



Athens-Clarke County, Georgia

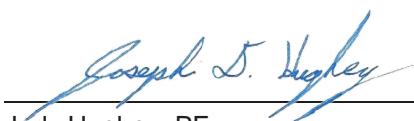
## 2018 ANNUAL REPORT

Impaired Waters Monitoring and  
Implementation Plan

January 31, 2019

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### Impaired Waters Monitoring and Implementation Plan



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## EXECUTIVE SUMMARY

Athens-Clarke County, Georgia developed and implemented an Impaired Waters Monitoring and Implementation Plan and Sampling Quality Assurance Plan (the Plan) in October 2015 as part of its Municipal Separate Storm Sewer System National Pollutant Discharge Elimination System permit requirements. As part of the Plan, fecal coliform bacteria, total suspended solids, and pH are regularly measured at sampling stations representative of impaired reaches within the permit area.

Data collected from initiation of monitoring efforts in October 2015 through fourth quarter 2016 were presented in the 2016 Annual Report. Data collected in 2017 were presented in the 2017 Annual Report. This annual report includes sampling results from all four quarters of 2018: two from November to April, and two from May to October. This report also includes analysis of pollutant of concern (POC) trends since initiation of monitoring.

Results collected from January 2018 through October 2018 indicated that 10 of the 16 pH levels measured for Kingswood Branch sampling stations attained state water quality standards. Results for total suspended solids measured at sampling stations on Carr Creek were consistently low, while results for Noketchee Creek were very high during January and April but decreased as the year progressed. Fecal coliform results were consistently low in January and April compared with the state standard. Almost all fecal coliform results exceeded the state standard in August (except for station ETR-1) and in October (except for ETR-1 and NO-3). It is unclear why there were so many exceedances in the August and October results. Rainfall does not appear to have been a factor in the high fecal coliform results.

Athens-Clarke County Government (ACCGOV) has implemented best management practices, including initiatives in pet waste management, sewer evaluations, septic system management, and bacteria source tracking, to help reduce fecal coliform and sediment loads to receiving waters, as well as to maintain acceptable levels of pH. Best management practices are considered effective given that substantial progress has been made by ACCGOV over the reporting period. Examples of this progress include: millions of feet of sewer lines have been cleaned, sewer inflow and infiltration studies have been completed to detect areas of potential leaks, approximately 735 miles of roadways were swept as part of street sweeping programs (resulting in removal of 8,900 cubic feet of debris), construction sites were inspected for proper erosion and sediment controls, pet waste education materials were distributed, and septic system education and outreach programs continued to gain momentum. A bacterial source tracking study was also conducted from 2015 through 2017, and results are being used to target appropriate fecal coliform reduction strategies. Results from this study suggest that human sources of fecal coliform are a consistent contributor in Tanyard Creek, Brooklyn Creek, and Trail Creek, and are either not a contributor or are a negligible contributor of fecal coliform in Carr Creek, Cedar Creek, Hunnicut Creek, Kingswood Branch, and unnamed tributary to Middle Oconee River. In 2018, nine Watershed Management Plans (WMPs) were completed for Bear Creek, East Fork Trail Creek, Malcolm Branch, Middle Oconee River, North Oconee River, Sandy Creek, Sulphur Spring Branch, Turkey Creek, and Walton Creek.

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## APPENDICES

Appendix A Water Quality Sample Results (January 2018 – October 2018)

Appendix B Water Quality Trends (October 2015 – October 2018)

## ACRONYMS AND ABBREVIATIONS

ACC	Athens-Clarke County, Georgia
ACCGOV	Athens-Clarke County Government
BioF	biota - fish communities
BioM	biota - macroinvertebrates
BMP	best management practice
BST	bacteria source tracking
CFU	colony forming units
EPA	U.S. Environmental Protection Agency
EPD	Georgia Environmental Protection Division
FC	fecal coliform bacteria
GIS	geographic information system
IWMIP	Impaired Waters Monitoring and Implementation Plan
mg	milligrams
mL	milliliter
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
POC	pollutant of concern
PUD	Public Utilities Department
QA/QC	quality assurance/quality control
RDII	rainfall-dependent inflow and infiltration
SQAP	Sampling Quality Assurance Plan
SSES	sanitary sewer field evaluations and survey
TSS	total suspended solids
WMP	Watershed Management Plan

## 1 INTRODUCTION

Athens-Clarke County (ACC) is classified as a small Municipal Separate Storm Sewer System (MS4) community with a population greater than 10,000 and is permitted under the General National Pollutant Discharge Elimination System (NPDES) Stormwater Permit No. GAG610000 (Georgia Department of Natural Resources 2017). The General NPDES Stormwater Permit for small MS4s (Permit) requires MS4 communities such as ACC to develop and implement an Impaired Waters Monitoring and Implementation Plan (IWMIP) for impaired waters within the permitted area. Permittees must identify impaired waters located within its permitted area using the latest approved 305(b)/303(d) List of Waters, which contains MS4 outfalls or waters within 1 linear mile downstream of MS4 outfalls. Permittees are also required to identify POCs, which are the water quality parameter(s) for which the identified impaired waters are listed as not meeting its designated uses, such as fishing or drinking water.

Athens-Clarke County Government (ACCGOV) identified a total of 18 impaired reaches in the ACC Permit area (i.e., ACC jurisdictional area). Seventeen of the 18 reaches are listed as impaired for fecal coliform bacteria (FC), two reaches are listed as impaired for sediment impacts to fish biota (BioF), one reach is listed and impaired for sediment impacts to macroinvertebrate biota, and two reaches are listed as impaired for pH (Table 1; Georgia Department of Natural Resources 2016). Thus, the POCs identified for the ACC MS4 Permit area are FC, pH, and sediment. The reach names, locations, designated uses, impairment parameters (or POCs), extent (length of impaired reach), and potential causes are listed in Table 1.

Table 1. Impaired Stream Reaches with MS4 Outfalls within 1 Linear Mile in Athens-Clarke County, Georgia

Reach Name	Location	Designated Use	Impairment Parameter(s)	Extent (miles)	Potential Causes
Brooklyn Creek	Headwaters to Middle Oconee River, Athens	Fishing	FC	2	Urban runoff
Carr Creek	Headwaters to North Oconee River, Athens	Fishing	BioF, Bio M*, FC, pH*	2	Industrial facility, urban runoff
Cedar Creek	Headwaters to Oconee River, Athens	Fishing	FC	4	Urban runoff
Cloverhurst Branch	Headwaters to Tanyard Branch (Athens)	Fishing	FC	2	Urban runoff
East Fork Trail Creek	Headwaters to West Fork Trail Creek, Athens	Fishing	FC	3	Urban runoff
Hunnicutt Creek	Headwaters to Middle Oconee River, Athens	Fishing	FC	1	Urban runoff
Kingswood Branch	Tributary to McNutt Creek, Athens	Fishing	FC, pH	1	Urban runoff
McNutt Creek	Headwaters at GA 316 and Dials Mill Road to Middle Oconee River	Fishing	FC	12	Non-point sources, urban runoff

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Reach Name	Location	Designated Use	Impairment Parameter(s)	Extent (miles)	Potential Causes
Middle Oconee River	Big Bear Creek to McNutt Creek	Fishing	FC	12	Non-point sources
Middle Oconee River	McNutt Creek to North Oconee River	Fishing	FC	4	Urban runoff
Noketchee Creek	Headwaters to Sandy Creek	Fishing	BioF	5	Non-point sources, urban runoff
North Oconee River	Sandy Creek to Trail Creek	Drinking Water	FC	2	Non-point sources
North Oconee River	Trail Creek to Oconee River	Fishing	FC	8	Municipal facility, urban runoff
Oconee River	Confluence of North and Middle Oconee Rivers, Athens to Barnett Shoals Dam	Fishing	FC	4	Urban runoff
Tanyard Creek	Upstream North Oconee River, Athens	Fishing	FC	1	Urban runoff
Trail Creek	East Fork Trail Creek to North Oconee River, Athens	Fishing	FC	2	Urban runoff
Tributary to Middle Oconee River	Downstream closed UGA Botanical Gardens Landfill (Milledgeville Ave. Site), Athens	Fishing	FC	1	Non-point sources, urban runoff
West Fork Trail Creek	Athens	Fishing	FC	3	Urban runoff

\*A BioM and pH impairment for Carr Creek were added to the approved 2016 305(b)/303(d) List of Impaired Waters; however, the list was not approved in time for a pH sample to be added for CA-1.

Source: Georgia Department of Natural Resources 2016

In 2015, ACCGOV developed and implemented an IWMIP and Sampling and Quality Assurance Plan (SQAP), referred to collectively as the Plan, to monitor and track POCs and to select initial best management practices (BMPs) to help reduce concentrations of the identified POCs. The Georgia Environmental Protection Division (EPD) approved the final IWMIP and SQAP in January 2016. ACCGOV began implementation of the Plan in October 2015, and implementation is ongoing. Combined with ACCGOV's ongoing Watershed Improvement Program, the Plan ultimately helps improve water quality and monitors progress toward removing the impaired waters from the 303(d) List.

In addition to satisfying MS4 Permit requirements, impaired water monitoring data are being collected in accordance with the SQAP component of the Plan (January 2016) to be submitted to EPD for consideration in 305(b)/303(d) listing decisions. Impaired waters monitoring data will be evaluated annually to help identify potential concentration trends and sources of POCs. Furthermore, the monitoring data are being used to help assess current watershed conditions and develop Watershed Management Plans (WMPs), as well as to help guide appropriate stormwater public education and outreach efforts. Results will be evaluated regularly to monitor progress toward delisting the streams from the Georgia 303(d) list.

## 2 METHODS

Impaired waters were sampled and tested for identified POCs according to the detailed methods described in the ACC IWMIP and SQAP (Arcadis-Tetra Tech January 2016). Data collection began in October 2015 and is ongoing. As mentioned in the Executive Summary, the 2018 Annual Report only includes detailed results from all four quarters of 2018 but also includes an analysis of POC trends since initiation of data collection.

The data collected and evaluated as part of this annual report extends from January 2018 to October 2018. Sampling results were compared to applicable Georgia numeric criteria to determine compliance with water quality standards. In addition to sampling data collection and evaluation, ACCGOV implemented BMPs designed to improve water quality for the identified POCs and impaired reaches.

### 2.1 Impaired Waters Sampling

#### 2.1.1 Study Area

The study area includes the following 18 impaired reaches within the ACC permitted area (Figure 1):

1. Brooklyn Creek
2. Carr Creek
3. Cedar Creek
4. East Fork Trail Creek
5. Hunnicutt Creek
6. Kingswood Branch
7. McNutt Creek
8. Middle Oconee River (section one)
9. Middle Oconee River (section two)
10. Noketchee Creek
11. North Oconee River (section one)
12. North Oconee River (section two)
13. Oconee River
14. Tanyard Creek
15. Cloverhurst Branch
16. Trail Creek
17. West Fork Trail Creek
18. Unnamed tributary to Middle Oconee River.

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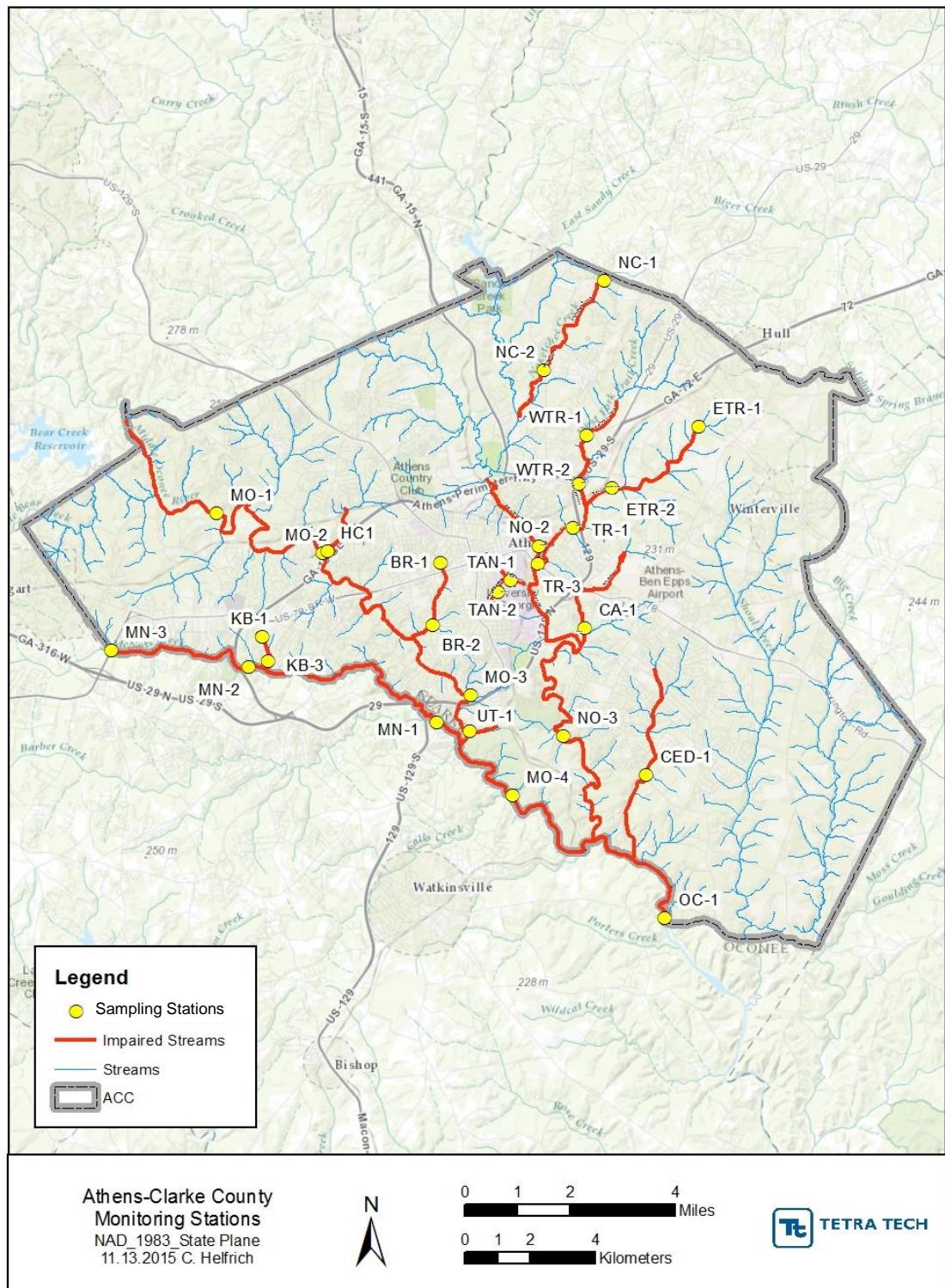


Figure 1. Impaired Stream Reaches within 1 Linear Mile of MS4 Outfalls and Sampling Stations in Athens-Clarke County, Georgia

## 2.1.2 Sampling Stations

The sampling station locations were selected to represent the 18 impaired reaches within 1 linear mile of MS4 outfalls and where water quality data were collected historically. Impaired streams are sampled at 28 stations in total. The 28 stations include 19 where water quality data have been collected in the past and nine new sampling stations installed since October 2015. Continued sampling at previous sampling stations will allow ACCGOV to analyze POC concentration trends over time as part of a long-term monitoring effort. The sampling stations, along with their geographic coordinates, are listed in Table 2.

Table 2. Sampling Stations in Impaired Stream Reaches in Athens-Clarke County, Georgia

Station ID	Impaired Reach	Criterion Exceeded	Latitude	Longitude
BR-1	Brooklyn Creek	FC	33.9547	-83.3993
BR-2	Brooklyn Creek	FC	33.9376	-83.4021
CA-1	Carr Creek	BioF, FC	33.9364	-83.3518
CED-1	Cedar Creek	FC	33.8958	-83.3321
ETR-1	East Fork Trail Creek	FC	33.9918	-83.3136
ETR-2	East Fork Trail Creek	FC	33.975	-83.3426
HC-1	Hunnicutt Creek	FC	33.9581	-83.4367
KB-1	Kingswood Branch	FC, pH	33.9347	-83.4584
KB-3	Kingswood Branch	FC, pH	33.9279	-83.4565
MN-1	McNutt Creek	FC	33.9107	-83.401
MN-2	McNutt Creek	FC	33.9263	-83.463
MN-3	McNutt Creek	FC	33.9314	-83.5098
MO-1	Middle Oconee	FC	33.969	-83.4733
MO-2	Middle Oconee	FC	33.9576	-83.4383
MO-3	Middle Oconee	FC	33.9183	-83.3898
MO-4	Middle Oconee	FC	33.8904	-83.3763
NC-1	Noketchee Creek	BioF	34.0322	-83.3444
NC-2	Noketchee Creek	BioF	34.0077	-83.3649
NO-2	North Oconee River	FC	33.959	-83.3669
NO-3	North Oconee River	FC	33.9068	-83.3593
OC-1	Oconee River	FC	33.8563	-83.3263
TAN-1	Tanyard Creek	FC	33.9497	-83.3761
TAN-2	Cloverhurst Branch	FC	33.9466	-83.3804
TR-1	Trail Creek	FC	33.9642	-83.3553
TR-3	Trail Creek	FC	33.9542	-83.3671
WTR-1	West Fork Trail Creek	FC	33.9896	-83.3509
WTR-2	West Fork Trail Creek	FC	33.9761	-83.3534

Station ID	Impaired Reach	Criterion Exceeded	Latitude	Longitude
UT-1	Unnamed tributary to Middle Oconee River	FC	33.908	-83.386

### 2.1.3 Sampling Parameters and Schedule

Sampling methods include in-situ pH measurements for stations KB-1 and KB-3; grab sampling for FC analytical testing at all stations except NC-1 and NC-2; and sampling for total suspended solids (TSS) at stations CA-1, NC-1, and NC-2. Sample parameters, sample types, sampling stations, total number of stations sampled, and sampling schedule are listed in Table 3.

Table 3. Sampling Parameters and Schedule

Parameter	Sample Type	Stations Sampled	Total Number of Stations Sampled	Sampling Schedule
FC	Grab	BR-1, BR-2, CA-1, CED-1, ETR-1, ETR-2, HC-1, KB-1, KB-3, MN-1, MN-2, MN-3, MO-1, MO-2, MO-3, MO-4, NO-2, NO-3, OC-1, TAN-1, TAN-2, TR-1, TR-3, WTR-1, WTR-2, UT-1	26	4 geometric means/year = 16 grab samples = (4 grab samples/1 geometric mean) x (4 samples/year)
pH	In-situ	KB-1, KB-3	2	20 samples per year
TSS	Grab	CA-1, NC-1, NC-2	3	4 samples per year (1 sample collected each calendar quarter)

Georgia water quality standards for the sampled parameters and impaired reaches designated uses are provided in Table 4. Sampling results are compared to the state standards to evaluate attainment of these criteria.

Table 4. Georgia Water Quality Standards for Sampled Parameters

Parameter	Standard	Source
Fecal Coliform Bacteria	May–Oct <200 colonies/100 mL as geometric mean and 4,000 colonies/100 mL as a single sample maximum Nov–Apr <1,000 colonies/100 mL and 4,000 as a single sample maximum	GA Water Quality Standards
pH	Between 6.0 and 8.5	GA Water Quality Standards
TSS	No quantitative standard in Georgia	NA

## **2.1.4 Sampling Methods**

Sampling methods included in-situ water quality measurements for pH and grab samples for laboratory analyses of FC and TSS. Sampling protocols are described in detail in Section 3.1, Sampling Methods, of the ACC Plan (Arcadis-Tetra Tech January 2016) and adhere to the requirements of the Water Protection Branch Quality Assurance Manual (Georgia Department of Natural Resources 1999) and Title 40 of the Code of Federal Regulations, Part 136. Sampling included quality assurance/quality control (QA/QC) procedures such as the collection of blank and duplicate samples and the completion of chain-of-custody forms for grab samples submitted to the laboratory for analysis. These QA/QC protocols are described in the SQAP (Section 3 of the Plan, January 2016).

Sampling personnel maintained field records during sampling events. Field records include completed field forms that provide information on sample location, date, time, weather conditions at the time of sampling, names of sampling personnel, observed field conditions, problems encountered, and any corrective actions taken as a result. Refer to Section 3.3.2, Field Records, of the Plan for additional details on the field records collected for each sampling event.

## **2.2 Best Management Practices**

BMPs have been implemented in ACC to control and reduce POC concentrations. ACCGOV has many ongoing programmatic BMPs in place to reduce FC levels and prevent other POCs from entering streams in ACC. These BMPs and associated efforts are documented in the Unified Government of Athens-Clarke County Watershed Protection Plan 2017-2018 Annual Report (Jacobs 2018), ACC's NPDES Phase II 2018 Annual Report, and in the ACC Plan. In addition to ongoing programmatic BMPs, ACCGOV has conducted bacteria source tracking (BST) to assist in identifying the primary sources of FC measured in streams. Results will be used to focus management efforts in a cost-effective manner. BST commenced in November 2015 and was completed in October 2017.

The summaries below describe BMP progress made by ACCGOV in 2018. Progress made before 2018 is described in the 2017 IWMIP Annual Report.

### **2.2.1 Pet Waste Management Initiatives**

This section discusses the activities ACC has undertaken to document, understand, and address pet waste management in ACC.

- During the reporting period, ACCGOV staff distributed brochures on pet waste/bag dispensers to promote public education on proper pet waste management. ACCGOV staff continues to actively monitor for pet waste “hot spots” in downtown Athens and beyond and will install additional pet waste stations or move current stations based on needs.
- The Stormwater Department passes out pet waste bag dispensers with bags for dog owners to clip to their leashes. They give these out at any tabling events they attend, and they supply animal shelters and hospitals with boxes of pet waste bags for dog adoption goody bags.
- The Leisure Services Department installs pet waste stations in public parks and at public trailheads. They maintain approximately 20 stations weekly.
- The ACC Stormwater Department is currently working with the ACC Solid Waste Department to find a pedestrian trash can design for downtown Athens that incorporates a pet waste bag dispenser. New cans will be installed in late 2019.

## 2.2.2 Sanitary Sewer Evaluation

Due to the high levels of FC in ACC, a key source control measure for 303(d)-listed streams identified in the ACCGOV Public Utilities' Department (PUD) Watershed Protection Plan was maintenance and evaluation of sanitary sewer lines. Consequently, the following activities were undertaken to maintain and evaluate sanitary sewer lines in ACC.

### 2.2.2.1 Sewer Maintenance

- In 2018, PUD used Rodder trucks to clean 1,157,565 feet of sewer line, flush/vacuum trucks to clean 1,602,659 feet of sewer line, and camera trucks to film 237,842 feet of sewer line. In addition, 346,600 feet of easements and right-of-way were cleared.
- ACC PUD plans to install approximately 7,700 linear feet of 8-, 12-, 18-, and 24-inch gravity sewer line and appurtenances within the Tanyard Creek watershed. Construction will occur in the right-of-way along Lumpkin, Baxter, Hull, and Newton Streets. Construction will be broken into four main segments of sanitary sewer, and work will be done during summer 2019. Both the condition and capacity of the sewer pipes necessitate these upgrades.
- ACC PUD is also finalizing construction plans for the Brooklyn Creek Interceptor Improvements. This project includes replacing the sewer interceptor from the trunk line at the Middle Oconee River up to Baxter Street, and increasing pipe size to provide greater capacity based on population projections for the future.

### 2.2.2.2 Sewer Evaluation Studies

- In 2015, PUD conducted a Flow Monitoring Study to identify rainfall-dependent inflow and infiltration (RDII) within the wastewater collection system.
- In 2015 and 2016, PUD performed detailed field as-built surveys of critical portions of the wastewater collection system. This information was used to update PUD's geographic information system (GIS) with accurate pipe locations, pipe materials, pipe diameters, and pipe slopes and depths.
- In 2015 and 2016, PUD updated and calibrated dynamic dry-weather and wet-weather models for most of the wastewater collection system. The entire wastewater collection system will be modeled in 2017. The results of the forecasting, flow monitoring, and modeling efforts have been used to identify both short- and long-term Service Delivery Plan Capital Improvement Projects to ensure that the wastewater collection system has adequate capacity.
- In 2016, PUD performed sanitary sewer field evaluations and surveys (SSESs) on that portion of the wastewater collection system that has the highest RDII for the purpose of identifying pipes that are in poor condition and need rehabilitation and/or replacement.
- In 2017, PUD continued to analyze results of SSES efforts to identify causes of inflow and infiltration and subsequent capital improvement projects to reduce inflow and infiltration. PUD continues to perform flow monitoring comparisons between pre-rehabilitation and post-construction activities to determine the effectiveness of the SSES program on the wastewater collection system.

### **2.2.3 Septic System Management**

Another key source control measure for FC identified in the Watershed Protection Plan was septic system management. The following activities were undertaken to support proper management of septic systems in ACC.

- The ACC Planning Department is currently responsible for maintaining the GIS septic system inventory. This inventory is updated regularly with newly built septic systems.
- ACCGOV uses the Manual for On-Site Sewage Management Systems (Department of Human Resources, Public Health, Chapter 290-5-26, 2016) to regulate sewer management systems and septic tanks. This includes minimum design and construction standards and minimum volume requirements.
- ACCGOV continues to enforce Sections 8-6-6 and 8-6-7 of the Protected Environmental Areas Ordinance, which prohibit septic tanks in floodplains and riparian zones, respectively.
- ACC maintained a Septic System Education Program, which includes a website (<http://www.accgov.com/5317/Septic-System-Education-Program>) and a phone number for questions. ACC continued targeted septic tank education efforts, including continued distribution of informational materials and an article in the September 2018 Stormwater Newsletter about the U.S. Environmental Protection Agency's (EPA's) Septic Smart Week.
- ACCGOV has adopted a General Sewer Use ordinance to regulate discharges to public sewers, septic tanks, and private wastewater systems. On October 5, 2018, ACC Mayor & Commission revised the Sewer Use Ordinance to include a recommendation from ACC PUD. Section 5-1-2 (b)(6) now reads “Athens-Clarke County recommends that septic tank disposal systems be inspected on intervals of not less than every five years, and maintenance performed as needed, at the owner's expense.”
- ACCGOV is considering a credit to the Stormwater Utility Fee for regular septic tank pumping. This consideration is part of a larger utility fee and credit review that started in late 2018 and will continue in 2019.

### **2.2.4 Street Sweeping**

ACCGOV conducted the following street sweeping activities in 2018.

- In 2018, approximately 735 miles of roadways were swept, resulting in removal of 8,900 cubic feet of debris from roadways. ACC contracts street sweeping services on major urban roadways (approximately 6.86 curb miles per month and 46.64 curb miles per quarter) and throughout the Central Business District (approximately 8.88 curb miles per week). Through this contract, approximately 730 miles of roadways are swept in ACC per year. In addition to the normal sweeping schedule, streets were swept following October political rallies in downtown Athens.
- In 2018, ACC Streets & Drainage crews inspected 5,690 catch basins/manholes and 18,021 feet of stormwater pipe. MS4 maintenance included cleaning 1,973 catch basins, repairing 91 catch basins, cleaning 10,997 feet of stormwater pipe, rehabilitating or replacing 982 feet of stormwater pipe, and cleaning 27.3 miles of shoulder/ditch. Another 420 cubic yards of waste was removed from the MS4 in addition to the debris removed from street sweeping.

## **2.2.5 Bacterial Source Tracking**

- ACCGOV implemented BST in 2015 to determine the primary source(s) of fecal bacteria in streams that are impaired due to FC. BST analysis is being undertaken as a phased approach. Phase two of the BST work was completed in October 2017.
- Results from this study suggest that human sources of FC are a consistent contributor of FC in Tanyard Creek, Brooklyn Creek, and Trail Creek, and are either not a contributor or are a negligible contributor of FC in Carr Creek, Cedar Creek, Hunnicutt Creek, Kingswood Branch, and an unnamed tributary to Middle Oconee River.
- Results from all FC samples collected from Tanyard Creek, Brooklyn Creek, and Trail Creek as a part of the BST study exceeded the May-October state standard of 200 colony forming units (CFU)/100 milliliters (mL) of drinking water supply and recreational designated uses with the highest reporting limit (16,000 most probable number [MPN]/100 mL) for all three stations from the wet weather samples. However, the wet weather samples detected the same human gene biomarker levels as the dry weather samples. These results suggest that species other than humans are also contributing to the FC levels in Tanyard Creek, Brooklyn Creek, and Trail Creek.
- Because samples from Carr Creek, Hunnicutt Creek, Kingswood Branch, and an unnamed tributary to Middle Oconee River did not detect the human gene biomarker, species other than humans are contributing to the FC levels in those Creeks.
- Potential animal sources of FC were noted during stream walks and upland evaluations conducted in 2016 and 2017 as part of the Watershed Management Planning efforts and include dog, goose, and deer throughout most parts of ACC, and livestock in rural/agricultural areas.
- Based on the results of this study, next steps for consideration include:
  - Use data and analysis from the 2016/2017 Watershed Management Planning efforts to identify the most likely species and locations contributing to FC pollution in the listed streams.
  - Conduct BST to identify non-human species contributing to FC pollution. These may include species such as dog, goose, deer, and others as needed.

## **2.2.6 TSS Reduction BMPs**

- Construction sites were inspected for watersheds with impairments for BioF to reduce sediment loads to receiving waters.
- During the reporting period, ACCGOV continued to increase the number of inspections in the Noketchee Creek and Carr Creek watersheds (which are listed as impaired for impacts to BioF) as well as the Middle Oconee watershed (which is listed as having impaired macroinvertebrate biota [BioM] above the confluence with Big Bear Creek). Street sweeping in watersheds with impairments for BioM are being evaluated by ACCGOV. ACCGOV's current street sweeping contract includes up to 35 additional miles of street sweeping to be used as necessary. ACCGOV continues to evaluate the allocation of these miles during fiscal year planning. A typical street sweeping program involves the deployment of street sweeper fleets on targeted routes based on schedules defined by desired load reduction goals and/or effectiveness. In ACC, the main objective is to target streets based on effectiveness.

## 2.2.7 Watershed Management Plans

Before 2018, the Arcadis, Tetra Tech, and ACC partnership completed watershed management documents for Brooklyn Creek, Hunnicutt Creek, Trail Creek, Tanyard Creek, Cedar Creek, Shoal Creek, Big Creek, Carr Creek, and McNutt Creek in accordance with the overarching goals of the Watershed Improvement Program. In 2018, the partnership completed WMPs for nine more watersheds, including Bear Creek, East Fork Trail Creek, Malcolm Branch, Middle Oconee River, North Oconee River, Sandy Creek, Sulphur Spring Branch, Turkey Creek, and Walton Creek. These recently completed plans will likely lead to additional initiatives to improve water quality.

The WMPs discuss the impaired water monitoring and results as they relate to characterizing the existing watershed and discussing water quality. Some of the watershed management needs and recommended management measures are tied to known impairments and/or the water quality data collected under the impaired waters monitoring program. For instance, the Middle Oconee is impaired for FC. Sampling as of the timeframe during which the WMP was being prepared (2017, finalized early 2018) confirmed issues with this. A recommended management measure identified in the WMP was MO-Res-01, also known as the Ben Burton Park Pet Waste and Managed Access Project. The project involves the augmentation of pet waste collection measures through the installation of pet waste stations and additional signage to reduce FC pollution in conjunction with construction of managed access points to the Middle Oconee River that include steps and a vegetated buffer to mitigate bank erosion. It would potentially deter park users from using unofficial access points through fencing and strategic vegetation. Benefits include nutrient uptake, runoff sediment reduction, and beautification.

## 3 RESULTS

Water quality monitoring data results collected during the study period are included in Appendix A.

### 3.1 Fecal Coliform

#### 3.1.1 All Data

During the January 2018 to October 2018 period of record, a total of 479 grab samples (including duplicates and blanks) were tested for FC. Individual grab sample results were compiled and used to calculate four geometric means for 26 stations following sampling protocols (Table 5, Figure 2). Each geometric mean was computed based on results from four grab samples collected within a 30-day period, with no one grab sample collected less than 24 hours from the time of the previously collected sample. Grab samples used to compute geometric means did not overlap between the months of April and May or October and November to ensure that the results could be compared to Georgia FC water quality standards, which are presented as geometric mean criteria (Table 4).

Geometric means calculated for each station were plotted by date (Figure 2). The 2018 data set does not support statistically sound trend analysis; however, analysis that incorporates all geomeans collected since 2015 will be discussed in Section 4.2.

In Table 5, the Exceedances of Standard column indicates whether a geometric mean exceeded the standard. Each tick mark corresponds to a geometric mean in chronological order from left to right. A red tick mark indicates an exceedance, and a green tick mark indicates no exceedance of the applicable standard. In Table 5, the red and green colors of the cells containing geometric mean results indicate

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whether sample results exceeded the water quality standard; red values indicate an exceedance, and green values indicate no exceedance.

Table 5. Fecal Coliform Bacteria Geometric Means (January 2018 - October 2018) and Comparison to State Standards

Date	Jan-18	Apr-18	Aug-18	Oct-18	Exceedences of Standard
Station	FC Geometric Mean (#10) cfu/100 mL (Nov-Apr)	FC Geometric Mean (#11) cfu/100 mL (Nov-Apr)	FC Geometric Mean (#12) cfu/100 mL (May-Oct)	FC Geometric Mean (#13) cfu/100 mL (May-Oct)	
BR-1	224.6	628.5	1470.8	892.2	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
BR-2	231.4	494.4	1215.7	628.5	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
CA-1	20.0	96.4	1517.6	329.5	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
CED-1	993.7	320.7	1261.8	984.2	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
ETR-1	147.2	225.9	132.0	149.0	<span style="color: green;">■■■■</span> <span style="color: red;">■■</span>
ETR-2	78.7	254.0	714.1	448.8	<span style="color: green;">■■</span> <span style="color: red;">■■■■</span>
HC-1	99.3	275.5	2420.4	588.1	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
KB-1	143.2	83.2	773.2	2252.4	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
KB-3	151.8	248.2	1677.6	1357.9	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
MN-1	327.3	176.0	702.2	335.7	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
MN-2	67.3	164.7	951.3	213.1	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
MN-3	96.9	341.2	442.3	447.2	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
MO-1	83.8	180.5	458.4	827.1	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
MO-2	65.1	113.3	371.6	486.3	<span style="color: green;">■■</span> <span style="color: red;">■■■■</span>
MO-3	77.1	203.5	545.0	349.2	<span style="color: green;">■■</span> <span style="color: red;">■■■■</span>
MO-4	88.9	277.6	407.6	610.8	<span style="color: green;">■■</span> <span style="color: red;">■■■■</span>
NO-2	245.3	240.9	851.7	545.3	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
NO-3	155.2	97.8	637.9	180.9	<span style="color: green;">■■■■</span> <span style="color: red;">■■</span>
OC-1	91.6	165.8	560.9	505.8	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
TAN-1	993.7	173.7	3178.0	1101.5	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
TAN-2	61.3	323.0	1201.0	588.1	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
TR-1	114.5	347.5	637.3	386.2	<span style="color: green;">■■</span> <span style="color: red;">■■■■</span>
TR-3	225.8	313.3	2783.2	3209.3	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
UT-1	83.5	16.8	716.2	962.4	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
WTR-1	122.7	279.1	762.4	377.2	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
WTR-2	52.1	59.9	446.1	354.9	<span style="color: green;">■■</span> <span style="color: red;">■■</span>
<b>State Standard</b>	<b>1,000</b>	<b>1,000</b>	<b>200</b>	<b>200</b>	

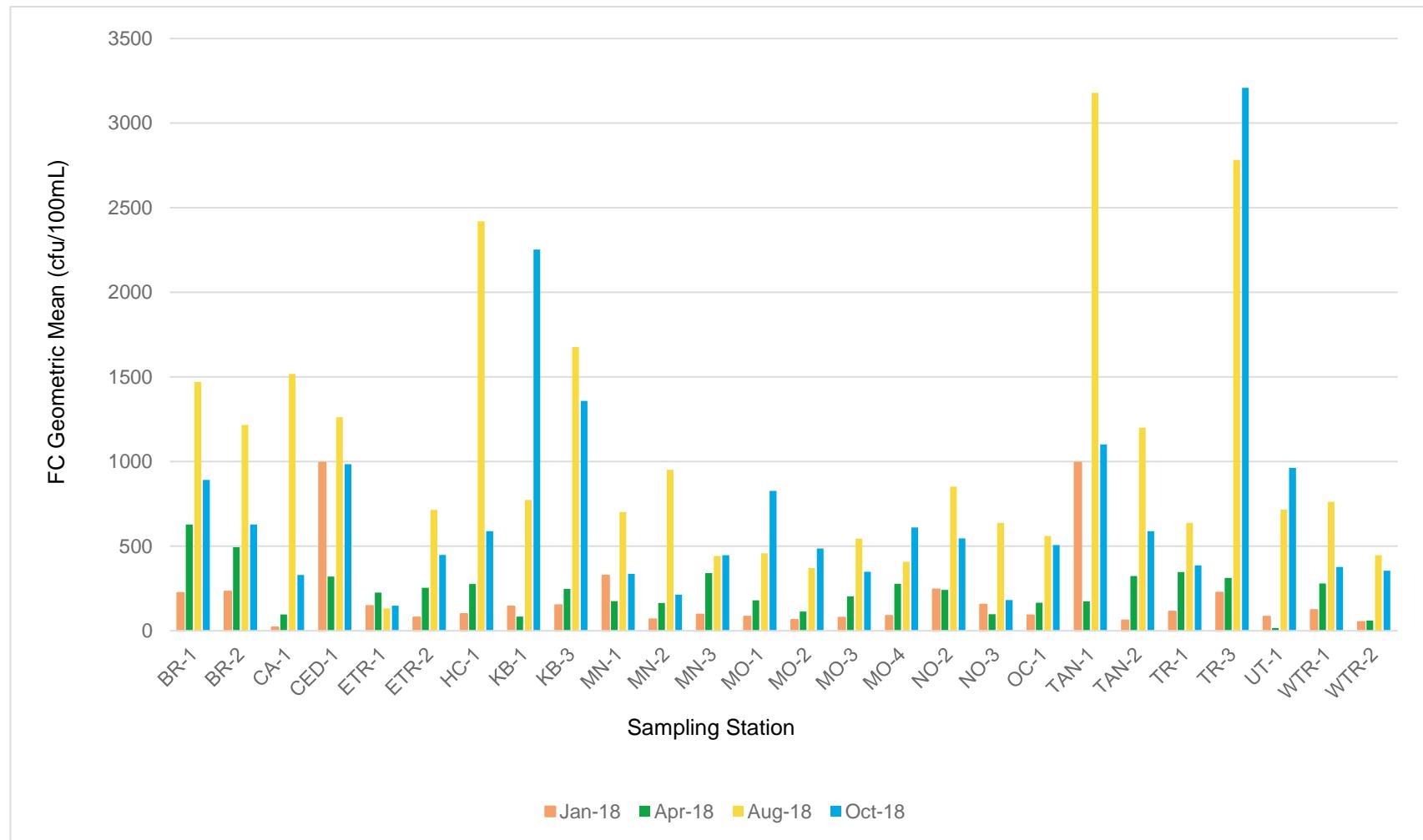


Figure 2. Fecal Coliform Geometric Means (January 2018 – October 2018)

During the January and April sampling events, results from all stations met the FC geometric mean standard of no greater than 1,000 CFU/100 mL. In August 2018, results from all stations except ETR-1 exceeded the FC geometric mean standard of no greater than 200 CFU/100 mL. Results from all but two stations exceeded the FC geometric mean standard of no greater than 200 CFU/100 mL during the October sampling event. Results from ETR-1 and NO-3 met the standard. ETR-1 was the only station where results met state standards during all sampling events.

FC results measured for individual grab samples were compared to the state water quality standard for FC single samples: <4,000 CFU/100 mL. The stations that exhibited exceedances, as well as the percentage of station samples that exceeded the standard, are listed below:

- 28% of samples for TAN-1 exceeded the standard.
- 19% of samples for station TR-3 exceeded the standard.
- <10% of samples for stations CED-1, HC-1, NO-3, WTR-1, ETR-2, WTR-2, NO-2, CA-1, KB-3, and BR-3 exceeded the standard.
- 0% of samples for all other stations exceeded the standard.

Individual grab sample FC data for the January 2018–October 2018 study period are provided in Appendix A. Results exceeding the standard are highlighted in red in the appendix.

### **3.1.2 November–April Data**

Geometric means computed for FC grab samples were differentiated by either November–April or May–October timeframes to evaluate POC trends in these seasons and to compare them to applicable Georgia water quality standards. Results for the November – April period, which include data collected in January 2018 and April 2018, are presented in Table 6 and on Figure 3. In Table 6, the red and green colors of the cells containing geometric mean results indicate whether a sample exceeded the water quality standard; green values indicate no exceedance. All of the geometric means were well below the state standard of 1,000 CFU/100 mL for data collected in November – April.

**Table 6. Fecal Coliform Bacteria Geometric Means (January 2018 and April 2018) and Exceedance of State Standards**

Date	Jan-18	Apr-18	Exceedences of Standard
Station	FC Geometric Mean (#10) cfu/100 mL (Nov-Apr)	FC Geometric Mean (#11) cfu/100 mL (Nov-Apr)	
BR-1	224.6	628.5	■■
BR-2	231.4	494.4	■■
CA-1	20.0	96.4	■■
CED-1	993.7	320.7	■■
ETR-1	147.2	225.8	■■
ETR-2	78.7	254.0	■■
HC-1	99.3	275.5	■■
KB-1	143.2	83.2	■■
KB-3	151.8	248.2	■■
MN-1	327.3	176.0	■■
MN-2	67.3	164.7	■■
MN-3	96.9	341.2	■■
MO-1	83.8	180.5	■■
MO-2	65.1	113.3	■■
MO-3	77.1	203.5	■■
MO-4	88.9	277.6	■■
NO-2	245.3	240.9	■■
NO-3	155.2	97.8	■■
OC-1	91.6	165.8	■■
TAN-1	993.7	173.7	■■
TAN-2	61.3	323.0	■■
TR-1	114.5	347.5	■■
TR-3	225.8	313.3	■■
UT-1	83.5	16.8	■■
WTR-1	122.7	279.1	■■
WTR-2	52.1	59.9	■■
<b>State Standard</b>	<b>1,000</b>	<b>1,000</b>	

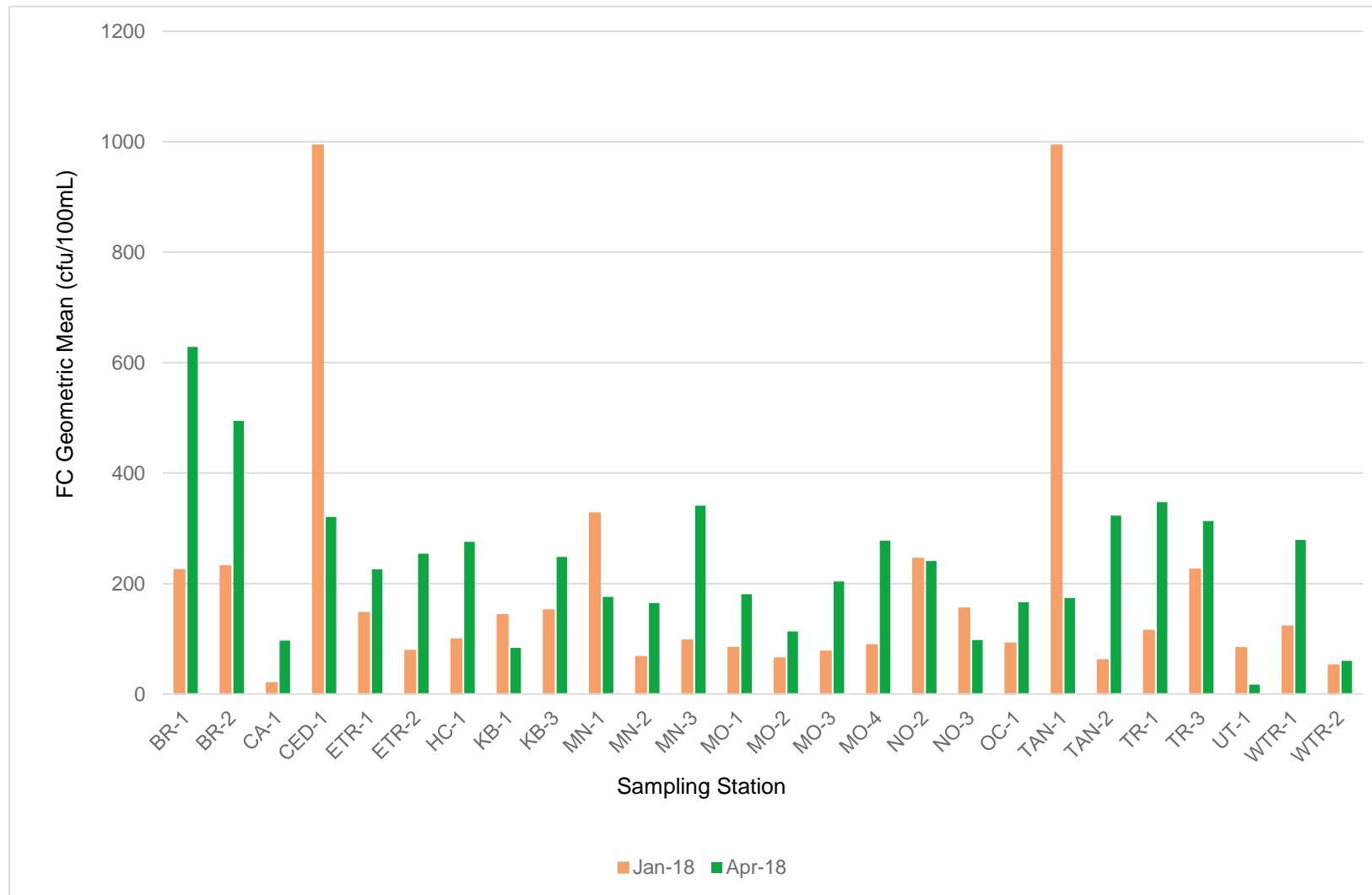


Figure 3. Fecal Coliform Geometric Means (January 2018 and April 2018)

### 3.1.3 May–October Data

Results for the May–October period, which include data collected in August 2018 and October 2018, are presented in Table 7 and on Figure 4. In Table 7, the red and green colors of the cells containing geometric mean results indicate whether results from a sample exceeded the water quality standard; red values indicate an exceedance, and green values indicate no exceedance. Two FC geometric means were computed during May–October for the 2018 study period. For the August sampling period, results from all stations exceeded the 200 CFU/100 mL state standard except ETR-1. For the October sampling period, results from all stations exceeded the standard except ETR-1 and NO-3.

**Table 7. Fecal Coliform Bacteria Geometric Means (August 2018 and October 2018) and Exceedance of State Standards**

Date	Aug-18	Oct-18	Exceedences of Standard
Station	FC Geometric Mean (#12) cfu/100 mL (May-Oct)	FC Geometric Mean (#13) cfu/100 mL (May-Oct)	
BR-1	1470.8	892.2	■■
BR-2	1215.7	628.5	■■
CA-1	1517.6	329.5	■■
CED-1	1261.8	984.2	■■
ETR-1	132.0	149.0	■■■■
ETR-2	714.1	448.8	■■
HC-1	2420.4	588.1	■■
KB-1	773.2	2252.4	■■
KB-3	1677.6	1357.9	■■
MN-1	702.2	335.7	■■
MN-2	951.3	213.1	■■
MN-3	442.3	447.2	■■
MO-1	458.4	827.1	■■
MO-2	371.6	486.3	■■
MO-3	545.0	349.2	■■
MO-4	407.6	610.8	■■
NO-2	851.7	545.3	■■
NO-3	637.9	180.9	■■■■
OC-1	560.9	505.8	■■■■
TAN-1	3178.0	1101.5	■■
TAN-2	1201.0	588.1	■■
TR-1	637.3	386.2	■■
TR-3	2783.2	3209.3	■■
UT-1	716.2	962.4	■■
WTR-1	762.4	377.2	■■
WTR-2	446.1	354.9	■■
<b>State Standard</b>	<b>200</b>	<b>200</b>	

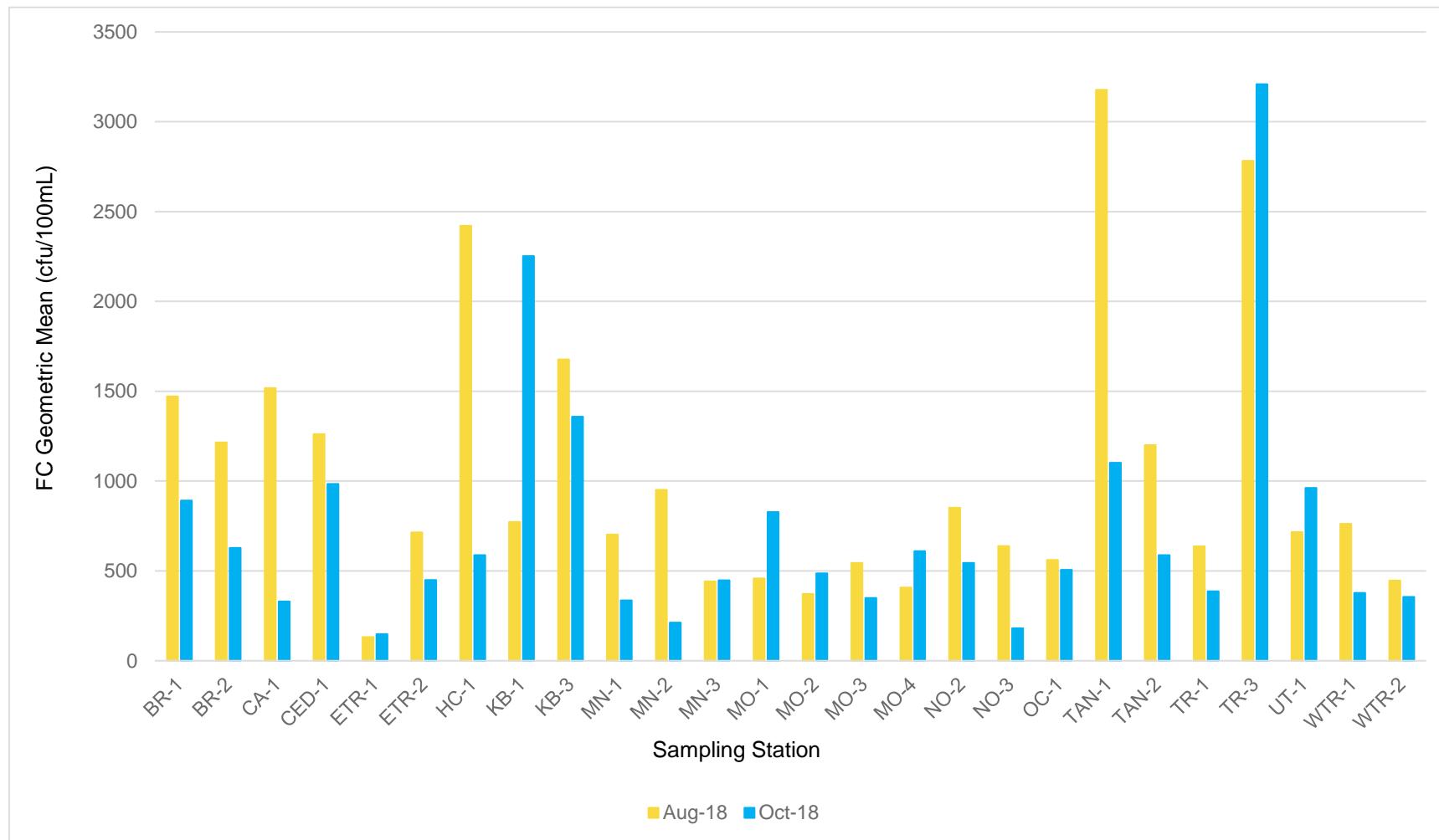


Figure 4. Fecal Coliform Geometric Means (August 2018 and October 2018)

### 3.2 pH

pH measurements collected for stations KB-1 and KB-3 during the study period are shown in Table 8 and on Figure 5. Results in green represent measurements within the standard limit, while results in red represent measurements outside of standard limits of 6 to 8.5. For KB-1, all measurements from August 7 and before were within the Georgia standard for pH. Measurements since August 14 were all below the standard range. For KB-3, all measurements were within the standard range. pH measured for KB-1 ranged from 5.60 to 7.69 and exhibited a median of 7.38. pH measured for KB-3 ranged from 6.09 to 8.27 and exhibited a median of 8.01. No consistent trends were observed for station KB-1 or KB-3. Results for KB-1 were slightly lower than those for KB-3 throughout the study period. The standard deviations computed for KB-1 samples and KB-3 samples were 0.89 and 0.85, respectively.

Table 8. pH measured at KB-1 and KB-3

Date	KB-1	KB-3
1/10/2018	7.48	8.05
1/16/2018	7.38	8.00
1/18/2018	7.46	8.26
1/22/2018	7.38	8.15
4/2/2018	7.69	8.14
4/4/2018	7.61	8.16
4/9/2018	7.72	8.01
4/11/2018	7.67	8.27
8/1/2018	7.59	8.18
8/7/2018	6.14	6.85
8/14/2018	5.86	6.63
8/21/2018	5.76	6.41
10/15/2018	5.60	6.09
10/18/2018	5.67	6.29
10/23/2018	5.95	6.61
10/29/2018	5.90	6.69
<b>Number of Samples</b>	16.00	16.00
<b>Min</b>	5.60	6.09
<b>Max</b>	7.69	8.27
<b>Median</b>	7.38	8.01
<b>Standard Deviation</b>	0.89	0.85

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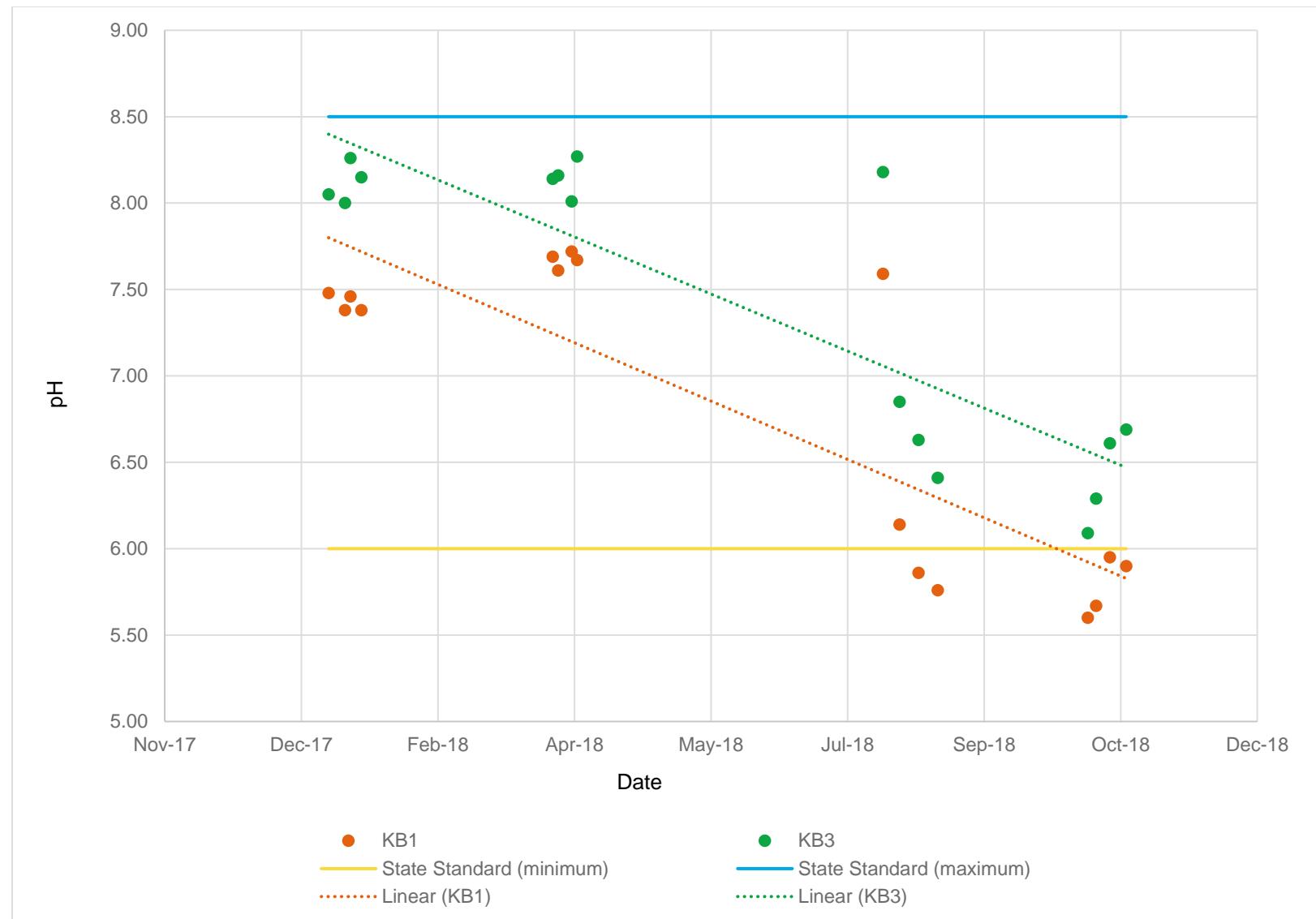


Figure 5. pH Measured at KB-1 and KB-3 Monitoring Stations

### 3.3 Total Suspended Solids

TSS concentrations (milligrams [mg]/L) measured for CA-1, NC-1, and NC-2 for the study period are presented in Table 9 and on Figure 6. Results for station CA-1 were consistent at about 3 mg/L. Results for NC-1 and NC-2 were inconsistent, with a maximum TSS value of 33 mg/L for station NC-2 in January 2018.

Table 9. Total Suspended Solids (mg/L) Measured at CA-1, NC-1, and NC-2

Date	CA-1	NC-1	NC-2
1/10/2018	3.10	9.70	33.00
4/12/2018	3.00	7.60	3.00
8/21/2018	3.00	3.00	3.00
10/22/2018	3.00	3.75	3.53

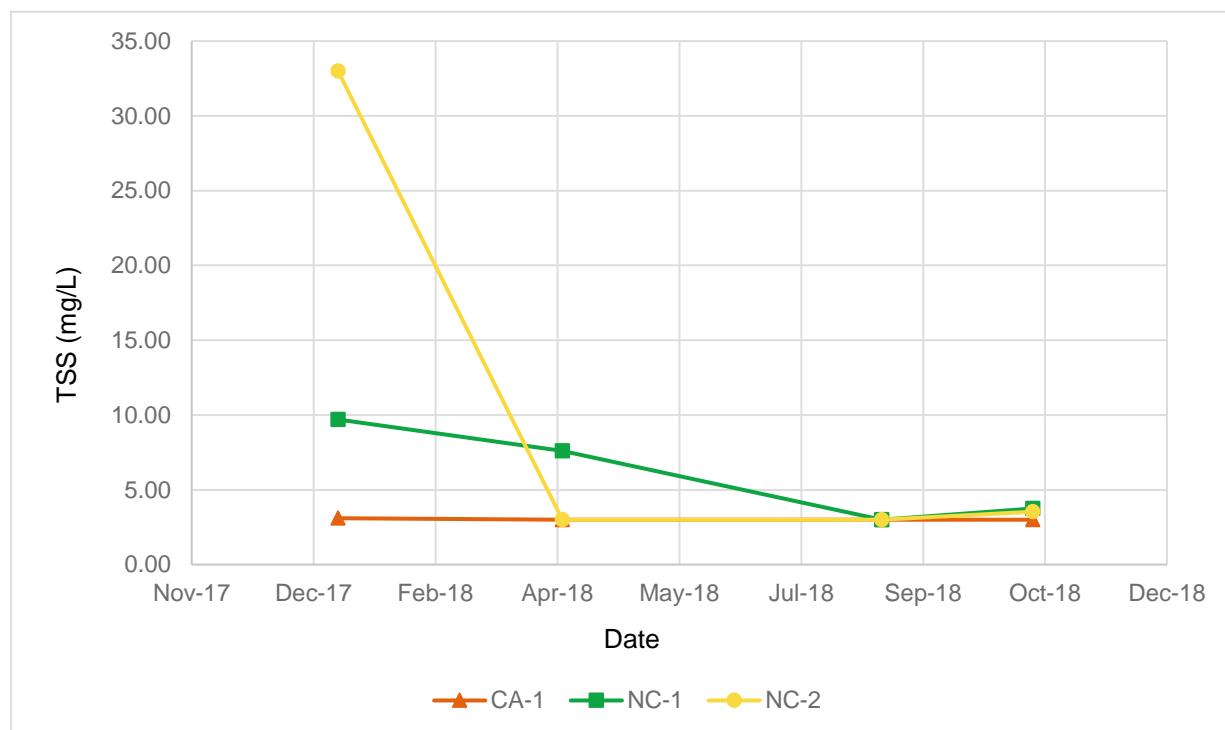


Figure 6. Total Suspended Solids Measured at CA-1, NC-1, and NC-2

### 3.4 Quality Assurance/Quality Control

QA/QC procedures were followed during the data collection, data entry, and data analysis components of the project according to the protocols described in the Plan (January 2016). The QA/QC procedures

included the collection of blank and duplicate samples throughout the data collection period, completion of chain-of-custody forms for grab samples delivered to the laboratory for analyses, calibration of the water quality meter used to measure pH in-situ before each pH sampling event, and data entry and data verification checks on the data entered into the master Excel spreadsheet. In total, eight blank samples and eight duplicate samples were collected and analyzed during the study period of record.

## 4 DISCUSSION

### 4.1 Sampling Results

The reason exceedances of state standards for FC were frequent for the May–October season compared to the November–April season is unclear. In some cases, it was due to the lower geometric mean criteria. During the May – October season, the state standard for geometric mean is 200 CFU/100 mL. During the November – April season, the state standard for geometric mean is 1,000 CFU/100 mL. None of the results from any stations exceeded this standard during the January and April sampling events. During the May–October season, FC geometric means were higher than the state standard at all sampling stations except ETR-1 during the August sampling event and at all stations except ETR-1 and NO-3 during the October sampling event.

The rainfall totals for all four months sampled are higher than the 30-year average. It does not appear that the rainfall contributed to high results, as rainfall amounts were actually greater in the months during which FC results were lower. Rainfall data in 2018 compared with the 30-year average are shown in Table 10.

Table 10. Monthly Rainfall Totals for Athens, Georgia (National Weather Service 2018)

	2018 Rainfall (in)	30-year Average (in)
January	4.63	4.05
April	5.49	3.15
August	4.36	3.53
October	4.26	3.55

Six pH measurements for station KB-1 were below the standard range. All other measurements for this station and all for station KB-3 attained state standards.

TSS levels were consistently low for station CA-1 (about 3 mg/L) and do not indicate high levels of sediment that could impact aquatic habitat. TSS levels for NC-1 and NC-2 were not as consistent, with a maximum measurement of 33 mg/L at station NC-2 in January. This measurement is potentially a mistake made by the laboratory that processed the data. According to the field observations from the day the sample was taken, the water was clear with a moderate flow. There was no indication that the TSS concentration would be higher, and there is no explanation for it. Therefore, this data point is considered an outlier, was not considered in this report's trend analysis or evaluation of BMP effectiveness, and will not be included in future trend analysis or evaluation of BMP effectiveness.

## 4.2 BMP Effectiveness Evaluation

The effectiveness of the BMPs described in Section 2.2 was evaluated in relation to water quality monitoring results collected since implementation of the Plan in October 2015. A summary of the effectiveness evaluations completed for each BMP is provided in Table 10. In general, BMPs are considered to be successful because of the implementation progress made by ACCGOV during the reporting period. However, many variables regarding BMP effectiveness and associated uncertainties are unknown and unmeasured. As a result, the evaluation of BMP effectiveness summarized in Table 11 is considered preliminary and qualitative.

**Table 11. Best Management Practices Effectiveness Evaluation**

BMP Type	Targeted POCs	Implementation Status	Effectiveness Evaluation	Rationale
Pet waste stations	FC	Implemented, ongoing	Effective	ACC staff continues to actively monitor for pet waste “hot spots” and will install additional pet waste stations or move current stations based on needs.  FC results attained standards for all stations during November–April season.
Sewer evaluation	FC	Implemented, ongoing	Effective	About 2,800,000 feet of sewer lines cleaned by Rodder trucks and flash/vacuum trucks.  FC results attained standards for all stations during November–April season.
Septic system management	FC	Implemented, ongoing	Effective	ACC continued public education and outreach efforts for proper septic system management.
Street sweeping	FC and TSS	Implemented, ongoing	Effective	In 2018, approximately 735 miles of roadways were swept, resulting in removal of 8,900 cubic feet of debris from roadways.
TSS reduction: increased construction inspections in Noketchee Creek, Carr Creek, and Middle Oconee watersheds	TSS	Implemented, ongoing	Effective	In 2018, ACCGOV continued inspections in the Noketchee Creek and Carr Creek watersheds, as well as the Middle Oconee watershed.  TSS results measured for CA-1 during the 2018 reporting period were low. Results ranged from 3 mg/L to 3.1 mg/L.

Arcadis also looked at data trends over the entire monitoring period to assess general BMP effectiveness. Appendix B contains charts showing FC by stream, pH measurements, and TSS results since sampling began. Each dataset was fitted with a trendline. Table 12 contains statements concerning the trend of water quality in each stream. It is difficult to make statements about water quality trends based on these trendlines. The data are scattered, producing very low R-squared values.

For FC, results at all stations are fluctuating.

For pH, measurements at both stations are fluctuating. For TSS, measurements at CA-1 appear to remain constant at about 3 mg/L. TSS results at NC-1 and NC-2 are fluctuating.

**Table 12. Trends in Water Quality by Stream**

Reach	FC	pH	TSS
Brooklyn Creek	Fluctuating		
Carr Creek	Fluctuating		Constant
Cedar Creek	Fluctuating		
East Fork Trail Creek	Fluctuating		
Hunnicut Creek	Fluctuating		
Kingswood Branch	Fluctuating	Fluctuating	
McNutt Creek	Fluctuating		
Middle Oconee River	Fluctuating		
Noketchee Creek	Fluctuating		Fluctuating
North Oconee River	Fluctuating		
Oconee River	Fluctuating		
Tanyard Creek	Fluctuating		
Trail Creek	Fluctuating		
West Fork Trail Creek	Fluctuating		

Water quality in all stream reaches appears to be fluctuating. Sample measurements for all POCs are scattered around linear trendlines. Population growth, development, and aging infrastructure are possible explanations for fluctuating water quality.

## 5 CONCLUSIONS

The MS4 Permit requires permittees to review the Georgia 303(d) List annually to determine if additional impaired waters within the Permit area have been listed. EPD published a draft 303(d) List in October 2016, which was approved in October 2018. ACCGOV reviewed it and determined that pH and BioM impairments were added for Carr Creek for the segment that extends from the headwaters to the North Oconee River in Athens. The pH impairment on Kingswood Branch was removed but Kingswood Branch

is still listed for FC. In 2019 ACC will continue to monitor pH on Kingswood Branch since some 2018 measurements were below the standard range. In 2019, ACCGOV may add in-situ pH monitoring to sampling for CA-1 and update the Plan accordingly. TSS monitoring is already being conducted at CA-1 as part of the existing Plan. The only other change noted in the 2016 303(d) List that applies to the ACC Permit area is the removal of “municipal point source” as a likely source of FC impairment of the North Oconee River for the segment that extends from Trail Creek to the Oconee River. According to EPD, this source was removed because the Athens North Oconee Water Pollution Control Plan met its FC limit for 2013-2015.

ACCGOV plans to submit the water quality data presented in this report and past annual reports, along with the data to be collected in the first quarter of 2019, to Georgia EPD in June 2019 as part of the SQAP report for consideration in 2020 305(b)/303(d) listing decisions.

It is difficult to evaluate BMP effectiveness and trends in water quality due to the limited and scattered data sets and many other unstudied variables and uncertainties. ACCGOV has made significant progress on BMP initiatives since the implementation of the Plan in October 2015. Water quality appears to be fluctuating, and ACCGOV plans to continue with significant BMP initiatives in 2019 to reduce the impacts of POCs and ultimately achieve water quality standards for receiving waters. It is possible that the fluctuating water quality improvement could be due to population growth; development; aging infrastructure; and an increase in the pet population, use of parks, and waste despite the pet waste management program. One project ACCGOV is implementing to address aging infrastructure and a growing population is the Brooklyn Creek Interceptor Improvements. The project includes replacing the sewer interceptor from the trunk line at the Middle Oconee River up to Baxter Street, as well as increasing pipe size to provide greater capacity based on population projections for the future. ACCGOV also plans to begin implementing projects suggested in the nine WMPs completed in 2018.

## 6 REFERENCES

Arcadis-Tetra Tech. 2016. Athens-Clarke County Impaired Waters Monitoring and Implementation Plan and Sampling and Quality Assurance Plan (SQAP). Prepared for Athens-Clarke County, Georgia. 54 pp. January 12.

Georgia Department of Natural Resources, Environmental Protection Division, Water Protection Branch. 1999. Water Quality Assurance Manual. June 1999, revised January 2005. 82 pp. Available at: [https://epd.georgia.gov/sites/epd.georgia.gov/files/related\\_files/site\\_page/Water\\_Protection\\_Branch\\_Quality\\_Assurance\\_Manual\\_Revision2005.pdf](https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/Water_Protection_Branch_Quality_Assurance_Manual_Revision2005.pdf)

Georgia Department of Natural Resources, Environmental Protection Division. 2016. Georgia 2016 305(b)/303(d) List of Waters. Approved by United States Environmental Protection Agency October 4, 2018. Available at: <http://epd.georgia.gov/georgia-305b303d-list-documents>.

Georgia Department of Natural Resources, Environmental Protection Division. 2017. General NPDES Stormwater Permit No. GAG610000. Effective December 6, 2017 through December 5, 2022. 46 pp. Available at: [https://epd.georgia.gov/sites/epd.georgia.gov/files/related\\_files/site\\_page/Phase%20II%202017%20final%20permit.pdf](https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/Phase%20II%202017%20final%20permit.pdf)

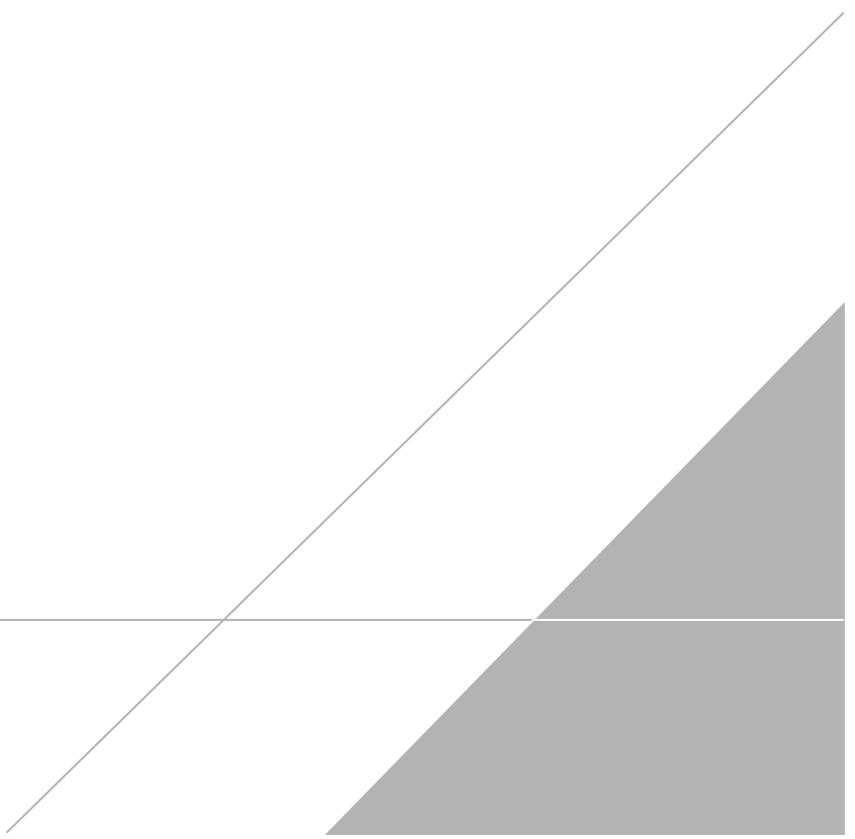
## 2018 Annual Report – Impaired Waters Monitoring and Implementation Plan

Jacobs. 2018. Unified Government of Athens-Clarke County Watershed Protection Plan 2017-2018 Annual Report. Prepared for Athens-Clarke County Public Utilities Department. June 30.

National Weather Service, National Oceanic and Atmospheric Administration. 2018. Rainfall Scorecard for Athens, Georgia. [Web Page] Located at: [http://www.weather.gov/ffc/rainfall\\_scorecard](http://www.weather.gov/ffc/rainfall_scorecard).

## APPENDIX A

Water Quality Sample Results (January 2018 – October 2018)



## FC Raw Data

Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geomean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
1/4/2018	0830	McNutt Creek	MN3			80	80			Slow flow, clear water		10	November-April
1/4/2018	0900	Middle Oconee	MO1			40	40			Moderate flow, clear water		10	November-April
1/4/2018	0925	Hunnicutt Creek	HC1			170	170			Moderate flow, clear water		10	November-April
1/4/2018	0920	Middle Oconee	MO2			40	40			3ft visibility, moderate flow		10	November-April
1/4/2018	1215	Unnamed Tributary	UT1		<	20	10			Moderate flow, clear water		10	November-April
1/4/2018	1245	Middle Oconee	MO4			40	40			Moderate flow, clear water		10	November-April
1/4/2018	1300	Oconee River	OC1			110	110			Moderate flow, clear water		10	November-April
1/4/2018	1310	Cedar Creek	CED1			1300	1300			Moderate flow, clear water		10	November-April
1/4/2018	1320	North Oconee	NO3			60	60			Moderate flow, clear water		10	November-April
1/4/2018	1150	Brooklyn Creek	BR2			130	130			Slow flow, clear water		10	November-April
1/4/2018	1140	Brooklyn Creek	BR1			80	80			Moderate flow, clear water		10	November-April
1/4/2018	1125	Tanyard Creek	TAN2			220	220			Slow flow, slight brown tint		10	November-April
1/4/2018	1116	Tanyard Creek	TAN1			500	500			Moderate flow, clear water		10	November-April
1/4/2018	0940	West Trail Creek	WTR1			270	270			Moderate flow, clear water		10	November-April
1/4/2018	0950	East Trail Creek	ETR1	Duplicate		300	300			Moderate flow, clear water		10	November-April
1/4/2018	0950	East Trail Creek	ETR1			130	#N/A	79.06976744		Moderate flow, clear water		10	November-April
1/4/2018	1000	East Trail Creek	ETR2			40	40			Moderate flow, clear water		10	November-April
1/4/2018	1000	East Trail Creek	ETR2	Blank	<	20	#N/A			Moderate flow, clear water		10	November-April
1/4/2018	1100	Trail Creek	TR3			130	130			Moderate flow, clear water	Ice on sand bar	10	November-April
1/4/2018	1105	North Oconee	NO2			110	110			Moderate flow, clear water	Slight green cast	10	November-April
1/10/2018	0900	McNutt Creek	MN3			500	500			Slow flow. Clear water with green tint		10	November-April
1/10/2018	0920	Middle Oconee	MO1			110	110			Moderate flow, clear water with green tint		10	November-April
1/10/2018	1030	Hunnicutt Creek	HC1			40	40			Moderate flow, clear water		10	November-April
1/10/2018	1025	Middle Oconee	MO2			80	80			Moderate flow, slightly turbid with green tint. Visibilit 2ft		10	November-April
1/10/2018	0945	Kingswood Branch	KB1			40	40			Moderate flow, clear water	Iron floc on bed in places	10	November-April
1/10/2018	0945	Kingswood Branch	KB1	Duplicate		70	#N/A	54.54545455		Moderate flow, clear water	Iron floc on bed in places	10	November-April
1/10/2018	0955	Kingswood Branch	KB3			80	80			No flow, clear water		10	November-April
1/10/2018	1335	Cedar Creek	CED1	Blank	<	20	#N/A			Moderate flow, clear water		10	November-April
1/10/2018	1005	McNutt Creek	MN2			80	80			Moderate flow, clear water	Slight gray tint	10	November-April
1/10/2018	1035	East Trail Creek	ETR1			230	230			Moderate flow, clear water		10	November-April
1/10/2018	1100	West Trail Creek	WTR1			300	300			Moderate flow, clear water		10	November-April
1/10/2018	1140	Trail Creek	TR1			130	130			Moderate flow, clear water	Slight green cast	10	November-April
1/10/2018	1155	West Trail Creek	WTR2			40	40			Moderate flow, clear water		10	November-April
1/10/2018	1205	Carr Creek	CA1			20	20			Moderate flow, clear water	Buff colored silt on bed	10	November-April
1/10/2018	1220	Middle Oconee	MO3			80	80			Moderate flow, clear water		10	November-April
1/10/2018	1230	McNutt Creek	MN1			270	270			Moderate flow, green tinted water	Slight tint to water color, visibility 2ft	10	November-April
1/10/2018	1250	Unnamed Tributary	UT1			130	130			Moderate flow, clear water		10	November-April
1/10/2018	1310	Middle Oconee	MO4			230	230			Moderate flow, slightly turbid. 2ft visibility		10	November-April
1/10/2018	1325	Oconee River	OC1			40	40			Moderate flow. Slight green tint. 2ft visibility		10	November-April
1/10/2018	1335	Cedar Creek	CED1			300	300			Moderate flow, clear water with very slight turbidity		10	November-April
1/10/2018	1345	North Oconee	NO3			140	140			Moderate flow, clear water		10	November-April
1/10/2018	1140	Trail Creek	TR1	Duplicate		80	#N/A	47.61904762		Moderate flow, clear water		10	November-April
1/10/2018	1100	West Trail Creek	WTR1	Blank	<	20	#N/A	73.97260274		Moderate flow, clear water		10	November-April
1/10/2018	1035	East Trail Creek	ETR1	Duplicate		500	#N/A			Moderate flow, clear water		10	November-April
1/11/2018	0905	Brooklyn Creek	BR2			500	500		Light rain	Moderate flow, clear water	Stormwater outfalls flowing	10	November-April
1/11/2018	0920	Brooklyn Creek	BR1			1700	1700		Light rain	Moderate flow, clear water		10	November-April
1/11/2018	0935	Tanyard Creek	TAN2			20	20		Light rain	Slow flow, clear water with surface film of dust		10	November-April
1/11/2018	945	Tanyard Creek	TAN1			5000	5000		Light rain	Moderate flow. Clear water with gray tint	Great blue heron in culvert	10	November-April
1/11/2018	1010	Trail Creek	TR3			500	500		Light rain	Moderate flow. Green tinted water, 2 ft visibility		10	November-April
1/11/2018	1015	North Oconee	NO2			230	230		Light rain	Moderate flow. Green tinted water, 2 ft visibility		10	November-April
1/11/2018	1035	East Trail Creek	ETR2			40	40			Moderate flow. Slightly turbid with 2ft visibility. Brown tint		10	November-April
1/16/2018	0840	McNutt Creek	MN3			110	110			Slow flow. Clear water with green tint		10	November-April
1/16/2018	0840	McNutt Creek	MN3	Duplicate		130	#N/A	16.66666667		Slow flow. Clear water with green tint		10	November-April
1/16/2018	0900	Middle Oconee	MO1			140	140			Moderate flow. Clear water, green tint		10	November-April
1/16/2018	0900	Middle Oconee	MO1	Blank	<	20	#N/A			Moderate flow. Clear water, green tint		10	November-April
1/16/2018	0925	Kingswood Branch	KB1			500	500			Moderate flow, clear water		10	November-April
1/16/2018	0935	Kingswood Branch	KB3			170	170			No flow, clear water		10	November-April
1/16/2018	0945	McNutt Creek	MN2			80	80			Moderate flow, clear water with brown tint		10	November-April
1/16/2018	1005	Middle Oconee	MO2			140	140			Moderate flow. Brown water, visibility 2ft.	Frost has loosened bank soil.	10	November-April
1/16/2018	1010	Hunnicutt Creek	HC1			130	130			Moderate flow, clear water		10	November-April
1/16/2018	1025	West Trail Creek	WTR2			230	230			Moderate flow, clear water. Slight green tint		10	November-April
1/16/2018	1035	Trail Creek	TR1			220	220			Moderate flow, clear water. Slight green tint		10	November-April
1/16/2018	1045	Carr Creek	CA1			20	20			Moderate flow, clear water.	Buff silt film on bed	10	November-April
1/16/2018	1105	Middle Oconee	MO3			130	130			Moderate flow, clear water	Strong brown tint	10	November-April
1/16/2018	1115	McNutt Creek	MN1			500	500			Moderate flow, clear water brown tint		10	November-April
1/16/2018	1140	Unnamed Tributary	UT1			170	170			Moderate flow, clear water		10	November-April
1/16/2018	1210	Middle Oconee	MO4			40	40			Moderate flow, clear water. Strong brown tint.		10	November-April
1/16/2018	1225	Oconee River	OC1			800							

## FC Raw Data

Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geomean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
1/18/2018	1115	Tanyard Creek	TAN2			40	40			Slow flow, clear water		10	November-April
1/18/2018	1120	Tanyard Creek	TAN1			130	130			Moderate flow, clear water		10	November-April
1/18/2018	1130	West Trail Creek	WTR1			40	40			Moderate flow, clear water. Slight green tint.		10	November-April
1/18/2018	1140	East Trail Creek	ETR1			40	40			Moderate flow, clear water		10	November-April
1/18/2018	1200	East Trail Creek	ETR2			300	300			Moderate flow, clear water		10	November-April
1/18/2018	1215	West Trail Creek	WTR2			20	20			Moderate flow, clear water with green tint		10	November-April
1/18/2018	1225	Trail Creek	TR1			20	20			Moderate flow, clear water with green tint		10	November-April
1/18/2018	1240	Trail Creek	TR3			80	80			Moderate flow, clear water with green tint		10	November-April
1/18/2018	1245	North Oconee	NO2			110	110			Slow flow. Clear water with green tint, visibility 2ft		10	November-April
1/18/2018	1300	Carr Creek	CA1	Duplicate	<	20	10			Moderate flow, very faint turbidity	Tan silt on bed	10	November-April
1/18/2018	1300	Carr Creek	CA1		<	20	#N/A	0		Moderate flow, very faint turbidity		10	November-April
1/22/2018	1050	McNutt Creek	MN3			20	20			Slow flow, clear water. Slight green tint		10	November-April
1/22/2018	1115	Middle Oconee	MO1			80	80			Moderate flow, slight green tint. Visibility 2ft		10	November-April
1/22/2018	1145	Hunicutt Creek	HC1			110	110			Moderate flow, clear water		10	November-April
1/22/2018	1140	Middle Oconee	MO2			40	40			Moderate flow, slight green tint. Visibility 2ft		10	November-April
1/22/2018	1150	Kingswood Branch	KB1			300	300			Moderate flow, clear water	Iron floc on bed	10	November-April
1/22/2018	1205	Kingswood Branch	KB3			300	300			No flow, clear water		10	November-April
1/22/2018	1215	McNutt Creek	MN2	Duplicate		80	80			Moderate flow, clear water. Slight green tint		10	November-April
1/22/2018	1215	McNutt Creek	MN2			130	#N/A	47.61904762		Moderate flow, clear water. Slight green tint		10	November-April
1/22/2018	1230	McNutt Creek	MN1			170	170			Moderate flow, clear water. Slight brown tint		10	November-April
1/22/2018	1230	McNutt Creek	MN1	Blank	<	20	#N/A			Moderate flow, clear water. Slight brown tint		10	November-April
1/22/2018	1240	Middle Oconee	MO3			20	20			Moderate flow, clear water. Slight green tint		10	November-April
1/22/2018	1300	Unnamed Tributary	UT1			220	220			Moderate flow, clear water		10	November-April
1/22/2018	1320	Middle Oconee	MO4			170	170			Moderate flow, clear water. Slight green tint		10	November-April
1/22/2018	1335	Oconee River	OC1			20	20			Moderate flow, slight green tint. Visibility 2ft		10	November-April
1/22/2018	1345	Cedar Creek	CED1			500	500			Moderate flow, clear water. Slight brown tint		10	November-April
1/24/2018	1115	Brooklyn Creek	BR2			210	210			Moderate flow, clear water. Very slight tint		10	November-April
1/24/2018	1105	Brooklyn Creek	BR1			170	170			Moderate flow, clear water		10	November-April
1/24/2018	1125	Tanyard Creek	TAN2			80	80			Slow flow, clear water		10	November-April
1/24/2018	1125	Tanyard Creek	TAN2	Blank	<	20	#N/A			Slow flow, clear water	turbidity swirls probably due to wildlife	10	November-April
1/24/2018	1135	Tanyard Creek	TAN1			3000	3000			Slow flow. Clear water but turbidity swirls probably due to wildlife		10	November-April
1/24/2018	1135	Tanyard Creek	TAN1	Duplicate	<	5000	#N/A	50		Slow flow. Clear water but turbidity swirls probably due to wildlife		10	November-April
1/24/2018	1235	West Trail Creek	WTR1			70	70			Moderate flow, strong green tint		10	November-April
1/24/2018	1245	East Trail Creek	ETR1			170	170			Moderate flow, clear water		10	November-April
1/24/2018	1230	East Trail Creek	ETR2			80	80			Moderate flow. Very slightly turbid		10	November-April
1/24/2018	1215	West Trail Creek	WTR2			40	40			Moderate flow. Slightly turbid with strong green color		10	November-April
1/24/2018	1205	Trail Creek	TR1			300	300			Moderate flow. Slightly turbid with strong green color		10	November-April
1/24/2018	1150	Trail Creek	TR3			500	500			Slow flow. Clear with green tint	Water up 6 inches from last sampling	10	November-April
1/24/2018	1155	North Oconee	NO2			1300	1300			Slow flow. Brown tinted water. Visibility 1ft		10	November-April
1/24/2018	1300	Carr Creek	CA1			40	40			Moderate flow. Very slight turbidity		10	November-April
1/24/2018	1310	North Oconee	NO3			300	300			Moderate flow. Turbid flow, brown tint. Visibility 1ft		10	November-April
4/2/2018	1015	McNutt Creek	MN3			220	220		Clear weather.	Moderate, turbid flow. Visibility <1'		11	November-April
4/2/2018	1030	Middle Oconee	MO1			80	80		Clear weather.	Moderate/high flow. Very turbid		11	November-April
4/2/2018	1100	Hunicutt Creek	HC1			80	80		Clear weather.	Moderate, clear flow.		11	November-April
4/2/2018	1105	Middle Oconee	MO2			170	170		Clear weather.	Moderate/high flow. Turbid. Visibility 1'		11	November-April
4/2/2018	1115	Kingswood Branch	KB1			80	80		Clear weather.	Moderate/high, clear flow.		11	November-April
4/2/2018	1120	Kingswood Branch	KB3			110	110		Clear weather.	Low, clear flow.		11	November-April
4/2/2018	1130	McNutt Creek	MN2			80	80		Clear weather.	Low/moderate flow. Slightly turbid.	New treefall directly above culvert	11	November-April
4/2/2018	1145	McNutt Creek	MN1			80	80		Clear weather.	Moderate/high flow. Slightly turbid. Visibility 2'		11	November-April
4/2/2018	1155	Middle Oconee	MO3			220	220		Clear weather.	High flow. Moderately turbid. Visibility 1'		11	November-April
4/2/2018	1215	Unnamed Tributary	UT1			20	20		Clear weather.	Moderate flow. Clear.		11	November-April
4/2/2018	1235	Middle Oconee	MO4			300	300		Clear weather.	High flow. Moderately turbid.		11	November-April
4/2/2018	1255	Oconee River	OC1			230	230		Clear weather.	High flow. Moderately turbid.		11	November-April
4/2/2018	1310	Cedar Creek	CED1	Duplicate		230	230		Clear weather.	Moderate flow. Slightly turbid		11	November-April
4/2/2018	1310	Cedar Creek	CED1	Blank	<	20	#N/A	54		Clear weather.		11	November-April
4/3/2018	0835	North Oconee	NO3			80	80		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/3/2018	0855	Brooklyn Creek	BR2			300	300		Clear weather.	Moderate, clear flow.	Faint sewage odor around stream	11	November-April
4/3/2018	0905	Brooklyn Creek	BR1			300	300		Clear weather.	Moderate, clear flow.	Area recently cleared of brush	11	November-April
4/3/2018	0905	Brooklyn Creek	BR1	Duplicate		500	#N/A	40		Clear weather.		11	November-April
4/3/2018	0920	Tanyard Creek	TAN2			110	110		Clear weather.	Moderate, clear flow.		11	November-April
4/3/2018	0930	Tanyard Creek	TAN1		<	20	10		Clear weather.	Moderate flow. Suspended sediment exiting culvert.		11	November-April
4/3/2018	0945	West Trail Creek	WTR1			300	300		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/3/2018	0955	East Trail Creek	ETR1			300	300		Clear weather.	Moderate, clear flow.	Lots of silt on bed.	11	November-April
4/3/2018	1010	East Trail Creek	ETR2			700	700		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/3/2018	1025	West Trail Creek	WTR2			70	70		Clear weather.	Moderate flow. Slightly turbid. Gray tinge.		11	November-April
4/3/2018	1035	Trail Creek	TR1			220	220		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/3/2018	1045	Trail Creek	TR3			300	300		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/3/2018</td													

## FC Raw Data

Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geomean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
4/4/2018	1045	McNutt Creek	MN1			500	500		Clear. Overnight rain.	High flow. Turbid. Visibility <1'		11	November-April
4/4/2018	1055	Middle Oconee	MO3			120	120		Clear. Overnight rain.	Moderate flow. Clear.		11	November-April
4/4/2018	1115	Unnamed Tributary	UT1			20	20		Clear. Overnight rain.	High flow. Turbid. Visibility 1'		11	November-April
4/4/2018	1135	Middle Oconee	MO4			300	300		Clear. Overnight rain.	High flow. Turbid. Visibility <1'		11	November-April
4/4/2018	1150	Oconee River	OC1			110	110		Clear. Overnight rain.	High flow. Turbid. Visibility <1'		11	November-April
4/4/2018	1205	Cedar Creek	CED1			230	230		Clear. Overnight rain.	Moderate flow. Clear to bottom with some suspended sediment		11	November-April
4/4/2018	1205	Cedar Creek	CED1	Blank	<	20	#N/A		Clear. Overnight rain.			11	November-April
4/5/2018	0915	North Oconee	NO3			110	110		Clear weather.	High flow, moderately turbid. Visibility 1'		11	November-April
4/5/2018	0930	Brooklyn Creek	BR2			800	800		Clear weather.	Moderate, clear flow.		11	November-April
4/5/2018	0940	Brooklyn Creek	BR1			500	500		Clear weather.	Moderate, clear flow.		11	November-April
4/5/2018	0950	Tanyard Creek	TAN2			3000	3000		Clear weather.	Moderate, clear flow.		11	November-April
4/5/2018	0955	Tanyard Creek	TAN1			140	140		Clear weather.	Moderate, clear flow.		11	November-April
4/5/2018	1010	West Trail Creek	WTR1			110	110		Clear weather.	Moderate flow. Slight turbidity.		11	November-April
4/5/2018	1025	East Trail Creek	ETR1			300	300		Clear weather.	Moderate, clear flow. Some particulates		11	November-April
4/5/2018	1040	East Trail Creek	ETR2			70	70		Clear weather.	Moderate, clear flow. Slight brown tinge.		11	November-April
4/5/2018	1050	West Trail Creek	WTR2			230	230		Clear weather.	Moderate, clear flow. Slight brown tinge.	Floating off-white foam on surface	11	November-April
4/5/2018	1050	West Trail Creek	WTR2	Duplicate		80	#N/A	187.5	Clear weather.	Moderate, clear flow. Slight brown tinge.	Floating off-white foam on surface	11	November-April
4/5/2018	1100	Trail Creek	TR1			170	170		Clear weather.	Moderate flow. Slight turbidity.		11	November-April
4/5/2018	1110	Trail Creek	TR3			270	270		Clear weather.	Moderate flow. Slight turbidity.		11	November-April
4/5/2018	1115	North Oconee	NO2			170	170		Clear weather.	High flow. Turbid. Visibility 1'		11	November-April
4/5/2018	1130	Carr Creek	CA1			140	140		Clear weather.	Moderate flow. Clear with gray silt on bed.		11	November-April
4/5/2018	1130	Carr Creek	CA1	Blank	<	20	#N/A		Clear weather.			11	November-April
4/9/2018	1055	McNutt Creek	MN3			176	176		Overnight rain. Slight drizzle.	High flow. Turbid with gray/green tinge		11	November-April
4/9/2018	1110	Middle Oconee	MO1			170	170		Overnight rain. Slight drizzle.	High flow. Turbid. Visibility <1'		11	November-April
4/9/2018	1135	Hunnicutt Creek	HC1			3000	3000		Overnight rain. Slight drizzle.	High, clear flow.	Faint sewage odor	11	November-April
4/9/2018	1140	Middle Oconee	MO2			110	110		Overnight rain. Slight drizzle.	High flow. Turbid. Visibility <1'		11	November-April
4/9/2018	1150	Kingswood Branch	KB1			20	20		Overnight rain. Slight drizzle.	High flow. Turbid with gray tinge		11	November-April
4/9/2018	1200	Kingswood Branch	KB3			300	300		Overnight rain. Slight drizzle.	High, clear flow.		11	November-April
4/9/2018	1205	McNutt Creek	MN2			500	500		Overnight rain. Slight drizzle.	High, clear flow. Some off-white foam on surface.		11	November-April
4/9/2018	1220	McNutt Creek	MN1			80	80		Overnight rain. Slight drizzle.	High flow. Slightly turbid. Visibility 2'		11	November-April
4/9/2018	1230	Middle Oconee	MO3			500	500		Overnight rain. Slight drizzle.	High flow. Turbid. Visibility 1'		11	November-April
4/9/2018	1230	Middle Oconee	MO3	Duplicate		270	#N/A	85.18518519	Overnight rain. Slight drizzle.	High flow. Turbid. Visibility 1'		11	November-April
4/9/2018	1250	Unnamed Tributary	UT1		<	20	10		Overnight rain. Slight drizzle.	Moderate flow. Clear.		11	November-April
4/9/2018	1310	Middle Oconee	MO4			220	220		Overnight rain. Slight drizzle.	High flow. Turbid. Visibility 1'		11	November-April
4/9/2018	1325	Oconee River	OC1			130	130		Overnight rain. Slight drizzle.	High flow. Turbid. Visibility 1'		11	November-April
4/9/2018	1335	Cedar Creek	CED1			500	500		Overnight rain. Slight drizzle.	High, clear flow.		11	November-April
4/9/2018	1335	Cedar Creek	CED1	Blank	<	20	#N/A		Overnight rain. Slight drizzle.			11	November-April
4/10/2018	0900	North Oconee	NO3			80	80		Clear weather. Drizzling yesterday.	High flow. Slightly turbid. Visibility <2'		11	November-April
4/10/2018	0915	Brooklyn Creek	BR2			500	500		Clear weather. Drizzling yesterday.	Moderate, clear flow.		11	November-April
4/10/2018	0930	Brooklyn Creek	BR1			1300	1300		Clear weather. Drizzling yesterday.	Moderate, clear flow.		11	November-April
4/10/2018	0935	Tanyard Creek	TAN2			110	110		Clear weather. Drizzling yesterday.	Moderate, clear flow.		11	November-April
4/10/2018	0940	Tanyard Creek	TAN1			1300	1300		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid from sediment plume visibly flowing from culvert.		11	November-April
4/10/2018	1000	West Trail Creek	WTR1			800	800		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid.		11	November-April
4/10/2018	1010	East Trail Creek	ETR1			170	170		Clear weather. Drizzling yesterday.	Moderate, clear flow. Brown silt covering bed		11	November-April
4/10/2018	1010	East Trail Creek	ETR1	Duplicate		130	#N/A	30.76923077	Clear weather. Drizzling yesterday.	Moderate, clear flow. Brown silt covering bed		11	November-April
4/10/2018	1025	East Trail Creek	ETR2			170	170		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid.		11	November-April
4/10/2018	1040	West Trail Creek	WTR2			20	20		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid with gray tinge.		11	November-April
4/10/2018	1050	Trail Creek	TR1			300	300		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid. Visibility 2'		11	November-April
4/10/2018	1055	Trail Creek	TR3			170	170		Clear weather. Drizzling yesterday.	Moderate flow. Slightly turbid.		11	November-April
4/10/2018	1100	North Oconee	NO2			300	300		Clear weather. Drizzling yesterday.	Moderate flow. Turbid. Visibility <1'		11	November-April
4/10/2018	1120	Carr Creek	CA1			110	110		Clear weather. Drizzling yesterday.	Moderate clear flow. Gray sediment covering bed.		11	November-April
4/10/2018	1120	Carr Creek	CA1	Blank	<	20	#N/A		Clear weather. Drizzling yesterday.			11	November-April
4/11/2018	0905	McNutt Creek	MN3			700	700		Clear weather.	Moderate flow. Turbid. Visibility 1'		11	November-April
4/11/2018	0925	Middle Oconee	MO1			260	260		Clear weather.	Moderate flow. Turbid. Visibility 1'		11	November-April
4/11/2018	0945	Hunnicutt Creek	HC1			300	300		Clear weather.	Moderate, clear flow.		11	November-April
4/11/2018	0950	Middle Oconee	MO2			110	110		Clear weather.	Moderate flow. Turbid. Visibility 1'		11	November-April
4/11/2018	1005	Kingswood Branch	KB1			130	130		Clear weather.	Moderate, clear flow.		11	November-April
4/11/2018	1010	Kingswood Branch	KB3			500	500		Clear weather.	Moderate, clear flow.		11	November-April
4/11/2018	1020	McNutt Creek	MN2			230	230		Clear weather.	Moderate, clear flow. Lots of particulates floating on surface		11	November-April
4/11/2018	1035	McNutt Creek	MN1			300	300		Clear weather.	Moderate flow. Slightly turbid.		11	November-April
4/11/2018	1045	Middle Oconee	MO3			130	130		Clear weather.	Moderate flow. Turbid. Visibility 1'		11	November-April
4/11/2018	1100	Unnamed Tributary	UT1			20	20		Clear weather.	Moderate, clear flow.		11	November-April
4/11/2018	1115	Middle Oconee	MO4			300	300		Clear weather.	Moderate flow. Slightly turbid. Visibility 1'		11	November-April
4/11/2018	1130	Oconee River	OC1	Duplicate		230	230		Clear weather.	Moderate flow. Slightly turbid. Visibility 1'		11	November-April
4/11/2018	1140	Cedar Creek	CED1	Blank	<	20	#N/A	</					

## FC Raw Data

Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geomean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
4/12/2018	1015	West Trail Creek	WTR2			40	40			Moderate flow. Green cast. Water level seemed lower than in past.	Water level seemed lower than in past.	11	November-April
4/12/2018	1008	Trail Creek	TR1			1300	1300			Moderate flow. Strong green cast to water.		11	November-April
4/12/2018	0955	Trail Creek	TR3			700	700			Moderate flow. Slight green cast to water. 2' visibility.		11	November-April
4/12/2018	1000	North Oconee	NO2			220	220			Slow flow. Slight green/brown cast to water. 2' visibility.		11	November-April
4/12/2018	1145	Carr Creek	CA1			140	140			Moderate flow. Clear water. Film of gray silt on bed.		11	November-April
8/1/2018	0945	McNutt Creek	MN3			2400	2400		Scattered showers	Moderate flow but level not up. Brown tint to water, 1' visibility.		12	May-October
8/1/2018	0945	McNutt Creek	MN3	Duplicate		3000	#N/A	20	Scattered showers	Moderate flow but level not up. Brown tint to water, 1' visibility.		12	May-October
8/1/2018	1010	Middle Oconee	MO1			800	800		Scattered showers	Moderate flow up 6". Brown tint/turbid, 6" visibility.		12	May-October
8/1/2018	1045	Hunnicutt Creek	HC1			5000	5000		Scattered showers	Moderate flow. Nearly clear.		12	May-October
8/1/2018	1045	Hunnicutt Creek	HC1	Blank	<	20	#N/A		Scattered showers	Moderate flow. Scattered showers		12	May-October
8/1/2018	1050	Middle Oconee	MO2			1700	1700		Scattered showers	Moderate flow up 6". Brown tint/turbid, 6" visibility.		12	May-October
8/1/2018	1110	Kingswood Branch	KB1			500	500		Scattered showers	Moderate flow. Nearly clear.		12	May-October
8/1/2018	1125	Kingswood Branch	KB3			3000	3000		Scattered showers	No visible flow. Slightly tinted brown		12	May-October
8/1/2018	1140	McNutt Creek	MN2			3000	3000		Scattered showers	Moderate flow. Level up a few inches. Brown tint/turbid. 6" visibility		12	May-October
8/1/2018	1155	McNutt Creek	MN1			1700	1700		Scattered showers	Moderate flow. Brown tint/turbid. 6" visibility		12	May-October
8/1/2018	1205	Middle Oconee	MO3			3000	3000		Scattered showers	Moderate flow up 6". Brown tint/turbid, 6" visibility.		12	May-October
8/1/2018	1230	Unnamed Tributary	UT1			1100	1100		Scattered showers	Moderate flow. Clear flow.		12	May-October
8/1/2018	1300	Middle Oconee	MO4			800	800		Scattered showers	Moderate flow. Brown/very turbid. 6" visibility		12	May-October
8/1/2018	1315	Oconee River	OC1			3000	3000		Scattered showers	Moderate flow. Brown/very turbid.		12	May-October
8/1/2018	1330	Cedar Creek	CED1			5000	5000		Scattered showers	Moderate flow. Brown tint/turbid. 12" visibility		12	May-October
8/2/2018	1250	North Oconee	NO3			16000	16000		Light rain	Rapid flow. Up 12". Very turbid/brown tint. Visibility 3"		12	May-October
8/2/2018	0925	Brooklyn Creek	BR2			3000	3000		Light rain	Moderate flow/turbid/brown tint. 12" visibility		12	May-October
8/2/2018	0925	Brooklyn Creek	BR2	Duplicate		2400	#N/A	25	Light rain	Moderate flow/turbid/brown tint. 12" visibility		12	May-October
8/2/2018	0905	Brooklyn Creek	BR1			2400	2400		Light rain	Moderate flow. Slightly turbid.	Recent heavy sand deposits	12	May-October
8/2/2018	0905	Brooklyn Creek	BR1	Blank	<	20	#N/A		Light rain			12	May-October
8/2/2018	0937	Tanyard Creek	TAN2			1700	1700		Light rain	Moderate flow. Slightly turbid/brown tint. 18" visibility		12	May-October
8/2/2018	0945	Tanyard Creek	TAN1			5000	5000		Light rain	Moderate flow. Slightly turbid/brown tint. 18" visibility		12	May-October
8/2/2018	1210	West Trail Creek	WTR1			16000	16000		Light rain	Rapid flow. Up 12". Very turbid/brown tint. Visibility 3"		12	May-October
8/2/2018	1200	East Trail Creek	ETR1			300	300		Light rain	Rapid flow. Up 6". Slightly turbid/brown tint. 12" visibility.	Recent sand deposits at 2' elevation.	12	May-October
8/2/2018	1130	East Trail Creek	ETR2			5000	5000		Light rain	Rapid flow. Up 6". Very turbid/brown tint. 3" visibility		12	May-October
8/2/2018	1050	West Trail Creek	WTR2			5000	5000		Light rain	Rapid flow. Up 6". Very turbid/brown tint. 3" visibility		12	May-October
8/2/2018	1035	Trail Creek	TR1			2200	2200		Scattered showers	Rapid flow. Up 12". Very turbid/brown tint. Visibility 3"		12	May-October
8/2/2018	1015	Trail Creek	TR3			5000	5000		Scattered showers	Moderate flow. Up 6". Very turbid/brown tint. 6" visibility		12	May-October
8/2/2018	1020	North Oconee	NO2			16000	16000		Scattered showers	Moderate flow. Up 12". Very turbid/brown tint. 3" visibility		12	May-October
8/2/2018	1230	Carr Creek	CA1		>	16000	17000		Heavy rain	Rapid flow. Up 12". Very turbid/brown		12	May-October
8/7/2018	0835	McNutt Creek	MN3			330	330			Moderate flow. Faint brown tint		12	May-October
8/7/2018	0900	Middle Oconee	MO1			230	230			Moderate flow. Turbid flow/brown tint. Visibility 12"		12	May-October
8/7/2018	0930	Hunnicutt Creek	HC1			2200	2200			Moderate flow. Clear.		12	May-October
8/7/2018	0935	Middle Oconee	MO2			220	220			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/7/2018	0950	Kingswood Branch	KB1			500	500			Moderate flow. Clear.		12	May-October
8/7/2018	0950	Kingswood Branch	KB1	Blank	<	20	#N/A					12	May-October
8/7/2018	1010	Kingswood Branch	KB3			1100	1100			Slow flow. Faint gray tint. Visibility 30"		12	May-October
8/7/2018	1010	Kingswood Branch	KB3	Duplicate		500	#N/A	120		Slow flow. Faint gray tint. Visibility 30"		12	May-October
8/7/2018	1025	McNutt Creek	MN2			1300	1300			Moderate flow. Slight brown tint. Visibility 30"		12	May-October
8/7/2018	1040	McNutt Creek	MN1			1300	1300			Moderate flow. Slight brown tint. Visibility 30"		12	May-October
8/7/2018	1050	Middle Oconee	MO3			700	700			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/7/2018	1115	Unnamed Tributary	UT1			230	230			Moderate flow. Clear water.		12	May-October
8/7/2018	1130	Middle Oconee	MO4			500	500			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/7/2018	1150	Oconee River	OC1			500	500			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/7/2018	1200	Cedar Creek	CED1			300	300			Moderate flow. Clear water with very slight brown tint.		12	May-October
8/8/2018	1255	North Oconee	NO3			230	230			Moderate flow. Turbid/brown tint. Visibility 12"		12	May-October
8/8/2018	1255	North Oconee	NO3	Duplicate		130	#N/A	76.92307692		Moderate flow. Turbid/brown tint. Visibility 12"		12	May-October
8/8/2018	1040	Brooklyn Creek	BR2			700	700			Moderate flow. Clear water.		12	May-October
8/8/2018	1025	Brooklyn Creek	BR1			500	500			Moderate flow. Clear water.		12	May-October
8/8/2018	1055	Tanyard Creek	TAN2			800	800			Slow flow. Clear water.		12	May-October
8/8/2018	1055	Tanyard Creek	TAN1			500	500			Slow flow. Clear water with very faint gray tint.		12	May-October
8/8/2018	1225	West Trail Creek	WTR1			110	110			Moderate flow. Slightly turbid/brown tint. Visibility 24"	Heavy sand deposits in channel.	12	May-October
8/8/2018	1215	East Trail Creek	ETR1			40	40			Moderate flow. Very slightly turbid/brown tint. Visibility 30"		12	May-October
8/8/2018	1200	East Trail Creek	ETR2			800	800			Moderate flow. Slightly turbid/brown tint. Visibility 24"		12	May-October
8/8/2018	1140	West Trail Creek	WTR2			90	90			Moderate flow. Slightly turbid/brown-gray. Visibility 24"		12	May-October
8/8/2018	1130	Trail Creek	TR1			500	500			Moderate flow. Slightly turbid/brown tint. Visibility 24"		12	May-October
8/8/2018	1110	Trail Creek	TR3			800	800			Moderate flow. Clear water.	Heavy recent sand/silt deposits on bed	12	May-October
8/8/2018	1115	North Oconee	NO2			230	230			Slow flow. Turbid water/brown. 12" visibility.		12	May-October
8/8/2018	1245	Carr Creek	CA1			1300	1300			Moderate flow. Clear.	Light gray silt on bed		

## FC Raw Data

Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geometric mean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
8/14/2018	1305	Oconee River	OC1	Blank	<	20	#N/A					12	May-October
8/14/2018	1320	Cedar Creek	CED1			1300	1300		Moderate flow. Clear water faint gray tint			12	May-October
8/14/2018	1320	Cedar Creek	CED1	Duplicate		1100	#N/A	18.18181818	Moderate flow. Clear water faint gray tint			12	May-October
8/15/2018	0935	North Oconee	NO3			90	90		Sunny	High flow. Moderately turbid.		12	May-October
8/15/2018	0955	Brooklyn Creek	BR2			1300	1300		Sunny	Moderate flow. Clear		12	May-October
8/15/2018	1005	Brooklyn Creek	BR1			1300	1300		Sunny	Moderate flow. Clear		12	May-October
8/15/2018	1015	Tanyard Creek	TAN2			900	900		Sunny	Moderate flow. Clear		12	May-October
8/15/2018	1025	Tanyard Creek	TAN1			2400	2400		Sunny	Moderate flow. Clear		12	May-October
8/15/2018	1035	West Trail Creek	WTR1			80	80		Sunny	Moderate flow. Slightly turbid. Silty bed.		12	May-October
8/15/2018	1045	East Trail Creek	ETR1			110	110		Sunny	Moderate flow. Slightly turbid		12	May-October
8/15/2018	1100	East Trail Creek	ETR2			130	130		Sunny	Moderate flow. Slightly turbid.		12	May-October
8/15/2018	1110	West Trail Creek	WTR2			110	110		Sunny	Moderate flow. Slightly turbid.	Sewage odor in area	12	May-October
8/15/2018	1115	Trail Creek	TR1			300	300		Sunny	Moderate flow. Slightly turbid.		12	May-October
8/15/2018	1125	Trail Creek	TR3			3000	3000		Sunny	Moderate flow. Slightly turbid.		12	May-October
8/15/2018	1130	North Oconee	NO2			110	110		Sunny	Moderate flow. Turbid		12	May-October
8/15/2018	1140	Carr Creek	CA1			300	300		Sunny	Moderate flow. Clear. Gray silt on bed.		12	May-October
8/15/2018	1140	Carr Creek	CA1	Duplicate		270	#N/A	11.11111111	Sunny	Moderate flow. Clear. Gray silt on bed.		12	May-October
8/15/2018	1140	Carr Creek	CA1	Blank	<	20	#N/A		Sunny			12	May-October
8/21/2018	1015	McNutt Creek	MN3			210	210			Moderate flow. Clear water.		12	May-October
8/21/2018	1035	Middle Oconee	MO1			800	800			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1100	Hunnicutt Creek	HC1			2400	2400			Moderate flow. Clear water.		12	May-October
8/21/2018	1105	Middle Oconee	MO2			300	300			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1115	Kingswood Branch	KB1			1300	1300			Moderate flow. Clear water.		12	May-October
8/21/2018	1125	Kingswood Branch	KB3			3000	3000			No flow. Clear with faint gray cast.		12	May-October
8/21/2018	1130	McNutt Creek	MN2			700	700			Moderate flow. Clear water.		12	May-October
8/21/2018	1155	McNutt Creek	MN1			500	500			Moderate flow. Clear with slight brown tint		12	May-October
8/21/2018	1155	McNutt Creek	MN1	Blank	<	20	#N/A					12	May-October
8/21/2018	1205	Middle Oconee	MO3			300	300			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1205	Middle Oconee	MO3	Duplicate		500	#N/A	40		Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1225	Unnamed Tributary	UT1			1300	1300			Moderate flow. Clear water.		12	May-October
8/21/2018	1245	Middle Oconee	MO4			230	230			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1300	Oconee River	OC1			300	300			Moderate flow. Turbid/brown. Visibility 12"		12	May-October
8/21/2018	1315	Cedar Creek	CED1			1300	1300			Moderate flow. Clear water.		12	May-October
8/22/2018	0920	North Oconee	NO3			500	500		Sunny	Moderate flow. Turbid		12	May-October
8/22/2018	0935	Brooklyn Creek	BR2			800	800		Sunny	Average flow. Clear.		12	May-October
8/22/2018	0945	Brooklyn Creek	BR1			3000	3000		Sunny	Average flow. Clear.		12	May-October
8/22/2018	0955	Tanyard Creek	TAN2			1700	1700		Sunny	Average flow. Clear.		12	May-October
8/22/2018	0955	Tanyard Creek	TAN2	Duplicate		1300	#N/A	30.76923077	Sunny	Average flow. Clear.		12	May-October
8/22/2018	1010	Tanyard Creek	TAN1		>	16000	17000		Sunny	Average flow. Clear.		12	May-October
8/22/2018	1030	West Trail Creek	WTR1			2400	2400		Sunny	Moderate flow. Slightly turbid.	Floating particulates.	12	May-October
8/22/2018	1040	East Trail Creek	ETR1			230	230		Sunny	Average flow. Slightly turbid.		12	May-October
8/22/2018	1100	East Trail Creek	ETR2			500	500		Sunny	Average flow. Moderately turbid.	Slight sewage odor.	12	May-October
8/22/2018	1110	West Trail Creek	WTR2			800	800		Sunny	Average flow. Moderately turbid.		12	May-October
8/22/2018	1120	Trail Creek	TR1			500	500		Sunny	Average flow. Slightly turbid.		12	May-October
8/22/2018	1125	Trail Creek	TR3			5000	5000		Sunny	Average flow. Slightly turbid.		12	May-October
8/22/2018	1130	North Oconee	NO2			1300	1300		Sunny	Moderate flow. Turbid.		12	May-October
8/22/2018	1140	Carr Creek	CA1			800	800		Sunny	Average flow. Clear with gray tinge.		12	May-October
8/22/2018	1140	Carr Creek	CA1	Blank	<	20	#N/A		Sunny			12	May-October
10/15/2018	0855	McNutt Creek	MN3			140	140			Moderate flow. Clear water with slight tint		13	May-October
10/15/2018	0855	McNutt Creek	MN3	Duplicate		500	#N/A	72		Moderate flow. Clear water with slight tint		13	May-October
10/15/2018	0940	Middle Oconee	MO1			2400	2400			Moderate flow. 1' visibility. Turbid with brown tint		13	May-October
10/15/2018	0940	Middle Oconee	MO1	Blank	<	20	#N/A			Moderate flow. 1' visibility. Turbid with brown tint		13	May-October
10/15/2018	0945	Hunnicutt Creek	HC1			1300	1300			Moderate flow. Clear water with slight tint		13	May-October
10/15/2018	0950	Middle Oconee	MO2			1300	1300			Moderate flow. 1' visibility. Turbid with brown tint		13	May-October
10/15/2018	1005	Kingswood Branch	KB1			3000	3000			Moderate flow. Clear water		13	May-October
10/15/2018	1020	Kingswood Branch	KB3			5000	5000			Moderate flow. Clear water with slight gray tint	No discernable flow.	13	May-October
10/15/2018	1025	McNutt Creek	MN2			230	230			Moderate flow. Clear water with slight brown tint		13	May-October
10/15/2018	1045	McNutt Creek	MN1			800	800			Moderate flow. Slightly turbid. Brown tint.		13	May-October
10/15/2018	1050	Middle Oconee	MO3			800	800			Moderate flow. 1' visibility. Turbid brown		13	May-October
10/15/2018	1115	Unnamed Tributary	UT1			1300	1300			Moderate flow. Clear water		13	May-October
10/15/2018	1130	Middle Oconee	MO4			500	500			Moderate flow. 1' visibility. Turbid brown		13	May-October
10/15/2018	1145	Oconee River	OC1			700	700			Moderate flow. 1' visibility. Turbid brown		13	May-October
10/15/2018	1145	Cedar Creek	CED1			230	230			Moderate flow. Clear water with slight tint		13	May-October
10/16/2018	0845	Brooklyn Creek	BR1			400	400			Moderate flow. Clear water	Heavy fresh sand deposits	13	May-October
10/16/2018	0845	Brooklyn Creek	BR1	Blank		500	#N/A			Moderate flow. Clear water	Heavy fresh sand deposits	13	May-October
10/16/2018	0900	Brooklyn Creek	BR2			1300	1300			Moderate flow. Clear water		13	May-October
10/16/2018	0900	Brooklyn Creek	BR2	Duplicate	<	20							

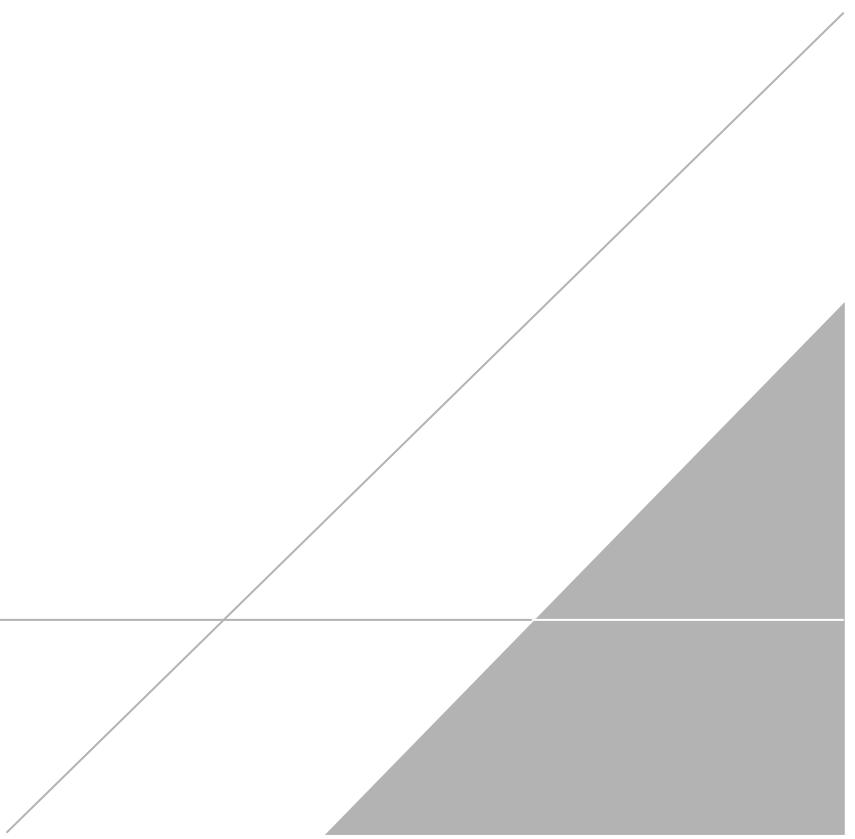
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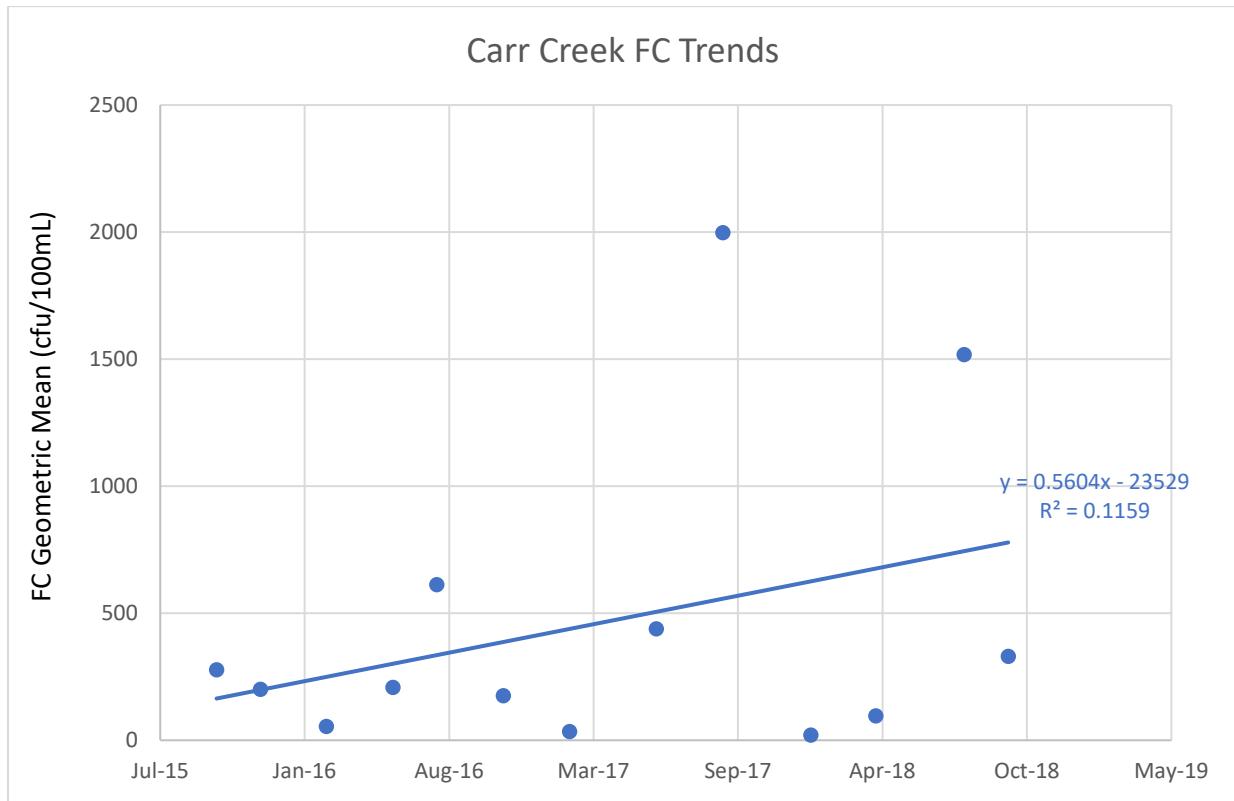
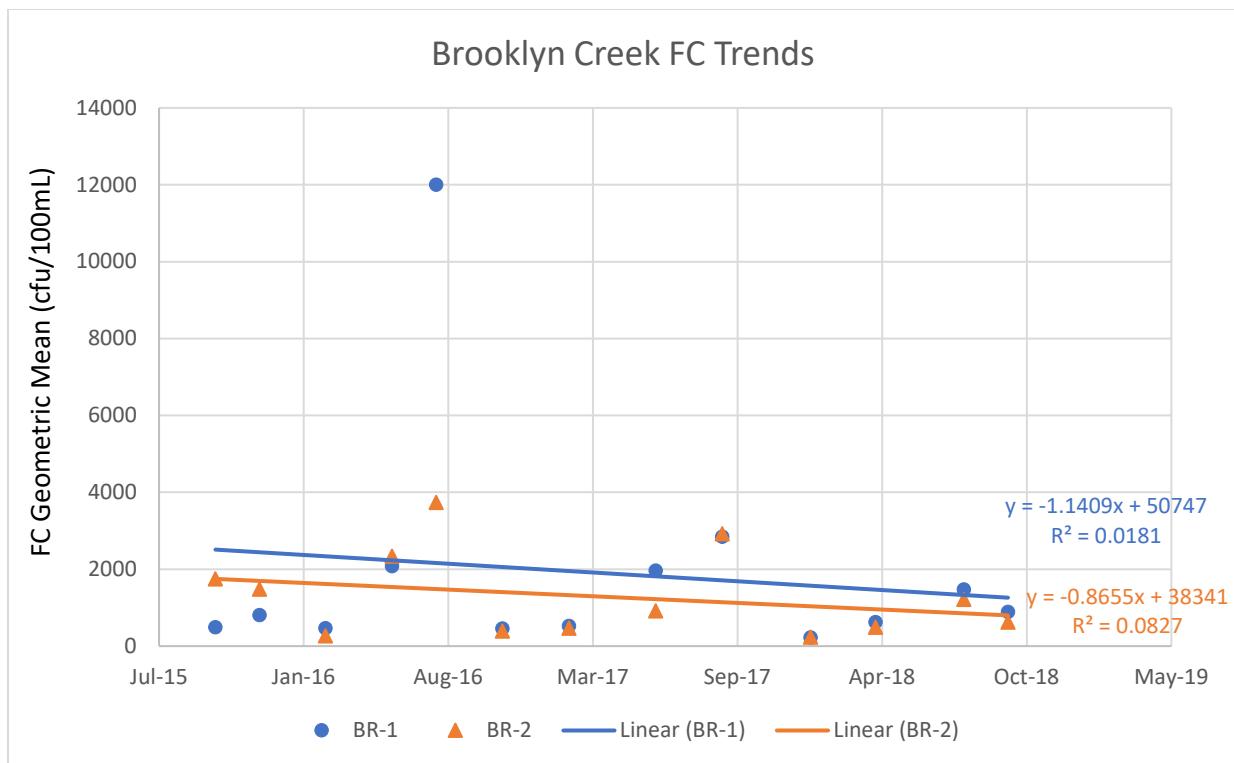
Date collected	Time collected	Stream	Station	Blank or duplicate	Less than or greater than	Reported value	Value for geomean	Relative percent difference (RPD)	Weather notes	Water notes	Other notes	Geomean number	Season
10/16/2018	1045	West Trail Creek	WTR1			800	800			Moderate flow. Turbid with green tint	Flow primarily in east barrel. West barrel now plugged with sand	13	May-October
10/16/2018	1100	Carr Creek	CA1			1700	1700			Moderate flow. Clear water.		13	May-October
10/16/2018	1110	North Oconee	NO3			300	300			Moderate flow. 2' visibility. Turbid with green/brown tint.		13	May-October
10/18/2018	0900	McNutt Creek	MN3			800	800		Clear, sunny.	Average flow. Slightly turbid. Visibility 1'		13	May-October
10/18/2018	0920	Middle Oconee	MO1			300	300		Clear, sunny.	Average flow. Turbid. Visibility <1'		13	May-October
10/18/2018	0945	Middle Oconee	MO2			170	170		Clear, sunny.	Average flow. Clear		13	May-October
10/18/2018	0945	Hunnicutt Creek	HC1			230	230		Clear, sunny.	Average flow. Turbid. Visibility <1'		13	May-October
10/18/2018	1000	Kingswood Branch	KB1			1300	1300		Clear, sunny.	Average flow. Clear		13	May-October
10/18/2018	1010	Kingswood Branch	KB3			800	800		Clear, sunny.	Average flow. Clear		13	May-October
10/18/2018	1020	McNutt Creek	MN2			130	130		Clear, sunny.	Average flow. Minimally turbid.		13	May-October
10/18/2018	1030	McNutt Creek	MN1			230	230		Clear, sunny.	Average flow. Slightly turbid. Visibility 1.5'		13	May-October
10/18/2018	1040	Middle Oconee	MO3			130	130		Clear, sunny.	Average flow. Turbid. Visibility <1'		13	May-October
10/18/2018	1105	Unnamed Tributary	UT1			600	600		Clear, sunny.	Average flow.		13	May-October
10/18/2018	1115	Middle Oconee	MO4			1100	1100		Clear, sunny.	Average flow.		13	May-October
10/18/2018	1130	Oconee River	OC1			500	500		Clear, sunny.	Average flow.		13	May-October
10/18/2018	1140	Cedar Creek	CED1	Duplicate		800	800		Clear, sunny.	Average flow.		13	May-October
10/18/2018	1140	Cedar Creek	CED1	Blank	<	500	#N/A	60	Clear, sunny.	Average flow.		13	May-October
10/22/2018	0855	Brooklyn Creek	BR1			9000	9000		Clear, sunny.	Moderate flow. Clear water		13	May-October
10/22/2018	0903	Brooklyn Creek	BR2			500	500			Moderate flow. Clear water		13	May-October
10/22/2018	0910	Tanyard Creek	TAN2			1300	1300			Moderate flow. Clear water		13	May-October
10/22/2018	0918	Tanyard Creek	TAN1			800	800			Moderate flow. Clear water downstream	Below culvert, no discernable flow in pool.	13	May-October
10/22/2018	0945	Trail Creek	TR3			3000	3000			Moderate flow. Slight green tint		13	May-October
10/22/2018	0950	North Oconee	NO2			130	130			Slow flow. Visibility 2'. Slight brown tint		13	May-October
10/22/2018	1000	Trail Creek	TR1			700	700			Moderate flow. Clear water with slight green tint.		13	May-October
10/22/2018	1000	Trail Creek	TR1	Blank	<	20	#N/A			Moderate flow. Clear water with slight green tint.		13	May-October
10/22/2018	1010	West Trail Creek	WTR2			230	230			Moderate flow. Clear water with slight green tint.		13	May-October
10/22/2018	1010	West Trail Creek	WTR2	Duplicate	<	170	#N/A	35.29411765		Moderate flow. Clear water with slight green tint.		13	May-October
10/22/2018	1020	East Trail Creek	ETR2			130	130			Moderate flow. Slightly turbid with brown tint.		13	May-October
10/22/2018	1030	East Trail Creek	ETR1			40	40			Slow flow. Clear water		13	May-October
10/22/2018	1040	West Trail Creek	WTR1			500	500			Moderate flow. Clear water with slight green tint.		13	May-October
10/22/2018	1118	Carr Creek	CA1			110	110			Moderate flow. Clear water.		13	May-October
10/22/2018	1130	North Oconee	NO3			70	70			Moderate flow. Visibility 30". Slight green tint		13	May-October
10/23/2018	0840	McNutt Creek	MN3			1700	1700		Clear	Average flow. Slightly turbid. Visibility 2'		13	May-October
10/23/2018	0900	Middle Oconee	MO1			500	500		Clear	Average flow. Turbid. Visibility <1'		13	May-October
10/23/2018	0920	Hunnicutt Creek	HC1			800	800		Clear	Average flow. Clear		13	May-October
10/23/2018	0920	Middle Oconee	MO2			230	230		Clear	Average flow. Turbid. Visibility <1'		13	May-October
10/23/2018	0945	Kingswood Branch	KB1			2200	2200		Clear	Average flow. Clear		13	May-October
10/23/2018	0955	Kingswood Branch	KB3			500	500		Clear	Average flow. Clear		13	May-October
10/23/2018	1005	McNutt Creek	MN2			230	230		Clear	Average flow. Clear		13	May-October
10/23/2018	1020	McNutt Creek	MN1			230	230		Clear	Average flow. Slightly turbid. Visibility 2'		13	May-October
10/23/2018	1020	McNutt Creek	MN1	Duplicate		230	#N/A	0	Clear	Average flow. Slightly turbid. Visibility 2'		13	May-October
10/23/2018	1035	Middle Oconee	MO3			110	110		Clear	Average flow. Slightly turbid. Visibility 1.5'		13	May-October
10/23/2018	1055	Unnamed Tributary	UT1			2200	2200		Clear	Average flow. Clear		13	May-October
10/23/2018	1110	Middle Oconee	MO4			230	230		Clear	Average flow. Turbid. Visibility 1'		13	May-October
10/23/2018	1125	Oconee River	OC1			110	110		Clear	Average flow. Turbid. Visibility 1'		13	May-October
10/23/2018	1140	Cedar Creek	CED1			1700	1700		Clear	Average flow. Clear		13	May-October
10/23/2018	1140	Cedar Creek	CED1	Blank	<	20	#N/A		Clear	Average flow. Clear		13	May-October
10/24/2018	0910	North Oconee	NO3			170	170		Clear	Average flow. Slightly turbid. Visibility 1.5'		13	May-October
10/24/2018	0925	Brooklyn Creek	BR2			800	800		Clear	Average flow. Clear		13	May-October
10/24/2018	0935	Brooklyn Creek	BR1			220	220		Clear	Average flow. Clear		13	May-October
10/24/2018	0945	Tanyard Creek	TAN2			800	800		Clear	Average flow. Clear		13	May-October
10/24/2018	0955	Tanyard Creek	TAN1			230	230		Clear	Average flow. Clear. Slight gray tinge		13	May-October
10/24/2018	0955	Tanyard Creek	TAN1	Duplicate		300	#N/A	23.33333333	Clear	Average flow. Clear. Slight gray tinge		13	May-October
10/24/2018	1015	West Trail Creek	WTR1			230	230		Clear	Average flow. Slightly turbid		13	May-October
10/24/2018	1025	East Trail Creek	ETR1			80	80		Clear	Average flow. Clear. Brown silt on bed.		13	May-October
10/24/2018	1040	East Trail Creek	ETR2			300	300		Clear	Average flow. Clear. Sandy bed.		13	May-October
10/24/2018	1050	West Trail Creek	WTR2			230	230		Clear	Average flow. Strong gray tinge.		13	May-October
10/24/2018	1100	Trail Creek	TR1			170	170		Clear	Average flow. Slightly turbid. Visibility 1.5'		13	May-October
10/24/2018	1105	Trail Creek	TR3			16000	16000		Clear	Average flow. Slightly turbid. Visibility 2'		13	May-October
10/24/2018	1110	North Oconee	NO2			500	500		Clear	Average flow. Very turbid. Visibility <1'		13	May-October
10/24/2018	1125	Carr Creek	CA1			210	210		Clear			13	May-October
10/24/2018	1125	Carr Creek	CA1	Blank	<	20	#N/A		Clear			13	May-October
10/29/2018	0915	McNutt Creek	MN3			210	210			Moderate flow. Clear water.		13	May-October
10/29/2018	0935	Middle Oconee	MO1			1300	1300			Moderate flow. Visibility 30". Slightly turbid brown.		13	May-October
10/29/2018	0955	Hunnicutt Creek	HC1			500	500			Moderate flow. Clear water.		13	May-October
10/29/2018	1000	Middle Oconee	MO2			1100	1100			Moderate flow. Slightly turbid brown.		13</td	

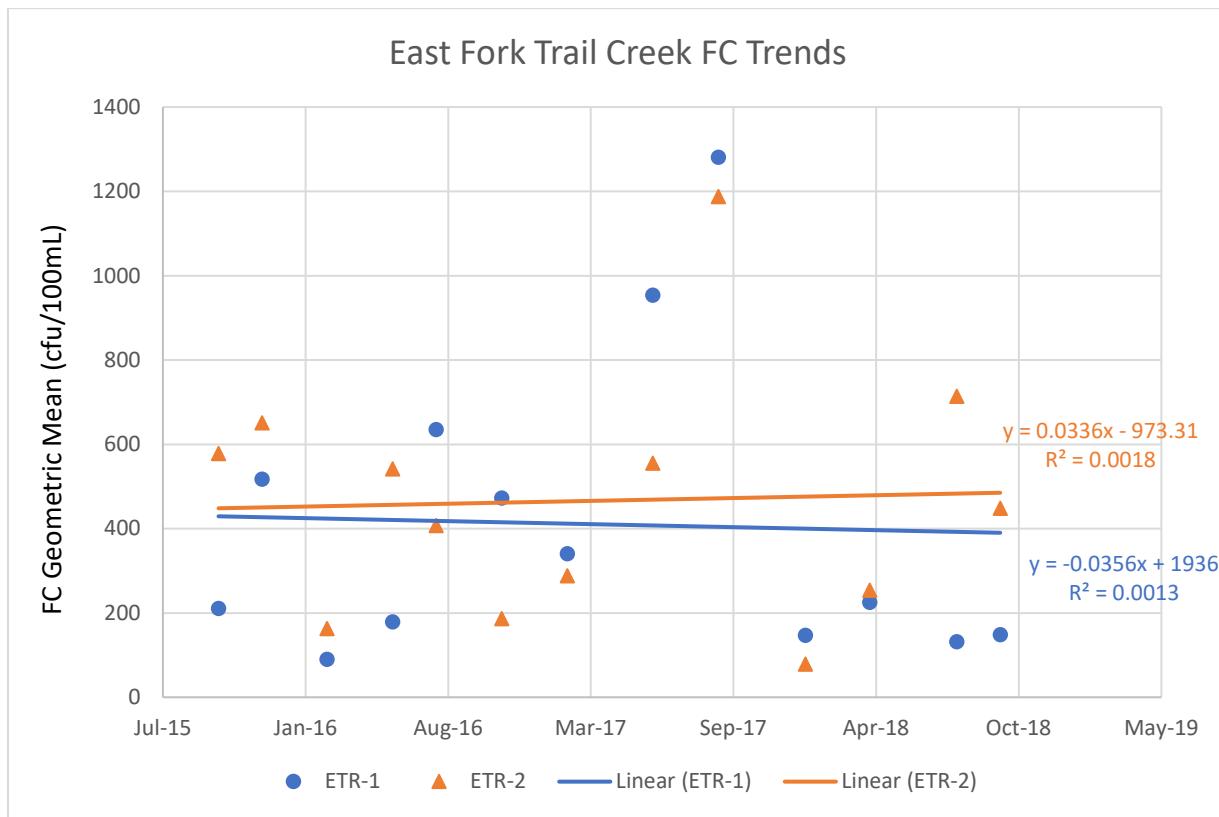
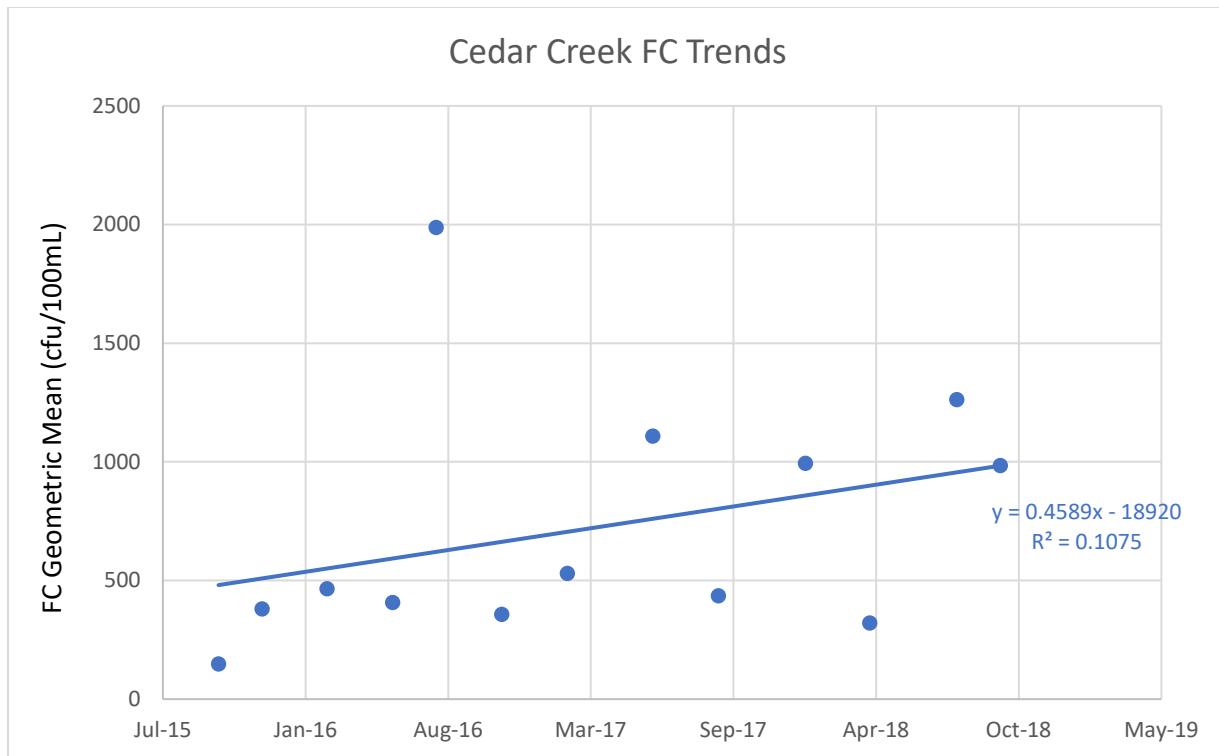
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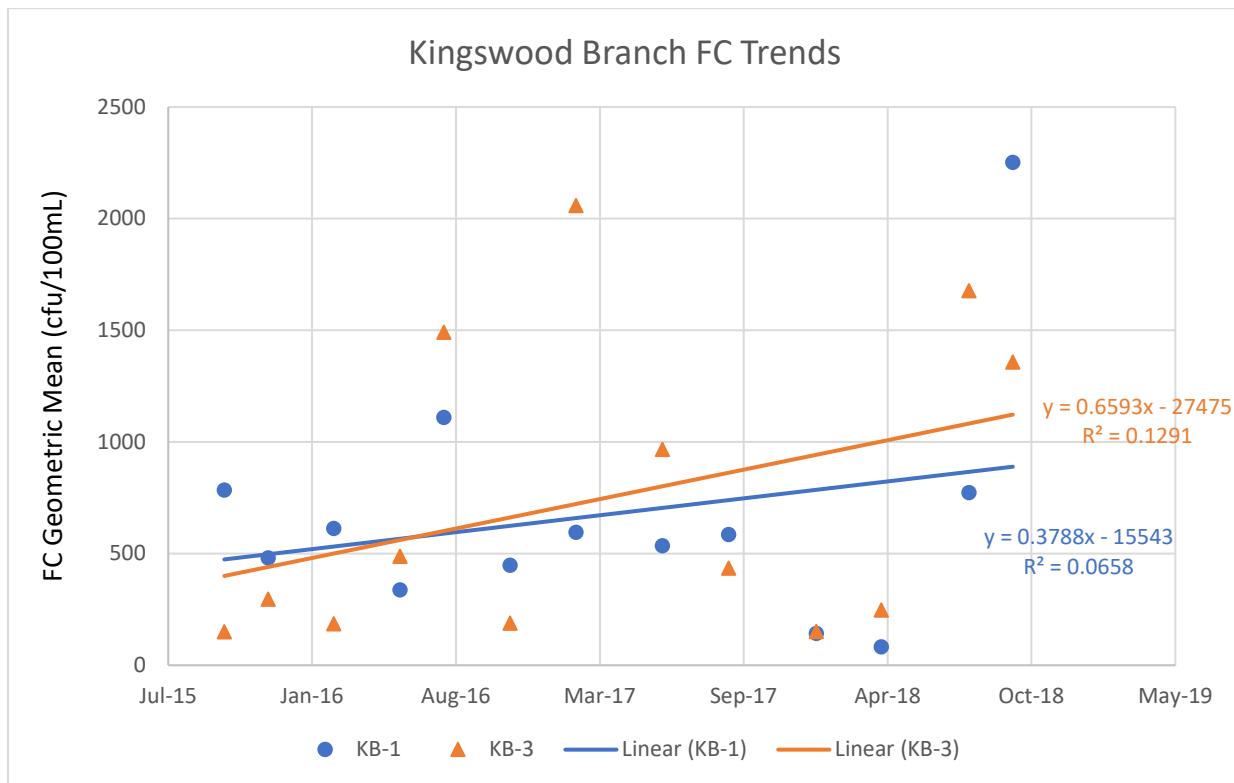
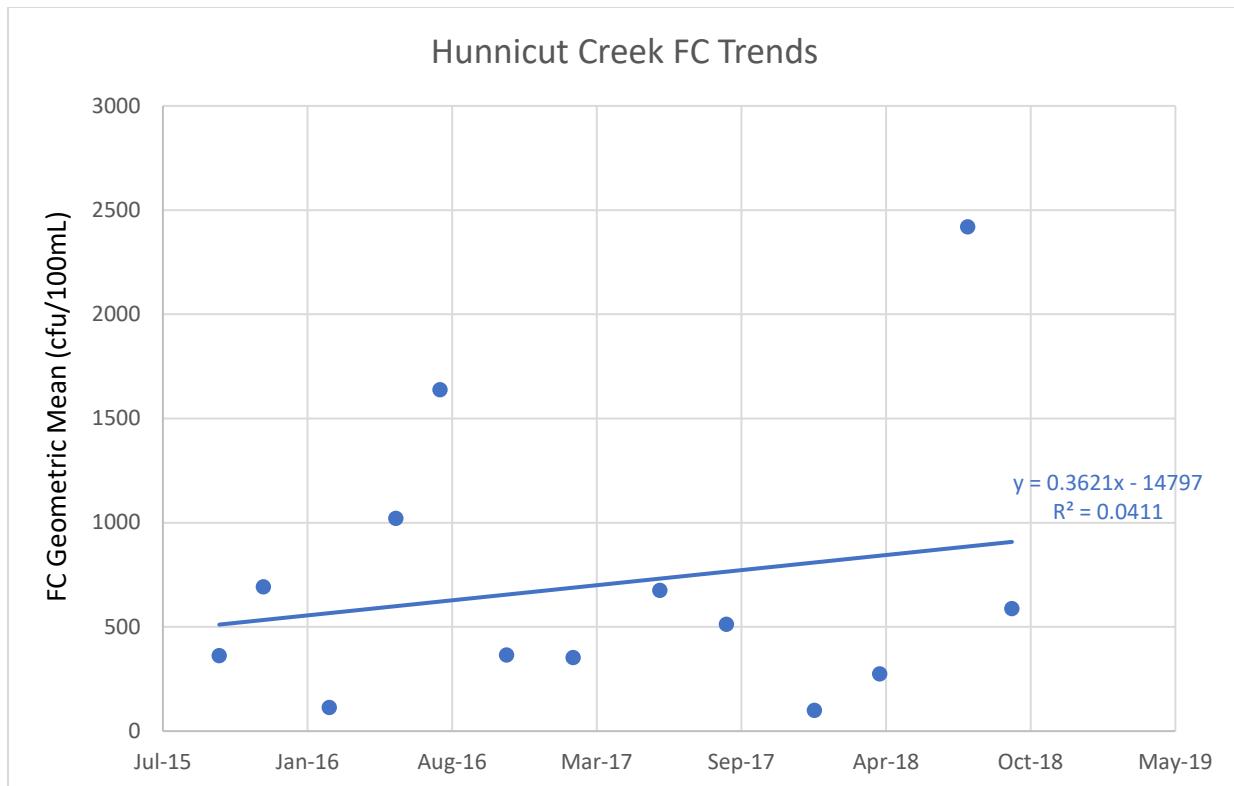
## APPENDIX B

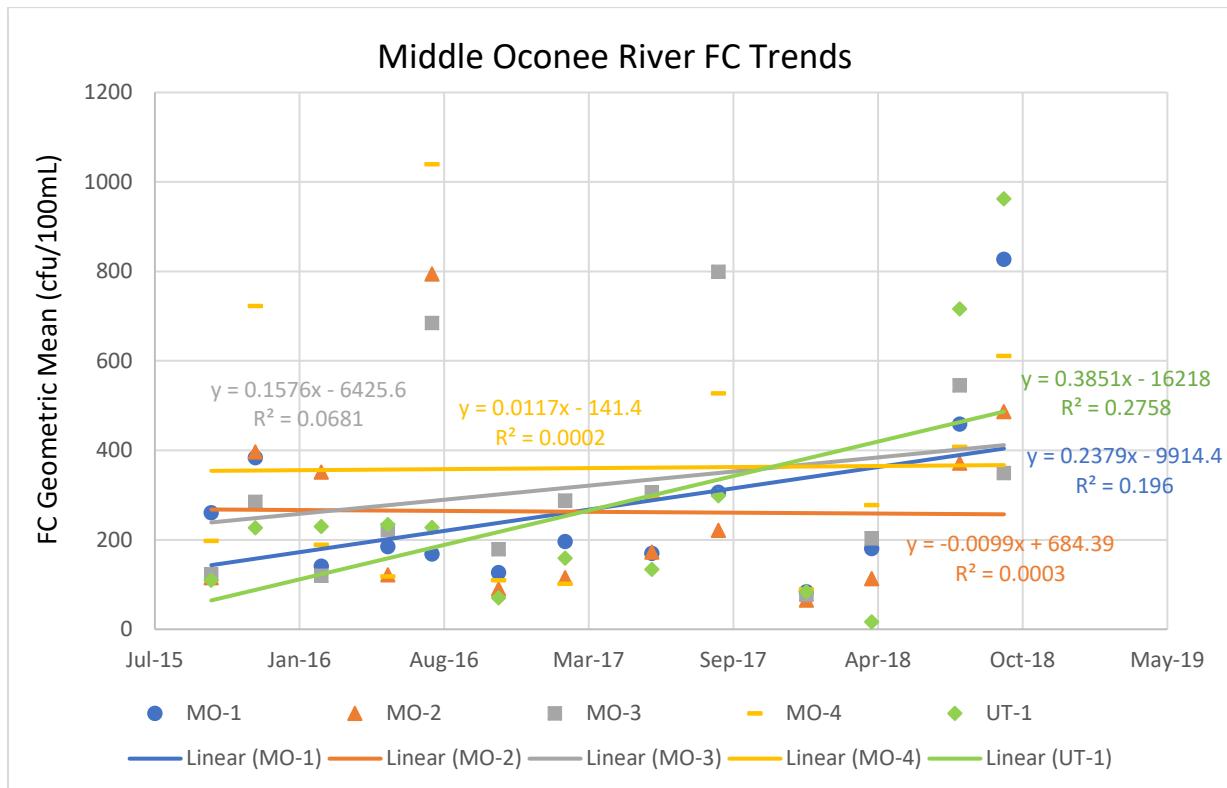
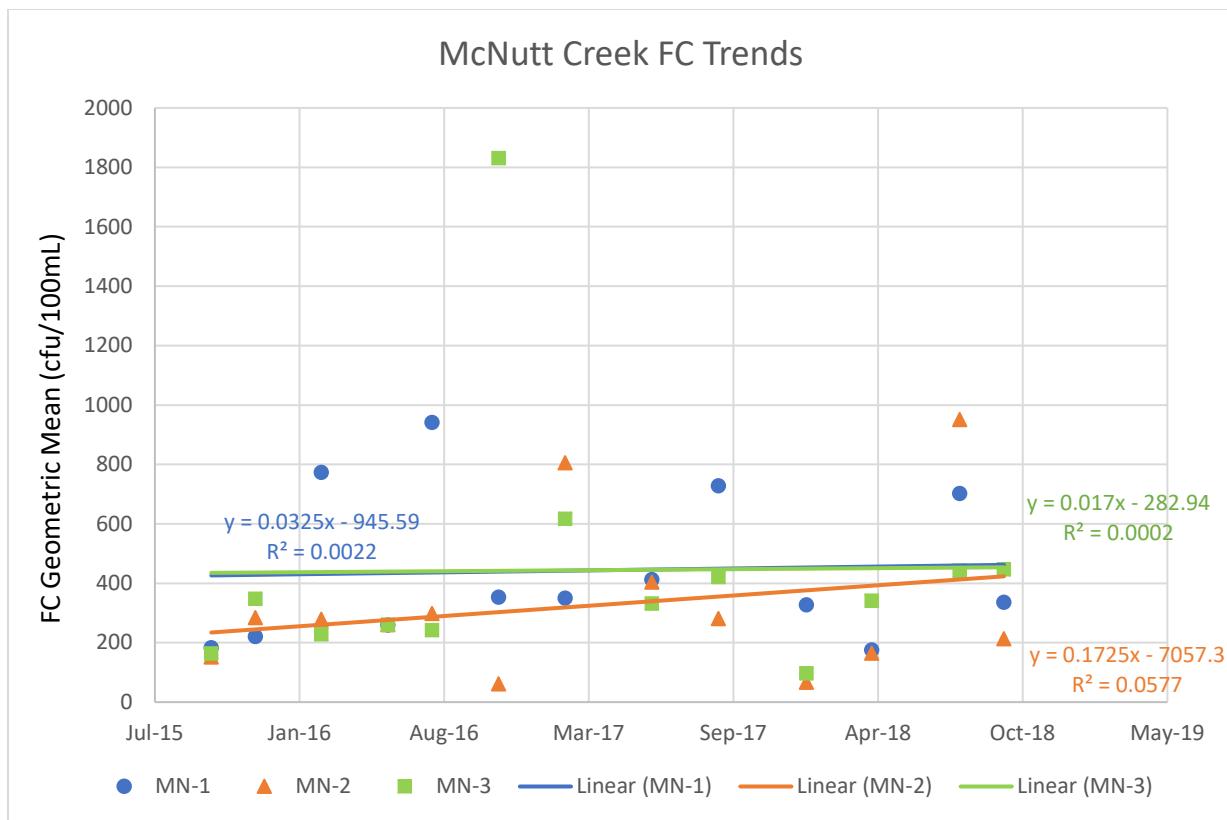
Water Quality Trends (October 2015 – October 2018)

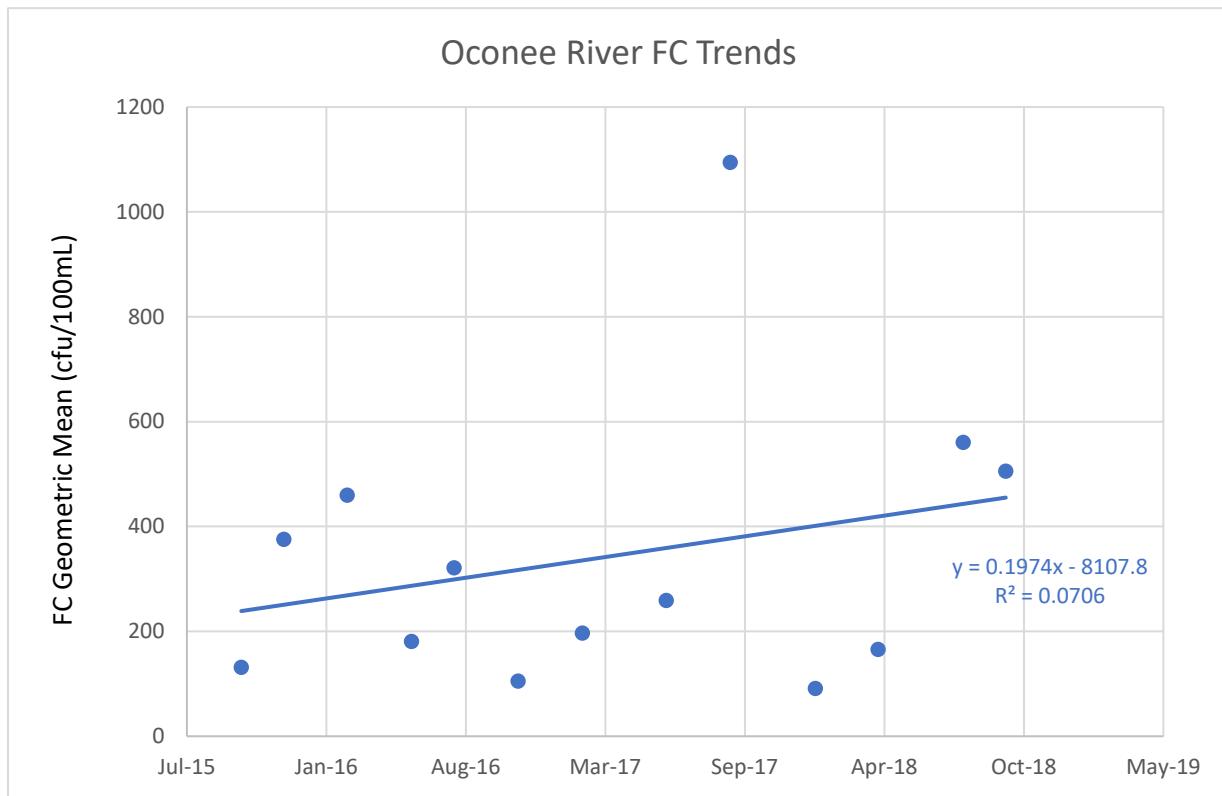
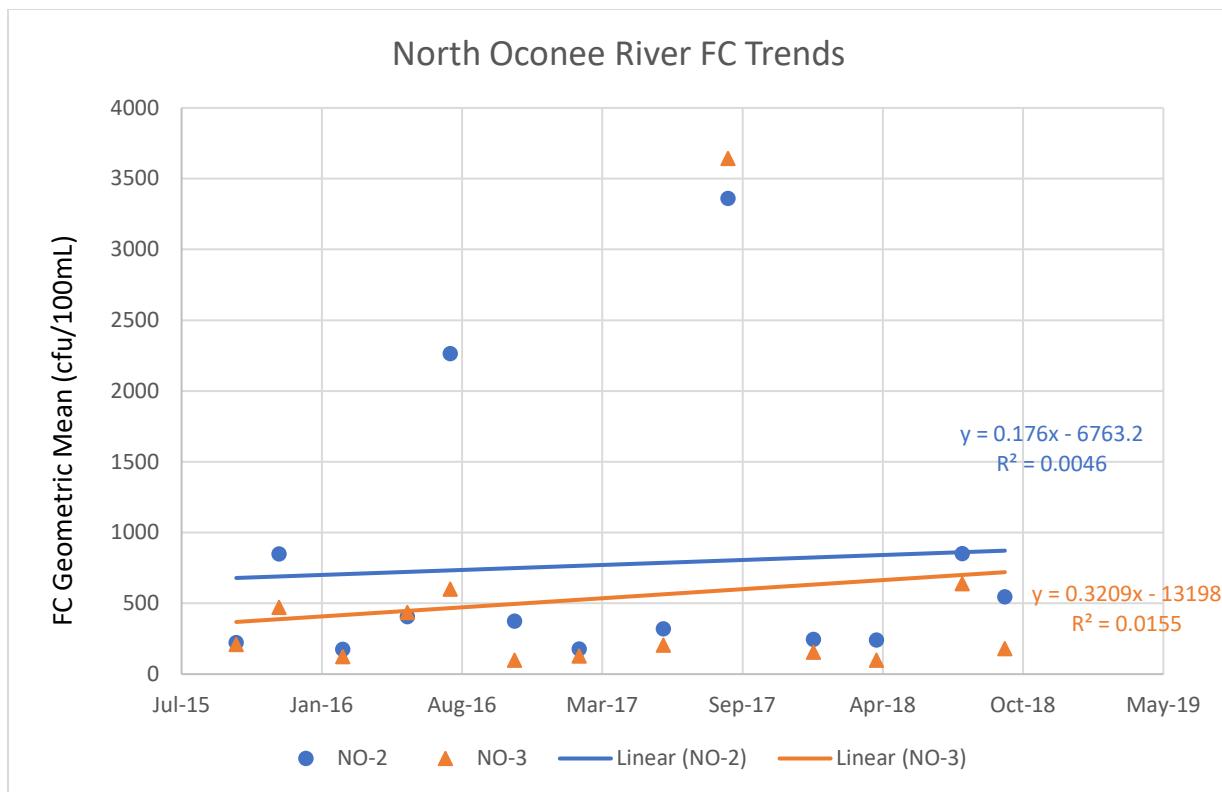


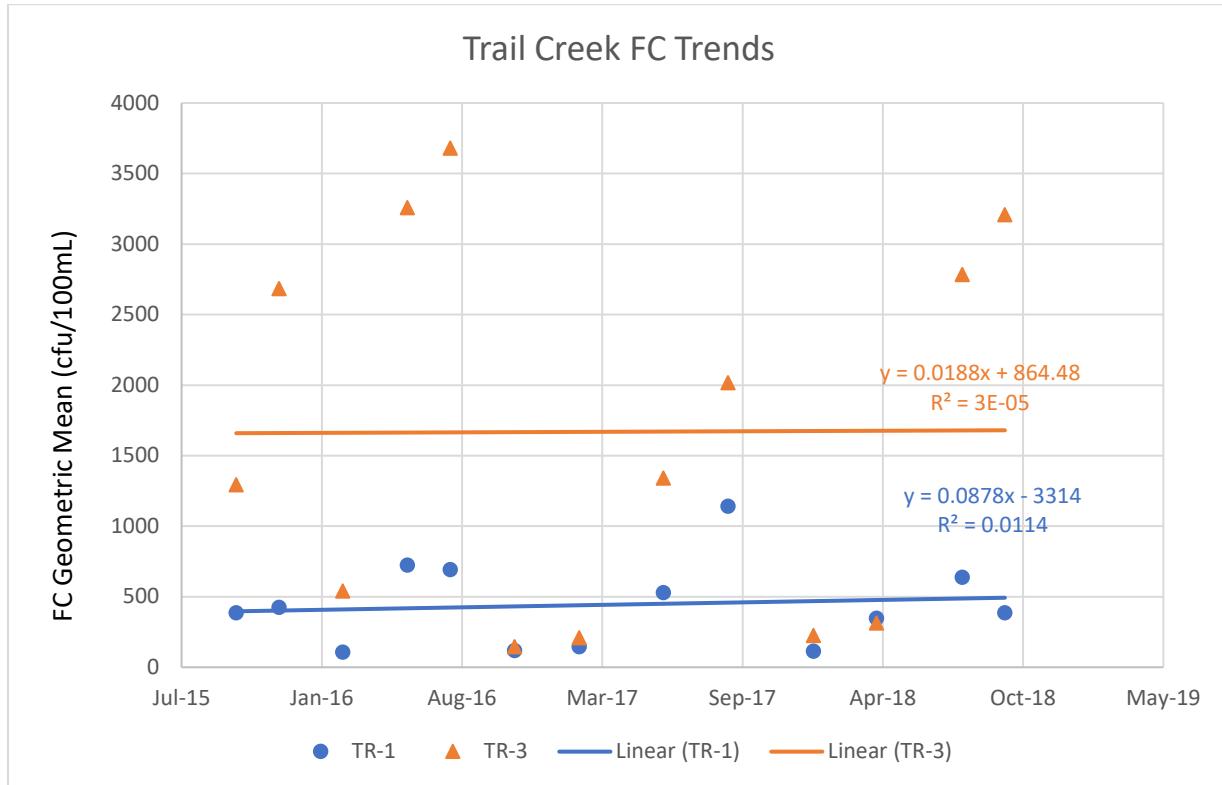
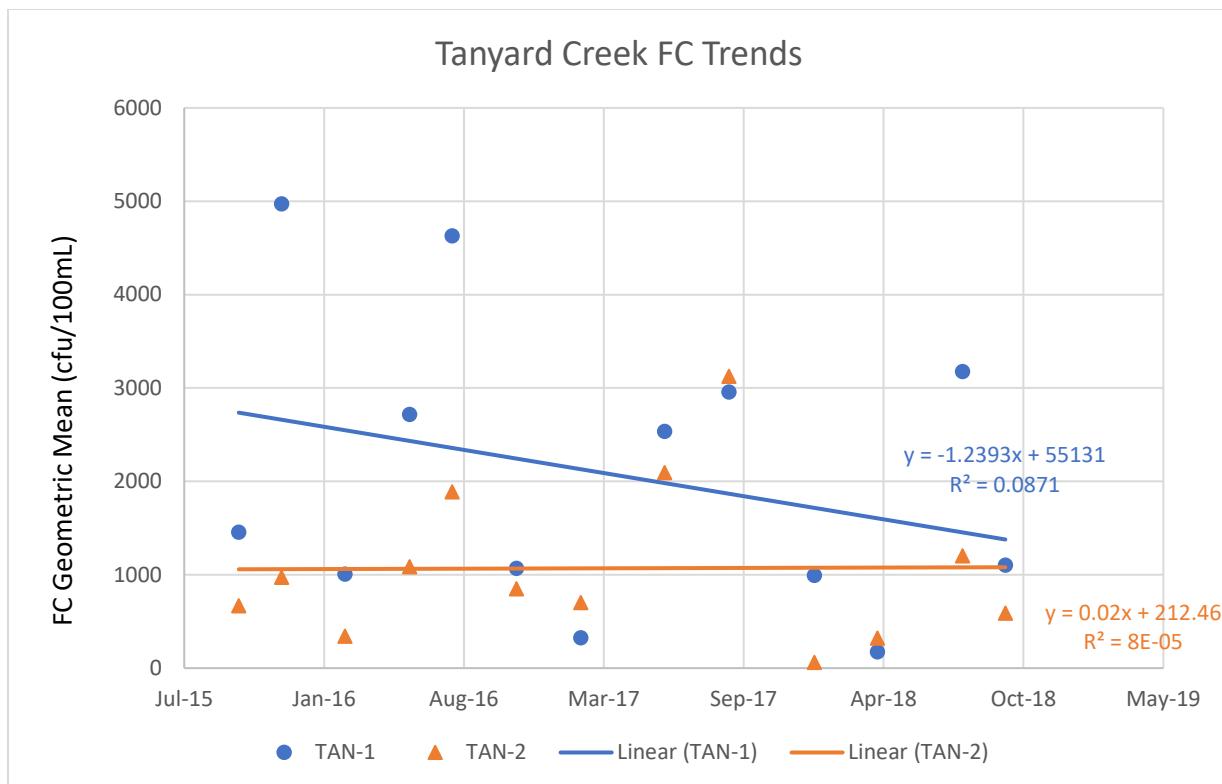


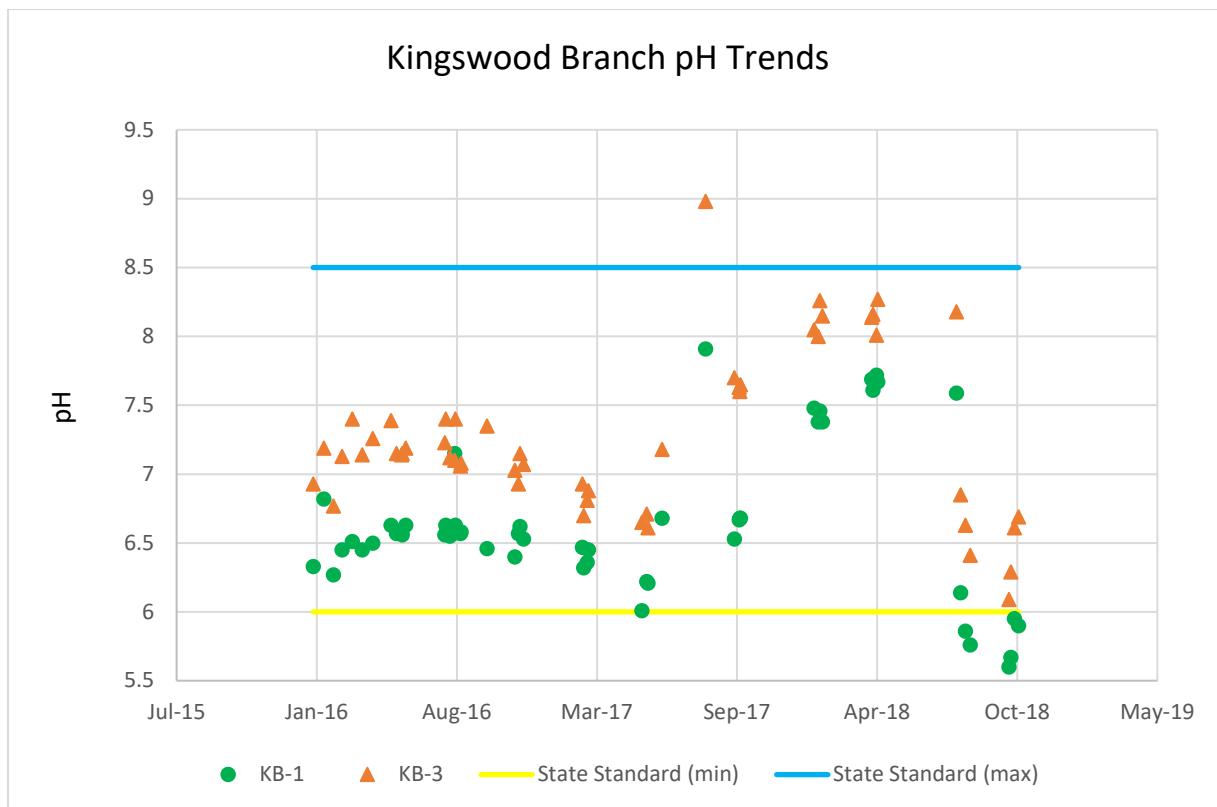
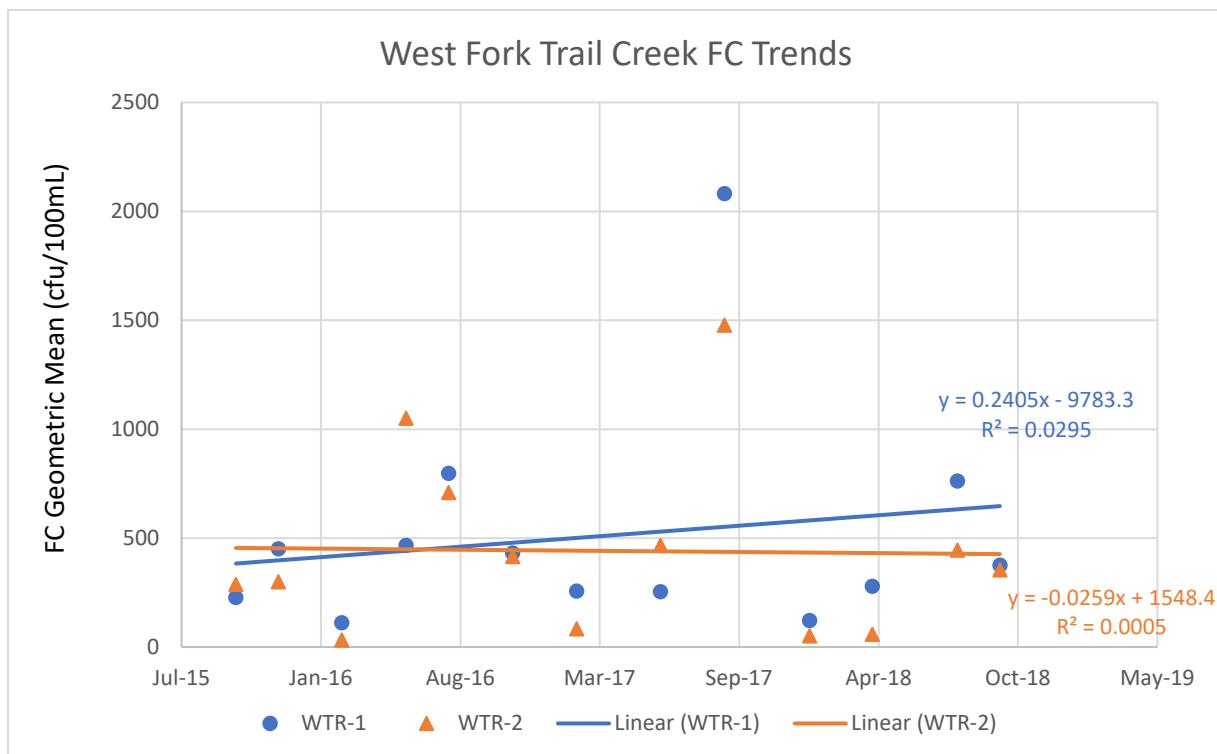


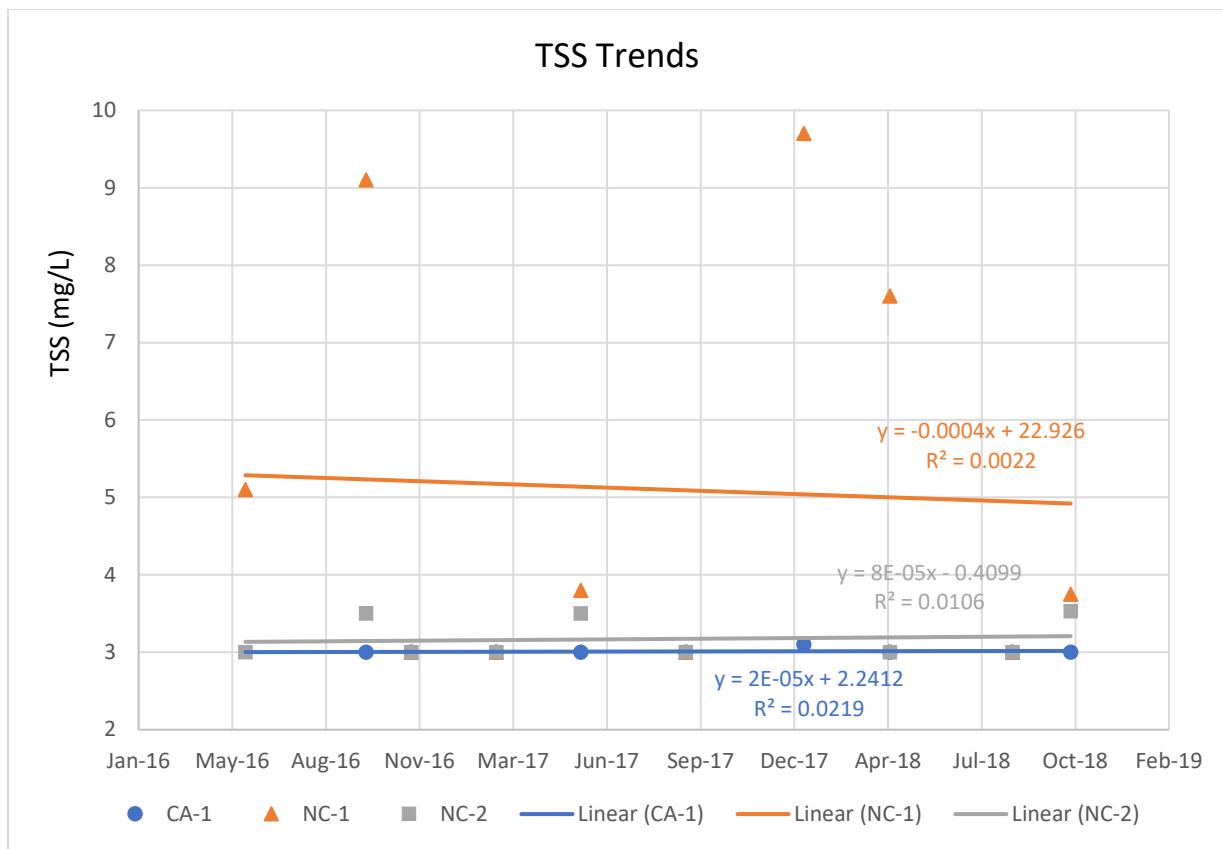












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