WATERSHED MANAGEMENT PLAN FOR CEDAR & FOLSOM CREEK WATERSHEDS

Prepared for:

Georgia Soil and Water
Conservation Commission

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ACKNOWLEDGMENTS

The Cedar and Folsom Creeks Watershed Management Plan was developed by Nutter & Associates with the assistance and guidance of the Cedar and Folsom Creeks Watershed Advisory Committee (WAC) and Stakeholder Group. The following individuals and organizations contributed their time, knowledge, and energy developing this final plan:

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EXECUTIVE SUMMARY

The watersheds of Cedar and Folsom Creeks have been identified by the Georgia Soil and Water Conservation Commission (GSWCC) as a suitable project area for implementation of a Watershed Management Plan (WMP) because of the environmental conditions and impairments of the watersheds, the number of agricultural producers located within the watersheds, landowner needs, and the current listing status on the GA EPD 305(b)/303(d) integrated report.

The watersheds of Cedar and Folsom Creeks comprise approximately 68,426 combined acres and are located in the northern portion of Wilcox County, Georgia. An approximate 7-mile segment of Cedar Creek and a 9-mile segment of Folsom Creek are listed on the 2012 GA EPD 305(d)/303(d) integrated report for not supporting their designated use for fishing. In 2007, the Georgia Environmental Protection Division (GA EPD) implemented a Total Maximum Daily Load (TMDL) evaluation for both Cedar and Folsom Creeks due to impaired biological communities as a result of sediment loading, which determined the need for a 68.3 percent and 60.2 percent reduction of sediment load in Cedar and Folsom Creeks, respectively.

The objective of the project was to develop and implement a nine-key element WMP using the US Environmental Protection Agency (US EPA) *Handbook for Developing Watershed Plans to Restore and Protect Our Waters.* The plan includes the long-term goal of meeting the recommended sediment load reductions in the TMDL with the intent of delisting Cedar and Folsom Creeks. This WMP was a collaborated effort of the advisory committee, stakeholder group, GSWCC, GA EPD, and Nutter & Associates (NAI). Funding for the WMP was financed through a grant from the US EPA to the GA EPD of the Department of Natural Resources (DNR) under Provisions of the Section 319(h) of the Federal Water Pollution Control Act.

To aid in the development of the WMP, a watershed characterization was conducted that assessed the current conditions of the watershed, established baseline conditions prior to management initiatives, identified pollutant sources, and prioritized areas for best management practices (BMPs) implementation. To assist in calculating pollutant load reductions the Spreadsheet Tool for Estimating Pollutant Load (STEPL) watershed model was used. Based on the results of the watershed characterization and STEPL model calculations, sediment has been identified as the primary pollutant within the Cedar and Folsom Creek watersheds while bacteria (fecal coliform) and nutrients have been identified as secondary pollutants within each watershed. Major sources of pollutants that flow into Cedar and Folsom creeks have been identified as unpaved roads and historic and current agricultural land use associated with stormwater runoff within each watershed.

Current modeled sediment loading within Cedar Creek watershed was approximately 0.33 tons/acre/year. For Folsom Creek, current modeled sediment load was 0.19 tons/acre/year. For the Cedar Creek watershed approximately 4,060 acres of row crops/pasture and 13 miles of unpaved roads have been identified for potential installation of sediment control BMPs. Within the Folsom Creek watershed, approximately 1,030 acres of row crops/pasture and 15 linear miles of unpaved roads have been identified for potential installation of sediment control BMPs. A modeled reduction of sediment loading shows the implementation of BMPs for the Cedar Creek watershed would result in an approximate 70%

reduction in sediment and 69% reduction for the Folsom Creek watershed since GA EPD's TMDL evaluation in 2007.

BMPs should be selected that will reduce sediment loads associated with agricultural land use practices and unpaved roads. In order to achieve the sediment load reductions, a series of agricultural and unpaved road BMPs will be implemented throughout the Cedar and Folsom Creek watersheds.

The WMP has been written to cover a 10-year time period and interim milestones and measures of success of the plan are broken down into three phases: short-term, mid-term, and long-term. To determine if load reductions are being achieved over time and substantial progress is being made towards the ultimate goal of delisting Cedar and Folsom Creeks, alternative success criteria and a long-term monitoring plan has been developed as a means to evaluate the success of the WMP.

1.0 INTRODUCTION

1.1 Location

The watersheds of Cedar and Folsom Creeks comprise approximately 68,426 combined acres and are located in the northern portion of Wilcox County, Georgia (Figure 1). The watersheds are located within the lower Ocmulgee sub-basin (HUC 03070104) of the larger Altamaha basin (Figure 2). A majority of the project area is located within the Atlantic Southern Loam Plains (65l) Level IV Ecoregion of the larger Southeastern Plains (65) Level III Ecoregion (Griffith et al., 2001). The Southeastern Plains are a combination of crop and pastureland with scattered southern mixed forests comprised of oak, hickory, and pine species. Elevations and relief are generally less than a majority of the Piedmont but greater than the mostly flat Southern Coastal Plain (Griffith et al., 2001).

1.2 Project Background

An approximate 7-mile segment of Cedar Creek and a 9-mile segment of Folsom Creek are listed on the 2012 GA EPD 305(d)/303(d) integrated report for not supporting their designated use for fishing (Figure 1). Both segments are listed as biota impacted (fish community) potentially due to nonpoint source (NPS) pollution. A *Total Maximum Daily Load (TMDL) Evaluation for Seventy Stream Segments in the Ocmulgee River Basin For Sediment (Biota Impacted)* was completed in 2007, in which the State of Georgia listed the two stream segments as water quality impaired for fishing due to sedimentation. The GA EPD calculated the sediment load for each watershed using the STEPL model.

Based on sampling and assessments conducted as part of the TMDL evaluation, a 68.3 and 60.2 percent reduction of sediment load was required in Cedar and Folsom Creeks, respectively (US EPA, 2007). Implementation of BMPs and NPDES compliance were recommended in the TMDL evaluation to aid in the improvement of stream water quality and aquatic habitats. Significant sources of sediment identified by the seventy stream TMDL included urban development, unpaved roads, and row crops (US EPA, 2007).

1.3 Project Objectives

The objective of the project is to develop and implement a nine-key element WMP. The nine key elements for watershed planning include:

1. Identification of causes and sources of pollution that need to be controlled;
2. Determine load reductions needed for each pollutant;
3. Develop NPS management measures that will be implemented to achieve reduction goals and critical areas where measures will be needed;
4. Identify technical and financial assistance needed to implement the plan;
5. Develop information/education component that identifies education and/or outreach activities for plan implementation;
6. Schedule for implementing NPS management measures;
7. Develop interim milestones to track implementation of management measures

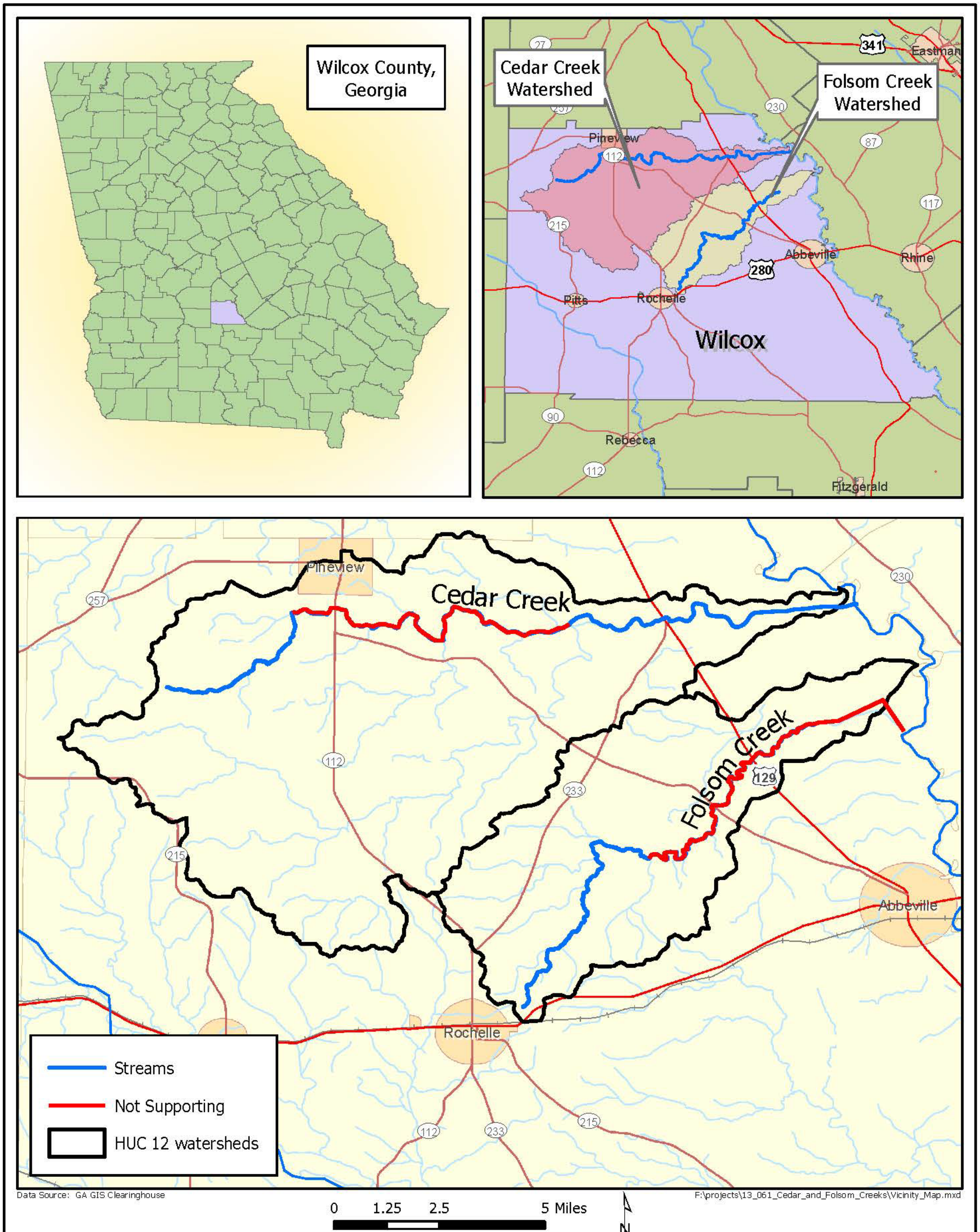

Figure 1. Vicinity Map, Watersheds of Cedar and Folsom Creeks, Wilcox County, Georgia.

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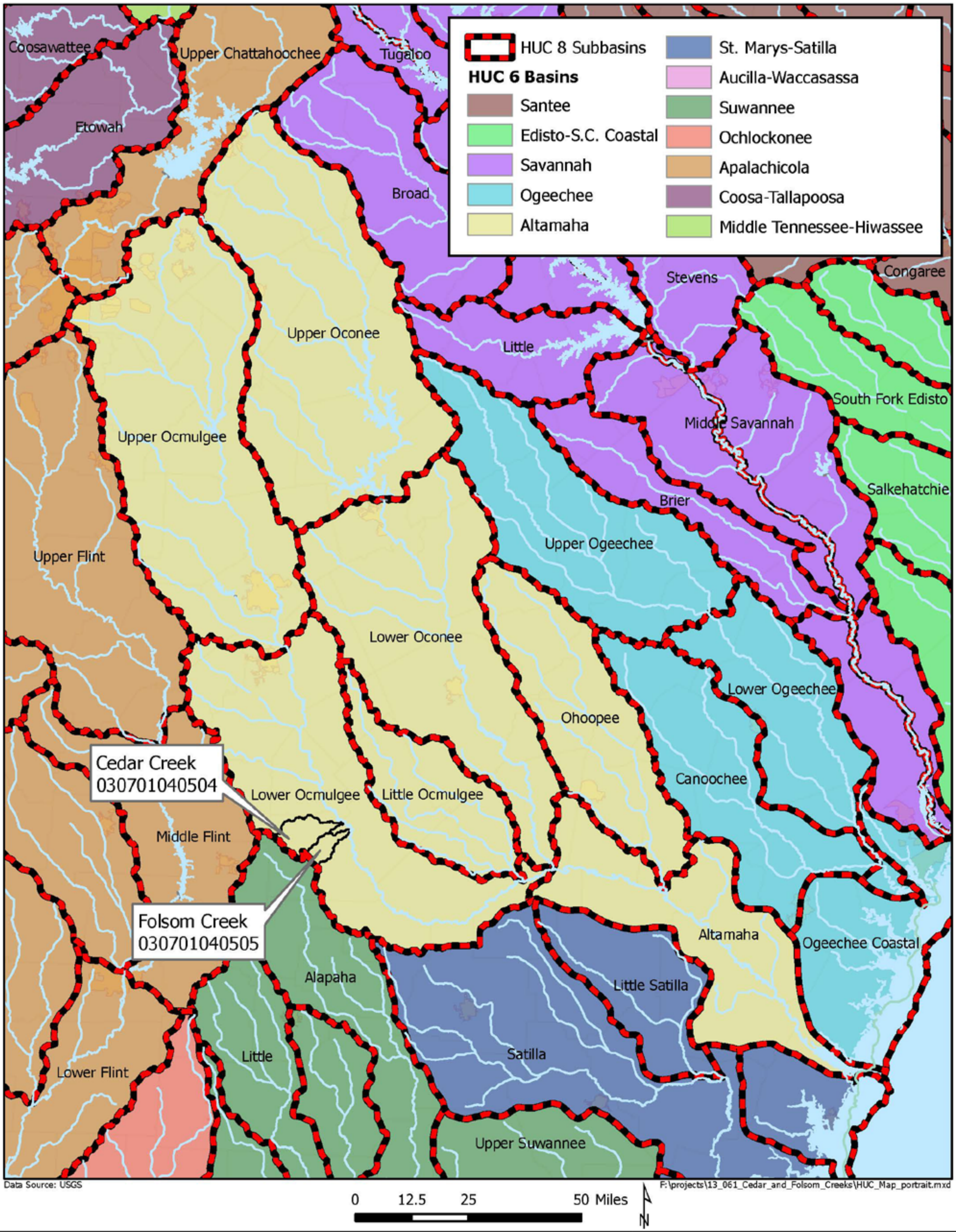

Figure 2. Location of HUC 6 and 8 watershed boundaries.

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8. Set of criteria to determine if load reductions are being met; and
9. Develop a monitoring component to evaluate effectiveness of management measures or BMPs over time.

To aid in the development of the WMP, a watershed characterization was conducted that assessed the current conditions of the watershed, established baseline conditions prior to management initiatives, identified pollutant sources, and prioritized areas for implementation of BMPs. The primary pollutant addressed during the characterization was sediment; secondary pollutants included nutrients and fecal coliform.

To assist in calculating sediment load reductions, the STEPL watershed model was used. The goal of the WMP is to achieve a 35 percent reduction in sediment one year following implementation of management measures in the plan. Based on the TMDL, long-term goals of the WMP include a 68.3 percent reduction in sediment in Cedar Creek and a 60.2 percent reduction in Folsom Creek ultimately leading to the delisting of both streams.

1.4 Community Based Planning

Public involvement is a crucial aspect of the watershed planning process. It allows the citizens that live and work in the Cedar and Folsom watersheds to provide insight and input in the decision making processes that set goals, objectives, and actions for improving water quality in the Cedar and Folsom watersheds. This WMP was a collaboration of the advisory committee, stakeholder group, GSWCC, GA EPD, and NAI. Funding for the WMP was provided by the US EPA to the GA EPD under Provisions of Section 319(h) of the Federal Water Pollution Control Act.

The Cedar and Folsom Creeks watershed advisory committee consisted of representatives from the Georgia Forestry Commission (GFC), University of Georgia Cooperative Extension Service, Heart of Georgia Regional Commission, Natural Resource Conservation Service (NRCS), and US Fish and Wildlife Service (FWS). The advisory committee was responsible for assisting with the development and preparation of the WMP, project promotion, public education and outreach, and reviewing draft and final copies of the WMP.

A stakeholder committee, which included local business and landowners, farmers, forestry and logging industry representatives, and County and regional representatives was formed to assist with the watershed planning process and plan development. Additionally, the committee was responsible for identifying issues or concern within the watersheds and creating a vision for the WMP.

2.0 WATERSHED INVENTORY

2.1 Watershed Characterization

Cedar and Folsom Creek Watersheds are located in Wilcox County within the Ocmulgee River watershed (Figures 1 and 2). A watershed characterization that included a visual assessment, water quality study, and fish community assessment was conducted within Cedar and Folsom Creek watersheds from February through May 2014. Results of the watershed characterization, fish community sampling, and water quality study are detailed in Appendix A.

The watersheds of both creeks exhibit conditions more indicative of wetland or swamp systems. The valleys and surrounding riparian zone of streams and tributaries within each watershed are generally flat and diffuse with very little stream bank or glide pool development. Most streams within the watersheds have multiple, shallow, wide and braided channels. Areas of concentrated flow are typically located downstream of road crossings within each watershed with other areas of the stream distributed over broad, flat valleys with little to no flow or stream-like habitat for aquatic organisms. Additionally and based upon personal communication with members of the stakeholder committee, many of the stream/wetland systems go dry seasonally and/or during periods of low rainfall.

2.1.1 Land Use and Land Cover

Based on 2001 land use, the Cedar Creek watershed was approximately 27 percent forested and 43 percent agriculture (row crops and pasture) while Folsom Creek was approximately 53 percent forested and 23 percent agricultural (US EPA, 2007). In 2011, existing land cover in the two watersheds was predominately agriculture (row crops and pasture) and forested (Figure 3). Approximately 49 percent of the Cedar Creek watershed was forested and 24 percent was row crops and pasture, while 53 percent of the Folsom Creek watershed was forested and 21 percent was row crop and pasture in 2011. Based on the visual assessment and field verification, the land use data presented in Figure 3 is generally accurate and was used for development of the WMP. Over the last decade, Cedar Creek has experienced a decrease in agricultural land use and an increase in forested land cover. Table 1 summarizes the percentages of land use coverages in both watersheds based on data from 2001 and 2011.

2.1.2 Location and Ecoregion

The watersheds are located within the lower Ocmulgee sub-basin (HUC 03070104) of the larger Altamaha basin (Figure 2). A majority of the project area is located within the Atlantic Southern Loam Plains (65l) Level IV Ecoregion of the larger Southeastern Plains (65) Level III Ecoregion (Griffith et al. 2001). The Southeastern Plains are a combination of crop and pastureland with scattered southern mixed forests comprised of oak, hickory, and pine species. Elevations and relief are generally less than a majority of the Piedmont but greater than the mostly flat Southern Coastal Plain (Griffith et al., 2001).

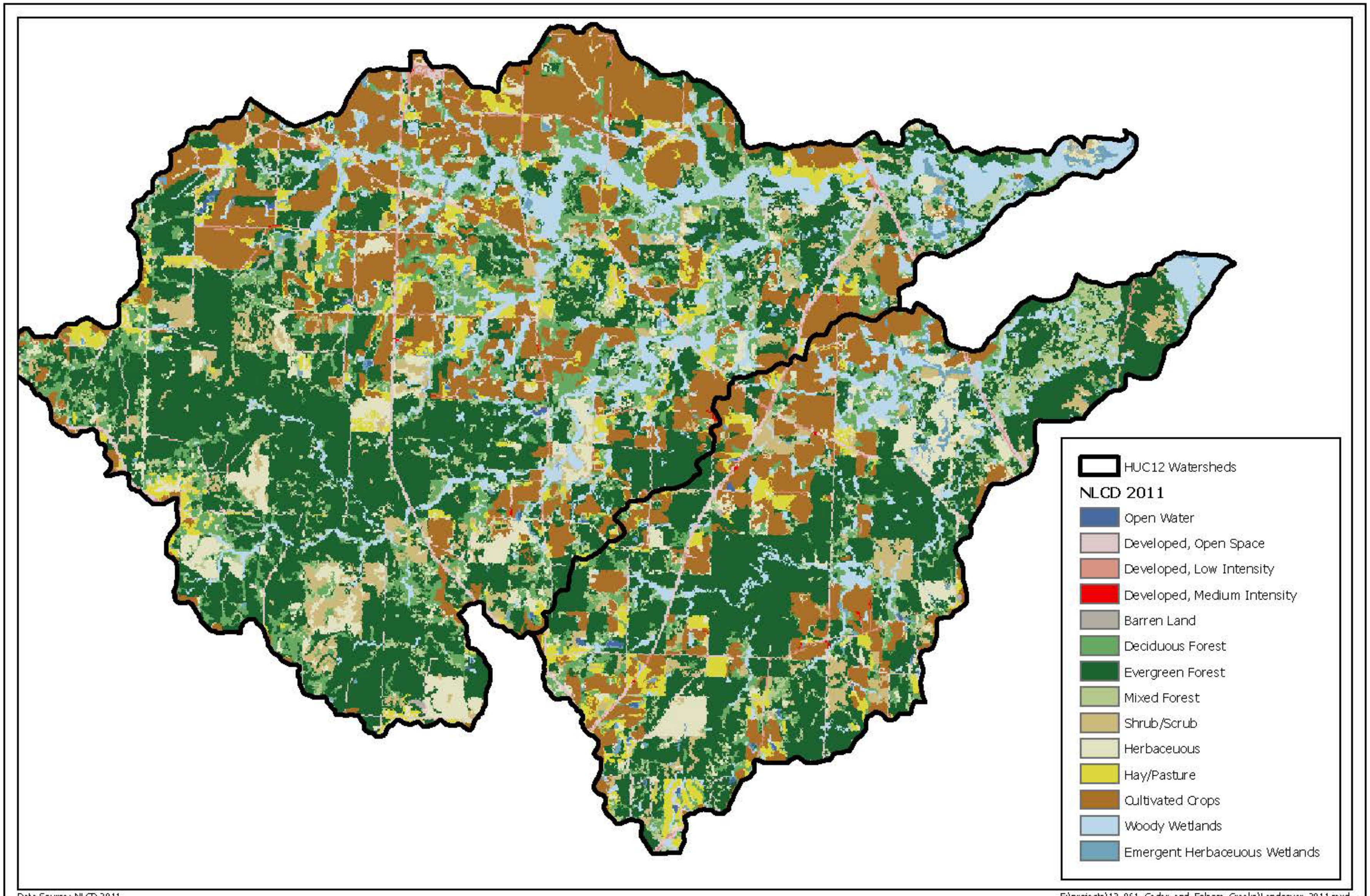

Figure 3. 2011 Landcover classification for the Cedar and Folsom Creek watersheds.

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Table 1. 2001 and 2011 Land cover characteristics of the Cedar and Folsom Creeks Watersheds.

	Folsom Creek		**Cedar Creek**	
	2001	**2011**	**2001**	**2011**
Land cover	Percent			
Beach, Dunes, Mud	0.00	0.00	0.00	0.00
Open Water	0.44	0.29	0.35	0.13
Low Intensity Urban	9.56	4.06	10.45	3.61
High Intensity Urban	0.61	0.07	1.17	0.05
Clearcut/Sparse	7.05	11.62	8.68	11.40
Quarries, Stripmines, Rock	0.19	0.09	0.18	0.08
Deciduous Forest	46.54	6.72	22.28	10.47
Evergreen Forest	5.73	39.96	4.26	33.89
Mixed Forest	0.75	6.17	0.17	5.08
Row Crops & Pasture	22.9	21.15	42.59	23.94
Forested Wetland	5.57	8.63	9.10	10.42
Non-Forested Wetland	0.66	1.24	0.77	0.92
Total	100	100	100	100

The Atlantic Southern Loam Plains Ecoregion, also called the Vidalia Upland in Georgia, is characterized by an abundance of fine-textured Tifton soils supporting a myriad of croplands. Forested areas of the region are located on both sloping or flat, poorly drained landscapes. Vegetation such as longleaf pine and turkey oak forests that are better suited for dry conditions and excessively drained dunal sand ridges are adjacent to the riparian forests that surround many of the major stream and wetland courses within the region.

2.1.3 Water Resources and Hydrology

The watersheds of Cedar and Folsom Creeks are centrally located in the Lower Ocmulgee Basin and just east of the headwaters of the Alapaha River (Figure 2). The predominate water resources in Wilcox County are groundwater and surface water. Generalized areas of significant groundwater recharge in the State of Georgia are mapped in Georgia Geologic Survey Hydrologic Atlas 18. A majority of the Cedar and Folsom Creeks watersheds have been delineated within the Floridan/Jackson aquifer system groundwater recharge area (Figure 4). Groundwater pollution susceptibility for the State of Georgia is presented in the Georgia Geologic Survey Hydrologic Atlas 20. The northern portion of Wilcox County, which contains the Cedar and Folsom watersheds, is mapped as being of high groundwater pollution susceptibility (Trent, 1992).

2.1.4 Geology, Soils, and Topography

Wilcox County is located in the Coastal Plain Province on a divide between the Vidalia Upland district and the Tifton Upland (Clark and Zisa, 1976). The watersheds of Cedar and Folsom Creek are located within the Vidalia Upland, which is characterized by moderately dissected but well developed dendritic drainage patterns. Relief in the district ranges from 100 to 500 feet. Higher elevations around 500 feet occur within the northwestern portion of the district, which drop to around 100 feet in the southeastern portion of the district, indicative of a regional dip.

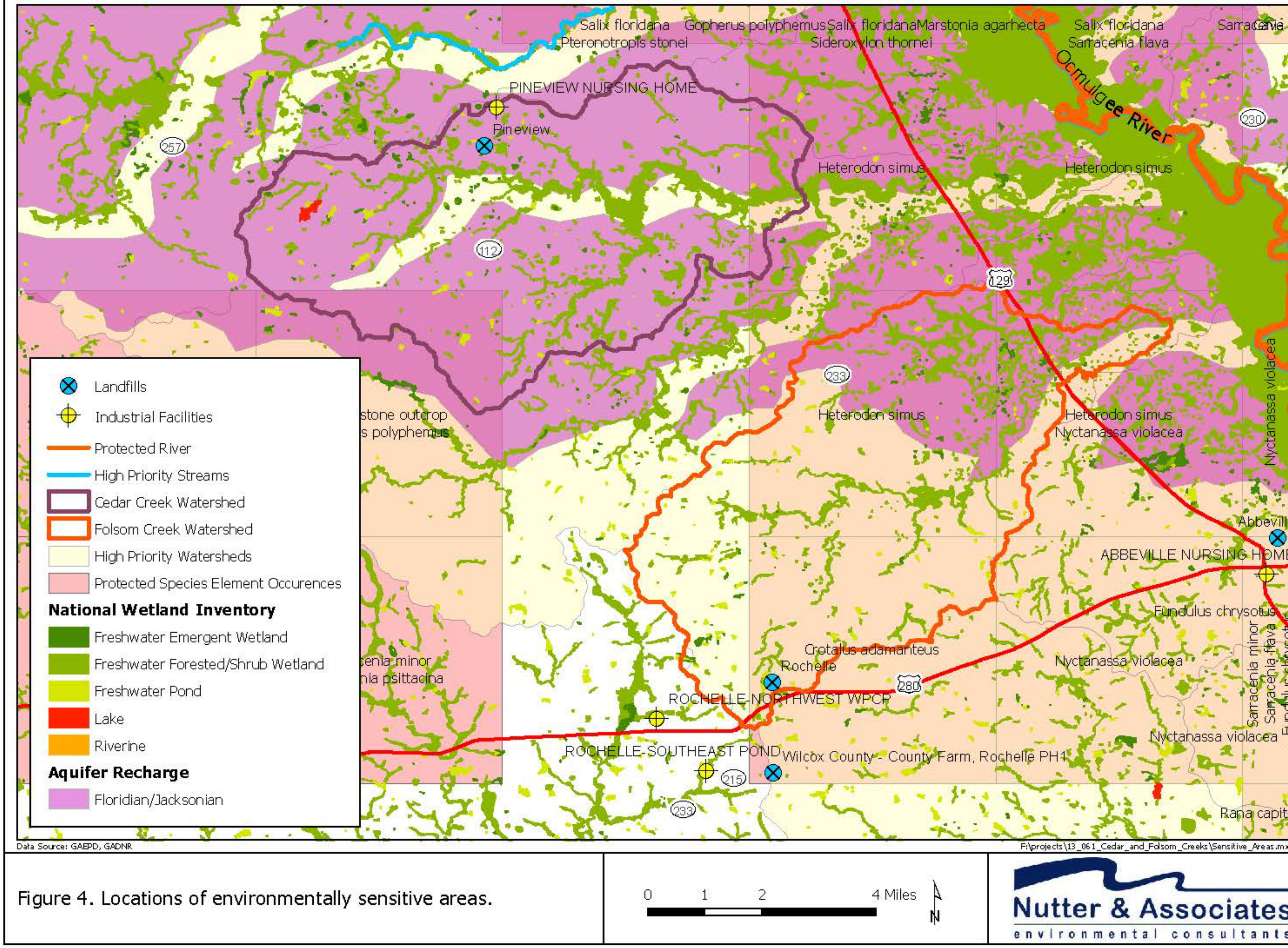

Figure 4. Locations of environmentally sensitive areas.

The southwestern boundary of the district is the base of the Pelham Escarpment and the southern drainage divide of the Alapaha River. The southern boundary follows the Orangeburg Escarpment, which rises above the Barrier Island Sequence District that runs along the coastline.

Based on soil mapping published by the Soil Conservation Service (SCS) for Pulaski and Wilcox Counties (issued 2003), soil series in the vicinity of the watersheds include: Ailey, Bibb, Blanton, Clarendon, Cowarts, Dothan, Faceville, Fuquay, Grady, Greenville, Lakeland, Lucy, Meggett, Nankin, Orangeburg, Osier, Pelham, Rains, Red Bay, Stilson, Susquehanna, Tawcaw, and Tifton soil types (Figure 5).

Most soils in the area have a sandy surface and loamy subsurface layer. Well drained soils are located along smooth, convex slopes on nearly level to gently sloping topography. Poorly drained soils are located along concave slopes adjacent to depressions and drainageways. Floodplain soils in the area are typically poorly drained, located along rivers and creeks, and are loamy throughout the profile. The soils within the County typically formed in parent materials weathered from Eocene to Miocene aged marine sediments consisting of layers of sand, clay, and limestone often with iron-rich or plinthitic layers (Pilkiton, 2003). Soils are considered to be one of the region's most basic and fragile natural resource.

This ecoregion has more rolling, hilly topography than the regions to the northwest and southeast (Griffith et al., 2001). Higher elevations occur in the northwestern portion of the region, which slopes to the southeast where relief diminishes and lower swampy areas become more common towards the Okefenokee Plains district.

2.1.5 Environmentally Sensitive Areas

Environmentally sensitive areas within and surrounding the Cedar and Folsom watersheds include but are not limited to: wetlands, water supplies, groundwater recharge areas, endangered and protected species habitat, and recreational areas (Figure 4). Environmentally sensitive areas within the Cedar and Folsom watersheds include riparian wetlands (freshwater emergent, freshwater forested/shrub, freshwater pond, lake, and riverine) and aquifer recharge areas (Figure 4).

Several protected species element occurrences are located within and surrounding both the Folsom and Cedar Creek watersheds. These include: (1) plant species such as Florida Willow (*Salix floridana*) and Georgia bully (*Sideroxylon thornei*); and (2) protected animal species, such as the lowland shiner (P*teronotropis stonei*), Gopher tortoise (*Gopherus polyphemus*), Ocmulgee marstonia (*Marstonia agarhecta*), southern hog-nosed snake (*Heterodon simus*), yellow crowned night heron (*Nytanassa violacea*), golden topminnow (*Fundulus chrysotus*), and the Eastern Diamondback (*Crotalus adamanteus).*

2.1.6 Potential Water Quality Stressors

Nutter & Associates searched GA DNR, GA EPD and US EPA databases (http://www.epa.gov/enviro/index.html) to identify water intakes, landfills, hazardous waste (CERCLIS) facilities, wastewater treatment plants, land application sites and other regulated

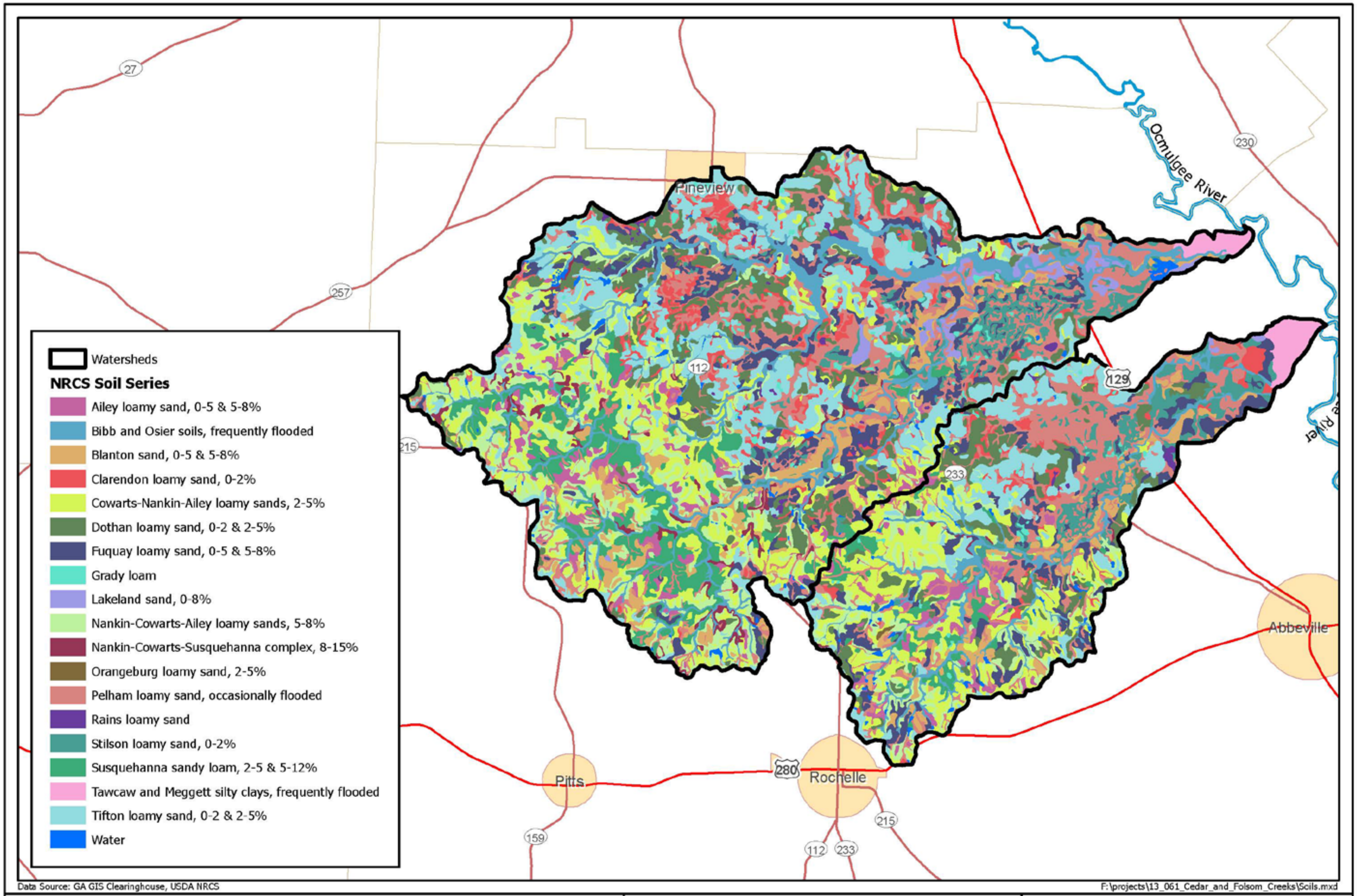

Figure 5. The Soils of Cedar and Folsom Creek Watersheds.

facilities within the Cedar and Folsom watersheds (Figure 4). Land use data were used to identify industrial areas. Locations of potential environmental stressors are identified in Figure 4.

Within the Cedar Creek watershed, one industrial facility (Pineview Nursing Home) and one landfill (City of Pineview) were identified (Figure 4). For the Folsom watershed, the City of Rochelle landfill was identified in the southern-most portion of the watershed (Figure 4). Other landfill facilities located just outside of the Folsom watershed include the Wilcox County and the City of Abbeville. Three additional industrial facilities (Rochelle Northwest Water Pollution Control Plant, Rochelle Southeast Pond, and Abbeville Nursing Home) were also identified just outside of the Folsom watershed (Figure 4).

2.1.7 Historic Water Quality Data

Water quality data was collected by the GA DNR at two stations (CC01 and FC01) in May 2000. One station was located on Cedar Creek just downstream of the Christian Hill Road crossing and the second was located just upstream of the US Highway 129 road crossing on Folsom Creek (Figures 6 through 9). Water quality data was collected at each station on May 3, 2000 and included a fish community assessment, habitat assessment, *in-situ* water quality parameters (temperature, dissolved oxygen, conductivity, pH, turbidity, total hardness, and alkalinity), and a stream reconnaissance (average stream width and depth, calculated sample reach, number of bends and pools, and the deepest pool). A summary of historic water quality data and the location of each water quality station is included in Table 2.

Table 2. Historic water quality data collected on May 3, 2000 for Cedar and Folsom Creeks.

	Station	
	Cedar Creek at Christian Hill Road	**Folsom Creek at US Highway 129**
Latitude (DMS)	83^{o} 28" 31.55" W	83^{o} 21' 37.25" W
Longitude (DMS)	32^{o} 05' 20.04" N	32^{o} 02' 31.88" N
Habitat Score	62.83	67.5
Average Width (m)	2.7	4.3
Average Depth (m)	0.11	0.2
Sample Reach (m)	95	151
Number of Bends	5	6
Number of Pools	0	4
Deepest Pool (m)	0	0.83
Temperature (^{o}C)	22.8	20.4
Dissolved Oxygen (mg/L)	4.6	2.6
Conductivity (µS/cm)	130.3	57.6
pH (S.U.)	6.5	6.0
Turbidity (NTU)	8.9	37.5
Total Hardness (mg/L)	68	20
Alkalinity (mg/L)	60	20

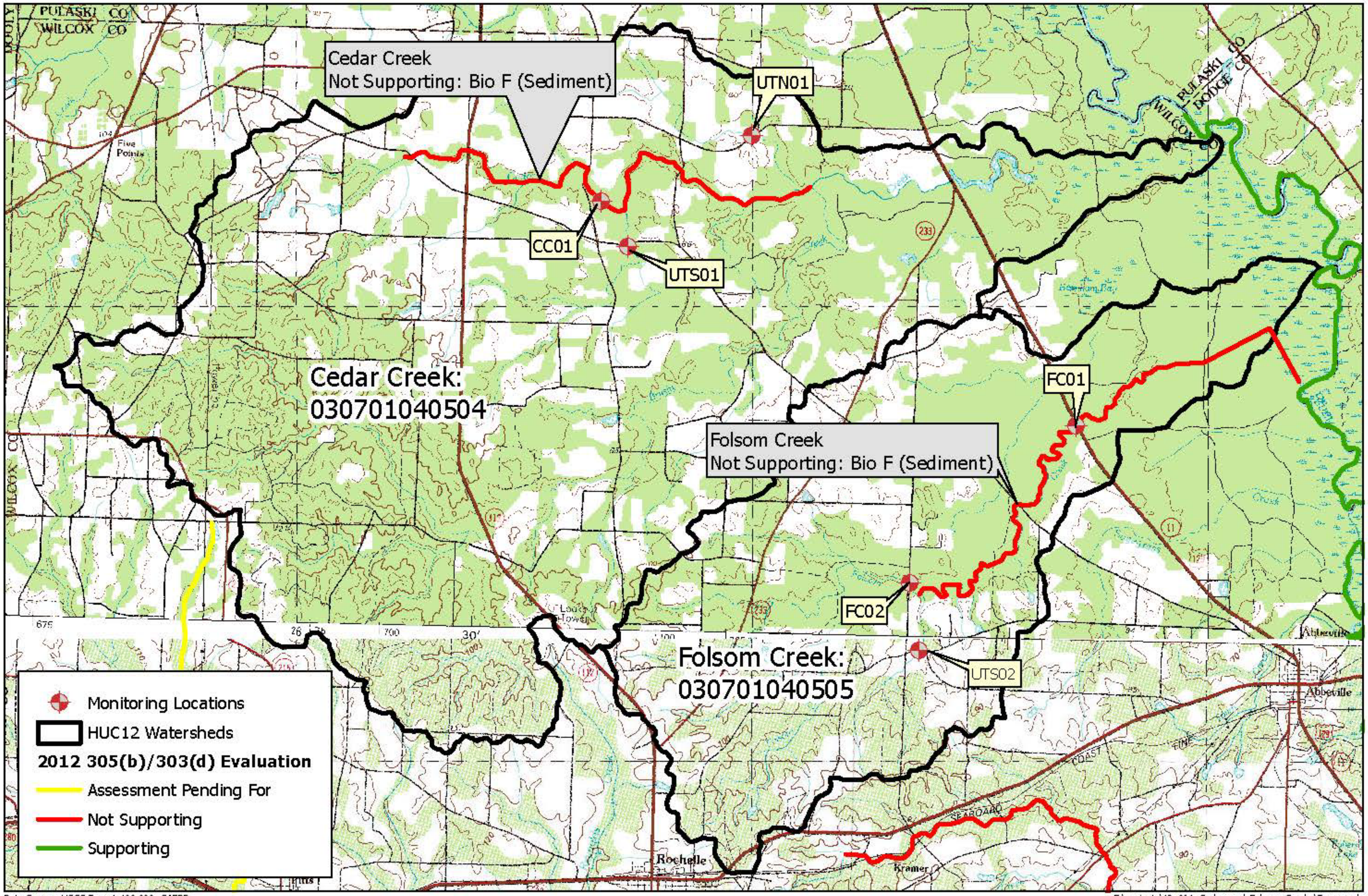

Figure 6. Location of water quality monitoring stations (topo).

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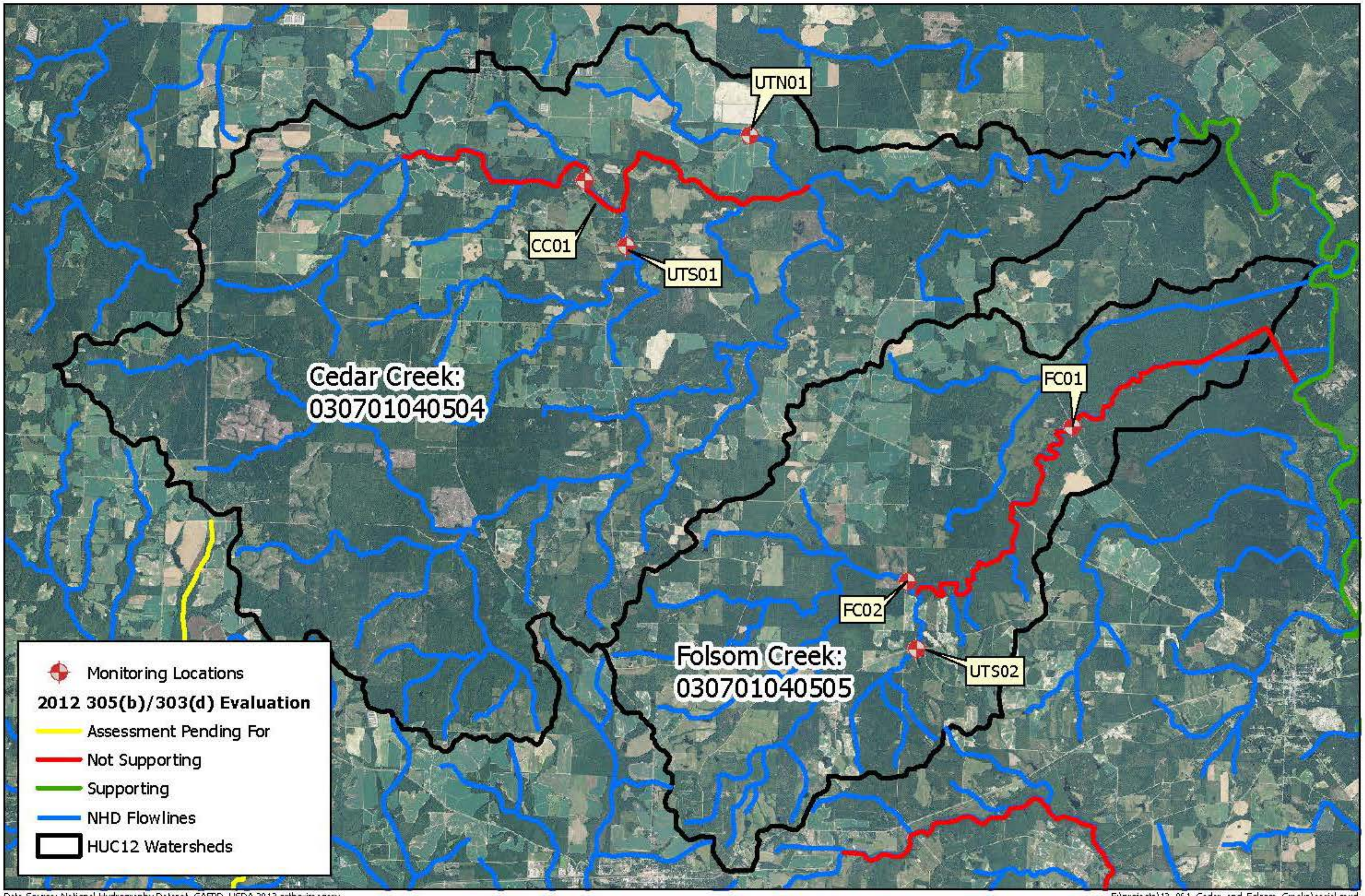
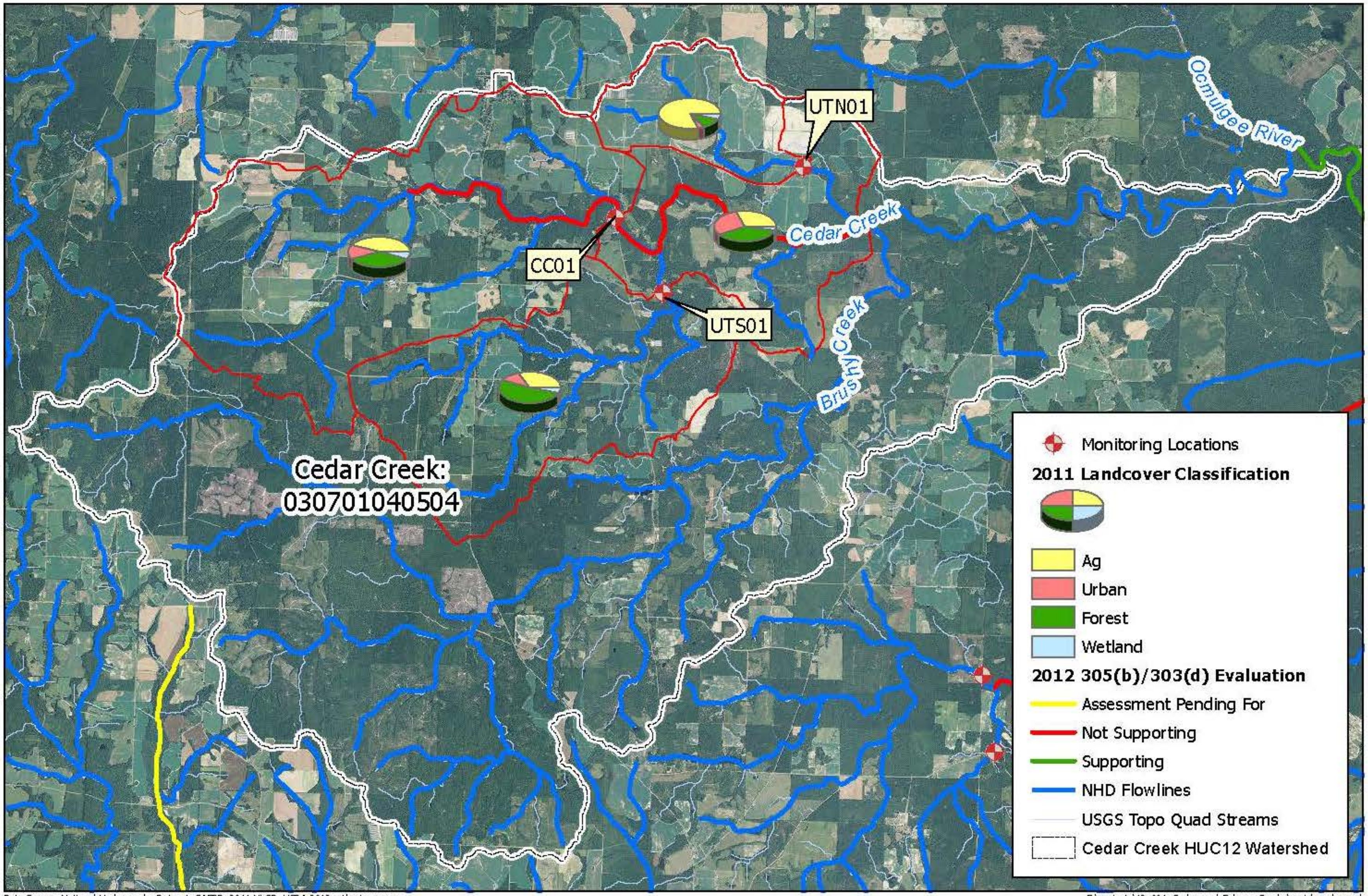


Figure 7. Location of water quality monitoring stations (aerial).



Data Source: National Hydrography Dataset, GAEPD, 2011 NLCD, USDA 2013 ortho-imagery

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Figure 8. Location of water quality monitoring stations, Cedar Creek watershed (aerial).

0 0.75 1.5 3 Miles

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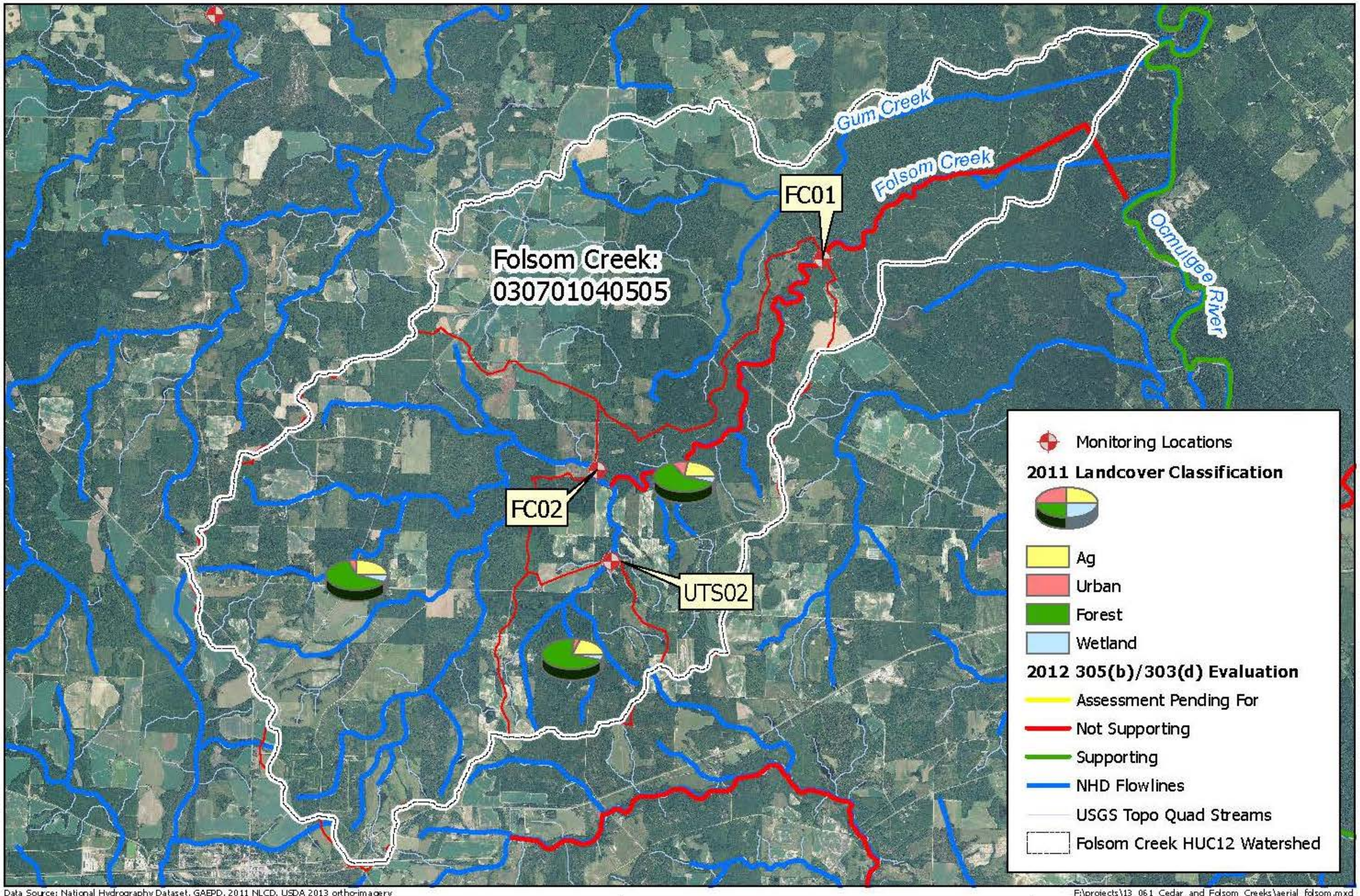

Figure 9. Location of water quality monitoring stations Folsom Creek watershed (aerial).

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2.2 Fish Community and Water Quality Assessment

2.2.1 Monitoring Events

A visual survey and turbidity analysis, water quality assessment, and fish community sampling were conducted within the Cedar and Folsom Creek watersheds. A visual survey that included a watershed reconnaissance and turbidity analysis was completed for each watershed on March 25, 2014. For the water quality and fish community assessment, six water quality monitoring stations were established on the major drainage features within the two watersheds (Figures 6 and 7). Water quality assessments were conducted at each station, while fish community assessments and associated habitat assessments and stream reconnaissance were conducted at only two stations: CC01 and FC01 (Figures 8 and 9). One dry weather and one wet weather water quality event were conducted at each monitoring station between March 25 and May 15, 2014. Fish sampling and associated habitat assessments and stream reconnaissance were conducted at stations CC01 and FC01 on May 8, 2014. GPS coordinates and sampling parameters for each station are provided below.

Monitoring Station ID	Station Type	Latitude	Longitude
		DDM	
CC01	Biological and Water Quality	32.08890	-83.47543
UTN01	Water Quality	32.09848	-83.43716
UTS01	Water Quality	32.07597	-83.46549
FC01	Biological and Water Quality	32.04219	-83.36035
FC02	Water Quality	32.01058	-83.98136
UTS02	Water Quality	31.99730	-83.39546

2.2.2 Results

The results of the visual survey for each watershed, water quality and fish community assessment sampling events are detailed in Appendix A and summarized below. Field data sheets and photographs completed in conjunction with each monitoring event are also included in Appendix A.

- Identified pollutants of concern within the watershed include sediment, nutrients, and bacteria.

- During the assessment, elevated turbidity and total suspended solids (TSS) concentrations were observed for all watersheds during the wet weather event, algal blooms were occurring at several locations throughout the watershed, and runoff and sedimentation resulting from unpaved roads and agricultural activities was observed.

- Highest TSS concentrations and turbidity readings occurred at Stations CC01, UTN01, and UTS02, which are high priority watersheds based on the results of the biological and water quality monitoring.

- Significant sources of pollution within the Cedar and Folsom Creek watersheds appear to be tied to stormwater runoff primarily associated with unpaved roads and historic and contemporary agricultural land use.

2.3 Spreadsheet Tool for Estimating Pollutant Loads (STEPL) Model

TMDL ASSESSMENT AND LOADING

Based on sampling and assessments conducted as part of the TMDL evaluation in 2007, the GA EPD calculated the annual sediment load of Cedar Creek to be approximately 3,446 tons/year and Folsom Creek to be 4,370 tons/year (US EPA, 2007). This resulted in a 68.3 and 60.2 percent reduction of sediment load required in Cedar and Folsom Creeks, respectively, to meet waste load allocations (US EPA, 2007). The total watershed size to compute the loading and reduction for each watershed was 7,521 acres for Cedar Creek and 11,978 acres for Folsom Creek (US EPA, 2007).

2.3.1 STEPL Methods

To assist in calculating current sediment loads and load reductions that would result from the implementation of various BMPs, the STEPL watershed model was used. STEPL can be used to calculate annual sediment loads based on current land uses and management practices using the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The USLE equation quantifies soil erosion as the product of six factors where:

$$A = R*K*L*S*C*P$$

A	=	Sediment load (tons/year)
R	=	Rainfall-runoff erosivity factor
K	=	Soil erodibility factor
L	=	Slope length factor
S	=	Slope steepness factor
C	=	Cover management practices
P	=	Conservation practices.

As presented in the 2007 TMDL (US EPA), the GA EPD calculated the sediment load for each watershed using the STEPL model. Default values for Wilcox County, Georgia were used for inputs of the R, K, L, S, C, and P factors. Rainfall data was collected from the Lewis B. Wilson Climate Station in Macon, Georgia. Because the model was used to calculate sediment load, all agricultural and septic system inputs used to determine the load of other pollutant sources (nitrogen, phosphorus, BOD_5) were not included in the 2007 TMDL. To assist in identifying high priority areas for the 2014 analysis, the watersheds of Cedar and Folsom Creek were divided into sub-watershed units. Four sub-watershed units were used in the Cedar Creek watershed (CC01, UTN01, UTS01, and Lower CC) and three were used within the Folsom Creek watershed (Lower FC, FC02, and UTS02). Figure 10 presents the HUC 12 watershed boundaries for Cedar and Folsom Creeks and the sub-watershed units within each watershed.

STEPL is a customized spreadsheet model that utilizes Microsoft Excel. For the model, a digital elevation model (DEM) from US Department of Agriculture National Elevation Dataset (USDA NED) was used to delineate the watershed boundary for Cedar and Folsom Creek (HUC 12 boundary). Using the DEM, the boundary and acreage of each sub-watershed unit

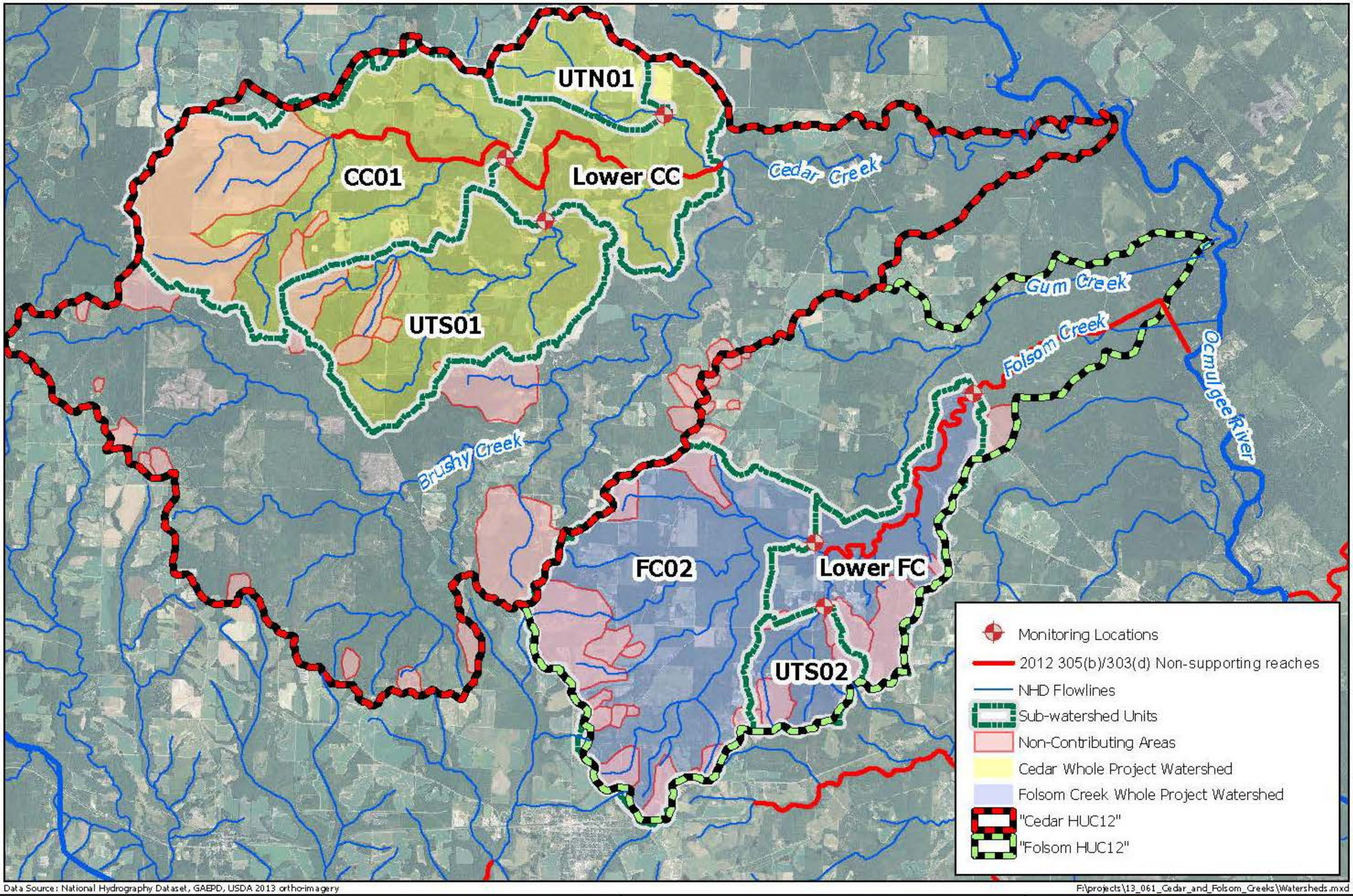

Figure 10. Location of sub-watershed units as used in the STEPL modeling.

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(CC01, UTS01, UTN01, Lower CC, Lower FC, FC02, and UTS02) was calculated and the 2011 National Land Cover Dataset (NLCD) and 2008 Georgia Land Use Trends (GLUT) was collected.

This information was used to determine the land cover composition for each specific watershed. Based on information gathered by the stakeholder group and watershed characterization, it was determined that unpaved or dirt roads contribute a significant portion of sediment to each watershed. Therefore, the Wilcox County Road department road shapefile was used to select dirt roads and the 2013 USDA County aerial was used to verify the accuracy of the shapefile. The following table summarizes the different land cover types used in STEPL.

NLCD Land Cover Types	**STEPL Analysis**
Developed, Open Space; Developed, Low Intensity; Developed, Medium Intensity	Urban
Deciduous Forest; Evergreen Forest; Mixed Forest	Forest
Herbaceuous; Hay/Pasture	Pasture
Cultivated Crops	Cropland
Open Water; Barren Land; Shrub/Scrub; Woody Wetlands; Emergent Herbaceuous Wetlands[1]	Other
Unpaved or Dirt Road	User Defined

1 This land cover was not included in the STEPL analysis.

CURRENT SEDIMENT LOADS

After calculating the acreage of each land cover type for the Cedar and Folsom Creek HUC 12 watersheds and each sub-watershed unit, the STEPL model was used to calculate the sediment load. Certain areas within each watershed were excluded from the model. Ponds act as natural sediment traps and therefore any areas within each watershed located upstream of a pond have been eliminated as potential sources of pollution. The watersheds of both Brushy and Gum Creeks were not included in the model because they are separate watersheds not associated with the listed reaches. These areas (ponds and upstream drainage basin, separate watersheds) are considered non-contributing areas; therefore the acreage of each non-contributing area was excluded from the current sediment load calculation. Areas delineated as non-contributing and the watersheds of Brushy and Gum Creek are shown on Figure 10. There were no identified non-contributing areas located within UTN01 and Lower Cedar Creek sub-watershed units. Results and current modeled sediment loads for each sub-watershed unit are presented in Tables 3 and 4 and are discussed in more detail in Section 4.2 below.

Table 3. Total sediment load for Cedar and Folsom Creek HUC 12 watersheds and each sub-watershed unit.

Outputs	Watersheds										
	HUC 12 Cedar Creek	**Whole Cedar Creek[1]**	**CC01**	**UTN01**	**UTS01**	**Lower Cedar Creek**	**HUC 12 Folsom Creek**	**Whole Folsom Creek[1]**	**Lower Folsom Creek**	**FC02**	**UTS02**
	tons/year										
Urban	253	115	54	11	34	15	107	57	13	37	7
Cropland	3,362	3,014	1563	1,111	732	770	1,548	801	345	554	76
Pastureland	377	191	90	27	97	43	180	124	36	101	11
Forest	125	41	15	2	23	16	76	54	17	39	10
User defined (dirt roads)	1,516	819	358	229	394	151	834	668	195	482	146
Total Sediment Load	**5,633**	**4,180**	**2,080**	**1,380**	**1,280**	**995**	**2,745**	**1,704**	**606**	**1,213**	**250**

Table 4. Total calculated sediment load from the 2007 TMDL compared to the calculated sediment load for the Cedar and Folsom Creeks HUC 12 watersheds and each sub-watershed unit.

Watershed	**Sediment Load**	**Watershed Size[1]**	**Sediment Load**
	tons/year	Acres	tons/acre/year
CC01 (2007)	3,446	7,521	0.46
HUC 12 Cedar Creek	5,633	33,685	0.16
Whole Cedar Creek[2]	4,180	12,865	0.33
CC01	2,080	4,513	0.46
UTN01	1,380	1,610	0.86
UTS01	1,280	4,092	0.31
Lower Cedar Creek	995	2,649	0.38
FC01 (2007)	4,370	11,978	0.36
HUC 12 Folsom Creek	2,745	15,128	0.18
Whole Folsom Creek[2]	1,704	8,820	0.19
Lower Folsom Creek	606	2,134	0.28
FC02	1,213	5,821	0.21
UTS02	250	866	0.29

3.0 POLLUTANT SOURCE IDENTIFICATION

Based on the results of the watershed characterization and STEPL model calculations, sediment has been identified as the primary pollutant within the Cedar and Folsom Creek watersheds while bacteria (fecal coliform) and nutrients have been identified as secondary pollutants within each watershed. Major sources of pollutants in the Cedar and Folsom have been identified as unpaved roads and historic and current agricultural land use associated with stormwater runoff within each watershed.

Table 5 summarizes total watershed size, total acres of agricultural land uses (row crops and pasture) per watershed, and the total acreage of agricultural land or linear miles of unpaved roads identified as pollution sources for both watersheds and the sub-watershed units. Figure 10 presents the location and boundary for each watershed and sub-watershed unit. Acreages for agricultural land uses for potential BMP installation within each watershed was estimated based on observed conditions during the watershed reconnaissance, aerial photography, and the properties proximity to environmentally sensitive areas (wetlands or streams). Total linear miles of unpaved roads for each watershed were estimated based on the Wilcox County Road Department road shapefile and aerial photography. It is assumed all unpaved roads are potential sources of pollution for each watershed.

Table 5. Pollutant source identification within the Cedar and Folsom Creek watersheds and each sub-watershed unit.

Watershed or Sub-watershed	Watershed Size[1]	Agricultural Land Use	Pollutant Source: Agricultural Land Use	Pollutant Source: Unpaved Road
	Acres			Linear Miles
Whole Cedar Creek	12,865	8,387	5,160	24.0
CC01	4,513	4,347	1,880	11.5
UTN01	1,610	1,350	1,490	3.2
UTS01	4,092	1,890	990	7.0
Lower CC	2,649	800	800	2.3
Whole Folsom Creek	8,820	5,358	1,740	20.1
Lower Folsom Creek	2,134	3,083	280	5.5
FC02	5,821	2,094	1,410	12.6
UTS02	866	181	50	2.0

1 Watershed size equals total acreage minus non-contributing areas.

For Cedar Creek watershed approximately 4,060 acres of row crops/pasture and 13 miles of unpaved roads have been identified for potential installation of sediment control BMPs (Table 6). For each sub-watershed unit located within the Cedar Creek watershed the following has been identified for potential installation of sediment control BMPs:

CC01 - 1,583 acres of row crops/pasture and 7 miles of unpaved roads;

UTN01 - 1,216 acres of row crops/pasture and 0.3 miles of unpaved roads;

UTS01 - 660 acres of row crops/pasture and 5 miles of unpaved roads and;

Lower CC - 600 acres of row crops/pasture and 0.6 miles of unpaved roads.

Within the Folsom Creek watershed, approximately 1,031 acres of row crops/pasture and 15 linear miles of unpaved roads have been identified for potential installation of sediment control BMPs (Table 6). For sub-watershed unit located within the Folsom Creek watershed the following has been identified for potential installation of sediment control BMPs:

Lower FC - 61 acres of row crops/pasture and 4 linear miles of unpaved roads;

FC02 - 938 acres of row crops/pasture and 9 linear miles of unpaved roads; and

UTS02 - 32 acres of row crops/pasture and 2 linear miles of unpaved roads.

According to the USDA Farm Service Agency in Wilcox County, no commercial feedlots or dairy farms are located within the two watersheds. However, several small scale cattle operations (100-150 heads of cattle) were observed during the visual survey of the watersheds. An exact number of small scale facilities could not be calculated because the operations were located within individual farms where access was not provided; therefore, an estimate of the acreage of small scale cattle facilities has been included as pasture land use in Table 5 (Pastureland). Based on information provided from the Farm Service Agency, approximately 30 chicken houses are located within the Cedar and Folsom Watersheds.

Table 6. Current modeled and proposed sediment load and percent sediment reduction prior to and following BMP implementation.

Watershed or Sub-watershed	Current Load	Reduction Since 2007	Proposed Acres of Agricultural BMPs		Proposed Linear Miles of BMPs	Load with BMPs	Reduction with BMPs	Total Reduction Since 2007
	tons/ac/yr	%	**Cropland**	**Pastureland**		tons/ac/yr	%	%
Cedar Creek 2007	0.46	--	--	--	--	--	--	--
Cedar Creek 2014	0.33	28	3,177	882	13	0.14	57	70
CC01	0.46	0	1,258	325	7	0.20	57.4	39
UTN01	0.86	-87	1,075	141	0.3	0.42	42	8
UTS01	0.31	33	384	276	5	0.20	35.5	56
Lower CC	0.38	17	460	140	0.6	0.16	12	65
Folsom Creek 2007	0.36	--	--	--	--	--	--	--
Folsom Creek 2014	0.19	47	529	502	15	0.12	51	69
Lower FC	0.28	22	39	22	4	0.14	51.4	62
FC02	0.21	42	472	466	9	.09	54	74
UTS02	0.29	19	18	14	2	0.14	52	61

4.0 POLLUTANT LOAD REDUCTIONS

4.1 Goals

Goals for the Cedar and Folsom WMP have been divided into three categories: short-term, midterm, and long-term. Short-term goals cover a time period of approximately less than two years following implementation of management measures; midterm goals range for a period of two to five years; and long-term goals are greater than five years following implementation of management measures. Short-term goals of the watershed management plan include:

1. Participation of landowners, farmers, and the Wilcox County Road Department;

2. Identification of exact site locations for management measures; and,

3. Initiation and implementation of recommendations from the WMP within three months of approval of WMP by GA EPD.

Midterm goals of the WMP include:

1. 35 percent reduction in sediment after initial implementation of WMP recommendations.

Long-term goals of the WMP have been identified based on the existing TMDL developed by the GA EPD in 2007 and include:

1. Sustained community involvement in water quality protection;

2. TMDL goal of 68.3 percent reduction in sediment in Cedar Creek and a 60.2 percent reduction in Folsom Creek; and

3. Delisting of Cedar and Folsom Creeks to meet the Clean Water Act (CWA) mandate to ensure the biological integrity.

4.2 Current Sediment Load

4.2.1 STEPL Results

Table 3 summarizes the output of the STEPL model, including the total sediment load and the load associated with each land cover type. Because of the elimination of non-contributing areas, the total acreage of the sub-watershed units within Cedar or Folsom Creek watersheds is not equal to the total acreage of the HUC 12 watershed. The HUC 12 sediment load calculations include Brushy and Gum Creeks.

Current modeled sediment loading within Cedar Creek watershed:

Lower CC - 995 tons/year

CC01 - 2,080 tons/year

UTS01 - 1,280 tons/year

UTN01 - 1,380 tons/year

Current modeled sediment loading within Folsom Creek watershed:

UTS02 - 250 tons/year

FC02 - 1,213 tons/year

Lower Folsom - 606 tons/year

For all watersheds, agriculture (crop and pastureland) and unpaved roads (user defined) are the largest contributors to total sediment loading (Table 3).

Due to the different size of each watershed, the total sediment load in tons/acre/year for each watershed was calculated to compare the 2007 calculated sediment load to the current calculated loadings. Table 4 summarizes the calculated sediment load from the 2007 TMDL compared to the current sediment load.

4.2.2 STEPL Conclusions

With the exception of UTN01, all watersheds have had a modeled decrease in sediment loading when compared to the 2007 calculated loading (Tables 4 and 6). Sub-watershed CC01 did not have a modeled decrease but remained approximately the same (Tables 4 and 6). According to the TMDL (US EPA, 2007), average sediment load for biota impacted streams was 0.19 tons/acre/year, ranging from 0.01 to 1.91 tons/acre/year. For streams not listed, the annual load ranged from 0.02 to 1.22 tons/acre/year with an average load of 0.16 tons/acre/year.

Since 2007, sub-watershed UTN01 has seen a modeled estimated increase in sediment load of 87 percent (Table 6), possibly attributed to the large portion of agriculture land use within the watershed. Within the Cedar Creek watershed, sub-watershed units UTS01 and Lower CC have a modeled estimated decrease in sediment of 33 percent and 17 percent, respectively (Table 6). For the entire Cedar Creek watershed (CC01, UNT01, UTS01, and Lower CC), a modeled estimated decrease in sediment since 2007 of 28 percent was calculated (Table 6). For the Folsom Creek watershed, the smallest modeled decrease in sediment loading was calculated for sub-watershed UTS02 (19 percent), while sub-watersheds Lower FC and FC02 had modeled decreases in sediment load of approximately 28 percent and 21 percent, respectively (Table 6). Since 2007, the entire Folsom Creek watershed (Lower FC, FC02, and UTS02), had an approximate modeled decrease in sediment of 47 percent (Table 6).

4.3 Expected Sediment Load Reductions

Table 6 summarizes a modeled estimate in load reductions since the 2007 TMDL, expected load reductions from BMP implementation or installation of management measures, and the total percent reduction for each sub-watershed unit. The HUC 12 watersheds for Cedar and Folsom Creeks contain the Brushy and Gum Creek watersheds. Brushy and Gum creek watersheds are not associated with the listed portion of Cedar and Folsom Creeks; therefore, the watersheds for these creeks have been excluded from the model.

The expected load reduction or sediment removal efficiency for individual BMPs used in the STEPL model are presented in Table 7. To calculate the expected load reduction from implementation of BMPs within each sub-watershed, an average sediment removal efficiency of all of the combined BMPs was calculated for each land use cover type. For example, for cropland the average sediment removal efficiency listed in Table 7 was used to determine the overall expected load reduction within each sub-watershed unit. A more comprehensive list of examples of BMPs that can be used to reduce sediment loads in each watershed for row crops and pasture land and unpaved roads are included in Tables 8 and 9, respectively.

In addition to sediment load reductions, each BMP selected in Tables 8 and 9 will also help reduced nutrient and bacteria loads, which were both identified as secondary pollutants within each watershed. Following implementation of BMPs within each sub-watershed unit, a modeled reduction of sediment loading since 2007 is approximately 70 percent for the Cedar Creek watershed and 69 percent for the Folsom Creek watershed, respectively (Table 6). In order to achieve this reduction, approximately 3,177 acres of cropland, 882 acres of pastureland, and 13 linear miles of unpaved roads will require implementation of BMPs within the Cedar Creek watershed (Table 6). For the Folsom Creek watershed, approximately 529 acres of cropland, 502 acres of pastureland, and 15 linear miles of unpaved roads will require implementation of BMPs (Table 6).

Table 7. Sediment removal efficiency of each BMP used in the STEPL modeled calculation and the average sediment removal efficiency calculated for each land use.

Land Use	BMP	Sediment Removal Efficiency	Average of Combined BMPs
		Percent	
Cropland	Contour Farming	40.5	60.1
	Diversion	35	
	Filter Strip/Buffer	65	
	Reduced Tillage Systems	75	
	Terrace	85	
Pastureland	Stream bank Stabilization and Fencing	75	75
Unpaved Roads	Diversion Channel	35	52.1
	Filter strip	65	
	Grass Swales	65	
	Buffer Strip/Buffer	60	
	Vegetated Swale	47.5	
	Road Dry Seeding	41	
	Road Hydro Mulch	41	
	Road Straw Mulch	41	
	Vegetated Filter Strips	73	

Table 8. Potential agricultural NPS management measures to be implemented to achieve sediment load reductions.

Pollutant Source	Causes of Impairment	Best Management Practices (BMPs)	
		Structural Practices	**Non-Structural Practices**
Agricultural	Row Crops	Contour Buffer Strips	
		Grassed Waterways	Reduced Tillage Systems
		Establishment of Riparian Buffer	Cover Crops
		Vegetative Buffer Strips	Establish Minimum Buffer Requirements
		Terraces	Educational Material
		Contour Farming	Erosion and Sediment Control Plans
		Diversions	
	Small Scale Cattle Operations	Heavy Use Areas	
		Live Fascines	
		Live Staking	Nutrient Management Plans
		Livestock Exclusion Fencing	GSWCC Farm Assessment
		Revetments	Prescribed Grazing
		Livestock wells	Residue Management
		Alternative Water Sources	Rotational Grazing
		Watering Ramps	
		Stream Crossings	
	Poultry	Covered Litter Stockpiles	
		Litter Stockpiles with Groundliners	
		Permanent Litter Storage Structures	
		Runoff Control	
		Pasture Management and Establishment	Nutrient Management Plans
		Vegetative Buffers and Boarders	
		Grassed Waterways	
		Riparian Buffers	
		Roof Runoff Management	

Table 9. Potential best management and maintenance practices for unpaved roads.

Pollutant Source	Causes of Impairment	Best Management and Maintenance Practices
Unpaved Road	Road Surface Runoff and Erosion	Vegetated Shoulders, Banks, and Roadside Ditches
		Use of Turnouts
		Avoid Discharging or minimize discharge to Sensitive Areas
		Installation of Gravel
		Hydro seeding
		Use of Rock Filter Dams
		Use of Bottomless Culverts
		Maintenance of Proper Road Surface Conditions
		Use of Proper Surface Materials
		Following Proper Maintenance Operations
		Protection of Sensitive Areas (Wetlands and Streams)
		Vegetated Right of Ways
		Avoid channelized runoff
		Avoid grading during dry periods
		Avoid grading following heavy rains (> 1 inch)
		Adding Water for Dust Control
		Adding New Materials or Aggregates to the Road
		Use of Geotextiles
		Installation of Underdrains or cross drains
	Road Drainage Issues	Reduce Areas of Concentrated Flow
		Avoid Discharging of Concentrated Flow into Sensitive Areas
		Install Broad-based Dips
		Proper Ditch Maintenance
		Install Frequent Turnouts in Roadside Ditches
		Use Drop Inlet Structures
		Install Rock Check Damns in Ditches
		Install Culverts and Cross Drains
		Install Plunge Basins
	Slope Stabilization and Erosion	Terracing
		Tracking
		Gabions
		Vegetation
		Silt Fence or Other Sediment Barriers
		Hay Bales
		Matting and Blankets
	Road Materials and Additives	Geotextiles
		Dust Control

5.0 NON-POINT SOURCE (NPS) MANAGEMENT MEASURES

5.1 Critical Areas

Based on the results of the model, land use data, and watershed characterization, sub-watersheds CC01, UTN01, and UTS02 have been identified as high priority watersheds (Figure 10). More specifically, watersheds CC01 and UTN01 have been identified as high priority watersheds for installation of agricultural management measures and the entire Folsom Creek watershed has been identified as a high priority watershed for installation of management measures for unpaved roads, specifically watershed UTS02. Therefore, the recommendation is to select BMPs that will reduce sediment loads associated with agricultural land use practices and unpaved roads. Additionally, watersheds with larger sediment loads (CC01, UTN01, UTS01, UTS02, Lower FC, and Lower CC) should be given priority over watersheds with less significant loads (FC02).

In order to achieve the sediment load reductions detailed in section 4.3 above, a series of agricultural and unpaved road BMPs will be implemented throughout the Cedar and Folsom Creek watersheds (Tables 8 and 9). Priority should be given to areas that occur along streams and wetlands and to roads that run along or cross environmentally sensitive areas. Within the Cedar Creek watershed, sub-watersheds CC01 and UTN01 have been identified as critical areas for the implementation of agricultural BMPs and the entire Folsom Creek watershed, specifically sub-watershed UTS02, has been identified as a critical area for installation of unpaved roads BMPs. A collaborative effort should be made between stakeholders within the Cedar and Folsom watersheds and project coordinators to carefully select BMPs and management measures which will achieve the long-term goal of delisting Cedar and Folsom Creeks.

5.2 Agricultural Management Measures

Table 8 summarizes the possible agricultural NPS management measures to be implemented in order to achieve sediment load reductions discussed in Section 4.0 above. Proposed BMPs listed in Table 8 are targeted toward the protection or establishment of riparian buffers, stormwater management strategies, and controlling agricultural runoff associated with row crops, small scale cattle facilities, and poultry houses.

5.3 Unpaved Roads Management Measures

A significant source of sediment loading within the Cedar and Folsom Creek watersheds is attributed to unpaved roads. The Georgia Better Back Roads Program is a collaboration of several agencies which published the *Georgia Better Back Roads Field Manual* (Manual) (2009). It is recommended that the Wilcox County Road Department adopt dirt road maintenance practices and BMPs from the Manual in order to achieve a reduction in sediment loading associated with erosion and sedimentation from unpaved roads in the Cedar and Folsom Creek watersheds.

Table 9 summarizes the possible unpaved roads NPS management measures to be implemented in order to achieve sediment load reductions discussed in Section 4.0 above. Proposed management measures should be targeted towards the protection of sensitive areas such as wetlands and streams through the elimination of discharging runoff into sensitive areas, the elimination of concentrated flow along roads and roadside ditches, erosion and sediment control, dust control, and the adoption of proper maintenance and management practices that protect sensitive areas within both watersheds.

In addition to the Manual, other resources for the management and maintenance of unpaved roads include the Georgia Department of Transportation (GA DOT), Georgia Forestry Commission (GFC), GSWCC, GA EPD, NRCS, and the US EPA. Specific references include the GA DOT listing of qualified products and materials, GFC BMP Manual, GSWCC Field Manual for Erosion and Sediment Control in Georgia and manual for BMPs for Georgia Agriculture, US EPA Environmentally Sensitive Maintenance for Dirt and Gravel Roads, and US EPA Gravel Roads: Maintenance and Design Manual.

6.0 FINANCIAL AND TECHNICAL ASSISSTANCE

6.1 Associated Costs

Table 10 presents the proposed costs associated with each task that must be implemented to make the WMP a success. For each identified task, the personnel, planning, time for implementation, operation, maintenance, and equipment costs is included in the total costs. Additionally, the party responsible for implementation of each task and proposed funding source has been identified. Several authorities, organizations, and individual producers will be relied upon for successful implementation of the Cedar and Folsom Creek WMP, which are identified below.

Authorities or Organizations relied upon for WMP implementation	
GSWCC	GA EPD
NRCS	US FWS
Heart of GA Regional Commission	GFC
UGA Sustainable Agriculture, Crop Production, and Animal Waste	Individual Producers
Wilcox County Board of Commissioners	Wilcox County Extension Office
Wilcox County Roads Department	Cattlemen's Association

Table 10. Approximate Costs for Implementation of WMP.

Objective 1			
Reduce sediment loads associated with agricultural land use and unpaved roads			
Tasks	**Responsible Party**	**Cost**	**Funding**
Identify agricultural Producers within the watershed	USDA Farm Service Agency	$0	319 (h) Grant
Contact producers for participation in cost-share program[1]	GSWCC	$2,500	
Identify unpaved roads for implementation of BMPs[2]	County	$0[3]	
Implementation of Agricultural BMPs	GSWCC, NRCS, County		
Structural		$115,000	
Non-structural		$16,500	
Implementation of Unpaved Road BMPs	GSWCC, Wilcox County	$60,000	
	Subtotal	**$194,000**	
Objective 2			
Information and Education Component			
Tasks	**Responsible Party**	**Cost**	**Funding**
Advertising, news articles, public notices, and public meetings	Advisory Committee, GSWCC, County	$500	319(h) Grant, US EPA Environmental Education (EE) Grant, US EPA Surface Water Grant and Loan Programs, US FWS Grants, NRCS EQIP, Georgia Environmental Finance Authority (GEFA), Clean Water State Revolving Fund, Southeastern Regional Water Quality Assistance Network, Catalog for Federal Funding
Educational brochures, quarterly fact sheets, direct mailings, fliers	Advisory Committee, GSWCC, County	$600	
Watershed signage	Advisory Committee, GSWCC, County	$2,000	
Website development and maintenance	Advisory Committee, GSWCC, County	$1,000	
Farm Assessment	GSWCC, NRCS	$0[3]	
Nutrient Management Plans	GSWCC, NRCS	$500	
Promotional materials for conservation agricultural programs and practices	GSWCC, NRCS, County	$600	
Meetings and trainings for producers	County, Local AAS	$800	
	Subtotal	**$6,000**	

Table 10. Approximate Costs for Implementation of WMP. (continued)

Objective 3			
Long-term Monitoring to measure success of project			
Tasks	**Responsible Party**	**Cost**	**Funding**
Conduct AAS monitoring (*in-situ* water quality analysis)	Local AAS, GSWCC, County, Volunteers, Advisory Committee, Stakeholders	$1,000	319(h) Grant, US EPA Environmental Education (EE) Grant, US EPA Surface Water Grant and Loan Programs, US FWS Grants, GEFA, Clean Water State Revolving Fund, Southeastern Regional Water Quality Assistance Network, Catalog for Federal Funding
TSS, turbidity, settleable solids analysis[3]	GSWCC	2,500	
Secure funding for future long-term monitoring	GSWCC	$0[4]	
Contract consultant to conduct long-term monitoring	GSWCC	$27,500	
Post BMP monitoring	NRCS, County, Volunteers	$5,000	
Biological assessment	GA EPD	$0[3]	
	Subtotal	**$36,000**	
	Project Total	**$236,000**	

1 = High priority given to those located in CC01, UTN01, or land within close proximity to listed stream segments and sensitive areas.
2 = High priority given to those in Folsom Creek Watershed, specifically sub-watershed UTS02.
3 = Cost includes equipment (turbidity meter, six Imhoff cones) and TSS laboratory analysis. Labor costs for conducting sampling and turbidity and settable solids analysis not included due to use of in-kind hours from GSWCC.
4 = No cost is associated with task due to the use of in-kind hours.

7.0 INFORMATION AND EDUCATION

An integral part of a WMP is to gather public support, promote the WMP, and educate the citizens of Wilcox County about the importance of water quality. Many of the recommended management measures require volunteer hours and public participation and increasing the public's understanding of the WMP is important to the success and implementation of the plan. Providing adequate education, outreach, and awareness of how land management practices influence NPS losses of sediment, nutrients, and bacteria to surface water resources may then motivate changes in behavior.

Specifically, the education and outreach components should be designed to teach producers and other stakeholders about the pollution issues facing the Cedar and Folsom Creek watersheds. The goal of the education and outreach component is to bring attention to what impact each individual's land use and management decisions will have on water quality in the Cedar and Folsom Creek watersheds, how they can address those impacts, and what opportunities and innovative solutions exist. The table below summarizes outreach and education activities recommended for the Cedar and Folsom Creek watersheds.

Tasks	Actions
Gather public support and participation, Promote WMP, Public Education	Work with local media through advertising, publishing news articles and public notices, and continue to conduct public meetings
	Educational brochures, quarterly fact sheets, direct mailings, fliers
	Develop watershed signage to promote activities in the watershed
	Develop a website
	Develop a local Adopt-a-stream program
Educate Producers	GSWCC Farm Assessment
	Nutrient Management Plans
	Promotional materials for reduced tillage systems, cover crops, crop rotations, and biological controls
	Conduct meetings and trainings

Advertising through published articles or notices and educational brochures such as quarterly fact sheets, direct mailings, or fliers (public educational materials) should contain information on the project, challenges, proposed solutions, and project updates. The public education materials can also contain information about water quality, the effects of NPS pollution on water quality, and the importance of BMPs for the protection of water quality.

Watershed signage can include watershed boundary signs, yard signs, or recognition of watershed improvements. Yard signs can promote individual property owners and recognize conservation practices that have been implemented. Recognition can be given to landowners or Wilcox County through signs that display “Stream-Friendly Farm”, “River-Friendly Farm”, or “Roads Improvement Project funded by the Cedar and Folsom WMP”.

A project website can also be developed and maintained by a webpage designer, which promotes the project, provides quarterly updates, and recognizes agricultural producers and volunteers. The stakeholder group can also establish a local adopt-a-stream (AAS) group. The goals of the AAS program are to increase public awareness of NPS pollution, provide citizens with tools and training to evaluate, monitor, and protect their local waterways, to encourage partnerships between local stakeholders, citizens, and local governments, and to collect water quality data. The AAS group could select streams to adopt within the Cedar and Folsom Creek watersheds, conduct an outreach event, conduct AAS monitoring, and attend AAS workshops. The level of AAS participation and involvement can be determined by the stakeholder committee and volunteer interest. More information concerning the AAS program and contact information for the program coordinator can be found at www.GeorgiaAdoptAStream.org.

To educate producers, promotional materials can be distributed or meeting and trainings can be conducted about sustainable agricultural practices, agricultural BMP implementation and maintenance, land owner recognition, and the progress of the WMP.   Other education and outreach activities that specifically target producers include the GSWCC Farm Assessment. The Farm Assessment is a voluntary program, which is a multi-phased nutrient planning initiative available to farmers. Updates can be made to existing nutrient management plans or new plans can be established. Other incentives of the Farm Assessment include record keeping protocols, identification of areas within each farm for improvements for the protection of natural resources, and the assistance in identifying potential funding sources to complete improvements based on the assessment.

8.0 IMPLEMENTATION SCHEDULE

Table 11 presents the proposed approach for implementing the Cedar and Folsom Creek WMP. The implementation schedule is meant to serve as a reference tool to recognize tasks that are scheduled immediately following plan approval and the upcoming year. The proposed schedule is also dependent on funding, producer and County participation, and public support. The schedule should be adaptable and updated on a regular basis due to shifting priorities, new opportunities, and expected delays.

Table 11. Proposed Implementation Schedule for the WMP.

Activity	2014			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	Oct	Nov	Dec										
Identify agricultural Producers within the watershed	Monthly	Monthly											
Contact producers for participation in cost-share program	Monthly	Monthly											
Identify unpaved roads for implementation of BMPs	Monthly	Monthly											
Conduct TSS, turbidity, and settleable solids, analysis prior to BMP implementation		Monthly	Monthly	First Quarter									
Implementation of structural BMPs		Monthly	Monthly	Monthly	First Quarter								
Implementation of non-structural BMPs		Monthly	Monthly	Monthly	Monthly	Monthly							
Post BMP monitoring		Monthly	Monthly	Monthly	Quarterly	Quarterly	Annually	Annually	Annually	Annually	Annually	Annually	Annually
Conduct TSS, turbidity, and settleable solids analysis after implementation of BMPs			Annually	Annually									
Education, Outreach, and Public Information Components		Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Establish Adopt-a-stream (AAS) Program		Monthly	Monthly	Monthly									
Conduct TSS, turbidity, and settleable solids monitoring during wet weather event			Annually	Annually									
Conduct AAS monitoring				Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Secure funding for long-term monitoring			Monthly	Monthly	First Quarter								
Conduct long-term monitoring				Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Review WMP and make changes as needed				Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually	Annually

- Monthly
- First Quarter
- Quarterly
- Annually

9.0 INTERIM MILESTONES, SUCCESS CRITERIA, AND LONG-TERM MONITORING

To determine if load reductions are being achieved over time and substantial progress is being made towards the ultimate goal of delisting Cedar and Folsom Creeks, a physical sediment load analysis has been developed as a means to evaluate the success of the WMP. The analysis will include TSS laboratory analysis, turbidity measurements, and determination of settleable solids. For a true and accurate assessment of sediment transport and loading, a very large amount of data collected by frequent sampling that includes stream discharge measurements in addition to turbidity and TSS would be needed. However, due to the timeline and financial constants of the project, three sampling events will be conducted, which include monitoring prior to BMP implementation, monitoring following BMP implementation, and monitoring during a wet weather event. Data collected following BMP implementation will be compared to data collected prior to implementation of BMPs and during the baseline monitoring to determine if a reduction in sediment load has occurred. As a measure of success, a reduction in TSS concentration, turbidity, and settleable solids should occur between pre and post BMP implementation.

9.1 Milestones and Success Criteria

The WMP has been written to cover a 10-year time period and interim milestones and measures of success of the plan are broken down into three phases: short-term, midterm, and long-term. A summary of each interim milestones and success criteria for each phase of the WMP is included within Table 12.

9.2 Long-term Monitoring

Water quality monitoring is an integral part of assessing the progress and success of the WMP. The sections below describe recommendations and needs for future monitoring for documenting the water quality improvements that occur due to the implementation of the WMP. Results of the long-term monitoring will also be an effective measure of determining the success of the WMP, or the need for future revisions.

BMP Monitoring

For all structural BMPs implemented, a post construction inspection should be conducted. Post construction inspections should occur immediately following installation of the structural BMPs and should include the examination of effectiveness for sediment control, proper installation, design, installation, and maintenance of installed measures, and/or the need for additional stabilization measures. Following the post construction monitoring, success monitoring should be conducted quarterly for the first two years following implementation and on an annual basis following implementation. Success monitoring of installed BMPs should include examination for proper maintenance, vegetation establishment and success, presence of erosion rills or gullies, or the need for reinstallation or additional measures. The parties responsible for conducting post BMP monitoring, associated costs, and potential funding sources are summarized in Table 10.

Table 12. Interim milestones for the short-term, mid-term, and long-term phases of the WMP.

Phase	Time after Implementation	Milestones	Measure of Success
Short-term	3 months	Participation and partnerships with landowners, producers, volunteers, & County Roads Department	90% involvement of stakeholders and advisory committee
			Public attendance and participation in public meetings
			Establishment of AAS program
			Development of cooperative partnerships
			40 man hours per volunteer per year
			In-kind donation of County equipment, man hours, and resources
	Within 3 months to 2 years	Initiation and implementation of management measures from WMP	90% of recommendations implemented according to schedule
			Implementation of management measures on approximately 28 linear miles of unpaved roads
			Implementation of agricultural management measures for approximately 5,090 acres
			In-kind donation of County equipment, man hours, and resources
	3 months to 2 years	Post BMP Success Monitoring	Exam for vegetation establishment and success
			Exam for effectiveness for sediment control, proper maintenance, or need for reinstallation
	Within 3 months to 1 year	TSS, turbidity, and settleable solids	Reduction from analysis conducted prior to implementation of BMPs for dry and wet weather events
Mid term	2 years	35% reduction in sediment loads	Measured by rerunning STEPL Model using implemented BMPs for model input
	2 to 5 years	Sustained landowner, producers, volunteers, and County involvement	Quarterly AAS monitoring events
			Continued support and donations from County and volunteers
			Continued public and stakeholder participation
Long-term	5 to 10 years	Sustained community involvement in water quality protection	Quarterly AAS monitoring events, continued public and stakeholder participation
	3 months to 10 years	Establish long-term monitoring program	Contract and hire consulting firm to conduct monitoring
			Conduct quarterly AAS events
			Reduction in TSS concentration, turbidity, and settleable solids
	5 to 10 years	68.3% reduction in sediment for Cedar Creek and 60.2% reduction for Folsom	Measured by rerunning STEPL Model using implemented BMPs and long-term monitoring

AAS Monitoring

If enough volunteer interest is shown, a community or watershed AAS program can be organized by the stakeholder group, Wilcox County Road Department, or other local agency. An AAS monitoring program would be an effective tool in monitoring the implementation of the WMP, establishing local partnerships, and increasing community involvement and education about NPS pollution. Training workshops can be scheduled to train local officials and volunteers on the proper procedures for collecting chemical and biological water quality data.

Sediment Load Analysis

In addition to BMP monitoring, a sediment load analysis will be conducted. Analyses should include laboratory determination of TSS, turbidity measurements, and evaluation of settleable solids using an Imhoff Cone. Analyses should be conducted prior to implementation of BMPs and following implementation during dry and wet weather conditions. Measurements collected following BMP implementation can be compared to measurements collected prior to BMP implementation and during dry and wet weather events from the baseline monitoring and watershed reconnaissance. Monitoring should be conducted at the six monitoring stations sampled during the fish and water quality assessment (Appendix A). All samples will be collected according to requirements of the GA EPD Watershed Protection Branch *Quality Assurance Manual* (2005a), GA DNR *Standard Operating Procedures for Conducting Biomonitoring on Fish Communities in Wadeable Streams in Georgia* (2005b), and the GA EPD *Macroinvertebrate Biological Assessment of Wadeable Streams in Georgia* - Standard Operating Procedures (SOP) (2007). *Title 40* of the *Code of Federal Regulations*, *Part 136* will be adhered to during all sample collection events.

10.0 FUTURE REVISIONS AND PLAN SUCCESS

Periodic reviews should be conducted by the local stakeholder group of the implementation schedule, accomplishments, and monitoring results to determine whether or not the goals of the WMP are being met. The WMP is a "living" document, meaning that the goals and objectives contained within can be modified, strengthened, and/or removed based upon water quality monitoring results and the needs of the stakeholders in the watershed. For long term success of the plan, it is recommended that the WMP be reviewed and evaluated on an annual basis to determine if milestones and associated success criteria are being accomplished. Revisions to the WMP should be made following the annual review process.

As discussed in Section 4.3 and presented in Table 6, a modeled reduction of sediment loading since 2007 for the Cedar Creek watershed is approximately 70 percent and 69 percent for the Folsom Creek watershed, respectively. Based on the watershed characterization, monitoring assessment, and STEPL model, a majority of the sedimentation within Cedar and Folsom Creek watersheds could be legacy sediment attributed to past agricultural practices. It is expected that with implementation of BMPs that control the additional input of sediment, that Cedar and Folsom Creeks will continually see a decrease in sediment leading to the long-term goal of delisting Cedar and Folsom Creeks.

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