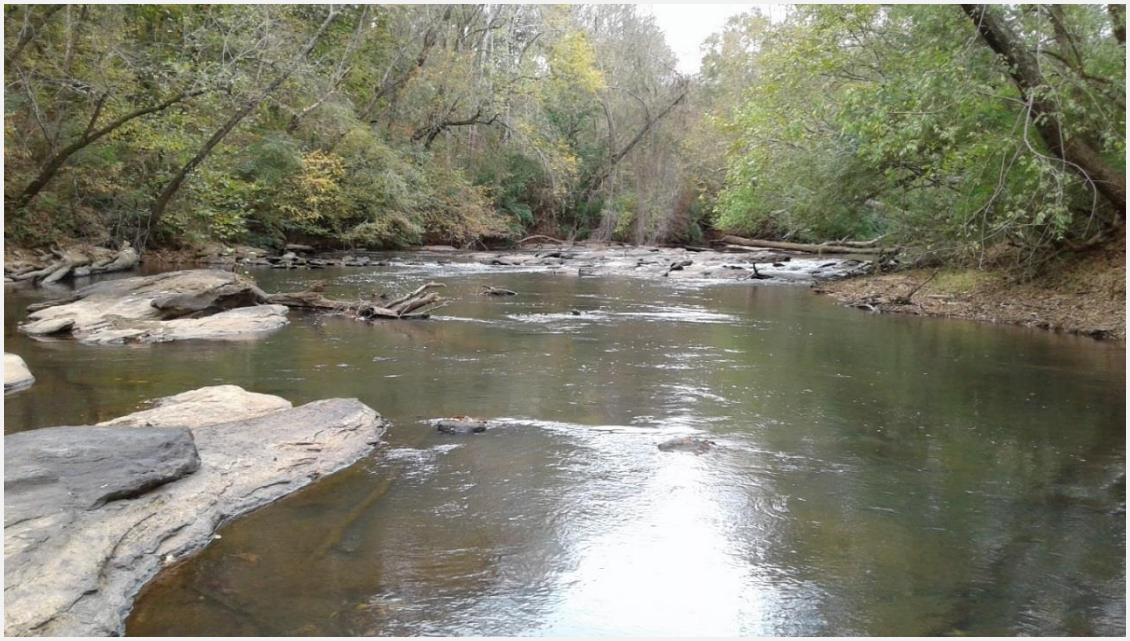
Draft Watershed Management Plan for North Oconee River

Athens-Clarke County

April 2018



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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 North Oconee River 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.

The drainage area of the North Oconee River watershed is 311 square miles, with 94 percent of the upper portion of the watershed located outside of ACC to the north. The study area portion of the watershed within ACC is 20 square miles in size. The North Oconee River flows south through the middle of ACC, including through the downtown area. The study area includes a short length of the Oconee River, downstream of where the North Oconee River joins the Middle Oconee River. Major tributaries of the North Oconee River within ACC include Walton Creek, Sandy Creek, Trail Creek, and Carr Creek, which have been assessed separately. Land cover in the study area primarily consists of developed land and forest, with about 15 percent impervious cover. The National Wetland Inventory (NWI) Map identifies palustrine forested wetlands around the edges of North Oconee River just upstream of the Sandy Creek Nature Center. Along with the 225-acre Sandy Creek Nature Center, the 3.5-mile multi-use trail and linear park system known as the North Oconee River Greenway comprise the major recreational areas in the watershed.

North Oconee River, downstream of Sandy Creek, is on the draft Georgia 2016 Integrated 305(b)/303(d) List of Streams, as not supporting its designated uses. The North Oconee River has the designated use of drinking water from Jackson County to Trail Creek, and has the designated use of fishing from Trail Creek to the Oconee River. The North Oconee River is impaired for fecal coliform (FC) bacteria from Sandy Creek to the Oconee River, and the Oconee River is impaired for FC bacteria from the confluence of the Middle and North Oconee River to Barnett Shoals Dam. Total maximum daily loads (TMDLs) were completed for the impaired segments in 2002 and 2007, with required FC bacteria load reductions ranging from 41 percent to 76 percent.

There are 56 point sources in the study area, and six of these facilities are permitted to discharge to water bodies through an NPDES permit. Potential nonpoint sources of pollution in the North Oconee River watershed include stormwater runoff from ACC's municipal separate storm sewer system (MS4) as well as runoff from forested and agricultural lands. Results of recent water quality monitoring efforts

suggest that surface waters in the study area are generally in compliance with the pH and temperature standards adopted by the State of Georgia. DO measurements do not meet state standards. None of the collected FC bacteria geometric means are in compliance with the May-through-October state standards. Average conductivity values meet the ACC benchmark, and average TSS concentrations exceed the standard at one of three sampling stations.

Stream walks in the North Oconee River watershed were conducted in October 2016 through December 2016 along North Oconee River and thirteen of its tributaries. Segments of the main stem of North Oconee River received overall stream conditions scores ranging from marginal to suboptimal. Four tributaries contained reaches with optimal stream conditions, and eight tributaries contained poor reaches. Noted impacts include sedimentation and large woody debris jams along several tributaries. Potential sources of FC bacteria include human, dog, and horse. Potential impacts to infrastructure due to erosion were observed on several tributaries, and trash was found to be common in two of the tributaries.

Based on information obtained in the watershed characterization, FC bacteria, DO, and hydrology were identified as watershed-wide management needs. Sediment and wetland preservation were determined to be management needs within specific subwatersheds.

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. Thirty-two site-specific management measures are recommended for implementation in the North Oconee River watershed, including five restoration BMPs, 19 stormwater control BMPs, and eight programmatic BMPs (Table ES-1). Concept plans and cost estimates were developed for the recommended projects. Programmatic measures that can be implemented watershed-wide are also recommended.

Table ES-1. Recommended Site-Specific Management Measures

BMP ID	Project Name
NO-Prog-01	Holland Youth Sports Complex Swale Maintenance
NO-Prog-02	ACC Gravel Lot Rehabilitation
NO-Prog-03	ACC Government Building Smart Site Design
NO-Prog-04	Downtown Athens Parking System on N. Jackson Street Drainage
NO-Prog-05	Athens Welcome Center Vegetation Maintenance
NO-Prog-06	Multimodal Transportation Center Waste Stations
NO-Prog-07	UGA Golf Course – Green Golf Course Management
NO-Prog-08	Cedar Creek Water Reclamation Facility/Oconee River Buffer Preservation
NO-Res-01	Chase Street to Barber Street Stream Restoration
NO-Res-02	Buffer Restoration on ACC Dirt Lot
NO-Res-03	Boulevard Woods Park Outfall Repair
NO-Res-04	North Oconee River Park Stream Restoration
NO-Res-05	North Oconee River Park Buffer Enhancement and Bank Stabilization

BMP ID	Project Name
NO-Str-01	Fleet Management Bioretention
NO-Str-02	Fleet Management Detention
NO-Str-03	Fleet Management Treatment Train
NO-Str-04	Leisure Services Bioretention
NO-Str-05	Leisure Services Detention
NO-Str-06	Leisure Services Treatment Train
NO-Str-07	ACC Government Building Parking Lot
NO-Str-08	Public Utilities Lot Bioretention
NO-Str-09	Public Utilities Lot Detention
NO-Str-10	Water Meter Building Cistern
NO-Str-11	Sewerline Construction and Repair Building Cistern
NO-Str-12	CHaRM Facility Detention
NO-Str-13	Housing Authority – College Avenue Infiltration Trench
NO-Str-14	Lay Park Bioswale
NO-Str-15	Fire Station #1 Rain Gardens
NO-Str-16	Fire Station #1 Cistern
NO-Str-17	Downtown Athens Parking System on Strong Street Porous Pavement
NO-Str-18	Broad Street Picnic Area Bioretention
NO-Str-19	UGA River Road Mixed Use Detention Pond

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 North Oconee River 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 North Oconee River WMP incorporates the United States Environmental Protection Agency's (USEPA) Nine Key Elements for WMPs. The nine key elements are:

1. Identify sources contributing to nonpoint source pollution.
2. Estimated expected load reductions.
3. Describe nonpoint source management measures.
4. Estimate Implementation costs.
5. Educate the public to engage public support.
6. Develop an implementation schedule.
7. Describe interim milestones.
8. Implement adaptive management measures to gauge success.
9. Monitor 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 portion of the North Oconee River watershed within 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

The North Oconee River joins the Middle 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 study area portion of the North Oconee River watershed is part of the Crooked Creek-North Oconee River Hydrologic Unit Code 12 (HUC 12) watershed (030701010501).

The North Oconee flows south through the middle of ACC, including through the downtown area. In the northern part of ACC the study area is roughly bounded by U.S. Route 441 to the east and U.S. Route 129 to the west. In the southern part of ACC it is bordered by Gaines School Road, Barret Shoals Road and Beaver Trail to the east, and South Milledge Avenue to the west (Figure 1). Major tributaries of North Oconee River within ACC include Walton Creek, Sandy Creek, Trail Creek, and Carr Creek. Additionally, the study area includes a short length of the Oconee River, downstream of where the North Oconee River joins the Middle Oconee River. Cedar Creek is a tributary to the Oconee River within this reach. None of these major tributaries are included in this characterization, as they have been assessed separately. Smaller, unnamed tributaries are included in the study area. The farthest downstream point of this study area is the point where the Oconee River flows out of ACC. The drainage area of the North Oconee River watershed (within and upstream of ACC) is 311 square miles, with 94 percent of the upper portion of the watershed located outside of ACC to the north. The extent of the North Oconee River watershed is shown in Figure 2-1. The study area portion of the watershed, within ACC, is 20 square miles in size and is shown in Figure 2-2.

The North Oconee River, downstream of Sandy Creek, is on the draft Georgia 2016 Integrated 305(b)/303(d) List of Streams, as not supporting its designated uses. The North Oconee River has the designated use of drinking water from Jackson County to Trail Creek, and has the designated use of fishing from Trail Creek to the Oconee River. The North Oconee River is impaired for fecal coliform bacteria from Sandy Creek to the Oconee River, and the Oconee River is impaired for fecal coliform bacteria from the confluence of the Middle and North Oconee River to Barnett Shoals Dam. Impaired segments of the North Oconee River and its tributaries within ACC are listed in Table 2-1, along with

information on total maximum daily loads (TMDLs) that have been developed. The 2007 TMDL for fecal coliform recommends the following management practices to achieve instream fecal coliform source loads:

- Compliance with National Pollution Discharge Elimination System (NPDES) permit limits and requirements;
- Adoption of Natural Resource Conservation Service conservation practices; and
- Application of best management practices (BMPs) appropriate to agricultural or urban land uses, where applicable.

There is one United States Geological Survey (USGS) stream gage (USGS 02217770) in the watershed study area where the North Oconee flows under College Avenue. There 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).

Table 2-1. Impaired Stream Segments in the North Oconee River Watershed in ACC

Stream segment	Impairment(s)	TMDLs	Required Load Reduction
North Oconee River, Sandy Creek to Trail Creek	FC (NP)	TMDL completed FC (2002 & 2007)	FC: 41%
North Oconee River, Trail Creek to Oconee River	FC (UR)	TMDL completed FC (2002 & 2007)	FC: 76%
Oconee River, confluence of North & Middle Oconee Rivers to Barnett Shoals Dam	FC (UR)	TMDLs completed for FC (2002 & 2007), TWR (2002)	FC: 61%
*Carr Creek	BioF, BioM, FC, ph (UR, I1, I2)	TMDLs completed Bio F & M (2002 & 2007), FC (2002 & 2007), pH (2002)	Sediment: 92.1% FC: 41% pH: Target of 6.0-8.5
*Cedar Creek	FC (UR)	TMDL completed FC (2002 & 2007)	FC: 92%
*Cloverhurst Branch	FC (UR)	TMDL completed FC (1998 & 2007)	FC: 26%
*East Fork Trail Creek, headwaters to west fork trail	FC (UR)	TMDL completed FC (2002 & 2007)	FC: 61%
*Noketchee Creek, headwaters to Sandy Creek	Bio F (UR, NP)	TMDL completed Bio F (2007)	Sediment: 0%
*Tanyard Creek	FC (UR)	TMDL completed FC (2002 & 2007)	FC: 94%
*Trail Creek- East fork Trail Creek to North Oconee River	FC (UR)	TMDL completed FC (1998 & 2007)	FC: 75%
*West Fork Trail Creek	FC (UR)	TMDL completed FC (1998 & 2007)	FC: 40%

* Indicates stream segments outside of the North Oconee River study area

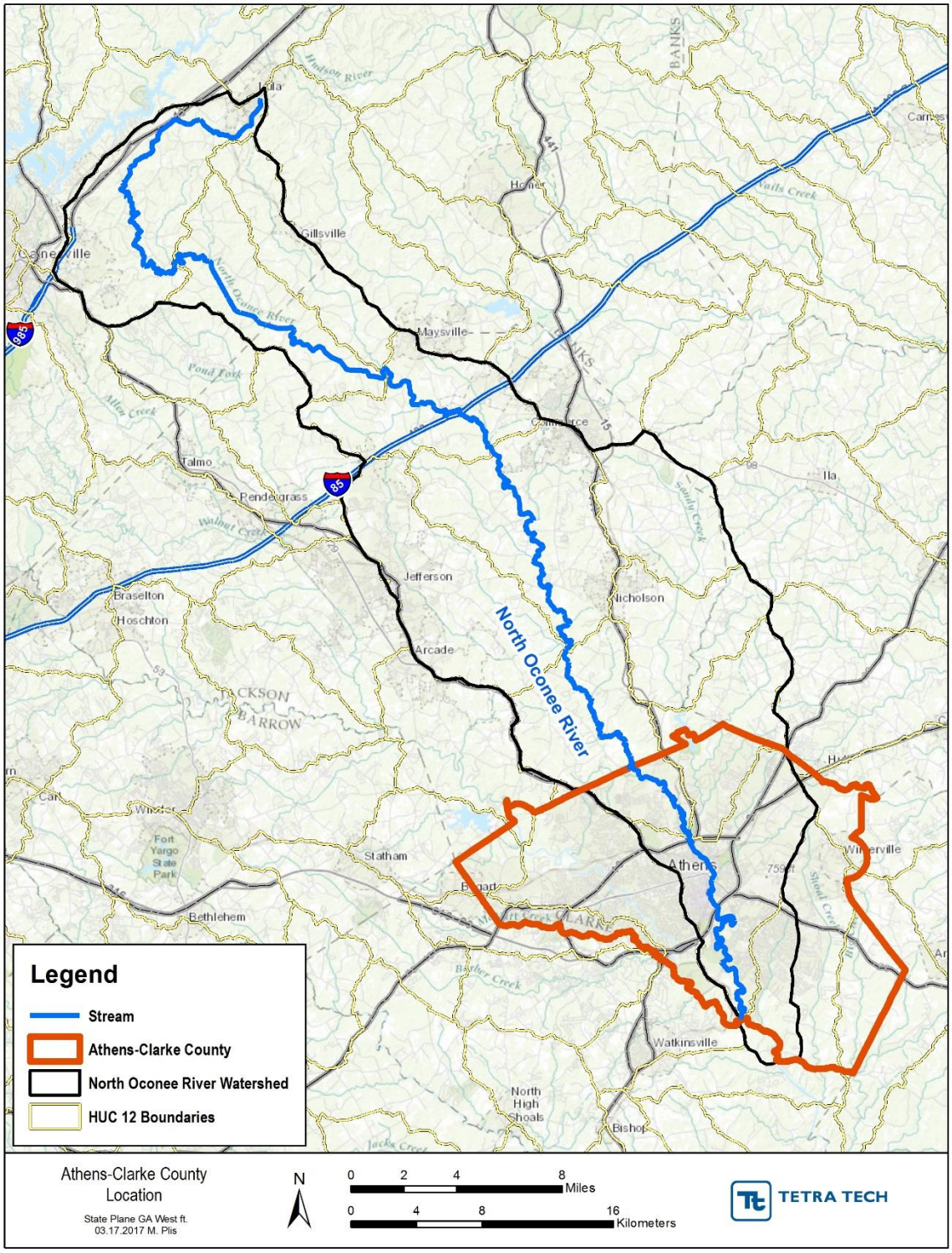

Figure 2-1. North Oconee River Watershed Location

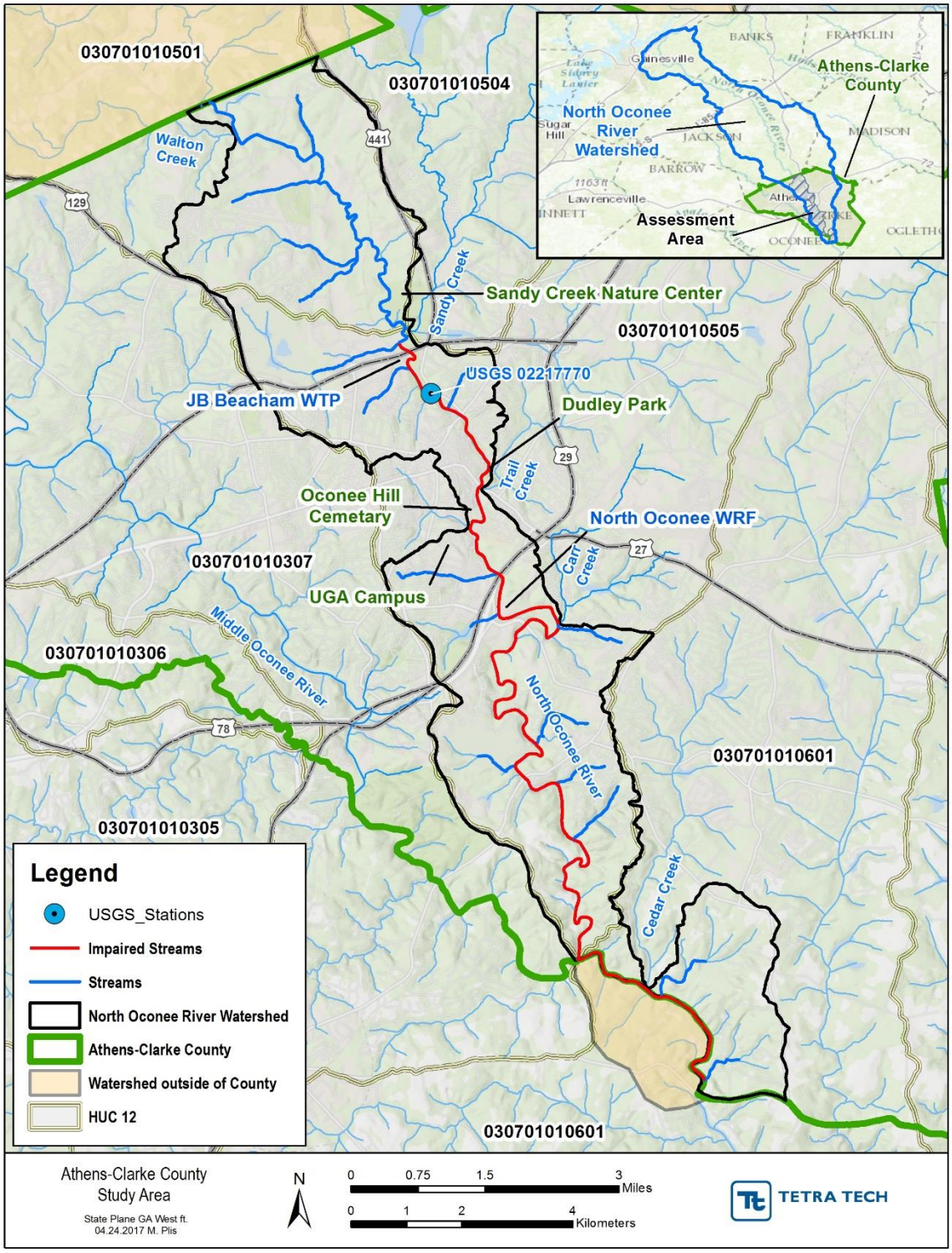

Figure 2-2. North Oconee River Watershed Study Area

2.2 Land Cover

The land cover in the study area consists of approximately 48 percent developed land 35 percent forest, 6 percent is pastureland/cropland, and 5 percent wetland, and the remainder is comprised of other land covers. 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 2-2.

Table 2-2. Athens-Clarke County North Oconee River Watershed NLCD Land Cover

NLCD Land Cover	% Land Cover
Open Water	0.8%
Developed	48.3%
Barren	0.1%
Forest	35.0%
Shrub/Scrub	0.8%
Herbaceous	4.1%
Pasture/Crop	5.9%
Wetland	5.0%

There are 50.1 miles of streams in the study area. Based on the 2011 NLCD land use and land cover data, 0.58 miles of streams in the watershed (approximately 1 percent) are directly connected to cropland or pasture land.

The study area is about 15 percent impervious, with the largest amount of impervious area located in the central part of study area, near the urban center. Impervious cover is shown in Figure 2-4 and is based on the 2011 NLCD impervious coverage.

Land cover in the portion of the North Oconee River watershed upstream of the study area outside of ACC is dominated by forest (44 percent) and pasture (23 percent). Developed land in this contributing drainage area is 19 percent of the land cover and contains mostly open space (e.g., lawns and parks), where impervious surfaces account for less than 20 percent of total cover.

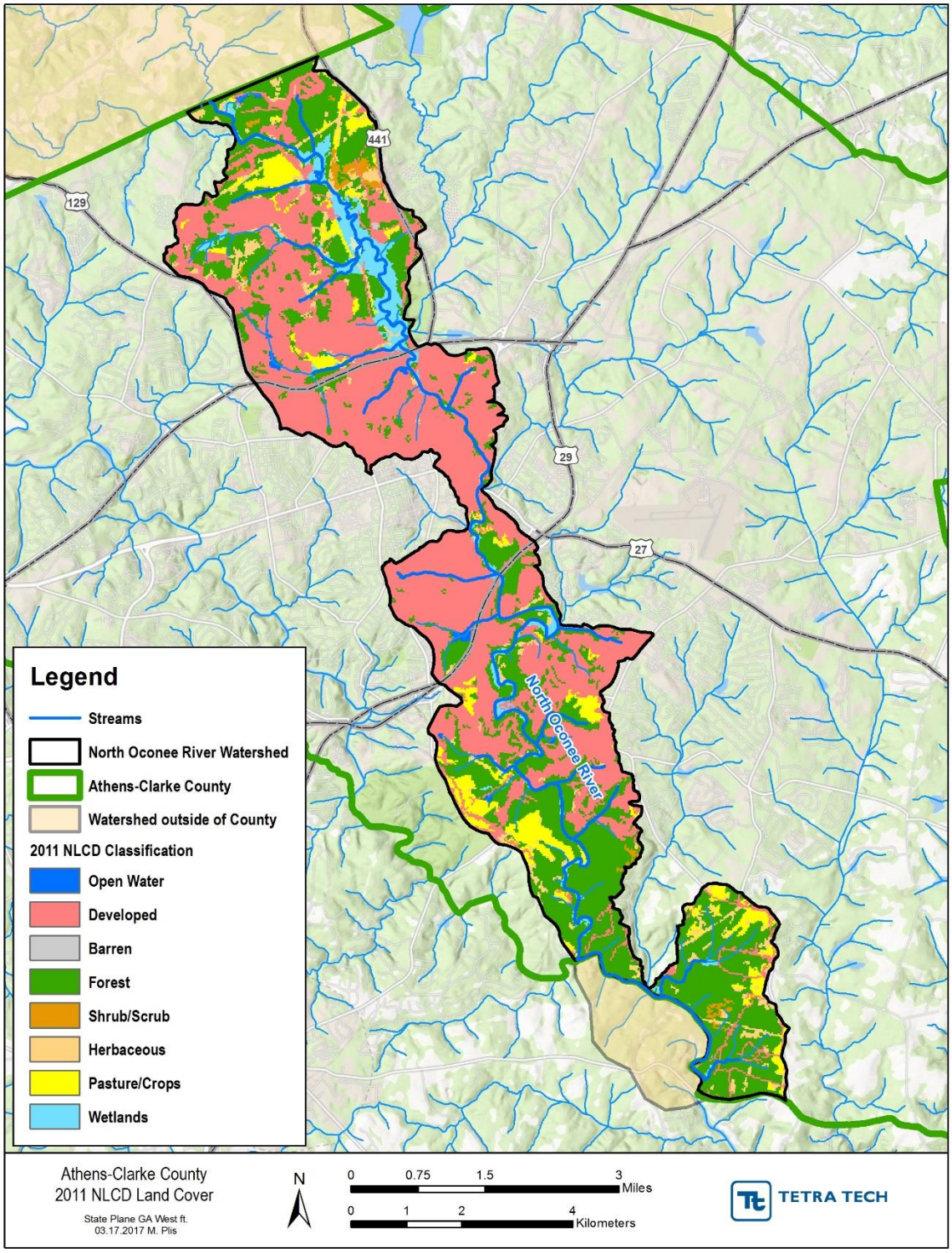

Figure 2-3. 2011 NLCD Land Cover

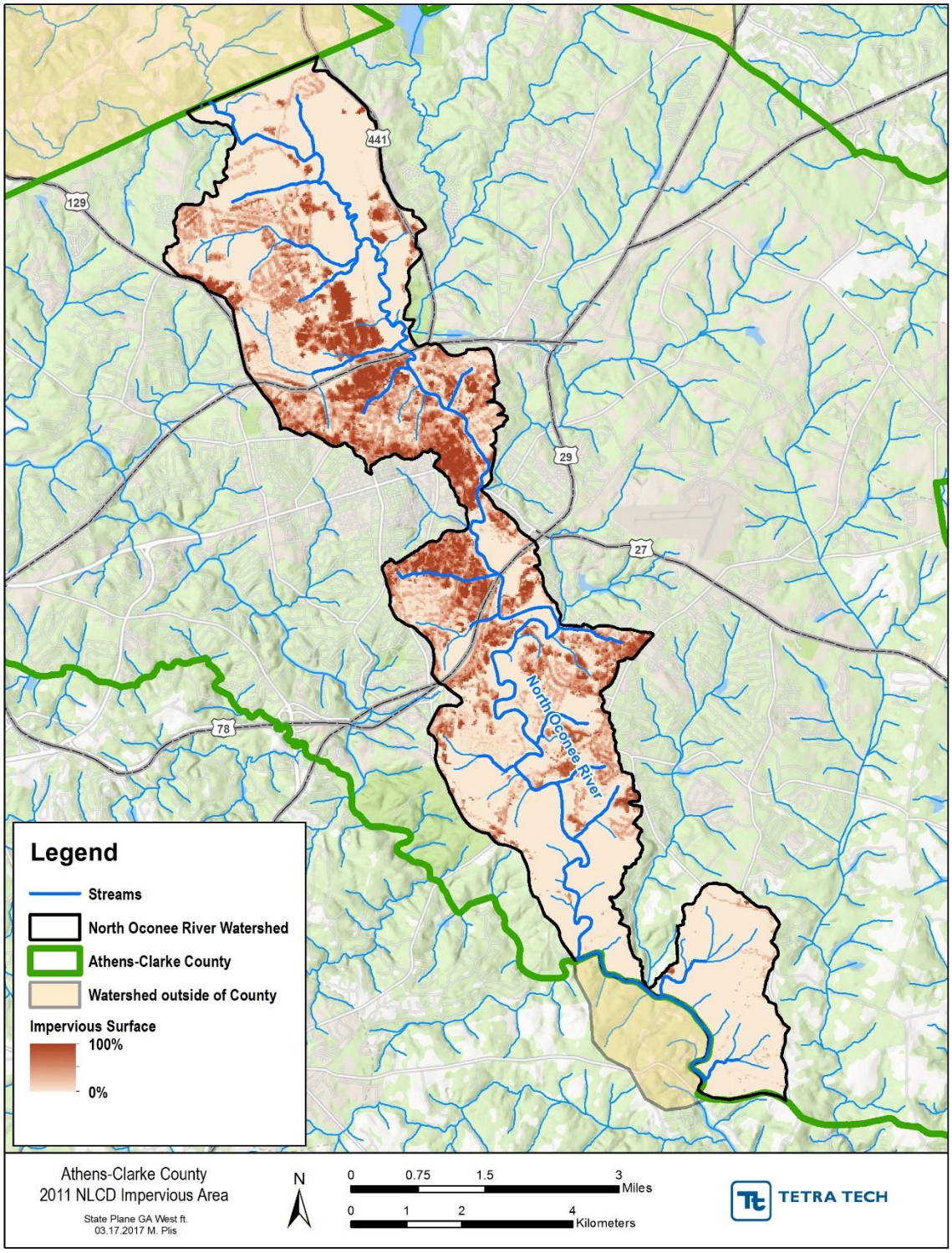

Figure 2-4. 2011 NLCD Impervious Cover

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. North Oconee River has the designated use of Drinking Water from Jackson County to Trail Creek. A water intake is located on the North Oconee River just downstream of Athens Perimeter Highway. The drainage area above this point is considered a large water supply watershed. This is a classification that refers to a large watershed that serves as a water supply that has no reservoirs within the jurisdiction. The National Wetland Inventory (NWI) Map identifies palustrine forested wetlands around the edges of North Oconee River, in the reach within and just upstream of the Sandy Creek Nature Center, as shown in Figure 2-5. These wetlands provide wildlife habitat and serve as a buffer around the streams, receiving and treating runoff and protecting the stream from nonpoint sources of pollution.

The Sandy Creek Nature Center, at the confluence of the North Oconee River and Sandy Creek, is a notable environmental resource and recreational area in the study area. The Nature Center is an ACC park that features 225 acres of woodlands and wetlands with over 4 miles of trails, including connections to the North Oconee River Greenway and Cook's Trail. There is also an education and visitor center, a circa 1815 log house, and several wildlife observation areas on site.

The Sandy Creek Nature Center is connected to the Dudley Park by the North Oconee River Greenway (Greenway). The Greenway is a 3.5-mile multi-use trail along the North Oconee River. The trail is a linear park system that provides a wildlife corridor, open space, and a family friendly multi-use path for the public's enjoyment.

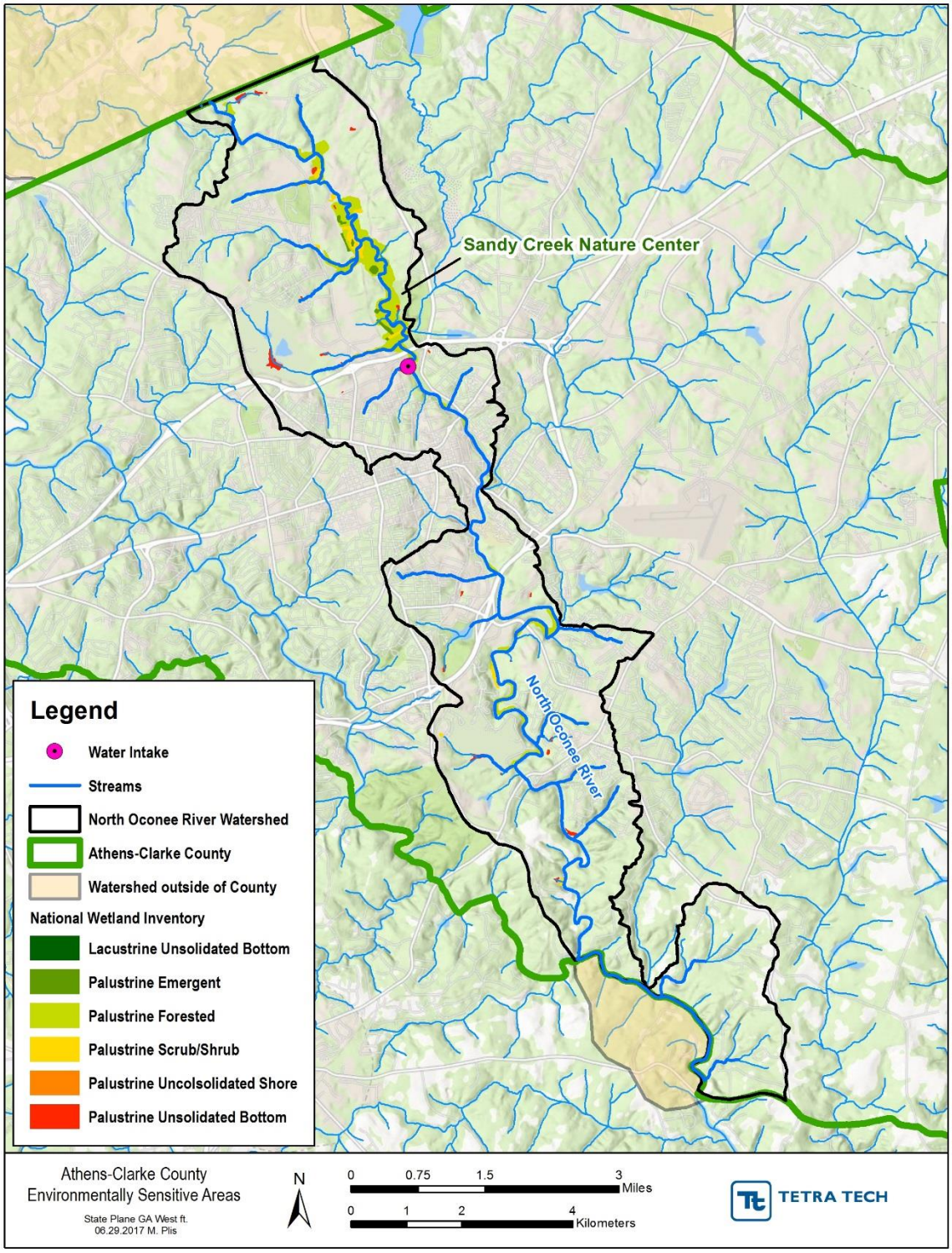

Figure 2-5. Environmentally Sensitive Areas

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 2-3. Only those facilities with NPDES Permit IDs are permitted to discharge to waterbodies. The Athens-Clarke County - North Oconee WPCP facility has permit limits on the average monthly concentration of fecal coliform bacteria that can be discharged.

Table 2-3. Point Sources in North Oconee River Watershed in Athens-Clarke County (USEPA 2016, GaEPD 2013)

Facility Name	EPA ID	NPDES ID	Data Source
Airgas South	110039577311	-	RCRA
Akins Concrete Co	110038657343	-	AFS
Alexander Wood Products	110038657389	-	AFS
Argos Athens Concrete Plant	110022447752	-	AFS/TRIS
Athens Concrete Products Co	110001325940	-	AFS
Athens Regional Medical Center	110028017651	-	AFS/RCRA
Athens-Clarke Co Vacant Prop	110005721380	-	RCRA
Athens-Clarke County - J.G. Beacham WTP	110011330755	GAG640043	NPDES
Athens-Clarke County - North Oconee WPCP	110064595228	GA0021725	NPDES
Blue Ridge Paper Products Inc. Dba Evergreen Packa	110043266480	-	RCRA
Campbell Hardage Inc	110005705371	-	RCRA
Central Soya Of Athens Inc	110005666001	-	RCRA
Champion International Corp	110020043415	-	AFS/TRIS
Coca Cola Bottling Co Inc Athens	110005666378	-	RCRA
Colonial Pipeline Bear Creek	110000788559	-	RCRA/AFS
Conagra Poultry Co. (Seaboard Farms)	110013761287	-	AFS
Cooper Tire & Rubber Oliver Rubber Co Div	110005666298	-	RCRA/AFS/TRIS
Csx Transportation Inc	110005684401	-	RCRA
Csx Transportation Inc	110045448832	-	RCRA
Dept Of Biological & Agricultural Engineering	110011328296	GAU020191	NPDES
Dixie-Cap Rubber Co	110038657361	-	AFS
Food Machinery Sales Inc	110005280481	-	RCRA
Forestry Science Laboratory	110006863581	-	RCRA
Ga Power Co Athens Dist Hq	110005665244	-	RCRA
Ga Power Co Transmission & Substation	110007482731	-	RCRA
Gary West Shutters	110015910380	-	RCRA
General Time Corp	110000358620	-	RCRA/AFS/TRIS

Facility Name	EPA ID	NPDES ID	Data Source
Gerstner Mfg Inc	110005682868	-	RCRA
Gold Kist Incorporated	110000518725	-	AFS/TRIS
Hd Supply Plumbing/Hvac Ltd - G0042	110031332993	-	RCRA
Jam Environmental & Vaccum Services LLC	110067047261	-	RCRA
Kangaroo #23	110005700312	-	RCRA
Kenny Properties Llc #003	110005688318	-	RCRA
Micro Macro International Inc	110012207067	-	RCRA
Naval Support Activity Athens	110046264010	-	RCRA
Pilgrim'S Pride Processing Plant	110000358586	-	AFS/TRIS
Power Partners Inc	110000358648	-	RCRA/AFS/TRIS
Rite Aid # 11822	110055057450	-	RCRA
Rite Aid # 11823	110055057600	-	RCRA
Smith Products Inc	110038657352	-	AFS
Stolls Studio	110005694533	-	RCRA
U S Postal Service Vmf	110005680352	-	RCRA
University Of Georgia - Arts Zone	110066983893	-	RCRA
University Of Georgia (Forestry Zone)	110067047378	-	RCRA
University Of Georgia - Pharmacy Zone	110066983875	-	RCRA
University Of Georgia - Veterinary School Zone	110066983857	-	RCRA
University Of Georgia - Brumby Hall	110039158862	GAG278034	NPDES
University Of Georgia - Composting Facility	110064640759	GAJ020191	NPDES
University Of Georgia Swine Center	110028252860	GAD000016	NPDES
University Of Georgia Veterinary Med	110010305507	-	AFS
Us Epa Bailey Field Research Annex	110005676250	-	RCRA
Us Epa Ecosystem Research Div	110005712096	-	RCRA
Usda Food Safety Inspection Service, Eastern Labor	110043991277	-	RCRA
Usda Se Poultry Research Lab	110001325977	-	RCRA/AFS
Usn Navy Supply School	110038657414	-	AFS

Notes: RCRA = Resource Conservation and Recovery Act; AFS = Air Facility System; NPDES = National Pollutant Discharge; Elimination System; TRIS = Toxic Release Inventory System.

Potential nonpoint sources of pollution in the North Oconee River watershed include stormwater runoff from ACC's municipal separate storm sewer system (MS4) as well as runoff from forested and agricultural 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 agricultural and 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, farms, 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. Urban pollutants from

roads, parking lot, and lawns are notable concern in this watershed because it has a high percentage of developed land, including the UGA campus and a large portion of the downtown, urban center.

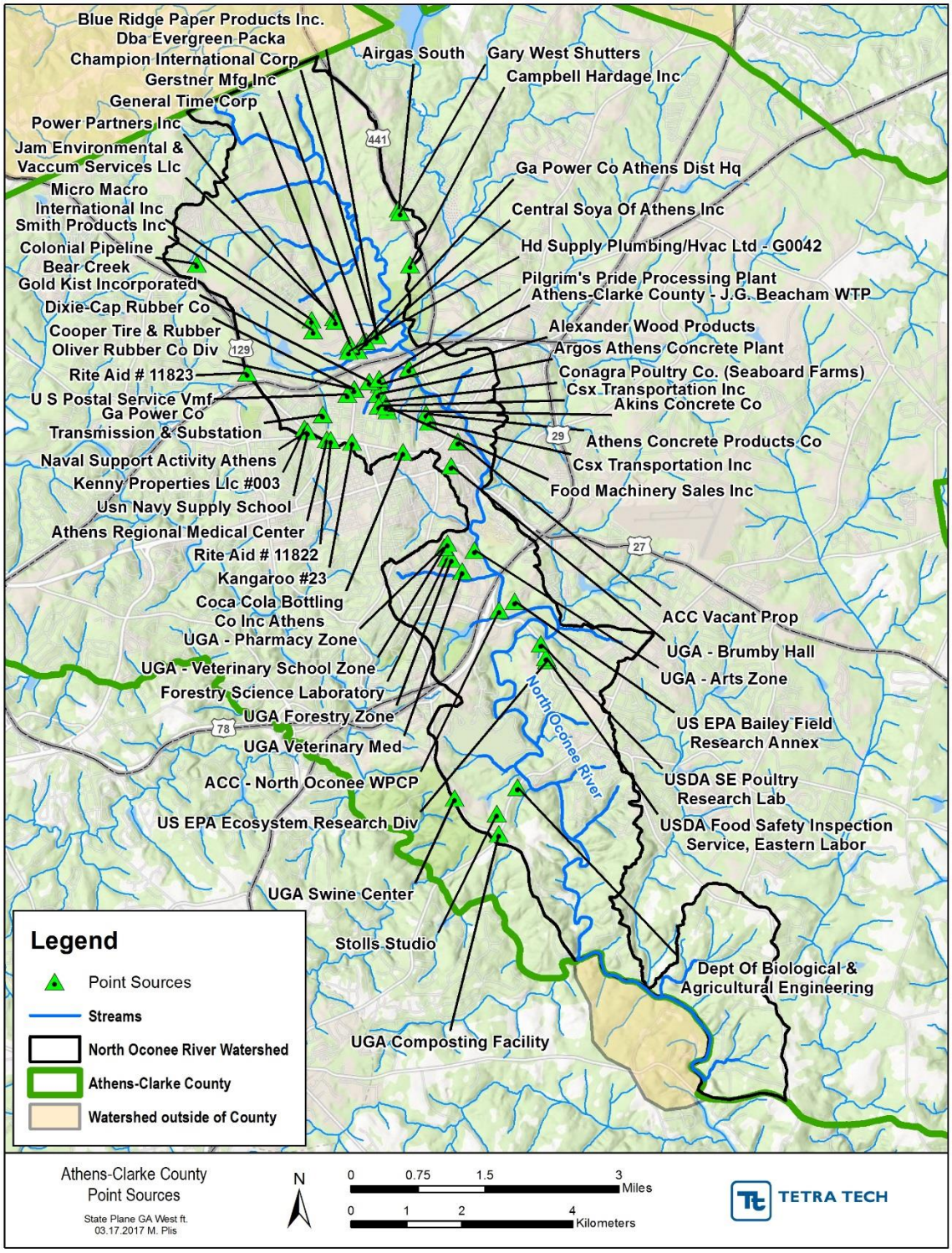

Figure 2-6. Point Sources (USEPA 2016, GaEPD 2013)

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 North Oconee River watershed were conducted along North Oconee River and thirteen of its tributaries (Trib A through Trib M), as well as a reach of the Oconee River from the confluence of the Middle Oconee and North Oconee to the county line, and two of its tributaries (Trib N and Trib O), 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 and prioritize capital improvement projects such as stormwater control and stream restoration measures. Refer to section 3.3.5 for a detailed discussion of evaluation and prioritization of management 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, with detail panels shown in Figure 2-8 through Figure 2-14. Notable features observed in the watershed are shown in Figure 2-15, with detail panels shown in Figure 2-16 through Figure 2-22.

Stream walk data summary tables are included in appendix C. Field notes and photographs from the stream walks are provided in appendix D.

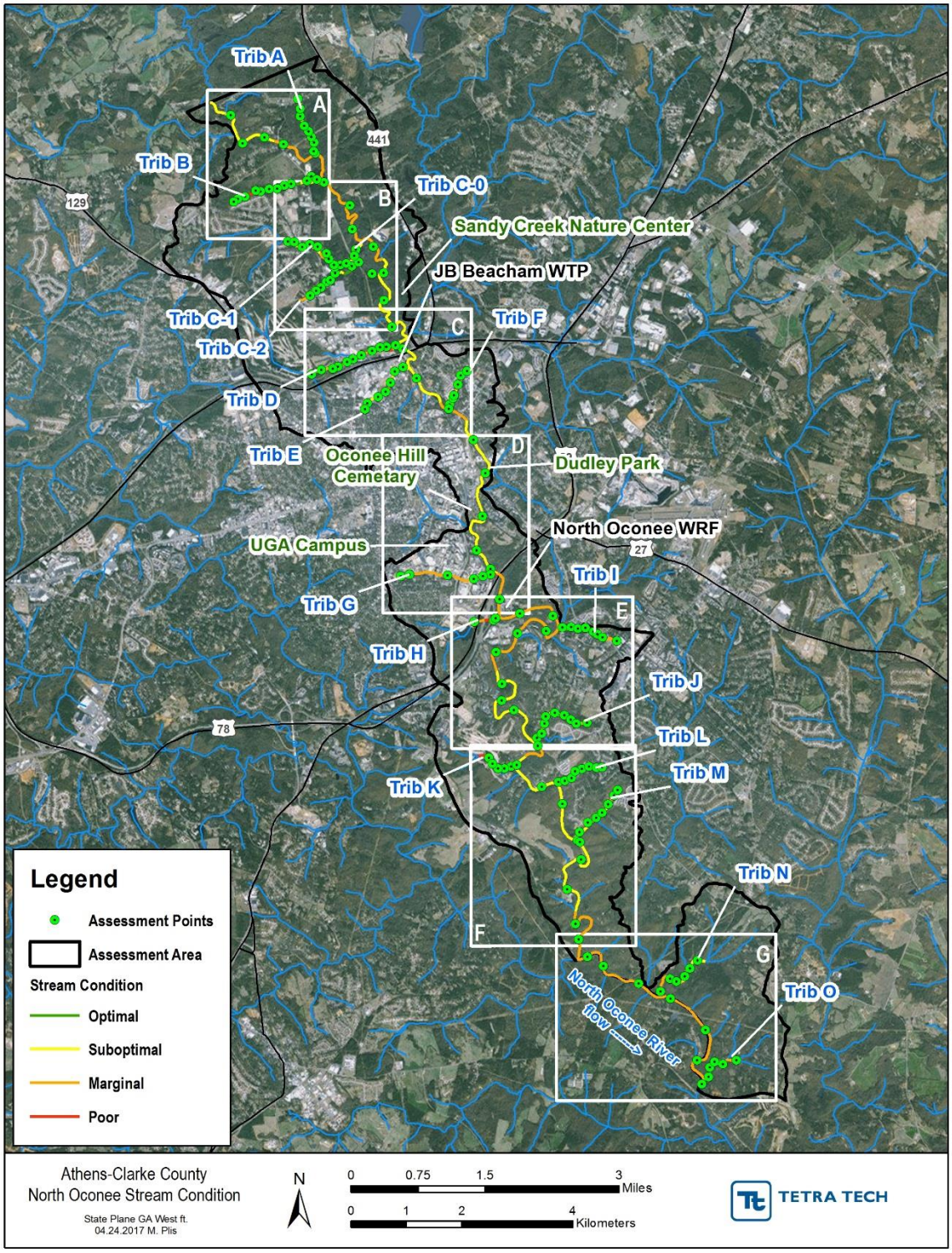

Figure 2-7. Stream Reach Condition Ratings

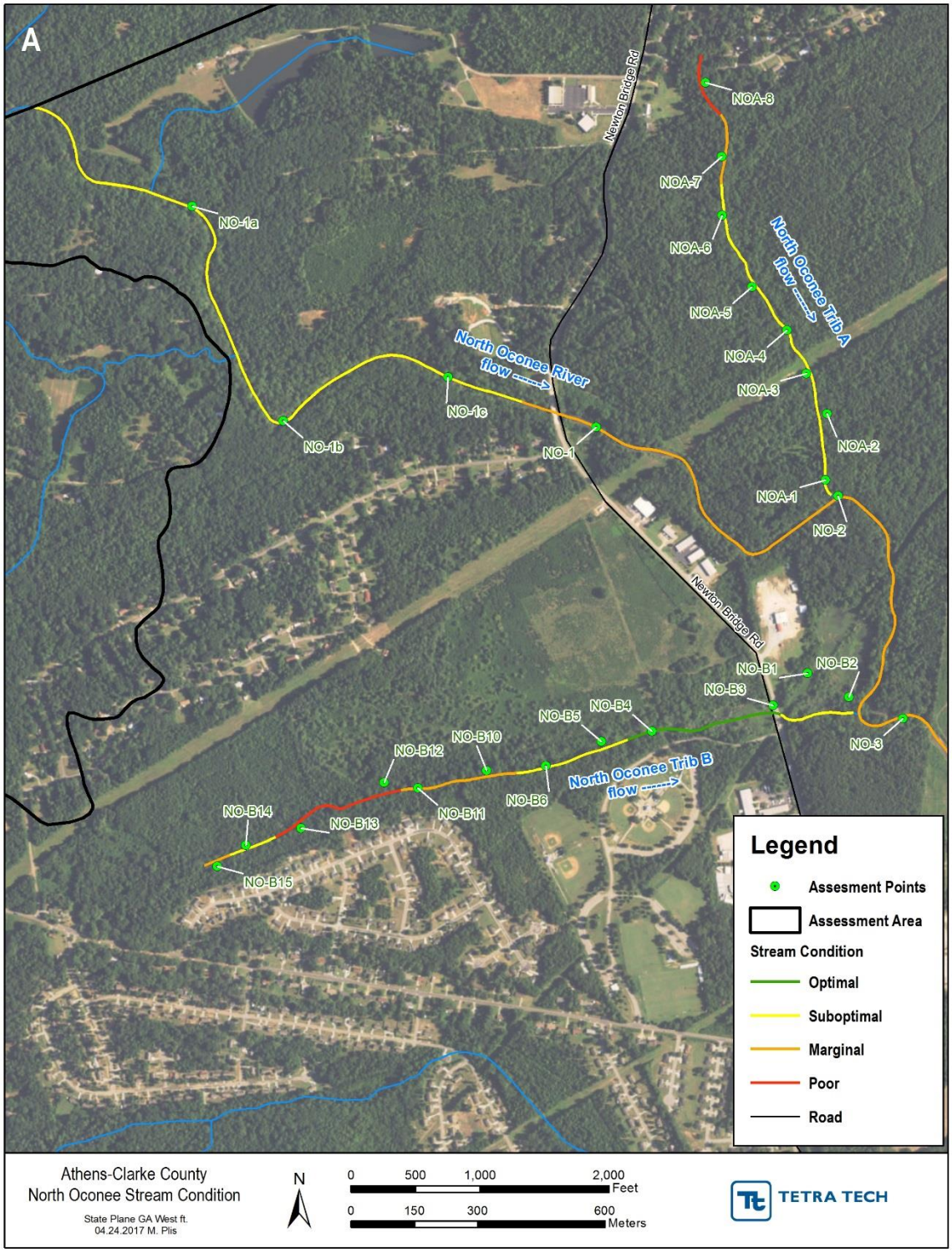

Figure 2-8. Stream Reach Condition Ratings—Panel A

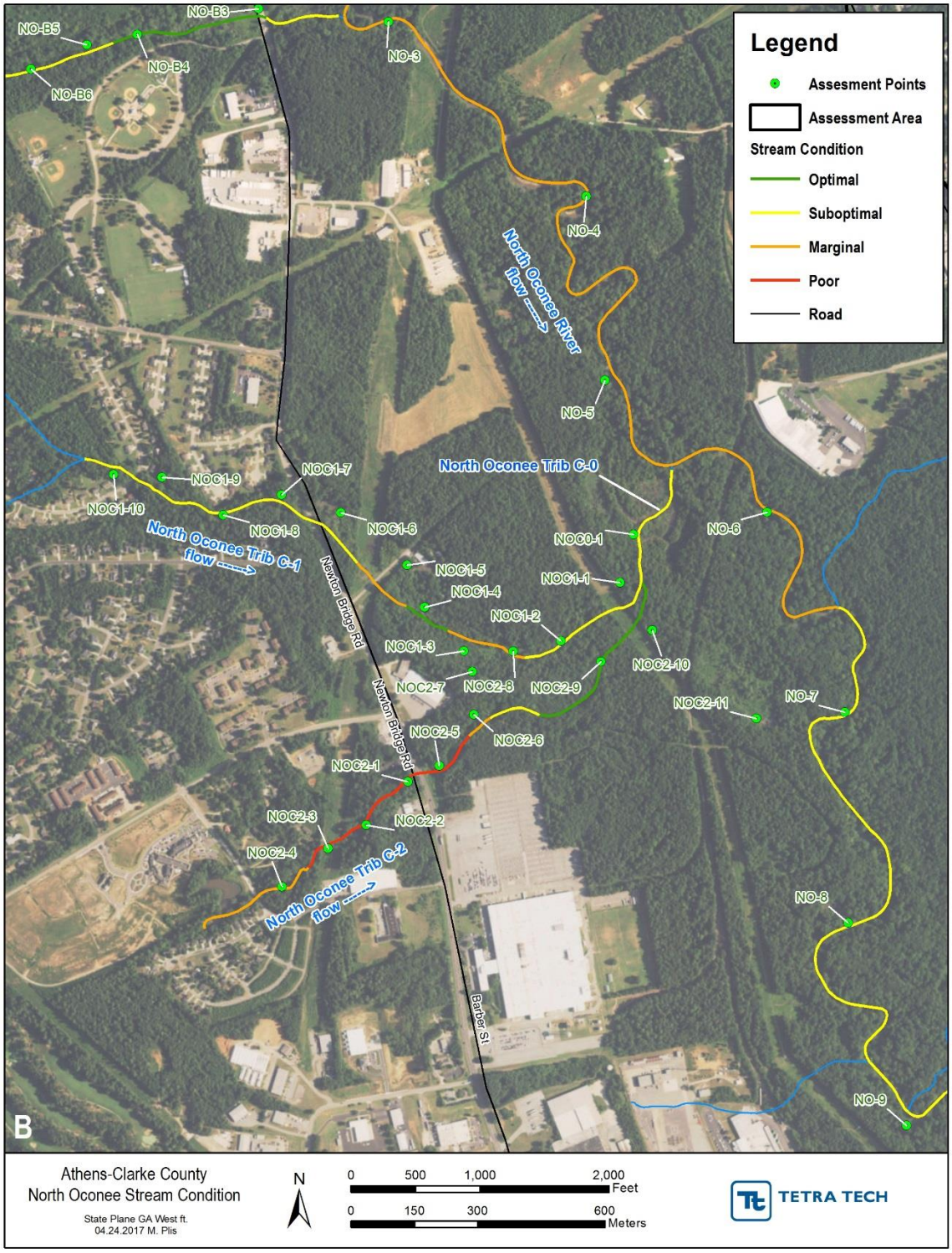

Figure 2-9. Stream Reach Condition Ratings—Panel B

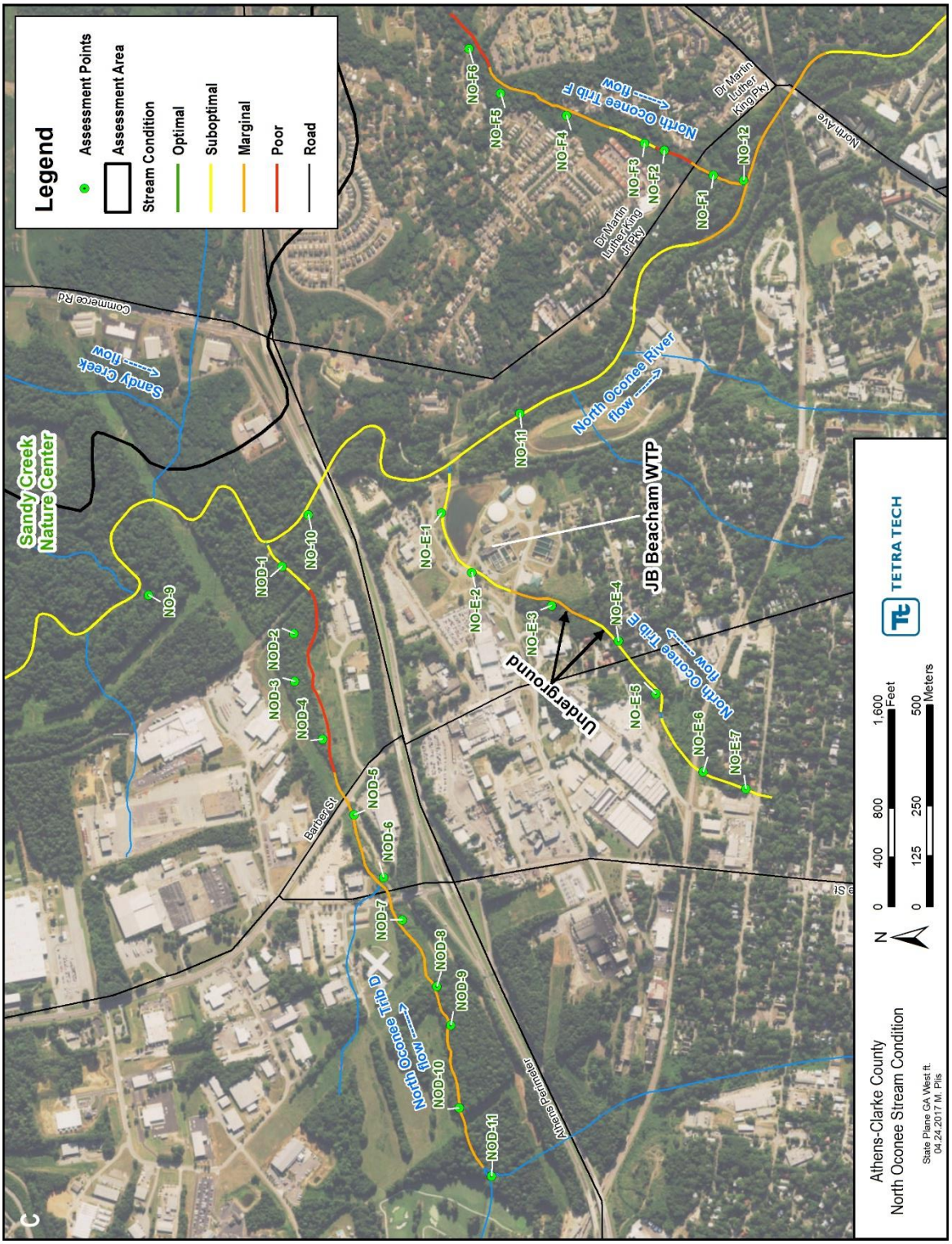

Figure 2-10. Stream Reach Condition Ratings—Panel C

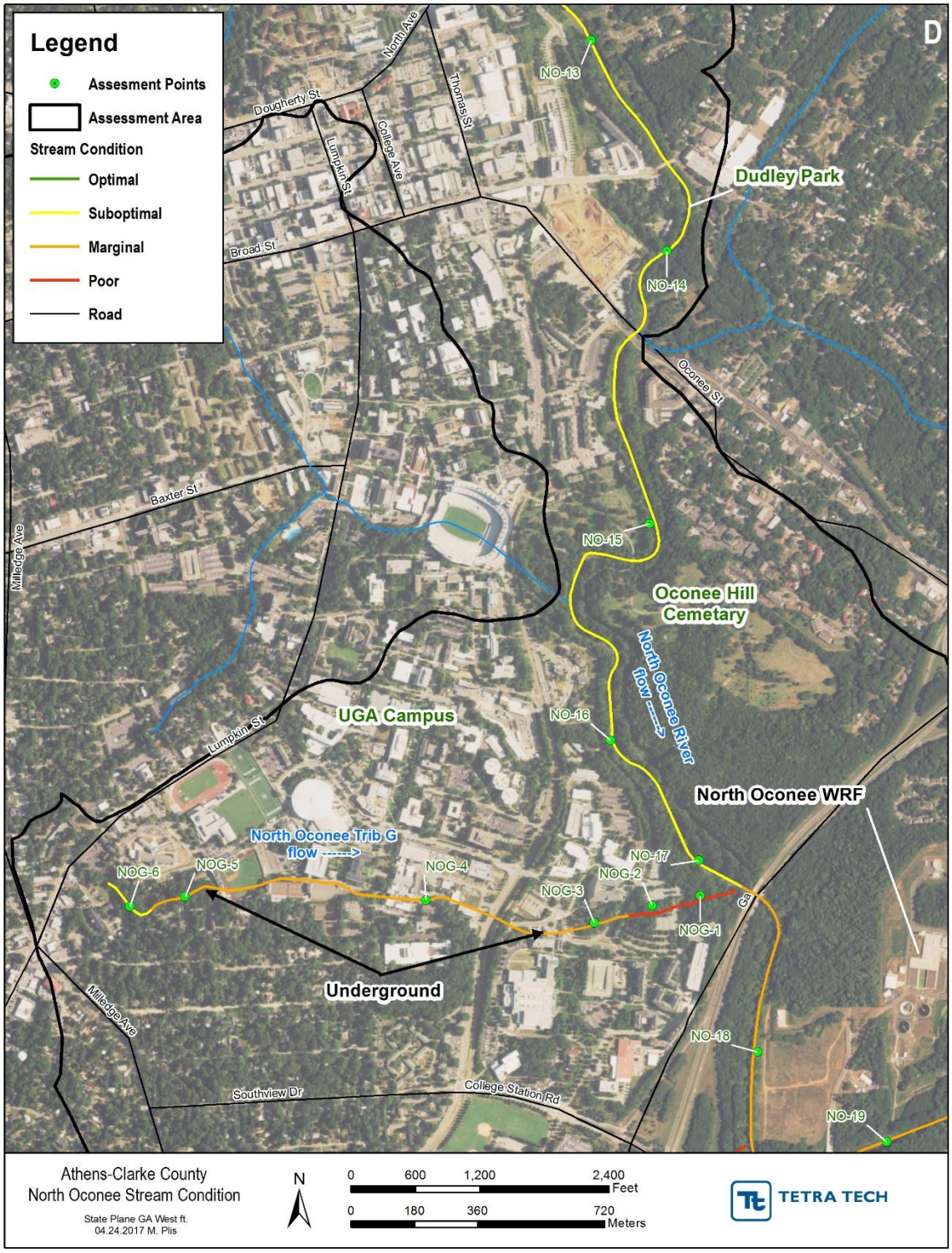

Figure 2-11. Stream Reach Condition Ratings—Panel D

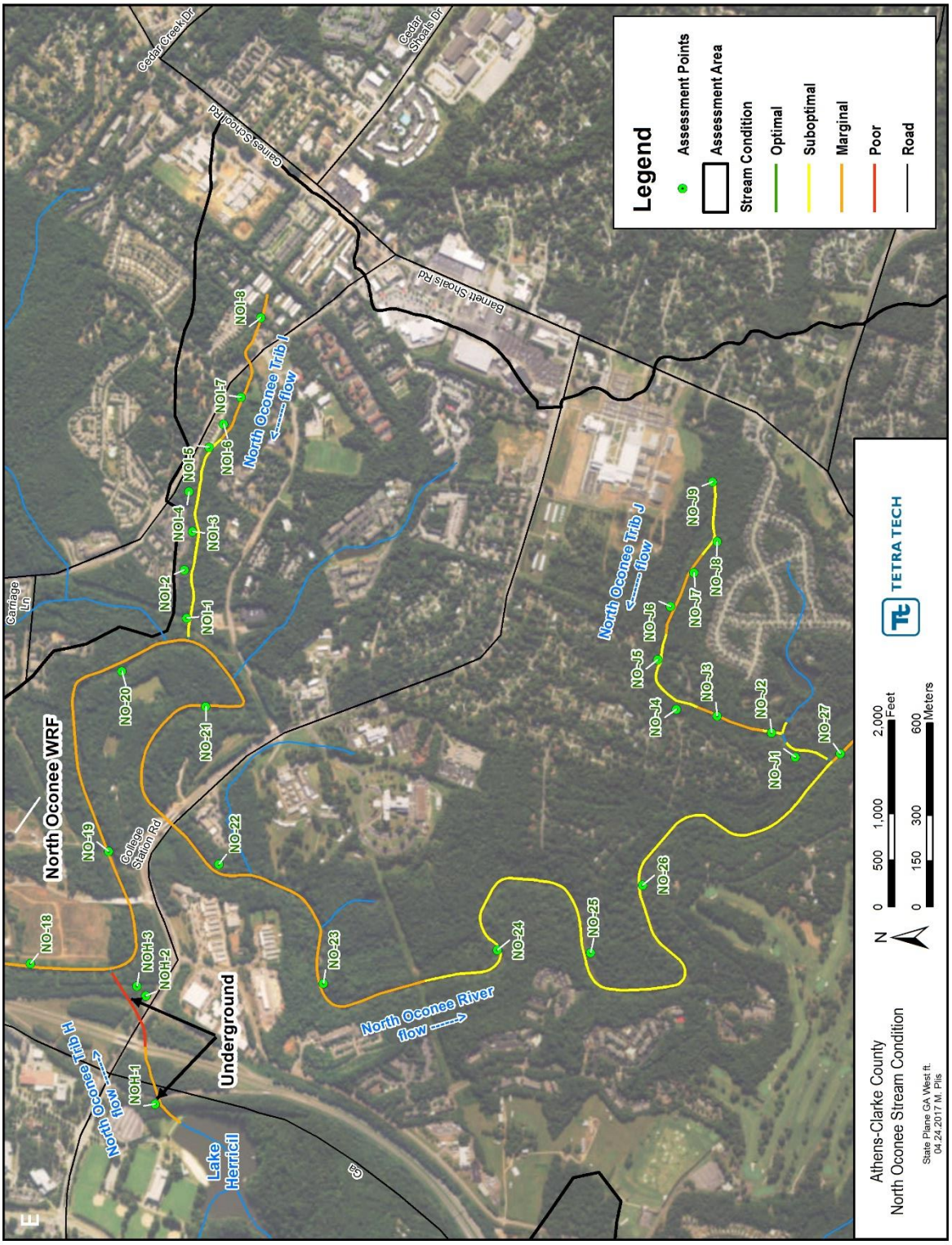

Figure 2-12. Stream Reach Condition Ratings—Panel E

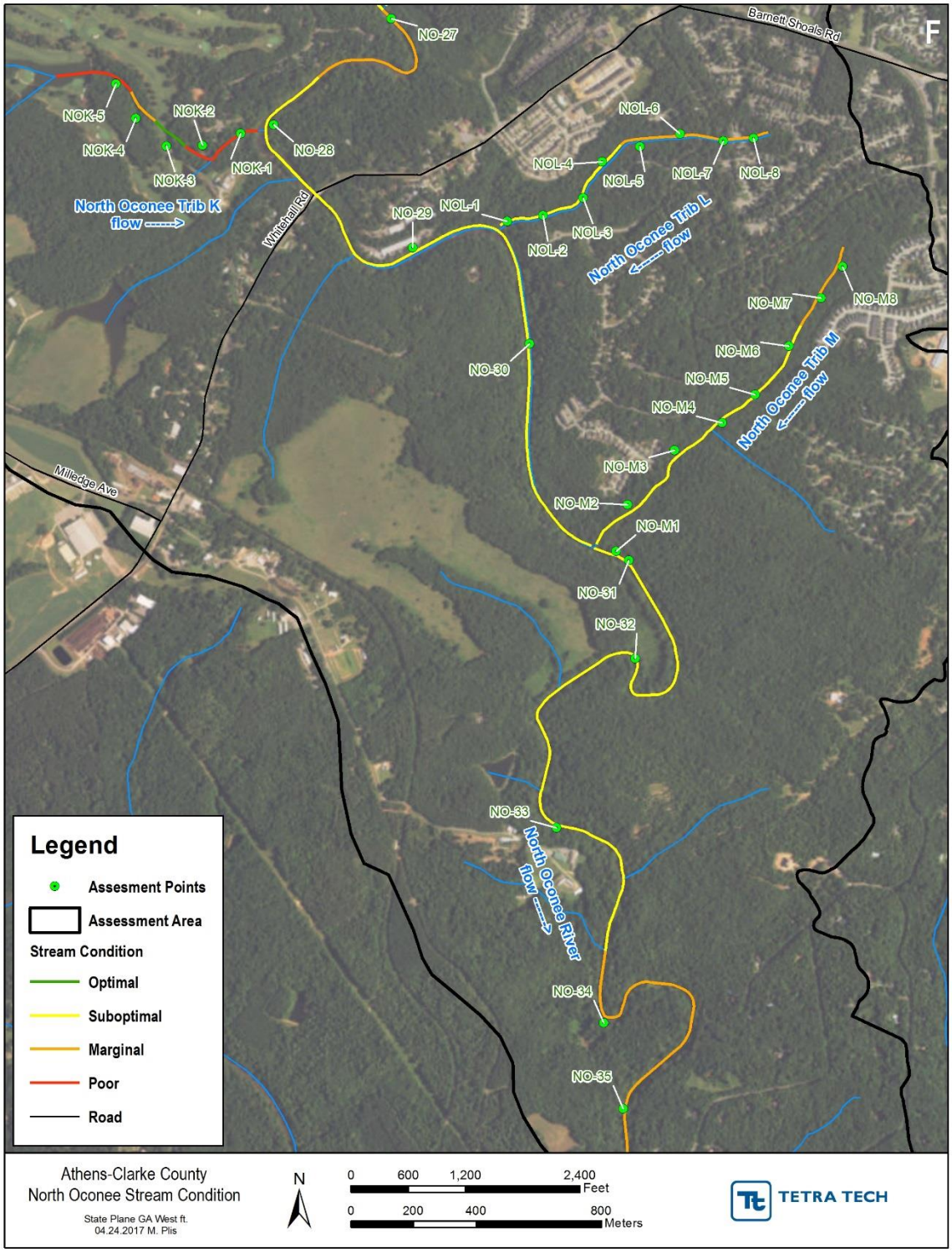

Figure 2-13. Stream Reach Condition Ratings—Panel F

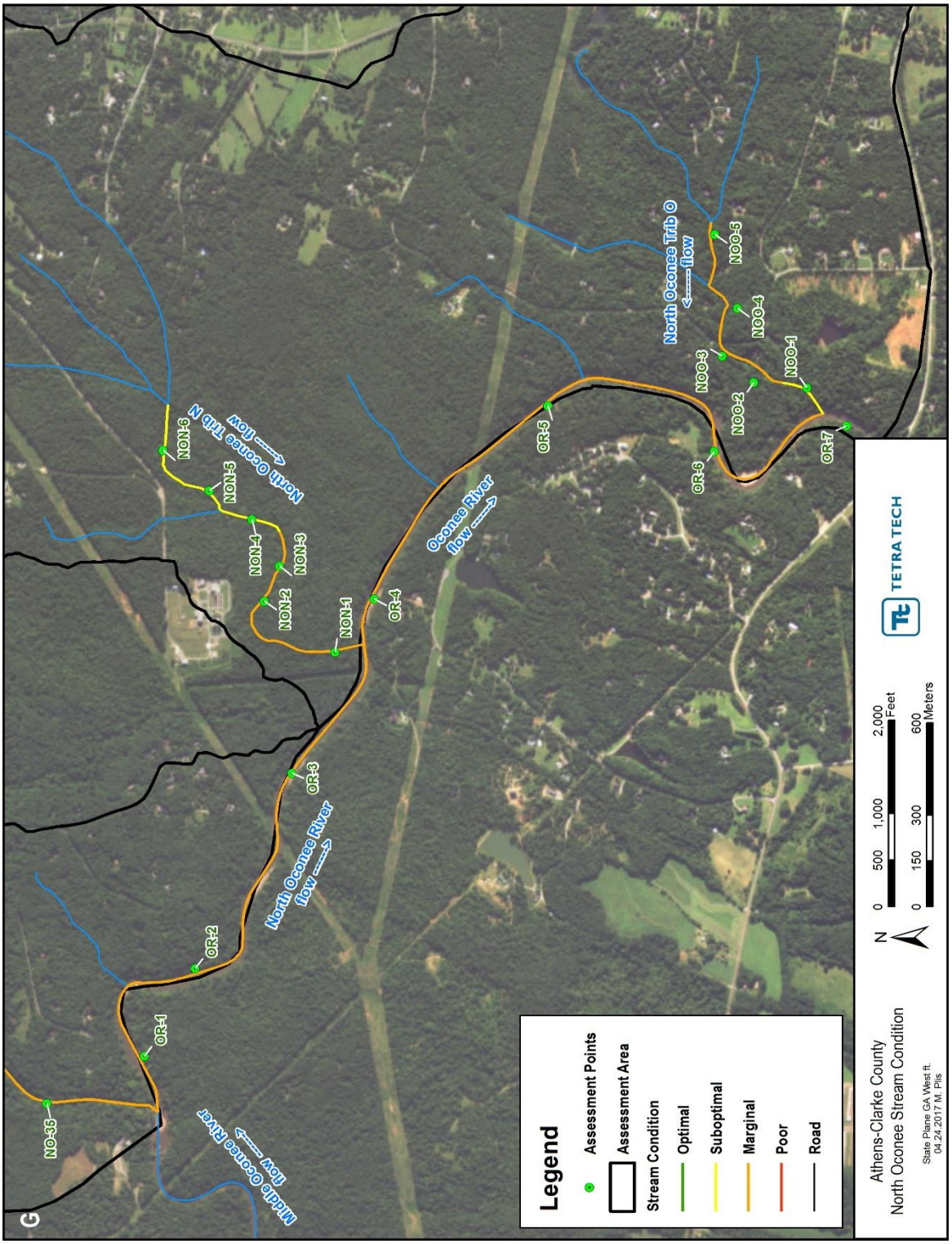

Figure 2-14. Stream Reach Condition Ratings—Panel G

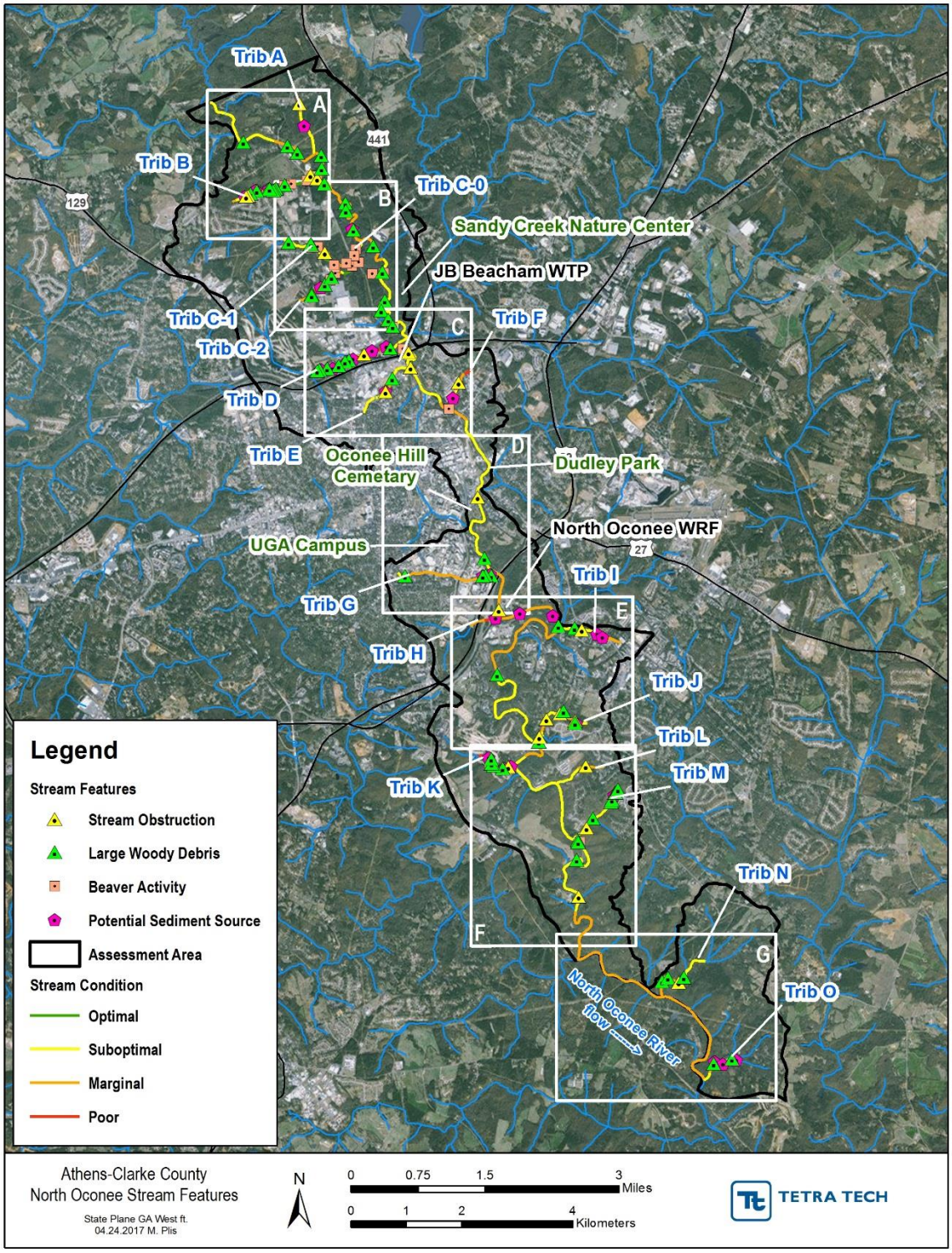

Figure 2-15. Stream Assessment Features

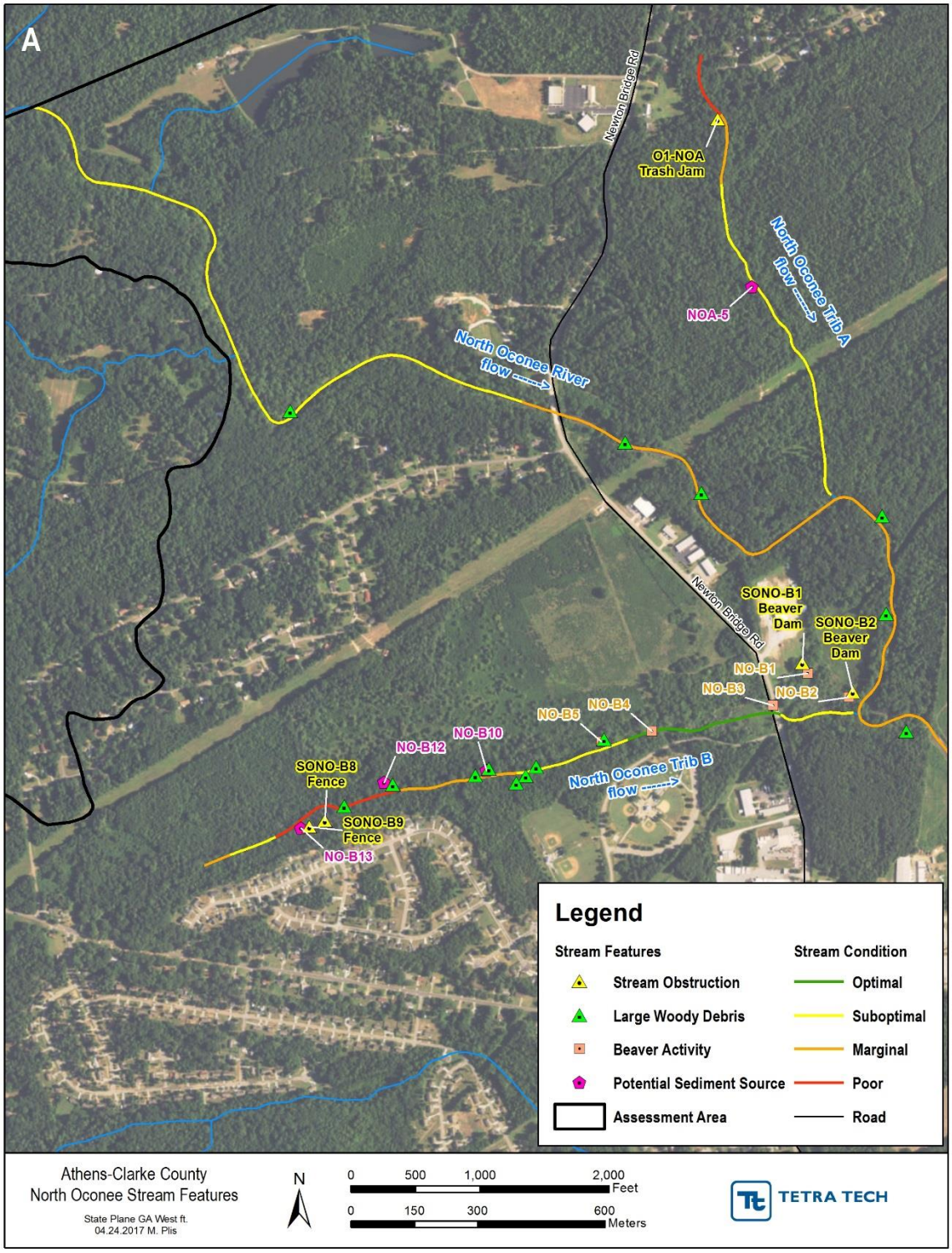

Figure 2-16. Stream Assessment Features—Panel A

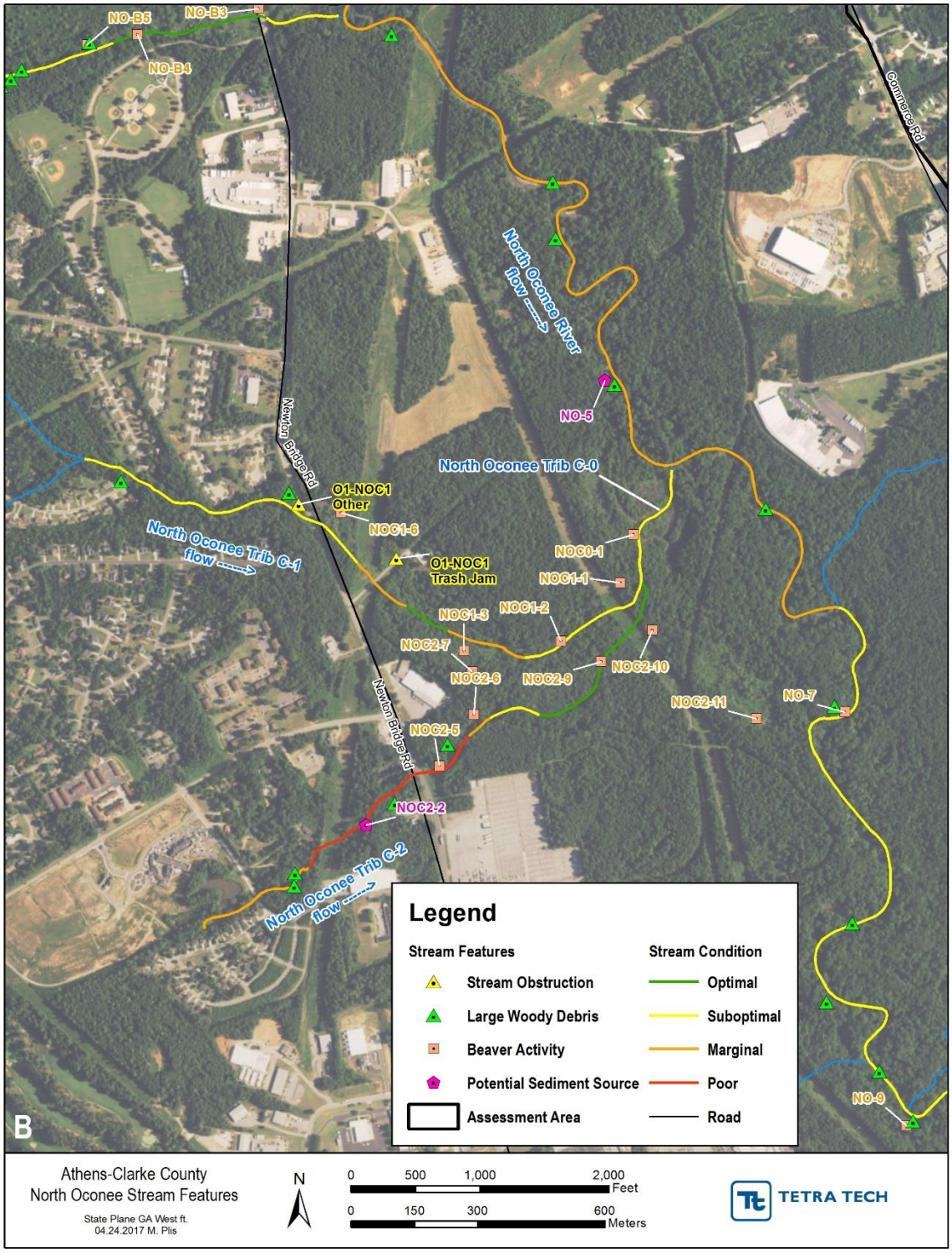

Figure 2-17. Stream Assessment Features—Panel B

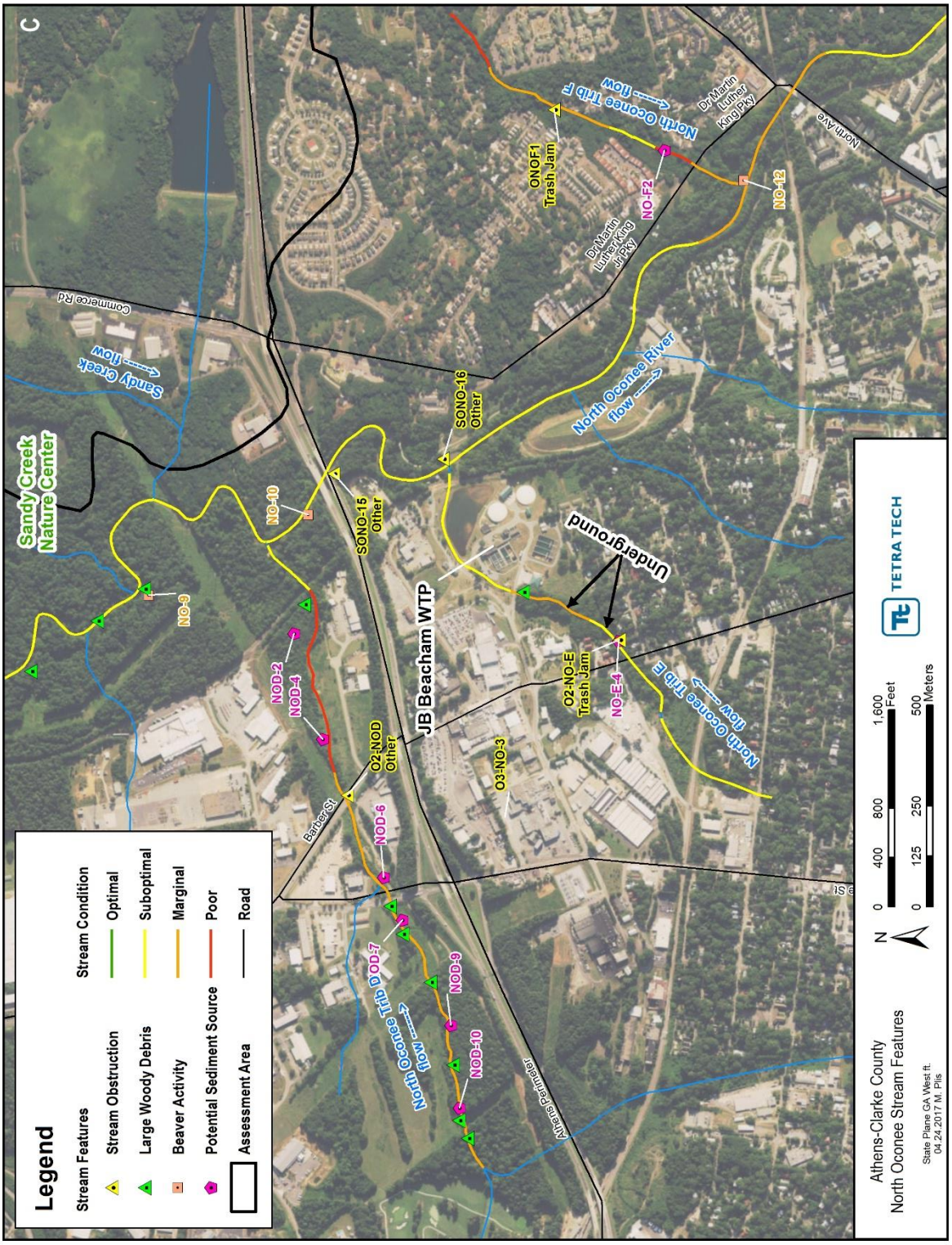

Figure 2-18. Stream Assessment Features—Panel C

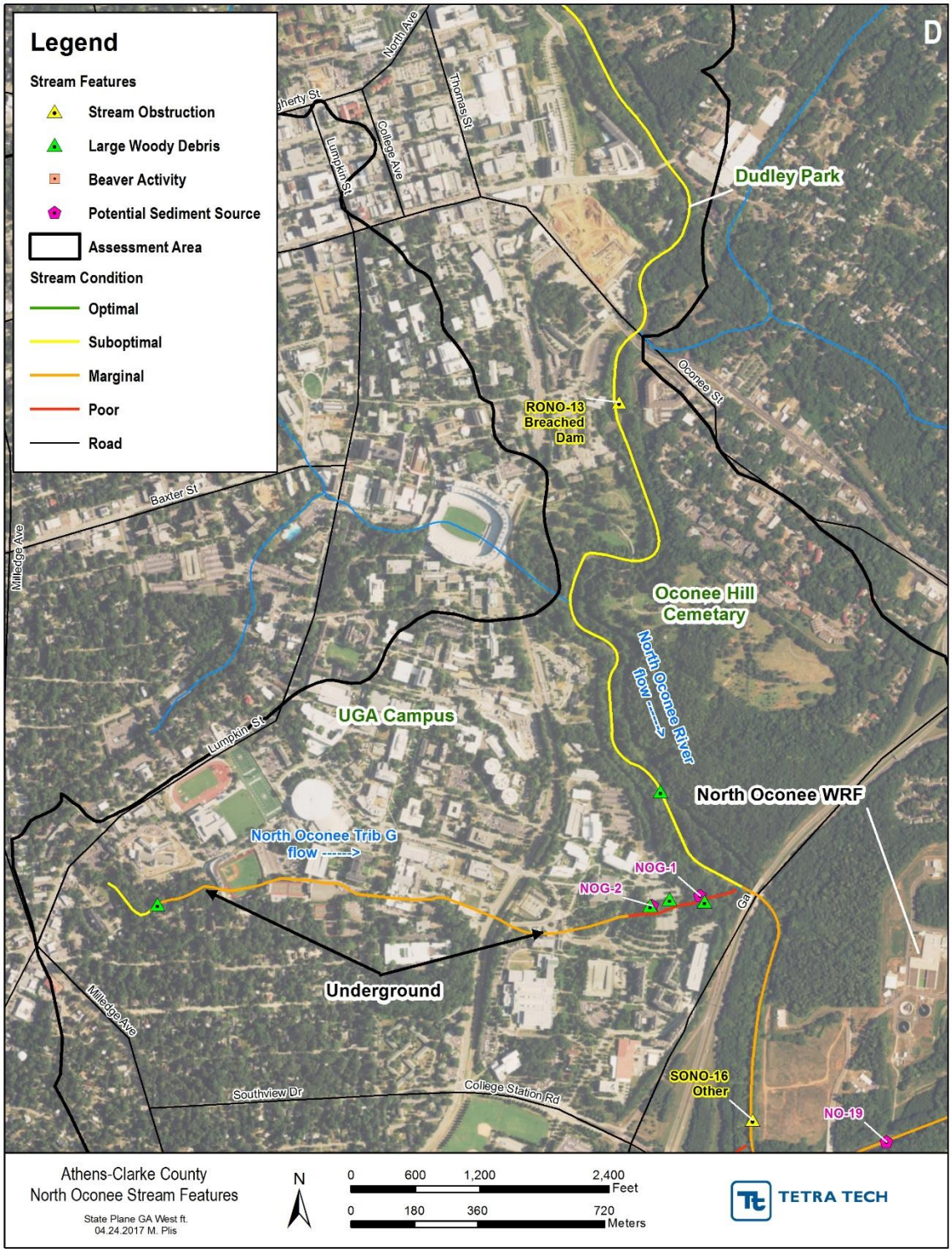

Figure 2-19. Stream Assessment Features—Panel D

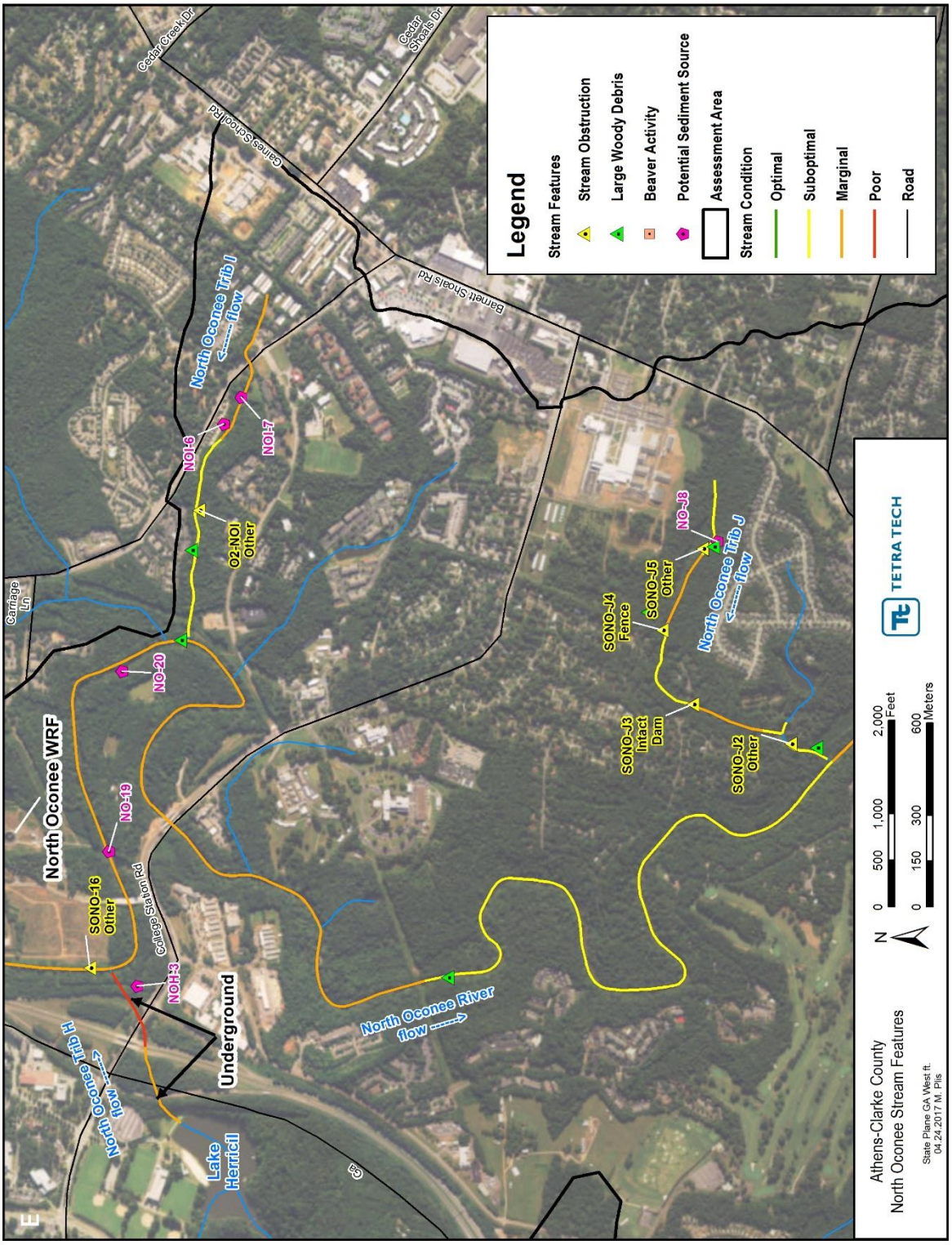

Figure 2-20. Stream Assessment Features—Panel E

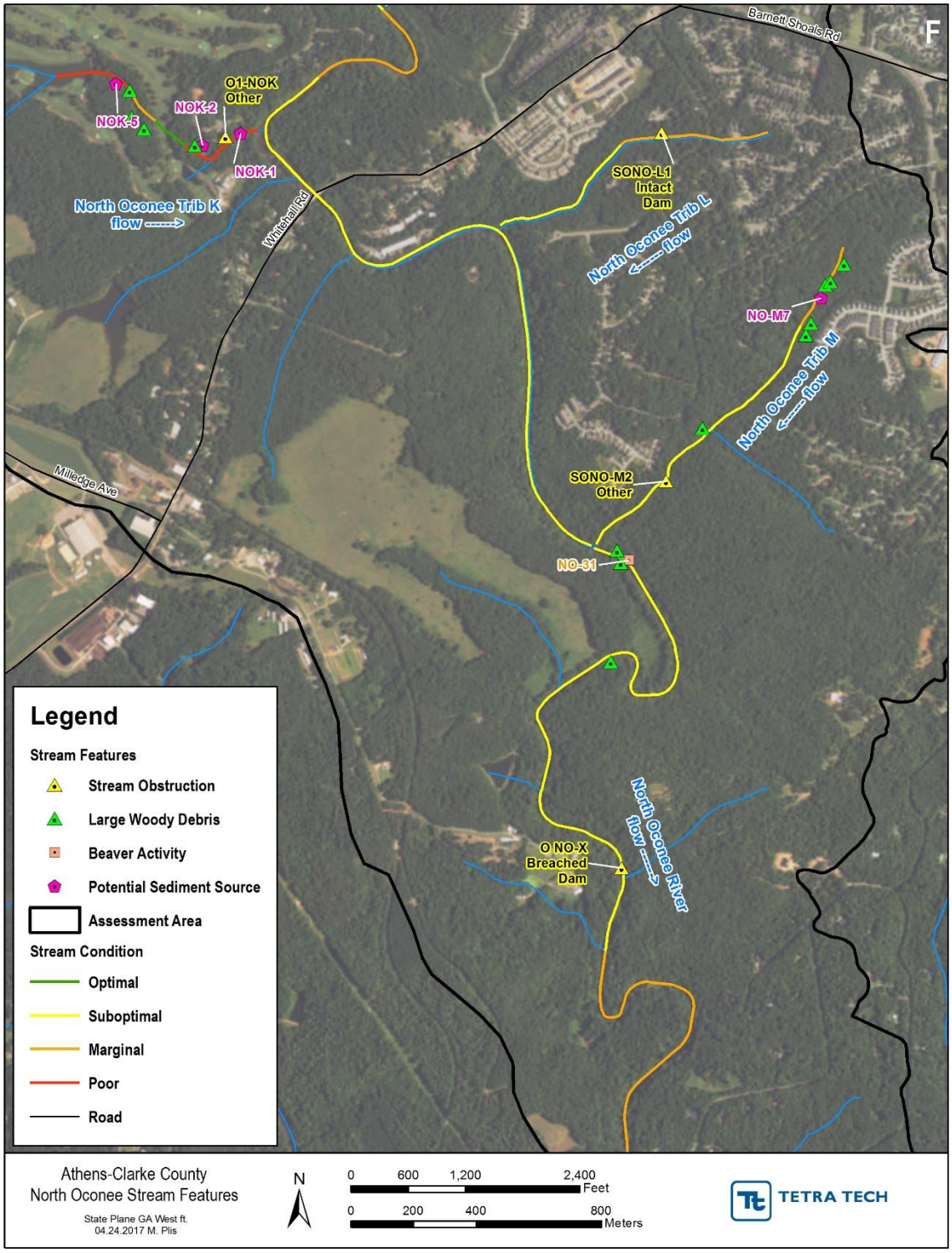

Figure 2-21. Stream Assessment Features—Panel F

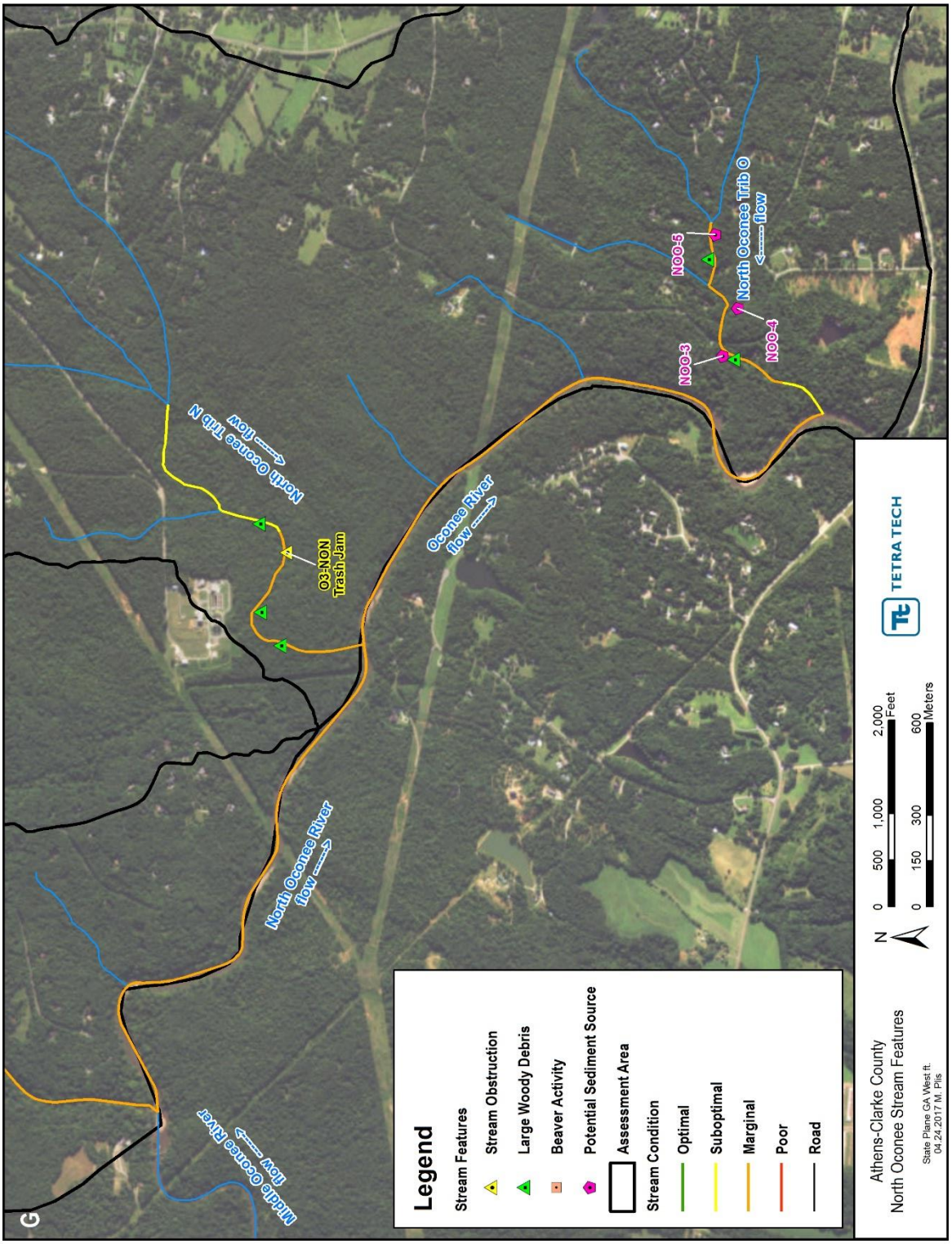

Figure 2-22. Stream Assessment Features—Panel G

2.7 Water Quality

There are three water quality monitoring stations in the study area (NO-1, NO-2, and NO-3) that were monitored by ACC in 2014. Monitoring stations are shown in Figure 2-23. 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.

There are also three impaired waters monitoring stations in the watershed including NO-2 and NO-3 plus one additional station, OC-1, where fecal coliform bacteria monitoring was initiated in 2015 and is ongoing (Figure 2-23). This monitoring is required by GaEPD per the ACC Impaired Waters Monitoring Plan because the North Oconee River downstream of Sandy Creek, and the Oconee River from the confluence of the Middle and North Oconee River to Barnett Shoals Dam, are impaired for fecal coliform bacteria. OC-1 is located on the Oconee River and all other stations are on the main stem of the North Oconee River.

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. According to Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03 (O.C.G.A. 2015[1]), the North Oconee River has a designated use of drinking water from Jackson County to Trail Creek, and has a designated use of Fishing from Trail Creek to the Oconee River. State standards for dissolved oxygen (DO), pH, FC bacteria, and temperature for waters with the designated uses of drinking water and Fishing are listed in Table 2-4.

[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.

Table 2-4. Georgia Water Quality Standards for Designated Use of Drinking Water and 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.

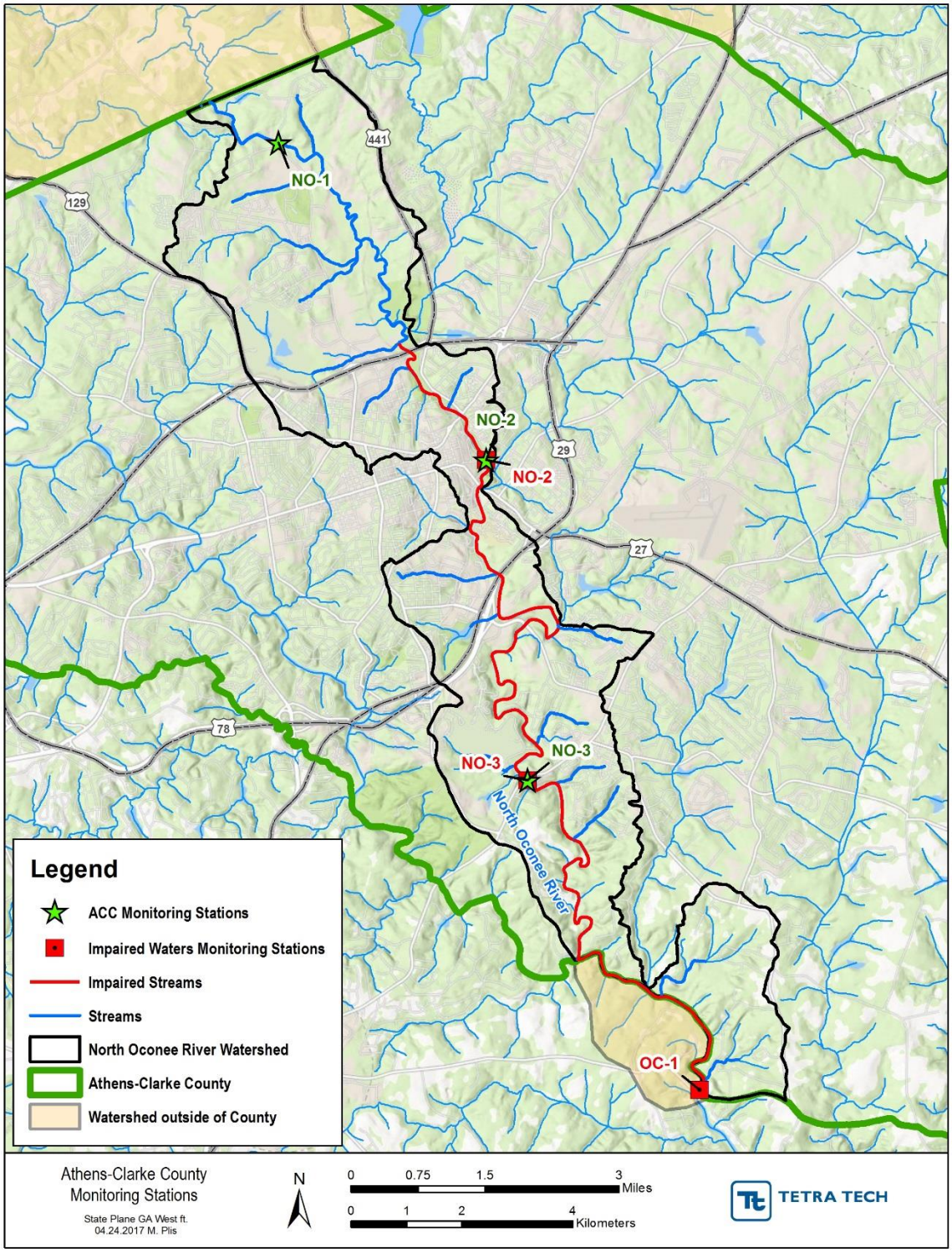

Figure 2-23. Water Quality Monitoring Stations

Water quality data collected by ACC from 2014 are summarized in Table 2-5. In this table, standards are based on the state standards for DO, pH, FC, and temperature, as shown in Table 2-4. Standards for all other parameters are based on benchmark values used by ACC that are not regulatory standards. FC bacteria geometric means are shown in Table 2-6. A single geometric mean was calculated from data collected by ACC in 2014 for stations NO-1, NO-2, and NO-3. Geometric means were calculated for stations NO-2, NO-3 and OC-1 from 2015 - 2016 as part of the impaired waters monitoring.

Plots of the raw grab sample data for DO, FC, pH, and temperature collected at each station are shown in Figure 2-24 through Figure 2-27. Data was collected from June through September 2014. The full set of tabulated data is provided in appendix E.

Table 2-5. ACC Monitoring Station Water Quality Data (2014)

Parameter	Unit	Standard	NO1				NO2				NO3			
			Samples	Average	Min	Max	Samples	Average	Min	Max	Samples	Average	Min	Max
Conductivity	mS/cm	≤ 0.3	7	0.050	0.000	0.090	7	0.055	0.009	0.090	8	0.113	0.000	0.230
Dissolved Oxygen	mg/L	≥ 4*	7	4.09	0.00	9.06	7	1.83	0.00	4.87	8	3.77	0.00	12.43
Fecal Coliform Bacteria	cols/100mL	Varies	10	536	5	1,373	7	509	143	1,340	9	1,005	5	6,000
pH	Standard units	6.0 - 8.5*	7	7.46	7.07	8.33	7	7.31	6.66	7.88	8	7.54	6.30	9.76
Temperature	Degrees Celsius	≤ 32*	7	21.97	19.89	23.85	7	23.22	20.41	24.63	7	22.78	19.90	25.03
Total Suspended Solids	mg/L	≤ 13	1	33	33	33	2	9	2	15	2	10	10	10

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

Table 2-6. Fecal Coliform Data and Water Quality Standard Comparison (2014-2016)

Parameter	Unit	Standard	Sample Dates	NO1				NO2				NO3				OC1			
				Samples	Geomean	Min	Max	Samples	Geomean	Min	Max	Samples	Geomean	Min	Max	Samples	Geomean	Min	Max
Fecal coliform bacteria May - Oct	cols/ 100 mL	<200	Sept 8-29, 2014	4	741	435	1,187	4	383	143	1,340	4	509	241	1,540	N/A	N/A	N/A	N/A
Fecal coliform bacteria May - Oct	cols/ 100 mL	<200	Oct 14-29, 2015	N/A	N/A	N/A	N/A	4	224	80	1,300	4	209	80	800	4	132	70	230
Fecal coliform bacteria Nov - Apr	cols/ 100 mL	<1,000	Nov 9-Dec 3, 2015	N/A	N/A	N/A	N/A	4	848	170	9,000	4	471	130	9,000	4	376	170	3,000
Fecal coliform bacteria Nov - Apr	cols/ 100 mL	<1,000	Mar 7-22, 2016	N/A	N/A	N/A	N/A	4	175	90	500	4	122	40	230	4	460	230	1,300
Fecal coliform bacteria May - Oct	cols/ 100 mL	<200	May 16-Jun 7, 2016	N/A	N/A	N/A	N/A	4	405	140	800	4	435	130	2,400	4	181	40	300
Fecal coliform bacteria May - Oct	cols/ 100 mL	<200	Aug 1-24, 2016	N/A	N/A	N/A	N/A	4	2,265	700	17,000	4	599	170	3,000	4	322	170	700
Fecal coliform bacteria Nov - Apr	cols/ 100 mL	<1,000	Nov 9-22, 2016	N/A	N/A	N/A	N/A	4	373	130	1,100	4	98	40	220	4	105	40	170

Notes: cols/100 mL = colonies per 100 milliliters; max = maximum; min = minimum. Red cells indicate averages not meeting the standard. Orange cells indicate minimum or maximum values not meeting the standard. 2014 data are from general ACC water quality monitoring. 2015-2016 data are from impaired waters monitoring.

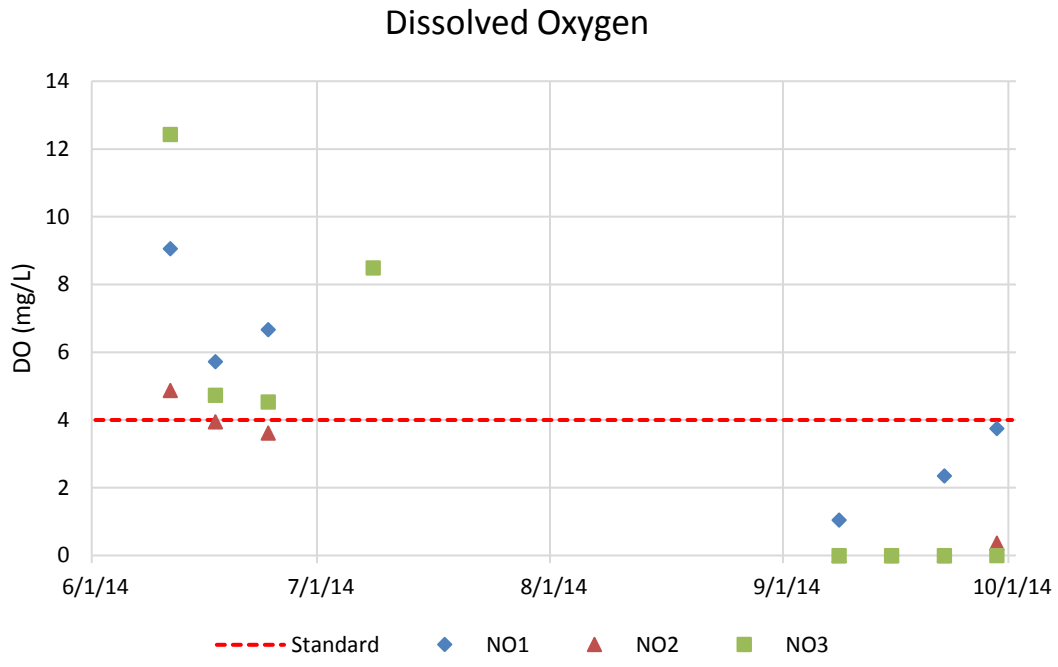

Figure 2-24. Dissolved Oxygen Grab Sample Results for North Oconee River Stations

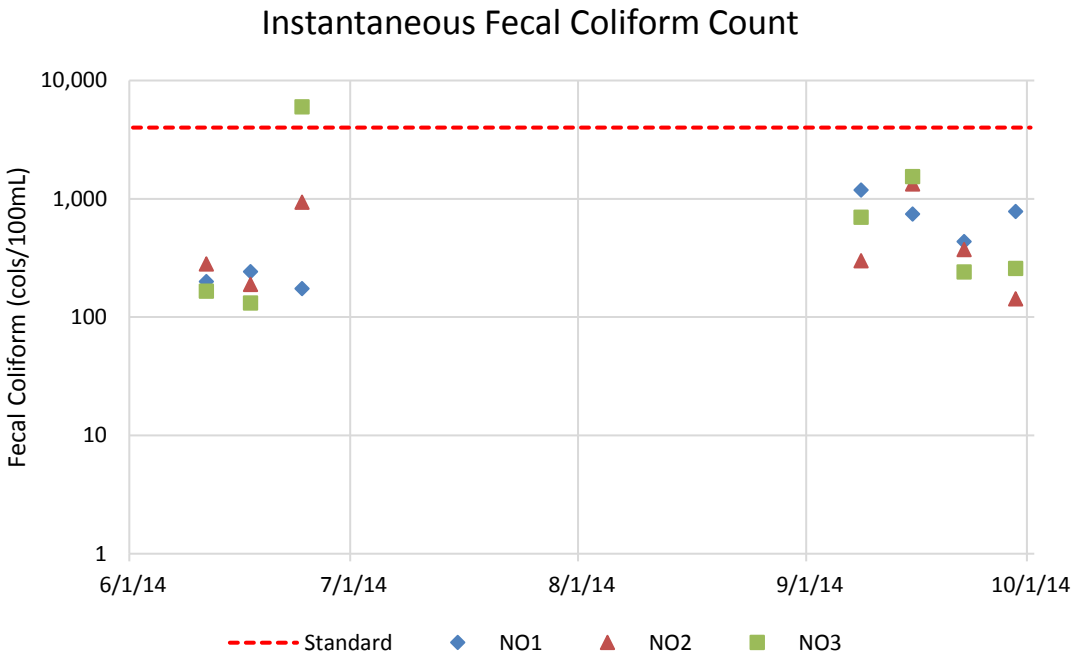

Figure 2-25. FC Bacteria Grab Sample Results for North Oconee River Stations

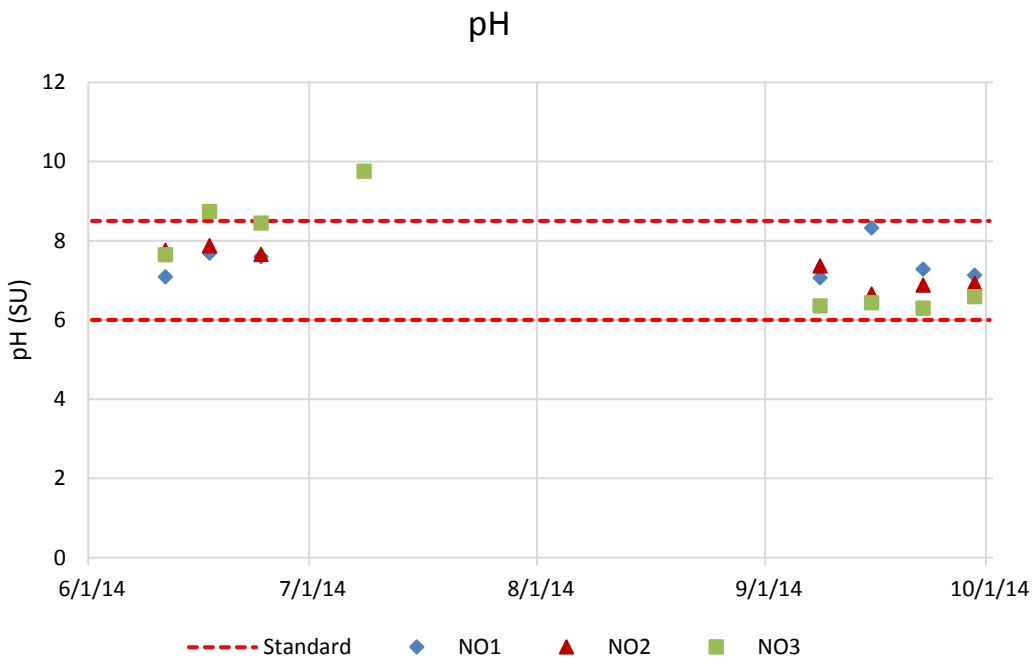

Figure 2-26. pH Grab Sample Results for North Oconee River Stations

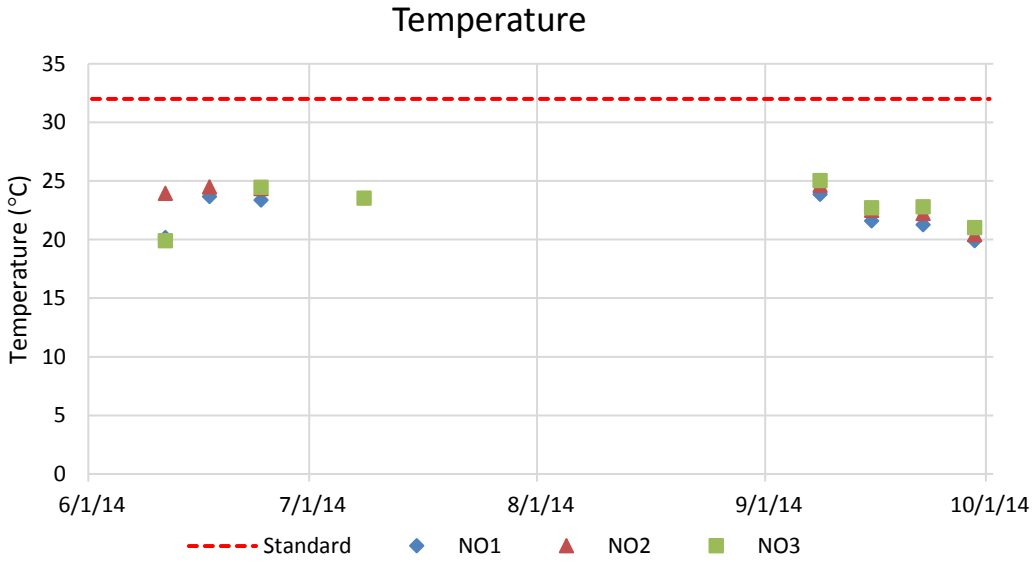

Figure 2-27. Temperature Grab Sample Results for North Oconee River Stations

Results of the water quality sampling effort suggest that surface waters in the study area are generally in compliance with the pH and temperature standards adopted by the State of Georgia. Average measurements of pH and temperature in the North Oconee River watershed are well within the state standards. On occasion, individual pH measurements did not meet the state standards, but do not appear to be indicative of chronic water quality problems. The pH standard maximum of 8.5 was exceeded on two occasions at station NO-3.

DO measurements do not meet state standards. All stations had multiple measurements that were below the instantaneous minimum standard of 4.0 milligrams per liter (mg/L), including measurements of 0.0 mg/L for each station; stations NO-2 and NO-3 have average concentrations that are below this standard. It is possible that equipment or recording errors for the samples collected in September of 2014 are responsible for these low values. FC geometric means indicate that all stations except for station NO-3 comply with the November-through-April standard a but none of the stations comply with the May-through-October standard (Table 2-6). Average conductivity values meet the standard at all stations. Average TSS concentrations exceed the standard at station NO-1.

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 2-28 through Figure 2-30) using results from the LSPC model developed for ACC. The modeled results identified the greatest TN and TP loads in the central, most heavily developed, parts of the study area. Modeled TSS loads are low to moderate throughout the study area, with slightly higher loads in the in the central, most heavily developed, parts of the study area. 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.

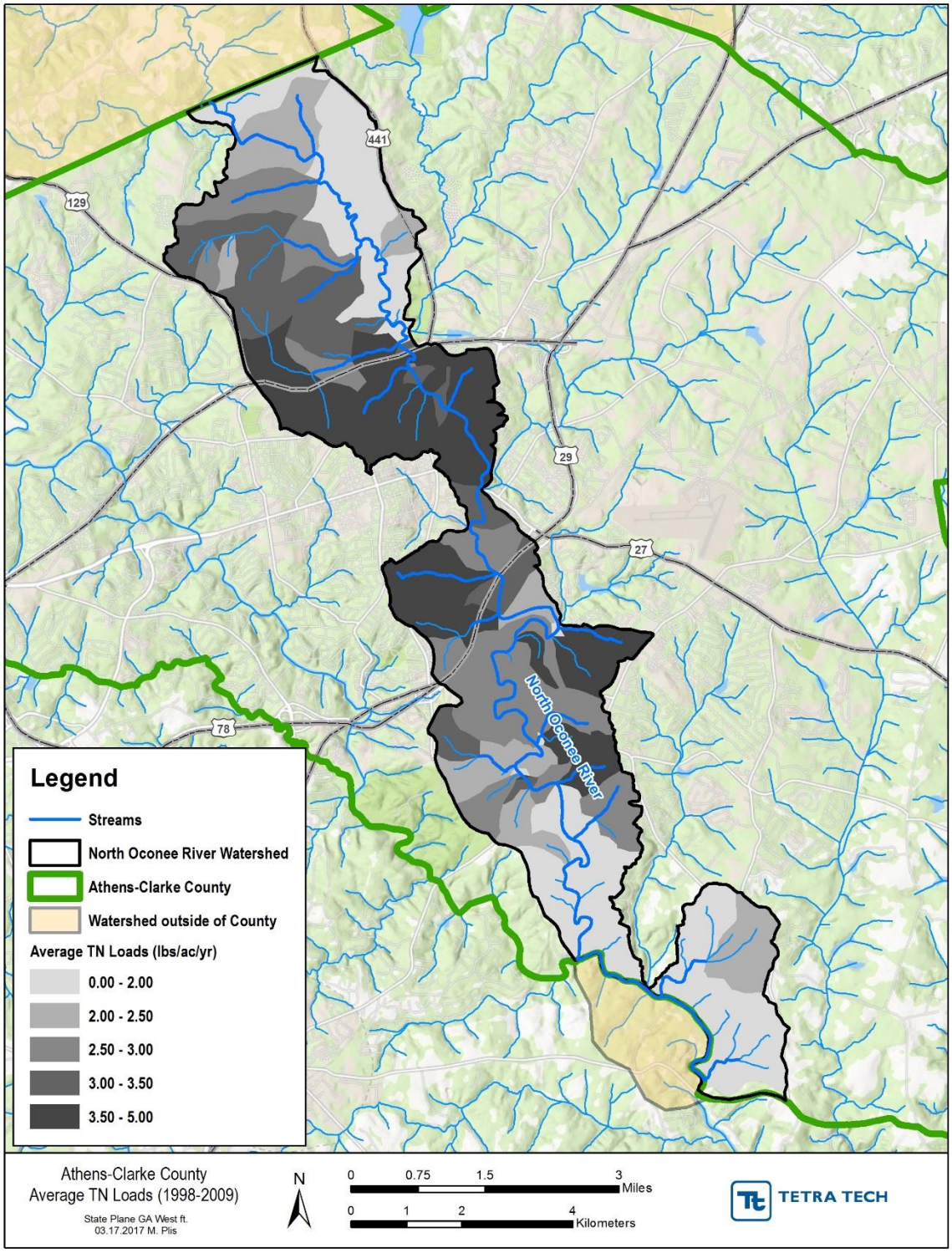

Figure 2-28. Average TN Loads

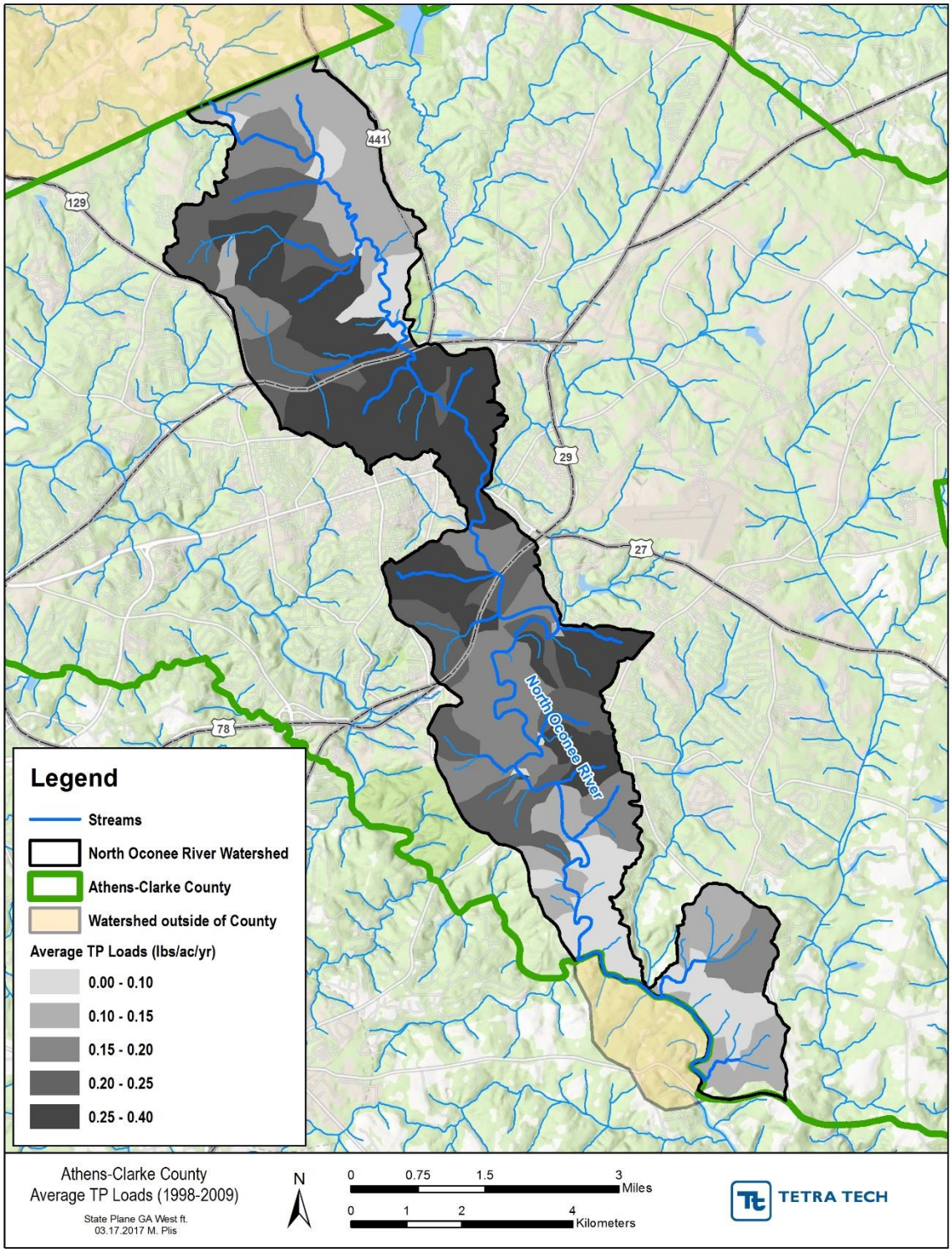

Figure 2-29. Average TP Loads

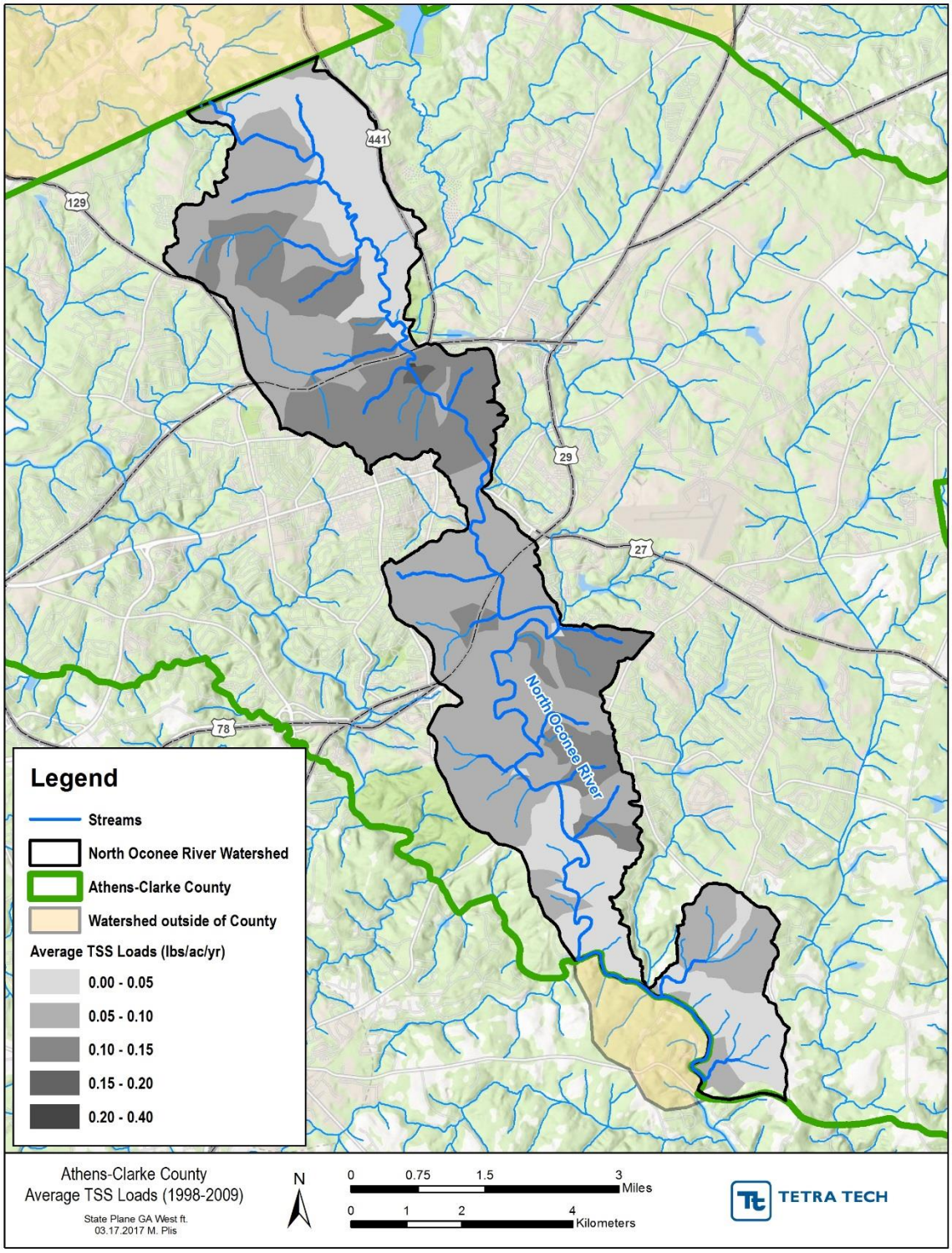

Figure 2-30. Average TSS Load

2.9 Summary

This watershed characterization describes existing conditions in the North Oconee River 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 North Oconee River watershed is composed primarily of developed and forest land. The study area is approximately 15 percent impervious, and includes the downtown area and the UGA campus. The North Oconee River is impaired for FC bacteria from Sandy Creek to the Oconee River, and the Oconee River is impaired for FC bacteria from the confluence of the Middle Oconee River and North Oconee River to Barnett Shoals Dam, downstream of ACC (GaEPD 2016).

DO is a potential concern in the study area. All stations had multiple measurements that were below the instantaneous minimum State standard of 4.0 mg/L (including measurements of 0.0 mg/L for each station), and stations NO-2 and NO-3 have average concentrations that are below this standard. It is possible that equipment or recording errors for the samples collected in September of 2014 are responsible for these low values.

FC bacteria is a concern in the North Oconee River watershed. Stations NO-1 and OR-1 each exceeded the state standard on one occasion, and stations NO-2 and NO-3 each exceeded the state standard on multiple occasions.

Sediment is a potential concern, as average TSS concentrations exceed the standard at station NO-1.

Notable key findings from the stream assessment include the following:

- High quality stream reaches include optimal reaches along Tribs B, C1, C2, and K.
- Poor quality stream reaches include poor quality reaches along Tribs A, B, C2, D, F, G, H, and K.
- The main stem of the North Oconee River ranges from marginal to suboptimal stream conditions.
- Sedimentation impacts were identified in Tribs A, B, C, F, H, J, K, and O.
- Potential sources of FC bacteria noted in the watershed include human, dog, and horse.
- Horses are present adjacent to the North Oconee River at NO-1c.
- Several dog-walking parks were observed adjacent to stream in this watershed, and dogs have access to the stream along Trib L.
- Large woody debris jams are common in tributaries throughout the watershed, with a particularly high number of jams collecting debris and partially obstructing flow on Tribs B and D.
- Beaver activity was only noted on the main stem of the North Oconee River, and in Tribs B and C.

- Infrastructure (culverts, parking lots, and small dams) is being affected by: scour under Newton Bridge Road in Trib C NOC2-1, floating debris under Barber Street in Trib D, channel erosion in Trib G at NOG-2, high flows in Trib J.
- Trash is common in Tribs E and F.

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 North Oconee River watershed. Shaded cells indicate that the need is watershed-wide.

Table 3-1. Watershed Management Needs Decision Criteria

Management Need	Decision Criteria	Applicable to North Oconee River[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.	Yes
Wetland Preservation	Large wetland areas identified in NWI Map.	Yes
Buffer Enhancement	High percentage of cropland/pastureland directly adjacent to streams.	
Hydrology	Watershed is ≥ 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 North Oconee River 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: Monitoring data show that Stations NO-1 and OR-1 each exceeded the state standard on one occasion, and stations NO-2 and NO-3 each exceeded the state standard on multiple occasions. Additionally, the North Oconee River is impaired for fecal coliform bacteria from Sandy Creek to the Oconee River, and the Oconee River is impaired for fecal coliform bacteria from the confluence of the Middle and North Oconee River to Barnett Shoals Dam. Therefore, fecal coliform bacteria was determined to be a watershed-wide management need. Areas upstream of ACC may also be contributing to high FC concentrations, limiting the ability of ACC to meet state standards.

Sediment: ACC monitoring data show that the TSS concentration at station NO1 in the North Oconee River was greater than the standard of 13 mg/L on the singe occasion when TSS was sampled at this location. Therefore, sediment was identified as a management need in the small portion of the study area upstream of this monitoring station.

Dissolved Oxygen: ACC monitoring data show that all stations had multiple measurements that were below the instantaneous minimum State standard of 4.0 mg/L (including measurements of 0.0 mg/L for each station), and stations NO-2 and NO-3 have average concentrations that are below this standard. Therefore, dissolved oxygen was determined to be a watershed-wide management need.

Wetland Preservation: Wetland preservation is a management need for the upper portion of the North Oconee River, upstream of Athens Perimeter Highway, because the NWI Map identifies a great deal of palustrine forested wetlands in this area that serve as a buffer between stormwater runoff and the stream. Preservation could be achieved through land acquisitions or conservation easements.

Hydrology: Hydrology was identified as a watershed-wide management need because the North Oconee River watershed is greater than 10 percent impervious. 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.

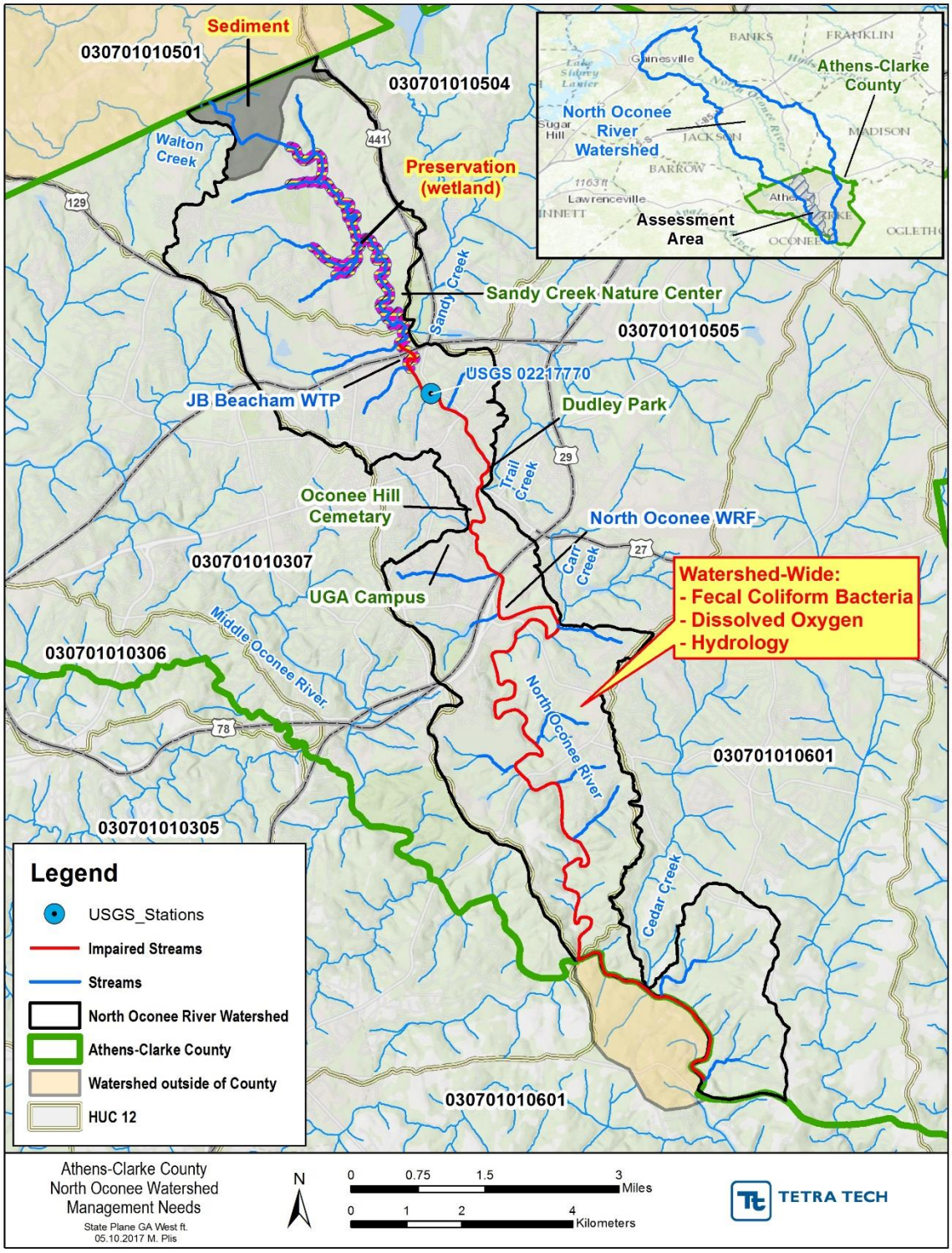

Figure 3-1. North Oconee River Management Needs

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 North Oconee River 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	Parcel Zoning	Total Score	Rank in Watershed[a]
Public														
243 049	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	20	0	2.5	7.5	10.0	0	6	6	6	0	78	1
183 010E	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	8	8	6	0	72	4
253 006	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	6	6	6	0	68	10
161 028	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	6	4	8	0	68	10
163D1 B004	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	5.0	10.0	10	6	6	8	0	67.5	12
171B2 C001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	4	4	6	0	64	19
173 001R	UNIVERSITY OF GEORGIA, BOARD OF REGENTS	10	0	10	2.5	7.5	10.0	10	8	8	8	0	64	19
163D1 A002	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	7.5	10	6	4	6	0	63.5	21
163A3 C001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	4	4	4	0	62	29
171B4 J001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	4	4	4	0	62	29
171B4 J001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	7.5	10.0	10	4	4	4	0	62	29
171B2 B001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	5.0	10.0	10	4	4	6	0	61.5	33
243 048	CLARKE COUNTY SCHOOL DISTRICT	15	0	0	2.5	7.5	10.0	0	1	1	1	0	38	1195
114C2 A034	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	5	7.5	10.0	0	1	1	1	0	45.5	386
171b2 a008	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	5	7.5	10.0	0	1	1	1	0	45.5	386
163C2 B002	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	2.5	5.0	10.0	10	4	4	4	0	59.5	49
163A4 A001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	5	7.5	10.0	10	1	1	4	0	58.5	55
163A2 A003B	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	20	0	0	5	7.5	10.0	10	1	1	4	0	58.5	55
163A1 A002	CLARKE COUNTY SCHOOL DISTRICT	20	0	0	7.5	7.5	7.5	0	1	1	1	0	45.5	386
171A2 H001	ATHENS-CLARKE COUNTY UNIFIED GOVERNMENT	15	0	0	7.5	7.5	10.0	0	1	1	1	0	43	498
163C5 A001	HOUSING AUTHORITY OF THE CITY OF ATHENS	15	0	0	5	7.5	10.0	0	1	1	1	0	40.5	820
Private														
182 008B	SHIVER FAMILY FARMS LLC	1	20	0	2.5	7.5	10.0	10	6	4	6	5.00	72.0	4
114 020	RICHBOURG BRUCE E	1	0	0	7.5	7.5	10.0	0	6	6	6	2.50	46.5	254

Note: a Rank indicates rank among all parcels in the watershed. Parcels with the same total score received the same rank.

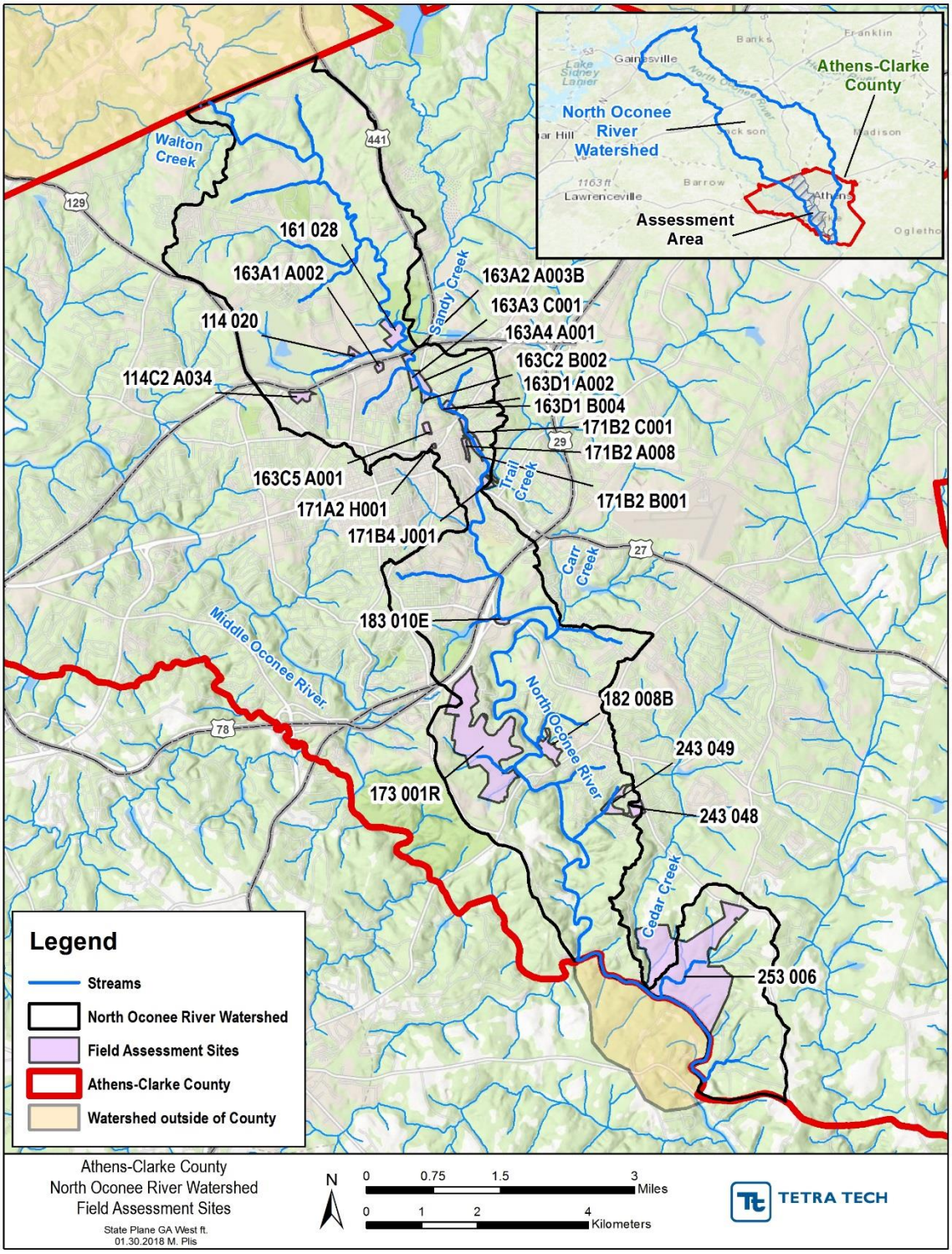

Figure 3-2. North Oconee River Field Assessment Sites

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. Twenty-eight sites were identified in the North Oconee River watershed. Parcel information and potential opportunities for the candidate sites are listed in Table 3-4 and the site locations are 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).

Table 3-4. Candidate Sites for Watershed Improvement Opportunities

Watershed	Parcel Number	Owner	Description	Opportunity	BMP ID
North Oconee River	114 021A	1430 Chase Street LLC	Industrial property between North Chase Street and Barber Street	Stream restoration	NO-Res-01
North Oconee River	163A2 A003B	Athens-Clarke County Unified Government	Dirt lot used for storage adjacent to North Oconee River	Buffer restoration	NO-Res-02
North Oconee River	163C3 A010, A011B, A011C	Athens-Clarke County Unified Government	Boulevard Woods Park	Outfall repair	NO-Res-03
North Oconee River	171B2 B001	Athens-Clarke County Unified Government	North Oconee River Park (west side of the river)	Stream restoration	NO-Res-04
North Oconee River	171B2 C001	Athens-Clarke County Unified Government	North Oconee River Park (east side of the river)	Buffer enhancement and bank stabilization	NO-Res-05
North Oconee River	114 034	Athens-Clarke County Unified Government	ACC Fleet Management Building	Bioretention cells	NO-Str-01
North Oconee River	114 034	Athens-Clarke County Unified Government	ACC Fleet Management Building	Detention pond	NO-Str-02
North Oconee River	114 034	Athens-Clarke County Unified Government	ACC Fleet Management Building	Stormwater runoff treatment train	NO-Str-03

Watershed	Parcel Number	Owner	Description	Opportunity	BMP ID
North Oconee River	114C2 A034	Athens-Clarke County Unified Government	Pound Street Complex. Where Leisure Services offices are located.	Bioretention area	NO-Str-04
North Oconee River	114C2 A034	Athens-Clarke County Unified Government	Pound Street Complex. Where Leisure Services offices are located	Detention pond	NO-Str-05
North Oconee River	114C2 A034	Athens-Clarke County Unified Government	Pound Street Complex. Where Leisure Services offices are located	Stormwater runoff treatment train	NO-Str-06
North Oconee River	114D3 G008	Athens-Clarke County Unified Government	Parking lot across the street from ACC "Governmental Building"	Bioretention area	NO-Str-07
North Oconee River	163A1 A002A	Athens-Clarke County Unified Government	Public Utilities Lot	Bioretention area	NO-Str-08
North Oconee River	163A1 A002A	Athens-Clarke County Unified Government	Public Utilities Lot	Detention pond	NO-Str-09
North Oconee River	163A1 A008B	Athens-Clarke County Unified Government	Water Meter Building	Cistern	NO-Str-10
North Oconee River	163A3 A002	Athens-Clarke County Unified Government	Sewerline Construction and Repair Building	Cistern	NO-Str-11
North Oconee River	163C2 B002	Athens-Clarke County Unified Government	Solid Waste and Recycling Facility (CHaRM)	Detention pond	NO-Str-12
North Oconee River	163C5 A001	Housing Authority of the City of Athens	Housing Authority College Ave.	Infiltration trench	NO-Str-13
North Oconee River	163D3 D001	Athens-Clarke County Unified Government	Lay Park/Lydon House Arts Center	Bioswale	NO-Str-14
North Oconee River	163D3 O001	Athens-Clarke County Unified Government	Fire Station #1	Rain gardens	NO-Str-15
North Oconee River	163D3 O001	Athens-Clarke County Unified Government	Fire Station #1	Cistern	NO-Str-16
North Oconee River	171A2 H001	Athens-Clarke County Unified Government	Downtown Athens Parking System on Strong St.	Porous pavement	NO-Str-17
North Oconee River	171B4 A001	Athens-Clarke County Unified Government	Small grass/vegetated picnic area south of Broad Street, behind BBQ shack and adjacent to River.	Bioretention area	NO-Str-18
North Oconee River	173 001, 173 001A	University of Georgia, Board of Regents	Stream with severe erosion and headcuts by UGA's Lamar Dodd School of Art at 190 River Road.	Detention pond	NO-Str-19
North Oconee River	104 001D	Athens-Clarke County Unified Government	Holland Youth Sports Complex	Swale maintenance	NO-Prog-01
North Oconee River	163D2 D013	Athens-Clarke County Unified Government	Empty gravel lot used for parking by Church, apartment complex	Gravel lot rehabilitation	NO-Prog-02
North Oconee River	163D3 G002	Athens-Clarke County Unified Government	ACC Government building	Smart site design	NO-Prog-03
North Oconee River	163D3 N001	Athens-Clarke County Unified Government	Downtown Athens Parking System on N. Jackson St.	Drainage system maintenance	NO-Prog-04
North Oconee River	171B1 A001	Athens-Clarke County Unified Government	Athens Welcome Center	Vegetation maintenance	NO-Prog-05
North Oconee River	171B2 A008A	Athens-Clarke County Unified Government	Multimodal Transportation Center	Waste stations	NO-Prog-06

Watershed	Parcel Number	Owner	Description	Opportunity	BMP ID
North Oconee River	173 001R	University of Georgia, Board of Regents	Golf Course with poor quality channelized stream and no buffers.	Green golf course management	NO-Prog-07
North Oconee River	253 006	Athens-Clarke County Unified Government	Large forested parcel on the Oconee River associated with the Cedar Creek Water Reclamation Facility	Buffer preservation	NO-Prog-08

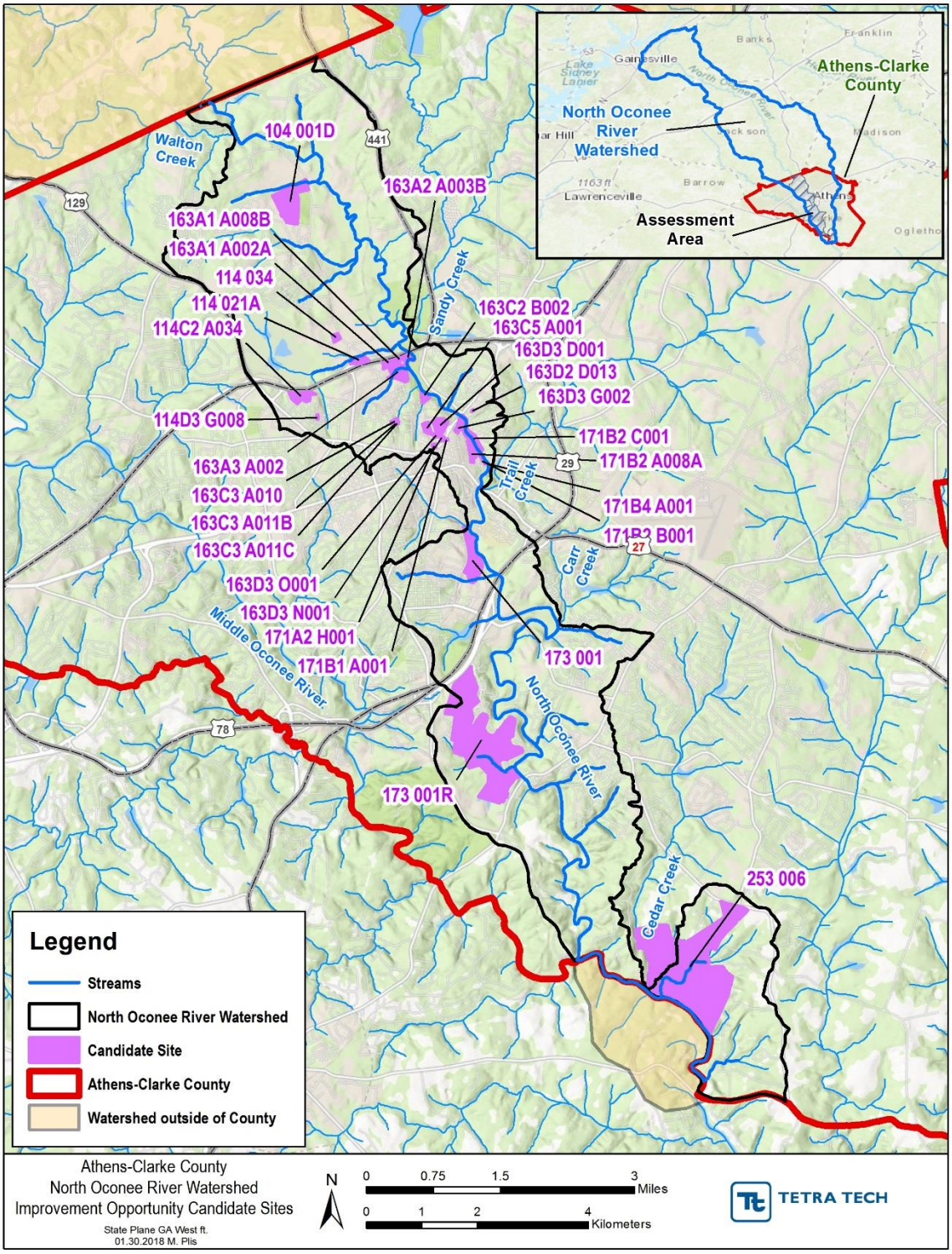

Figure 3-3. North Oconee River Watershed Improvement Opportunity Sites

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. In the North Oconee River Watershed, green infrastructure would be particularly appropriate for incorporation into the redevelopment of downtown areas.
Coordination with Jackson County on Stormwater Management	Determine if stormwater management at the J&J Flea Market could improve hydrology in the tributary to Sandy Creek that runs along the southern edge of Sandy Creek Park.

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.

3.3.4 BMP Modeling and Optimization

Potential watershed improvement measures identified in the North Oconee River watershed include stormwater control measures, restoration measures, and programmatic measures (structural BMPs). Stormwater control measures are stormwater best management practices (BMPs) that store and/or infiltrate stormwater runoff. These measures address both water quality and water quantity concerns. BMP simulation and optimization modeling was performed on site-specific stormwater control measures to evaluate BMP effectiveness at reducing flows and pollutant loads and to optimize the BMPs to identify the best size to achieve the greatest benefit for the least cost. Modeling results were then used to help develop cost estimates, and to help score and rank potential projects.

Proposed BMPs were modeled using the Stormwater Management Optimization Tool (Opti-Tool) developed by Tetra Tech for EPA Region 1.

After the model was used to optimize the size of BMPs, engineers estimates of probable cost were developed for each BMP. Without detailed engineering data, these costs are assumed to be accurate within plus 50 percent to minus 30 percent of actual implementation costs. Each cost estimate is comprised of construction costs, mobilization, and design. Land acquisition costs were not incorporated into the cost estimates and need to be considered should any of the proposed structural measures be selected for implementation.

The construction costs were estimated with RSMeans CostWorks software, using construction cost data for the Athens area. The unit rate cost assumptions are shown in the final cost opinions in appendix J. Design and engineering costs were assumed to be 25 percent of the construction cost. Table 3-6 provides a summary of the runoff volume and peak flow reductions and estimated total cost for each of the modeled structural BMPs in the North Oconee River watershed.

Table 3-6. Modeling Results and Cost Estimates of Stormwater Control BMPs in the North Oconee River Watershed

Parcel Number	Project Name	BMP ID	Drainage Area (ac)	BMP Area (ac)	Runoff Volume % Reduction	Runoff Peak Flow % Reduction	Total Cost
073 016	Georgia Square Mall Bioretention	MO-Str-01	5.00	0.43	63%	24%	$547,000
073 016	Georgia Square Mall Detention	MO-Str-02	63.35	1.61	3%	75%	$1,059,000
073 016	Georgia Square Mall Treatment Train	MO-Str-03	63.35	1.68	59%	77%	$1,388,000
114 034	Fleet Management Bioretention	NO-Str-01	2.19	0.12	63%	24%	$153,000
114 034	Fleet Management Detention	NO-Str-02	2.19	0.04	1%	80%	$84,000
114 034	Fleet Management Treatment Train	NO-Str-03	2.19	0.15	63%	68%	$206,000
114C2 A034	Leisure Services Bioretention	NO-Str-04	3.70	0.26	63%	24%	$340,000
114C2 A034	Leisure Services Detention	NO-Str-05	3.70	0.09	1%	79%	$151,000
114C2 A034	Leisure Services Treatment Train	NO-Str-06	3.70	0.36	63%	78%	$435,000
114D3 G008	ACC Government Building Parking Lot Bioretention	NO-Str-07	0.32	0.03	63%	24%	$60,000
163A1 A002A	Public Utilities Lot Bioretention	NO-Str-08	6.05	0.30	63%	24%	$333,000
163A1 A002A	Public Utilities Lot Detention	NO-Str-09	6.05	0.11	1%	79%	$130,000
163A1 A008B	Water Meter Building Cistern	NO-Str-10	0.16	N/A	55%	N/A	$24,000
163A3 A002	Sewerline Construction and Repair Building Cistern	NO-Str-11	0.23	N/A	54%	N/A	$26,000
163C2 B002	CHaRM Facility Detention	NO-Str-12	161.30	10.02	7%	68%	$2,718,000
163C5 A001	Housing Authority - College Ave. Infiltration Trench	NO-Str-13	0.28	0.02	80%	24%	$50,000
163D3 D001	Lay Park Bioswale	NO-Str-14	0.20	0.02	63%	24%	$33,000
163D3 O001	Fire Station #1 Cistern	NO-Str-16	0.37	0.01	55%	N/A	$39,000
163D3 O001	Fire Station #1 Rain Gardens	NO-Str-15	0.37	0.04	83%	11%	$60,000

3.3.5 Evaluation and Prioritization of Stormwater Control and Restoration BMPs

A meeting was held with Tetra Tech, Arcadis, and ACC to discuss the identified watershed improvement opportunities. Tetra Tech and ACC staff visited several sites to discuss potential improvement measures

and to see examples of current management practices that appear to be working well. Feedback from this meeting was used to develop a list of attributes for prioritizing projects.

Stormwater control BMPs were evaluated based on 10 attributes and restoration BMPs were evaluated based on 9 attributes:

Stormwater Control BMP Attributes

- Drainage Area
- Ownership
- Education Potential
- Public Amenity Potential
- Constructability/Conflicts
- Maintenance Needs
- Storm Flow Control
- Runoff Reduction
- Overall Impact or Environmental Benefit
- Cost level

Restoration BMP Attributes

- Drainage Area
- Ownership
- Education Potential
- Public Amenity Potential
- Constructability/Conflicts
- Maintenance Needs
- Habitat Enhancement
- Overall Impact or Environmental Benefit
- Cost level

BMPs were evaluated by scoring the attributes for each project, with each attribute receiving a possible score between 0 and 10. The attributes and scoring system were developed in close coordination with ACC so that they reflect the priorities important to ACC.

Some attributes were recognized as having more importance for than others for the purpose of achieving the goals and objectives of the WMP. To account for this relative difference in attribute importance, weighting factors of 0.5, 1, or 2 were applied to each attribute. This was done in such a way that the total the total possible score is 100 points after the weightings are applied, for both stormwater control and restoration projects. Attribute weighting factors for stormwater control and restoration BMPs are shown in Table 3-7.

Table 3-7. BMP Attribute Weighting Factors

BMP Ranking Attribute	*Weighting Factors*	
	Stormwater Control BMPs	Restoration BMPs
Drainage area treated	2	N/A
Stream Size	N/A	2
Ownership	2	2
Education potential	0.5	0.5
Public amenity potential	0.5	0.5
Ease of Constructability	0.5	0.5
Maintenance Needs	0.5	0.5
Storm flow control	1	N/A
Runoff Reduction	1	N/A
Habitat Enhancement	N/A	1
Overall Impact/ Environmental Benefit	1	2
Cost Level	1	1

Once all projects were evaluated and scored, they could be ranked from highest to lowest score. Higher ranking projects represent higher priority projects for ACC. A complete description of the methodology used to evaluate and prioritize projects is provided in appendix H, including a detailed description of the scoring criteria for each BMP attribute. A prioritized list of stormwater control and restoration projects for the North Oconee River watershed is provided in Table 3-8.

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Table 3-8. Scoring and Prioritization for Stormwater Control and Restoration Projects in the North Oconee River Watershed

Parcel Number	BMP ID	Drainage Area/Stream Size	Ownership	Education Potential	Public Amenity Potential	Constructability/ Conflicts	Maintenance Needs	Storm Flow Control	Runoff Reduction	Habitat Enhancement	Overall Impact or Environmental Benefit	Cost Level	Total Weighted Score	Rank
		Attribute Score												
171B2 C001	NO-Res-05	10	10	10	10	5	5	N/A	N/A	10	10	7.5	92.5	1
171B2 B001	NO-Res-04	10	10	10	10	5	5	N/A	N/A	10	10	2.5	87.5	2
163C2 B002	NO-Str-12	10	10	10	10	0	5	5	0	N/A	10	2.5	70	3
173 001	NO-Str-19	10	5	10	10	0	10	7.5	0	N/A	10	2.5	65	4
114 034	NO-Str-02	7	10	0	0	10	10	7.5	0	N/A	5	7.5	64	5
114 034	NO-Str-03	7	10	0	0	10	0	7.5	10	N/A	5	2.5	64	5
114C2 A034	NO-Str-06	7	10	0	0	10	0	7.5	10	N/A	5	2.5	64	5
163A1 A002A	NO-Str-09	8	10	0	0	10	10	7.5	0	N/A	5	5	63.5	8
163A2 A003B	NO-Res-02	10	10	0	0	10	5	N/A	N/A	10	0	5	62.5	9
114C2 A034	NO-Str-05	7	10	0	0	10	10	7.5	0	N/A	5	5	61.5	10
114 021A	NO-Res-01	10	0	0	0	10	5	N/A	N/A	10	10	2.5	60	11
163C3 A010, A011B, A011C	NO-Res-03	0	10	10	10	10	10	N/A	N/A	0	5	10	60	11
114 034	NO-Str-01	7	10	0	0	10	0	0	10	N/A	5	5	59	13
171B4 A001	NO-Str-18	7	10	10	10	0	0	0	10	N/A	0	5	59	13
163A1 A002A	NO-Str-08	8	10	0	0	10	0	0	10	N/A	5	2.5	58.5	15
163C5 A001	NO-Str-13	5	7.5	10	0	5	10	0	10	N/A	0	10	57.5	16
114C2 A034	NO-Str-04	7	10	0	0	10	0	0	10	N/A	5	2.5	56.5	17
171A2 H001	NO-Str-17	7	10	10	0	0	5	2.5	10	N/A	0	2.5	56.5	17
163A1 A008B	NO-Str-10	5	10	0	0	10	0	0	10	N/A	0	10	55	19
163A3 A002	NO-Str-11	5	10	0	0	10	0	0	10	N/A	0	10	55	19
163D3 B025, D001	NO-Str-14	5	10	0	0	5	5	0	10	N/A	0	10	55	19
163D3 O001	NO-Str-16	5	10	0	0	5	0	0	10	N/A	0	10	52.5	22
114D3 G008	NO-Str-07	5	10	0	0	5	0	0	10	N/A	0	7.5	50	23
163D3 O001	NO-Str-15	5	10	0	0	0	5	0	10	N/A	0	7.5	50	23

3.4 Recommended Management Measures

Stormwater control, restoration, and programmatic management measures have been selected for ACC to serve as the basis for this WMP, which is tailored to the county's watershed goals and objectives. The selection of site-specific opportunities was based on a comprehensive prioritization using remote spatial data, on-site review of opportunities and constraints, and modeling.

3.4.1 Stormwater Control and Restoration Management Recommendations

Stormwater control and restoration BMPs can be very effective at improving watershed health by reducing storm flows and harmful pollutants in stormwater runoff, or they can address a particular watershed concern. This WMP prioritized project opportunities that target multiple objectives in the North Oconee River watershed. Recommended projects are listed in Table 3-9. Concept plan sheets for these projects are provided in appendix I and planning level cost estimates are provided in appendix J.

Table 3-9. Recommended Stormwater Control and Restoration Measures

BMP ID	Project Description
NO-Res-05	**North Oconee River Park Buffer Enhancement and Bank Stabilization** This project involves the stabilization of banks on the North Oconee River where they are eroding from saturated ground near stormwater outfalls through the creation of a vegetated buffer between outfalls and the river to dissipate energy and to promote the evapotranspiration of runoff. Concentrated storm flows from outfalls in the park are currently causing bank erosion. Benefits include nutrient uptake, sediment removal, beautification, and improved stream function.
NO-Res-04	**North Oconee River Park Stream Restoration** This project involves repairing two stream channels that flow through the park into the North Oconee River. This project proposes creating a stable grade to address active mass wasting and headcutting, and reconnecting the streams to the floodplain. The design will include channel stabilization around stormwater outfalls and adding a vegetated buffer along the restored stream channels. Benefits include nutrient uptake, reduction in sediment transport, and improved stream function.
NO-Str-12	**CHaRM Facility Detention** This project involves construction of a wet detention pond in the southern corner of the parcel to treat stormwater runoff from the parcel and surrounding areas. Other options for this parcel including lining the existing pipe or re-routing the existing pipe through a new pipe along College Ave. The stormwater pipes that serve mostly residential areas around the facility currently meet at the southern border of the property and route stormwater north through one large pipe. This parcel is part of the Greenway Network Plan. Benefits of the wet detention pond include peak flow attenuation, nutrient uptake, sediment removal, and beautification.
NO-Str-19	**UGA River Road Mixed Use Detention Pond** This project involves the construction of a multi-purpose wet detention pond at River Road to address erosional concerns on site and to alleviate high stormflows downstream. Active erosion and two headcuts are contributing large sediment loads to the stream. This project could be considered for a portion of the large drainage area represented by UGA, and also incorporate walkable park features. Benefits include reduction of peak flows, nutrient uptake, sediment removal, beautification, and improved stream function.

BMP ID	Project Description
NO-Str-02	**Fleet Management Detention** This project involves the construction of a small dry detention pond to treat stormwater runoff from the Fleet Management Building and surrounding paved and gravel parking lots. Runoff from the paved parking lot is currently being routed through storm drains and stormwater pipes to an intermittent stream than runs through several industrial properties. Benefits include peak flow attenuation and reduced sediment transport.
NO-Str-03	**Fleet Management Treatment Train** Construction of a stormwater runoff treatment train consisting of a pretreatment bioretention cell that overflows into a detention basin on the north side of the Fleet Management Building. The combination of these two BMP practices is a cost effective strategy to achieve the benefits of each, including peak flow attenuation, nutrient removal, reduction of sediment loads, and beautification.
NO-Str-06	**Leisure Services Treatment Train** This project involves the design and construction of a stormwater runoff treatment train consisting of a pretreatment bioretention cell(s) that overflows into a detention basin in the northwest corner of the Pound Street Complex parcel. The combination of these two BMP practices is a cost effective strategy to solve the current ponding issues and gain the benefits of each, including peak flow attenuation, nutrient uptake, sediment removal, and beautification.
NO-Str-09	**Public Utilities Lot Detention** This project involves the construction of a dry detention pond to treat stormwater runoff from the property. Stormwater treatment for this entirely impervious parcel does not exist. Benefits include peak flow attenuation and sediment removal.
NO-Res-02	**Buffer Restoration on ACC Dirt Lot** This project involves relocating stored equipment and materials and installing vegetation to restore the riparian buffer and reduce erosion and sediment transport from site. This parcel is part of the Greenway Network Plans and there is interest in acquiring the parcel to the north to create a corridor and path on both parcels. Benefits include sediment removal, beautification, and improved stream function.
NO-Str-05	**Leisure Services Detention**This project involves the construction of a dry detention pond in the northwest corner of the parcel to treat stormwater runoff from the western half of the Pound Street Complex. A linear stormwater retention practice currently treats the eastern half of the Complex. Runoff from this area is currently being routed through storm drains and stormwater pipes to an unknown location. Benefits include peak flow attenuation and a reduction in sediment transport.
NO-Res-01	**Chase Street to Barber Street Stream Restoration** This project involves restoring a stream reach between Barber Street and Chase Street using natural channel design. Existing channel banks and surrounding riparian buffer lack sufficient vegetation for stream stability. Benefits include nutrient uptake, sediment removal, beautification, and improved stream function. In addition, channel improvements would enhance in stream and riparian habitat.
NO-Res-03	**Boulevard Woods Park Outfall Repair** This project involves reconstruction of the stormwater outfall and creation of a vegetated channel for an intermittent stream that flows east through the forested parcel. The current outfall configuration is creating an erosional ditch through a parcel that currently provides small walking trails. Benefits include reduced sediment transport, beautification, and improved stream function.
NO-Str-01	**Fleet Management Bioretention** This project involves the construction of a bioretention cell to treat stormwater runoff from the Fleet Management Building and surrounding paved and gravel parking lots. Runoff from the paved parking lot is currently being routed through storm drains and drainage piping to an intermittent stream than runs through several industrial properties. Benefits include nutrient uptake, reduction of sediment transport, and beautification.

BMP ID	Project Description
NO-Str-18	**Broad Street Picnic Area Bioretention** This project involves the construction of a bioretention feature to treat stormwater runoff from the road and adjacent parcels to the West. Runoff currently flows over the grassed and sparsely vegetated area before flowing down a steep embankment into the North Oconee River. Benefits include nutrient uptake, sediment removal, and beautification.
NO-Str-08	**Public Utilities Lot Bioretention** This project involves the construction of bioretention cell(s) to treat stormwater runoff from the property. Stormwater treatment for this entirely impervious parcel does not exist. Benefits include nutrient uptake, sediment removal, and beautification.
NO-Str-13	**Housing Authority – College Avenue Infiltration Trench** This project involves the construction of a sand infiltration trench to treat runoff from the parking lot. There is currently no stormwater treatment for this parcel. Adding infiltration measures would provide nutrient uptake and sediment removal benefits.
NO-Str-04	**Leisure Services Bioretention** This project involves the construction of a large bioretention cell in the northwest corner of the parcel or a series of bioretention cells on the western perimeter of the property to treat stormwater runoff from the western half of the Pound Street Complex. A linear stormwater retention practice currently treats the eastern half of the Complex. The western half is currently being routed through storm drains and stormwater pipes to an unknown location. Benefits include nutrient uptake, sediment removal, and beautification.
NO-Str-14	**Lay Park Bioswale** This project involves retrofitting of the existing swale adjacent to a paved lot to the north of the main building through the implementation of bioswale features. The current configuration appears to detain stormwater from the immediate area before being routed to a drainage system. Bioswale features provide enhanced treatment over traditional grass swales by improving infiltration through engineered media and improving water quality through plants. Benefits include nutrient uptake and beautification.
NO-Str-17	**Downtown Athens Parking System on Strong Street Porous Pavement** This project involves replacing the parking space areas with porous pavement, and regrading travel lanes to drain towards the porous pavement. The parking lot currently does not have stormwater treatment and is elevated above the streets to the east and south. Benefits include nutrient uptake.
NO-Str-10	**Water Meter Building Cistern**This project involves retrofitting the Water Meter Building with a cistern to collect stormwater runoff from the roof. There is currently no stormwater treatment for the building. Benefits of a cistern include peak flow attenuation.
NO-Str-11	**Sewerline Construction and Repair Building Cistern** This project involves retrofitting the building using a cistern to collect stormwater runoff from the roof. There is currently no stormwater treatment for the structure. A cistern would provide peak flow attenuation benefits.
NO-Str-16	**Fire Station #1 Cistern** This project involves retrofitting the building's current downspouts to drain into a stormwater harvesting system, such as cisterns. The current downspouts empty onto grass or are piped underground. Benefits include peak flow attenuation.
NO-Str-07	**ACC Government Building Parking Lot** This project involves the construction of a bioretention cell to treat stormwater runoff from the parking lot. Conventional storm drains and stormwater pipes currently serve to route runoff off the property. Reconfiguring the current piping system to route flow into the bioretention cell(s) would provide nutrient uptake, sediment removal, and beautification benefits.

BMP ID	Project Description
NO-Str-15	**Fire Station #1 Rain Gardens** This project involves retrofitting the building's current downspouts to drain into small rain gardens. The current downspouts empty onto grass or are piped underground. Benefits include nutrient uptake, sediment removal, and beautification.

The design of structural BMPs should follow guidelines set forth in the *2016 Georgia Stormwater Management Manual* (ARC 2016). This manual provides estimated pollutant load reductions for various BMPs. Pollutant removal estimates for applicable measures are shown in Table 3-10.

Table 3-10. BMP Pollutant Removal Estimates

BMP Type	TSS	Total Phosphorus	Total Nitrogen	Metals	Fecal Coliform
Stormwater Ponds	80%	50%	30%	50%	70%
Dry Detention Basins	60%	10%	30%	50%	NA*
Infiltration Trench	100%	100%	100%	100%	100%
Rainwater Harvesting	Varies	Varies	Varies	Varies	Varies
Enhanced Dry Swale	80%	50%	50%	40%	x
Bioretention Basins	85%	80%	60%	95%	90%
Permeable Paver Systems	80%	50%	50%	60%	NA*

Notes:

* - Helps restore pre-development hydrology, which implicitly reduces post-construction stormwater runoff rates, volumes, and pollutant loads.

X - BMP may contribute, but is not likely to fully meet the stormwater management or treatment requirement.

3.4.1 Programmatic Management Recommendations

General programmatic recommendations for watershed improvement are listed in Table 3-5. In addition, site-specific programmatic management measures were identified through observations made during the on-site field assessments of potential BMP opportunities. Concept plan sheets for three of the general programmatic measures (mowing maintenance practices, bank stabilization, and green infrastructure) and the recommended site-specific programmatic measures are provided in appendix I. Site-specific programmatic measures are listed in Table 3-11. Pollutant load reductions are expected from the recommended programmatic measures, but cannot be accurately quantified.

Table 3-11. Recommended Site-Specific Programmatic Measures

BMP ID	Project Description
NO-Prog-01	**Holland Youth Sports Complex Swale Maintenance.** Manage functionality of swales through proper maintenance/inspection. The ditches are currently filling in with sedment.
NO-Prog-02	**ACC Gravel Lot Rehabilitation** This project involves the reconstruction of the trash container enclosure currently serving an apartment complex in addition to regrading/regraveling the parking lot to better direct stormwater flows. Runoff currently washes out gravel and transports trash to a vegetated swale adjacent to train tracks during high flows. Promoting better waste management and defining flowpaths throughout the parking lot will reduce gravel washouts and the introduction of trash to streams. Benefits include sediment removal and beautification.

BMP ID	Project Description
NO-Prog-03	**ACC Government Building Smart Site Design** Should building be repurposed or redeveloped, Tetra Tech recommends considering the implementation of green infrastructure / low impact development techniques in a "smart" site design. There is currently no stormwater management. Potential benefits include peak flow attenuation, nutrient uptake, sediment removal, and beautification.
NO-Prog-04	**Downtown Athens Parking System on N. Jackson Street Drainage** This project involves improving maintenance activities for the stormwater drains that serve this parking lot and the vegetated medians. Clogging of the drains has seriously impaired the functionality of the stormwater drainage system; the adjacent parcel sits below the parking lot, and patrons of the building have resorted to placing sand bags around the building so the basement does not flood from stormwater coming from the parking lot.
NO-Prog-05	**Athens Welcome Center Vegetation Maintenance** This project involves providing better vegetative maintenance for the area surrounding the main building, including less frequent mowing. Stormwater runoff from the parking lot and areas to the south seem to be causing erosion that is potentially elevating the pollutant load in watershed. Consider installing shade tolerant vegetation in areas with limited sunlight. Benefits include sediment removal and beautification.
NO-Prog-06	**Multimodal Transportation Center Waste Stations** This project proposes adding waste collection containers to the grassed open area south of the detention basin to reduce the amount of trash and contaminants in stormwater runoff. Trash and pet waste were observed during a site visit and may be contributing to pollutant loads in the watershed. Benefits include nutrient uptake and beautification.
NO-Prog-07	**UGA Golf Course – Green Golf Course Management** This project involves re-meandering channelized streams and providing vegetated stream buffers with low-growing grasses and rushes compatible with current use of the golf fairway and ponds throughout the entire golf course. Benefits include sediment removal, beautification, and improved stream function.
NO-Prog-08	**Cedar Creek Water Reclamation Facility/Oconee River Buffer Preservation** This project involves preserving the large forested parcel associated with the Cedar Creek Water Reclamation Facility to maintain the vegetative protection it provides the Oconee River. Increasing amounts of runoff from developments may destabilize natural waterways and contribute higher sediment and pollutant loads. Benefits of buffer preservation include peak flow attenuation, 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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