Draft Watershed Management Plan for Malcolm Branch

Athens-Clarke County

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Prepared For:

Athens-Clarke County
Transportation and Public Works
120 W Dougherty Street
Athens, GA 30601

Prepared By:

Tetra Tech
1899 Powers Ferry Rd SE
Suite 400
Atlanta, GA 30339

ARCADIS
2410 Paces Ferry Rd SE
Suite 400
Atlanta, GA 30339

Tt TETRA TECH

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Executive Summary

The objective of this watershed management plan (WMP) is to provide ACC with a guidance document that characterizes the Malcolm Branch watershed and provides recommendations for structural and programmatic BMPs that can be implemented to reduce nonpoint source pollution and improve the overall health of the watershed. This WMP is the result of a collaborative effort between Tetra Tech, ARCADIS, and ACC, and incorporates the United States Environmental Protection Agency's (EPA's) Nine Key Elements for WMPs that guide watershed management efforts throughout the country. A watershed characterization was conducted as part of this WMP to document current conditions and watershed impairments through stream walks and a review of existing information, including watershed models, geographical information system (GIS) data, water quality data, and previous reports and studies. A comprehensive analysis of potential site-specific and watershed-wide management improvement opportunities based on watershed needs has identified structural and programmatic BMPs that are recommended for implementation.

Malcolm Branch is located in the west-central part of ACC, and contained entirely within ACC. There are no named tributaries to Malcolm Branch. The drainage area of the Malcolm Branch watershed is 1.1 square miles with 2.6 miles of stream. Malcolm Branch flows into the Middle Oconee River within ACC which in turn joins the North Oconee River to form the Oconee River. Land cover in the study area consists of approximately 81 percent developed land, 17 percent forested land, and less than 2 percent other land covers, with about 29 percent impervious cover. The National Wetland Inventory (NWI) Map identifies a very small area of forested wetland adjacent to Malcolm Branch where it joins the Middle Oconee River. No other environmentally sensitive areas were identified.

There are no streams in the Malcolm Branch watershed study area that are listed as impaired on the draft Georgia 2016 Integrated 305(b)/303(d) List of Streams.

There are several point sources in the study area, but none of these facilities discharge to water bodies. Potential nonpoint sources of pollution in the Malcolm Branch watershed include stormwater runoff from ACC's municipal separate storm sewer system (MS4) as well as runoff from forested lands. Results of recent water quality monitoring efforts suggest that surface waters in the study area are generally in compliance with the DO, pH, and temperature standards adopted by the State of Georgia, with few exceptions. Average conductivity, total nitrogen (TN) and total phosphorous (TP) results meet the benchmarks set by ACC. FC bacteria geometric means indicate that Malcolm Branch complies with the November-through-April standard but it exceeded the May-through-October standard for the single geometric mean that was calculated for that time of year. Average TSS concentrations slightly exceeded the ACC benchmark of 13 mg/L.

Stream walks in the Malcolm Branch watershed were conducted in October 2016 through December 2016 along the main stem of Malcolm Branch. One third of the stream is culverted under shopping plazas. Of the assessed segments, none received an overall stream condition score above marginal. A

headcut and gulley at the most upstream end of Malcolm Branch is an ongoing erosion problem that has the potential to impact infrastructure in the future.

Based on information obtained in the watershed characterization, FC bacteria, sediment, and hydrology were all identified as watershed-wide management needs. Due to the watershed's high impervious coverage, Malcolm Branch seems to be suffering "urban stream syndrome", causing it to have lower baseflow and higher peak storm flows that tend to cause significant erosion.

A desktop GIS analysis and field assessment was conducted to identify potential watershed improvement opportunities. Structural projects, including stormwater control best management practices (BMPs) and restoration BMPs were evaluated and prioritized. Only one site-specific programmatic BMP is recommended for Malcolm Branch (Table ES-1). A concept plan was developed for the recommended project. Programmatic measures that can be implemented watershed-wide are also recommended.

Table ES-1. Recommended Site-Specific Management Measures

BMP ID	Project Name
MB-Prog-01	Malcom Branch / Middle Oconee River Buffer Preservation

This WMP includes an implementation schedule with suggested annual activities, activities that can be taken every 3-5 years, and long-term efforts spanning 5-10 years. As changes occur in the watershed and additional data become available, however, watershed management needs and management opportunities might change. Therefore, this WMP should be revisited regularly and revised as needed to ensure that the watershed continues to be managed effectively into the future.

1 Introduction

1.1 Background

Since 2010, Tetra Tech and ARCADIS, in partnership with Athens-Clarke County (ACC), Georgia, have produced several guidance documents to assess and improve the health of ACC's rivers and streams in support of the Countywide Watershed Improvement Program. The work completed through this partnership has led to development of an analytical process that informs the monitoring and characterization of watershed conditions. This includes the establishment of goals, objectives, indicators, and benchmarks for evaluating management needs and measuring success; and the identification and prioritization of management opportunities, including the use of hydrologic and water quality models to assess structural best management practices (BMPs).

Prior to this effort, the Tetra Tech-ARCADIS-ACC team created watershed management documents for Big Creek, Brooklyn Creek, Carr Creek, Cedar Creek, Hunnicutt Creek, McNutt Creek, Shoal Creek, Tanyard Creek, and Trail Creek in accordance with the overarching goals of the Watershed Improvement Program. In 2016, the team proceeded with development of watershed management plans (WMPs) for nine more watersheds: Bear Creek, East Fork Trail Creek, Malcolm Branch, Middle Oconee River, North Oconee River, Sandy Creek, Sulphur Springs Branch, Turkey Creek, and Walton Creek.

1.2 WMP Objectives

The objective of this WMP is to provide ACC with a guidance document that characterizes the Malcolm Branch watershed and provides recommendations for structural and programmatic BMPs that can be implemented to reduce nonpoint source pollution and improve the overall health of the watershed. The methodology used by the Tetra Tech-Arcadis-ACC team to identify appropriate management measures to accomplish this objective are discussed throughout the following sections.

The Malcolm Branch WMP incorporates the United States Environmental Protection Agency's (EPA's) Nine Key Elements for WMPs. Following are the nine key elements:

1. Identifying sources contributing to nonpoint source pollution.
2. Estimating expected load reductions.
3. Describing nonpoint source management measures.
4. Estimating implementation costs.
5. Educating the public to engage public support.
6. Developing an implementation schedule.
7. Describing interim milestones.
8. Implementing adaptive management measures to gauge success.
9. Monitoring the effectiveness of implementation efforts.

1.3   Stakeholders

Many departments and entities are stakeholders in ACC's watershed management activities. Following are the key stakeholders:

- ACC Central Services
- ACC Leisure Services
- ACC Mayor and Commission
- ACC Planning
- ACC Public Utilities
- ACC Transportation and Public Works Department Stormwater Management Program
- Georgia Department of Environmental Protection (GaEPD)
- The Public (Businesses, Residents, and other Members of the Community)

The ACC Transportation and Public Works Department Stormwater Management Program coordinates closely on watershed management efforts with other ACC departments, including Public Utilities, Planning, Central Services, and Leisure Services.

To meet National Pollutant Discharge Elimination System (NPDES) permit requirements, the Public Utilities Department has conducted watershed assessments in all of the county's watersheds and developed a watershed protection plan (WPP) in 2009 (JJG 2009). This WMP builds on and supplements information provided in the WPP. The Leisure Services Department manages all of ACC's park properties. These parks compose a large area of land that is owned and managed by ACC and are, therefore, high-priority areas for implementing watershed improvement projects. Interdepartmental meetings are held with these departments, the Planning Department, and the Central Services Department to promote communication and coordination between departments on large projects in order to meet the overall needs of ACC.

2 Watershed Characterization

This watershed characterization describes existing conditions in the Malcolm Branch watershed in ACC. Geographical information system (GIS) data, along with information from previous studies and monitoring efforts, were reviewed and assessed in order to understand the nature and condition of the watershed. A watershed model was also used to characterize nutrient and total suspended solids (TSS) loads. The following sections include information on watershed location and water resources, land cover, ecoregion, environmentally sensitive areas, potential sources of pollution, stream walk assessments, water quality, and nutrient and TSS loading. Key information is provided in the narrative and depicted in figures and summary tables. Additional details, including stream walk assessment notes and data tables and water quality data, are provided in the appendices.

2.1 Location and Water Resources

Malcolm Branch flows into the Middle Oconee River within ACC. The Middle Oconee River joins the North Oconee River to form the Oconee River. The Oconee River then joins the Ocmulgee River to form the Altamaha River, which flows to the Atlantic Ocean. The Malcolm Branch watershed is part of the Calls Creek-Middle Oconee River Hydrologic Unit Code 12 (HUC 12) watershed (30701010307).

Malcolm Branch is located in the west-central part of ACC and is roughly bounded by Timothy Road to the southwest and State Route 10 (Athens Perimeter) to the northwest (Figure 1). The watershed is contained entirely within ACC. There are no named tributaries to Malcolm Branch. The farthest downstream point of this watershed is the confluence of Malcolm Branch with the Middle Oconee River. The drainage area of the Malcolm Branch watershed is 1.1 square miles with 2.6 miles of stream. The extent of the Malcolm Branch watershed is shown in Figure 2-1 and a detailed map of the study area is shown in Figure 2-2.

There are no streams in the Malcolm Branch watershed study area that are listed as impaired on the draft Georgia 2016 Integrated 305(b)/303(d) List of Streams.

There are no United States Geological Survey stream gages in the watershed study area. There also are no groundwater recharge areas in the watershed study area, according to the map of the Most Significant Groundwater Recharge Areas of Georgia (GaEPD 1982).
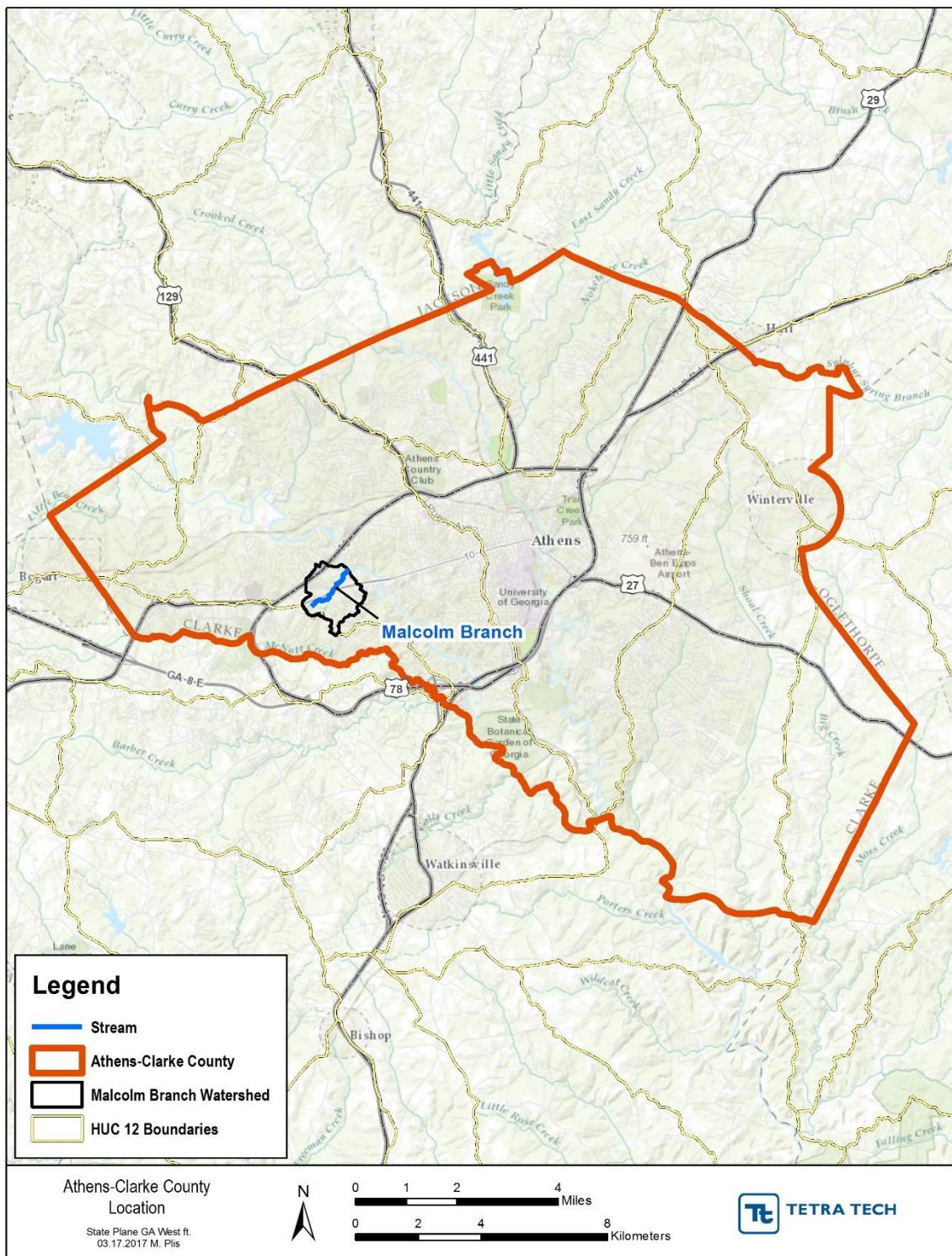
Figure 2-1. Malcolm Branch Watershed Location
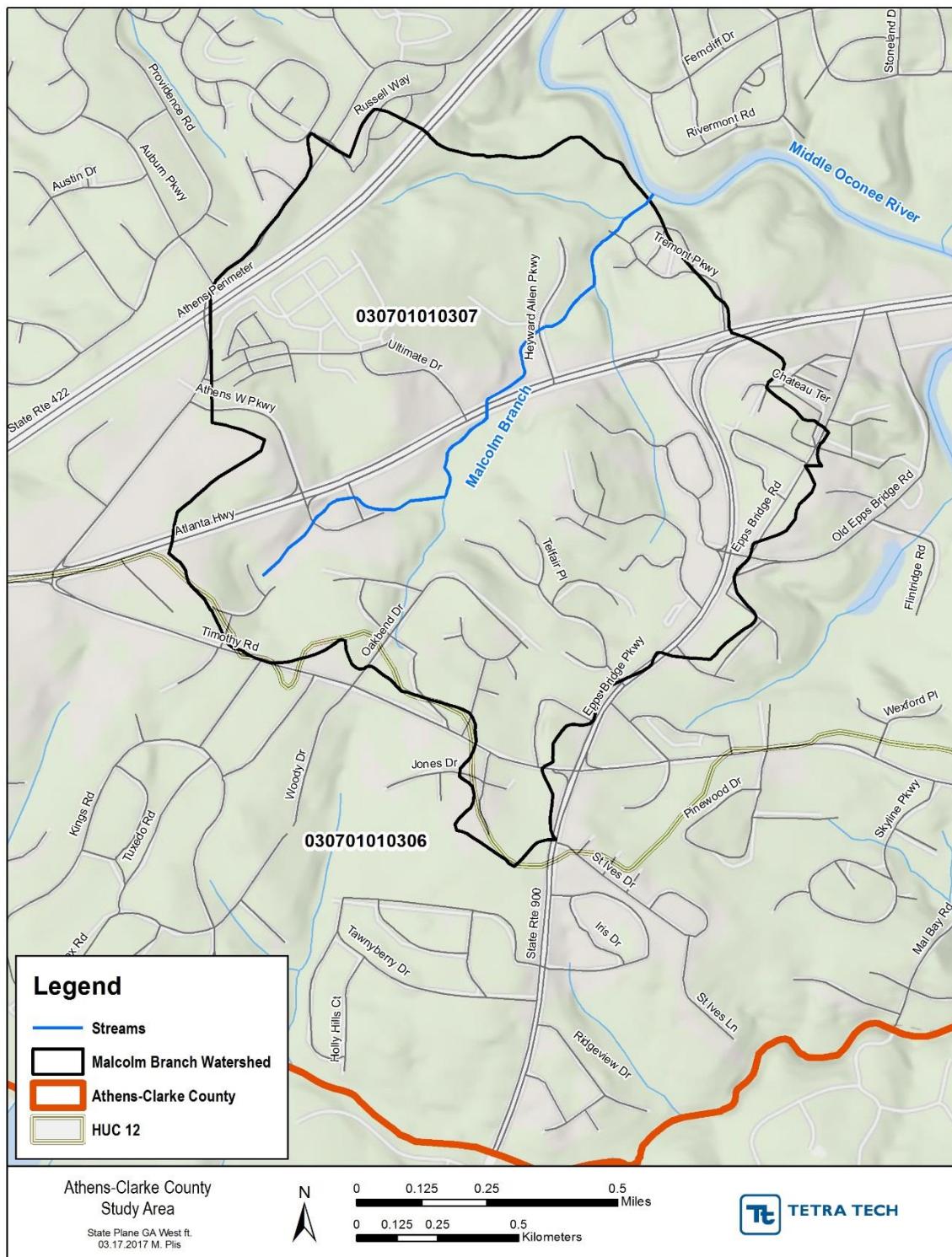
Figure 2-2. Malcolm Branch Watershed Study Area

2.2 Land Cover

The land cover in the study area consists of approximately 81 percent developed land, 17 percent forested land, and less than 2 percent other land covers. There is negligible to no pastureland/cropland in the watershed. Land cover information for the watershed was obtained from the 2011 National Land Cover Database (NLCD) as shown in Figure 2-3. This NLCD coverage has a spatial resolution of 30 meters. The percent breakdown by land cover in the study area portion of the watershed is shown in Table 2-1.

Table 2-1. Athens-Clarke County Malcolm Branch Watershed 2011 NLCD Land Cover

NLCD Land Cover	% Land Cover
Open Water	0.4%
Developed	80.9%
Barren	0.2%
Forest	17.4%
Shrub/Scrub	0.0%
Herbaceous	0.6%
Pasture/Crop	0.0%
Wetland	0.4%

The study area is about 29 percent impervious. There are many large commercial buildings and parking lots along Atlanta Highway, which cuts through the middle of the watershed, and residential homes and apartments further from the highway. Impervious cover is shown in Figure 2-4 and is based on the 2011 NLCD impervious coverage. It should be noted that areas of pervious pavement are likely classified as impervious in this coverage.
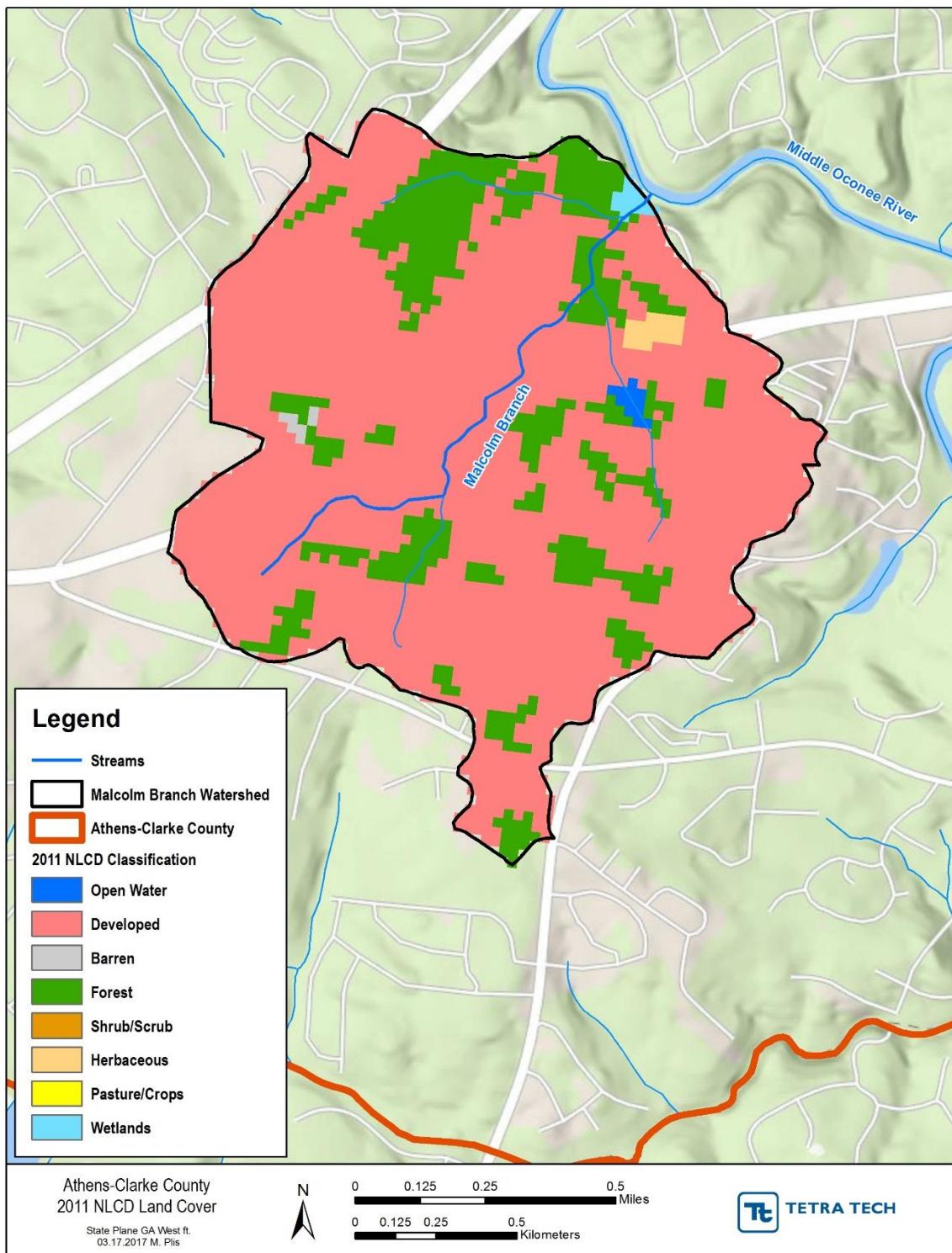
Figure 2-3. 2011 NLCD Land Cover
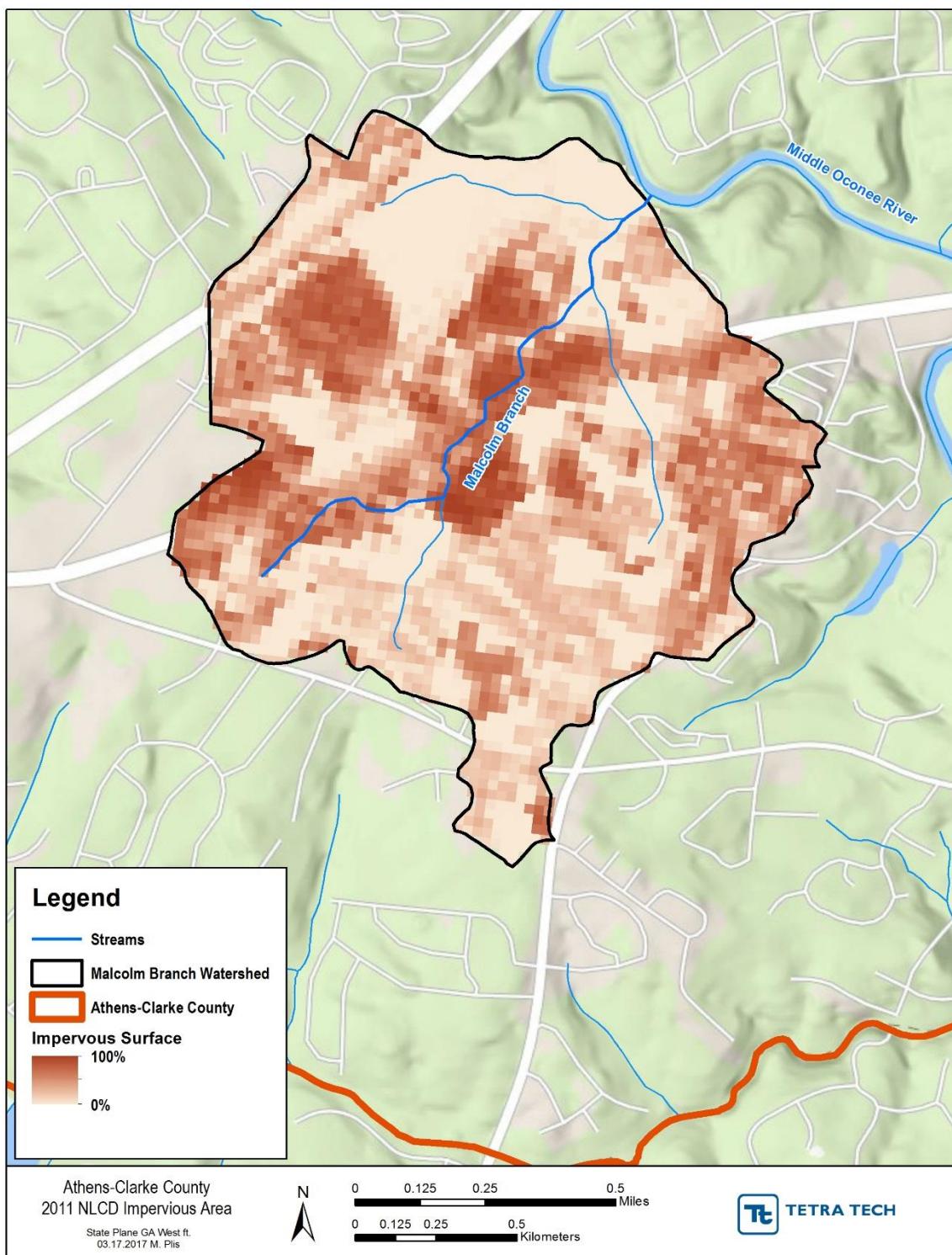
Figure 2-4. 2011 NLCD Impervious Cover

2.3   Ecoregion

The study area and all of ACC are located within the Southern Outer Piedmont level IV ecoregion (45b). This ecoregion has lower elevations, less relief, and less precipitation than the Southern Inner Piedmont ecoregion (45a) to the northwest. Loblolly-shortleaf pine is the major forest type, with less oak-hickory and oak-pine than 45a. Gneiss, schist, and granite are the dominant rock types, covered with deep saprolite and mostly red, clayey subsoils. The majority of soils are Kanhapludults. The southern boundary of the ecoregion occurs at the Fall Line, where unconsolidated coastal plain sediments are deposited over the Piedmont metamorphic and igneous rocks (Griffith et al. 2001).

2.4   Environmentally Sensitive Areas

Environmentally sensitive areas include wetlands, water supply watersheds, and other natural areas that are important for wildlife habitat and/or recreational use. There are no water supply watersheds in the watershed. The National Wetland Inventory (NWI) Map identifies a very small area of forested wetland adjacent to Malcolm Branch where it joins the Middle Oconee River, as shown in Figure 2-5. However, wetlands were not observed here during the stream walks.

No other environmentally sensitive areas were identified.
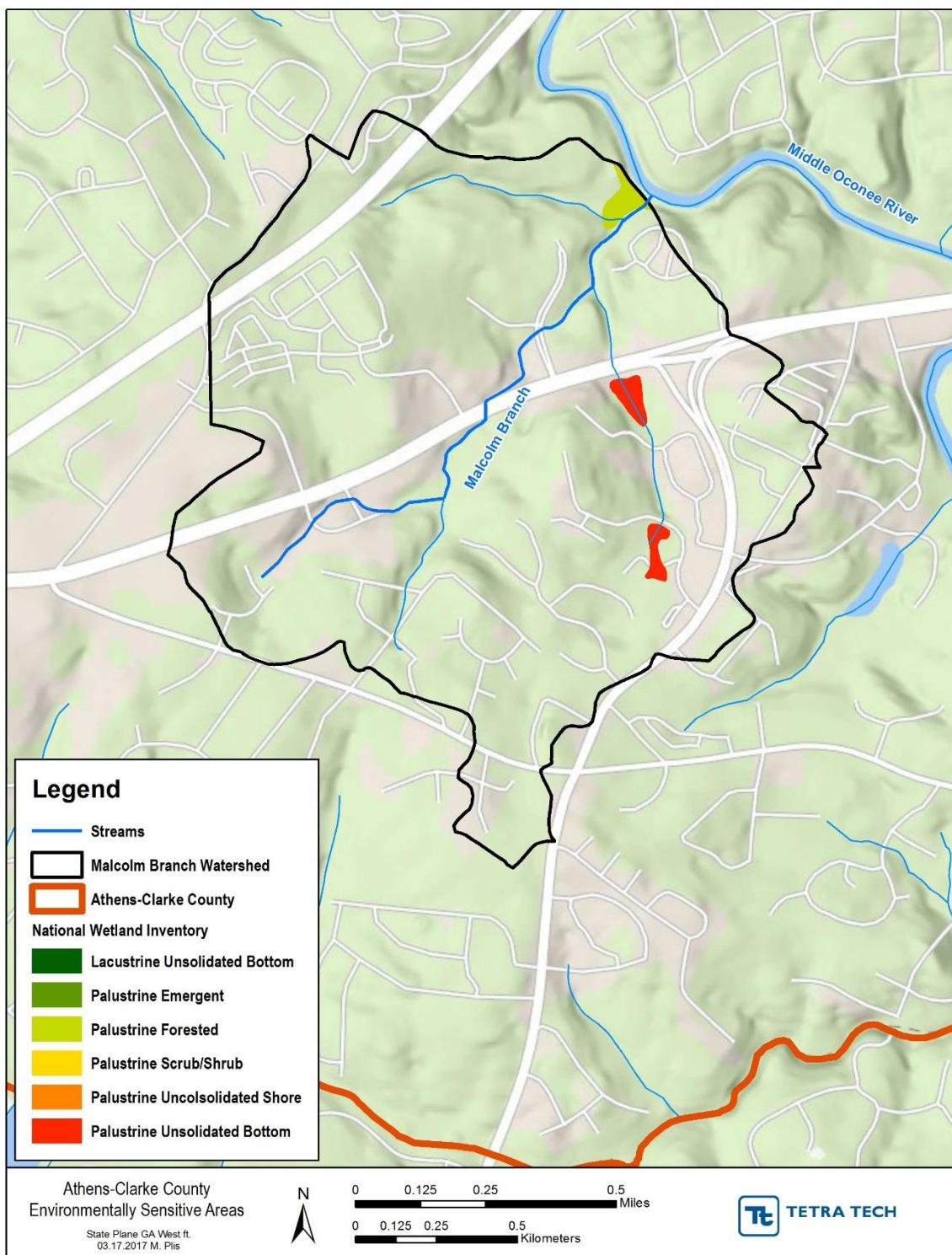
Figure 2-5. Environmentally Sensitive Areas

2.5 Potential Sources of Pollution

A search was conducted for known point sources of pollution from state and federal databases including the GaEPD database of NPDES permits (GaEPD 2013) and the United States Environmental Protection Agency (USEPA) Envirofacts Multisystem Search (USEPA 2016). The online EPA Multisystem Search pulls multiple environmental databases for facility information. The known point sources obtained from these databases are shown in Figure 2-6 and listed in Table 2-2. None of these facilities discharge to waterbodies.

Table 2-2. Point Sources in Malcolm Branch Watershed in Athens-Clarke County (USEPA 2016)

Facility Name	EPA ID	Data Source
Akins Lincoln Mercury	110005681324	RCRA
Athens West Cleaners	110005719561	RCRA/AFS
Athens West Shopping Center	110009359185	RCRA
Heyward Allen Toyota	110007044466	AFS
Heyward Allen Toyota	110032649187	RCRA/AFS
Hughes Collision Center	110031329989	RCRA/AFS
Parrish Toyota Inc.	110005678445	RCRA
Target Store T1453	110024440390	RCRA
Walmart Neighborhood Market #5267	110067047369	RCRA

Notes: RCRA = Resource Conservation and Recovery Act; AFS = Air Facility System.

Potential nonpoint sources of pollution in the Malcolm Branch watershed include stormwater runoff from ACC's municipal separate storm sewer system (MS4) as well as runoff from forested lands. Oil, grease, and metals are common pollutants in runoff from urban areas. Fertilizers (nutrient pollution), herbicides, and pesticides can enter streams through runoff from residential lands. Fecal coliform (FC) bacteria and other bacteria that are a concern for human health can come from the waste of humans and other animals. These sources can include pets, wild animals, leaky sewer pipes, and septic systems. Sediment can also be a pollutant when excess amounts enter surface waters from eroding upland areas and from eroding stream banks. There is no agricultural land in the watershed, so polluted runoff from crop or pasture land is not a concern.
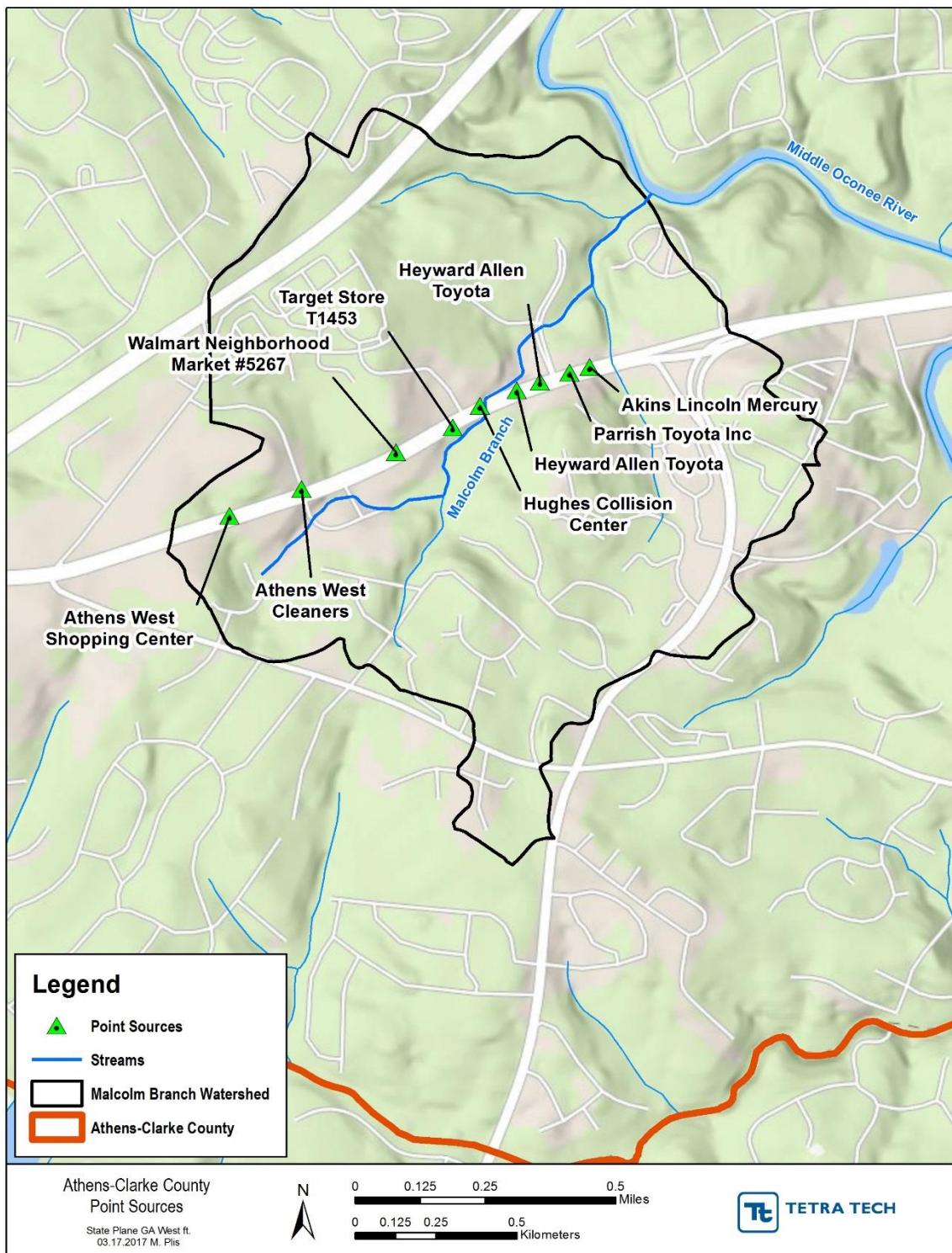
Figure 2-6. Point Sources (USEPA 2016)

2.6 Stream Condition

Stream walks were conducted in October 2016 through December 2016 to characterize existing stream conditions, identify areas of impairment, help identify potential causes of impairment, and help identify priority areas for management efforts. Stream walks in the Malcolm Branch watershed were only conducted along the main stem of Malcolm Branch, as shown in Figure 2-7.

2.6.1 Methodology

The stream walks consisted of collecting data points on computer tablets using the Environmental Systems Research Institute (Esri) Collector application while walking within wadeable streams and from the stream bank or by canoe for unwadeable streams. For consistency, data points were selected at distance intervals based on stream size (about 40 times the stream width) or when a significant change in channel form or stream characteristics was observed.

To quantify stream condition, each of four stream condition parameters—in-stream habitat rankings, bankface vegetation density, bank erosion ratings, and floodplain connection—were scored on a scale of 0 to 20, with 20 being the best possible individual parameter score. Overall stream condition for each reach was determined by totaling the scores of the four parameters, with 80 being the best possible score. The total numerical scores were given narrative condition ratings as follows:

- Poor: 0-23
- Marginal: 24-40
- Suboptimal: 41-63
- Optimal: 64-80

In addition to the stream condition parameter scores, each data point included global positioning system information; photographs capturing general stream features; and a reach level assessment that characterized surrounding land use, base flow as a percentage of channel width, dominant substrate, water clarity, aquatic plants in stream, wildlife in and around the stream, stream shading, channel dynamics, and reach accessibility. Geomorphic observations were also recorded that included bank height, channel width, and areas of erosion and mass wasting.

The range of data collected, along with the range of values and classifications defined in the tablets for the field assessments, is summarized in the table of Data Types and Classifications in Tablet (appendix A).

Once the data were collected, they were organized and processed geospatially with corresponding attribute tables in GIS in order to produce figures. The complete set of processed geospatial data was also provided to ACC for future use.

Stream condition and other data collected during this assessment were used to help identify watershed improvement opportunities.

2.6.2 Results

The stream condition scores for each data point collected in the study area are provided in appendix B. Each assessment point and the overall condition rating of each stream reach is shown in Figure 2-7. Notable features observed in the watershed are shown in Figure 2-8.

Stream walk data summary tables are included in appendix C. Field notes and photographs from the stream walks are provided in appendix D.
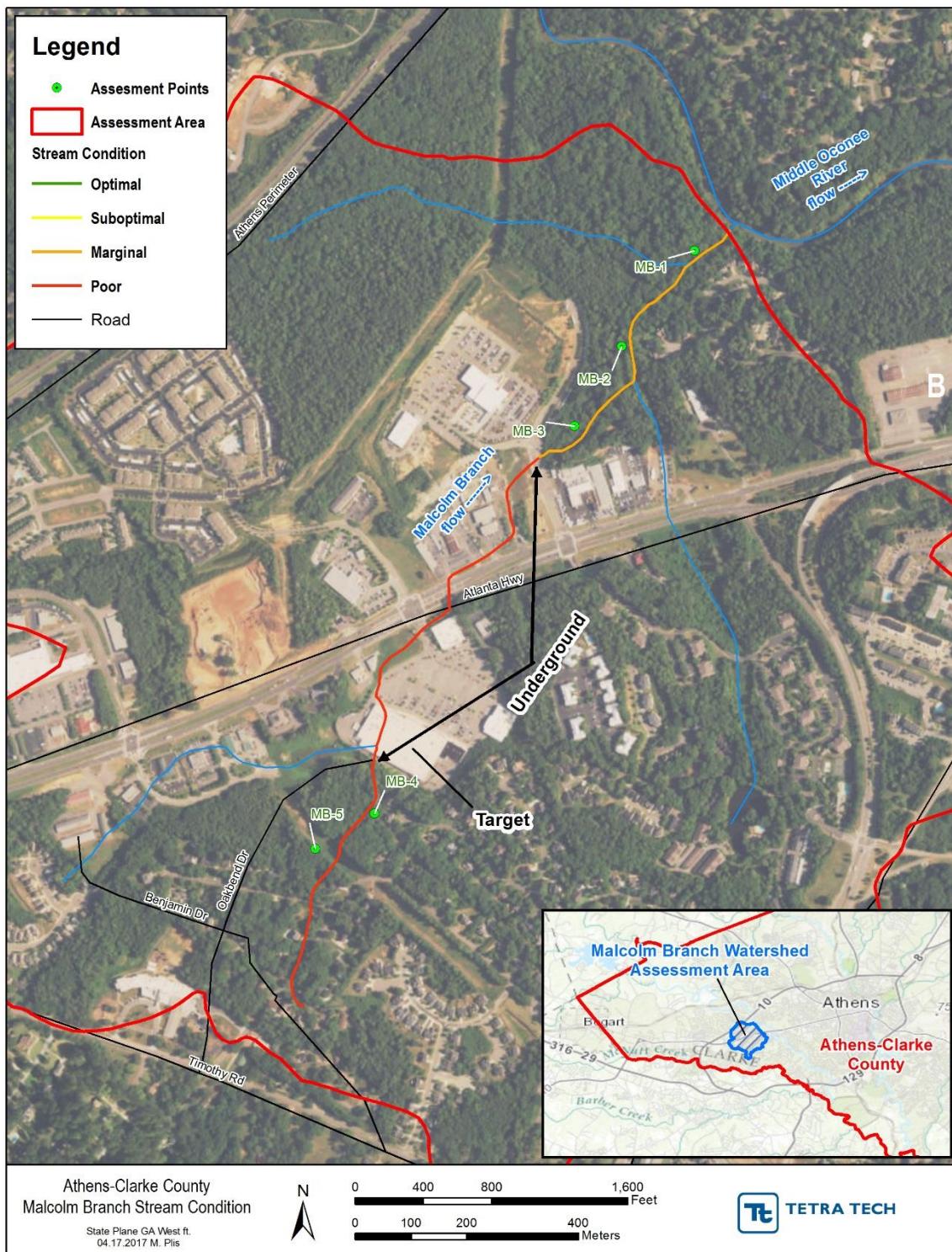
Figure 2-7. Stream Reach Condition Ratings
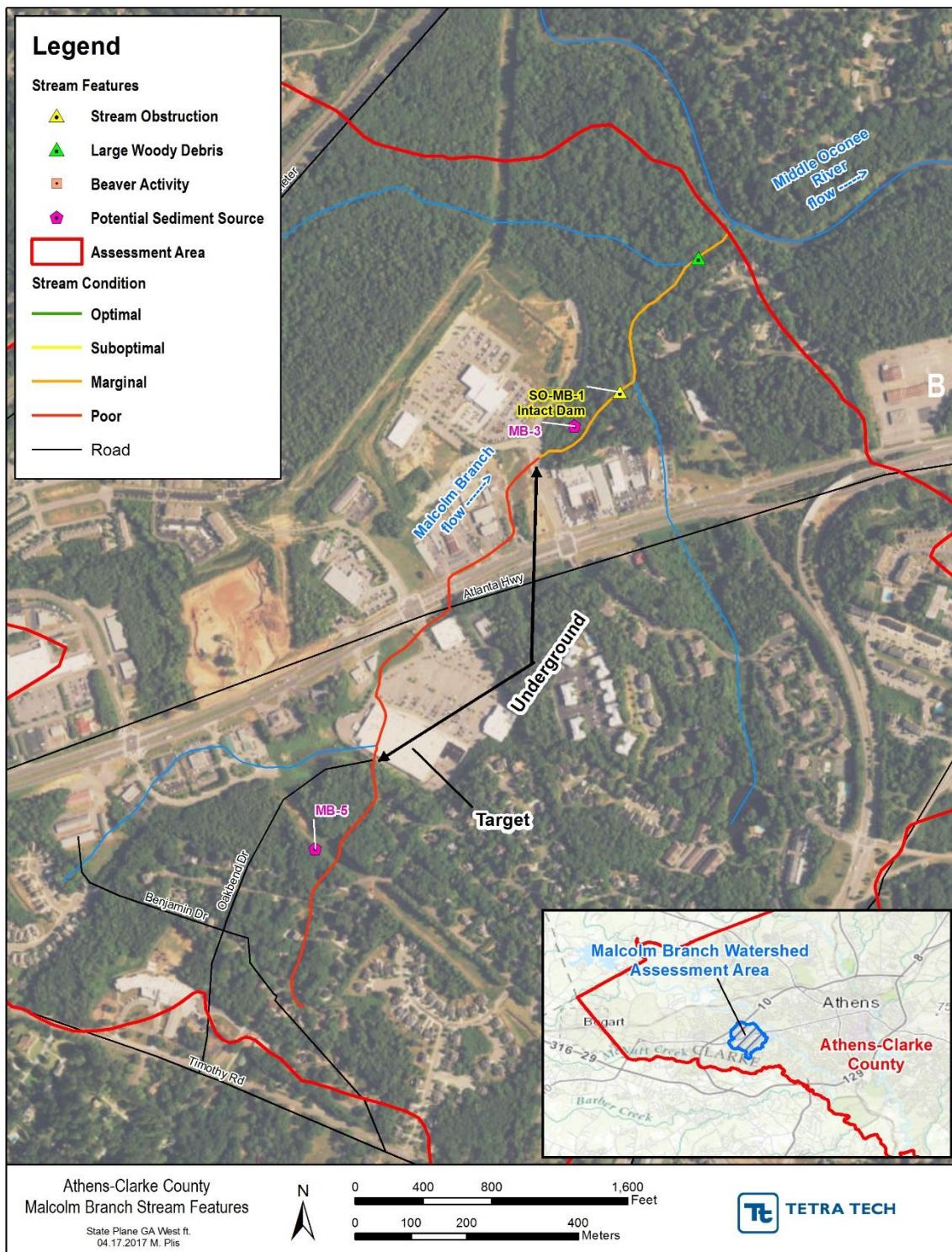
Figure 2-8. Stream Assessment Features

2.7 Water Quality

There is one water quality monitoring station in the study area (MB-1) that was monitored by ACC from 2012 to 2013. The monitoring station is shown in Figure 2-9. ACC does not have a regulatory obligation to conduct long-term monitoring. However, they have a proactive Stormwater Management Program that includes conducting monitoring on a rotating basis between the different watersheds in ACC to get representative conditions in the major streams and track trends in water quality over time. Collecting and testing water quality samples over time will provide a general picture of what pollutants are a concern in ACC's waterways.

The federal Clean Water Act has led to the development of water quality standards to restore and maintain the chemical, physical, and biological health of the nation's surface waters. Agencies use these standards to guide watershed management activities. The classification of a water body's designated use (e.g., drinking water supply) determines the applicable water standards. Malcolm Branch has a designated use of fishing according to Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03 (O.C.G.A. 2015[1]). State standards for dissolved oxygen (DO), pH, FC bacteria, and temperature for waters with the designated use of fishing are listed in Table 2-3.

Table 2-3. Georgia Water Quality Standards for Designated Use of Fishing (GaEPD 2015)

Dissolved Oxygen	pH	FC Bacteria	Temperature
Daily average of 5.0 mg/L and no less than 4.0 mg/L at all times	6.0-8.5	May-Oct < 200 colonies/100 mL as a geometric mean based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours, and 4,000 colonies/100 mL as a single-sample maximum.	Not to exceed 90 degrees Fahrenheit (32 degrees Celsius)
		Nov–Apr < 1,000 colonies/100 mL as a geometric mean based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours, and 4,000 colonies/100 mL as a single-sample maximum.	

Notes: mg/L = milligrams per liter; mL = milliliters.

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[1] O.C.G.A (Official Code of Georgia Annotated). 2015. Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03. Amended: F. Oct. 2, 2015; eff. Oct. 22, 2015.
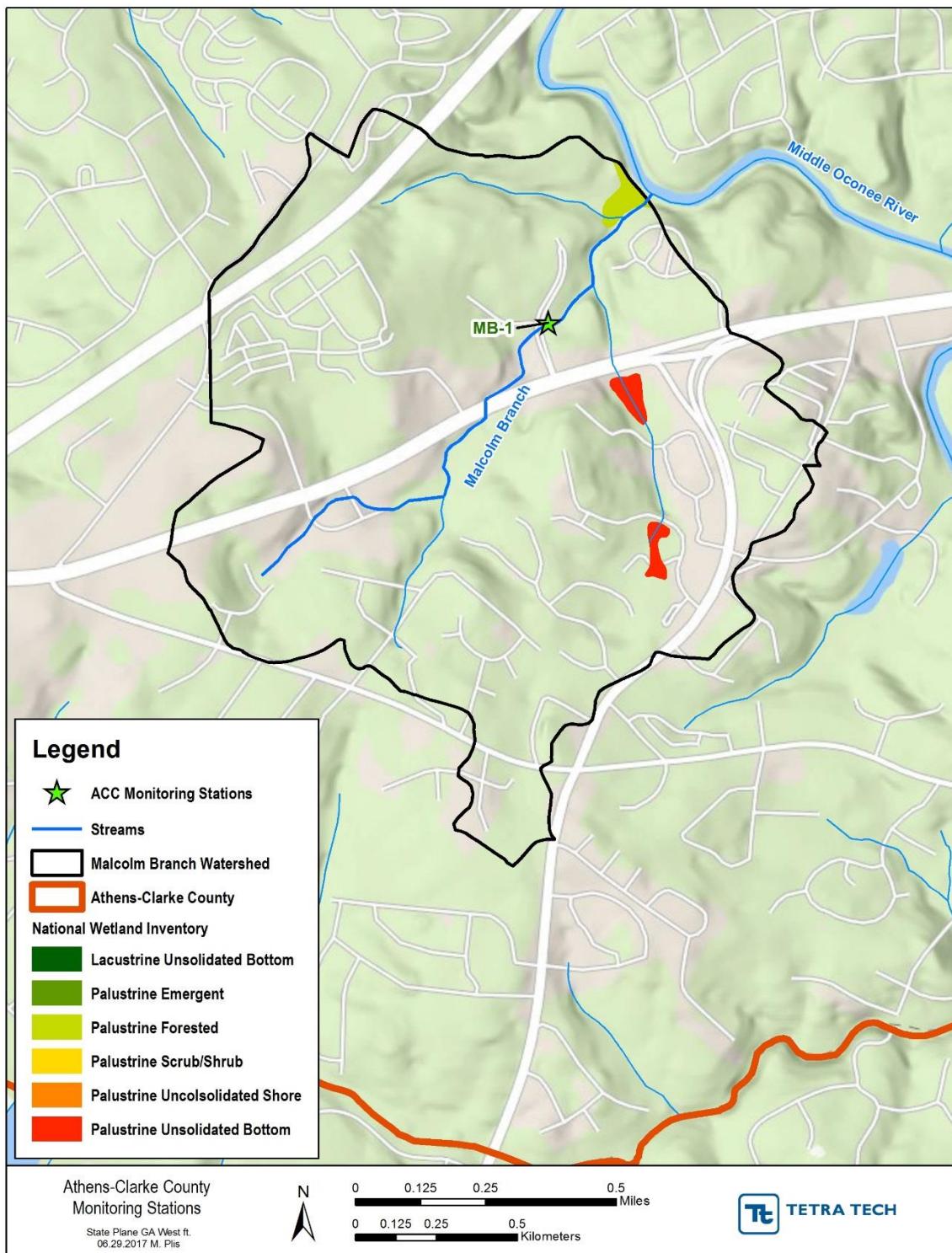
Figure 2-9. Water Quality Monitoring Stations

Water quality data collected by ACC from 2012 to 2013 is summarized in Table 2-4. In this table, standards are based on the state standards for DO, pH, FC, and temperature, as shown in Table 2-3. Standards for all other parameters are based on benchmark values used by ACC that are not regulatory standards. FC bacteria geometric means collected by ACC are shown in Table 2-5.

Plots of the raw grab sample data for DO, FC, pH, and temperature collected at station MB-1 are shown in Figure 2-10 through Figure 2-13. Data was collected from August 2012 through May 2013. The full set of tabulated data is provided in appendix E.

Table 2-4. ACC Monitoring Station Water Quality Data (2012-2013)

Parameter	Unit	Standard	MB1			
			Samples	Average	Min	Max
Conductivity	mS/cm	≤ 0.3	15	0.071	0.025	0.094
Dissolved Oxygen	mg/L	≥ 4*	15	7.91	5.46	11.41
Fecal Coliform Bacteria	cols/100mL	Varies	13	755	88	2,420
Ammonium (NH_4)	mg/L	not established	3	40.77	0.06	65.30
pH	Standard units	6.0 - 8.5*	15	6.60	5.63	7.33
Temperature	Degrees Celsius	≤ 32*	15	14.99	5.75	22.56
Total Nitrogen	mg/L	≤ 3	3	1.39	1.36	1.44
Total Phosphorus	µg/L	≤ 200	3	18.05	14.60	24.41
Total Suspended Solids	mg/L	≤ 13	3	23	5	54

Notes: cols/100 mL = colonies per 100 milliliters; µg/L = micrograms per liter; mg/L = milligrams per liter; max = maximum; min = minimum; mS/cm = millisiemens per centimenter. Red cells indicate averages not meeting the standard. * indicates state standard.

Table 2-5. Fecal Coliform Data and Water Quality Standard Comparison (2012)

Parameter	Unit	Standard	Sample Dates	MB1			
				Samples	Geomean	Min	Max
Fecal coliform bacteria May - Oct	cols/ 100 mL	<200	Aug 1-28, 2012	4	720	141	2,420
Fecal coliform bacteria Nov - Apr	cols/ 100 mL	<1,000	Nov 6-27, 2012	4	254	161	435
Fecal coliform bacteria Nov - Apr	cols/ 100 mL	<1,000	Feb 5-26, 2012	4	408	88	1,553

Notes: cols/100 mL = colonies per 100 milliliters; max = maximum; min = minimum. Red cells indicate averages not meeting the standard.
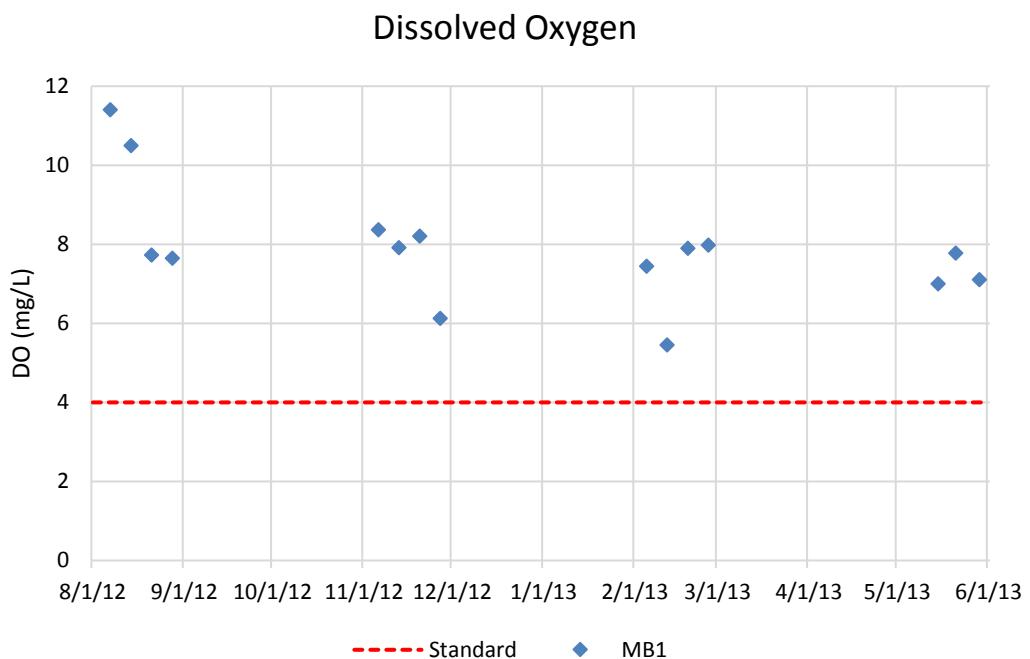
Dissolved Oxygen

Figure 2-10. Dissolved Oxygen Grab Sample Results for Malcolm Branch Station

Instantaneous Fecal Coliform Count
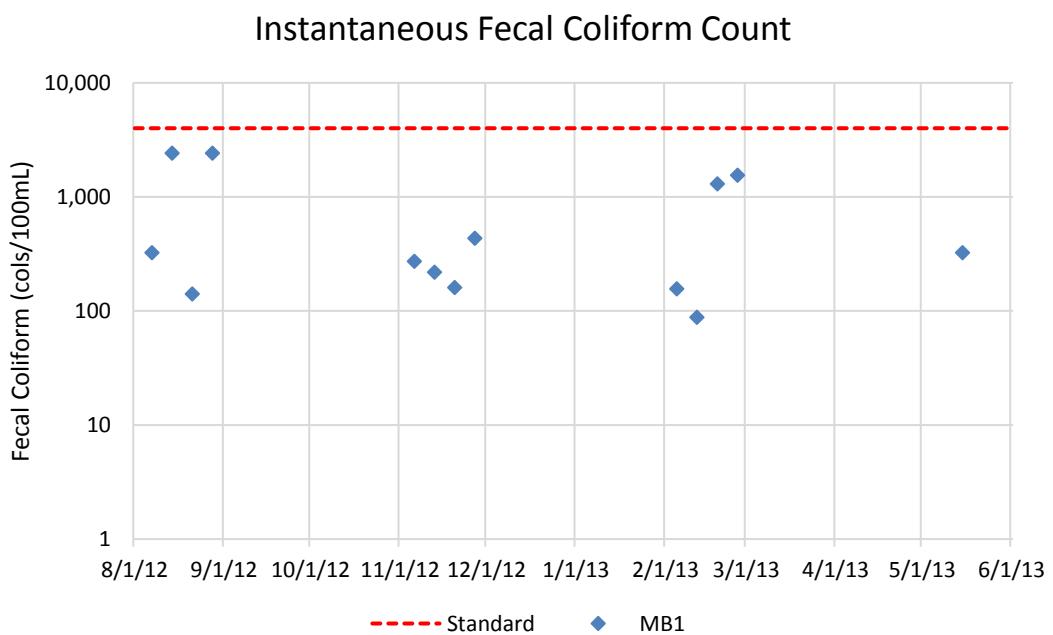
Figure 2-11. FC Bacteria Grab Sample Results for Malcolm Branch Station

pH
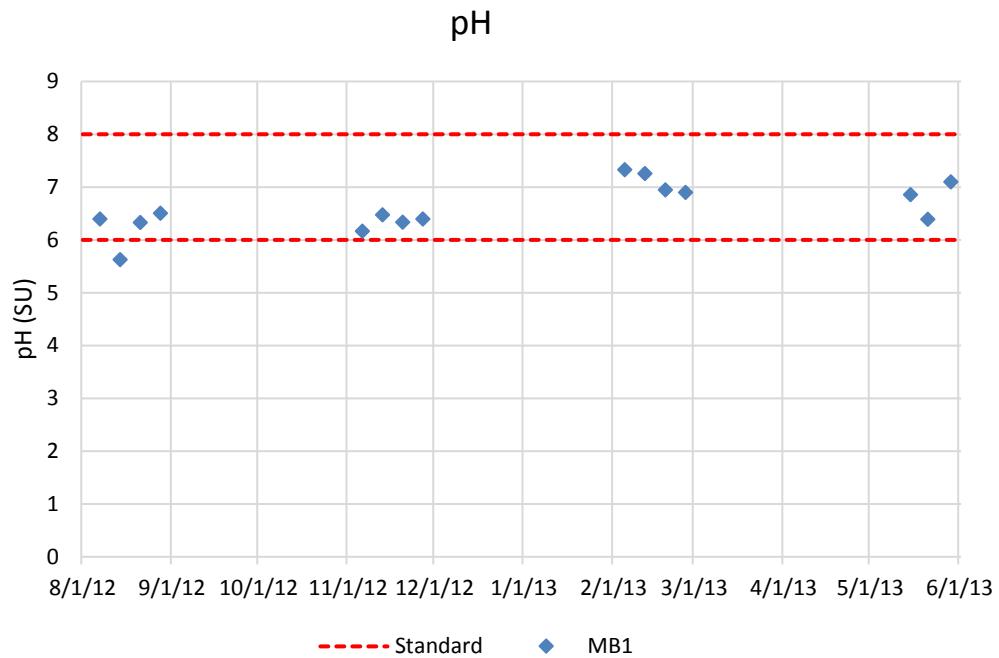
Figure 2-12. pH Grab Sample Results for Malcolm Branch Station
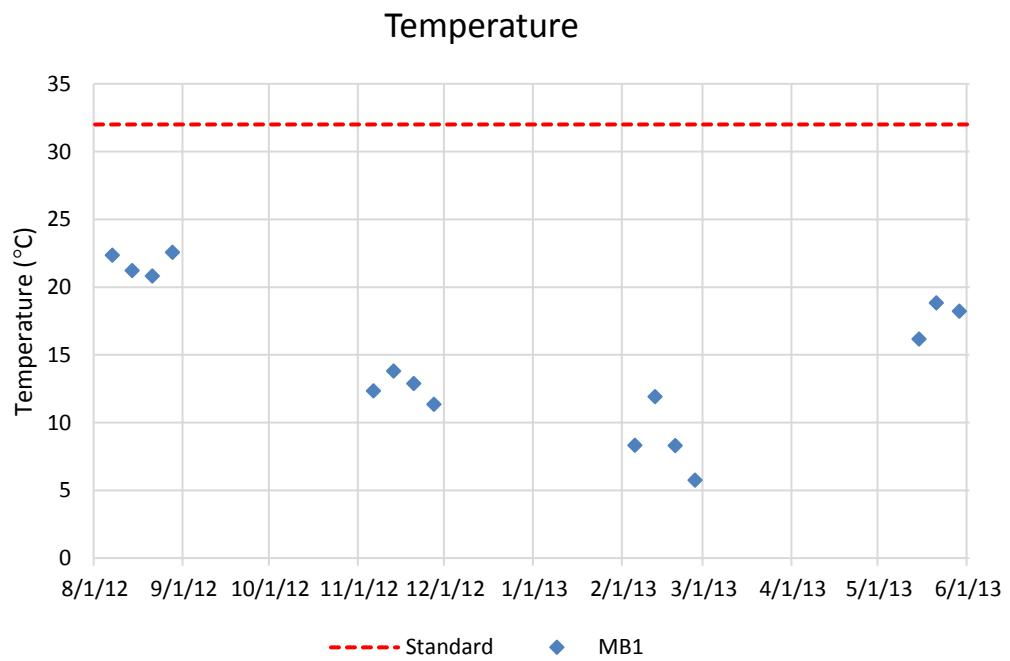
Temperature

Figure 2-13. Temperature Grab Sample Results for Malcolm Branch Station

Results of the water quality sampling effort suggest that surface waters in the study area are generally in compliance with the DO, pH, and temperature standards adopted by the State of Georgia. Average concentrations of DO and average measurements of pH and temperature in Malcolm Branch are well within the state standards. The pH standard minimum was not met on one occasion where a measurement was slightly below 6.0, but this does not appear to be indicative of a chronic water quality problem.

FC geometric means indicate that the Malcolm Branch station complies with the November-through-April standard but it exceeded the May-through-October standard for the single geometric mean that was calculated for that time of year (Table 2-5). Average conductivity, total nitrogen (TN) and total phosphorous (TP) results meet the standards. Average TSS concentrations slightly exceeded the standard of 13 mg/L.

2.8 Nutrient and TSS Loading

2.8.1 LSPC Watershed Model

The Loading Simulation Program C++ (LSPC) was used to represent the hydrological and water quality conditions for the study area. LSPC is a comprehensive data management and modeling system that is capable of representing loading, both flow and water quality, from nonpoint and point sources and simulating in-stream processes. It is capable of simulating flow, nutrients, TSS, and other conventional pollutants, as well as temperature and pH for pervious and impervious lands and water bodies. LSPC was configured to simulate the watershed as a series of hydrologically connected subwatersheds. LSPC is based on the Mining Data Analysis System (MDAS), with modifications for nonmining applications such as nutrient modeling. MDAS was developed by EPA Region 3 through mining TMDL applications.

2.8.2 Watershed Segmentation

The contributing drainage area was represented by a series of subwatersheds to evaluate the sources contributing to a water body and to represent the spatial variability of these sources within the watershed model. Subwatersheds were delineated using the National Elevation Dataset in 1/3-arc-second resolution (10 meters) and the National Hydrography Dataset.

2.8.1 Simulation Period

The ACC LSPC model was set up and calibrated to simulate a 10-year period from January 1, 1998, through December 31, 2009. That calibration time period was selected as it captured two drought periods (1999-2001 and 2006-2007) and several wet years, including 2003 and 2005.

2.8.2 Land Cover Representation

The watershed model uses land cover data as the basis for representing hydrology and nonpoint source loading. Land cover data was used from the University of Georgia (UGA) Georgia Land Use Trends (GLUT) coverage, and included urban, forest, crop and pasture land, wetlands, water, barren, golf

courses and utility swaths. The GLUT coverage represented conditions in year 2008 based on an existing model developed as part of State water planning efforts. In addition, the LSPC model requires division of land cover in each subwatershed into separate pervious and impervious land units. For this, the GLUT impervious cover was intersected with the GLUT land cover. Again, the GLUT land cover data was used in modeling because of its consistency with State water planning efforts and because it is more representative of the modeled simulation period (January 1, 1998, through December 31, 2009) than the NCDC 2011 Land Cover described in section 1.2.

2.8.3   Loading Maps

Loading maps were created to represent average TN, TP, and TSS loading rates in pounds per acre per year for each of the subwatersheds in the study area (Figure 2-14 through Figure 2-16) using results from the LSPC model developed for ACC. The modeled results identified high TN and TP loads throughout watershed. Modeled TSS loads are moderate throughout the watershed. There are no numeric standards for TN, TP, or TSS loads in streams in Georgia, so the figures are not meant to show areas that exceed an allowable value, but to depict average nutrient and sediment loads across the watershed based on land use.
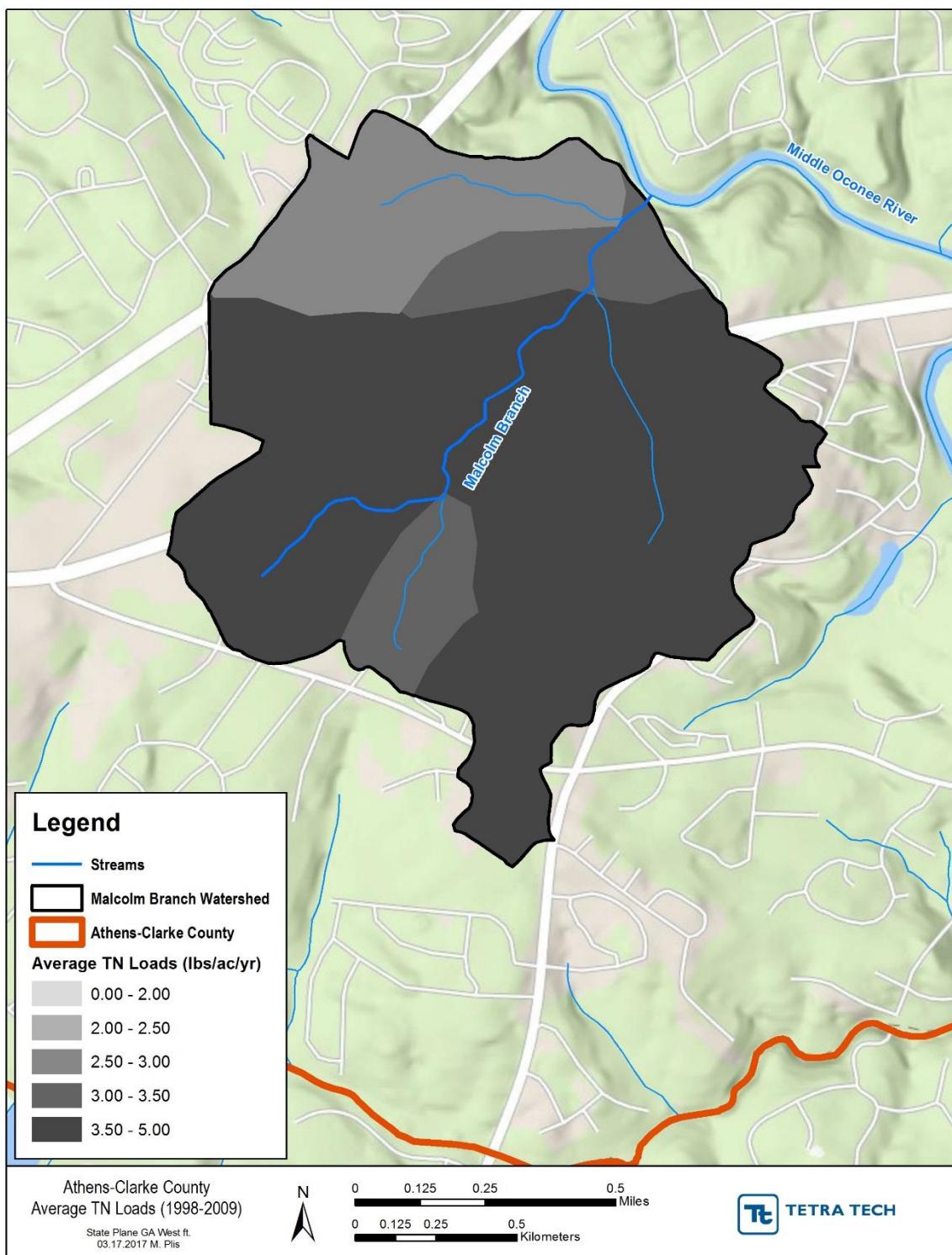
Figure 2-14. Average TN Loads
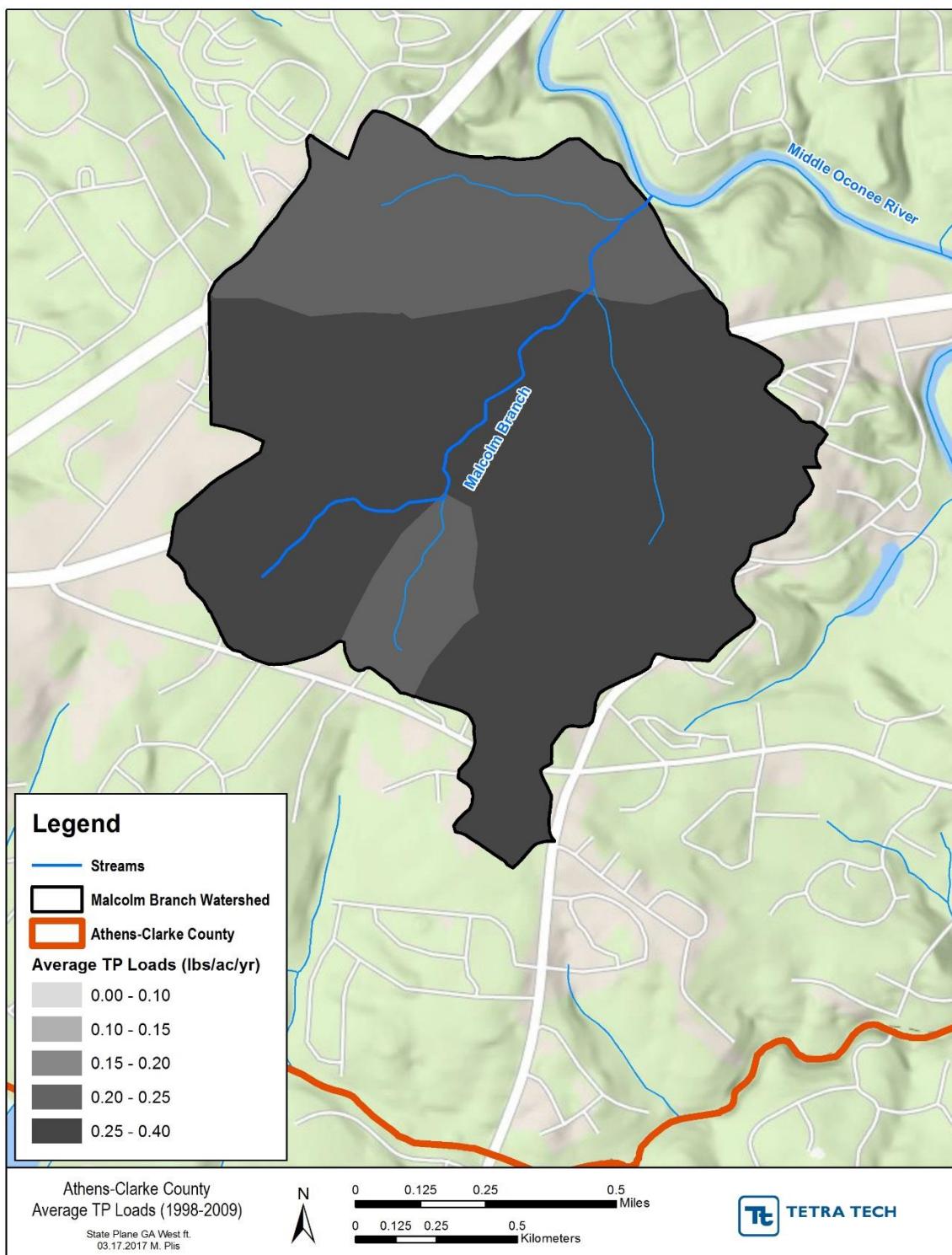
Figure 2-15. Average TP Loads
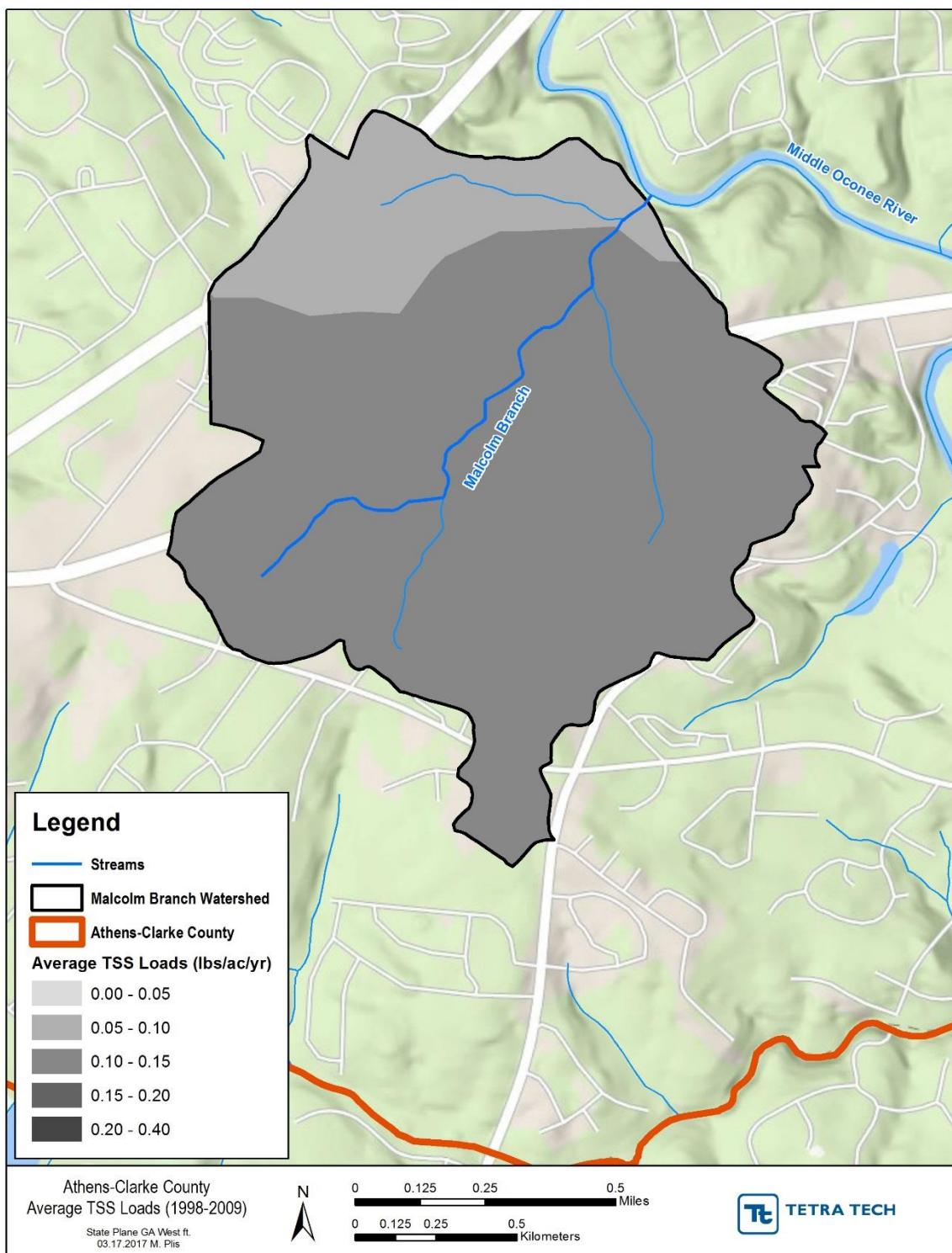
Figure 2-16. Average TSS Load

2.9 Summary

This watershed characterization describes existing conditions in the Malcolm Branch watershed within ACC. The nature and condition of the study area was characterized from previous studies, monitoring efforts, and stream assessments. A watershed model was also used to identify subwatersheds contributing to nutrient and TSS loads.

The Malcolm Branch watershed is composed primarily of developed land, and is approximately 29 percent impervious. There are no impaired streams in the study area (GaEPD 2016).

Water quality monitoring data indicate that FC bacteria may be a concern in the study area. Although limited data has been collected, there was one exceedance of the May-October State standard. Sediment is also a potential concern in the Malcolm Branch watershed, as the average TSS concentration was above the standard.

Notable key findings from the stream assessment include the following:

- Malcolm Branch can be characterized as having marginal stream conditions downstream of Atlanta Highway, and poor stream conditions upstream of Atlanta Highway.
- A headcut and gulley at the most upstream end of Malcolm Branch is an ongoing erosion problem that has the potential to impact infrastructure in the future.
- There is an intact dam below Atlanta Highway, approximately six feet above the water surface.
- One third of the stream is culverted under shopping plazas.

3 Watershed Management Measures

3.1 Current Measures

ACC is currently implementing numerous structural and programmatic management measures to maintain and improve water quality throughout the county. The implementation of these measures is a collaborative effort by various ACC departments and other stakeholders mentioned in section 1.3.

As part of ACC's efforts to implement watershed protection strategies, measures have been taken to prevent detrimental changes in hydrologic conditions and reduce, prevent, or treat stormwater pollutants through protective ordinances, development reviews/inspection programs, staff training sessions, public education and outreach, compliance with ACC's Phase II MS4 permit, water quality monitoring, and long-term watershed characterization studies. A complete list of BMPs and programmatic management activities implemented from July 2016 through June 2017 is included in Table 2-1 of the 2016-2017 Public Utilities Department WPP Annual Report and provided as appendix F of this WMP.

3.2 Watershed Management Needs

3.2.1 Method for Determining Management Needs

Eight watershed management needs were identified across ACC based on information obtained from the watershed characterizations. Decision criteria were developed to determine if a management need applied to each assessed watershed. The criteria for determining ACC management needs are listed in Table 3-1. The table also identifies which of these management needs apply to the Malcolm Branch watershed. Shaded cells indicate that the need is watershed-wide.

Table 3-1. Watershed Management Needs Decision Criteria

Management Need	Decision Criteria	Applicable to Malcolm Branch[a]
FC Bacteria	Listed as impaired for FC; or Geometric mean not meeting state WQ standards.	Yes
Sediment	Listed as impaired for biota (fish or macro) due to sediment; or Average TSS value greater than standard of 13 mg/L.	Yes
pH	Average value not meeting state WQ standards.	
Conductivity	Average value greater than the standard of 0.3 mS/cm.	
Dissolved Oxygen	Average value not meeting state WQ standards.	
Wetland Preservation	Large wetland areas identified in NWI Map.	
Buffer Enhancement	High percentage of cropland/pastureland directly adjacent to streams.	
Hydrology	Watershed is $\geq$ 10% impervious; or Poor stream condition scores.	Yes

Note: mg/L = milligrams per liter; mS/cm = millisiemens per centimenter.

a Dark shading indicates the management need is watershed-wide.

3.2.2   Management Needs by Area

The Malcolm Branch watershed was determined to have the following watershed management needs. For each management need a rationale is provided in addition to identifying to what area of the watershed it applies. Refer to Figure 3-1 for locations of management needs by area.

FC Bacteria: Limited water quality data has been collected at the single monitoring station in the Malcolm Branch watershed, however there was one exceedance of the May–October state standard for fecal coliform bacteria at this station. Therefore, this was determined to be a watershed-wide management need.

Sediment: The average TSS concentration is greater than the standard of 13 milligrams per liter at the single monitoring station in the Malcolm Branch watershed. Therefore, this was determined to be a watershed-wide management need.

Hydrology: Hydrology was identified as a watershed-wide management need because the Malcolm Branch watershed is greater than 10 percent impervious. Large areas of development along Atlanta Highway, including a Target store and other commercial developments, are influencing the hydrology of Malcolm Branch; the stream is piped underground over 1,600 linear feet of its length. As the percentage of impervious area increases in a watershed, stream hydrology is altered. This altered hydrology, sometimes referred to as "urban stream syndrome," causes streams to have lower baseflow and higher peak storm flows than they would in a less developed watershed.   Stormwater management practices that help detain stormwater runoff and release it slowly, and those that help infiltrate water into the ground can help restore a more natural hydrology to the receiving streams.
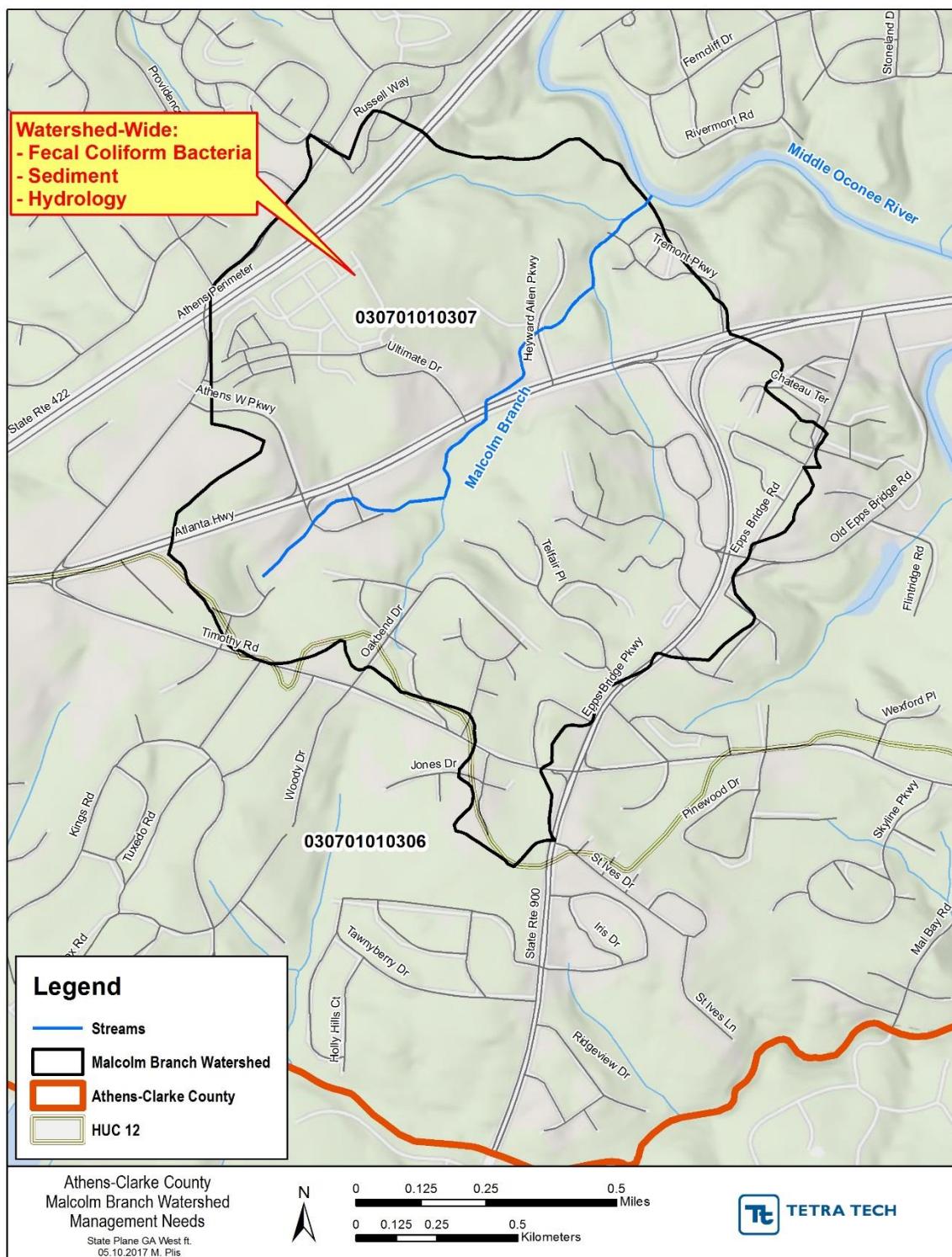
Figure 3-1. Malcolm Branch Management Needs

3.3   Management Opportunities

The Tetra Tech-Arcadis-ACC team conducted a GIS analysis and field assessment to identify watershed management opportunities, including stormwater control, restoration, and programmatic measures. Particular consideration was taken by the team to identify and prioritize opportunities that target the management needs specific to the Malcolm Branch watershed. This section presents details and results of the analytical methodology employed by the team to develop a prioritized list of viable opportunities, including parcel screening criteria, field assessment information, BMP modeling scenarios, and scoring and ranking metrics.

3.3.1   Identification of Potential Sites for Management Opportunities through GIS Analysis

A GIS screening analysis was conducted as an initial step in identifying potential sites for watershed improvement measures. Eleven metrics were used to score all parcels in the watershed. Point values were assigned to different categories within each metric so that preferred attributes received a higher score (Table 3-2). Some site features were preferred over others when selecting candidate sites because they had features such as publicly owned land, large parcel size, and close proximity to an impaired stream. Weighting of preferred features was done within the scoring system itself, rather than applying a weighting factor to each metric. Therefore, the total possible points are different for individual metrics. Individual metric scores were summed to obtain a total score for each parcel in the watershed. The maximum score possible was 119. All parcels in the watershed were scored and ranked based on this system.

The top 20 ranked sites in each watershed were evaluated further using GIS data and Google Earth images to evaluate the potential for management opportunities on these parcels. Some parcels were removed from further consideration if opportunities were limited (based on ownership information, existing land use, position in the watershed, access constraints, and other factors). Some parcels had characteristics that informed programmatic management opportunities (e.g., preservation opportunities, stream buffer enhancement, and agricultural BMPs), but did not require a site visit.

Additional sites were added to the list of places to visit in the field following consultation with the Transportation and Public Works Department and the Leisure Department, both of which provided a list of sites already identified as having stormwater management concerns and other potential management opportunities. Other sites were added based on opportunities identified from stream walks or from a visual scan of the watershed in Google Earth and GIS. The visual scan helped identify sites that might not have been captured by the scoring metrics such as highly disturbed or erosional areas. A list of the sites identified for field assessments is included in Table 3-3 and their locations are shown on Figure 3-2.

Table 3-2. Metrics and Scoring System for Site Prioritization

Parcel Metric		Score	Source	Notes
Publicly Owned	County Gov	20	ACC GIS layer	Higher scores assigned to publicly owned parcels.
	Other County	15		
	State Owned	10		
	No	1		
Planned Development	Yes	20	ACC GIS layer	Targets parcels slated for development as opportunities for BMP incorporation.
	No	0		
Within 150 ft of Agricultural Stream Segment	Yes	10	Based on National Land Cover Database (NLCD)	Targets parcels contributing runoff from agricultural and/or livestock activity.
	No	0		
Impervious Cover %	76-100	10	Based on National Land Cover Database (NLCD)	Targets parcels with higher impervious cover.
	51-75	7.5		
	26-50	5		
	0-25	2.5		
Hydrologic Soil Group	A	10	USDA Web Soil Survey coverage	Targets parcels with more permeable soils.
	B	7.5		
	C	5		
	D	2.5		
Parcel Size (ac)	1.52+	10	ACC tax parcel data	Higher scores for large parcels as they are more suitable for BMP opportunities.
	0.61-1.51	7.5		
	0.34-0.60	5		
	0.0-0.33	0		
Within 150 ft of Impaired Stream Segment	Yes	10		Targets parcels in proximity to stream segments listed as Impaired on the 303(d) list.
	No	0		
Erosion Score	Poor	8	On-site visual assessment	Higher scores assigned to parcels proximal to stream segments with obvious erosion issues.
	Marginal	6		
	Suboptimal	4		
	Optimal	0		
Vegetation Score	Poor	8	On-site visual assessment	Higher scores assigned to parcels lacking vegetative coverage along banks.
	Marginal	6		
	Suboptimal	4		
	Optimal	0		
Overall Score	Poor	8	On-site visual assessment	Composite score combining bank erosion, vegetation coverage, in-stream habitat conditions, floodplain connection, and accessibility.
	Marginal	6		
	Suboptimal	4		
	Optimal	0		
Zoning	C-G	5	ACC GIS layer	Commercial – General.
	C-D	5		Commercial – Downtown.
	C-N	5		Commercial – Neighborhood.

Parcel Metric		Score	Source	Notes
	C-O	5		Commercial – Office.
	E-I	2.5		Employment – Industrial.
	I	2.5		Industrial.

Notes: ac = acres; ft = feet; USDA = U.S. Department of Agriculture.

Table 3-3. Sites Identified for Field Assessment

Parcel No.	Owner	Publicly Owned	Planned Development Parcel	Agricultural Stream Segment	Impervious Cover %	Hydrologic Soil Group	Parcel Size	Impaired Stream Reach	Erosion Score	Vegetation Score	Overall Score	Parcel Zoning	Total Score	Rank in Watershed[a]
Public														
072 003	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	7.5	0	1	1	1	0	40.5	147
074 A016	CLARKE COUNTY SCHOOL DISTRICT	15	0	0	2.5	7.5	10.0	0	1	1	1	0	38	190
074 A006B	CLARKE COUNTY SCHOOL DISTRICT	15	0	0	2.5	7.5	10.0	0	1	1	1	0	38	190
Private														
072 013L	RIGBY FAMILY LLLP3	1	20	0	2.5	7.5	10.0	10	6	6	6	0.00	69.0	1
123 004	THE OAKS AT EPPS BRIDGE LLC	1	20	0	5.0	7.5	10.0	0	1	1	1	5.00	51.5	13

Note:

a Rank indicates rank among all parcels in the watershed. Parcels with the same total score received the same rank.
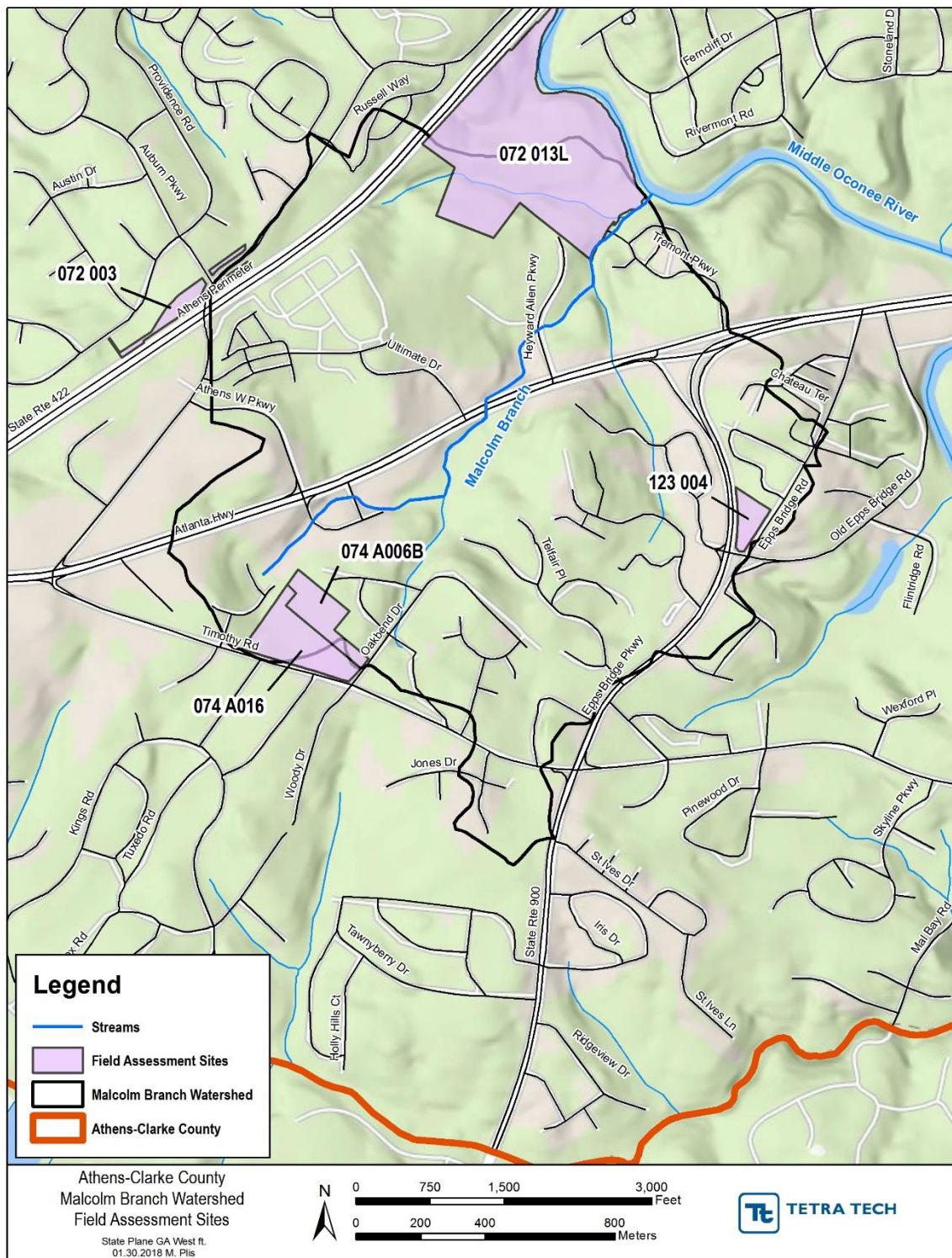
Figure 3-2. Malcolm Branch Field Assessment Sites

3.3.2 Field Assessment

Each site identified for field assessment was visited to further evaluate opportunities for management measures. Access to some sites was limited, either because of private ownership or because of fencing. In addition to the identified site field assessments, a windshield survey was performed while traveling throughout the study area to identify other parcels where opportunities might exist. If new opportunities were identified, they were assessed at that time.

Watershed Improvement Opportunity Field Assessment forms (appendix G) were filled out for sites where management opportunities exist and for sites where it was important to document existing site conditions in support of the general watershed characterization. The forms include information about landowners, existing conditions, land use, and potential utility conflicts as well as a description of proposed management measures and photo notes.

3.3.3 Initial Site Screening and Identification of Management Opportunities

Following the field assessments, sites that had no viable management opportunities and those that had significant constraints or challenges were removed from further consideration. The remaining sites were identified as candidate sites for watershed improvement opportunities. One site was identified in the Malcolm Branch watershed. Parcel information and potential opportunities for the candidate site are listed in Table 3-4 and the site location is shown in Figure 3-3. BMPs were assigned a unique ID based on an abbreviation of the watershed name and whether the BMP is structural stormwater control (Str), restoration (Res), or programmatic (Prog). No stormwater control or restoration BMP opportunities were identified in the Turkey Creek watershed.

Table 3-4. Candidate Sites for Watershed Improvement Opportunities

| Watershed	Parcel Number	Owner	Description	Opportunity	BMP ID
Malcolm Branch	072 013L	Rigby Family LLLP3	Forested parcel bordering Malcolm Branch and Middle Oconee River	Buffer Preservation	MB-Prog-01
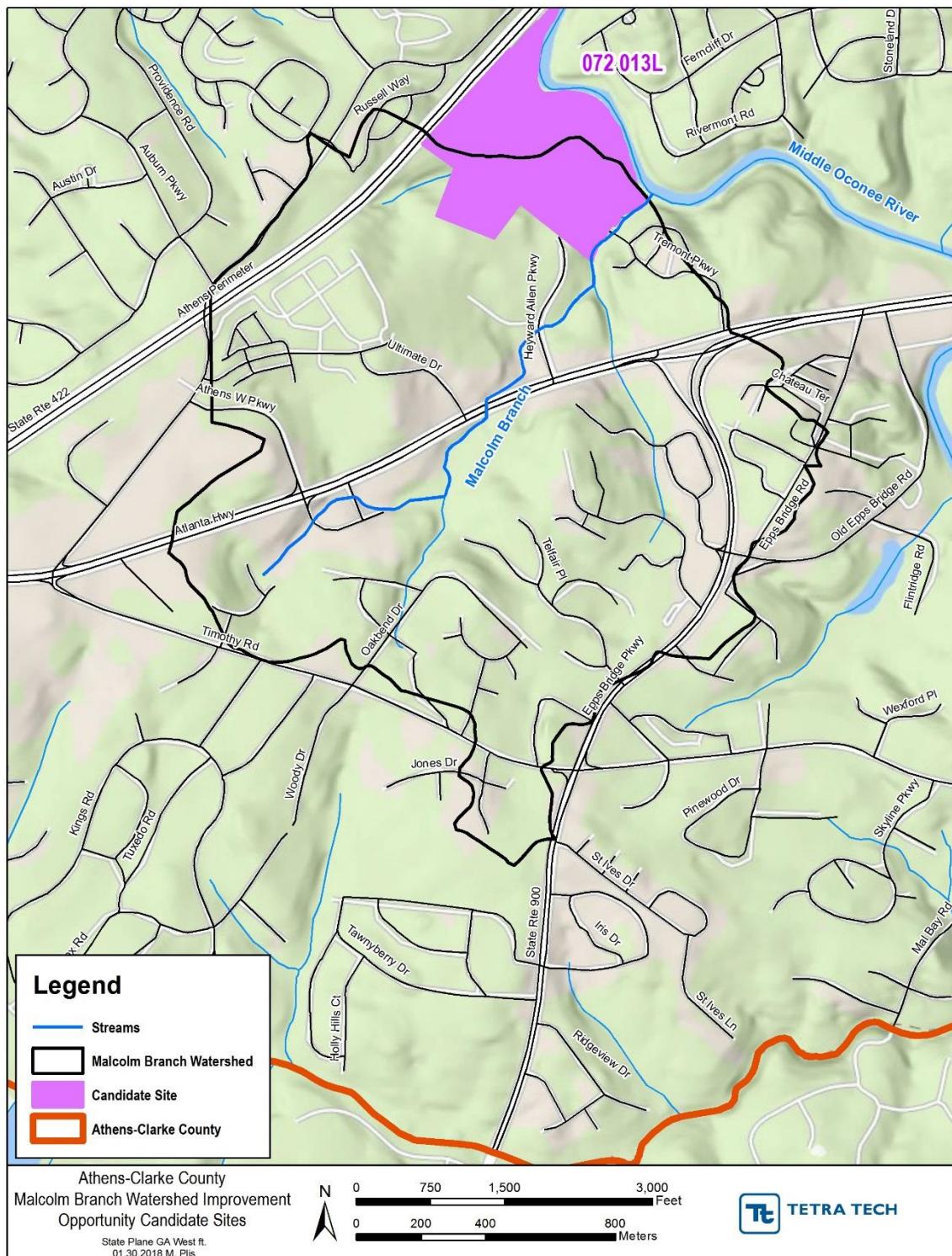
Figure 3-3. Malcolm Branch Watershed Improvement Opportunity Sites

Programmatic watershed improvement opportunities were identified through the GIS analysis and field assessments. These programmatic opportunities include measures such as the development or modification of standard operating procedures for vegetation management, review of inspection and maintenance programs, development of education programs, creation of incentives for stormwater management retrofits, encouragement of green infrastructure and low impact development practices, and the development of a more comprehensive stormwater inventory. A full list of programmatic management opportunities that are not parcel-specific is provided in Table 3-5.

Table 3-5. Programmatic Watershed Improvement Opportunities (not parcel-specific)

Measure	Description
Bacterial Source Tracking	Bacterial source tracking (BST) may help identify the source (e.g., human, dog, goose, or deer) of FC bacteria in the watershed. Specific sampling locations may be selected based on anecdotal evidence to help determine the type of management measures that will be most effective at reducing FC levels.
Vegetated Stream Buffers	Educate Department of Leisure Services and contractor personnel not to mow within the 75-ft buffer along perennial streams. Allow limited mowing once or twice a year in specific areas to limit growth of woody vegetation. Leave as tall as possible. Educate landscape companies, farmers, golf courses, and homeowners to leave a vegetated buffer along streams. Fliers and/or in-person meetings with farmers about federal programs that provide funding to move feeding operations away from streams.
Mowing Maintenance Practices[a]	Develop standard operating procedures for ACC departments and contractors mowing ACC and ACC School District properties about landscaping BMPs for protection of water resources. Mowing height should be at least 2 inches.
Bank Stabilization[a]	Use site-specific measures to stabilize eroding banks, using vegetation and natural materials that will provide wildlife habitat where feasible.
Retrofit Incentives	Increase incentives to retrofit older developments that have no stormwater management so they provide it, possibly through utility fee credit.
New and Redevelopment Inspections[a]	Continue NPDES inspections of new and redevelopment sites for compliance with required erosion and sediment control practices.
Linear Infrastructure BMPs	For linear projects such as transportation, sanitary sewer, or stormwater sewer improvements, assist in reducing sediment and pollutant loading in streams through inspections and education.
Cisterns on Public Buildings	Assess the need for harvested rainwater. Does ACC currently use potable water for irrigation, dust control, or other needs? Use cisterns at ACC facilities to reduce cost, increase infiltration, recharge the groundwater, and reduce runoff from impervious surfaces, thereby helping protect the county's streams. Filtration may be needed/considered for specific sites.
GIS Stormwater Inventory	Develop a more comprehensive stormwater inventory, including a complete inventory of structures, conveyances, outfalls, stormwater ponds, and runoff reduction BMPs. This watershed improvement opportunity will help the Transportation and Public Works Department analyze the stormwater system

Measure	Description
	capacity, determine BMP inspection schedules, and assist in future development plans.
Green Infrastructure / Low Impact Development	Include in development and redevelopment an assessment of opportunities for runoff reduction through green infrastructure and low impact development practices, including permeable pavement, cisterns, bioretention, and green roofs. This could be incorporated into plan review or ordinance revisions.

Note:

a Some of these measures may already be partially addressed by programs from other departments. Similar BMPs are listed in Table 2-1 of the 2016-2017 ACC Watershed Protection Plan Public Utilities Department Annual Report.

3.4   Recommended Management Measures

No stormwater control or restoration measures are recommended in the Malcolm Branch watershed. This recommendation is based on a comprehensive review of remote spatial data, and on-site review of opportunities and constraints. Programmatic management measures have been selected to serve as the basis for this WMP, which is tailored to the ACC's watershed goals and objectives.

General programmatic recommendations for watershed improvement are listed in Table 3-5. In addition, one site-specific programmatic management measure was identified through observations made during the on-site field assessments of potential BMP opportunities. Concept plan sheets for two of the general programmatic measures (mowing maintenance practices and bank stabilization) and the recommended site-specific programmatic measure are provided in appendix H. The site-specific programmatic measure is identified in Table 3-6. Pollutant load reductions are expected from the recommended programmatic measures, but cannot be accurately quantified.

Table 3-6. Recommended Site-Specific Programmatic Measure

BMP ID	Project Description
MB-Prog-01	**Malcom Branch / Middle Oconee River Buffer Preservation** Tetra Tech recommends considering the purchase of this property by the County for preservation purposes or possible trails and park amenities similar to the North Oconee River Park and Cook's Trail along Sandy Creek. The parcel currently provides forested buffer protection to Malcom Branch and Middle Oconee River from a highly impervious commercial and industrial area. Potential benefits include nutrient uptake, sediment removal, beautification, and improved stream function.

4 Plan Implementation and Evaluation

4.1 Implementation Schedule

Scheduling the implementation of management measures is crucial to the success of the WMP. The challenge in creating a realistic schedule is balancing the WMP objectives with the different components that dictate the timeline of their required tasks, such as securing funding, stakeholder approval and participation, and public involvement. The WMP schedule should be adaptable and easily revised by ACC according to shifting priorities, unexpected constraints and delays, and new opportunities as they appear. Table 4-1 proposes a WMP implementation schedule that ensures that watershed conditions are assessed regularly and that ACC will continue implementing watershed management measures.

Table 4-1. WMP Implementation Schedule

Time Frame	Watershed Management Measure
Annually	Review the recommended projects from each of the ACC WMPs and determine which projects will be implemented in ACC over the next 1–3 years. Coordinate with other ACC departments as necessary on the planning and design stages of structural and restoration projects. Develop a plan for implementing selected programmatic measures.
Annually	Develop a monitoring and maintenance plan for stormwater improvement projects under construction.
Annually	Monitor and maintain all ACC-managed BMPs according to the monitoring and maintenance schedule. Maintain a database of records of monitoring and maintenance events, including BMP monitoring checklists.
Annually	Review water quality data from the previous year and flag or highlight measurements that exceed state water quality standards or ACC benchmark values.
Annually	Document progress such as monitoring, maintenance, and project implementation in the annual report to GaEPD.
Every 3–5 Years	Review water trends and identify areas of improvement or degradation. If the monitoring results indicate water quality degradation, ACC should: o Try to identify point sources of any degradation; o Attempt to identify the cause of the degradation; o Evaluate the current BMPs established; and o Propose additional BMPs that might address the cause of the degradation.
Every 3-5 Years	Review the long-term monitoring program. Plan which watersheds will be monitored over the next 3 years as part of the rotating schedule. Determine if there should be any changes to monitoring station locations.
Every 5-10 Years	Conduct stream assessments in the watershed to identify areas of erosion, maintenance needs, and opportunities for bank stabilization or stream restoration.
Every 5-10 Years	Update the WMP to reflect changes in the watershed, updated stream assessment and water quality data, BMPs that were implemented (remove from the list), and new watershed management opportunities.

4.2   Monitoring and Maintenance

Regular monitoring and maintenance will need to be conducted for any site-specific management measures that are implemented. Visual assessments should be conducted regularly to ensure that measures are functioning properly and in good repair, and that the vegetation is healthy and well maintained. Structural measures should be monitored at least quarterly during the first 2 years after construction and annually thereafter. Additionally, they should be inspected after the first couple of large rain events following construction to assess their performance following storm events.

Regular monitoring events should include an assessment of general site conditions, notes on areas of failure or instability, a vegetation assessment, photographic documentation, and identification of any maintenance needs or adaptive management measures that might be required. BMP monitoring checklists are provided for numerous types of BMPs in the *2016 Georgia Stormwater Management Manual* (ARC 2016).

4.3   Potential Funding Sources

The implementation costs for both programmatic and structural BMPs can be restrictive for local governments when budgeting for projects across several departments. Fortunately, a number of programs exist to help fund projects to achieve water resource management goals. The following list summarizes the most relevant funding opportunities for ACC:

- **USEPA Clean Water Act Nonpoint Source Grant (Section 319 Grants):** Funded by USEPA through the Clean Water Act and administered by GAEPD, these grants provide funding for best management practices (BMPs) and other water quality improvement efforts. They require a 40% non-federal match that can be met through local funds, in-kind services, or other non-federal sources. Applications are typically due in the fall of each year, and awards are announced in the spring.
  https://epd.georgia.gov/section-319h-georgias-nonpoint-source-implementation-grant

- **USEPA Clean Water State Revolving Fund (CWSRF):** Administered by the Georgia Environmental Finance Authority, the CWSRF provides low-interest loans for a variety of pollution prevention projects, including: water quality and water conservation; repairing and replacing stormwater control projects; and implementing water conservation projects and programs. Loans are available at a low interest rate for a maximum of 30 years. http://gefa.georgia.gov/clean-water-state-revolving-fund

- **U.S. Department of Transportation (USDOT) Transportation Alternatives Set-Aside:** The Transportation Alternatives Set-Aside provides funding for many activities relating to highways, including stormwater management, control, and water pollution prevention or abatement related to highway construction or due to highway runoff. Projects involving streetscaping and corridor landscaping may also be eligible. Transportation projects funded under this grant program must originate through a competitive grant project selection process in consultation

with Georgia DOT. Most awards require a 20% state or local match.
http://www.fhwa.dot.gov/environment/transportation_alternatives/

4.4   Milestones and Evaluation Criteria

The achievement of any plan requires evaluation criteria and measures of success. Milestones met relative to this WMP (such as completion of a management action from the implementation schedule) will be noted in appropriate sections of the annual report.

Short-term and long-term evaluation criteria listed in this section can be used to determine the level of success of WMP implementation.

4.4.1   Short-Term Criteria

- Have BMPs been monitored according to schedule? Are records up to date?
- Has water quality monitoring been conducted as scheduled? Are records up to date?
- Have stream assessments been conducted as scheduled? Are records up to date?
- Have watershed improvement projects been implemented as planned?

4.4.2   Long-Term Criteria

- Does water quality monitoring indicate an improvement in water quality?
- Have BMPs implemented as part of the Impaired Waters Monitoring Plan made progress towards addressing stream impairments? This can be measured through BMP monitoring or through documenting the utilization of ACC programs (i.e. attendance at educational workshops or use of pet waste stations).

4.5   Adaptive Management

This WMP was developed based on the best available information at the time. As changes occur in the watershed, or additional water quality data become available, or as funding opportunities change, watershed management needs and management opportunities might change. Sometimes the best opportunities are those that take advantage of other planned projects or situations of the time such as a planned transportation or infrastructure project in which stormwater improvement measures could be incorporated cost effectively, or the presence of a strong advocate or partner such as a school superintendent who wants to use green infrastructure as an educational opportunity for the school system. Therefore, this WMP should be revisited regularly and revised as needed to ensure that the watershed continues to be managed effectively into the future.

5 References

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