Several Best Management Practices exist for the Pennahatchee Creek Watershed. Dooly County strives to keep its waterways clean and has implemented several ordinances to reduce the pollution levels within its watersheds. Table 6 describes these ordinances and their responsible entity.

Table 6. Existing Management Measures for Pennahatchee Creek.

Regulation/Ordinance or Management Measure	Responsible Government, Organization or Entity	Description
River Corridor Protection Ordinance	Dooly County	Establishes measures to guide and control growth in areas along the Flint River to protect the water

		quality and the river corridors' plant and wildlife habitats
Policy 3.1	Dooly County	Growth will be directed away from environmentally sensitive lands and other natural areas unsuitable for urban development; such as floodplains, groundwater recharge areas, etc.
Policy 5.2	Dooly County	Local services such as fire and police protection, roads, drainage, water and sewer, and parks and recreation will be planned to adequately serve the population and employment densities anticipated
Animal feeding operations management	GA EPD	Enforcement of wastewater treatment regulations applicable to feedlot operations
Nutrient Management Plans	Poultry Federation	Matching nutrient value of poultry waste with amendment needs of farmland
Agricultural BMPs	Ag producers	Maximizing production without causing deleterious effects to other resources
Wild game hunting	Landowners and hunters	Hunting wildlife for recreational purposes
Promote voluntary adoption of agricultural BMPs	Soil and water Conservation District	Provide leadership in the protection, conservation, and improvement of soil, waster and related resources
Environmental Quality Incentives Program	USDA / NRCS	Develop standards and specification regarding conservation practices, animal waste management systems, grazing activities, et. al. – implements state priorities
Disseminate information	Cooperative Extension Service and Experiment Stations	Consultative assistance, information on non-point-related impacts on water quality, water quality monitoring analysis of nutrients and other constituents in animal waste, nutrient management plans
Water quality improvement practices (Conservation Reserve Program)	Farm Service Agency (FSA)	Administration of cost-sharing and incentive programs for practices that improve environmental quality of farms. Funds targeted for high-priority watersheds with water quality problems
Disease Control	GA Department of Agriculture	Provides guidance in location of animal waste facilities and disposal

		of dead animals
Agriculture research and monitoring	USDA Agricultural Research Service (ARS)	Research on grazing land systems and irrigation methods relevant to watershed scale monitoring projects and nutrient movement in surface water and groundwater
Volunteer activism	Resource Conservation and Development Council	Citizen activism in conservation of rural resources
Wildlife survey	GA DNR	Survey of the impaired creek segment to determine whether wildlife are present in numbers sufficient to be major contributors to any unsafe fecal coliform levels
Adopt-A-Stream	High School / Local citizens	Volunteer program active in watershed surveys, visual surveys, biological monitoring, chemical testing, cleanups

River corridors are the strips of land that flank major rivers in Georgia. These corridors are of vital importance to Georgia because they help preserve those qualities that make a river suitable as a habitat for wildlife, a site for recreation, and a source for clean drinking water. River corridors also allow the free movement of wildlife from area to area within the state, help control erosion and river sedimentation, and help absorb flood waters. For these reasons, a River Corridor Protection Ordinance was established to maintain the plant and animal life within a 150 foot buffer zone along the Flint River.

Policies 3.1 and 5.2 prevent the formation of densely populated areas near floodplains and groundwater recharge areas. Throughout this watershed, and immediately around Pennahatchee Creek, there are no heavily populated areas, with exception of the City of Vienna.

Proper management of livestock will reduce pollution loads within the watershed. These management practices include Concentrated Animal Feeding Operations (CAFO) management, Environmental Quality Incentives Program, and disease control of dead animals.

Managing the wildlife by controlling the population will help regulate the amount of fecal coliform entering into the watershed. Landowners and hunters, GA Department of Agriculture, and GA Department of Natural Resources have all made contributions by providing needed information about the wildlife or by reducing invasive feral hogs and other species through hunting.

8.0 RECOMMENDATIONS FOR ADDITIONAL MANAGEMENT MEASURES

There are several management practices that can be applied within the watershed to help alleviate the pollution levels. There are two known cow operations and one known hog operation within the watershed to total approximately 250 cows and 100 hogs. At these locations, several Best Management Practices should be installed. BMPs that can help reduce

levels of fecal coliform entering into Pennahatchee Creek include, but are not limited to, alternative watering sources, fencing, composting facilities, stream crossings, waste facility covers, tree/shrub buffers, filter strips, water wells etc. In order to effectively reduce pollution levels sourced from these operations, it is recommended to install four to six BMPs at each location.

Stakeholder opinion and evidence of "hog wallow" within the stream indicate that the most abundant source of fecal coliform originates from the invasive feral hog. Since this species is invasive, highly destructive to crops, has no natural predators, reproduces at an alarming rate, and directly contributes to a water quality impairment that is detrimental to human health, it is highly recommended by all stakeholders and advisors that these hogs within the watershed be harvested.

Currently there are no Best Management Practices for feral hog harvesting recognized by GA EPD. Traditional methods for harvesting include small, portable box-style traps and hunting by rifle and/or dog. While these methods may result in the capture/harvest of a feral hog, they do little to affect the overall population of these hogs. According to the 2009 peer reviewed scientific study, *Trap Style Influences Wild Pig Behavior and Trapping Success*, by Auburn University researchers Brian L. Williams, Robert W. Holtfreter, Stephen S. Ditchkoff, and James B. Grand, corral traps are the most effective and efficient means of harvesting wild hogs when correctly implemented.

Successful implementation requires several weeks of preparation before the harvest. First, a survey must be conducted to determine the location of the hogs. This may be accomplished by direct observation or by capturing a hog and placing a transmitter on it. Next you must condition the hogs to be comfortable within the harvest area. This is accomplished by having a feeder set to dispense food at the same time every day, preferably at sun down or sun up. After a week or so, the hogs begin to anticipate the feeding and arrive before the feeder starts. Next a corral of approximately 15 to 20 feet in diameter is placed around the feeder, leaving an opening for the hogs to enter. Conditioning continues for about a week. Initially, the juveniles will enter the corral but the adults are skeptical. However, near the end of the conditioning period, larger males and females will enter the corral in anticipation for food. Once they are conditioned, an on-site person engages the remote trigger, and a gate closes on the corral. Hogs that remain outside of the corral when the gate closes are shot immediately by strategically placed marksmen. The remaining hogs in the corral are then harvested.

This is the only known method to successfully harvest the sounder, or the reproductive group of the hogs (females and juveniles). Without implementation of the plan described above, populations of the invasive hogs will continue to flourish within the watershed, and the water quality of Pennahatchee Creek will continue to demonstrate an impairment of fecal coliform.

It will also be very helpful if the farmers and stakeholders within the watershed are educated on proper techniques to harvest the hogs. Therefore, an education campaign with two workshops will be an effective Best Management Practice. This campaign may include, but is not limited to, presentations from expert speakers, BMP demonstrations, brochures and fliers, and even a technical guide for feral hog harvesting.

Funding for the above mentioned BMPs will be sought through Section 319(h) of the Federal Clean Water Act.

9.0 Partnership Advisory Council and Partner Organizations

An Advisory Group recruitment from a number of working group partners were prioritized to also serve to provide input for this Watershed Improvement Plan. Representatives include agriculture, members of local government, and landowners. Table 7 shows the final Advisory Group of major Stakeholders and community participants.

Table 7. Advisory Group for Pennahatchee Creek.

Name	Address	City	State	ZIP	Organization
Emerson Lundy	PO Box 436	Vienna	GA	31092	City of Vienna
Nathan Jordan	210 West Union St	Vienna	GA	31092	City of Vienna
Graylen Hall	1150 Industrial Blvd Suite 301	Vienna	GA	31092	United States Department of Agriculture
Bob Lamaster	204 West Union St	Vienna	GA	31092	Dooly County Health Department
Chad Pritchett	243 U.S. Highway 19 N	Americus	GA	31709	Georgia Forestry Commission
Joseph Clint Martin	2024 Newton Rd	Albany	GA	31701	Wildlife Resources Division
William L. Tietjen	800 Georgia Southwestern State Univ Dr	Americus	GA	31709	Georgia Southwestern State University
Carl Lowell	259 Georgia Highway 41	Vienna	GA	31092	Dooly County Forestry Unit
Jerome Deal	PO Box 2299	Columbus	GA	31902	Regional Environmental Health Officer
Charles E. Ellis	209-C West Union St	Vienna	GA	31092	County Extension Agent
Terrell Hudson	PO Box 747	Unadilla	GA	31091	Dooly County Farm Bureau
Steve Sanders	PO Box 348	Vienna	GA	31092	Dooly County Administrator
Gail Bembry	PO Box 436	Vienna	GA	31092	City of Vienna
Rodney Hair	N/A	N/A	GA	N/A	Dooly County Public Works
Bill Powell	N/A	N/A	GA	N/A	Georgia Rural Water Association
Kathyrn Braxton	203 W Cotton St	Vienna	GA	31092	Keep Vienna Beautiful
Brad	209 West	Vienna	GA	31092	County Extension Agent

Sangster	Union St				
Alan Woodward	1150 Industrial Dr	Vienna	GA	31092	United States Department of Agriculture / Natural Resources Conservation Service
Harry Wand	PO Box 144	Vienna	GA	31092	Dooly County
N/A	2525 Peachtree Rd	Atlanta	GA	30305	Lenco, Ltd.
N/A	311 Hudson Rd	Vienna	GA	31092	Five Oaks South, LLC
N/A	20820 Highway 27	Vienna	GA	31092	Creekwood Farms Inc.

The TMDL Advisory Group is a collection of individuals who bring unique knowledge and skills which complement the knowledge and skills of the public in order to more effectively accomplish this revision. The purpose of the TMDL Advisory Group is to provide a forum for the public, partners, etc., to discuss potential concerns and solutions that will impact Pennahatchee Creek, and to make recommendations relative to TMDLs.

The Advisory Group's key responsibilities were to:

- **Advise** on matters of concern to the community;
- **Contribute to the education** of the residents of the watershed on water quality issues;
- **Help identify** contributing pollution sources;
- **Assist** in arriving at equitable pollution reduction allocations among contributors;
- **Recommend specific actions** needed to effectively control sources of pollution; and
- **Help develop** and set in motion an extended plan.

A Stakeholder/Advisory Group meeting was held on September 16, 2010 at 6:00 pm at Marise County Cooking in Vienna, and at Vienna City Hall on August 24, 2011 at 3:30 pm to discuss potential ways to assess the watershed of Pennahatchee Creek. See Appendix F for meeting minutes.

10.0 SCHEDULE OF SEQUENTIAL MILESTONES

The main goal of this Watershed Improvement Plan is to bring Pennahatchee Creek into compliance with water quality standards, which will result in its removal from the 303(d) list of impaired waters. This goal will be measured by the concentration of fecal coliform samples taken during future stages of implementation.

Money to fund the management practices outlined in Section 8 of this report will be sought through Section 319(h) of the Federal Clean Water Act. The 319(h) grant application will be submitted to EPD by the October 31, 2011 deadline. Notification of approved applications will be in spring of 2012, and funding and project activities will begin in fall of 2012.

Should the grant application be funded, evaluation of BMP locations will begin immediately. Installation of all BMPs, including invasive hog harvesting, will take up to a year or more to

complete. During this time, the educational outreach component will take place and continue on through the second year. All of the outputs of the 319(h) application will take approximately two years to complete.

11.0 PUBLIC INVOLVEMENT

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort. Table 8 shows a list of interested Stakeholders within the Pennahatchee Creek Watershed.

TABLE 8. STAKEHOLDER GROUP FOR PENNAHATCHEE CREEK.

Name	City	State	ZIP
Mattie Mays	Vienna	GA	31902
Ralph Long	Marshallville	GA	31057
Ivana A Fox	Bath	PA	18014
Eddie Daniels	Cordele	GA	31010
Mark L. Holcomb & Ronald G. Steis	Cumming	GA	30040
Robert Z. Brown et, al.	Miami	FL	33056
Thomas H. McCook	Macon	GA	31210
Michael C. Griffin & Robert T. Mullis	Macon	GA	31208
Thomas H. Sims, II	Tampa	FL	33617
Willie Haugabrook, Jr., et, al.	Vienna	GA	31092
Armond Lamar Baggs	Vienna	GA	31092
Charles B. Coley	Vienna	GA	31092
Joe Hinson	Vienna	GA	31092
Billy Sanders	Vienna	GA	31092

Building partnerships was a key component in order to declare input from the Stakeholder perspective in evaluating the Watershed Improvement Plan; and to provide an opportunity for Stakeholders to understand how the peer review process contributes to the development of TMDL plans and results. As a result of their participation, Stakeholders became knowledgeable advocates to help manage or decrease non-point source pollution impacts.

Stakeholders' key responsibilities were to:

- **Provide** technical support and assistance;
- **Distribute** and share information;
- **Identify** opportunities and common concerns; and
- **Develop** public support.

RVRC staff encouraged public participation in the development of this TMDL Plan by inviting Stakeholders to participate in a meeting throughout the development stages. The objective of

this meeting was to obtain feedback from Stakeholders about the concerns and composition of watershed activities. The Stakeholder Group meeting was held on September 16, 2010 at 6:00 pm at Marise County Cooking in Vienna and at Vienna City Hall on August 24, 2011 at 3:30 pm to discuss potential ways to assess the watershed of Pennahatchee Creek. See Appendix F for meeting minutes.

Examples of Stakeholder recommendations include:

- Additional monitoring to verify effectiveness of measures implemented;
- Review of all existing development codes, ordinances, and policies to identify where revisions could be made to reduce non-point source water pollution;
- Design and implement a citizen education program to make citizens aware of the non-point source water pollution problem and their role in improving the water quality;
- Encourage the continuing formation of volunteer groups to conduct community based stream protection efforts such as restoring vegetative cover within riparian areas, stream clean-up, and reporting of problems;
- Conduct screening level analyses of structural and non-structural BMPs;
- Investigate grant and funding opportunities to fund these efforts;
- Propose best management practices (BMPs) or other ways to correct problems at each location; and
- Evaluate technical assistance needed and how to administer this assistance.

12.0 RECOMMENDATIONS FOR MONITORING AND CRITERIA FOR MEASURING SUCCESS

Targeted monitoring for Pennahatchee Creek was conducted once per month from December of 2010 through September of 2011. The results of this monitoring may be found in Appendix H. Appendix G contains the results of sampling that was conducted in 2002. It should be noted that the 2002 study yielded similar results as the 2011 study. Samples taken at Templeton Road in July of 2002 were TNTC (too numerous to count). Samples taken at Slosheye Trail Road (approximately two miles upstream from Templeton Road) during July of 2011 were well above the 200 CFU/100mL limit at 2,867 CFU/100mL

Should the 319(h) application be funded, fluorometric measurements should be taken from Pennahatchee Creek prior to BMP installation. Fluorometric measurements of optical brighteners (OBs) are an inexpensive, simple, and fast method for distinguishing sources of human fecal contamination from non-human sources. OBs are fluorescent agents added to modern laundry detergents to provide a whitening effect. Because laundry effluents discharge into sewer or septic systems, mixing with sewage and other household wastewater, OBs in the environment can indicate the presence of human waste. This will be especially useful to determine whether or not the LAS (Land Application System) from the City of Vienna is contributing to the fecal coliform impairment.

After Best Management Practices have been installed, follow-up monitoring should be conducted to determine load reductions of fecal coliform within the watershed. Sites sampled during the

Revision period (see Figure 5 and Table 9) will be sampled again throughout the remainder of the 319(h) contract. If BMPs were correctly installed and implemented, a reduction of fecal coliform should be the result. It should be noted that staff from the RVRC sampled for *E. coli* during the Revision period. Therefore, in order to accurately compare results, the same standard should be sampled.

FIGURE 5. PENNAHATCHEE CREEK WATERSHED SAMPLING SITES.

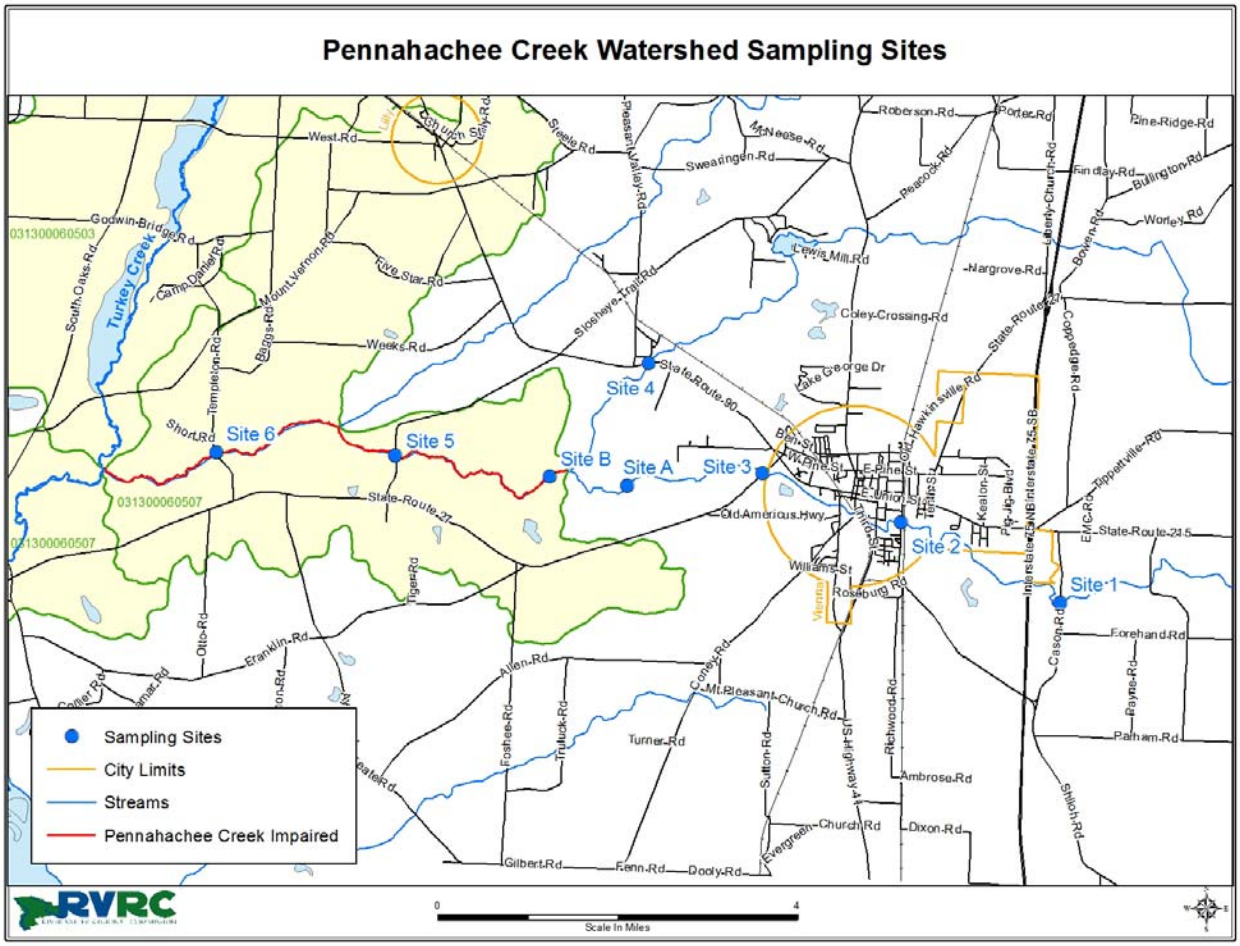


TABLE 9. SAMPLING STATIONS.

Station Number	General Location	Sampling Site Coordinates		Sample Parameters
		Longitude	Latitude	
1	Pennahatchee Creek and Cason Road	-83.757124	32.074774	*E. coli*
2	Pennahatchee Creek and S. Seventh Street	-83.787656	32.08712	*E. coli*

3	Pennahatchee Creek and Ford Street	-83.814225	32.094373	*E. coli*
4	Sandy Mount Creek and State Route 90	-83.836267	32.111532	*E. coli*
5	Pennahatchee Creek and Slosheye Trail Road	-83.883787	32.095606	*E. coli*
6	Pennahatchee Creek and Templeton Road	-83.917728	32.095375	*E. coli*
A	Billy Sanders farm	-83.839747	32.091650	*E. coli*
B	Hardy Gregory farm	-83.854494	32.093284	*E.coli*

Records will be maintained by the Planning Division of the River Valley Regional Commission located at 1428 2nd Avenue, Columbus, Georgia 31902 for a period of three years from the conclusion of the project, and will be available for review. Additionally, data will be posted by the Regional Commission to the Georgia Adopt-A-Stream database.

13.0 PLAN IMPLEMENTATION

The objective of TMDL Implementation Plan is to restore impaired water quality to meet water quality standards. From a broader perspective, Georgia's water quality management strategy addresses three things:

1. Protection: Prevent the degradation of healthy waters.
2. Restoration: Develop and execute plans to eliminate impairments.
3. Maintaining Restored Waters: Institutionalize technical and administrative procedures to prevent or offset new pollutants.

A list of management measures and other general actions to be implemented during the Section 319(h) grant phase is shown in Table 10.

TABLE 10. IMPLEMENTATION SCHEDULE FOR 319(H) GRANT PHASE.

Management Measure	Responsible Organization	Date(s)
Installation of livestock operation BMPs	River Valley Regional Commission/ Two Rivers Resource Conservation and Development Council	October 2012 – December 2013
Installation of feral hog BMP	River Valley Regional Commission	October 2012 – March 2013

Education Campaign	River Valley Regional Commission/ Two Rivers Resource Conservation and Development Council	October 2012 – September 2014
Targeted Monitoring	River Valley Regional Commission	December 2013 – September 2014

During each semi-annual evaluation of implementation on Pennahatchee Creek, a reassessment of implementation priorities will be made by the Advisory Group to readjust and fine – tune the targeting approach in concert with the staged implementation approach. If reasonable progress toward implementing the management practices is not demonstrated, the Advisory Group will consider additional implementation actions.

If it is demonstrated that reasonable and feasible management measures have been implemented for a sufficient period of time, and TMDL targets are still not being met, the TMDL will be reevaluated and revised accordingly. If after three years, the Advisory Group determines that load reductions are being achieved as management measures are implemented, then the recommended appropriate course of action would be to continue management measure implementation and compliance oversight. If it is determined that all proposed control measures have been implemented, yet the TMDL is not achieved, further investigations will be made to determine whether: 1) the control measures are not effective; 2) fecal coliform loads are due to sources not previously addressed; or 3) the TMDL is unattainable.

14.0 Plan Appendices

- **A. Nine (9) – Key Element Summary**
- **B. Pennahatchee Creek HUC 12 Watersheds**
- **C. Land Use Maps: Land Use Trends and Future Land Use**
- **D. Field Notes and Pictures**
- **E. Copies of Public Notices and Other Literature**
- **F. Meeting Minutes**
- **G. Supporting Documentation**
- **H. Targeted Monitoring Data**

APPENDIX A. NINE (9) – KEY ELEMENT SUMMARY

Element 1 – An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load allocations or achieve water quality standards. Sources should be identified at the subcategory level.

There are many invasive feral hogs within this watershed. Little has been done to quantify their abundance. However, farmers in the area can ascertain this abundance by the amount of damage that is done on their crops by the invasive hogs. Since these hogs have no natural predators and they can produce litters of 12 or more two to three times per year, they can thrive and destroy without any opposition. These hogs also degregate the quality of water by wading directly into streams, especially during the hot months of the summer.

Wildlife and waterfowl within the watershed include deer, armadillos, raccoons, varmints, ducks, cranes, and geese and do contribute to fecal coliform contamination of Pennahatchee Creek. However, these animals are native to the watershed and their waste should be considered natural. The deer density within Dooly County is approximately 17.3 deer per square mile.

The Land Application System of the City of Vienna operates under an NPDES permit. The spray fields may contribute to contamination during heavy rain events. However, the most impaired Site 5 has approximately 4 miles of stream between it and the LAS. Due to the proximity of the site and that high sample counts were taken during dry periods, there is a low probability that this site is a significant source of impairment.

Improper disposal of hunted animal carcasses can contribute to a fecal coliform impairment. Sometimes hunters neglect to dispose of the carcass in a landfill and leave it on the ground or in a creek. Although this happens in nearly every watershed, there is no evidence to suggest that this is the major pollutant source within the Pennahatchee Creek watershed.

Septic systems can certainly cause an impairment to underground aquifers and thus, to streams. However, according to the Dooly County Health Department, there have not been any reported failing septic systems in the area. Furthermore, there are too few septic systems in the area to even cause an impairment.

Livestock farms can cause pollution problems within a watershed. According to stakeholders, there are three livestock farms within the watershed. The one hog operation, located at 32.114100, -83.854082, contains approximately 100 domestic hogs. One cattle operation, located at 32.088723, -83913063, contains approximately 100 cattle and the other, located at 32.112620, -83.904993, contains approximately 150 cattle. These sources of fecal coliform may be significant enough to contribute to the impairment.

Element 2 – An estimate of the load reductions expected for the management measures described under Element 3.

Currently, a TMDL for Pennahatchee Creek requires a 70.2% reduction of fecal coliform in order to be within the water quality standard. Several Best Management Practices need to be implemented throughout this watershed. These may include, but are not limited to, alternative watering sources, fencing, composting facilities, stream crossings, waste facility covers, tree/shrub buffers, filter strips, and water wells. Installing four to six of the above listed BMPs at each animal operation farm will greatly reduce the amount of fecal coliform within the watershed.

According to the 2007 *Best Management Practices for Georgia Agriculture* by the Georgia Soil and Water Conservation Commission, installing an alternative watering source "significantly reduce[s] the amount of waste and sediment entering the water." Fencing animals out of second order streams has reduced fecal coliform colony forming units by 99% in studies. Composting facilities provide a place to store manure away from a steam. The load reduction of this BMP is unknown. Streams crossings prevent livestock from entering the stream and should reduce fecal coliform at the same order as fencing. Waste facility covers prevent overflows and runoff of wastes. This can reduce the amount of fecal coliform entering from this location by approximately 99%. Tree/shrub buffers prevent erosion help absorb up to 59% of nutrients. Filter strips can potentially remove up to 60% of pathogens. Hog harvesting should be treated as fencing since the harvesting is physically preventing the hogs from entering the stream. There are many additional BMPs that may be installed within each livestock farm.

It should be noted that the above reductions loads do not occur at Pennahatchee Creek's collection Site 5, but rather at the location of the BMP. Therefore, it is extremely difficult to quantify the percent reduction of fecal coliform within Pennahatchee Creek prior to installation of the BMPs. Although a reduced load is a good hypothesis, due to the proximity of the livestock operations from the creek itself, it is certain that the stream will collect additional fecal coliform colonies from native species within the watershed downstream from the BMP installations, as well as dilute the fecal coliform colonies that do slip past the BMPs. Determining the load reduction of Pennahatchee Creek itself is not plausible until after BMP installation.

Element 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.

There are several management practices that can be applied within the watershed to help alleviate the pollution levels. There are two known cow operations and one known hog operation within the watershed to total approximately 250 cows and 100 hogs. At these locations, several Best Management Practices should be installed. BMPs that can help reduce levels of fecal coliform entering into Pennahatchee Creek include, but are not limited to, alternative watering sources, fencing, composting facilities, stream crossings, waste facility covers, tree/shrub buffers, filter strips, water wells etc. In order to effectively reduce pollution levels sourced from these operations, it is recommended to install four to six BMPs at each location.

Stakeholder opinion and evidence of "hog wallow" within the stream indicate that the most abundant source of fecal coliform originates from the invasive feral hog. Since this species is invasive, highly destructive to crops, has no natural predators, reproduces at an alarming rate, and directly contributes to a water quality impairment that is detrimental to human health, it is highly recommended by all stakeholders and advisors that these hogs within the watershed be harvested.

Currently there are no Best Management Practices for feral hog harvesting recognized by GA EPD. Traditional methods for harvesting include small, portable box-style traps and hunting by gun and/or dog. While these methods may result in the capture/harvest of a feral hog, they do little to affect the overall population of these hogs. According to the peer reviewed scientific study, *Trap Style Influences Wild Pig Behavior and Trapping Success*, by Auburn University researchers Brian L. Williams, Robert W. Holtfreter, Stephen S. Ditchkoff, and James B. Grand, corral traps are the most effective and efficient means of harvesting wild hogs when correctly implemented.

Successful implementation requires several weeks of preparation before the harvest. First, a survey must be conducted to determine the location of the hogs. This may be accomplished by direct observation or by capturing a hog and placing a transmitter on it. Next you must condition the hogs to be comfortable within the harvest area. This is accomplished by having a feeder set to dispense food at the same time every day, preferably at sun down or sun up. After a week or so, the hogs begin to anticipate the feeding and arrive before the feeder starts. Next a corral of approximately 15 to 20 feet in diameter is placed around the feeder, leaving an opening for the hogs to enter. Conditioning continues for about a week. Initially, the juveniles will enter the corral but the adults are skeptical. However, near the end of the conditioning period, larger males and females will enter the corral in anticipation for food. Once they are conditioned, an on-site person engages the remote trigger, and the gate closes on the corral. Hogs that remain outside of the corral when the gate closes are shot immediately by strategically placed hunters. The remaining hogs in the corral are then harvested.

This is the only known method to successfully harvest the sounder, or the reproductive group of the hogs (females and juveniles). Without implementation of the plan described above, populations of the invasive hogs will continue to flourish within the watershed, and the water quality of Pennahatchee Creek will continue to demonstrate an impairment of fecal coliform.

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

Funding for implementation of the suggested Best Management Practices will be sought though Section 319(h) of the Federal Clean Water Act. This application will be submitted to GA EPD by the October 31, 2011 deadline.

There are several agencies that will be involved with the 319(h) grant. River Valley Regional Commission will play the lead role in the application process and oversee grant implementation. Two Rivers RC&D Council and USDA/NRCS will oversee BMP installation for livestock

operations. GA EPD will provide up to 60% of the total project costs. The Dooly County Government and the City of Vienna will assist with outreach development. The Upper Flint Regional Water Council will provide guidance as needed. The GA Farm Bureau will publicize the value of the project through printed literature and Farm Monitor TV.

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

This Watershed Improvement Plan for Pennahatchee Creek document will be available for all persons who wish to obtain it. The RVRC will hold additional Stakeholder/Advisory meetings to update interested persons in the status of the WIP/319(h) grant. Advisors and Stakeholders will be contacted by telephone, e-mail, or mailed letters.

It will also be most helpful if the farmers and stakeholders within the watershed are educated on proper techniques harvest the hogs. Therefore, an education campaign with two workshops will be an effective Best Management Practice. This campaign may include, but is not limited to, presentations from expert speakers, BMP demonstrations, brochures and fliers, and even a technical guide for feral hog harvesting.

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

The 319(h) grant application will be submitted to EPD by the October 31, 2011 deadline. Notification of approved applications will be in spring of 2012, and funding and project activities will begin in fall of 2012.
Should the grant application be funded, evaluation of BMP locations will begin immediately. Installation of all BMPs, including invasive hog harvesting, will take up to a year or more to complete. During this time, the educational outreach component will take place and continue on through the second year. All of the outputs of the 319(h) application will take approximately two years to complete.

Element 7 – A description of interim, measurable milestones for determining whether management measures or other control actions are being implemented.

River Valley Regional Commission staff will make monthly visits to the watershed in order to monitor the progress of the BMP installation.

The success of the installed Best Management Practices will be measured by collecting samples throughout the watershed. This will be implemented once all BMPs have been installed. In addition, results from the hog harvest BMP may be noticed by observation; i.e., there will be noticeably less damage to croplands and stream banks in the area.

Element 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.

Monitoring, following installation of Best Management Practices, will be implemented in order to determine water quality. These results will be used to compare with water quality results obtained during the Revision phase of the WIP. Successful implementation of the BMPs will yield sample counts that are lower than those in previous years.

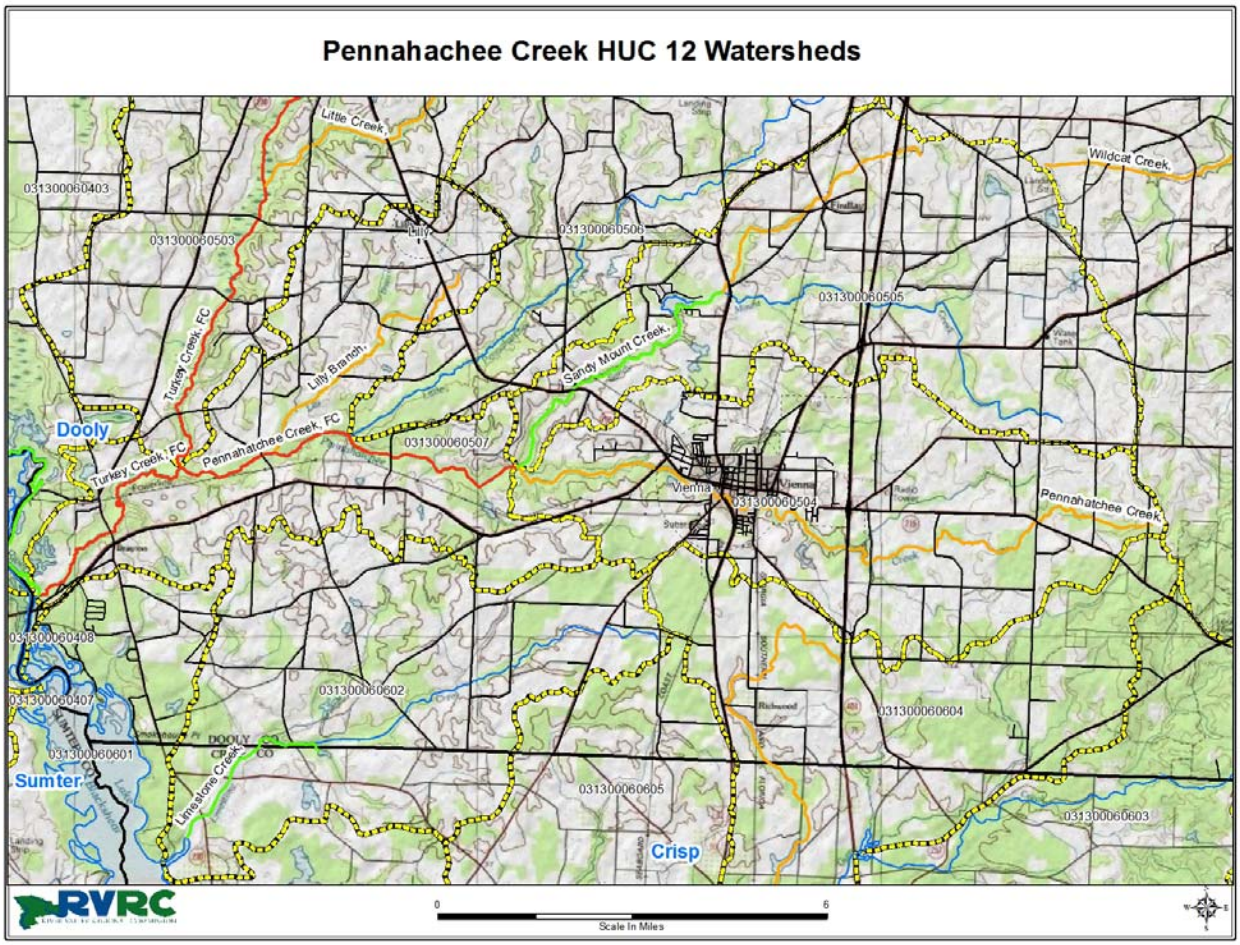
During each semi – annual evaluation of implementation on Pennahatchee Creek, a reassessment of implementation priorities will be made by the Advisory Group to readjust and fine-tune the targeting approach in concert with the staged implementation approach. If reasonable progress toward implementing the management practices is not demonstrated, the Advisory Group will consider additional implementation actions.

Element 9 – A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under Element 8.

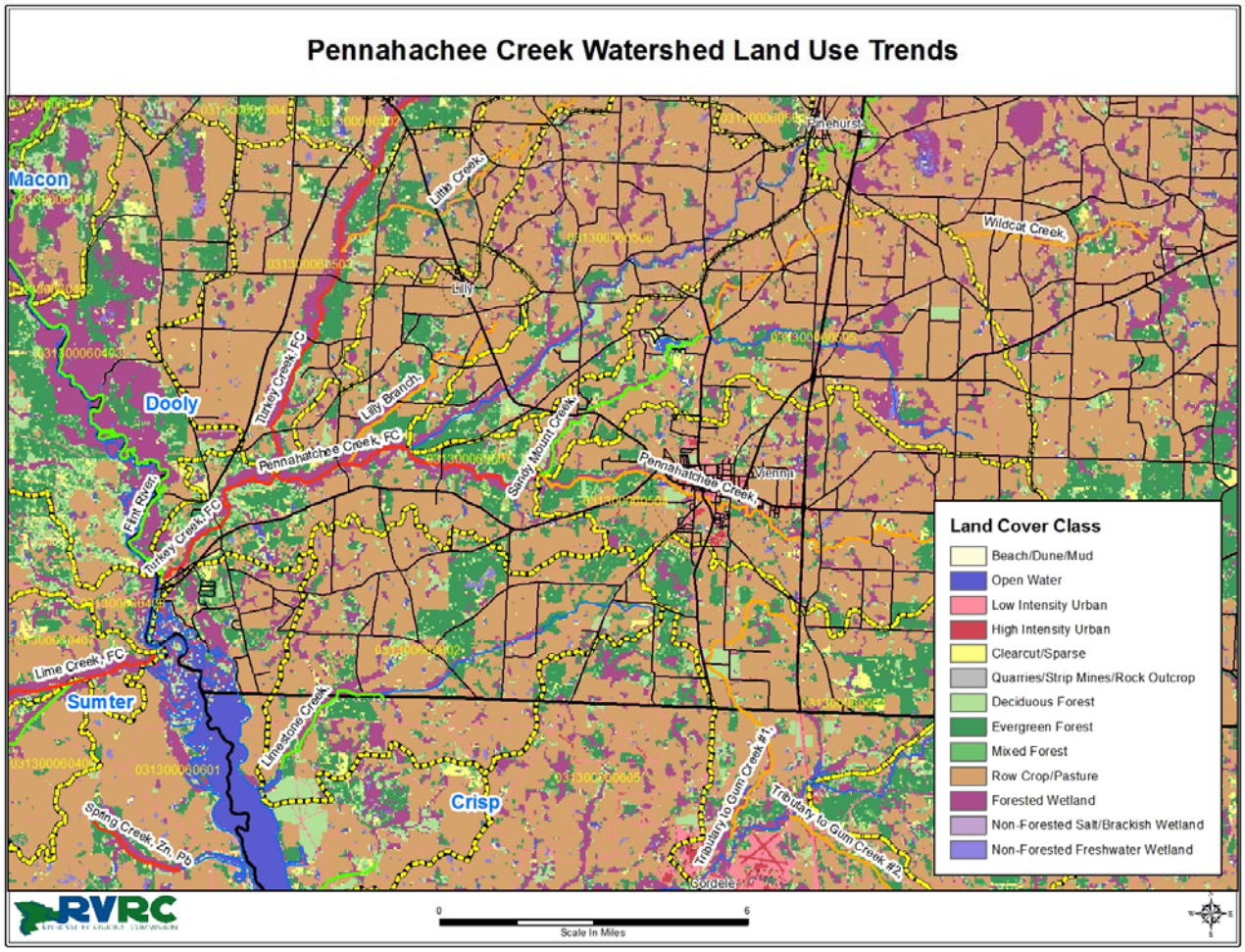
Should the 319(h) application be funded, fluorometric measurements should be taken from Pennahatchee Creek prior to BMP installation. Fluorometric measurements of optical brighteners (OBs) represent an inexpensive, simple, and fast method for distinguishing sources of human fecal contamination from non-human sources. OBs are fluorescent agents added to modern laundry detergents to provide a whitening effect. Because laundry effluents discharge into sewer or septic systems, mixing with sewage and other household wastewater, OBs in the environment can indicate presence of human waste. This will be especially useful to determine whether or not the LAS system from the City of Vienna is contributing to the fecal coliform impairment.

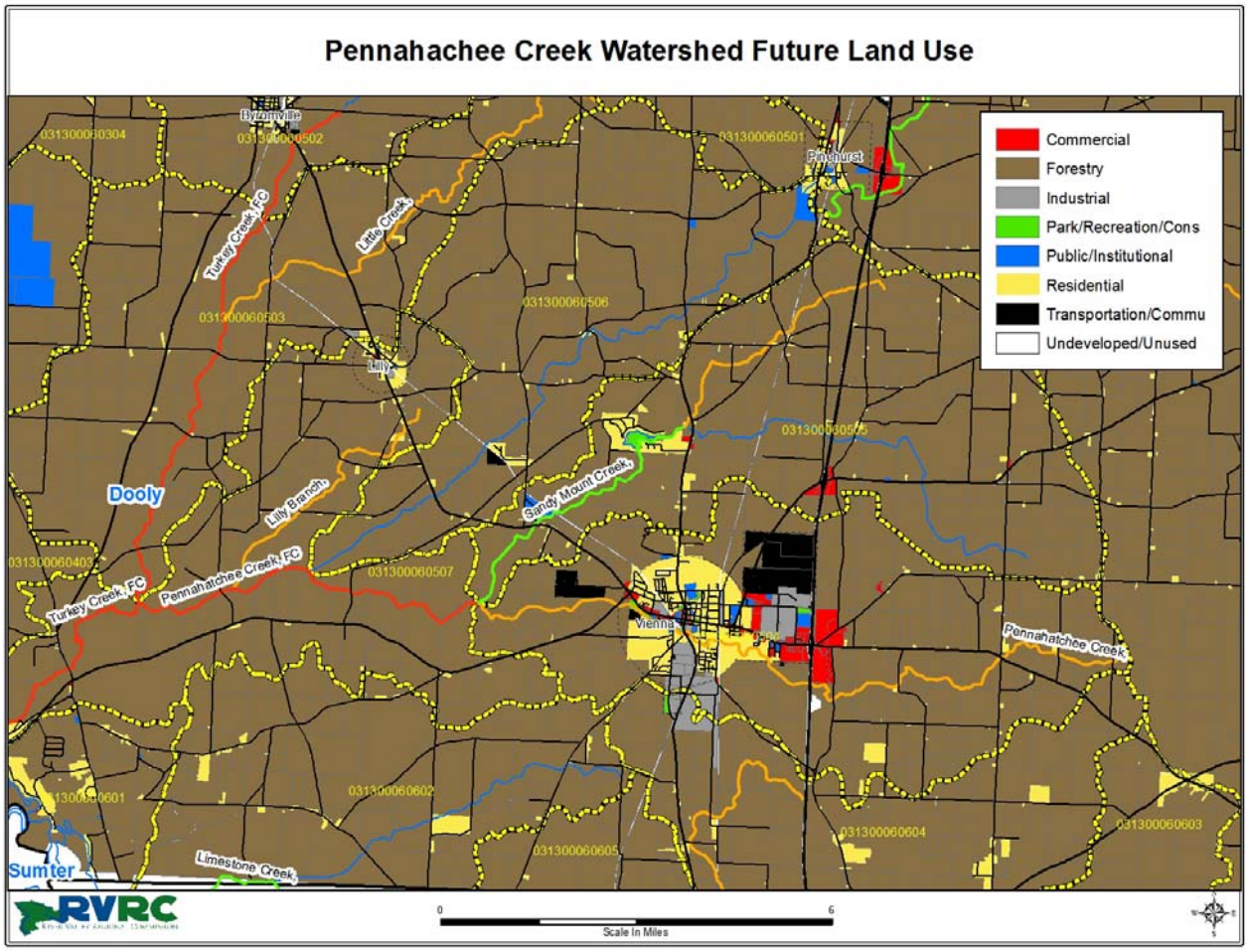
After Best Management Practices have been installed, follow-up monitoring should be conducted to determine load reductions of fecal coliform within the watershed. Sites sampled during the Revision period (see Figure 5 and Table 9) will be sampled again throughout the remainder of the 319(h) contract. If BMPs are correctly installed and implemented, a reduction of fecal coliform should be the result. It should be noted that staff from the RVRC sampled for *E. coli* during the Revision period. Therefore, in order to accurately compare results, the same standard should be sampled.

APPENDIX B. PENNAHATCHEE CREEK HUC 12 WATERSHEDS



APPENDIX C. LAND USE MAPS: LAND USE TRENDS AND FUTURE LAND USE.

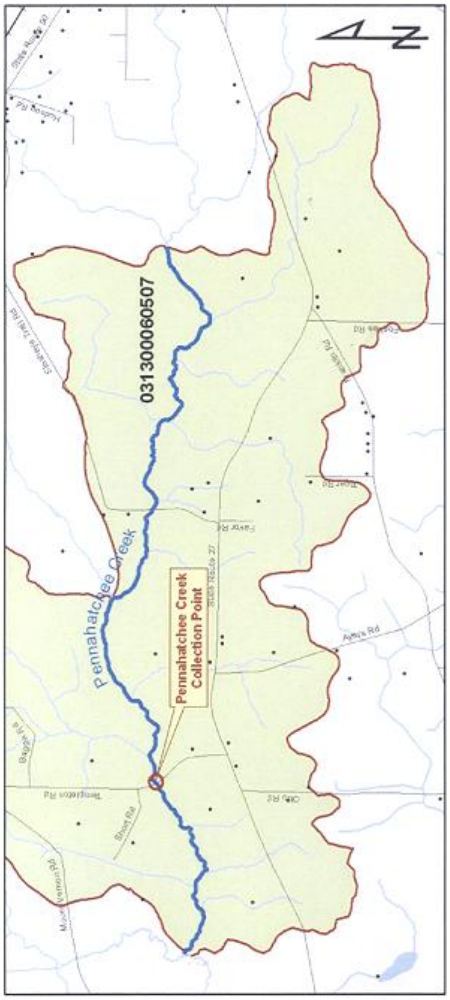



Pennahachee Creek Watershed Future Land Use
Commercial
Forestry
Industrial
Park/Recreation/Cons
Public/Institutional
Residential
Transportation/Commu
Undeveloped/Unused
Byromville
Pinehurst
Lilly
Dooly
Vienna
Sumter
Turkey Creek, FC
Little Creek
Lilly Branch
Sandy Mount Creek
Pennahatchee Creek, FC
Pennahatchee Creek
Limestone Creek
031300060304
031300060502
031300060501
031300060503
031300060506
031300060505
031300060403
031300060507
031300060602
031300060604
031300060603
031300060605
RVRC
0
6
Scale In Miles

APPENDIX D. FIELD NOTES AND PICTURES

Show stream or road segment & landmarks (crossing stream or road) or distances marking the upper & lower end of segment. If a stream, show the direction of flow, ponds or swampy areas, & estimate the width of the riparian corridor from each bank. Use an arrow to show the approximate direction of north. Show & describe (in the notes section) major adjoining land activities (see attached table) & show the location of specific potential sources & describe in the notes section. Show the direction and number of photographs taken.

Stream or Road Segment Map
Or Drawing



Pennahatchee Creek___ Visual Field Survey
Date: 9/17/09_____ Arrival Time: 1:00 PM_____
Site Location Templeton Rd. / Slosheye Trail Rd.___
GPS Coordinates (if taken) 32.095228 & -85.917719
Current Weather overcase__ Time Since Last Rain +24 Hr__
Team Members: Lance Renfrow_____

Notes (point to/reference applicable activity on map):

Barbed wire, south-east of where Pannahatchee Creek crosses Templeton Rd, can be noticed. This indicates that animals may be contained within the fenced area. However there are no visual signs of animals currently present. This area land is not cleared and growth is abundant. This suggests that fenced-in-animals are probably not abundant near the creek. There are no other indications of sources of contamination.

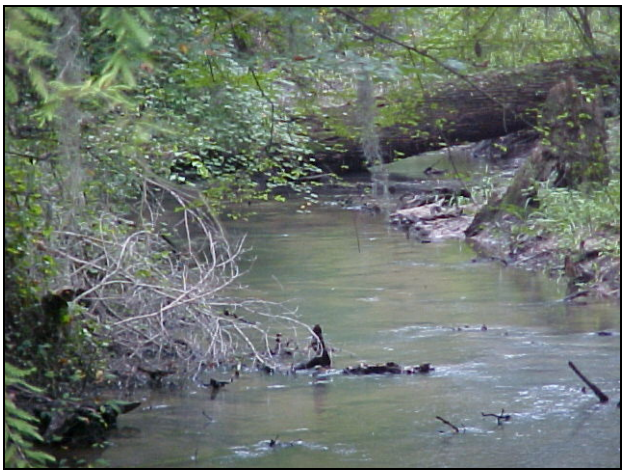
STREAM CONDITIONS @ ROAD CROSSINGS (Check as appropriate)
Channel Type: Swamp ☐; pool ☐; run ☒, riffle☐; other_____.
Flow Stage: High☐; medium ☒; low ☐; dry☐.
Odors: None/normal ☒; sewage ☐; petroleum ☐; chemical ☐; chlorine ☐; rotten egg ☐; animal waste ☐; other_____.
Water Clarity: Clear ☐; tea-colored ☒; cloudy ☐; opaque ☐; red or brown from sediment ☐; other_____.
Water Surface: None ☒; slick ☐; oil sheen ☐; oil sheen—breaks into plates ☐; globs ☐; flecks ☐; foam ☐; other _____.
Algal Growth—Description & Extent: moderate growth_____.
Sediment: Eroded banks ☒; mid-channel bars ☐; recent sediment deposition on banks ☐; other

S:\RVRC Planning and Admin\Lance\TMDL\TMDL '09\Pennahatchee Creek\Pennahatchee Creek\Pennahatchee Creek Field Survey\Pennahatchee Field Survey.doc


Pennahatchee Creek near Templeton Rd.



Pennahatchee Creek near Slosheye Trail Rd.




APPENDIX E. COPIES OF PUBLIC NOTICES AND OTHER LITERATURE

RIVER VALLEY REGIONAL COMMISSION

Columbus Office
1428 Second Avenue
P. O. Box 1908
Columbus, GA 31902
Phone (706) 256-2910
Fax (706) 256-2908

Americus Office
228 West Lamar Street
Americus, GA 31709
Phone (706)256-2910
Fax (229) 931-2745
Fax (229) 931-2917

www.rivervalleyrc.org

Toll Free (877)819-6348

August 25, 2010

Dear Sir/Madam:

Analysis of water samples taken from Pennahatchee Creek in 2002 by the Department of Natural Resources indicated the presence of fecal coliform bacteria at a level which exceeded state water quality standards. Consequently, a six mile segment of the creek was placed on the federal 303(d) list of impaired waterways, and a Total Maximum Daily Load evaluation of the creek was performed. A formal procedure must now be followed to remove Pennahatchee Creek from the impaired waterways list.

The general water quality criteria for fecal coliform bacteria states, "All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses." The state's water use classification for Pennahatchee Creek is fishing, and previous studies report adverse impacts on fish in waters with elevated fecal coliform bacteria levels.

A Total Maximum Daily Load Implementation Plan was previously developed for Pennahatchee Creek. In order to further efforts for the removal of Pennahatchee Creek from the 303(d) list of impaired streams, a meeting has been scheduled to conclude a secondary Tier II Implementation Plan. This plan will address the general characteristics of the watershed, the sources of non-point pollution, stakeholders and public involvement, and educational/outreach activities. Additionally, the plan describes regulatory and voluntary practices and control actions, known as Best Management Practices (or BMPs), for reducing non-point sources of pollutants, developing milestone schedules for the BMPs, and creating a monitoring plan to measure BMP effectiveness.

You may recall a similar letter and meeting addressing this issue last August. You are asked to attend and participate in the follow-up meeting because, (1) a review of county tax records indicates you own property fronting that segment of Pennahatchee Creek reported to have a fecal coliform level in excess of current water quality standards, or (2) you have otherwise been determined to have a stake or interest in the quality of water in this creek.

The meeting is scheduled for 6:00 p.m., Thursday, September 16, at Marise Country Cooking, 1017 East Pine Street, Vienna. East Pine Street is off East Union Street / GA Highway 27. You are asked to support your watershed and attend this meeting. If you have any questions in the interim, you may call Lance Renfrow or Gerald Mixon at 877-819-6348.

Sincerely,

Lance Renfrow
Environmental Planner

Chattahoochee | Clay | Crisp | Dooly | Harris | Macon | Marion | Muscogee
Quitman | Randolph | Schley | Stewart | Sumter | Talbot | Taylor | Webster

RVRC
RIVER VALLEY REGIONAL COMMISSION
www.rivervalleyrc.org

Columbus Office
1428 Second Avenue
P. O. Box 1908
Columbus, GA 31902
Phone (706) 256-2910
Fax (706) 256-2908

Americus Office
228 West Lamar Street
Americus, GA 31709
Phone (706) 256-2910
Fax (229) 931-2745
Fax (229) 931-2917

Toll Free (877) 819-6348

August 9, 2011

Dear Pennahatchee Creek Stakeholder/Advisor,

It is time again to have our annual review of the Pennahatchee Creek Watershed. As you may know, Georgia Environmental Protection Division listed Pennahatchee Creek on the 303(d) list of impaired streams after samples in 2002 indicated high levels of fecal coliform. A formal procedure is now being followed in order to reduce the level of this impairment.

In order to further the efforts for the removal of Pennahatchee Creek from the 303(d) list of impaired streams, a meeting has been scheduled so that local stakeholders and advisors may have an opportunity to provide feedback on upcoming events. RVRC staff plans to submit a 319(h) grant in October of 2011 to address this impairment. This grant can be used to establish and install Best Management Practices that can help mitigate these pollution levels. In addition, a draft Watershed Improvement Plan (WIP) has been developed for this watershed. Public comments and suggestions are encouraged for both the upcoming 319(h) grant and the WIP.

You are asked to attend and participate in the follow-up meeting because, (1) a review of county tax records indicated you own property fronting that segment of Pennahatchee Creek reported to have a fecal coliform level in excess of current water quality standards, or (2) you have otherwise been determined to have stake or interest in the quality of water in this creek.

The meeting is scheduled for 3:30 p.m., Wednesday, August 24, 2011, in the Vienna City Hall, 203 West Cotton Street, Vienna, Georgia 31092. You are asked to support your watershed and attend this meeting. If you have any questions in the interim, you may contact me at 706-256-2910 or by e-mail at lrenfrow@rivervalleyrc.org.

Sincerely,

Lance Renfrow
Environmental Planner

APPENDIX F. MEETING MINUTES

TMDL Stakeholder/Advisory Committee Meeting Minutes
September 16, 2010

Persons Attending

Lance Renfrow, RVRC
Tina Rust, RVRC
Emerson Lundy, Mayor of Vienna
Nathan Jordan, City of Vienna
Mattie Mays, Land Owner
Ralph Long, Land Manager

This meeting was held at 6:00 pm at Marise County Cooking in Vienna to discuss potential sources and solutions for the fecal coliform pollution in Pennahatchee Creek.

Lance Renfrow provided an overview of the Total Maximum Daily Load Implementation Plan that is being written for Pennahatchee Creek and the role that the Stakeholder/Advisory Committee has in providing input into the plan.

- Lance asked the stakeholders what they thought were sources of pollution for Pennahatchee Creek.
- Some people agreed that it is definitely feral hogs in the area contributing to the pollution. It is probably not cattle and definitely not development.
- Lance explained that these hogs are an invasive species and have no natural predators.
- Ralph suggested that we trap the hogs in cages and keep moving the cages around so the hogs don't get wise to the trapping.
- Some people have been shooting the hogs with night vision but it is not putting a dent in the population.
- Other suggestions for hog removal is poisoning the hog or giving it a fertility pill.
- Ralph suggested putting out a bounty for the hogs.
- Mattie suggested that hunters are the problem because they are transporting the hogs to hunting farms and repopulating them in other areas.
- Stakeholders agreed that a good plan would be to organize a bounty and organize a hunt.
- Lance suggested that we use the hogs in a food bank.

Meeting was adjourned at 7:30 pm.

TMDL Stakeholder/Advisory Committee Meeting Minutes
August 24, 2011

Persons Attending

Lance Renfrow, RVRC
Buddy Strength, RVRC
Emerson Lundy, Mayor of Vienna
Rodney Hair, Dooly County Public Works
Terrell Hudson, Dooly County Commissioner, Dooly County Farm Bureau
Bill Powell, Georgia Rural Water Association
Graylen Hall, NRCS
William L. Tietjen, Georgia Southwestern State University
Kathryn Braxton, Keep Vienna Beautiful
Brad Sangster, Extension Office
Gail Bembry, City of Vienna
Alan Woodward, USDA/NRCS
Harry Wand, Dooly County Commissioner
Billy Sanders, land owner
Joe Hinson, land owner

This meeting was held at 3:30 pm at Vienna City Hall in Vienna to discuss potential sources and solutions for the fecal coliform pollution in Pennahatchee Creek.

Lance Renfrow provided an overview of the Total Maximum Daily Load Watershed Improvement Plan that is being written for Pennahatchee Creek and the role that the Stakeholder/Advisory Committee has in providing input into the plan.

- Public to offer comments, suggestions about Draft Watershed Improvement Plan

- Fecal coliform source unknown
- RVRC to help improve water in Pennahatchee Creek area
- Water sampling shows E. coli
- Testing 9 months (six sites) no sites isolated as source until July -- Site 5 Slosheye Trail numbers spiked
- But in 2002 same trend was noted at same site (EPD)
- Results after rain skewed, inconsistent
- RVRC now finished with EPD contract
- have to apply for new grant 319(h) grant from Federal Clean Water Act
- Probable source feral hogs -- need to be harvested
- 3 HUC-12 water sheds in area
- Proposal: Hog Harvest
    - Hunting with bounty paid to land owners, farmers
    - Farmers may not have time to hunt (best hunting at night in winter)
- Jager Pro (Professional hunters)
    - Rod Pinkston (Columbus)
    - Corral with food, remote control drop-gate, hogs enter to eat, get used to going in corral
    - Older hogs won't go in

  - Cameras watch over period of time to see when hogs eat
  - Hunters surround area at feeding time: when hogs enter, gate drops, hunters open fire on hogs outside of pen, those inside disposed of as desired—captured or shot
- Grant:
  - 60% EPD funds
  - 40% local (non federal), can be in-kind, other sources
  - Need a panel to help form a budget, volunteers from area
- Farmers may allow hunting on property but need to check on liability insurance
  - Can receive Best Management Practices, e.g. install fencing (farmer pays 40% of cost of fence)
- NRCS Equip (after October)
  - Water quality, soil quality, irrigation (different concerns)
- Farmers need to help with program, form a budget, give some money to start
- Species specific DNA testing to determine source of contamination expensive but may be worth it to find out what is causing problem
- Discussion:
  - Eugene Casen
  - Match- volunteer's time, some money to start with
  - Grant due October 31 (notified in spring)
  - Details of budget needed: costs
  - Are there EPD experts to help? Other sources of help?
- Technical manual on hog harvesting GA does not have, needs one; Mississippi and Alabama do have one, considered good, check website
- Joesph Jones Foundation wildlife
- Need at this time: estimated count of feral hog population per acre to determine how many to harvest—contact Terrell Hudson about person he knows who has been hunting hogs in Dooly County for a while
- Billy Sanders to help find volunteers, also Rodney (Dooly County Utilities Director)

Meeting was adjourned at 5:00 pm.

APPENDIX G. SUPPORTING DOCUMENTATION

Plan for Pennahatchee Creek
HUC 10 # 0313000605

2002 FECAL COLIFORM STUDY
TURKEY CREEK
DOOLY COUNTY, GEORGIA

The preparation of this report was financed in part through a grant from the U.S. Environmental Protection Agency under the Provisions of Section 604(b) of the Federal Water Pollution Control Act, as amended, for the Environmental Protection Division of the Department of Natural Resources, State of Georgia, and the Middle Flint Regional Development Center.

This report was prepared by Dr. Elizabeth Elder, Biology Department, Georgia Southwestern State University, 800 Wheatley Street, Americus, Georgia 31709.

September, 2002

2002 FECAL COLIFORM STUDY

C:\Documents and Settings\lance\Desktop\Pennahatchee Cr '09 Tier 2.DOC

Plan for Pennahatchee Creek
HUC 10 # 0313000605

TURKEY CREEK
DOOLY COUNTY, GEORGIA

SAMPLE LOCATIONS: Samples were collected from four locations within the Turkey Creek watershed. The sample locations were:

Site 1: Turkey Cr at Georgia Highway 230
Site 2: Pennahatchee Cr at Templeton Rd (TMDL Implementation Plan site #4)
Site 3: Turkey Cr Godwin Bridge Rd (TMDL Implementation Plan site #2)
Site 4: Turkey Cr at CSX RR trestle (TMDL Implementation Plan site #3)

Site 1 was located at the down-stream end of the impaired segment of Turkey Creek. Site 2 was located on Pennahatchee Creek, a tributary of Turkey Creek which carries the effluent from the Vienna, Georgia, sewage treatment plant. Site 3 was at the middle of the impaired segment of Turkey Creek. Site 4 was in the up-stream end of the impaired segment. The flow in Turkey Creek was from Site 4 through Site 3 to Site 1. Pennahatchee Creek flows into Turkey Creek upstream of Georgia Highway 230.

SAMPLE DATES AND TIMES:

Table 1: Sample Collection Dates and Times

DATES (2002)	TIMES
May 22, 24, 28, 31 June 3, 5, 10, 17 July 1, 8, 16, 29, August 2, 6, 16	Site 1: 11:00 am Site 2: 10:30 am Site 3: 10:00 am Site 4: 9:30 am
August 22	Site 1: 5:00 pm Site 2: 4:30 pm Site 3: 4:00 pm Site 4: 3:30 pm

PERSONNEL: The principal investigator involved in the project was Dr. Elisabeth D. Elder, a Professor of Biology on the Faculty of Georgia Southwestern State University. Dr. Elder has a PhD in microbiology from Texas A&M University, a MS in microbiology from Stephen F. Austin State University, and a BS in biology from Southern Methodist University. Research for both the MS and PhD were field studies which included fecal coliform analysis of water samples. Subsequent experience in fecal coliform work was gained through a water quality study on Spring Creek and Warren Slough, portions of Lake Blackshear, Georgia, and through 22 years as an academic microbiologist. A resume for Dr. Elder is attached. Dr. Elder was responsible for all sample work including collection, handling, and processing plus all data collection and analyses. Dr. Elder was assisted by Ms. Theresa Wieszalski, an undergraduate student at Georgia Southwestern State University. Ms. Wieszalksi has microbiology lab experience through an course taken at Georgia Southwestern. Dr. Elder was also assisted by Ms. Chelsea Carter, an undergraduate student at the State University of West Georgia in Carrollton, Georgia. Ms. Carter has previous experience on a research team studying fecal coliforms in west Georgia watersheds. Both students were supervised by Dr. Elder during the project.

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SAMPLE COLLECTIONS METHODS: The study was undertaken in compliance with the procedures required by the Georgia Department of Natural Resources, Environmental Protection Division in Title 40 CFR 136 which was updated in 1999 and downloaded from the web in January 2001. The use of these procedures was verified with Ms. Vickie A. Yarbrough, Environmental Outreach Coordinator with the Georgia Department of Natural Resources, prior to initiating the project and again prior to data analysis. Samples, composed of at least 100 mL of water, were collected in sterile bottles with lids that did not have liners. All samples were collected in mid-stream and at mid-depth by a grab technique which involved:

1. Opening the sterile bottle under the water surface,
2. Holding the open mouth of the bottle upstream,
3. Filling the bottle to within 1 inch of the mouth,
4. Closing the bottle under the surface, and
5. Immediately placing the bottle on ice for transport.

All samples were processed on the same days they were collected, immediately upon return to the lab. The processing of the samples utilized the approved membrane filtration technique with 3 portions (10.0, 1.0, and 0.1 mL) filtered for each water sample. These portions were selected to provide colony counts within the desired range while utilizing portions that would flow through the filters without clogging. To evenly disperse the bacterial cells over the membranes all portions were mixed with 50.0 mL of sterile buffer prior to filtration. A control was run with each set of samples by filtering 50.0 mL of sterile buffer. Filters were incubated for 24± 2 hours in a 44.5° C circulating water bath. Blue colonies, indicative of fecal coliforms, were counted with the aid of a Quebec colony counter. The characteristic blue color of fecal coliforms was verified by filtering buffer inoculated with a diluted Escherichia coli culture obtained from Presque Isle Cultures in Presque Isle, PA.

DATA:

Table 2: Fecal Coliform Counts

	Site 1		Site 2		Site 3		Site 4	
Date	Portion (mL)	Colony Count	Portion (mL)	Colony Count	Portion (mL)	Colony Count	Portion (mL)	Colony Count
5/22	10.0	19	10.0	18	10.0	26	10.0	23
	1.0	2	1.0	2	1.0	6	1.0	2
	0.1	0	0.1	0	0.1	0	0.1	0
5/24	10.0	6	10.0	71	10.0	53	10.0	35
	1.0	0	1.0	4	1.0	3	1.0	1
	0.1	0	0.1	0	0.1	1	0.1	1
5/28	10.0	27	10.0	67	10.0	15	10.0	13
	1.0	3	1.0	7	1.0	1	1.0	3
	0.1	0	0.1	0	0.1	0	0.1	0
5/31	10.0	10	10.0	32	10.0	13	10.0	14
	1.0	2	1.0	2	1.0	0	1.0	3

Plan for Pennahatchee Creek
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	0.1	1	0.1	1	0.1	0	0.1	0
6/3	10.0	2	10.0	41	10.0	11	10.0	22
	1.0	1	1.0	0	1.0	6	1.0	4
	0.1	0	0.1	0	0.1	0	0.1	0
6/5	10.0	26	10.0	81	10.0	15	10.0	44
	1.0	5	1.0	11	1.0	0	1.0	0
	0.1	0	0.1	0	0.1	0	0.1	0
6/10	10.0	20	10.0	20	10.0	31	10.0	37
	1.0	1	1.0	1	1.0	2	1.0	0
	0.1	0	0.1	0	0.1	0	0.1	1
6/17	10.0	18	10.0	61	10.0	7	10.0	9
	1.0	0	1.0	3	1.0	0	1.0	0
	0.1	0	0.1	0	0.1	1	0.1	0
7/1	10.0	34	10.0	71	10.0	16	10.0	18
	1.0	2	1.0	5	1.0	1	1.0	3
	0.1	0	0.1	0	0.1	0	0.1	0
7/8	10.0	31	10.0	36	10.0	15	10.0	23
	1.0	3	1.0	3	1.0	4	1.0	3
	0.1	0	0.1	0	0.1	0	0.1	0
7/23	10.0	36	10.0	TNTC	10.0	21	10.0	18
	1.0	2	1.0	52	1.0	5	1.0	0
	0.1	0	0.1	2	0.1	0	0.1	0
7/29	10.0	16	10.0	15	10.0	23	10.0	41
	1.0	0	1.0	1	1.0	2	1.0	3
	0.1	0	0.1	1	0.1	0	0.1	0
8/2	10.0	33	10.0	33	10.0	70	10.0	16
	1.0	4	1.0	1	1.0	5	1.0	1
	0.1	0	0.1	0	0.1	1	0.1	0
8/6	10.0	69	10.0	35	10.0	39	10.0	46
	1.0	2	1.0	1	1.0	2	1.0	2

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	0.1	0	0.1	0	0.1	0	0.1	1
8/16	10.0	22	10.0	72	10.0	60	10.0	52
	1.0	0	1.0	8	1.0	5	1.0	0
	0.1	0	0.1	1	0.1	2	0.1	0
8/22	10.0	15	10.0	11	10.0	6	10.0	16
	1.0	1	1.0	2	1.0	0	1.0	2
	0.1	0	0.1	0	0.1	0	0.1	0

Table 3: Geometric Means
Fecal Coliforms/100 mL

Month	Site 1	Site 2	Site 3	Site 4
May	134	407	220	205
June	123	449	147	232
July	272	672	189	232
August	291	314	307	278

TURKEY CREEK DISCUSSION: The fecal coliform counts in Turkey Creek were high for the majority of the study. Site I met the requirements in May and June. Site 3 met the requirements in June and July. Site 2 and Site 4 never met the Georgia or EPD requirements. Problems in the area may be a result of:

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1. The ongoing drought decreasing flow through the Turkey and Pennahatchee Creeks. (See the rainfall data attached to Beaver Creek report.) Rainfall was low and spotty throughout the study period.
2. The ongoing drought resulted in decreased water available for wildlife, therefore more animals were coming to the Creeks to drink. Prints of canine, felines, raccoons, rabbits, deer, pig, and deer were routinely seen within the area. Live foxes, deer, rabbits, and bobcats were seen in the area. Several dead pigs were also seen in the area.
3. Although the area is used in agricultural practices, no domesticated animals were seen in direct contact with the streams. Runoff from the fields could potentially carry bacteria into the streams but the counts don't appear to correlate with the rainfall.
4. Pennahatchee Creek receives the outfall of the sewage treatment facility in Vienna, Georgia. Since the fecal coliform counts were routinely higher in Pennahatchee Creek than in Turkey Creek, the sewage treatment plant might be having an impact on that area. More samples along different areas of Pennahatchee Creek would have to be collected to prove the sewage treatment plant is the source of the problem. Since the areas of Turkey Creek above the junction with Pennahatchee Creek also exceed the Georgia and EPD limits for fecal coliforms, the impact of the sewage treatment plant is not the only problem within Turkey Creek.
5. The exact source of the problem is still unknown.

Rainfall Data

Source	May Total (inches)	June Total (inches)	July Total (inches)	August Total (inches)
Georgia Forestry Commission, Oglethorpe	2.55	1.49	2.39	1.15
Cordele Airport	2.42	3.94	5.62	4.55
Flint River Nursery	1.13	3.20	4.99	4.07
Catahoula Farm, Cordele	0.8	2.46	3.89	1.78*
Experiment Station, Plains	1.09 2.64	5.27	3.04	

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Plan for Pennahatchee Creek
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Turkey Creek Physical Data

Date		Site 1	Site 2*	Site 3*	Site 4*
5/22	Air	21.8	23.1	17.7	17.0
	Water	16.7	16.5	16.3	16.0
	DO	9.2	9.8	8.7	8.2
	pH	7.6	7.6	7.6	7.6
	Cond	150	162	85	108
5/24	Air	23.9	23.9	22.5	18.4
	Water	18.4	17.3	16.9	17.3
	DO	6.6	7.9	7.8	6.3
	pH	7.5	7.6	7.8	7.8
	Cond	144	174	90	102
5/28	Air	27.1	26.1	24.4	23.2
	Water	22.7	22.0	21.1	20.1
	DO	6.0	6.8	6.5	5.6
	pH	7.4	7.6	7.6	7.7
	Cond	128	215	96	115
5/31	Air	29.1	24.8	23.3	21.6
	Water	23.5	22.1	21.3	20.-6
	DO	6.0	7.7	7.4	7.4
	pH	7.6	7.7	7.6	7.8
	Cond	136	224	96	115
6/3	Air	29.4	28.5	26.7	26.8
	Water	25.3	24.9	23.5	22.3
	DO	5.8	8.0	6.6	5.7
	pH	7.3	7.6	7.4	7.5
	Cond	139	248	101	118
6/5	Air	27.7	27.9	25.8	24.0
	Water	25.4	24.9	23.5	22.4
	DO	5.38	6.8	17.1	5.9
	pH	7.6	7.6	7.4	7.5
	Cond	132	248	101	118
6/10	Air	26.4	31.0	24.7	23.8
	Water	23.0	23.8	21.9	21.5
	DO	NA	NA	NA	NA
	pH	7.6	7.6	7.6	7.6
	Cond	122	132	115	162
6/17	Air	23.7	26.5	23.2	22.8
	Water	22.3	21.8	21.2	20.0
	DO	7.6	8.7	8.2	8.0
	pH	7.5	7.6	7.6	7.8
	Cond	135	212	98	116
7/8	Air	27.5	26.5	25.2	25.3
	Water	24.6	24.4	23.0	22.4
	Do	7.6	8.2	8.0	7.4
	pH	7.4	7.6	7.5	7.3
	Cond	145	245	119	115

* Site 2 is identified as site 4 in the Turkey Creek TMDL Implementation Plan
Site 3 is identified as site 2 in the Turkey Creek TMDL Implementation Plan
Site 4 is identified as site 3 in the Turkey Creek TMDL Implementation Plan

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Plan for Pennahatchee Creek
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Date					Site 1		Site 2*	Site 3*	Site 4*
7/11		Air			28.4		27.2	26.2	23.9
		Water			24.2		23.7	22.5	21.5
		DO			6.6		8.2	8.0	7.5
		pH			7.2		7.4	7.3	7.4
		Cond			134		252	99	118
7/23	Air		25.9	25.5	24.8	24.0			
		Water			24.6		24.5	23.2	22.0
		DO			6.6		7.1	7.3	6.9
		pH			7.2		7.2	7.2	7.2
		Cond			135		150	92	118
7/29		Air			27.8		25.8	26.5	24.8
		Water			25.9		24.9	23.8	22.3
		DO			6.6		8.0	7.5	7.8
		pH			7.8		7.7	7.6	8.0
		Cond			136		212	99	114
8/2		Air			27.4		27.8	26.2	24.7
		Water			24.6		24.3	23.0	21.8
		DO			6.3		8.1	7.9	6.9
		pH			7.9		8.1	8.2	8.0
		Cond			132		210	95	115
8/6		Air			28.2		29.9	27.0	26.0
		Water		25.8	24.7		23.5	22.4	
		DO			6.1		7.1	8.1	7.9
		pH			7.8		7.8	7.9	7.8
		Cond			132		250	92	112
8/16		Air			27.1		27.8	25.1	24.2
		Water		25.3	24.5		23.4	22.2	
		DO			5.0		5.9	6.6	7.9
		pH			7.9		8.0	8.1	8.1
		Cond			122		222	92	105
8/22		Air			31.3		32.4	29.2	29.2
		Water			26.5		27.8	25.0	24.3
		DO			5.8		6.9	7.2	7.6
		pH			8.0		8.0	8.2	8.2
		Cond			145		280	98	112

* Site 2 is identified as site 4 in the Turkey Creek TMDL Implementation Plan
Site 3 is identified as site 2 in the Turkey Creek TMDL Implementation Plan
Site 4 is identified as site 3 in the Turkey Creek TMDL Implementation Plan

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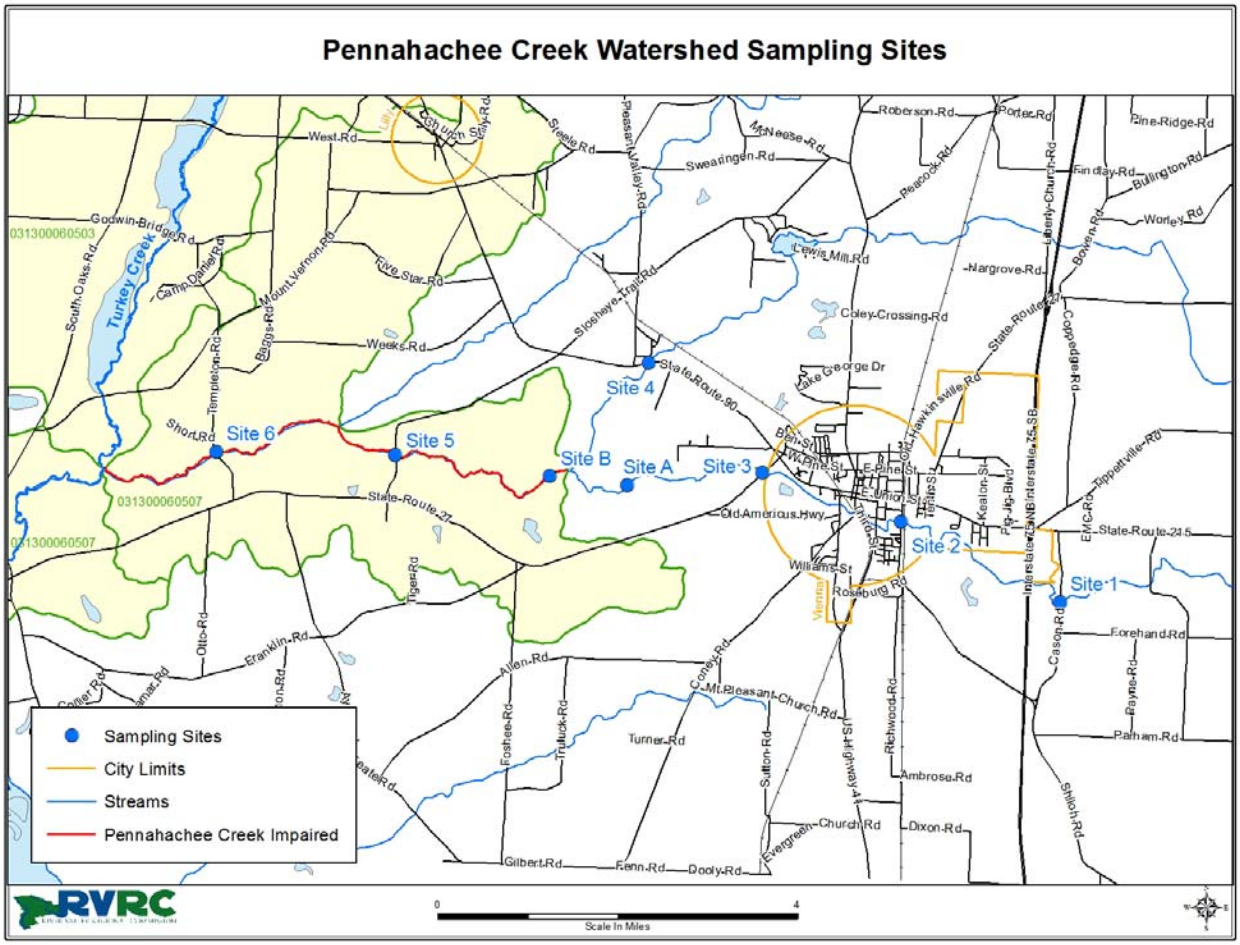
APPENDIX H. TARGETED MONITORING DATA



Sites A and B (see Table 9 for coordinates) were added after a high count of *E. coli* was measured at Site 5 on July 13, 2011. The sites were added to further isolate the impairment source. Results of the targeted watershed monitoring conducted from December 15, 2010 through September 27, 2011 are shown below. Concentrations are measured by CFU/100mL.

Pennahatchee Creek Watershed *E. coli* Targeted Monitoring Data

CFU abundance		Date											
		12/15/2010	1/5/2011	2/16/2011	3/17/2011	4/11/2011	5/17/2011	6/15/2011	7/13/2011	8/9/2011*	8/24/2011	9/27/2011	Average
Site Number	1	1	1	33	1	33	1	DRY	DRY	433	N/A	DRY	71.8571
	2	1	33	33	33	67	DRY	DRY	DRY	1733	N/A	DRY	316.667
	3	567	33	167	1	33	200	133	67	1233	N/A	DRY	270.444
	4	33	1	1	33	267	33	33	33	867	N/A	33	133.4
	5	233	133	33	200	33	200	133	2867	367	700	DRY	489.9
	6	233	67	133	133	1	300	67	100	267	N/A	DRY	144.556
	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	767	67	DRY	417
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	533	100	67	233.333

*Samples on 8/9/11 were taken approximately 12 hours after a rain event accumulating approximately 1 inch of precipitation.