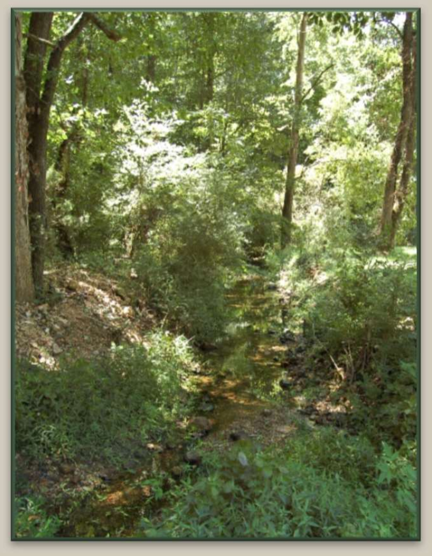
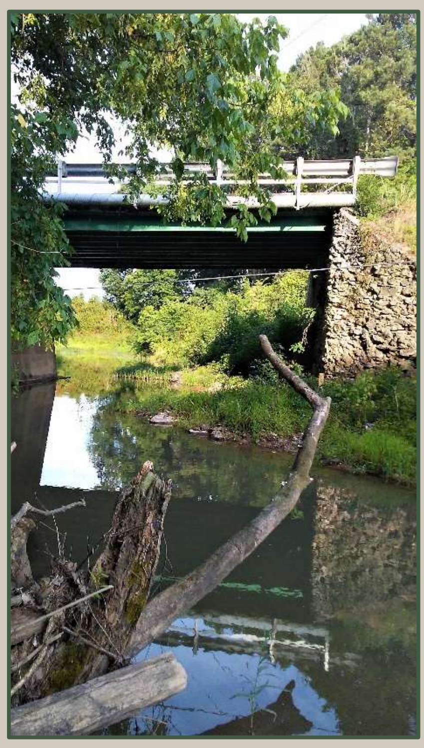
WOODWARD CREEK WATERSHED MANAGEMENT PLAN





June 2020

Northwest Georgia Regional Commission

The preparation of this plan was financed in part through a grant from the Georgia Environmental Protection Division, Georgia Department of Natural Resources

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Acknowledgements

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Prepared by:

Northwest Georgia Regional Commission
Gretchen Lugthart, Senior Planner
Kevin McAuliff, Senior Planner
503 West Waugh Street
Dalton, GA 30720

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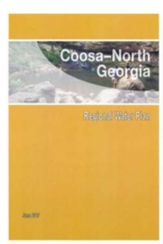
Georgia Environmental Protection Division



Coosa-North Georgia Regional Water Planning Council

NWGRC
NORTHWEST GEORGIA REGIONAL COMMISSION
A Region With A Bright Future

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Executive Summary

Woodward Creek is a small tributary to the lower Oostanaula River that flows into the river in Floyd County. Most of the watershed lies in northern Floyd County, with headwater portions in Bartow and Gordon Counties. In 2001 high fecal coliform bacteria levels in the stream lead to listing by the Georgia Environmental Protection Division (EPD) as an impaired stream. An update of an existing Woodward Creek Watershed Management Plan has been developed to address ways to decrease fecal coliform bacterial load levels in the stream. The US Environmental Protection Agency's Nine Key Elements have been incorporated in the plan. This plan outlines a process for achieving the load reductions needed to return the stream and its watershed to a restored condition with improved ecosystem function. A large part of this effort would be coordinating with and supporting the various government agencies and non-government organizations at work in the Oostanaula River Watershed and larger Coosa Basin.

NWGRC staff assessed current conditions and identified sources of the problem through on-the - ground observations and stream monitoring. This included water quality and macroinvertebrate sampling and field observations on the condition of the streambanks and riparian areas at seven stream locations throughout the watershed. Staff examined aerial photography and the land use database map from Georgia Land Use Trends (GLUT) 2015 satellite images and other databases to characterize the watershed. GIS methods were used to map perennial and intermittent streams, extent of riparian buffers, and residential and commercial structures with potential septic systems. Land use categories in the GLUT database include evergreen and deciduous forested areas, clearcut and sparse areas, row crops and pastures, wetlands, and low and high intensity urban areas. Consideration was given to land use trends and conservation issues in the larger Lower Oostanaula Watershed within which Woodward Creek watershed lies.

Results from the 2019 sampling period showed that the stream still had elevated levels of fecal coliform bacteria but not as high as observed in 2001. This study relied mainly on *E. coli* measurements as a surrogate for fecal coliform, coupled with some fecal coliform sampling. High *E. coli* was more of a problem further downstream and was worse in the summer, when water temperatures went up. Dissolved oxygen was generally lower in the summer as well. There were no unusual values for conductivity or pH; they were within normal ranges. The macroinvertebrate populations sampled in April 2019 were rated excellent at five sites and good at two sites. In terms of streamside areas lacking 25-foot buffers, ten miles of Woodward Creek and its perennial tributaries have no buffer on one or both sides of the stream, which means 41% of the perennial streams lack buffers. Restoring these riparian areas would filter out pollutants, shade the water to reduce temperatures and increase oxygen levels in summer, and provide leaf litter to feed the existing healthy macroinvertebrate community so it can continue its role of filtering and cleaning the water. Stream habitat surveys at sampling points indicated generally good conditions, but no excellent conditions. According to aerial photography analysis, there are an estimated 885 structures with septic systems. Using the EPA estimate that 10% of septic systems need maintenance, that would round to 90 septic systems needing repair. GLUT land use data indicate that 60% of the watershed is forested. To maintain this beneficial level of forested land to protect water quality in this drinking water source stream, restoration of streamside buffers is recommended, as well as other land conservation efforts such as conservation easements and land acquisition for greenspace/greenways. This would counter imminent development pressures in the area as transportation routes expand.

Advisory committee input generally supported a mix of agricultural BMPs and septic system repairs to restore the watershed. These agricultural BMP's could include providing fencing to exclude livestock from streams, alternative water sources, and hardened pads for heavy use areas. Observations in the

watershed also indicate a need for restoring riparian areas and putting land in conservation management. Other projects could include green infrastructure demonstration projects, and unpaved road maintenance. Accomplishing these tasks would be a collaborative effort with existing government agencies and non-government organizations. Proposed funding for these efforts would involve three funding request cycles over nine years. The first two funding requests would be for Clean Water Act Section 319 grants for agricultural BMPs, riparian restoration, and septic system repair and maintenance programs with each grant request at $191,210. The final funding requirement would be $24,684 for green infrastructure demonstration projects and unpaved road maintenance. This funding need includes items not typically paid for by 319 grants, so other funding sources would need to be identified. These funding estimates do not include the cost of increasing conservation or greenspace lands in the watershed. These efforts may involve using existing programs or establishing a new program and working with various government agencies or private conservation organizations. The cost of this effort is difficult to estimate. The funding estimates do not include the smaller costs for various outreach and education materials such as flyers and brochures, AAS equipment, signage, and pet waste stations.

Extensive efforts in water-related outreach and education exist now in the Lower Oostanaula watershed, both from government and non-government organizations. To achieve further progress in community support of clean water, collaboration and partnerships among all the government and nongovernment groups concerned with good water quality are important in Northwest Georgia. Further efforts should include informing the public of opportunities to participate in Adopt-A-Stream programs and Rivers Alive cleanups and making educational materials available on green infrastructure. Further progress would be made through the outreach and education elements that are required in Clean Water Act Section 319 grant programs.

Section 1: Plan Preparation and Implementation

The goal of updating the Woodward Creek Watershed Management Plan (WMP) is better water quality in Woodward Creek and the Oostanaula River, the waterbody into which the creek flows. Since the original development of a management plan for the creek in 2011 by the Northwest Georgia Regional Commission, the creek continues to have elevated fecal coliform bacteria levels and is still on the Georgia EPD Section 303(d) list of impaired waters. It is on the EPD's HUC 12 Priority Watershed List and on the NRCS's National Water Quality Initiative Priority list. After purchasing the Shannon Water Treatment Plant on Woodward Creek in 2004 from Galey and Lord, a textile manufacturing company, Floyd County now uses the creek as a public drinking water source and has invested considerable funds, including a $1.3 million GEFA loan, in improvements for the continued use of the stream water.

The WMP update allowed the NWGRC staff to perform additional targeted monitoring to assess current conditions in the stream and the watershed. This plan will allow managers to focus on issues in the watershed that affect water quality. They can plan projects and secure funds to address these issues. The planning process seeks to engage the public as well as managers in working together to solve the water quality issues at hand. This plan is also part of an ongoing effort to educate the public and managers about methods to protect and enhance water resources throughout the Lower Oostanaula Watershed with the ultimate goal of better water quality for generations to come. This plan was funded by a Regional Water Plan Seed Grant, through Georgia EPD, to the NWGRC on behalf of and with the support of the Coosa-North Georgia Water Council. The plan helps fulfill one of the Water Council's key goals, which is to identify practices that reduce nonpoint source pollution and control stormwater to protect and enhance water quality and ecosystems in lakes and streams, particularly those in Priority Watersheds and EPD Section 303(d) listed (impaired) streams.

Figure 1. Woodward Creek shows excellent water clarity at Autry Road crossing in the headwaters

Georgia EPD is undertaking an effort across the state to update all of its Total Maximum Daily Load (TMDL) Implementation Plans so that they include the nine key elements of an effective plan recommended by the US Environmental Protection Agency (EPA). This watershed management plan is part of this effort. The nine key elements are a new addition to these plans to help ensure that stakeholder involvement and approval lead to a location-specific prescription that will eventually meet watershed restoration objectives. The nine key elements are shown below:

Figure 2. Water clarity is often lower at Gaines Loop Rd crossing

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 delist (remove from Georgia EPD Section 303(d) list of streams not in compliance with water quality standards) 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.

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

The Northwest Georgia Regional Commission has developed the Woodward Creek WMP to include each of these nine elements with funds from a Coosa North Georgia Regional Water Plan Seed Grant administered by the Georgia EPD. The Woodward Creek WMP carries out the Regional Water Plan by working toward improving water supply in the region.

Specifically, high fecal coliform is a health hazard in drinking water and controlling its levels decreases costs of providing a safe water supply. Lowering sediment levels by stabilizing banks and adding riparian buffers contributes to cleaner water because bacteria are associated with sediment particles in the water.

This watershed management plan is more specific than the TMDL Implementation Plans because it uses specific watershed observations, water quality data, and GIS analysis of aerial photography to identify missing riparian buffers and location of structures with septic systems and compare this information with updated land use data from satellite sources.

The individuals in Table 1 represent the various agencies and organizations that showed interest in working on the issues concerning Woodward Creek. Included in this list are representatives of local, state and federal government, higher education, and private groups advocating for the protection and enhancement of streams and rivers.

Table 1. Advisory Committee Members who participated in the WMP development

WATERSHED ADVISORY COMMITTEE MEMBERS		
Name	Title/Organization	Email address
Corey Babb	Compliance Team Leader/Southern Company/Georgia Power/Wood Engineering	corey.babb@woodplc.com
Stephen Bontekoe	Limestone Valley Resource Conservation and Development	stevebontekoe@gmail.com
Cathy Borer	Environ Science Professor/Berry College	cborer@berry.edu
Chris Cleary	Brighton Water Treatment Plant Manager/ Floyd County Water Department	ccleary@floydcountyga.org
Jesse Demonbruen-Chapman	Executive Director and Riverkeeper/Coosa River Basin Initiative	jesse@coosa.org
Mike Hackett	Director/Rome-Floyd Water and Sewer	mhackett@romega.us
Katie Hammond	Superintendent/UGA NW GA Research and Education Center	khammon@uga.edu
Steve Hulsey	Director/Floyd County Water Department	hulseys@floydcountyga.org
Katie Owens	Field Manager/The Nature Conservancy	kowens@tnc.org
Sheri Teems	District Conservationist/Natural Resource Conservation Service	sheri.teems@ga.usda.gov
Emma Wells	Executive Director/Keep Rome-Floyd Beautiful	ewells@romega.us
Ben Winkelman	Director/Rome-Floyd ECO Center	bwinkelman@romega.us

Section 2: Woodward Creek Watershed Description

2.1 Landscape Setting

Watershed Description

Woodward Creek is located in the Ridge and Valley physiographic region of the Appalachian Mountains. The region's long ridges run on a northeastern trend through much of northwest Georgia with broad valleys in between. The extreme headwaters of Woodward Creek lie in Bartow and Gordon Counties, flowing west from an upland that includes Armstrong Mountain, Snow Springs Mountain, Boyd Mountain and Brownlee Mountain. The creek flows into Floyd

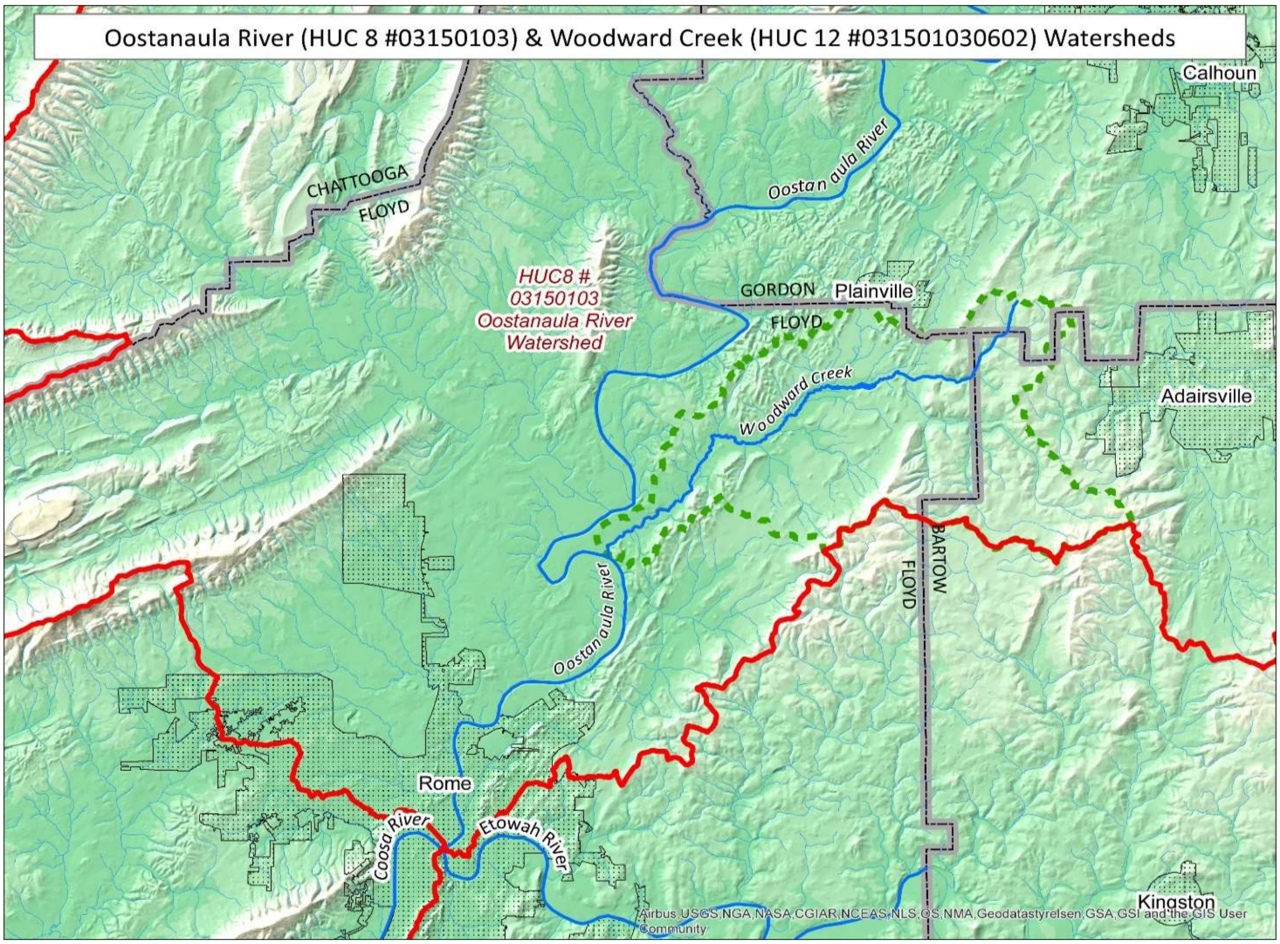


Figure 3. Map of Woodward Creek watershed, Floyd, Bartow, and Gordon Counties, Georgia. The preparation of this map was financed in part through a grant from the Georgia Environmental Protection Division.

County and joins the Oostanaula River upstream of Rome. Below the headwater region is an open valley that leads to the floodplain of the Oostanaula River through a line of low ridges. The creek drains an area of 17,253 acres. Woodward Creek and its surrounding watershed are shown in Figure 3, marked with green dashes and the red line that is the shared boundary of the larger HUC 8 Oostanaula Watershed, in which this watershed lies. Figure 4 shows a subset of the Oostanaula Watershed, the lower Oostanaula Watershed, which is a HUC 10 watershed that includes the northern part of the City of Rome but excludes Armuchee Creek.

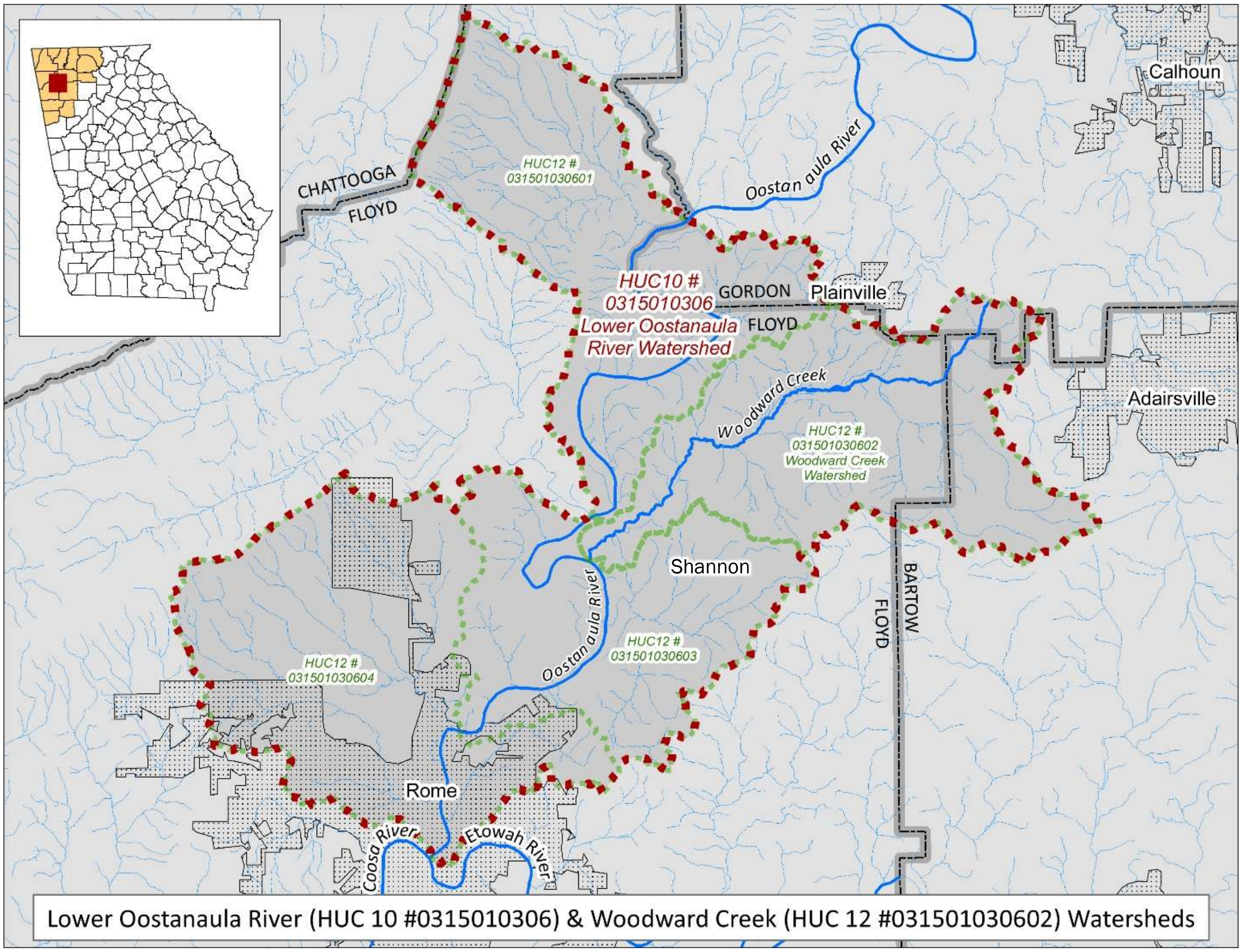


Figure 4. Lower Oostanaula Watershed. The preparation of this map was financed in part through a grant from the Georgia Environmental Protection Division.

Watershed Geology and Soils Considerations

The long ridges in the Ridge and Valley physiographic region are typically composed of chert and capped sandstone, while the valleys are usually limestone or shale. 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 helps form the acidic soils which support the forested areas of this region.

The upper reaches of the creek in the Armstrong Mountain area flow over the Knox Formation, which contains limestone and dolomite and is known for its Karst topography, including springs and sinkholes, and streams that flow underground then reappear further down the valley. In the valley, the Conasauga Formation contains shale-limestone mix and areas of shale and limestone alone. This underlying calcium carbonate-rich geology provides a source for fertile agricultural soils. It also supported the diverse array of mussels and snails historically found in the Oostanaula River and its tributaries. The Rome Formation covers part of the valley, with shale, siltstone, sandstone, and quartzite (Cressler 1970).

As Woodward Creek enters Floyd County, it coalesces from a number of intermittent branches coming down from Brownlee Mountain in Bartow County. Near Autry Road, still intermittent, it traverses a band of Subligna gravelly loam soils then, after flowing under Autry Road, it becomes a perennial stream, passes through an area of Fullerton cherty silt loam, then Chewacla silt loam, followed by a passage through Roanoak silt loam, crossing under Hwy 53, then through Chewacla silt loam and another stretch of Roanoak silt loam, coming to a confluence with a small branch in Chewacla silt loam, before crossing under Gaines Loop Road, and through a pocket of Wolftever silt loam, the site of another stream confluence. From there, it passes through a pocket of Montevallo very shaly silt loam, then into a band of Roanoak silt loam, at which point the creek is approximately in the middle of an oval delineated by Gaines Loop and Turkey Mountain Road, where it is more than half way on its journey from an intermittent stream on the boundary between Bartow and Floyd Counties and its destination in the Oostanaula River. By this point, a clear pattern of various silt loam soils has emerged and continues to the river. Most of these loamy soils are well- to poorly- drained and tend to be found in areas of slight to moderate slopes. The presence of various silty soils suggests that the creek has deposited much of the soils adjacent to its course.

Climate and Streamflow

The Soil Survey for Chattooga, Floyd, and Polk Counties (1978), describes the climate as moist and temperate with an average daily minimum temperature of about 30◦ F in February, and an average daily maximum temperature of 89◦ F in August. About 52 inches of precipitation fall annually and are somewhat evenly distributed throughout the year, although winter and spring are often the wettest seasons. Snowfall is rare, except on the mountains. The abundant precipitation contributes to the presence of many perennial streams on the landscape, and stream flow levels closely follow precipitation. Heavy winter and spring rainfall can lead to major runoff events and high stream flows. Much of the precipitation percolates through the soil and moves dissolved or suspended materials downward, leaving the soils generally low in bases. Plant remains decay rapidly and produce organic acids that hasten the breakdown of minerals in the underlying rock.

Figure 5. Woodward Creek dry streambed upstream of Autry Road Bridge in October 2018

The NWGRC staff observed the stream to be dry above Autry Road in October 2018 during the visual stream survey. Directly downstream of the bridge there was water in the creek. Further observations throughout 2019 showed that the stream was perennial at least up to that bridge crossing. There is a spring with good flow there that enters the creek just below the bridge. The Buttrum Road tributary was perennial downstream of the bridge at all seasons. On another tributary in the headwaters that crosses Big Oak Tree Road, the stream was dry in October 2018, and the landowner indicated it was frequently dry since an upstream landowner built a pond on the creek. Downstream, the flow at the Shannon drinking water intake is always sufficient for the water intake.

There is no USGS gaging station to measure streamflow or discharge on Woodward Creek. Instantaneous flow data was collected in 2001 by the EPD at Bell's Ferry Road when gathering samples for the Total Maximum Daily Load assessment (GA DNR EPD 2004) and is shown in Table 2. This limited data set shows the highest flows in the late winter/early spring and lowest flows in October, which would be expected from rainfall patterns in this area.

Figure 6. Tributary to Woodward Creek downstream of bridge at Buttrum Road.

Table 2. Instantaneous streamflow observations from Georgia EPD TMDL study 2001 (GA DNR EPD 2004)

Date	Estimated Instantaneous Flow on Sample Day (cfs)	Mean Flow for the sample period (cfs) (four samples for each period)
February 27, 2001	20	16
March 12, 2001	10	
March 15, 2001	20	
March 19, 2001	15	
May 24, 2001	7	10
June 4, 2001	19	
June 13, 2001	10	
June 24, 2001	6	
July 30, 2001	6	5
August 7, 2001	4	
August 14, 2001	6	
August 21, 2001	4	
October 3, 2001	4	4
October 11, 2001	5	
October 25, 2001	3	
October 31, 2001	4	

2.2 Important Flora and Fauna

Forest Ecosystems

The forests of the Ridge and Valley Province are mixed conifer and hardwoods. This province, combined with the adjacent Cumberland Plateau, has very high diversity of natural communities because of the complex geology and topography, with a wide range of elevations and with more acid soils on the ridges and often rich calcareous soils in the valleys (Edwards et al. 2013). These authors identify five forest types on the ridge slopes, depending on the exposure and soil: mesic forests, dry calcareous forests, acidic oak-pine-hickory forests, pine-oak woodlands, and montane longleaf woodlands and forests. Among these types, dry calcareous forests and acidic oak-pine-hickory forests now cover large areas. Dry calcareous forests occur over high calcium soils and include tree species such as chinquapin oak, Shumard oak, chalk maple, white ash, eastern red cedar, redbuds, elms, and hickories. Acid oak-pine-hickory forests occur over acidic rock such as sandstone, chert, and some shales, and the tree species include rock chestnut oak, southern red oak, scarlet oak, and some hickories, black gum, red maple and pines. In the valleys, which are now often dominated by housing, agriculture, urban development, and industry, several natural communities occurred historically. Two of these types, the flatwoods natural community and the floodplains, bottomlands, and riparian zone natural community, would have been widespread and are of great value in protecting water quality in stream and rivers. The flatwoods contain willow oak, white oak, Shumard oak, cherry bark oak, green ash, white ash and sugarberry (hackberry). The forested floodplains, bottomlands and riparian zones, a natural community that is greatly restricted and degraded today, include cherrybark oak, willow oak, swamp chestnut oak, Shumard oak, overcup oak, water oak, sweet gum, red maple, river birch, sycamore, tulip-tree, green ash, and box elder. Understanding which species naturally thrive in these critical streamside areas is essential to success in restoring vegetative buffers. In other words, these are the tree species that should be planted there.

The Georgia Land Use Trends (GLUT) data for 2015 show 60% of the Woodward Creek Watershed as forested, or 61% if the forested wetlands are included (see Land and Resource Uses section below). Along Woodward Creek, the NWGRC staff observed mostly hardwood trees in the riparian area, with dense understory of shrubs and vines. The woody vegetation included box elder, elm, sycamore, red maple, sumac, elderberry, oak, dogwood, walnut, redbud, buckeye, and pine. Invasive plants such as Chinese privet were found at each of the seven sampling sites, with abundant privet at Bell's Ferry Crossing and Gaines Loop Road.

Figure 7. Northern Red Salamander at Buttrum Road Crossing

Wildlife and Habitat

The forests of the Ridge and Valley Province provide habitat for several types of large mammals and many small mammals. White-tail deer, Black bear, and coyotes, bobcats and wild hogs all are found in the region. Non-native wild hogs can be particularly destructive in riparian areas along small streams as they disturb the soil digging for plant roots. Although the NWGRC staff did not see wild hogs, they are undoubtedly present in the forests of Floyd County. Smaller terrestrial mammals include raccoons, skunks, opossums, squirrels, mink, weasels, rabbits and many types of mice, voles, and rats. As aquatic mammals, otters, beavers, and muskrats depend on the streams, rivers and reservoirs of Northwest Georgia for food and habitat. Beavers are present in the Woodward Creek watershed; NWGRC staff observed beaver dams at Gaines Loop Road. A number of reptiles and amphibians inhabit the region, with the Southern Appalachians overall having the most salamander species in the world. Although there are not extensive wetlands or lakes in the area, some waterfowl that will use smaller waterbodies include Canada Geese and wood ducks. Great blue herons, green herons, and other wading birds can be found on smaller waterbodies as well. Raptors include many hawks, owls, osprey and bald eagles. A diverse array of migrant songbirds moves through the forests of the area, with some species staying to breed. Neotropical migrant songbirds that breed in riparian areas include Louisiana waterthrush, yellow warbler, and common yellowthroat.

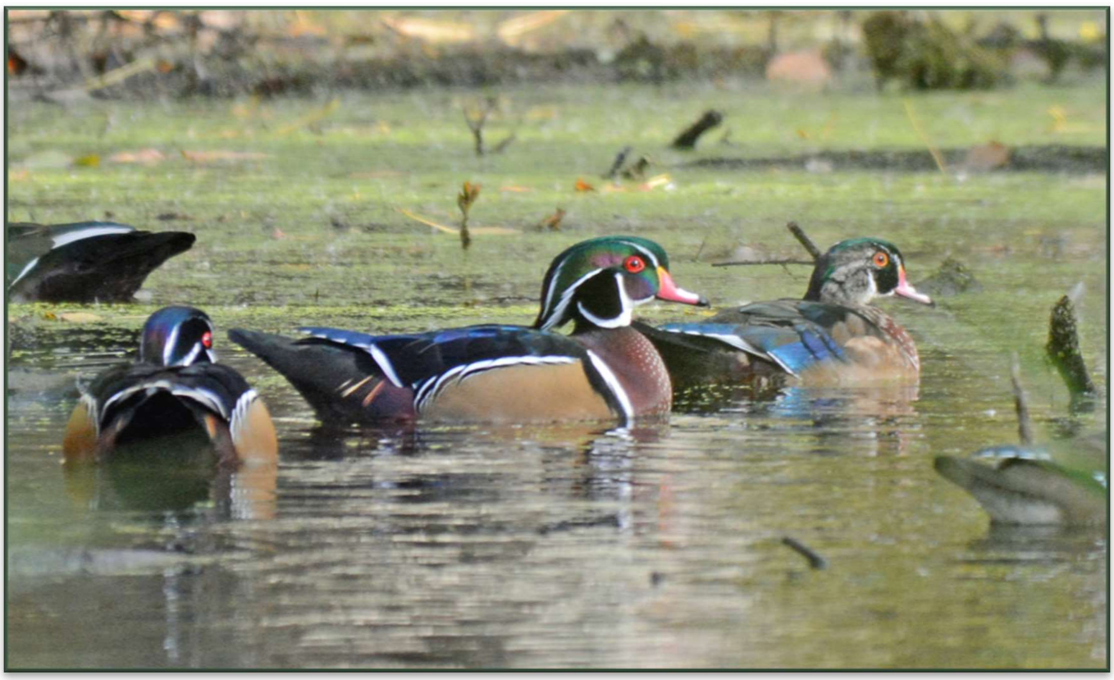


Figure 8. Wood duck. This waterfowl species was spotted while NWGRC staff sampled the creek. Photo: Giff Beaton

Aquatic Animal Species with Protected Status

Many mollusks and fish in the Coosa Basin are in decline due to water quality issues and the construction of reservoirs. Table 3 shows the aquatic species receiving special protection from the state and federal government. This list includes three mussels, one snail, one dragonfly, and four fish (see Figures 9-12). None of these animals have been found in Woodward Creek, but sampling has not been extensive. The habitat for the two smaller fish, the coldwater darter, and the trispot darter could be found in the spring areas of Woodward Creek and its tributaries. Although the large river redhorse is a fish of medium to larger rivers, it might enter Woodward Creek from the Oostanaula River to spawn.

Figure 9. Trispot Darter. Photo Dick Biggins, USFWS

Figure 11. Cherokee Clubtail Dragonfly. Photo Giff Beaton

Figure 10. Coldwater Darter. Photo tnacifin.com

Figure 12. River Redhorse. Photo tnacifin.com

Table 3. Protected Aquatic Species of the Lower Oostanaula Watershed

Lower Oostanaula River Aquatic Protected Species			
Species	State Status	Federal Status	Habitat
Alabama Spike (mussel) *Elliptio arca*	Endangered	No US federal protection	*Medium creeks to large rivers; sand and gravel substrate*
Southern Clubshell (mussel) *Pleurobema decisum*	Endangered	Listed Endangered	*Large rivers to medium sized streams with flowing water; gravel with interstitial sand*
Rayed Kidneyshell (mussel) *Ptychobranchus foremanianus*	Endangered	Listed Endangered	*Medium to large rivers in moderate to swift current; sand and gravel substrate*
Interrupted Rocksnail *Leptoxis foremani*	Endangered	Listed Endangered	*Rocky shoals in current*
Cherokee Clubtail (dragonfly) *Gomphus consanguis*	Threatened	No US federal protection	*Spring-fed moderately-flowing forest streams, especially where they drain small ponds*
Coldwater Darter (fish) *Etheostoma ditrema*	Endangered	No US federal protection	*Vegetated springs and spring runs or small streams with spring influence*
Trispot Darter (fish) *Etheostoma trisella*	Endangered	Listed Threatened	*Breeding: vegetated spring seepage areas. Nonbreeding: clear streams in vegetated shallow slackwater areas*
Lined Chub *Hybopsis lineapunctata*	Rare	No US federal protection	*Upland creeks over sandy substrate with gentle current*
River Redhorse (fish) *Moxostoma carinatum*	Rare	No US federal protection	*Swift waters of medium to large rivers*

Fisheries Restrictions

Although it is not the focus of this document, there is also a Commercial Fishing Ban (also termed Fish Consumption Guidance or FCG) due to PCB's (polychlorinated biphenyls) in Woodward Creek, as shown in Table 4 (Georgia DNR EPD 2009). Throughout the Oostanaula River Watershed, streams have been impacted by PCB's (polychlorinated biphenyls), whose source was the General Electric Company's plant in Rome, GA, which operated from 1954 to 1998. The PCB's came from the manufacture of transformers. Details of fish consumption guidelines for the Oostanaula River, which Woodward Creek flows into, and the Coosa River, which is formed by the confluence of the Oostanaula River and the Etowah River, can be found in the 2020 Georgia Fishing Regulations (Georgia DNR 2020).

Table 4. Water Quality Standard Violation related to PCB's in Woodward Creek

Stream Name and 303(d) Location	Violation	Extent	Year TMDL Completed
Woodward Creek, Oostanaula River tributary (Floyd Co)	Commercial Fishing Ban (CFB) or Fish Consumption Guidance (FCG)	8 miles	2009

2.3 Anthropogenic Features

Land and Resource Uses

Figure 13. Upstream of Bell's Ferry Bridge.

The 17,252-acre (27 square mile) watershed serves as a drinking water supply watershed for the Shannon Community. None of the land is publicly owned as a watershed protection set-aside. Land use data for the Woodward Creek watershed is available from the state TMDL evaluation with 1995 data from National Land Cover Database (Georgia DNR EPD 2004). The breakdown of the land uses can be found in Table 5. Updated land use data from the 2015 Georgia Land Use Trends data can be found in the map in Figure 15 and Table 6. Although the categories are broken down somewhat differently, it is still possible to make comparisons between the two databases. It is apparent that the developed area that includes residential, industry and commercial land uses had increased from only 162 acres (1%) to 1635 acres (9.5 %). Forests comprised 70% of the watershed in 1995, but by 2015 the combined forest types had dropped to 60% (61% if forested wetlands are included). Agricultural uses made up of row crops and pasture crept up from 24% in 1995 to 28 % twenty years later. NWGRC staff observed on the ground that the agricultural use is actually all pasture and hay field; virtually no row crops were found.

The 2015 land use data show extensive forested land in the uplands on the east and south side of the watershed, with a band of agriculture and development across the flat area in the middle of the watershed. Additional forests are found on the low ridges in the western part of the watershed before the stream runs into the Oostanaula River. The flat floodplain near the Oostanaula River is pasture. See Figure 13 for a photo of the creek near the Oostanaula, Figure 14 for a photo of the creek at the Shannon Water intake and Figure 16 for a photo of the creek in the central agricultural area at Plainville Road Bridge.

State Route 53 bisects the watershed from southwest to northeast, in the flat middle area, and most of the highly developed land is along this corridor, mainly in the form of industries (including the new Lowe's distribution center) and gas stations. State Route 140 runs from east to west across the middle of the watershed. . Extensive construction activity is ongoing along this route on the eastern side of the watershed as GA DOT expands the road from two lanes to four lanes. At the junction of SR 53 and SR 140, Rome Floyd Development Authority has cleared and prepared a 46.3-acre site for the North Floyd Industrial Park, but no structures have been built yet. Overall the watershed is still rural, with large areas of forest and pasture. The residential housing in the watershed is almost all low-density rural housing. The exceptions to that are 29 acres of subdivision-style residential development in the extreme top of the watershed in Bartow County off of SR 140 and an area of 67 acres on the north side of Shannon community. The rest of the Shannon community is outside the watershed. The area around the intersection of SR 53 and SR 140 will probably become more heavily developed when the road-widening project is completed. This will provide relatively direct four-lane access to Interstate 75 to the east. This development will probably affect water quality and quantity and the overall use of the area as a drinking water supply watershed as the area of impervious surface increases.

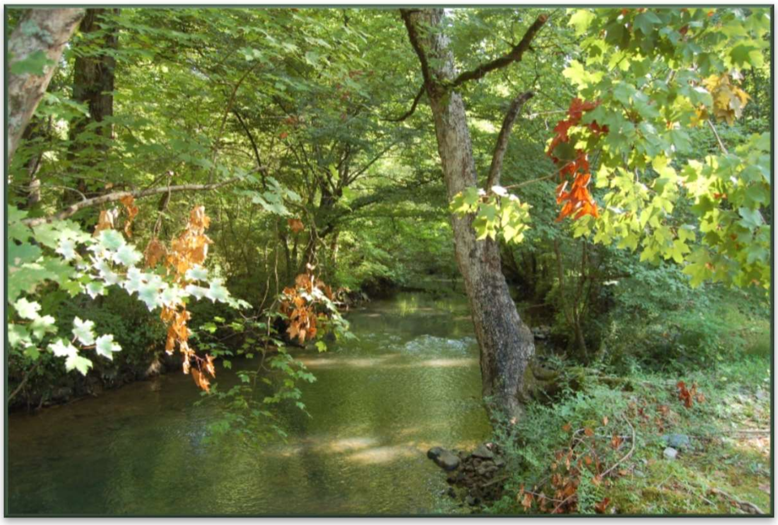


Figure 14. Woodward Creek at Shannon Water intake

Undisturbed forested land protects the quality of the water in water supply watersheds. While having the whole watershed in forest would provide the ultimate protection, this is usually not practical on most landscapes with existing agricultural, residential, commercial, and industrial land uses. Cleaner surface water results in lower drinking water processing cost (Warziniack, 2016). According to one study looking at water supply watersheds across the nation, forested land should comprise at least 60% of the land based on costs of treating drinking water (Ernst et al. 2004). This 60% benchmark has been adopted as a goal in the Lower Savannah River watershed (Krueger and Jordan 2014) and the Upper Oconee River Basin (Dwivedi et al. 2020). As a variation of this concept, Elkins and Gerrin (2019) included wetlands and grasslands to get to 60% natural land cover in the Middle Chattahoochee River Basin as they mapped parcels of land for conservation and restoration. Maintaining the Woodward Creek watershed at 60% forested, its current state, using tools such as conservations easements, land use regulations, restoration of forested buffers along the creek, and land purchases in key locations would contribute significantly toward securing clean water for future generations.

Table 5. Land use data for Woodward Creek Watershed National Land Cover Dataset 1995

Land use data for Woodward Creek Watershed from National Land Cover Database 1995		
Land Use	Acres	Percentage
Open water	37	0.2%
Low density residential	0	0%
High density residential	42	0.2%
High intensity commercial, industrial, transportation	162	0.9%
Bare rock, sand, clay	0	0%
Quarries, strip mines, and pits	34	0.2%
Transitional	601	3.5%
Forest	12,148	70.4%
Row crops	808	4.7%
Pasture/hay	3,360	19.5%
Other Grasses(urban, recreation, parks, lawns)	45	0.3%
Woody wetlands	10	0.1%
Emergent herbaceous wetlands	5	0%
Total	17,252	100%

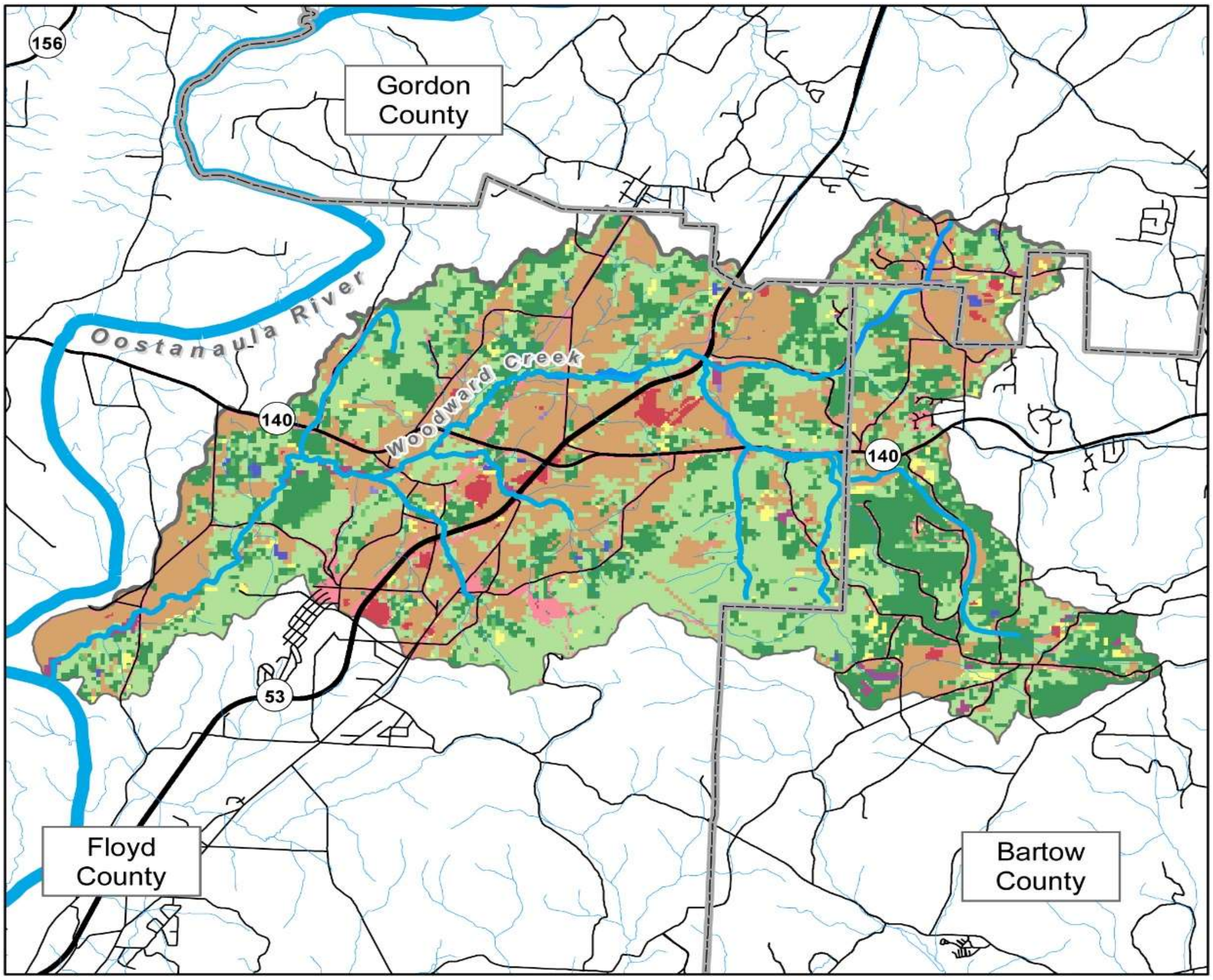
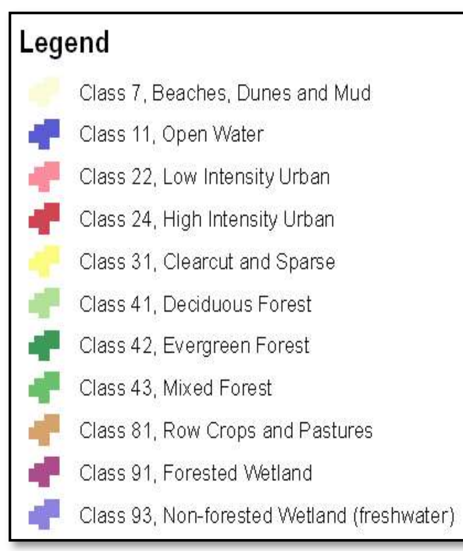


Figure 15. Georgia Land Use Trends (GLUT) 2015 Map for Woodward Creek watershed. The preparation of this map was financed in part through a grant from the Georgia Environmental Protection Division.

Table 6. Georgia Land Use Trends (GLUT) 2015 data Woodward Creek Watershed

Land use according to Georgia Land Use Trends (GLUT), 2015 data		
Land Use	Acres	Percentage
Open water (11)	51	0.3%
Low intensity Urban (22)	1,365	7.9%
High intensity Urban (24)	270	1.6%
Clearcut and sparse (31)	317	1.8%
Deciduous Forest (41)	6,279	36.4%
Evergreen Forest (42)	3,732	21.6%
Mixed Forest (43)	305	1.8%
Row Crops and Pastures (81)	4,773	27.7%
Forested Wetland (91)	147	0.9%
Non-Forested Wetland (93)	15	0.1%
Total:	17,254	100%



Political/Jurisdictional Boundaries

The majority of the watershed, 12,184 acres, is located in Floyd County, with headwater areas on the east comprising 4,233 acres in Bartow County. A small 836-acre area of the headwaters on the northeast side is located in Gordon County. There are no incorporated cities in the watershed. The largest nearby city is Rome. Although the unincorporated community of Shannon benefits from receiving drinking water from the creek, most of the community lies outside the watershed on the south side just off of SR 53. Floyd, Gordon, and Bartow counites have zoning to regulate development. See Figure 4 for map showing the county boundaries and the location of the watershed in relation to the cities of Rome, Adairsville, and Calhoun.

Active Groups within the Watershed

The efforts of the following agencies and groups affect the small Woodward Creek watershed and the larger Lower Oostanaula Watershed in which it is found. Groups that work with resource conservation in Floyd County include federal and state agencies such as the Natural Resources Conservation Service (NRCS), the Georgia Department of Natural Resources (DNR), and the Georgia EPD. University of Georgia Agricultural Extension has extension agents in Floyd, Bartow and Gordon counties. The Floyd County Water Department withdraws drinking water from Woodward Creek. Rome Floyd Water and Sewer Department withdraws drinking water from the Etowah and Oostanaula Rivers. Both water utilities are concerned with good water quality for drinking water supply. The Rome-Floyd ECO Center educates thousands of school children each year aquatic life and how to keep stream water clean. The Keep Rome Floyd Beautiful organization works to educate the public about litter control and holds public cleanups. Non-government conservation groups include the Nature Conservancy (Upper Coosa Basin project) and the Coosa River Basin Initiative (CRBI-Upper Coosa Riverkeeper).

Figure 16. Woodward Creek downstream of Plainville Bridge

Section 3: Watershed Conditions and Monitoring Results

3.1 Water Quality Standards and Impairments

Georgia Water Quality Criteria

The state regulates water quality by assigning standards. The water quality standards are split into two groups of criteria. The first, a general criterion of cleanness, must be met for all waters, but it is a qualitative or descriptive criterion:

- 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 second type of criterion, which is specific and numeric, applies to the designated use of a waterbody. There are six designated uses in Georgia, and the standards vary in how strict they are depending on the designated use.

The six designated uses in Georgia are:

- Drinking Water Supplies
- Recreation
- Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life
- Wild River
- Scenic River
- Coastal Fishing

Woodward Creek is a drinking water supply stream, with water withdrawn by Floyd County Water Department for the community of Shannon in the north part of the county. The plant is operated under Georgia EPD Permit #057-1414-02 with the permitted monthly average of 0.7 million gallons/day (MGD) and a 2019 actual average withdrawal of 0.35 MGD (Coosa North Georgia Regional Water Planning Council 2020). See Table 7 below for the water quality criteria for drinking water supply waters. Between the months of May and October, the fecal coliform levels as a geometric mean of at least four samples within an interval of 30 days cannot go above 200 colony-forming units per 100 milliliters (cfu/100 ml). From November and April, the 30-day geometric mean of at least four samples cannot go above 1000 cfu/100 ml or never more than 4000 cfu/100 ml in any one sample (instantaneous maximum). There is no instantaneous maximum for the warmer months. The difference in standard for the cold and warm seasons assumes more human water contact during the warmer months and is therefore stricter.

Other parameters for which the state has numeric criteria include dissolved oxygen (DO), pH, and water temperature. For dissolved oxygen, in non-trout waters such as Woodward Creek, the level must average at least 5 mg/l on a daily basis, but the value can never fall below 4 mg/l. Adequate levels of oxygen in the water are critical for the respiration of fish, aquatic macroinvertebrates, and molluscs. Oxygen can enter the water from photosynthesis of aquatic plants or at the water/air interface, and when the water tumbles over rocks or is otherwise mixed to provide natural aeration. The dissolved oxygen in the water is closely linked with the water temperature. According to the state standard, the temperature of a non-trout stream should never exceed 90° F (32.2°C). Temperatures in this range would be exceedingly hazardous to aquatic life, since the oxygen level decreases with increasing water temperature. In general, in north Georgia streams, much lower temperatures than 90° F are expected. Warm water can enter the stream from a point source such as a power-plant discharge of cooling water, or from nonpoint sources such as runoff from parking lots and roof surfaces during hot weather. When the streamside forests that naturally occur in Georgia are cut, the stream loses beneficial shading and water temperatures will increase. These inputs would also lower the oxygen level. Other reasons for low oxygen values include raw sewage or other large amounts of organic matter in the water, because the bacteria consuming this organic matter respire and use up the available oxygen. If there are high levels of algae because of nutrient enrichment, the balance between respiration and photosynthesis may skew towards respiration at night or during cloudy weather, causing the oxygen level to drop. High temperatures would add to these problems because bacterial and algal growth would be stimulated by higher temperatures.

The pH standard in Georgia, a measure of the hydrogen ion concentration, falls between the range of 6 and 8.5. The pH varies naturally with bedrock composition over which the stream is flowing, and the expected natural range is between 6 and 8 in Georgia. Streams over limestone substrate would have a pH around 7, or neutral, while streams over more acidic bedrock, like sandstone, would have a slightly lower pH. Aquatic animals are adapted to a narrow range of pH and variation from this can be fatal. Point discharge of various chemicals could cause the pH to become very acid or very basic. Acid mine drainage could lower the pH to dangerously low levels.

Table 7. The quantitative water quality criteria for waters designated for the use of drinking water supplies.

GEORGIA'S WATER QUALITY CRITERIA FOR DRINKING WATER SUPPLY WATERS				
Designated Use	Fecal Coliform Bacteria	Dissolved Oxygen	pH	Temperature
Drinking Water Supplies	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 For non-trout waters	Between 6.0 and 8.5	< 90° F or <32.2° C
**The summer recreation season is defined as running from May through October. Most water-contact activities are expected to occur during these months.* ***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.*				

Fecal Coliform Impairments

The waters of Woodward Creek violated the water quality standards for fecal coliform bacteria, as well as the previously mentioned Commercial Fishing Ban/Fish Consumption Guidance (Table 8). The stream is on the Georgia 303(d) list for Not Supporting for drinking water for eight miles, which is essentially from the headwaters to the confluence with the Oostanaula River. See Figure 3 for a map of the Woodward Creek Watershed, with the impaired creek shown in blue. The Total Maximum Daily Load (TMDL) reduction required for Fecal Coliform is 82% (Georgia DNR EPD 2004).

Fecal coliform bacteria come from the feces of humans and other warm-blooded animals, which can include domestic animals and a wide range of wild animals, including deer, wild pigs, and geese. Therefore, land used for pasture, feedlots, and forest can be a source for animal fecal coliform bacteria. Fecal coliform bacteria are also present in human waste, and sources for this type of contamination can be failed septic systems and leaking sewer pipes. The fecal coliform bacteria can survive outside the bodies of animals and when found in the environment at low levels are not a cause for concern. When it rains, fecal material can wash into streams and lakes with storm water runoff. High level of fecal coliform in the water can be used as an indicator for disease-causing organisms that might be present in human and animal waste. It is cost-prohibitive to monitor water for all of the different disease-causing organisms from fecal material on a routine basis. By monitoring fecal coliform bacteria, the potential incidence of disease-causing bacteria like *Salmonella*, and *Shigella* (both of which cause gastroenteritis), and *Pseudomonas aeruginosa* (which causes swimmer's ear and dermatitis), parasites like *Giardia* and *Cryptosporidium* (also causing gastroenteritis), and viruses like hepatitis A can be estimated.

When sources of fecal coliform contamination are from non-point sources like pastures, failed septic systems, and forest areas with wild animals, the fecal coliform has been shown to be higher in stream water during high flows (storm events) while low flows may show low levels of fecal coliform (Gregory and Frick 2000). Storm water runoff flushes accumulated fecal material off the landscape. The Woodward Creek watershed has pasture, forest land, rural housing, and very little suburban housing, so spikes in fecal coliform during storm flows could be expected in this watershed (see Section 2.3 Anthropogenic Features- Land and Resource Uses).

The state of Georgia bacterial standard uses fecal coliform, but in developing the Woodward Creek WMP, the NWGRC sampled for both fecal coliform and *Escherichia coli (E.coli)* as a surrogate for fecal coliform. The bacterium *Escherichia coli* (*E. coli)* is a species of fecal coliform associated with disease outbreaks. Between 60% and 80% of fecal coliform bacteria in streams have been found to be *E. coli.* The US EPA has recommended that *E. coli* be used as an indicator species for recreational waters and the detection of health risks in those waters because *E. coli* is more closely associated with swimming-related gastrointestinal illnesses compared to fecal coliforms (Georgia Adopt-A-Stream Bacterial Monitoring manual. 2014).

Table 8.The water quality standard violations in Woodward Creek.

Stream Name and 303(d) Location	Violation	Extent	Year TMDL Completed
Woodward Creek, Oostanaula River tributary	Fecal Coliform, Commercial Fishing Ban (CFB) or Fish Consumption Guidance (FCG)	8 miles	Fecal Coliform (2004), Commercial Fishing Ban (2005, revised 2009)

3.2 Available Monitoring/Resource Data from Recent Years

DNR Fish Sampling

Available information on this small stream is limited. The Georgia DNR conducted a fish survey in 2010 and found eight species, none of which have protected status (Table 9). This short list should not be considered a complete list of the species in the watershed (Anakela Popp, DNR biologist, personal communication).

Table 9. Fish species collected by Georgia DNR, Woodward Creek, 2010

Fish Species collected by Georgia DNR, Woodward Creek, 2010	
Common name	Scientific name
Largescale Stoneroller	*Campostoma oligolepis*
Red Shiner (invasive)	*Cyprinella lutrensis*
Blacktail Shiner	*Cyprinella venusta*
Greenbreast Darter	*Etheostoma jordani*
Speckled Darter	*Etheostoma stigmaeum*
Bluegill	*Lepomis macrochirus*
Silverstripe Shiner	*Notropis stilbius*
Blackbanded Darter	*Percina nigrofasciata*

Georgia EPD Water Quality Sampling

The Georgia EPD sampled the water in Woodward Creek throughout 2001 at Bell's Ferry Road Bridge as part of the development of Total Maximum Daily Loads for fecal coliform bacteria for a number of creeks in the Coosa River Basin (DNR EPD 2004). See Figure 21 for a map showing the location of Bell's Ferry Road Bridge. The fecal coliform results are shown in Figure 17. The numbers in red show the violation of the standard. For the February/March series of four samples, the geometric mean did not exceed the wintertime geometric mean standard of 1000 cfu/100 ml, but the single measurement of 22,000 cfu/100 ml exceeded the wintertime instantaneous standard of 4000 cfu/100 ml. In May/June the geometric mean of 672 cfu/100 ml was above the summertime geometric mean standard of 200 cfu/100 ml, as was the July/August geometric mean of 300 cfu/100 ml. In October, the summertime geometric mean standard was not exceeded.

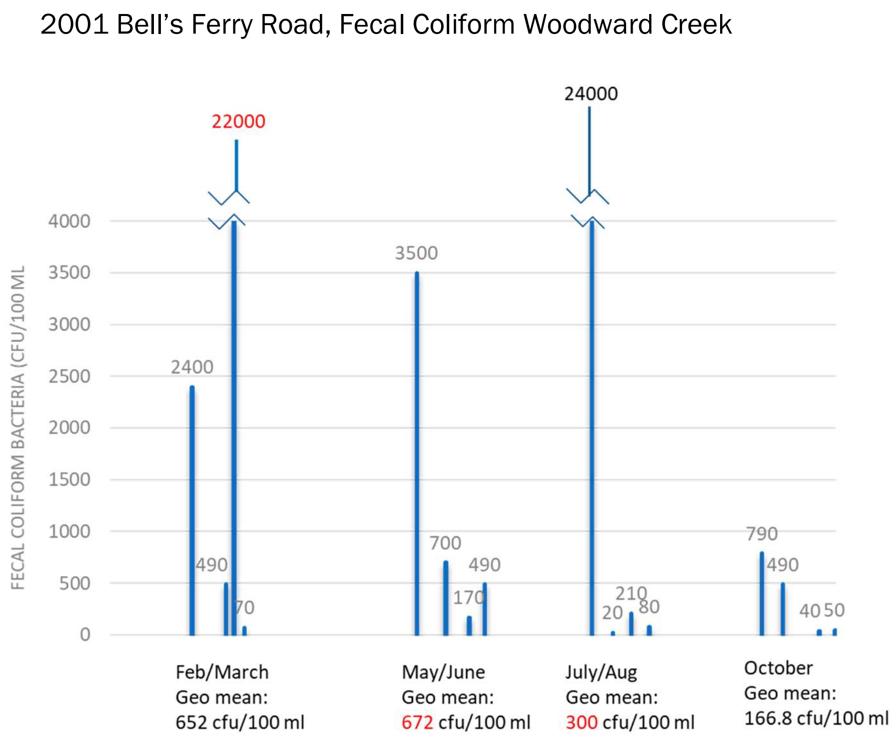


Figure 17. Georgia EPD Fecal Coliform Sampling Results 2001 at Bell's Ferry Road Bridge, Woodward Creek

The Georgia EPD sampled again at Bell's Ferry Road Bridge in 2005. After a single high result of 2400 cfu/100 ml in June, they collected additional samples for calculating the geometric mean in July/August and September/October. In July/August the geometric mean of 237 cfu/100 ml exceeded the summertime geometric mean standard, as did the September/October sampling series of 257 cfu/100 ml. See Figure 18.

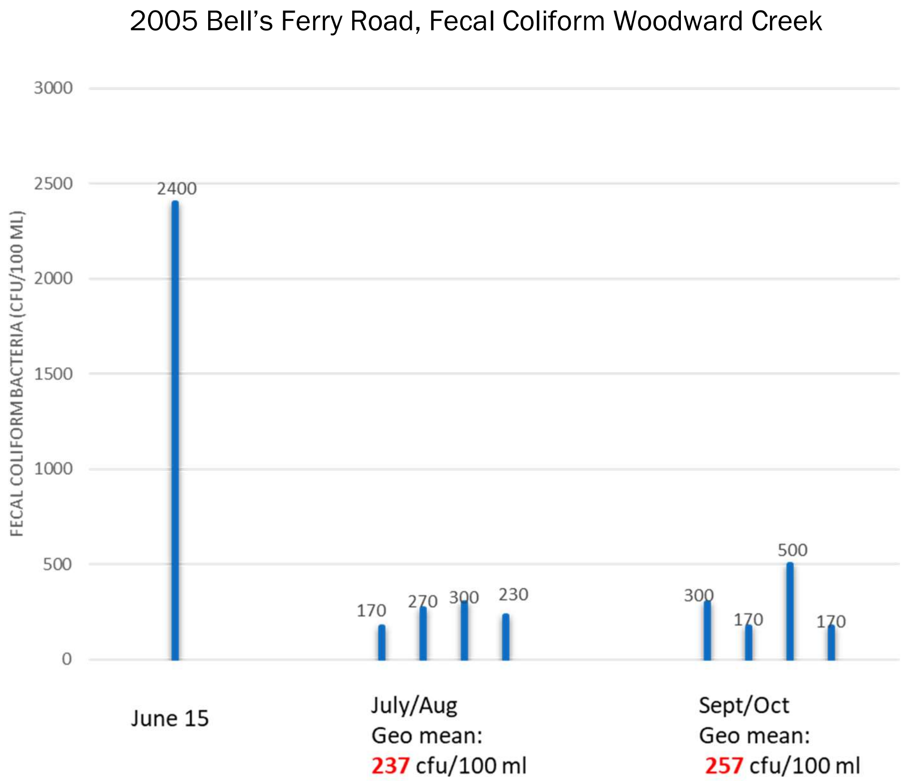


Figure 18.Georgia EPD Fecal Coliform Sampling results 2005 at Bell's Ferry Road, Woodward Creek

In 2018, the Georgia EPD went upstream to Gaines Loop Road Bridge to sample. See Figure 21 for a map of the location of Gaines Loop Road Bridge. The geometric mean of the January/February series of four samples did not exceed the wintertime geometric mean standard of 2000 cfu/100 ml, but the geometric mean of the May/June series, 338 cfu/100 ml did exceed the summertime geometric mean of 200 cfu/100 ml (Figure 19).

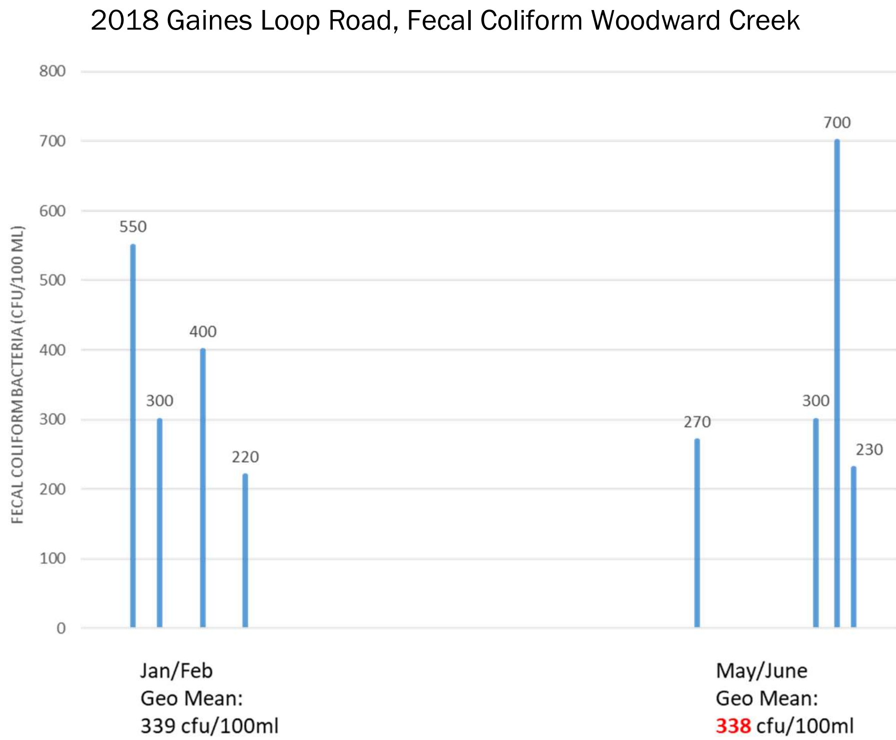


Figure 19. Georgia EPD Fecal Coliform Sampling Results 2018 at Gaines Loop Road Bridge, Woodward Creek

The results of additional parameters sampled by the Georgia EPD on these dates can be found in Appendix C.

Floyd County Water Department Sampling

The Floyd County Water Department checks for the presence/absence of fecal coliform in the raw water at the water intake plant before treatment. They always detect the presence of fecal coliform.

3.3 Monitoring/Resource Data and Field Observations

Sampling Locations and Schedule

Figure 20. Sampling macroinvertebrates above Shannon Water Intake.

To support the development of the Woodward Creek WMP, staff of the Northwest Georgia Regional Commission collected water quality data four times throughout the year in 2019 at seven sites (see Figure 21 for location of sampling sites). *E. coli* bacterial levels, air and water temperature, dissolved oxygen, and conductivity were measured using Georgia Adopt-A-Stream (AAS) methods in January, April, August, and December at seven sites in the watershed. In these months, stream water grab samples were collected and delivered on ice to Rome Water Reclamation Facility Laboratory for total fecal coliform testing. Staff sampled *E. coli* in June to provide additional bacterial information during the summer months. NWGRC staff conducted AAS Macroinvertebrate Assessments on all seven sites in April and AAS Stream Habitat Surveys in August (Figure 20).

Visual Survey

A Visual Survey was completed in October 2018 with photographs to evaluate obvious impacts to the creek at each sampling site. See Appendix B for complete Visual Survey. Six of these sites are on the main stem of the stream, and one, at Buttrum Road Crossing, is on a tributary (Figure 21). The sites were chosen to characterize a wide range of perennial flow in the watershed. The site lowest in the watershed was at the Georgia EPD sampling site at Bell's Ferry Road Bridge at the UGA Northwest Georgia Research and Education Center, an agricultural cattle research station with pastures on each side of the creek. There are buffers here, but the right-of-way for the power line prevents a complete forested buffer. We obtained permission from Floyd County to sample at the Shannon water plant intake, the only site that is not accessible from the right-of-way of a bridge. At the next site, Minshew Road Bridge, the creek runs through a forested area with a long riffle above the bridge. Compared to the other sites, the Shannon water intake and the Minshew Road Bridge sites have the most intact forested riparian areas. The Gaines Loop Bridge site is in the middle portion of the watershed where the stream gradient is lower. Beavers are active here and the area resembles a beaver meadow. The Plainville Road site has some forested riparian buffer, but pastures and mowed fields compose the majority of the landscape. Autry Road Bridge is in the headwaters, with hilly forested land just upstream, and a mowed field on one side of the creek. There is a spring here that flows directly into the creek. The Buttrum Road site was selected because it is on a long tributary to the main stem of Woodward Creek. Measured from the confluence of this tributary and the main stem of Woodward Creek, this tributary, flowing out of Bartow County, drains a larger area than the main stem. The Buttrum Road site has some forested riparian buffer, with a mowed field on one side of the creek.

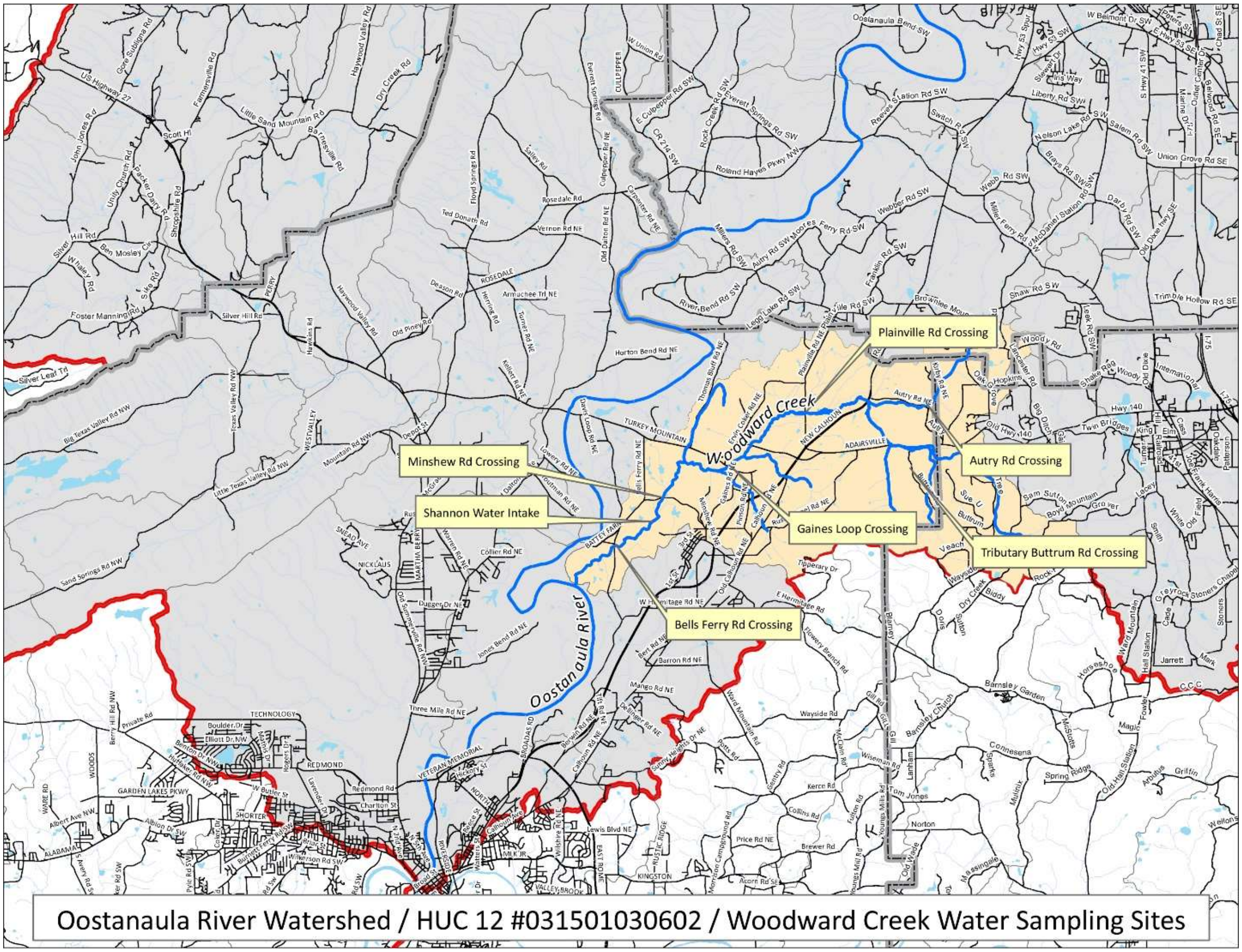


Figure 21. Woodward Creek NWGRC sampling sites. The preparation of this map was financed in part through a grant from the Georgia Environmental Protection Division.

Bacterial, Water Quality, Macroinvertebrate, and Stream Habitat Results

The results of NWGRC bacterial sampling are shown in Figure 22. Following AAS sampling procedures, NWGRC staff collected one grab sample at each site and three bacterial incubation plates were cultured from this sample, with the results shown here as the mean of the three plates. None of these samples were taken after a rainstorm. The bacterial species *E.coli* was present at all sites at some time during the year in 2019. This is to be expected in this rural landscape with forest and pasture harboring wildlife and livestock. There were generally higher levels at the five downstream sites compared to the two sites highest in the watershed. The exception to this was in December when Buttrum Road Bridge had the highest reading, although at 133 cfu/100 ml, it was not unusually high. With regard to the two headwater sampling sites high in the watershed, on three of the sample dates, January, April, and December, no *E. coli* were detected at Autry Road and none were detected in January at Buttrum Road. The highest measured levels were at Bell's Ferry, 1566 cfu/100 ml in June and 600 cfu/100 ml in August.

The general category of fecal coliform bacteria was sampled at Bell's Ferry in January, April, August, and December, with the highest value, 1137 cfu/100 ml, found in August. In terms of how well the measured values of *E.coli* track with the expected 60-80% of fecal coliform, the measured value for *E.coli*, 600 cfu/100 ml in August is 53% of the measured value for fecal coliform. None of the other *E.coli* samples taken at Bell's Ferry in January, April, and December fall with the 60%-80% bracket mentioned earlier, which could be sampling error or variation at this site from the expected ratio of *E. coli* to fecal coliform.

None of these values are the geometric mean of four samples taken within a month period at intervals of no less than 24 hours, the required sampling regime to evaluate the water for Georgia's list of impaired streams. However, these data show that there still are elevated levels of fecal coliform in the water in Woodward Creek, although not as high as the Georgia EPD measured in 2001 and 2005.

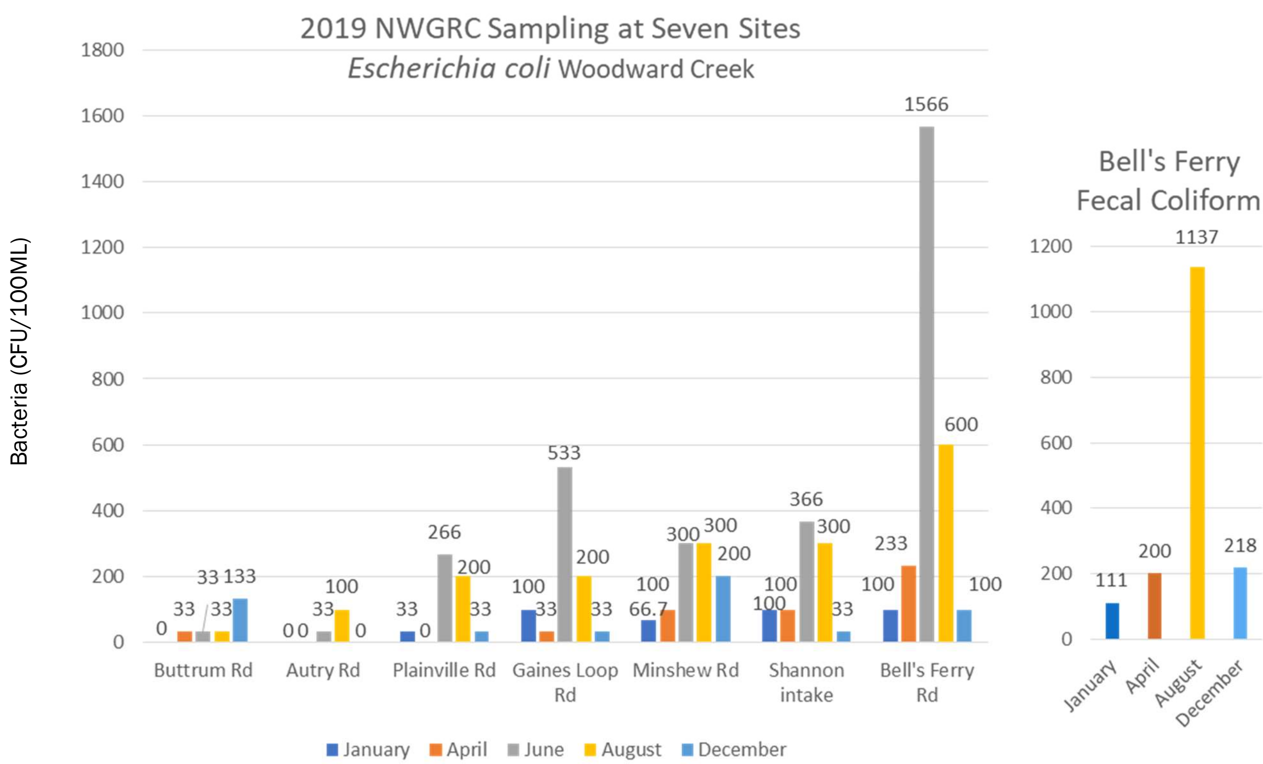


Figure 22. NWGRC sampling results for Escherichia coli at seven sites on Woodward Creek

Water temperature varied with the seasons, which is not surprising, with levels of 6.9°C (44.4°F) in December to 23.8°C (74.8°F) in August. As the water temperature increases, it holds less oxygen, as shown in the dissolved oxygen results where low oxygen levels were found in the stream in August. See NWGRC data tables in Appendix C for temperature, dissolved oxygen, and conductivity results. Although there are trout streams in Floyd County, Gordon and Bartow Counties, these data support the DNR's designation of this stream as non-trout waters because it does go above the 20°C (68°F) temperature at which trout experience stress. The conductivity ranged from 60-280 µS/cm, with most values above 200 µS/cm and the pH ranged from 6.5 to 7.25. These values are typical for streams with calcium carbonate substrate in the watershed.

The Macroinvertebrate Water Quality Rating was excellent at five of the sites, and good at two of the sites (Figure 23). Macroinvertebrates are good indicators of water quality for many reasons, including that they are affected by temperature and oxygen changes in the stream. Some sensitive species live long enough, one to two years, to be affected by short-term and long-term pollution events. Pollution-sensitive mayflies and stoneflies were found at all sites, with mayflies being common or dominant at all sites and stoneflies common or dominant at all sites except Bell's Ferry Bridge. The sensitive group gilled snails were dominant at all the sites, indicating the availability of calcium carbonate in the water because of the limestone substrate.

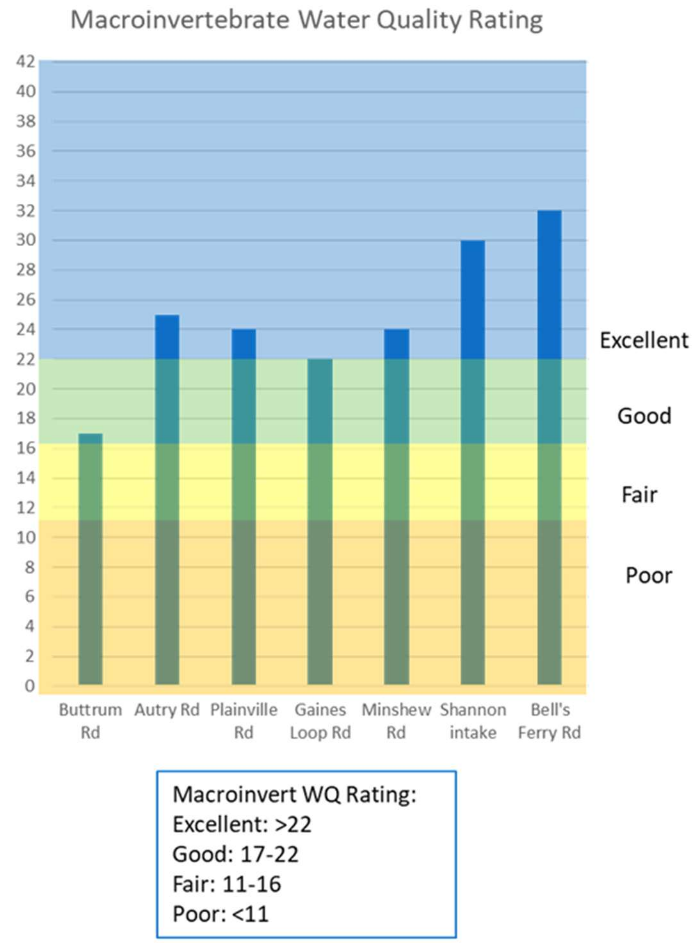


Figure 23. NWGRC macroinvertebrate sampling April 2019 Woodward Creek

The AAS Stream Habitat Survey is a simple and efficient tool to rate the stream and its riparian area for suitable conditions for aquatic and riparian organisms and stability of streambanks. The survey evaluates such important factors as the amount of woody debris for fish cover and macroinvertebrate colonization, fine sediment levels, pool/riffle/run availability, width and diversity of riparian buffer and shade level, and degree of steep banks with exposed soil, and evidence of human-caused channel alterations. According to the survey completed in August 2019, none of the sites had excellent conditions, but almost all were in the good range, except for Plainville Road Bridge, which was fair (Figure 24).

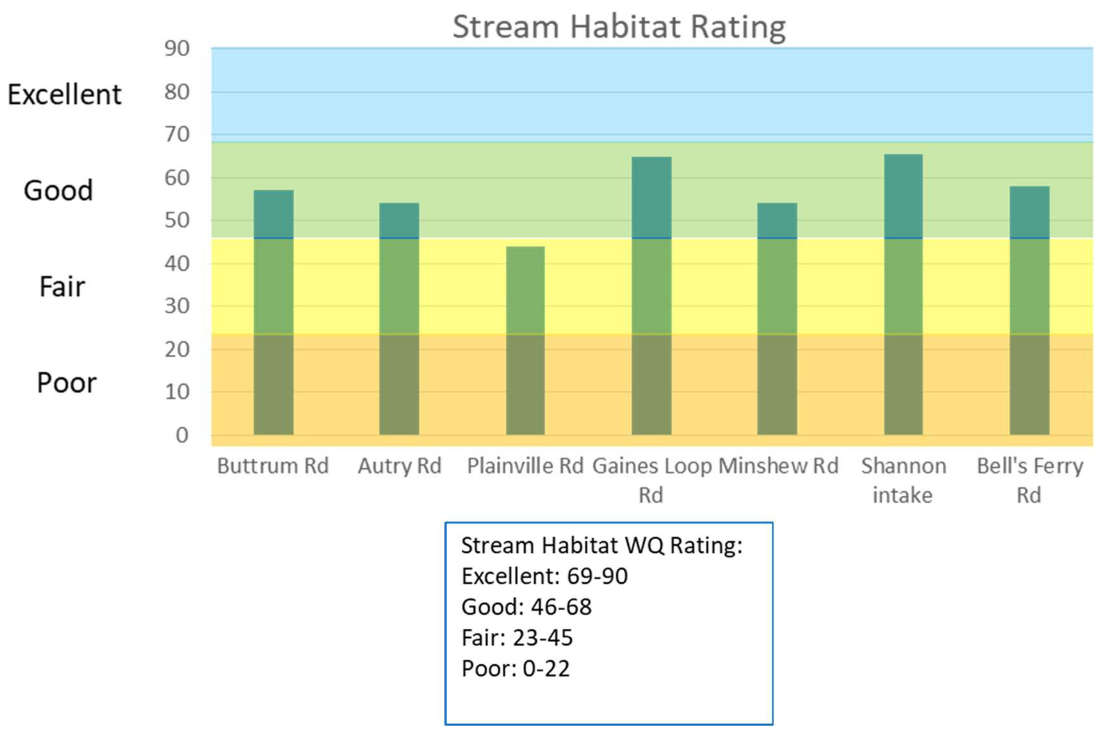


Figure 24. NWGRC Stream Habitat Survey August 2019 Woodward Creek

These chemical, physical, biological and habitat results, combined with land use information about the watershed suggest probable causes for the high fecal coliform and what needs to be managed to improve conditions in the stream. According to the 2015 GLUT land use data (Figure 13) 60% of the watershed is forested, which suggests that wildlife contributes a significant proportion of the fecal coliform load in the creek. The importance of wildlife as a source of fecal coliform bacteria in streams varies considerably, depending on the animal species present in the watersheds. Based on information provided by the Wildlife Resources Division (WRD) of GA DNR, the animals that spend a large portion of their time in or around aquatic habitats are the most important wildlife sources of fecal coliform. Waterfowl, particularly ducks and geese, are potentially the greatest contributors of fecal coliform. Other potentially important animals regularly found around aquatic environments include raccoons, beavers, muskrats, and to a lesser extent, river otters and minks. Recently, rapidly expanding feral swine populations have become a significant presence in the floodplain areas of all the major rivers in Georgia, and numerous sightings have been reported in Floyd County, especially around Johns Mountain. Wild swine have been shown to increase fecal coliform counts in streams (Kaller, Hudson, Achberger, and Kelso. 2007) and to prefer riparian areas (Mersinger and Silvy 2007).

Cows and other livestock in pastures can also contribute to fecal coliform in stream water, especially if they have unrestricted access to the creek and streamside buffers are lacking to slow the flow of runoff. Row crops and pasture comprise 27.7% of the watershed according to the GLUT data, and on-the-ground observations indicate that this agricultural land is primarily pasture (Figure 15). This indicates that part of the fecal coliform could be coming from livestock, especially from areas where NWGRC staff have observed animals in pastures surrounding the stream, or near the stream.

Septic system failure may contribute to bacteria in the stream or its tributaries in areas of the watershed away from the SR 52 corridor that bisects the watershed from northeast to southwest. Along that corridor, there is sewage service to accommodate businesses and industries along the highway. In the part of the watershed in Bartow County near Adairsville, that city provides sewer service. Gordon County does not provide sewer service in the small portion of the watershed that lies within the county. Those residences not served by sewer lines or who chose to not connect to the available sewer lines should have septic systems, according to current building code standards. The EPA estimates that about 10% of septic systems need maintenance. Violations of building codes with regard to septic systems still occur, and it is possible to find sewage piped straight to the creek in rural North Georgia, as well as inadequate and failing septic systems. Since sewer lines are present in the watershed, there is the possibility of leaking lines contributing to bacteria in the stream or its tributaries, but the sewer line coverage is limited.

Protecting and increasing forested stream buffers would help control non-point fecal coliform bacteria, as buffers slow down and filter runoff from pastures during storm events. Buffers also control nutrient runoff from manure that would stimulate algal growth. EPA guidance on riparian areas and nonpoint source pollution summarizes many studies where nitrogen and phosphorus in the stream were reduced by the presence of a forested riparian buffer (US EPA. 2005). A forested buffer also shades the stream and keeps the temperature low, so oxygen levels remain high.

It is not just the trees, the leaf litter, and the rich organic soil next to a stream with intact buffers that filter out the nutrients. The organisms in the stream capture, filter, and cycle organic matter and nutrients constantly, turning it into biomass. In this way, a functioning aquatic ecosystem helps to purify the water.

Figure 25. Eroding streambank at Buttrum Road Crossing.

Even though this watershed has evidence of high fecal coliform, the macroinvertebrates indicate a healthy stream ecosystem due very little impervious surface from urban development in the watershed and large forested areas. The healthy and diverse macroinvertebrate population in Woodward Creek is an indication of the resilience of the stream ecosystem. Moderate levels of bacteria in the stream do not detrimentally affect the macroinvertebrates; the presence of bacteria indicate a nutrient-rich environment for insects. The forested areas in the watershed provide populations of sensitive aquatic species like mayflies and stoneflies for recolonization of more disturbed stream reaches. These forested areas provide leaf-litter inputs every fall, which is the organic matter that is the basis for the food chain in smaller shaded streams. Some macroinvertebrates like stoneflies shred the leaves as they eat. All mussels and many aquatic insects are filter-feeders and remove particles from the water column as they feed. The leaves feed the macroinvertebrates, which in turn feed the fish, turtles and salamanders. An intact stream ecosystem in the Eastern US includes the riparian zone, the stream, the bacteria and algae on the substrate, and the invertebrates and the fish that rely on them for food. If the stream ecosystem is intact, the microorganisms, macroinvertebrates, mussels, snails, and fish work to clean the stream by grabbing nutrients, sediment, and organic matter as it flows by. Work at the Stroud Aquatic Research Center in Pennsylvania has shown that with forested buffers, the stream is wider, so that there is more instream habitat. They compared paired deforested and forested stream sections and found that processing of organic matter and nitrogen uptake was greater in forested reaches (Sweeney et al 2004). Maintaining and restoring forested buffers will assure that the macroinvertebrates will continue to play their role as cyclers of organic material in the stream, with many species filtering the water to remove suspended solids.

The condition of the seven stream crossings were assessed using the Southeast Aquatic Resources Partnership's (SARP) Stream Crossing Survey (https://connectivity.sarpdata.com/) and the information was put into the SARP publicly accessible online database. The main focus of this survey is to determine whether a stream culvert or bridge impedes upstream and downstream movement of fish and other aquatic animals. However, if a stream crossing has deteriorated to the extent that fish cannot move through it, it may need replacing because of structural damage as well. This stream crossing survey and database allows agencies and local governments to prioritize stream crossings that need to be replaced so the maximum benefits of new, well-designed bridges and culverts to both motor-vehicle transportation and wildlife can be achieved. All the crossings but the one at Autry Road were bridges that had enough water for fish passage throughout the year. Autry Road's bridge over Woodward Creek is not wide enough and poorly aligned. Although bridge conditions may not directly relate to fecal coliform, poorly designed crossings can lead to sediment in the creek when banks wash out or when plunge pools below culverts form. Maintenance on these problem crossings can cause further disturbance to the stream. At the Autry Road bridge cobble substrate has been scooped out of the channel and piled along the bank downstream of the bridge.

3.4 Buffer Analysis

Forested vegetated strips of land along streams, or riparian buffers, are essential to controling sediment, nutrients, and fecal coliform movement into streams when areas near streams are disturbed by agriculture, logging, and development (Figure 25, Firgure 26). As discussed above, the forest buffer shades the stream, holds soil in place, slows down runoff, filters out sediment, nutrients, and fecal coliform and provides food in the form of leaves and wood for the stream ecosystem. The tree roots stabilize the streambanks,especially during heavy floods. The riparian forest buffer provides habitat for terrestrial wildlife and corridors for animals like deer, bobcats, and bears to move between larger areas of forest.

Buffer analysis allows the watershed manager to pinpoint where pollutants may be entering the stream because of large stretches of missing buffer, and areas where livestock have unrestricted access to the creek, which would result in fecal waste being deposited directly into the creek.

This buffer analysis was done with aerial photography and GIS technology. The buffer width chosen was twenty-five feet because this is the minimum required buffer on a non-trout stream. Areas along Woodward Creek and the perennial tributaries were examined on aerial photographs for stretches lacking twenty-five feet of forest vegetation on either side of the stream (both banks needed to be vegetated). In addition, the location of homes and businesses that would have septic systems were marked in the watershed. Barns and other farm outbuildings were not counted See Figure 26..

The streamside areas lacking 25-foot naturally vegetated forest buffers on at least one side, marked in purple, include 10 miles along Woodward Creek and its perennial tributaries, or 41% of the watershed's 24.3 miles of total perennial streams.

The map shows all the residential/business structures as red dots. Forty-seven houses in the Shannon community that fall within Woodward Creek watershed were excluded because sewer is provided to this community. In Bartow County, 106 houses in a suburban development setting were excluded because sewer is provided by the city of Adairsville to these houses. Along SR 53, 12 non-residential buildings were excluded because they probably are on the provided sewer line. All the other residential and business structures were included even if they were not directly on a mapped stream because many smaller tributaries feed into the main stem of Woodward Creek. With the structures with possible sewer excluded, there are an estimated 885 structures with septic systems. The US EPA estimates 10% of septic systems need maintenance. In this watershed, that would round to 90 septic systems needing repair.

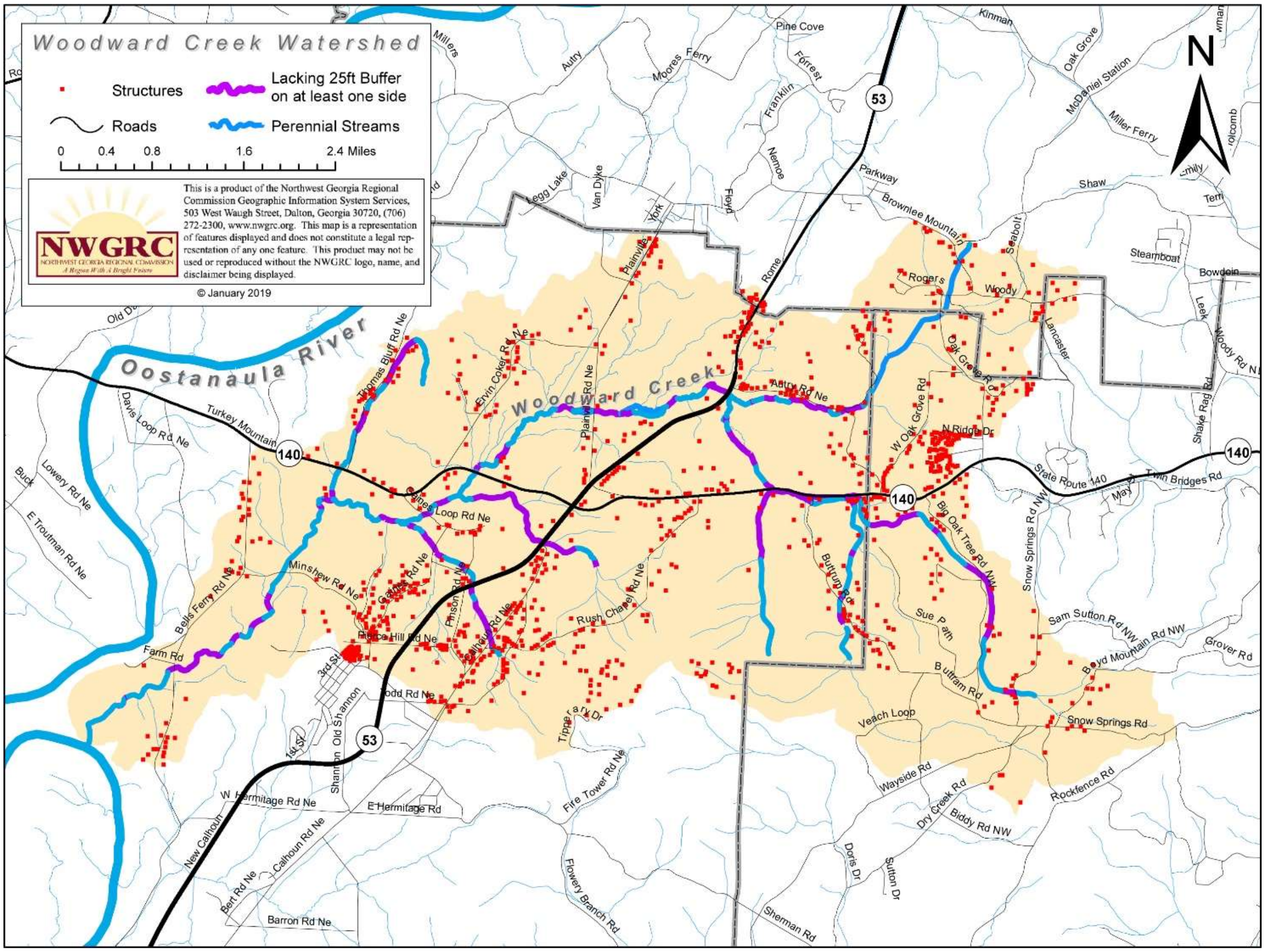


Figure 26. Map of insufficient 25-foot riparian buffers and total residential/business structures in the watershed. The preparation of this map was financed in part through a grant from the Georgia Environmental Protection Division.

Section 4: Pollution Source Assessment

4.1 Nonpoint Sources

Land managers characterize nonpoint sources of pollution as those materials that move into the stream during storms, degrade the stream ecosystem, and are hard to link to a single source or waste pipe discharging pollutants directly into the water. Naturally occurring materials like soil from surrounding agricultural fields are not harmful until they reach the stream and are hard to track in terms of their specific source. Bacteria are a non-point source of pollution when they are washed into streams during rainfall events from agriculture fields, forests with wildlife or timber operations, and human dwellings with poorly maintained septic systems. Most of the pollution in Woodward Creek is assumed to be from these diffuse sources because there are no factories, utilities or animal operations that have permits for point discharge into any waterbodies in this watershed under the NPDES program.

Agriculture

There are substantial number of beef cattle and chickens raised in the three counties in which Woodward Creek watershed lies (Table 10). In terms of land use, the GLUT 2015 database shows 28% of the watershed in row crops and pasture (Figure 15). Although the NWGRC dataset does not distinguish between fecal coliform from cattle or wildlife, sites with pastures did have high fecal coliform, in particular Plainville Road and Bell's Ferry. NWGRC staff observed that the area around Autry site is now mowed field and the landowner indicated that it has not had cows on it for some time. This suggests that agriculture plays a significant role in delivering fecal coliform to the creek, although in this watershed containing a patchwork of forest and pastureland, bacteria most likely come from a variety of sources.

Table 10. Livestock Census Figures for Bartow, Floyd, and Gordon Counties, 2017. USDA NASS

Livestock Populations								
County	Beef Cattle	Dairy Cattle	Swine	Sheep	Horses	Goats	Chickens Layers	Chickens Broilers Sold
Bartow	6,802	4	60	227	976	740	119,427	15,699,854
Floyd	5,325	111	NA	613	1,128	1,475	1,895	9,379,373
Gordon	10,717	10	793	429	1,257	859	143,043	81,260,488

Wildlife

The GLUT 2015 database indicates that 60% of the watershed is forested (figure 15). A good portion of this forested land is in the upland areas of the watershed. It is safe to assume that wildlife contribute to the fecal coliform levels in the stream because so much of the area is suitable habitat for deer, turkey, coyote, feral hogs, and aquatic mammals such as beaver, muskrat, otter and mink. The waterfowl contribution is probably small since open water comprises just 51 acres, and forested wetlands comprise 15 acres. According to Georgia's Deer Management Plan 2015-2025, the estimated deer density in the Ridge and Valley counties, which include Bartow, Floyd, and Gordon counties, is 20-25 deer/square mile (Georgia DNR WRD 2015). Through hunting management, the DNR's current goal is to keep deer populations in the state stable around the estimated 2012 level of 990,000. If forested areas decline due to development, the wildlife component of the fecal coliform is also likely to decline.

Suburban/Rural Residential Runoff

Table 11 shows septic system information for Bartow, Floyd and Gordon Counties from the Georgia Department of Public Health, the most currently available data. It indicates a trend of increasing numbers of septic systems as the population of Northwest Georgia increases. The upward trend in septic systems is attenuated by the extension of sewer into new areas as the counties surrounding Atlanta become increasingly urbanized. In Bartow County, the city of Adairsville has extended sewer service into part of Woodward Creek watershed, even though it is a rural area. The number of septic systems in Floyd County dropped from 2001 to 2018, probably because of the extension of sewer lines.

Sewer system leaks into Woodward Creek are possible since parts of the watershed are served by sewer. In addition to the service Adairsville provides in the part of the watershed in Bartow County, Rome Water and Sewer Department provides sewer service along the SR53 corridor passing through the middle of the watershed. However, leaking sewer lines may be less of an issue than septic systems in this area of limited sewer coverage.

Table 11. Septic system installation and repair information compiled from 2001 to 2018 (Georgia Department of Public Health)

Septic System Statistics					
County	Existing Systems (2001)	Existing Systems (2007)	Existing Systems (2018)	Number of Systems Installed (2007 to2018)	Number of Systems Repaired (2007 to 2018)
Bartow	22,361	22,593	23,674	1,081	1,570
Floyd	16,981	15,984	16,493	509	1,398
Gordon	13,888	16,685	17,360	675	1,144

Silviculture

Tree removal itself does not produce bacteria, but when large areas of trees are removed without proper care, runoff increases and moves soils disturbed from timber roads, skid trails, and log landings into creeks. Sediment in the water harbors bacteria because bacteria stick to these sediment particles. The timber in this watershed has probably been removed several times since European settlement. Sediment in the creek may still be moving out from past logging operations, especially before forestry Best Management Practices (BMPs) aimed at protecting soil and water resources were developed and encouraged in the twentieth century. As noted above, according to the GLUT database, the forested land, in hardwoods, pine, and mixed categories combined, was 60% of Woodward Creek watershed in 2015. The GLUT category of “clearcut and sparse” measured only 1.8%, or 317 acres. This shows low timber activity in the watershed and demonstrates that cut-over areas revegetate quickly in Georgia even without formal replanting. Since there is so much private forested land in the watershed, there is potential for soil to move off the land from timber harvest operations and into the creek and its tributaries in the future if development does accelerate because of the widening of SR 14. Application of BMP’s to forestry operations on private land is voluntary.

Transportation and Utility Infrastructure

Unpaved roads can be a source of sediment to the creek as fine material washes off the gravel or dirt surface. At the Shannon water intake, the steep gravel road from the stream intake to the water plant at the top of the hill could be improved. The bridge that crosses Woodward Creek at Autry Road is poorly aligned and not high enough for some current storm flows. Maintenance on this bridge has included scooping cobble substrate form the channel and piling it on the bank. This type of channel disturbance may lead to sediment in the creek, which may lead to higher bacteria counts as bacteria sticks to sediment. Where powerlines cross the creek, banks are de-vegetated and slumping.

4.2 Point Sources

Point sources of pollution, harmful materials that get into a stream or lake by way of “discrete conveyances”, like discharge pipes from a factory, are assumed to be very few in this watershed compared to nonpoint sources. If there are any, they have not received a permit through the Georgia EPD NPDES permitting system, because there are no such permits listed in the Woodward Creek watershed. There are no confined animal feeding operation (CAFO) permits for swine, dairy or poultry in the watershed.

Figure 27. Minshew Bridge outside of Shannon. Streamside buffers are present along the creek here.

Section 5: Watershed Improvement Goals/Pollution Reduction

5.1 Overall Objectives

This Water Management Plan has as its ultimate goal a healthy Woodward Creek that provides not only the ecosystem service of clean drinking water, but also habitat for the diverse array of fish and mussels that are a natural treasure of the Southeastern US, and safe recreation opportunities for fishermen, boaters, and children wading and swimming. The creek should also serve as a stable conveyance for rainwater, with sufficient flows in non-storm periods to maintain safe temperatures and oxygen levels. The first objective in reaching this goal is to return the creek to compliance with state water quality standards and to prevent further degradation of the water. This requires that the management of the land surrounding the creek must be improved. Since virtually all of the land in the watershed is private land, a large part of the work to be done involves working with landowners on their property to install BMPs, fix septic systems, and establish conservation areas. Another large part of this effort involves educating landowners, residents, and local government leaders about watershed restoration, green infrastructure, septic system management, and the value of clean stream water, and their role in safeguarding water resources for downstream users and future generations.

5.2 Load Reduction Targets

Georgia's standard for fecal coliform is shown in Table 7. The US EPA and the Georgia EPD further regulate fecal coliform pollution in streams and rivers through a modeling process to identify Total Maximum Daily Loads (TMDLs). EPD staff sample many streams, establish the cleaner ones as reference streams, and designate the ones above the standard as impaired. Then watershed conditions are assessed for sources of fecal coliform in the watershed to identify Total Maximum Daily Loads (TMDLs) for the impaired streams. The process allows managers to have some means of knowing the level of restoration needed to achieve stream water with fecal coliform levels below the standard.

Table 12 provides information contained in the state documents that establish TMDLs for the impaired Woodward Creek (GA DNR 2004). By definition, "wasteload allocations" (WLA) for municipal and industrial wastewater discharges and for storm water outfalls (WLAsw) are established in permitted areas, while "load allocations" (LA) are established for nonpoint sources of pollution. Wasteload allocations are assigned by Georgia EPD during the NPDES permitting process and are not part of the TMDL implementation planning process, which deals solely with nonpoint sources of pollutants. As shown in Table 12, there are no wasteload permits for Woodward Creek. All sources of pollution are assumed to be nonpoint sources. The MOS (margin of safety), which is set at 10% of the load allocation in this case, adds in additional fecal coliform to make the estimate of total fecal coliform load in the creek more robust and account for error in the process.

For Woodward Creek, the current load is 323 trillion (or 3.23E+14) counts/30 days, but it should be 58.7 trillion (or 5.87E+13) counts/30 days for a load reduction of 82% needed to meet the TMDL goal (Table 12).

Table 12. Fecal Coliform Loads and Required Fecal Coliform Load Reductions (GA DNR 2004)

FECAL COLIFORM LOAD REDUCTIONS NEEDED							
Impaired Stream Segment	Current Load (counts/30 days)	WLA (counts/30 days)	WLAsw (counts/30 days)	Load Allocation (counts/30 days)	MOS (counts/30 days)	Total Maximum Daily Load (counts/30 days)	Percent Reduction
Woodward Creek	3.23E+14	0	0	5.28E+13	5.87E+12	5.87E+13	82%

5.3 Existing Conservation Programs

Existing Structural and Nonstructural Programs and Practices

The ongoing efforts of many agencies and organizations counter the negative impacts of development, leaking septic systems, wildlife, and agriculture on water quality throughout northwest Georgia. In Floyd County, two other watersheds, Dikes Creek and Dozier Creek, are in the NWQI program. From 2017 to 2019, twenty-two EQIP contracts were approved for projects in the NWQI watersheds, for a total of $545,225 in federal spending for BMP's in those watersheds (Pam Traylor, NRCS, personal communication). Pollution reduction in Woodward Creek watershed could be achieved by continuing to focus the resources of the EQIP program and other programs in this land area. See Table 13 for the various programs, which include nonstructural programs directed toward education and outreach.

Table 13. Existing Structural and Nonstructural Programs and Practices in the Woodward Creek watershed

Existing Structural Programs and Practices			
Agency/organization	Program Name	Funding Arrangement	Type of Practice
USDA NRCS	EQIP-Environmental Quality Incentive Program	cost share	BMP's: Heavy use area stabilization Streambank stabilization Riparian enhancement
USDA Farm Service Agency	CRP-Conservation Reserve Program	Yearly rental payments to keep sensitive areas out of production	BMP's: Buffers on streams Vegetative cover Off-stream watering areas
Northwest Georgia Health District-Georgia Department of Public Health	Septic tank permitting programs	Permit paid for by landowner	Proper installation of new septic systems Proper repair of failed septic systems Licensing of contractors
Limestone Valley Resource Conservation and Development Council	conservation programs	grants	Agricultural BMPs, community assistance and outreach
Georgia EPD	Erosion and Sedimentation Act		Buffers on waterbodies: 25 feet of natural vegetation in the riparian zone on non-trout streams
Existing Nonstructural Programs and Practices			
USDA NRCS	Conservation plans and Conservation Nutrient Management Plans-CNMPs		Manage natural resources Control runoff May lead to structural improvements
USDA NRCS	Farm and ranch land protection program		Preserves land as farmland in land trust

Georgia Forestry Commission	Forestry BMP Program	State-funded	Educate forestry community to encourage BMP use, monitor BMP use and effectiveness, investigate and mediate forestry-related water quality complaints
Georgia Forestry Commission	Forest Legacy Program		Preserves land as forest in land trust
Rome-Floyd County Government	Floyd County Unified Development Code and Zoning		River Corridor Buffer restrictions re: development, septic systems, lot sizes and other activities
Rome-Floyd County Government	WaterFirst Community	State-sponsored program with county funds for practices and programs	Community applies water management practices above and beyond requirements and does extensive outreach to engage community in caring for and improving water resources
Education and Outreach Specific Programs			
Georgia EPD	Georgia Adopt A Stream, Rivers Alive	Funding from Georgia EPD Non-Point Program	AAS - Citizen Science Program for stream water testing, education and outreach, training for all ages Rivers Alive – Annual river cleanup event across Georgia
Rome-Floyd County Government	Rome-Floyd E.C.O. Center	Government-funded, satisfying part of stormwater permit requirements	Environmental Education for K-12, college and adults
Rome-Floyd County Government	Keep Rome-Floyd Beautiful	Government funded	Education on waste and litter reduction, recycling, litter cleanups
North Georgia Water Resource Partnership	Annual Education Workshop	Regional water supply professional organization	Hosts annual workshop for continuing education on current issues
Coosa River Basin Initiative (CRBI)	Coosa Riverkeeper	Non-profit organization	Water monitoring and education through AAS, boating events, cleanups, other outreach and advocacy
The Nature Conservancy	Various programs	Non-profit organization	Land protection and restoration through land acquisition, easements, partnerships, outreach, research

5.4 Proposed Conservation Program for Woodward Creek

Proposed Structural Practices of the Restoration Program

Agricultural BMP installation would help control fecal coliform bacteria and sediment from pastures, with the most efficient means of encouraging landowner participation coming from the existing NRCS EQIP program. In addition, Clean Water Act Section 319 grants could further facilitate BMP installation and work well in situations where the EQIP program cannot be used, such as government-owned land. This BMPs could include exclusion fences to keep livestock out of streamside areas, planting and restoring stream buffers, and provision of off-channel watering systems and hardened feeding areas.

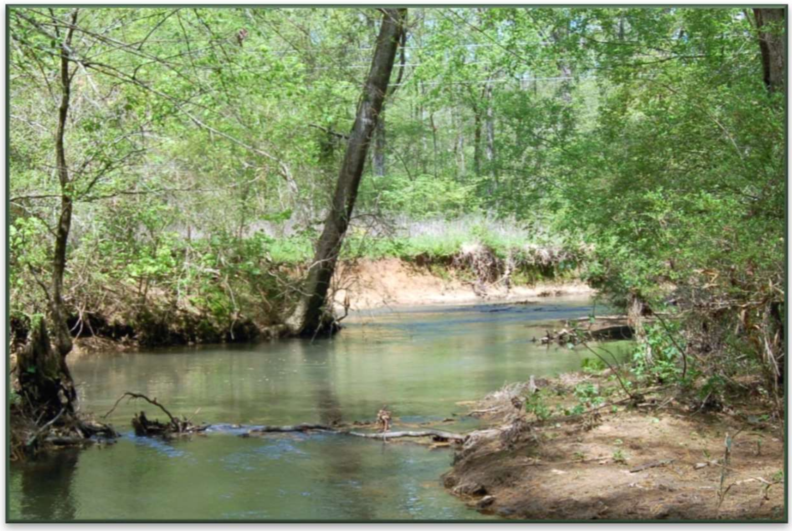


Figure 28. Eroding bank at power line cut above Shannon intake

An emphasis on protecting and enhancing stream buffers is needed to maintain at least 60% of the watershed in forested land, since these are critical areas for protecting instream water quality. These streamside buffers could be added through agricultural BMP programs, or they could be obtained through conservation easement programs or greenspace/greenway acquisition for recreational programs. Boating access sites would further enhance these types of acquisitions.

Gravel roads in key areas near streams could be stabilized and upgraded using the criteria of the Better Backroads Program. Minimizing disturbance of stream bottom substrate during bridge maintenance and replacement would further help control sediments. Well- designed and installed stream crossing structures reduce the need for stream bank and stream bottom-disturbing maintenance. Planning for resilience to increasingly severe storms in bridge and culvert design will also help minimize maintenance. The bridge at Bell's Ferry Road crossing over Woodward Creek is scheduled for replacement in 2025 as a GDOT project because it currently has a weight limit. It is anticipated that a new bridge that has gone through the GDOT process of design for flood flows and environmental review will improve the flows and streambank condition at this location. Improved management of land under the power line at stream crossings would reduce slumped banks and sediment in the creek. Vegetation could include managed forbs or short shrubs such as elderberries, buttonbush, or blueberries for wildlife as well as soil stability benefits. Some modification of Georgia Power's Project Wings could be developed.

On average per year, between the years of 2002 and 2018, less than 1% (0.6%) of the septic systems in Floyd County were repaired (Georgia Department of Public Health). US EPA estimates that 10% of septic systems across the country are not working properly. In the Woodward Creek watershed, the low rate of repairs for the last seventeen years provides further evidence that planning to repair 10% of the septic systems in the watershed is reasonable. The number of structures in the watershed with septic systems is estimated to be 885 (see Section 3, Buffer Analysis subsection). This plan proposes to repair a rounded-up ten percent, or 90. This could be part of a Clean Water Act Section 319 grant, possibly combining nearby NRCS Priority watersheds in Floyd County to increase the potential pool of landowner applicants.

Proposed Non-Structural Practices of the Restoration Program

This watershed management plan is a working document to be used by government agencies, non-government organizations, and private individuals to improve water quality in the watershed. The plan encourages partnerships among those engaged in current long-term outreach programs to avoid duplication of effort. These include Georgia EPD's Adopt A Stream and Rivers Alive programs, Rome-Floyd E.C.O. Center, Keep Rome-Floyd Beautiful, Coosa River Basin Initiative's Coosa Riverkeeper program, and the Nature Conservancy. These groups are active in training citizens to monitor streams, teaching school children and adults about ecosystems and stewardship, organizing cleanups on land and water, offering recreational float trips, and leading hikes to unique habitats in the area.

Seminars and conferences are more formal opportunities to learn about conserving and protecting water resources in the area. Every spring, the North Georgia Water Resources Partnership hosts an annual Education Seminar for water supply professionals to keep them up-to-date on the latest developments in their field. In the fall of 2019, the Georgia DNR's Wildlife Resources Division collaborated with Kennesaw State University to hold the Upper Coosa Conservation Summit to showcase the aquatic conservation and research efforts that are ongoing in the basin and to encourage federal, state, and local agencies, nongovernmental organizations, and college-level researchers working in the watershed to share their results and collaborate on new projects. This event was organized by the state's aquatic biologist for the Coosa Basin, who plans to continue hold the event semi-annually. The Upper Oostanaula watershed lies within the Coosa Basin, so this will be an education opportunity for college-aged students to present posters and talks on original research.

Reaching the general public is important to achieve support for water quality goals and recruit participants in conservation programs, and volunteers for restoration and monitoring programs. One goal of the Coosa North Georgia Regional Water Plan, whose seed grant funded by the Georgia EPD led to the development of this Woodward Creek study, is to increase community knowledge of and involvement in water resource conservation in the Lower Oostanaula Watershed. Further activities could include meeting with local civic organizations and governments to present information about Woodward Creek, water supply watersheds, and green infrastructure. Demonstration of green infrastructure, such as rain gardens with signage explaining the importance of caring for water supply watersheds could be a permanent addition to a public space. Information on water conservation and green infrastructure could be posted on government and nongovernment websites. Additional local groups such as 4-H could participate in the Georgia Adopt A Stream program to get volunteers in the creek to learn about caring for the watershed. Stream cleanups in the watershed sponsored by local utilities with support from Rivers Alive and Keep Rome-Floyd Beautiful would increase the investment of local citizens in stewardship of their creek. Along roads in the Lower Oostanaula Watershed, signage that identifies the watershed name and creek names increase awareness and interest. Specifically using signage at crossings along Woodward Creek to identify it as a water supply watershed would call attention to the need to protect it. At local parks throughout the Lower Oostanaula Watershed, pet waste stations would raise awareness of sources of fecal coliform and allow residents to actively participate in keeping fecal coliform out of the creeks.

For the septic repair program, press releases and online advertising would inform landowners of the opportunity and participating landowners would attend a septic repair workshop.

Clean Water Act Section 319 grants require water quality monitoring to track the effectiveness of BMP installation. This could involve basic "targeted" monitoring to get a general idea of the condition of the stream, or it could involve more rigorous monitoring with an approved Sampling Quality Assurance Plan (SQAP) and sample analysis by an accredited laboratory This SQAP process would produce data acceptable to the Georgia EPD for officially removing the stream from the Section 303(d) list of impaired streams if the data showed that fecal coliform values met the standard. Rome-Floyd Water and Sewer Department would be a possible partner with lab capabilities in the SQAP process, since that lab analyzed fecal coliform samples for this plan. NWGRC staff have submitted a proposal regarding this future opportunity to the water department.

Section 6: Implementation

6.1 Management Strategies

The goal of this watershed management plan is excellent water quality in Woodward Creek, a drinking water supply stream. The most efficient means of achieving this goal is restoring the stream ecosystem, with intact buffers, substantial areas of the watershed in forest land, and stream and riparian plants and animals playing their roles in filtering and purifying the water. Riparian buffers and forested areas provide shade to reduce stream temperatures, help keep oxygen levels high, and slow down runoff during storms, and increase groundwater infiltration, which moderates flood flows. During dryer periods, forested areas help store and release subsurface water gradually, to maintain beneficial flows. Overall the stream less "flashy", which ensures a steady level of water at the drinking water intake.

An important step toward this water quality goal is removing the stream from the state list of impaired streams. This means measurably reducing fecal coliform bacteria loads in the water. When the stream is delisted, it will no longer contribute to the degradation of the Oostanaula River into which it flows. Since this is nonpoint pollution, the management strategies that would help achieve this step are those that reduce unpaved road sediment, agricultural sediment, agricultural fecal coliform, and residential fecal coliform inputs into Woodward Creek. Riparian forest buffer restoration and protection of streamside areas with conservation easements would further stabilize soil in the watershed. These would be the focus of this effort, with the Environmental Health Departments of Floyd, Bartow, and Gordon Counties, the NRCS, Georgia EPD, and the county agricultural extension agents being potential partners. Landowners, agencies, and organizations participate voluntarily in programs involving grants and easements, and private property rights will be respected.

The TMDL for fecal coliform bacteria for Woodward Creek calls for reducing fecal coliform by 82% (Table 12). Carrying out restoration projects that would achieve an 82% reduction would be costly. In addition, past experiences in Floyd County suggest that the level of landowner participation for agricultural restoration may be low, so it might be hard to get the kind of participation resulting in an observable 82% instream decrease in fecal coliform.

This plan employs the strategy of spreading three funding proposals out over nine years so that adjustments can be made depending on landowner response and measured progress toward controlling fecal coliform is more or less rapid than anticipated with the first grant. Partial treatment of the watershed might yield greater results than anticipated. This would allow more judicious use of limited grant funds. The first two grants would be Clean Water Act Section 319 grants or similar efforts with agricultural BMP's and septic system repairs. The third effort would involve other issues in the watershed, such as green infrastructure demonstrations, unpaved road improvements, and conservation easement program establishment, whose funding may come from various sources and generally would not fall under 319 grant funding guidelines.

6.2 Management Priorities

Advisory committee members attended a meeting and filled out surveys regarding different conservation practices to use in the watershed. Their input was used to develop management priorities. See Appendix D for Advisory Committee documents. Other factors in developing priorities involved watershed size (small) and current watershed conditions (60% percent forested). Based on advisory committee member input and these other factors, the first two grant requests will focus on agricultural BMPs/riparian buffer restoration and septic system improvements. The last grant request will focus on unpaved road improvements, green infrastructure demonstrations such as rain gardens, and conservation easement program establishment. Evaluation of progress made is part of the process. If substantial progress is made after one or two grant cycles, further grants may not be pursued.

The NRCS is focusing on this watershed because it is a National Water Quality Initiative watershed and much of that work overlaps what can be done with a Clean Water Act Section 319 grant. Duplicating their efforts is not efficient. Efforts should also involve coordinating with the NRCS, directing landowners to their resources, supporting their efforts and providing input whenever possible at stakeholder meetings.

6.3 Interim Milestones

The following objectives will help in determining whether the goal of water quality improvement and delisting of Woodward Creek have been achieved.

OBJECTIVE #1: Coordinate with NRCS and UGA Agricultural Extension on agricultural BMP implementation in 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.

Landowners will participate on a voluntary basis, with projects that will be tailored to their specific needs as well as to improve water quality and land management.

OBJECTIVE #2: In coordination with NRCS or through Clean Water Act Section 319 Grant, 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.
- Implement agricultural BMPs in the watershed anticipated for each grant period as shown in Table 16.
- Estimate load reductions from projects when possible.

OBJECTIVE #3: Reduce pollution inputs from residential and agricultural areas through education and outreach

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 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.
- Provide green infrastructure and BMP demonstration opportunities in the larger Lower Oostanaula Watershed See Section 7, Education and Outreach for further details.

OBJECTIVE #4: Create a septic system repair cost-share program in the watershed possibly in coordination with efforts in nearby NRSC WQIP Priority watersheds (Dozier Creek and Dykes Creek).

MILESTONES:
- Identify local certified septic system contractors interested in participating in the program.
- Hold meetings with NGAHD representatives to design program.
- 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.

Homeowners will participate on a voluntary basis. Failing septic systems within 100 feet of the creek and its tributaries will receive priority for repair. Homeowners will share the cost of the repair.

OBJECTIVE #5: Reduce fecal coliform bacteria and sediment loading due to transportation issues in the watershed
- Identify funding partners to cost share on specific projects
- Meet with county road managers in the field to discuss solutions to inadequate bridges in the watershed.
- Use Georgia Better Backroads Guidelines to choose unpaved road BMPs that fit specific sediment issues in the Woodward Creek Watershed.
- Get any inadequately-designed bridges in watershed on county priority list

OBJECTIVE #6: Encourage participation in existing conservation easement programs or establish a conservation easement program in lower Oostanaula Watershed
- Identify government and/or nongovernment partners to administer program
- Develop criteria for participation
- Advertise program and distribute information through website and meetings
- Prioritize sensitive areas to include in program
- Work with landowners to define easement boundaries

Landowner participation in conservation easement programs is strictly voluntary, with landowner confidence and satisfaction a primary focus. This allows the program to develop a positive reputation and garner more conservation interest in the watershed.

OBJECTIVE #7: Document changes in water quality throughout WMP implementation.

MILESTONES:
- Submit a water quality monitoring plan for each grant received.
- Conduct Pre- and Post-BMP monitoring for large agricultural BMP projects.
- Sample to potentially delist the stream from being impaired for fecal coliform violations (SQAP process).
- Initiate WMP revisions.

If Clean Water Act Section 319 grants for installation of BMPs are obtained, water quality sampling will be included in the process. When a large agricultural BMP project is planned, sampling will take place for *E. coli* and fecal coliform before and after the project to check the effectiveness of the management practices. Improvements will trigger reassessment of the activities in the watershed management plan.

A Sampling and Quality Assurance Plan (SQAP) should also be created for each Clean Water Act Section 319 grant received. This will allow for the rigorous sampling required to delist the stream if the water quality standards are met.

The Georgia EPD will be monitoring fecal coliform, stream chemistry, and fish and macroinvertebrates as part of its regular sampling rotation. These results will show whether the stream can be removed from the list of impaired streams.

OBJECTIVE #8: Provide local community leaders with the knowledge to consider the effects management decisions may have on stream health in the watershed. Increase education and awareness of water quality issues with coordinated efforts of existing education groups. Establish renewed outreach efforts through AAS program, green infrastructure demonstration projects, stream signage to identify water supply watersheds, and pet waste stations in parks.

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.
- Hold AAS training workshops to establish AAS sampling groups and river cleanups through Rivers Alive
- Increase informative signage, green infrastructure demonstrations, public facilities like pet waste stations

City and county personnel will be updated regularly through presentations at local meetings to keep up involvement and /or awareness during the restoration process. The stakeholders will receive monitoring data as it is collected.

6.4 Schedule of Activities

The schedule in Table 14 shows the anticipated years in which various objectives and milestone in the WMP implementation process would occur. Activities are dependent on whether funding is obtained.

Table 14. Milestone activities and a timeline in which they will each be addressed during the implementation of the WMP

IMPLEMENTATION SCHEDULE									
MILESTONE ACTIVITY	2021	2022	2023	2024	2025	2026	2027	2028	2029
Submit funding proposal to Georgia EPD or other funding sources	X			X			X		
Create an agricultural BMP cost-share program		X							
Create septic system cost-share program		X							
Establish conservation easement program							X		
Install Agricultural BMPs			X	X	X	X	X	X	X
Install Septic System BMPs			X	X	X	X	X	X	X
Install other specific management practices in watershed: unpaved road improvements, green infrastructure demonstration					X		X	X	X
Establish AAS Monitoring Group	X		X		X		X		X
Update County Commission/Press Releases			X		X		X		X
Conduct Education/Outreach Events		X	X	X	X	X	X	X	X
Conduct WQ Monitoring (Targeted)	X			X		X			X
Conduct WQ Monitoring by state or other qualified party (SQAP delisting)	X			X			X		
Reevaluate Milestones					X			X	
Initiate Reassessment of WMP						X			X

6.5 Indicators to Measure Progress

The most basic measure of progress in improving conditions in the watershed would be tallying the number of septic systems fixed, the number of agricultural improvement projects completed, and miles of stream buffer replanted, and acres of land in conservation. Completion of specific projects like unpaved road maintenance and green infrastructure demonstration installations would also indicate success.

In addition, the level of landowner participation in the restoration effort is a good indicator of awareness of and good will toward the state's investment in improving the water quality conditions in the watershed. It will be sign of progress if landowners are showing increased interest and understanding of the need for BMP's over the course of the project. As individual BMP projects are completed, it is hoped that these projects will serve as an advertisement to increase participation.

If additional water quality data is collected after management measures are installed, the results could demonstrate progress. Particular parameters to sample would be fecal coliform bacteria, *E. coli*, temperature, dissolved oxygen and macroinvertebrate assessments and possibly turbidity, which was only visually assessed in this sampling effort. The sampling would have to be well-timed and frequent enough to account for many uncontrolled variables in the watershed. One area upstream of the sampling site may be restored while another newly disturbed upstream area creates a new source of fecal coliform and sediment. Quarterly or monthly samples that also include storm events would help represent a range of conditions in the creek, since fecal coliform often is washed off the land during storms. This targeted monitoring is part of Clean Water Act Section 319 grants involving installation of agricultural BMPs.

Georgia EPD monitors fecal coliform, sediment, macroinvertebrates, fish, and many other parameters on a periodic basis. If bacterial load reductions are met, then the stream can be delisted for fecal coliform. If low values for fecal coliform are maintained, then Woodward Creek will stay off the list of impaired streams. This type of monitoring can also be done by another entity, such as a wastewater treatment plant lab, with the results submitted to the EPD to demonstrate that the stream meets EPD standards. The EPD requires that the entity first submit a Sampling and Quality Assurance Plan (SQAP) to ensure they are following EPD standards and procedures.

6.6 Technical Assistance and Roles of Contributing Organizations

Table 15 shows the various groups that would be possible partners in the effort to restore the watershed. The Georgia EPD, the US EPA, and the NRCS would provide funding for these efforts. Georgia DNR provides ongoing monitoring to see which streams meet state criteria. The NWGRC could provide monitoring and support as well. The Northwest Georgia Public Health Department could be expected to contribute expertise in the septic system repair program. Nonprofit advocacy organizations including the Nature Conservancy and the Coosa Basin Initiative would provide education and outreach activities. The Natural Resource Conservation Service would be a logical partner in providing expertise in_agricultural BMP installation and communication with landowners, as would the University of Georgia Cooperative Extension Agency and the Limestone Valley RC&D.

Input from possible participants was obtained from the Advisory Committee at the Advisory Committee meeting in January 2019 and through other meetings, emails, and phone calls. Due to the Covid-19 pandemic in the spring of 2020, the public meeting and other planning meetings to finalize participatory roles have been postponed.

Table 15. The following groups may contribute to the Woodward Creek WMP by taking on the roles below

Organization Roles and Responsibilities		
Organization Name	Organization Type	Description of Role in WMP
Northwest Georgia Regional Commission and other partners	Regional Agency	Monitor water quality to assess effectiveness of BMP's
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 delisting efforts.
Georgia Environmental Protection Division	State Agency	Administer Clean Water Act Section 319 Grants to provide funding for this restoration program.
Environmental Protection Agency	Federal Agency	Provide Clean Water Act Section 319 funds to Georgia EPD to administer through the state 319 grant program.
Northwest Georgia Public Health	State Agency	Provide technical expertise for septic system repairs. This process will include assessing, planning, permitting, 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.
The Nature Conservancy-	Nonprofit	Serve as a vehicle to promote the Woodward Creek Restoration Project and assist in marketing its outreach efforts.
Limestone Valley RC&D	Quasi-governmental Agency	Serve as a vehicle to promote the Woodward Creek Restoration Project and assist in marketing its outreach efforts. Provide expertise in BMP installation and communication with eligible landowners
Coosa Basin Initiative	Nonprofit	Serve as a vehicle to promote the Woodward Creek Restoration Project and assist in marketing its outreach efforts.
Natural Resource Conservation Service	Federal Agency	Provide expertise in BMP installation and communication with eligible landowners
UGA Cooperative Extension Agency	State Agency	Provide expertise in BMP installation and communication with eligible landowners

6.7 Estimates of Funding

Many sources of funding are available for conservation, water management, and watershed restoration in Georgia, but problems with nonpoint source pollution still persist in the Oostanaula River watershed and the Coosa Basin in which it is located. More coordinated efforts are required. One source of funding which the comprehensive restoration effort proposed here would draw from is the Clean Water Act Section 319 program with the collaboration of the partners in Table 15 above. Also assumed is the continuous consistent effort from the other programs previously mentioned in order for water quality improvements to occur.

Septic system BMP needs were estimated based on failure statistics provided by the US EPA, and GIS analysis of structures in watershed, with areas reached by county sewer lines subtracted out. Types of agricultural BMPs were determined from agricultural experts and past Clean Water Act Section 319 grant efforts in Northwest Georgia.

Agricultural BMP quantities were estimated from GIS analysis of missing riparian buffers and locations of fields and pastures.

The total cost for comprehensive treatment of the watershed was first calculated as shown in Table 16. The total agricultural and septic BMP's were estimated with their costs, then this total was reduced to 60% because the Clean Water Act Section 319 grants have a cost share ratio of 60% grant-funded and 40% landowner match. Next, all of the cost of the other management treatments, such as green infrastructure demonstrations and unpaved road maintenance, is included. Some of these projects may be covered by other types of funding besides 319 grants. Those treatments are listed with as a whole cost since the cost share breakdown for these treatments is not known. This results in a $407,104 value for the total cost of watershed treatment. The cost of comprehensive watershed treatment may seem like a large number, but it is possible that 100% of the treatments would not be needed, since the required reduction in fecal coliform bacteria load is 82%.

Based on Advisory Committee responses, we propose to focus first on the more conventional projects of septic system repairs and agricultural and streambank improvements for the first two grant cycles. The unpaved road improvements and green infrastructure demonstration projects will be undertaken during the last funding cycle if improvements in water quality and the accompanying delisting do not occur sooner. After the first grant cycle, evaluation of progress would be made, and the amount of money requested in the next grant cycle would be more or less depending on the degree of progress made over the years. This allows for planned, comprehensive treatment spread out over a number of years.

Table 16. An estimate of the cost associated with a hypothetical instantaneous watershed-wide treatment for fecal coliform reduction at all critical sites.

TOTAL WATERSHED TREATMENT TABLE			
Agricultural BMPs (Name - Code)*	Quantity	Cost/Unit	Cost Estimate
Fence - 382	31,680 lin.ft.	$2.53/lin.ft.	$80,150
Heavy use area (pad - concrete; 3'x 4'w/ 614 below) - 561	10 pads	$2.13/sq ft	$256
Heavy use area (pad – geotextile 50' x 50') - 561	4 pads	$1.00/sq ft	$10,000
Livestock Pipeline - 516	2000 lin. ft	$1.42/ft	2,840
Riparian forest buffer -391	30 acres	$247.31/ac	$7,419
conservation cover –pollinator species 327	4 acres	$1,105.4/acre	$4,422
Streambank and Shoreline protection bioengineered 580 (stabilization)	1515 lin. ft	$66.12/lin.ft.	$100,172
Water well - 642	8 wells	$5,227.34 each	$41,819
Watering facility (4 ball freeze proof)- 614	10 facilities	1,178.41 each	$11,784
Brush management – privet control-mechanical roller, chopper 314	10 acres	$50.54/acre	$505
Septic System BMPs (Name - Code)	Quantity	Cost/Unit	Cost Estimate
Conventional system repair	85	$4000 each	$340,000
11Experimental system Installation	5	$7000 each	$35,000
Educational Events	Quantity	Cost/Unit	Cost Estimate
Septic installer workshop	1	$1,500	$1,500
Homeowner workshops (septic maintenance)	1	$1,500	$1,500
TOTAL AG. AND SEPTIC TREATMENT COST			$637,367
60% OF TOTAL TREATMENT COST AG AND SEPTIC (other 40% would be provided by landowner contributions)			$382,420
Other Management Treatments	Quantity	Cost/Unit	Cost Estimate
Rain Garden demonstration (15 ftx20 ft)	1	-	$684**
Interpretive signage for rain garden	4	1,000	$4,000
Unpaved road maintenance	1 mile	$20,000	$20,000
TOTAL OTHER MANAGEMENT TREATMENT COST			$24,684
TOTAL WATERSHED TREATMENT COST (60% of ag and septic system plus total other management treatment cost)			$407,104

*The agricultural item costs needed for Agricultural BMP's come from the NRCS Georgia EQIP FY2020 cost list.

**estimate from Three Rivers Rain Garden Alliance Allegheny County, PA
http://raingardenalliance.org/right/calculator

Table 17.Recommended financial proposals for each of three funding requests sought by NWGRC attempting comprehensive watershed restoration.

	septic system repair funds	Agriculture projects/stream restoration funds	unpaved roads/green infrastructure funds	Total
Proposal 1 2021	$113,400	$77,810	-	$191,210*
Proposal 2 2024	$113,400	$77,810	-	$191,210*
Proposal 3 2027	-	-	$24,684	$24,684
Total watershed restoration				$407,104

** The sum of the septic system improvements and the agricultural BMP improvements is 60% of total watershed treatment as displayed in Table 16, with landowner contribution excluded*

Section 7: Education and Outreach Strategy

Figure 29. Floyd County 4-H students learn about AAS sampling

The agencies and groups listed in Table 13 will continue their programs that contribute to better land management and improved water quality throughout the Lower Oostanaula Watershed. The NRCS works with farmers to encourage the use of agricultural BMPs and provide nutrient management plans. The USDA Farm Service Agency arranges conservation easements on sensitive land through the Conservation Reserve Program. The Georgia Forestry Commission educates and assists landowners and timber operators in managing forest land with the use of forestry BMPs. NW Georgia Health District manages septic tank permitting programs. Georgia EPD oversees the Erosion and Sedimentation Act and nonpoint pollutions sources. The Adopt A Stream and Rivers Alive programs allow the public to participate in water stewardship by engaging in citizen science with stream monitoring and stream and lake cleanups.

The local government contributes to the Rome-Floyd ECO Center, which provides a venue for learning and educates children and adults about nature and ecosystems. Keep Rome-Floyd Beautiful also benefits from local government support and organizes river cleanups and educates about the hazards of trash.

Private organizations include CRBI and the Nature Conservancy. CRBI's leadership trains volunteers for the AAS program and provides float trips on local streams and rivers to educate about the importance of clean water. In addition to their role in acquiring parcels of unique habitats for preservation, The Nature Conservancy sponsors river cleanups and educational hikes, and has helped replace bridges to improve fish passage on streams in the Coosa Basin.

The North Georgia Water Resources Partnership Annual Education Seminar will continue to provide continuing education to water supply professionals.

The Upper Coosa Conservation Summit will continue on a semiannual basis to increase knowledge and encourage collaboration among those working on improving water quality and preserving aquatic species in the Coosa Basin.

Community support of these excellent existing programs and resources in dealing with conservation issues in the area is essential. The efforts of these groups should be encouraged and supported to solve the water quality problems in the Woodward Creek watershed and the larger Lower Oostanaula watershed. These agencies and groups need to pursue more collaboration and partnerships, since despite the application of funding and professional and volunteer effort, the job is not yet done.

To help with coordination of effort, NWGRC conducted an online survey of those working in environmental fields in the area to see what the state of water quality education and outreach is in the Lower Oostanaula Watershed and developed a bibliography of educational resources for water conservation, streams and rivers, green infrastructure. Some required meetings were not completed due to the COVID-19 pandemic. These include one public meeting, one presentation to a county commission or city council, and one presentation to a community, civic, or professional organization. These meetings will take place when in-person meetings are again possible. NWGRC will post green infrastructure materials on NWGRC websites and make these materials available for local governments to post. NWGRC will advertise WaterFirst program, which rewards local governments that excel in water stewardship.

Summary of Nine Key elements

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.

Section 2 describes the overall condition of the watershed and shows the 1995 National Land Cover Dataset for Woodward Creek watershed that was used in the 2004 TMDL evaluation for this stream (DNR EPD 2004). This section also has an updated land use dataset from the Georgia Land Use Trends for 2015 with land use map of watershed. This map shows a rural watershed with 60% forest cover, but with areas of pasture, mostly low-density residential development, and some commercial development along State Route 53. Section 3.2 shows data collected in Woodward Creek by the Georgia EPD in 2001, 2005, and 2018. Section 3.3 shows water quality, macroinvertebrate, and stream habitat data collected by the NWGRC. Fecal coliform values were never as high as some EPD measurements made in 2001. Measurement of E. coli bacteria were mainly used as a surrogate for fecal coliform. There were still elevated levels of *E. coli*, especially downstream and in the summer. Since 60% of the watershed is forested, wildlife are expected to contribute fecal coliform to the creek, but cattle are also present in the watershed and are found in pastures adjacent to the creek at two sampling sites. Although it is not possible to distinguish the fecal coliform sources from this data, livestock and septic system failures probably contribute to the fecal coliform load in the watershed. The amount of land area in the watershed in row crops and pasture in 28%. In Section 3.4 stream buffer analysis with aerial photography and GIS technology identified that 10 miles, or 41% of the watershed's perennial streams (main stem of Woodward Creek and its tributaries) were missing 25-foot buffers. Further sources of fecal coliform are discussed in Section 4, covering wildlife, livestock, and septic system numbers supplied by DNR, USDA, and Georgia Department of Public Health. Application of agricultural BMP's, septic system repairs, riparian buffer restoration, and improvements to unpaved roads and other transportation facilities could all address high fecal coliform levels. Although road improvements may not directly relate to fecal coliform, fecal coliform can be associated with sediment in the stream, and unpaved roads can contribute sediment to streams.

2. An estimate of the load reductions needed to delist (remove from Georgia EPD Section 303(d) list of streams not in compliance with water quality standards) impaired stream segments;

The TMDL reduction required by the 2004 TMDL evaluation (DNR EPD 2004) is 82%, as shown in Section 5.2. Section 6 contains Table 16, showing measures to treat the whole watershed. If all these measures were simultaneously enacted, the goal of 82% reduction in fecal coliform would probably be met. However, development in the watershed will continue even if these fixes are put in place. Carrying out these improvements over a series of years allows for feedback and adjustment to restoration plans. Table 17 shows three funding requests from 2021 to 2027. This would include assessing landowner participation in programs and using monitoring to see if fecal coliform levels respond when only part of the watershed is treated.

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;

Section 6.3 lists milestones for accomplishing the process of reaching the load reduction targets These include working with farmers to install agricultural BMPs and restore streamside buffers, repairing septic systems, fixing transportation issues in watershed to reduce sediment, increasing conservation lands in watershed, and monitoring progress in the watershed. Table 14 shows an implementation schedule for proposed work. Tables 16 and 17 show the watershed treatments with their costs.

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

Section 6 contains Table 16, the total watershed treatment table shows estimated costs of the various treatments, using NRCS EQIP FY2020 cost list and other sources for cost estimates. Table 17 shows the breakdown of funding requests over 9 years. Table 15 shows organizations that may participate in the restoration process and their various roles.

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

The education and outreach strategy is found in Section 7. The various groups that already are active in the watershed (see Table 13) will continue their roles. The outreach portion of 319 grants could include the Adopt A Stream and Rivers Alive programs to get the public invested in clean water. Two training events, the annual North Georgia Water Resources Partnership Annual Education Seminar, and the biannual Upper Coosa Conservation Summit would provide additional awareness to water issue in Northwest Georgia. Green infrastructure information will be posted NWGRC's website.

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

Table 14 in Section 6.4 shows the milestone activities and a timeline over nine years, from 2021 to 2029 for accomplishing these activities. This timeline spreads the work over three funding cycles. This timeline could be adjusted if more progress than expected is made on restoring the watershed.

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;

Section 6.3 has objectives and milestones to measure progress. These milestones include coordinating with NRCS and UGA agricultural extension on planning and executing agricultural BMP implementation, setting up a septic system homeowner educational workshop and repairing homeowner's septic systems, improving unpaved roads and other transportation facilities to reduce sediment, encouraging participation in conservation easement programs, monitoring the water for improvement as these other milestones are carried out, and educating leaders about the effect of management decisions on clean water..

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.

Section 6.5 discusses criteria for determining if progress is being made. This could be done by counting the number BMP installations and fixed septic systems. Landowner participation level over time is a good indicator that landowners know about the program and its benefits. Monitoring to show if specific projects are effective could provide evidence of progress. An excellent criterion of progress is whether the stream no longer violates the fecal coliform standard, as shown by SQAP monitoring either by the Georgia EPD or a certified entity. As these criteria are met, re-evaluation of whether additional funding is needed can be done.

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

Water quality information was collected for Woodward Creek for the development of this watershed management plan (see Section 3.3). Continued monitoring as this WMP is implemented could include the same parameters, including fecal coliform bacteria, *E. coli,* water temperature, conductivity, dissolved oxygen, pH, macroinvertebrates, and stream habitat. Sampling bacteria during storm events could provide more information on whether fecal coliform is moving off the land during that critical time. The addition of turbidity to the list of parameters would help establish where the along the course of the watershed sediment begins to move into the creek. Monitoring fecal coliform for delisting (SQAP monitoring) by either the Georgia EPD or another certified entity would provide official evidence that the stream has been restored.

Glossary of Acronyms

AAS - Adopt-A-Stream
BMP - Best Management Practice
CNMP - Comprehensive Nutrient Management Plan
cfs - cubic feet per second
cfu - colony-forming units
DNR - Department of Natural Resources
EPA - Environmental Protection Agency
EPD – Georgia's Environmental Protection Division
GIS - Geographic Information Systems
GLUT - Georgia Land Use Trends
MGD – million gallons per day
NPS - Nonpoint Source
NRCS - Natural Resource Conservation Service
NWGRC – Northwest Georgia Regional Commission
PCB – Polychlorinated Biphenyl
TMDL - Total Maximum Daily Loads
USDA – United States Department of Agriculture
USDA NASS – US Dept of Ag National Agricultural Statistics Service
WMP - Watershed Management Plan

References

Coosa North Georgia Regional Water Planning Council. April 14, 2020. Stakeholder Meeting Handout.

Cressler, C.W. 1970. The Geology and Ground-water Resources of Floyd and Polk Counties, Georgia. The Geological Survey of Georgia Department of Mines, mining and Geology. Atlanta. 95 pages.

Dwivedi, Puneet, F.J. Benez-Secanho, J.Skaggs, D.Elkins, W.L. Gerrin, C. Lord. 2020. Conservation and Restoration Priorities in the Upper Oxone River Basin. Warnell School of Forestry and Natural Resources, University of Georgia. 27 pages.

Edwards, L., J. Ambrose, and L.K. Kirkman. 2013. The Natural Communities of Georgia. University of Georgia Press, Athens and London. 675 pages.

Elkins, Duncan and W. Gerrin. 2019. Conservation and Restoration Priorities in the Middle Chattahoochee River Basin. Georgia Forestry Commission. 18 pages.

Ernst, Caryn, K. Hopper, and D. Summers. 2004. Protecting the Source: Land Conservation and the Future of America's Drinking Water. Trust for Public Land and American Water Works Association. 55 pages.

Georgia Department of Natural Resources: Environmental Protection Division. 2004. Total Maximum Daily Load Evaluation for 58 Stream Segments in the Coosa River Basin for Fecal Coliform.

Georgia Department of Natural Resources: Environmental Protection Division. 2009. Total Maximum Daily Load Evaluation for PCBs in Fish Tissue (14 segments), and Commercial Fishing Ban due to PCBs (24 segments).

Georgia Department of Natural Resources: Environmental Protection Division. 2014. Georgia Adopt-A-Stream Bacterial Monitoring Manual.

Georgia Department of Natural Resources. 2020. Georgia Sport Fishing Regulations Freshwater Fish Consumption Guidelines: Georgia Waters. http://www.eregulations.com/georgia/fishing/fish-consumption-guidelines-georgia-waters/

Georgia Department of Natural Resources. Wildlife Resources Division. 2015. Georgia's Deer Management Plan 2015-2015.

Gregory, M.B. and E.A Frick. 2000. Fecal-coliform bacteria concentrations in streams of the Chattahoochee River National Recreation Area, Metropolitan Atlanta, Georgia, May-October 1994-1995. U.S. Geological Survey Water Resources Investigations Report 00-4139. 8 p.

Kaller, M. D., J. D. Hudson, E. C. Achberger, and W. E. Kelso. 2007. Feral hog research in western Louisiana: expanding populations and unforeseen consequences. Human-Wildlife Conflicts 1(2):168–177.

Krueger, Eric and N. Jordan. 2014. Preserving Water Quality in the Savannah River: Protecting the Future of Drinking Water Supply. The Nature Conservancy. 32 pages.

Mersinger, R.C. and N.J. Silvy. 2007. Range size, habitat use, and dial activity of feral hogs on reclaimed surface-mined lands in East Texas. Human-Wildlife Conflicts 1:161-167.

Southeast Aquatic Resource Partnership Southeastern Aquatic Barrier tool. Version 5/12/2019. https://connectivity.sarpdata.com/

State of Georgia. Water use classifications and water quality standards. 391-3-6.

Sweeney, B.W., T.L. Bott, J.K. Jackson, L.A. Kaplan, J.D. Newbold, L.J. Standley, W.C. Hession, and R.J. Horwitz. 2004. Riparian Deforestation, Stream Narrowing, and Loss of Stream Ecosystem Services. Proceedings of the National Academy of Sciences 101(39):14132-14137.

Warziniack, T, C.H. Sham, R. Morgan, and Y. Feferholtz. 2016. Effects of forest cover on drinking water treatment costs. American Water Works Association. 51 pages.

US Department of Agriculture, National Agriculture Statistics Service. 2017 Census of Agriculture.
U.S. Department of Agriculture: Soil Conservation Service. 1978. Soil Survey for Chattooga, Floyd, and Polk Counties, Georgia. 151 pages.

US EPA. 2005. National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution. Office of Water. EPA-841-B-05-003.

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Appendix A Targeted Monitoring Plan for Woodward Creek

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Targeted Monitoring Plan-Woodward Creek December 2018

Required Quality Assurance/Quality Control (QA/QC) Water Quality Monitoring Plan

SFY2018 Regional Water Plan Seed Grant

Project Title: Update of the Coosa-North Georgia Regional Water Plan Implementation for the Woodward Creek Watershed

Lead Organization: Northwest Georgia Regional Commission
PO Box 1798 (mailing)
1 Jackson Hill Drive
Rome, GA 30162-1798
Phone: (706) 295-6485

Primary Contact: Julianne Meadows, Planning Director
1 Jackson Hill Drive
PO Box 1798
Rome, GA 30162-1798
Phone: (706) 295-6485
Email: jmeadows@nwgrc.org

Background information/Location of Study Area: Woodward Creek has its headwaters in Bartow and Gordon Counties, then flows southwest into Floyd County. Woodward Creek drains into the Oostanaula River (Figure 1 Map). Most of the watershed is rural and is in agricultural and forestry use. A now-closed textile mill (historically Brighten Mills, most recently Galey and Lord) in Shannon had a water intake on the creek for process water. This intake was converted to a drinking water intake managed by Floyd County Water Department for the community of Shannon. The creek has not met the state criteria for fecal coliform bacterial contamination for a number of years. In 2010-2011, the Northwest Georgia Regional Commission (NWGRC) developed a Woodward Creek Watershed Management Plan, which has not been implemented. The NWGRC has been awarded a SFY2018 Regional Water Plan Seed Grant from the Georgia EPD to update the Woodward Creek Watershed Management Plan.

Objective: The objective of this monitoring plan is to establish baseline conditions for water quality, as well as instream physical conditions and watershed conditions for Woodward Creek. This information will help show how instream conditions are tied to the adjacent land uses and will be used in updating the Woodward Creek Watershed Management Plan for the creek. The management plan will then be available to guide efforts to improve the water quality in the creek so it can be removed from the State of Georgia list of impaired waters (2016 Integrated 305(b)/303(d) List Streams). We will not be addressing the commercial fishing ban by sampling for PCB in fish tissue due to expense and a lack of commercial fishing on this creek.

Table 1. Woodward Creek is listed for fecal coliform bacteria and has a Commercial Fishing Ban due to PCB's.

Reach Name	Reach Location/County(s)	Criterion violated	Potential causes	Extent	Designated Use	Notes
Woodward Creek	Tributary of Oostanaula River/Floyd, Bartow, and Gordon	Fecal Coliform Bacteria (FC), Commercial Fishing Ban (CFB/ PCBs)	FC=Non-point source; CFB/PCBs=Nonpoint and residual from industrial source (I2)	8 miles	drinking water	TMDL completed CFB 2005 (revised 2009) & FC 2004; Listing Status Category=4a*

*Category 4a- Data indicate that at least one designated use is not being supported, but TMDL(s) have been completed for the parameter(s) that are causing a water not to meet its use(s).

Proposed timeline: one year; January 2019 to January 2020

Visual Survey:
An initial Visual Survey will proceed monitoring of the creek. The visual survey is a rapid and efficient way to characterize stream conditions along the stream. Survey information will be collected at bridge crossings and photos will be taken to record any changes from the 2010-2011 visual surveys.

Visual Survey using Georgia Adopt-A-Stream form (see Figure 2 below):

1. Weather Conditions
2. Visual assessment of flow conditions including water level, clarity, color, surface, and odor
3. Human-caused trash level
4. Photos from photo point

Targeted Monitoring Plan:
The monitoring plan focuses on estimating levels of bacterial contamination with supporting information to further characterize the stream and provide data to help explain the fecal coliform levels.

1. Bacterial sampling:
   a. *E. coli* using Adopt-a-Stream methods in the Georgia Adopt-A-Stream Program, *Bacterial Monitoring* manual (2014) (see Figure 3 below).
   b. fecal coliform grab samples collected by NWGRC and analyzed by Rome-Floyd Water and Sewer Department in their laboratory

2. Additional Parameters to sample:
   Chemical/physical parameters for first level Adopt-a-Stream Sampling using methods and procedures described in the most current Georgia Adopt-A-Stream program, *Macroinvertebrate and Chemical Stream Monitoring* manual (2015) (see Figure 3 below):
   a. air temperature
   b. water temperature
   c. pH
   d. Conductivity
   e. Dissolved Oxygen

Sites to be sampled: Five sites from the previous watershed improvement plan will be sampled, plus the Shannon Water intake site (see Table 2 and Figure 1 Map). . One more site may be added to provide additional information from a tributary to Woodward Creek on the south side of the watershed (see Table 2). This adds to six definite sites and possibly seven sites in all.

Table 2. Proposed Woodward Creek water sampling sites.

Site	location	Lat/Long	Elevation (estimated from topo map)
Bells Ferry Road Crossing-Georgia EPD's sampling site for water quality compliance	Turn west off of SR 53 onto West Hermitage Rd, then north onto Bell's Ferry Road. Site closest to Oostanaula River	34.343454, -85.110406	580 ft

Minshew Road Crossing	Continue north on Bell's Ferry, east onto Minshew Road to crossing	34.356262, -85.094476	600 ft
Gaines Loop Crossing	Continue southeast on Minshew Rd then north on Gaines Rd then east onto Gaines Loop Road to crossing	34.364349, -85.073068	620 ft
Plainville Road Crossing	From SR 53 turn north on Plainville Rd to crossing	34.378274,-85.047940	640 ft
Autry Road Crossing	Turn east off of SR 53 onto Autry Rd to crossing	34.379638,-85.009880	710 ft
New site: Shannon Water intake	Accessible by gated service road from water filtration plant in Shannon	34.347677, -85.099561	580 ft
Possible new site: Tributary to Woodward Cr crossing at Buttrum Road	Turn south off of SR 140 onto Buttrum Road to first crossing.	34.367697, -85.013963	700 ft

Additional monitoring: Additional information will be obtained from macroinvertebrate sampling and stream habitat survey using Georgia Adopt-A-Stream protocol. See Figures 4 and 5 below.

Schedule of Sampling: Sampling of *E. coli* bacteria will take place once each season over the course of one year (four times). In addition, sampling will target at least one rain event to better characterize the movement of fecal coliform during this critical period. This may involve an extra sampling event. Fecal coliform will be sampled twice, in the winter and summer, and during one rain event if possible, for a possible total of 21 samples.

Table 3. Proposed sampling schedule

Site	January 2019	April 2019	August 2019	December 2019	Rain Event
Bells Ferry Road Crossing-	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Macroinvertebrates Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform
Minshew Road Crossing	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform
Gaines Loop Crossing	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform
Plainville Road Crossing	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform
Autry Road Crossing	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform
New site: Shannon Water intake	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform

Possible new site: Tributary to Woodward Creek Crossing at Buttrum Road	*E. coli*, Chemical/Physical Fecal Coliform	*E. coli*, Chemical/Physical Stream Habitat Survey	*E. coli*, Chemical/Physical Fecal coliform	*E. coli*, Chemical/Physical	*E.coli*, Fecal coliform

Rome-Floyd Water and Sewer would process fecal coliform samples from seven sites sampled on three dates, for a total of 21 fecal coliform samples if sampling occurs as proposed.

Data Reporting: Data collected using the Adopt-A-Stream protocols will be entered at the Adopt-A-Stream Website, https://adoptastream.georgia.gov/. The Woodward Creek Watershed Management Plan will include both this data and fecal coliform results.

Figure 1. Map of Woodward Creek Watershed

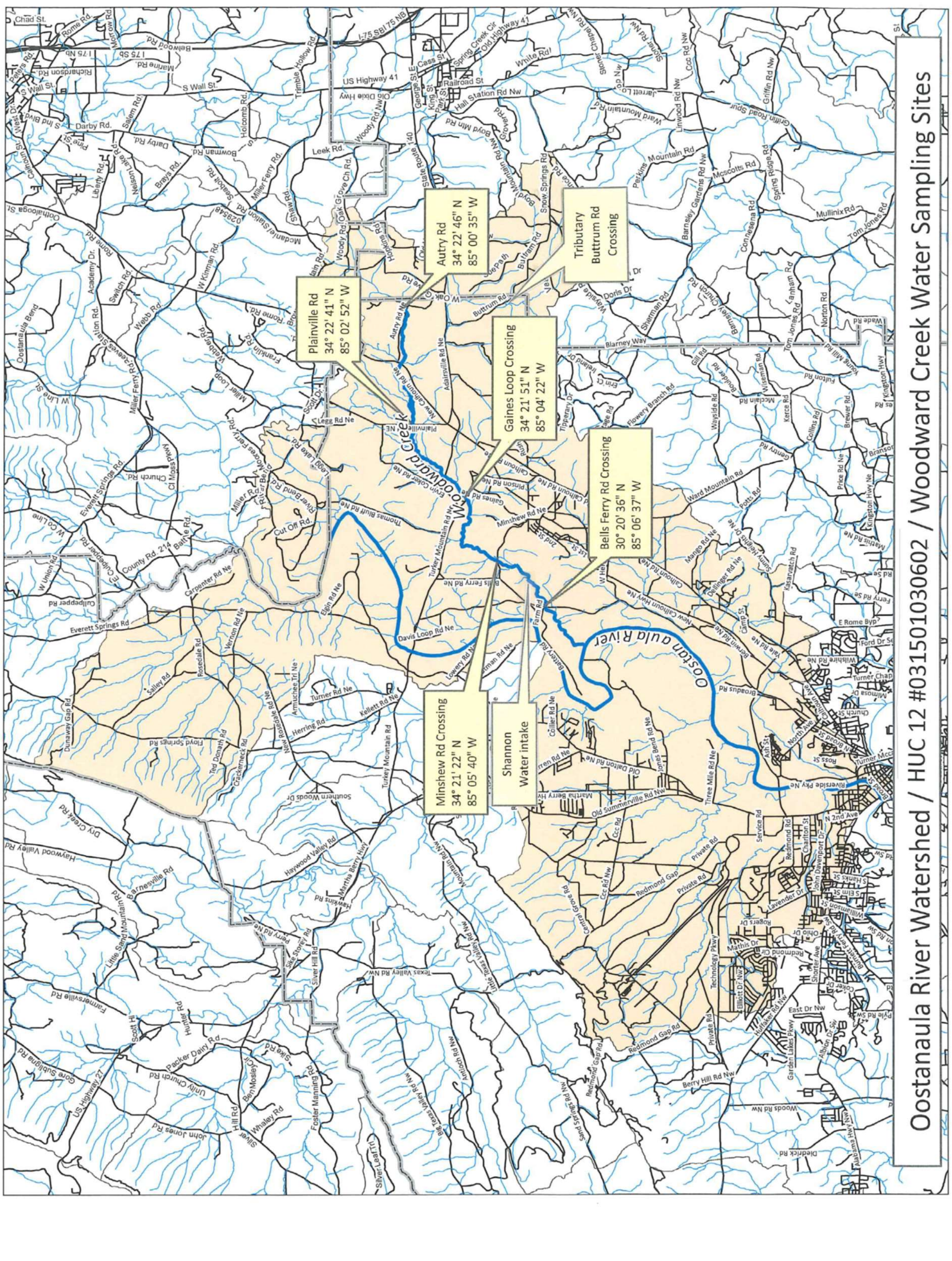


Figure 2. Georgia Adopt-A-Stream: Basic Visual Form

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name:______________________ Event Date: __________________ (MMDDYYYY)

Group ID: G-________ Site ID: S-_________ Time Sample Collected:___________ (HHMM am/pm)

Stream Name:______________________ Time Spent Sampling: ___________ (Min)

Monitor(s):________________________ Total Time Spent Traveling *(optional)* : ________ (Min)

Number of Participants:____________ Furthest Distance Traveled *(optional)* : ________(Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☐ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches:________

In Last Hours/Days:________

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:__________

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:__________

Water Surface: ☐ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ◯ Greater than 3" high ◯ It is pure white ☐ Other:____________________

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other:______________

Trash: ☐ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+)___________ (DD.DDDD°) Longitude (-)____________ (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°)________

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance __________(ft/in)

Camera height at permanent Photo Point location (PPL): Height __________(ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Figure 3. Georgia Adopt-A-Stream: Chemical/Bacterial Form

GEORGIA ADOPT-A-STREAM: Chemical/Bacterial Form

To be conducted every month

SITE INFORMATION

Group Name:______________________ Event Date: ____________________ (MMDDYYYY)

Group ID: G-________ Site ID: S-_________ Time Sample Collected:____________ (HHMM am/pm)

Stream Name:______________________ Time Spent Sampling: _____________ (Min)

Monitor(s):______________________ Total Time Spent Traveling *(optional)*: _________ (Min)

Number of Participants:__________ Furthest Distance Traveled *(optional)*: _________(Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☐ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches :_________

In Last Hours/Days:________

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: (check all that apply) ☐ Dry ☐ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flow (over banks)

Water Clarity: ☐ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:_______

Water Surface: ☐ Clear ☐ Oily Sheen: does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ◯ Greater than 3" high ◯ It is white

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other:_______________

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Send photo to AAS@gaepd.org.

Trash: ☐ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

CHEMICAL

Conductivity Meter Calibration (within 24hrs of sampling)

Date_______ Time________ Standard Value________ Initial Meter Reading_______ Meter Adjusted to__________

Reagents: Are any reagents expired? ☐ Yes ☐ No List any expired: ________________

Core Tests	Test 1	Test 2	Units	Other Tests	Test 1	Test 2	Units
Air Temp			°C	Secchi Depth(+/- 10)			cm
Water Temp			°C	Chlorophyll a			ug/L
pH (+/-0.25)			Standard unit	Salinity (+/- 1)			ppt
Dissolved Oxygen (+/-0.6)			mg/L or ppm				
Conductivity			uS/cm				

BACTERIAL

3M Petrifilm Method: *Escherichia coli*

Run three (3) plates/tests for each site, plus one (1) blank plate. Process within 6-24hrs, incubate at 35°C ±1° and read at 24 ± 1 hr

Plate	Colonies	Find AVG of Number of Colonies (total # colonies/total # of plates (do not include blank))	cfu/100mL
Blank			
1		(/) x 100 =	
2			
3			
Total # Colonies			

Sample Holding Time (HH): ____________

Date START(MMDDYYYY): ___________ Date END (MMDDYYYY):________

Time START (HHMM):_____________ Time END (HHMM):___________

MIN Temp (°C):_________________ MAX Temp (°C): ___________

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at AdoptAStream.Georgia.gov

Figure 4. Georgia Adopt-A-Stream Macroinvertebrate Form

GEORGIA ADOPT-A-STREAM: Macroinvertebrate Form (page 1)

To be conducted quarterly

SITE INFORMATION

Group Name:____________________	Event Date: ________________ (MMDDYYYY)
Group ID: G-______ Site ID: S-______	Time Sample Collected:__________ (HHMM am/pm)
Stream Name:____________________	Time Spent Sampling: __________ (Min)
Monitor(s):____________________	Total Time Spent Traveling *(optional)*: ________ (Min)
Number of Participants:__________	Furthest Distance Traveled *(optional)*: ________(Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches:________
In Last Hours/Days:________
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:__________

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:__________

Water Surface: ☐ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ◯ Greater than 3" high ◯ It is pure white ☐ Other:__________________

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:______________

Trash: ☐ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Figure 4 continued

GEORGIA ADOPT-A-STREAM: Macroinvertebrate Form (page 2)

METHODS

Stream Type: ☐ Rocky Bottom Stream ☐ Muddy Bottom Stream

Method Used: ☐ Kick seine (2 x 2 ft area) ☐ D-Frame net (1 x 1 area) **Total Area Sampled:** ________ ft^2

Habitats Sampled: ☐ Leaf Packs/Woody Debris ☐ Vegetated Bank Margin ☐ Riffle

☐ Streambed with silty area (very fine particles) ☐ Streambed with Sand or small gravel

Directions: ***Consult the macroinvertebrate monitoring manual for sampling guidelines***

1. Separate the macroinvertebrates into the different taxa groupings listed in the table below.

2. Note which **taxa** are present and their **abundance code** based on the number of individuals present in your sample. Enter these codes in the boxes below for each taxa. *Abundance Codes:* **R** (rare)=1-9, **C** (common)=10-99, and **D** (dominant)=100 individuals or greater

TAXA GROUPS

SENSITIVE TAXA	SOMEWHAT SENSITIVE TAXA	TOLERANT TAXA
☐ Stonefly Nymphs	☐ Common Net Spinning Caddisflies	☐ Midge Fly Larvae
☐ Mayfly Nymphs	☐ Dobsonfly/Helgrammite & Fishfly	☐ Black Fly Larvae
☐ Water Penny Larvae	☐ Dragonfly & Damselfly Nymphs	☐ Lunged Snails
☐ Riffle Beetle Larvae/Adults	☐ Crayfish	☐ Aquatic Worms
☐ Aquatic Snipe Flies	☐ Crane Flies	☐ Leeches
☐ Caddisflies	☐ Aquatic Sow Bugs	
☐ Gilled Snails	☐ Scud	
	☐ Clams & Mussels	

WATER QUALITY INDEX/RATING

☐ # of taxa groups times 3 =____	☐ # of taxa groups times 2 =____	☐ # taxa groups times 1 =__

Now add together the three index values to get your **Water Quality Index Score** =______
Use this score to find out your **Water Quality Rating** for your stream (below).
Good water quality is indicated by a variety of different kinds of taxa/organisms, with no one kind making up a majority of the sample.

Water Quality Rating

☐ *Excellent (>22)* ☐ *Good (17-22)* ☐ *Fair (11-16)* ☐ *Poor (<11)*

OTHER

Optional: Do you see any of the following in your samples? Please count number of individuals.

☐ Fishes #:______ ☐ Tadpoles #:______

☐ Asian Clams #:______ ☐ Nonnative Crayfish Which species?

☐ Salamanders #:______ ______________________________

Please submit data to our online database at www.GeorgiaAdoptAStream.org

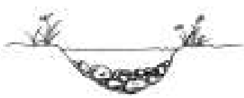
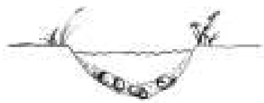
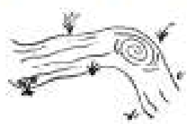
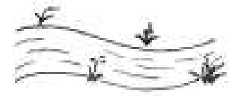
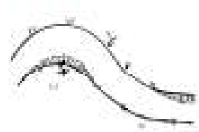
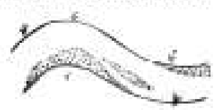
Figure 5: Georgia Adopt-A-Stream Stream Habitat Survey

Stream Habitat Survey: For Rocky and Muddy Bottom Streams (circle one)

Group ________ Stream name or Site ID __________________ Investigators __________________ Date ______

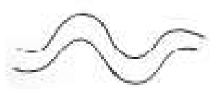
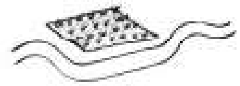
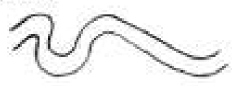
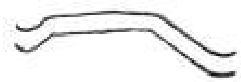
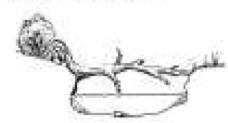
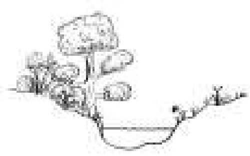
Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ----------	----------	----------Poor	
1. Epifaunal Substrate What types of submerged materials are on the channel bottom?	Abundant stable habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	Adequate stable habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	Little or no stable habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
2. Embeddedness *For ROCKY BOTTOM streams only Are fine sediments being deposited in riffle/run area?	Gravel and cobble are slightly embedded in riffle area. 	Gravel and cobble are partially embedded in riffle area. 	Gravel and cobble are completely embedded in riffle area. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
3. Riffle/Run/Pool Is a diversity of instream habitats available: riffle, runs and pools?	Yes, all three (3) habitat types (riffle, run, pool) are present and frequent. 	Two (2) habitat types are present. 	Only one (1) habitat type present and dominant. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
4. Sediment Deposition Are sand bars and islands present?	Little or no enlargement of vegetated islands or point bars. 	Some new bar formation of the channel bottom with new deposition in pools. Some increase in point bar formation. 	Heavy deposits of usually fine sediment; channel affected by extensive deposition. Point bars are bare. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
5. Channel Flow Status How much water is in the stream channel?	Water reaches base of both lower banks; little substrate exposed. 	Some substrate is exposed and water partially fills channel. 	Most substrate is exposed and very little water in channel. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score

Total first side ____

Take two photographs, looking upstream and downstream, capturing banks and riparian zone on both sides.

Habitat Parameter	Excellent --		--Poor	
6. Channel Alteration Is the stream channel altered by humans?	No evidence of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	Some evidence of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	Most of stream reach channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
7. Channel Sinuosity * For MUDDY BOTTOM streams only Does the channel have lots of curves and bends?	Yes, bends in the channel are frequent. 	There are more bends than straight sections. 	There are more straight sections than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7	6 5 4 3	2 1 0	Score
8. Bank Stability How stable are the streambanks? Determine right/left bank by facing downstream	Bank stable; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	Bank moderately stable; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	Bank unstable; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank Right bank	5 4.5 4 3.5 5 4.5 4 3.5	3 2.5 2 1.5 3 2.5 2 1.5	1 .5 0 1 .5 0	Score (Add both banks)
9. Vegetative Protection Are streambanks covered & shaded by a variety of vegetation? Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a large variety of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by some variety of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. Little variety of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank Right bank	5 4.5 4 3.5 5 4.5 4 3.5	3 2.5 2 1.5 3 2.5 2 1.5	1 .5 0 1 .5 0	Score (Add both banks)
10. Riparian Vegetative Zone Width What is the amount of buffer available? Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least three channel widths on each side. 	Some buffer present; some variety of vegetation extends two to one channel width on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends less than one channel width on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank Right bank	5 4.5 4 3.5 5 4.5 4 3.5	3 2.5 2 1.5 3 2.5 2 1.5	1 .5 0 1 .5 0	Score (Add both banks)

Stream Habitat Score: Excellent (69-90) Good (46-68) Fair (23-45) Poor (0-22)

Total second side ____

Total first side ____

Total ____

Please submit data at: www.GeorgiaAdoptAStream.org
Or send to: 4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Fax: 404-675-6245 Phone: 404-675-6240

References:

Georgia Department of Natural Resources: Environmental Protection Division. 2004. Total Maximum Daily Load Evaluation for fifty-eight stream segments in the Coosa River Basin for Fecal Coliform.

Georgia Department of Natural Resources: Environmental Protection Division. 2009. Total Maximum Daily Load Evaluation for thirty-four segments in Coosa River Basin for PCBs in Fish Tissue (14 segments), and Commercial Fishing Ban due to PCBs (24 segments).

Georgia Department of Natural Resources: Environmental Protection Division. Georgia Adopt-A-Stream Manual: Visual Stream Survey. 2014.

Georgia Department of Natural Resources: Environmental Protection Division. Georgia Adopt-A-Stream Manual: Macroinvertebrate and Chemical Stream Monitoring. 2015

Georgia Department of Natural Resources: Environmental Protection Division. Georgia Adopt-A-Stream Manual: Bacterial Monitoring. 2014.

Georgia Department of Natural Resources: Environmental Protection Division. 2016 Integrated 305(b)/303(d) List Streams.

Gregory, M.B. and E.A Frick. 2000. Fecal-coliform bacteria concentrations in streams of the Chattahoochee River National Recreation Area, Metropolitan Atlanta, Georgia, May-October 1994-1995. U.S. Geological Survey Water Resources Investigations Report 00-4139. 8 p.

Northwest Georgia Regional Commission. 2011. Revision Work Plan for Woodward Creek located in Floyd County Final Report. Includes Watershed Improvement Plan, September 30, 2011.

Appendix B Visual Survey

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SFY2018 Regional Water Plan Seed Grant

Project Title: Update of the Coosa-North Georgia Regional Water Plan Implementation for the Woodward Creek Watershed

Lead Organization: Northwest Georgia Regional Commission
PO Box 1798 (mailing)
1 Jackson Hill Drive
Rome, GA 30162-1798
Phone: (706) 295-6485

Primary Contact: Julianne Meadows, Planning Director
1 Jackson Hill Drive
PO Box 1798
Rome, GA 30162-1798
Phone: (706) 295-6485
Email: jmeadows@nwgrc.org

Visual Survey Woodward Creek

October 25, 2018, Gretchen Lugthart and Kevin McAuliff

The right bank designation follows the convention that the it is the bank on the right when the looking downstream.

Bell's Ferry Road Bridge crossing on Woodward Creek

See attached visual survey form for observations. This site is on University of Georgia Northwest Georgia Research and Education Center land. The bridge crossing is at the upstream edge of the property. The stream flows through the experiment station before entering the Oostanaula River. Cattle pastures lay upstream and downstream of this site. On October 25, 2018, water was cloudy here. Bank instability was visible in upstream and downstream view of creek. The visual survey data sheet with field observations follows.

1. Bell's Ferry Road Bridge site looking upstream

2. Bell's Ferry Road Bridge site looking at right bank

3. Bell's Ferry Road Bridge site looking downstream

4. Bell's Ferry Road Bridge looking at left bank

✓ created site on AAS oct 30, 2018

Bell's Ferry

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: The Lugthart Clan — Event Date: 10/25/2018 (MMDDYYYY)

Group ID: G-1656 Site ID: S-5217 — Time Sample Collected: 09:35 (HHMM (am)/pm)

Stream Name: Woodward Ck Bell's Ferry — Time Spent Sampling: 15 (Min)

Monitor(s): Gretchen Lugthart + Kevin McAuliff — Total Time Spent Traveling *(optional)*: ______ (Min)

Number of Participants: 2 — Furthest Distance Traveled *(optional)*: ______ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24 hrs

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☒ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☒ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other: ______

Water Color: ☐ No Color ☐ Brown/Muddy ☒ Green ☐ Milky/White ☐ Tannic ☐ Other: ______

Water Surface: ☐ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☒ Foam ○ Greater than 3" high ○ It is pure white ☐ Other: ______

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☒ Fishy ☐ Chlorine ☐ Other: ______

Trash: ☐ None ☐ Yes, I did a cleanup ☒ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.343282 (DD.DDDD°) Longitude (-) 85.110062 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 320

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 12 ft (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4' 8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Shannon Water intake on Woodward Creek

This site is located at the Shannon Water intake for the water supply facility run by Floyd County Water Department. Floyd County purchased Shannon Water Treatment Plant on Woodward Creek in 2004 from Galey and Lord, a textile manufacturing company. The county now uses the creek as a public drinking water source for the unincorporated community of Shannon.

Bank condition was good and the area above and below the water intake is forested. The water is somewhat cloudy here. The public has limited access to this site because it is at the end of a gravel service road, although hunters do use the area. There was no trash. The visual survey data sheet with field observations follows.

5. Shannon water intake

6. Shannon water intake looking upstream

7. Shannon Water intake right bank

8. Shannon Water intake looking downstream

9. Shannon water intake left bank

✓ created site on AAS Oct 30, 2018

at Shannon water intake

ref: maple tree on same bank as water intake structure

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: THE LOGTHART CLAN Event Date: 10/25/2018 (MMDDYYYY)

Group ID: G-1656 Site ID: S-5218 Time Sample Collected: 10:40 (HHMM am/pm)

Stream Name: Woodward Ck SHANNON WATER INTAKE Time Spent Sampling: 15 (Min)

Monitor(s): Gretchen Logthart, Kevin McAuliff Total Time Spent Traveling *(optional)*: ________ (Min)

Number of Participants: 2 Furthest Distance Traveled *(optional)*: ________ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☒ Low ☐ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☒ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other: ________

Water Color: ☒ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other: ________

Water Surface: ☒ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other: ________

Water Odor: ☒ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other: ________

Trash: ☒ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.

Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.347792 (DD.DDDD°) Longitude (-) 85.098374 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) ________ maple tree on bank

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance ~6 FT (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4'8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Minshew Road Bridge on Woodward Creek

This site is located near the Shannon community and it gets a lot of recreational use. The site is fully wooded both upstream and downstream of bridge. On October 25, 2018, there was trash on the banks and two deer carcasses that had been thrown in the water. The water was somewhat cloudy here. The visual survey data sheet with field observations follows.

10. Minshew Road Bridge looking upstream

11. Minshew Road Bridge right bank

12. Minshew Road Bridge looking downstream

13. Minshew Road Bridge left bank

Created site on AAS Nov 5, 2018
Minshew

ref: pier on E side of bridge
bearing: 300
distance 30 ft

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: The Lugthart Clan — Event Date: 10/25/18 (MMDDYYYY)

Group ID: G-1656 — Site ID: S-5226 — Time Sample Collected: 11:10 (HHMM am/pm)

Stream Name: Woodward Ck Minshew Rd — Time Spent Sampling: 15 (Min)

Monitor(s): Gretchen Lugthart + Kevin McAuliff — Total Time Spent Traveling *(optional)*: ____ (Min)

Number of Participants: 2 — Furthest Distance Traveled *(optional)*: ____ (Miles)

WEATHER

Present conditions (check all that apply)

- [ ] Heavy Rain
- [ ] Steady Rain
- [ ] Intermittent Rain
- [x] Overcast
- [ ] Partly Cloudy
- [ ] Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* [ ] Dry [ ] Stagnant/Still [ ] Low [x] Normal [ ] High [ ] Flood (over banks)

Water Clarity: [ ] Clear/Transparent [x] Cloudy/Somewhat Turbid [ ] Opaque/Turbid [ ] Other: ____

Water Color: [ ] No Color [x] Brown/Muddy [ ] Green [ ] Milky/White [ ] Tannic [ ] Other: ____

Water Surface: [x] Clear [ ] Oily sheen: Does it break when disturbed? Yes/No (circle one) [ ] Algae [ ] Foam ○ Greater than 3" high ○ It is pure white [ ] Other: ____

Water Odor: [ ] Natural/None [ ] Gasoline [ ] Sewage [ ] Rotten Egg [ ] Fishy [ ] Chlorine [x] Other: dead deer

Trash: [ ] None [ ] Yes, I did a cleanup [x] This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.356218 (DD.DDDD°) Longitude (-) 85.094395 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 300

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 30 ft (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4' 8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

2 deer carcasses downstream of bridge
good stand of water willow
kid weir still there for swimming hole
Photo taken of Deer + Sent to Chris Cleary

Photos are upstream of Bridge (North side away from Dead deer)

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Gaines Loop Road Bridge on Woodward Creek

A beaver dam was impeding the flow just downstream below the bridge. This caused a pool of slack water at the site where the photos were taken. The water was somewhat cloudy here. The land on the right bank is grassed and flat and looks like a beaver meadow. The visual survey data sheet with field observations follows.

14. Gaines Loop Road Bridge looking upstream

15. Gaines Loop Road Bridge right bank

16. Gaines Loop Road Bridge looking downstream

17. Gaines Loop Road Bridge left bank

Entered on Nov 5, 2018
SITE into AAS

Gaines Loop

opposite bank of road

marker = box elder
180 = bearing

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: The Logthart Clan	Event Date: 10/25/18 (MMDDYYYY)
Group ID: G-1656 Site ID: S-5227	Time Sample Collected: 11:30 (HHMM am/pm)
Stream Name: Woodward Gaines Loop	Time Spent Sampling: 20 (Min)
Monitor(s): Gretchen Logthart + Kevin McAuliff	Total Time Spent Traveling *(optional)*: ______ (Min)
Number of Participants: 2	Furthest Distance Traveled *(optional)*: ______ (Miles)

WEATHER

Present conditions (check all that apply)

- ☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
- ☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☒ Stagnant/Still ☐ Low ☐ Normal ☒ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☒ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:______

Water Color: ☐ No Color ☒ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:______

Water Surface: ☒ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other:______

Water Odor: ☒ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:______

Trash: ☒ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.
Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.364500 (DD.DDDD°) Longitude (-) 85.072076 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 180

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 6 (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4' 8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Beaver dam has it backed up. There is a beaver meadow of long standing

Dam is above Minshew Road Bridge (other small bridge is over a creek.)
Photo point is downstream of Bridge.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Plainville Road Bridge on Woodward Creek

The land on either side at this site is grassy fields, but no cows were observed on this day. The water was clear here. There are scattered houses and a veterinarian clinic nearby. The visual survey data sheet with field observations follows.

18. Plainville Road Bridge looking upstream

19. Plainville Road Bridge right bank

20.Plainville Road Bridge looking downstream

21. Plainville Road Bridge left bank

Created this site on AAS Nov 5, 2018

Plainville Rd

downstream privet
215
20ft

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: THE LUGTHART CLAN — Event Date: 10/25/18 (MMDDYYYY)

Group ID: G-1656 Site ID: S-5228 — Time Sample Collected: 12:20 (HHMM am/pm)

Stream Name: Woodward Plainville Rd — Time Spent Sampling: 25 (Min) (walking to creek)

Monitor(s): Gretchen — Total Time Spent Traveling *(optional)*: ____ (Min)

Number of Participants: 2 — Furthest Distance Traveled *(optional)*: ____ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☒ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☒ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:____

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☒ Tannic ☐ Other:____

Water Surface: ☒ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ◯ Greater than 3" high ◯ It is pure white ☐ Other:____

Water Odor: ☒ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other:____

Trash: ☒ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.

Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.377918 (DD.DDDD°) Longitude (-) 85. ____ (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 215

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 20 ft (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4'8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

Autry Road Bridge on Woodward Creek.

This crossing is in the upper part of the watershed. The stream was dry above the bridge except for the area directly under the bridge structure (see Figure 21). Downstream of the bridge, there was standing water. The water is very clear here. There is a spring downstream of the bridge on the left side. The visual survey data sheet with field observations follows.

22. Autry Road Bridge looking upstream-stream is dry

23. Autry Road Bridge right bank

24. Autry Road Bridge looking downstream of site

25. Autry Road Bridge left bank

Created in AAS on Nov 5, 2018

Autry Rd

dry upstream, dug out on downstream side bridge sign bearing 20°

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: THE LUGTHART CLAN
Event Date: 10/25/18 (MMDDYYYY)
Group ID: G-1656 Site ID: S-5229
Time Sample Collected: 12:45 (HHMM am/pm)
Stream Name: Woodward
Time Spent Sampling: 15 (Min)
Monitor(s): Gretchen
Total Time Spent Traveling *(optional)*: ________ (Min)
Number of Participants: 2
Furthest Distance Traveled *(optional)*: ________ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0
In Last Hours/Days: 24 hrs

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☒ Dry ☒ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☒ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:________

Water Color: ☒ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:________

Water Surface: ☒ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ◯ Greater than 3" high ◯ It is pure white ☐ Other:________

Water Odor: ☒ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:________

Trash: ☒ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.3796 (DD.DDDD°) Longitude (-) 85.2099 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 20 ↳ From AAS map when site was created on AAS website

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance ~ 8 (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4'8" (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

THE sampling site would be Downstream of Bridge, although the photo point was upstream of Bridge

Please submit data to our online database at www.GeorgiaAdoptAStream.org

24

Big Oak Tree Road Bridge tributary to Woodward Creek

This tributary was dry in October 2018 when we visited the site. The landowner came down from his house to talk to us and explained that the stream was dry except for storm events because an upstream landowner built a pond across the creek several years ago. There is grass in the streambed now. We decided not to use this site as a sampling site since it is dry.

26. Big Oak Tree Road Bridge tributary to Woodward- stream is dry site created in AAS Nov 5, 2018

TRIBUTARY STREAM CROSSES Big Oak Tree Rod off of SR 140

STREAM CR 13

high elevation

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: THE LUETHART CLAN — Event Date: 10/25/18 (MMDDYYYY)

Group ID: G-1656 Site ID: S-5230 — Time Sample Collected: 1:15 (HHMM am/pm)

Stream Name: Woodward Trib. — Time Spent Sampling: 25 (Min)

Monitor(s): Gretchen + Kevin McNulty — Total Time Spent Traveling *(optional)*: ________ (Min)

Number of Participants: 2 — Furthest Distance Traveled *(optional)*: ________ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☒ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 24 HRS

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☒ Dry ☐ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☐ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:________

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:________

Water Surface: ☐ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ◯ Greater than 3" high ◯ It is pure white ☐ Other:________

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other:________

Trash: ☒ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data. 1 photo taken upstream view

Reference Location (RL): Latitude (+)________ (DD.DDDD°) Longitude (-)________ (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°)________

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance ________ (ft/in)

Camera height at permanent Photo Point location (PPL): Height 4' 8" (ft/in)

COMMENTS

☒ ***Any changes since you last sampled at this site? If yes, please describe.***

Ball player built lake upstream and it dried up what was a perennial stream. Will flood in a severe storm.

pond 15 yrs ago.

photo of upstream pond taken

Grizzle was last name of lady

Please submit data to our online database at www.GeorgiaAdoptAStream.org

84 Big Oak Tree Rd

Buttrum Road Bridge tributary to Woodward Creek

This tributary was chosen as an alternate for sampling because the other tributary was dry in October. These photos were taken January 10, 2019 when the stream was sampled for fecal coliform and chemical parameters. The landscape is a mix of forest and open fields. The flow was good here probably because of recent rainfall. . The water was somewhat cloudy here, possibly also because of the rain. There was a lot of trash, part of which we picked up. The chemical/bacterial data sheet with the same field observations as the visual survey form follows.

27. Buttrum Road Bridge tributary looking upstream

28. Buttrum Road Bridge tributary right bank

29. Buttrum Road Bridge tributary looking downstream

30. Buttrum Road tributary left bank

Entered Jan 15, 2019

Figure 3. Georgia Adopt-A-Stream: Chemical/Bacterial Form

GEORGIA ADOPT-A-STREAM: Chemical/Bacterial Form

To be conducted every month

SITE INFORMATION

Group Name: [illegible] Event Date: 1-10-19 (MMDDYYYY)

Group ID: G-1656 Site ID: S-5283 Time Sample Collected: 11:43 AM (HHMM am/pm) 12:18

Stream Name: Buttram Rd Time Spent Sampling: 30 (Min)

Monitor(s): [illegible] + Emily Luethart Total Time Spent Traveling *(optional)*: ____ (Min)

Number of Participants: 2 Furthest Distance Traveled *(optional)*: ____ (Miles)

WEATHER

Present conditions (check all that apply)
☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☒ Clear/Sunny

Amount of rain, if known?
Amount in Inches: 0
In Last Hours/Days: 24
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: (check all that apply) ☐ Dry ☐ Stagnant/Still ☐ Low ☒ Normal ☐ High ☐ Flow (over banks)

Water Clarity: ☐ Clear/Transparent ☒ Cloudy/Somewhat Turbid ☐ Opaque/Turbid * only a little

Water Color: ☒ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other: ____

Water Surface: ☒ Clear ☐ Oily Sheen: does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ◯ Greater than 3" high ◯ It is white

Water Odor: ☒ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other: ____

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Send photo to AAS@gaepd.org.

Trash: ☐ None ☒ Yes, I did a cleanup ☐ This site needs an organized cleanup

CHEMICAL

Conductivity Meter Calibration (within 24hrs of sampling)

Date 1-10-19 Time 7:40 Standard Value 84 Initial Meter Reading 90 Meter Adjusted to ——

Reagents: Are any reagents expired? ☐ Yes ☒ No List any expired: ____

Core Tests	Test 1	Test 2	Units	Other Tests	Test 1	Test 2	Units
Air Temp	4.5		°C	Secchi Depth(+/- 10)			cm
Water Temp	11.8		°C	Chlorophyll a			ug/L
pH (+/-0.25)	7	7	Standard unit	Salinity (+/- 1)			ppt
Dissolved Oxygen (+/-0.6)	9.3		mg/L or ppm				
Conductivity	140		uS/cm				

BACTERIAL

3M Petrifilm Method: *Escherichia coli*
Run three (3) plates/tests for each site, plus one (1) blank plate. Process within 6-24hrs, incubate at 35°C ±1° and read at 24 ± 1 hr

Plate	Colonies	Find AVG of Number of Colonies (total # colonies/total # of plates (do not include blank))	cfu/100mL
Blank	0	(0 / 3) x 100 =	0
1	0		
2	0	Sample Holding Time (HH): ____	
3	0	Date START(MMDDYYYY): 1-10-19	Date END (MMDDYYYY): 1-11-19
Total # Colonies	0	Time START (HHMM): 3:33pm	Time END (HHMM): 3:06 pm
		MIN Temp (°C): 35	MAX Temp (°C): 35.4

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

photo point
180° strait off bridge abuttment facing downstream

Please submit data to our online database at AdoptAStream.Georgia.gov

I forgot to write in the second test for DO. I preformed it but did not write it in. It was in range of ±0.6.

Photo point = 180°
Distance to permanent Photo Point from Reference location = ~6 Feet
Camera Height 4'8"

Latitude = +34.3677
Long = -85.0140
) From AAS site map when I registered

7

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Appendix C- Tables of Georgia EPD and NWGRC water quality data

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Georgia EPD water quality data from years 2001-2018 at various sites, noted at top of each table.

Georgia EPD Bell's Ferry Road Crossing Data									
	February/March 2001					May/June 2001			
Date	27-Feb	12-Mar	15-Mar	19-Mar		24-May	4-Jun	13-Jun	19-Jun
Fecal coliform cfu/100 ml	2400	490	22000	70		3500	700	170	490
	fecal coliform geometric mean:1160					fecal coliform geometric mean: 672			
pH	-	8	-	8		8.1	7.7	7.3	8
Conductivity µs/cm	132	185	98	140		235	167	219	232
Water temp °C	10.9	12	11.4	11		18	18.9	20.8	24.2
Air temp °C	10	14.3	11	14.5		19.8	22.3	21.5	32.6
Dissolved Oxygen mg/L	9.9	9.8	9.7	10.6		8.2	8.1	6.8	8.7

Georgia EPD Bell's Ferry Road Crossing Data									
	July/August 2001					October 2001			
Date	30-Jul	7-Aug	14-Aug	21-Aug		3-Oct	11-Oct	25-Oct	31-Oct
Fecal coliform cfu/100 ml	24000	20	210	80		790	490	40	50
	fecal coliform geometric mean:300					fecal coliform geometric mean:166.8			
pH	8	7.8	7.8	8.1		7.9	7.8	7.6	8.5
Conductivity µs/cm	250	248	232	253		257	243	260	223
Water temp °C	26	24.6	23.5	22.7		13.7	15.7	15.3	10.9
Air temp °C	26.5	27.8	25.6	28.9		8.5	16.4	8.5	24.6
Dissolved Oxygen mg/L	6	6.1	6.3	6.4		7.9	7.5	6.8	10.3

Georgia EPD Bell's Ferry Road Crossing Data										
	July/August 2005						September/October 2005			
Date	15-Jun	20-Jul	27-Jul	3-Aug	10-Aug		13-Sep	20-Sep	27-Sep	4-Oct
Fecal coliform cfu/100 ml	2400	170	270	300	230		300	170	500	170
	(one sample)	fecal coliform geometric mean:237.2					fecal coliform geometric mean:256.6			
pH	-	7.82	7.85	7.88	7.66		8.14	8.05	7.84	8.02
Conductivity µs/cm	-	212	240	236	201		257	259	258	262
Water temp °C	-	23.23	24.77	22.41	22.74		22.01	21.16	22.25	20.96
Air temp °C	-	25.1	26.7	21.3	23.4		29.5	27.9	24	27.1
Dissolved Oxygen mg/L	-	9.77	6.85	7.39	7.05		8.71	8.33	7.24	8.14

Georgia EPD Gaines Loop Road Crossing Data									
	January/February 2018					May/June 2018			
Date	24-Jan	29-Jan	6-Feb	14-Feb		9-May	31-May	4-Jun	7-Jun
Fecal coliform cfu/100 ml	550	300	400	220		270	300	700	230
	fecal coliform geometric mean:339					fecal coliform geometric mean:338			
pH	7.72	7.46	6.82	7.28		7.51	7.2	7.34	7.49
Conductivity µs/cm	251.4	256.1	178.8	119.1		226.5	141.4	156.6	192
Water temp °C	6.85	9.13	7.44	11.45		18.38	19.98	19.18	19.35
Air temp °C	8	9	5	9		24	24	25	28
Dissolved Oxygen mg/L	11.68	9.93	10.71	9.92		7.89	7.5	7.9	7.9

The following tables have Woodward Creek Sampling Data 2019 collected by Northwest Georgia Regional Commission for seven sites.

NWGRC Bell's Ferry Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml	111	200	-	-	1137	-	218
E.coli cfu100 ml	100	233	-	1566	600	-	100
pH	7	7		7	7		7
Conductivity µs/cm	160	220	-	280	220	-	260
Water temp °C	12.3	11.6		22.8	23.8	--	6.9
Air temp °C	11.5	5	-	21.7	23	-	3.5
Dissolved Oxygen mg/L	8.9	9	-	-	5.7	-	9.7
Macroinvertebrate Water Quality Index	-	-	32	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	58	-

NWGRC Shannon Water intake Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml			-	-		470	102
E.coli cfu100 ml	100	100	-	366	300	-	33
pH	7.25	7		7	7		7
Conductivity µs/cm	160	220	-	270	230	-	260
Water temp °C	12.3	11.7		22.8	23.6		6.9
Air temp °C	12.5	8.5	-	22.7	24	-	8
Dissolved Oxygen mg/L	9.1	9.35	-	-	5.9	-	9.7
Macroinvertebrate Water Quality Index	-	-	30	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	65.5	-

NWGRC Minshew Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml			-	-	420		270
E.coli cfu100 ml	66.7	100	-	300	300	-	200
pH	7	7	-	7	7		7
Conductivity µs/cm	160	220		270	240	-	260
Water temp °C	12.4	12.4		22.6	23.8		7.6
Air temp °C	14.5	15	-	23.2	26	-	12
Dissolved Oxygen mg/L	9.4	9.4	-	-	5.9	-	9.45
Macroinvertebrate Water Quality Index	-	-	24	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	54	-

NWGRC Gaines Loop Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml	128	257	-	-		550*	
E.coli cfu100 ml	100	33		533	200	-	33
pH	7	7	-	7	7		7
Conductivity µs/cm	160	220	-	270	240	-	270
Water temp °C	12.8	12.3	-	21.6	23.3		7.8
Air temp °C	14.5	15.5	-	24	27	-	18
Dissolved Oxygen mg/L	8.8	9.1	-	-	5.45	-	8.65
Macroinvertebrate Water Quality Index	-	-	22	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	65	-

*possible contamination of sample when collected

NWGRC Plainville Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml	-	-0	-	266	200		
E.coli cfu100 ml	33	0	-	266	200		33
pH	7	7		7	7		7
Conductivity µs/cm	140	210	-	260	270	-	260
Water temp °C	13.8	14.5		19.8	21.8		10.5
Air temp °C	16	21	-	24.8	31	-	17
Dissolved Oxygen mg/L	8.8	9.6	-	-	6.85	-	8.7
Macroinverteb rate Water Quality Index	-	-	24	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	44	-

NWGRC Autry Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml	-	-	-	-	-	-	-
E.coli cfu100 ml	0	0	-	33	100	-	0
pH	6.5	6.5		7	7		7
Conductivity µs/cm	60	60	-	260	280	-	280
Water temp °C	13.7	14.6		17.3	16.7		14.9
Air temp °C	17	23.5	-	24.9	26.5	-	17
Dissolved Oxygen mg/L	9.15	8.6	-	-	6.55	-	5.3
Macroinverteb rate Water Quality Index	-	-	25	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	54	-

NWGRC Buttrum Rd Tributary Crossing Water Quality and Habitat data							
Date	1-10-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19
Fecal coliform cfu/100 ml	-	--	-	-	-	-	-
E.coli cfu100 ml	0	33	-	33	33	-	133
pH	7	7		7	7	-	7
Conductivity µs/cm	140	190	-	230	240	-	220
Water temp °C	11.8	15.6		16.7	19.2	-	11.3
Air temp °C	4.5	23	-	25.1	31	-	17
Dissolved Oxygen mg/L	9.3*-	9.05	-	-	6.55	-	5.3
Macroinvertebrate Water Quality Index	-	-	17	-	-	-	-
Stream Habitat Survey value	-	-	-	-	-	57	-

*one value only for dissolved oxygen on this date

Appendix D Advisory Committee Documents

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Woodward Creek Management Plan Development/Lower Oostanaula Watershed Outreach
Advisory Committee Meeting Friday, January 25, 2019, 12 PM

Rome/Floyd ECO Center, 393 Riverside Parkway NE
Rome, GA 30161

Agenda

1. Staff/Stakeholder introductions
2. Woodward Creek Watershed Condition Presentation
3. Lunch
4. Effort Allocation Survey
5. Discussion of current issues, ongoing efforts, potential projects and partnerships

Adjourn

ADVISORY COMMITTEE MEETING WOODWARD CREEK WATERSHED MANAGEMENT PLAN UPDATE

	NAME	PHONE (HOME)	PHONE (CELL)	EMAIL
1	Katie Hammond		706-512-6810	khammond@uga.edu
2	Cathy Borer		706-346-2195	cborer@berry.edu
3	John Boyd		706-252-5176	jboyd@romega.us
4	Dave Davis		762-235-4179	davisd@floydcountyga.org
5	Chris Cleary		770 548 5280	clearyc@floydcountyga.org
6	Gretchen Lugthart			
7	Salaughn Irons			
8	Jason Hosford		706-844-2210	jhosford@romega.us
9	Mike Hackett		(706) 346-3090	mhackett@romega.us
10	John Boyd (C.O.R.)			
11	Jesse Demonbreun-Chapman		678.978.4665	jesse@coosa.org
12	Ashley Rey		423-635-1004	aray@coosa.org
13	Corey Babb		404-276-5945	cdbabb@southernco.com
14	K McAuliff		706 272-2300	kmcauliff@nwgrc.org
15	Julianne Meadows		(706) 295-6485	jmeadows@nwgrc.org

ORGANIZATION	TIME	EVENT DATE	LOCATION
Northwest Georgia Regional Commission	12 pm	January 25, 2019	Rome/Floyd ECO Center, 393 Riverside Parkway NE, Rome, GA 30161

Woodward Creek Management Plan Development/Lower Oostanaula Watershed Outreach
Advisory Committee Meeting Friday, January 25, 2019, 12 PM

Rome/Floyd ECO Center, 393 Riverside Parkway NE
Rome, GA 30161

Minutes

The meeting opened with introductions of all present. See attached attendance sheet. Gretchen Lugthart presented a PowerPoint on the current condition of Woodward Creek, with photos and data from NWGRC's sampling in 2018-2019, maps of land use, riparian buffers, and structures in the watershed. Also included was EPD data collected for Woodward Creek. Then she passed out an Effort Allocation Survey to the committee to get them to comment on which types of work in the watershed might be most effective (see attached). While the group ate lunch, there was an open discussion of the survey questions, ideas about where problems in the watershed may be, and outreach in the overall Lower Oostanaula Watershed in which Woodward Creek is located. Additional materials on riparian management and green infrastructure were made available. The meeting adjourned at 1:15 pm.

Recorded by Gretchen Lugthart on January 28, 2019

Survey Tally: results

Woodward Creek Management Plan Development/Lower Oostanaula Watershed Outreach – 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 projects verses septic system projects in the Woodward Creek Watershed? Please circle an answer, or fill in your own below.

   Agricultural : Septic
   Tally:

   a. 60:40 1+1+1+1=4

   b. 50:50 1+1+1+1=4

   c. 40:60 1

   d. other____70:30_

Comments:

1. May depend on the watershed land use (50:50)

2.Maybe even more on the Ag/buffer side. Data seem to indicate problem is pasture runoff. Fecal source tracking could identify where the bacteria is coming from but it's pretty pricey.

3. approaching septic systems may be "easier" than approach the ag community; potential for faster results

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

   ______________Fecal Coliform
   Tally:1+1+1+1+1+1+1+1=8

   _____________________Sediment
   1+1=2

Comments:

1. It's likely that sediment BMP and riparian buffer restoration will also solve some FC issues

2. They go hand in hand

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

_____Individual Septic System Fixes Three people ranked this as #1 in importance, four people ranked this as #2, one person ranked it as #3.
(3 1 +1+1+2+2+2+3+2)

_____Pump-out assistance (maintaining functioning systems) Two people ranked this as #1 in importance, four people ranked this as #2, two people ranked it as #3.
(2 +2+2+1+1+3+2+3)

_____Educational Materials Three people ranked this as #1 in importance, five people ranked this as #3
(3 +3+3+3 +3+1+1+1)

___1__Other=Replace with maintained county/city septic service lines

The "winner" is Individual septic system fixes with the highest rankings

Comments:

4. Please identify priority areas within the watershed. For example, potential priority areas in the watershed include: lower watershed in the experiment station area just before Woodward Creek runs into the Oostanaula River; area around Shannon and the water intake; headwater area across SR 140. Are there other specific areas would you like to see discussed?

1.Not enough info to determine
2.The intake area
3. Balta [?] cattle, trash removal
4. between sampling points: Plainville -Gaines (based on your data)
One person ranked the areas mentioned in the question: 1. Lower watershed in experiment station area, 2.area around Shannon 3. Headwater area across SR140
Other Comments:
Around Shannon and pasture land through the center of watershed are most likely culprits for FC issues

Buffers on both sides of at least 25 ft

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

_______Stream Cleanups Three people ranked this as #1 in importance, three people ranked this as #2, two people ranked it as #3
(1 +2+3+1+1+3+2+2)

_______Adopt-A-Stream Program Two people ranked this as #1 in importance, one person ranked this as #2, four people ranked it as #3, one person ranked this as #4
(3 +3+2+3+1+1+4+3)

_______ Rain barrel workshop One person ranked this as #1 in importance, One person ranked this as #2, five people ranked it as #4
(4 +4+4+2+4+1+4)

_______Pump-out Workshops Three people ranked this as #1 in importance, two people ranked this as #2, one person ranked it as #3, one person ranked it as #4
(2 +1+1+4+2+3+1)

_______Other=rank #5 outreach to landowner/homeowner,   rank #1=ag BMP

The "winner" is hard to determine because not everyone ranked every item, but stream cleanups and pump-out workshops both got three #1 rankings.

Comments: People love cleanups although I'm not sure there would be much to pick up in the watershed

6. Please check the education activities that you think would improve water stewardship in the Oostanaula River Watershed, with a * by those most likely to be effective.

6 with 1 star-Adopt-A-Stream in the middle school or high school classroom (1+1+1+1+1+1*+1)

6 with 2 stars-Presentations in local schools/colleges (1+1+1+1*+1*+1)

5 with 2 stars-Training for teachers in Project Wet/Project Wild (1*+1+1+1*+1)

2 with 2 stars-Presentations before city councils/county commission meetings(1*+1*)

3 with 2 stars-Educational booth/table at local festivals/events (1+1*+1*)

4 with 3 stars-Periodic column in local newspaper (1+1*+1*+1*)

1 with a star-Website with literature on water conservation (1*)

5 with 1 star-Educational tours of water treatment facilities (1+1+1+1*+1)

6 with 5 stars-Site visit/tour of model BPM installation (1*+1*+1*+1*+1*+1)

6 with 3 stars-Recreational float trips (1*+1+1*+1+1*+1)

1______Other___AG BMP. Stream buffer education + property owner grants for implementation

Comments:
Consider contacting Taylor Farm/OTR Industries for support as they are located adjacent to Woodward Creek on Minshew Mtn Road