Impaired Waterbodies Water Quality Assessment
Monitoring and Implementation Work Plan
BACTERIA
Rocky Creek Augusta, Georgia

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act (CWA) requires Georgia Environmental Protection Division (GA EPD) to develop 305(b)/303(d) list of waters. The GA EPD develops this list for the State of Georgia rivers and streams in accordance with 40 CFR Part 130.7(b)(4) and guidance provided by the United States Environmental Protection Agency (U.S. EPA). The 2022 Section 303(d) list identified Rocky Creek in Richmond County as not supporting the designated use due to violation of Surface Water Quality Bacteria Criteria. The lower two-mile segment of Rocky Creek from SR56 to New Savannah Road (Doug Bernard Parkway) is listed for Fecal Coliform (FC) bacteria impairment identified as due to urban runoff.

The purpose of this work plan is to comply with the Augusta, GA Area wide National Pollutant Discharge Elimination System (NPDES), Municipal Separate Storm Sewer System (MS4) permit, and in general implement integrated management control measures to manage the identified pollutant(s) of concern to Maximum Extent Practicable (MEP).

INTRODUCTION

Augusta is located adjacent to the Savannah River in east central Georgia. It is bounded by Columbia County to the north and northwest; McDuffie County and Jefferson County to the southwest; Burke County to the south; and the Savannah River and South Carolina to the east (Figure 1). Augusta is approximately 150 miles east of Atlanta, Georgia and approximately 68 miles southwest of Columbia, South Carolina. The County encompasses approximately 324 square miles, almost 75 percent of which is serviced by Augusta. The majority of Augusta is located within the Upper Coastal Plain Physiographic Province. However, a small northern portion, which includes Rock Creek and Raes Creek, lies in the Piedmont Physiographic Province. The Coastal Plain is underlain by stratified and weakly unconsolidated marine sedimentary rock. Rocky Creek flows in an easterly direction from an elevation of 355 feet above MSL to an elevation of 155 feet above MSL. The creek flows through a highly urbanized area.

WATERSHED DESCRIPTION

The majority of the creek is south of Gordon Highway (U.S. 78) and north of Bobby Jones Expressway (I-520). Rocky creek has numerous small tributaries flowing into it, and eventually empties into Phinizy Swamp which is 1.2 miles downstream of Doug Bernard Pkwy. The creek drains approximately 11,024 acres (17.23 square miles) of Richmond County (Augusta, GA). The creek is 8.9 miles in length from its headwaters located north of Gordon Highway to its mouth at Phinizy Swamp. As stated earlier, the watershed is well developed, with a significant volume of existing residential and commercial facilities. This results in a high impervious percentage for the overall watershed. The majority of the soil in the watershed is either type A, B or C. The following are characteristics of each of the hydrologic soil groups as defined by the Natural Resource Conservation Service (NRCS).

> Type A – Sand, loamy sand or sandy loam type; Low runoff potential; Mostly sandy soils; high infiltration rate, deep, well to excessively drained sands or gravel and have a high rate of water transmission.

Type B – Silt loam or loam type; Moderately low runoff potential; Mostly sandy soils; less deep and less aggregated than Type A, but the group as a whole has above average infiltration after thorough wetting.

Type C – Sandy clay loam type; Moderately high runoff potential; Comprises shallow soils and soils containing considerable clay and colloids, though less than those of group D. The group has below average infiltration after saturation.

Rocky Creek watershed is well developed, with approximately 66% of the watershed in either residential or commercial development. Land use distribution (% of watershed) within the watershed is presented below (Augusta Watershed Assessment 2003):

Commercial/Industrial	37.2
Residential	36.3
Forests /Natural area	25.1
Agriculture	1.4
Wetlands/water	0.4

PROJECT OBJECTIVE

The purpose of this work plan is to comply with Augusta, GA Area wide National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. The objective of this plan is to monitor and reduce listed bacteria concentrations in designated section of the creek using integrated management control measures to Maximum Extent Practicable.

PROJECT MEASURE OF SUCCESS

Data gathered so far by the Phinizy Center for Water Sciences and Augusta, GA indicate that sediments are highly likely the primary driver for noted bacteria contamination and that sediment-borne bacteria could have contributed to the occasionally increased concentrations that lead to the listing of the creek's lower segment as "not supporting" its designated use (fishing). In addition, it is documented that dryfall and rainfall are other significant sources of such bacteria. As a result, it is nearly impossible to determine sources of listed bacteria from watersheds and to implement cost-effective Best Management Practices that would reduce listed bacteria loads from urban watersheds. The Measure of success for noted bacteria is managing the listed bacteria in the listed impaired segment at concentrations that will not result in further degradation of its water quality.

PROJECT CONTACT

Primary contacts for this Implementation Plan for Augusta GA is Augusta Engineering Department, Director Engineering or Associate Director. Current contact information is provided below:

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SCOPE OF WORK

The scope of work consists of conducting periodic water quality monitoring within the impaired segment of Rocky Creek. Georgia 2022 Section 303(d) list identified Rocky Creek in Richmond County as not supporting their designated use of "Fishing" due to violation of Surface Water Quality Bacteria Criteria. The lower two-mile segment of Rocky Creek from SR56 to New Savannah Road (Doug Bernard Parkway) is listed for Fecal Coliform (FC) bacteria impairment due to urban runoff.

a) Sampling Location

Sampling will be conducted at two locations (upstream and downstream one each) for E. Coli within Rocky Creek as shown on Figure 2 respectively. These locations are selected to coincide with other monitoring & restoration activities within this watershed. It is also based on the ability to assess the reach.

b) Sampling Methods

Manual grab surface water samples will be collected for E. Coli analysis. Samples will be taken in vicinity of stream center area and at a point that is safely accessible. Where possible, the sample will be collected directly into the sample container. If direct access to the stream is not possible or wadable, then supplemental sampling equipment (i.e., sampling rod with clean collection bucket) will be utilized. Samples will only be collected from flowing water.

Water quality sampling methods will conform to the EPA present approved Microbiological Methods for Ambient Water (40 CFR 136.3-Table IH). Augusta prefers to use IDEXX Colilert 18 methodology.

c) Sampling Frequency

Samples for E. Coli will be collected monthly at one location (Rocky @ Doug Bernard/Fig2). One sample will be collected each month. Augusta will initiate data trend evaluation during the third year. If trend assessment reveals minor or no variation in data trend then Augusta will reduce sampling frequently to quarterly sampling.

Due to changes in the in-stream water quality standards for bacteria sampling variance will be documented in case monthly representative samples collection within specified period is not feasible due to safety hazard conditions for the creek. Such variance will be reported in the Annual Report.

d) Sampling Parameters

Sampling collected during each event will be analyzed for the following parameters and methods:

i) E. Coli: EPA approved method for Ambient Water – IDEXX Colilert 18 method or alternate EPA approved method.

Samples analysis will be performed by Augusta Publicly Owned Treatment Works (POTW) Laboratory or Phinizy Center for Water Science Laboratory or other external certified laboratory. After collection, E. Coli samples will be delivered immediately to the laboratory by the field staff to maintain 8 hour holding time.

e) Documentation

Each sample will be labeled and sealed immediately after collection. Sample identification documents will be prepared so that identification and chain-of-custody records can be maintained. The following sample identification will be utilized.

i)Sample Label ii) Field Form iii) Chain-of-custody forms

f) Sampling Schedule

Sampling will commence in the summer period of 2024. The sampling schedule is established on a repeating annual basis. The MS4 reporting period ends in March of each year.

g) Sampling Duration and Data Reporting

Samples will be collected per schedule for a three-year period starting 2024. Monitoring data will be included in MS4 yearly report starting 2024-2025 Annual Report Submittal. Augusta will initiate data trend evaluation during the third year using first year data as baseline data for trend assessment. At a minimum data will be included in tabulated format.

STORMWATER QUALITY INTEGRATED CONTROL MEASURES

Augusta, Georgia has in-progress surface water quality management integrated control measures and is proposing to continue these practices. Relevant measures are listed below. Chosen control measures are based on assessment of current land use within the listed impaired drainage area. Gathered data suggest that noted fecal coliform presence is associated to non-human source, most likely sediment and tropospheric pollution. Augusta, GA will review the following listed control measures and make adjustments / improvement on as needed basis or location specific basis.

I) Natural Resources Management – Natural Resources Conservation, Erosion & Sedimentation outreach Events (Workshop / Training)

In association with Brier Creek Soil and Water Conservation District and the Georgia Soil and Water Conservation Commission, an Erosion &Sediment (E&S) Control Workshop will be conducted to provide information on latest changes for E&S Control in Georgia and the checklists. Various best management practices including skimmers will also be discussed. Augusta, GA will continue such educational activities.

II) Natural Resource Management – Protection of local natural resources by enforcement of land development ordinances such as Erosion, Sedimentation and Pollution Control Plan compliance, encourage incorporation of low impact development / green infrastructure measures in overall land development practices, and watershed protection through management of various intensity storms. Augusta, GA will continue all in-progress control measures.

III) Augusta has an ongoing aging sanitary sewer replacement program. The program provides additional capacity and reduces Inflow and Infiltration. Recently Augusta has also developed a Sanitary Sewer Connection Program, which the Augusta Utilities Department connects costumers to the sewer main and demolishes their septic tank. Augusta will continue these efforts. Augusta, GA will review these control measures and make adjustments / improvement on as needed basis or location specific basis.

PROJECT DATA EVALUTION AND REPORTING

Described under above listed section “Scope of Work (g)”.

STORMWATER INTEGRATED MANAMEGEMENT PLAN PERFORMANCE MEASURE

Measure of success for listed bacteria is managing E. coli bacteria in listed impaired segment at concentrations that will not result in further degradation of its water quality. Targeted threshold is not to exceed geometric mean of 126 count/100ml for months of May through October and 265 count/100ml for months of November through April, and 406 counts/100ml for single sample for months of May through October and 861 count/100ml for months of November through April. In case of significant upward trend in noted values, Augusta will re-evaluate adopted control measures or stream natural conditions and propose modifications accordingly.

Natural Water Quality of listed segment may not be within the specific requirements contained herein (such as Bacteria criteria for non-human sources). Such circumstances do not constitute violation of water quality standards. The Best Management Practices will be the primary mechanism for ensuring that MS4 discharges will not create a harmful situation.

Augusta has done extensive research on fecal and E. coli bacteria in Augusta-Richmond County watersheds. In addition to proving E. coli survives and thrives in stream sediments, we also sampled water running off road, bridge, and other paved surfaces as well as ponded water in parking lots, tree holes, downdrains, and many other sites; we found that E. coli concentrations, more times than not, exceeded the USEPA standard and often exceeded the Colilert-18 maximum concentration. These results are typical and there is much research to support these findings (See a list of example papers below). If high loads of E. coli occur in runoff from watershed surfaces, then differentiation of this source from actual problem areas is itself problematic. The EPA determined that loads of coliform bacteria in urban runoff generally exceed the listed criteria and suggested that fecal coliform bacteria may not be a suitable indicator for identifying potential health risks in stormwater runoff.

Finally, the viability of E. coli outside the gut has been questioned for years and within both freshwater and saltwater. For example, Stephenson and Rychert (G. R. *Stephenson* and R. C. *Rychert*, "Bottom Sediment A Reservoir of Escherichia coli in Rangeland Streams," Journal of Range Manage, Vol. 35, No. 1, *1982*) found E. coli concentrations 2 to 760 times higher in the sediment than the overlying water in a rangeland stream and that survivability was high. Gerba and McLeod (*Gerba*, C.P. and *McLeod*, J.S. (*1976*) Effect of sediments on the survival of Escherichia coli in marine waters. Appl Environ Microbiol. 32, 114-120) found that E. coli could survive for longer periods in unsterilized sea water with sediment than in unsterilized seawater without sediment; they attributed longer survivability to organic matter content of the sediment. While these are somewhat "dated" examples, they were seminal articles in making the case that fecal bacteria survive just fine in sediments; there are hundreds if not thousands of similar articles that discuss survivability of these bacteria in the environment.

This leads to the final question of regulation of these bacteria in creeks. How can these bacteria effectively be used as indicators if they exist on road surfaces, creek sediments and even clouds (DeLeon-Rodriguez, Natasha, et al. "Microbiome of the upper troposphere: Species composition and prevalence, effects of tropical storms, and atmospheric implications." *Proceedings of the National Academy of Sciences*110.7 (2013): 2575-2580)?

Selected list of papers that support dryfall and rainfall as significant source of E. Coli.

1) DeLeon-Rodriguez, Natasha, et al. "Microbiome of the upper troposphere: species composition and prevalence, effects of tropical storms, and atmospheric implications." *Proceedings of the National Academy of Sciences* 110.7 (2013): 2575-2580.
2) Chubaka, Chirhakarhula Emmanuel, et al. "Microbiological values of rainwater harvested in Adelaide." *Pathogens* 7.1 (2018): 21.
3) Denissen, Julia K., et al. "Human pathogenic bacteria detected in rainwater: risk assessment and correlation to microbial source tracking markers and traditional indicators." *Frontiers in microbiology* 12 (2021): 659784.
4) Ahmed, Warish, Jatinder PS Sidhu, and Simon Toze. "An attempt to identify the likely sources of Escherichia coli harboring toxin genes in rainwater tanks." *Environmental Science & Technology* 46.9 (2012): 5193-5197.
5) Sánchez, A. S., E. Cohim, and R. A. Kalid. "A review on physicochemical and microbiological contamination of roof-harvested rainwater in urban areas." *Sustainability of Water Quality and Ecology* 6 (2015): 119-137.

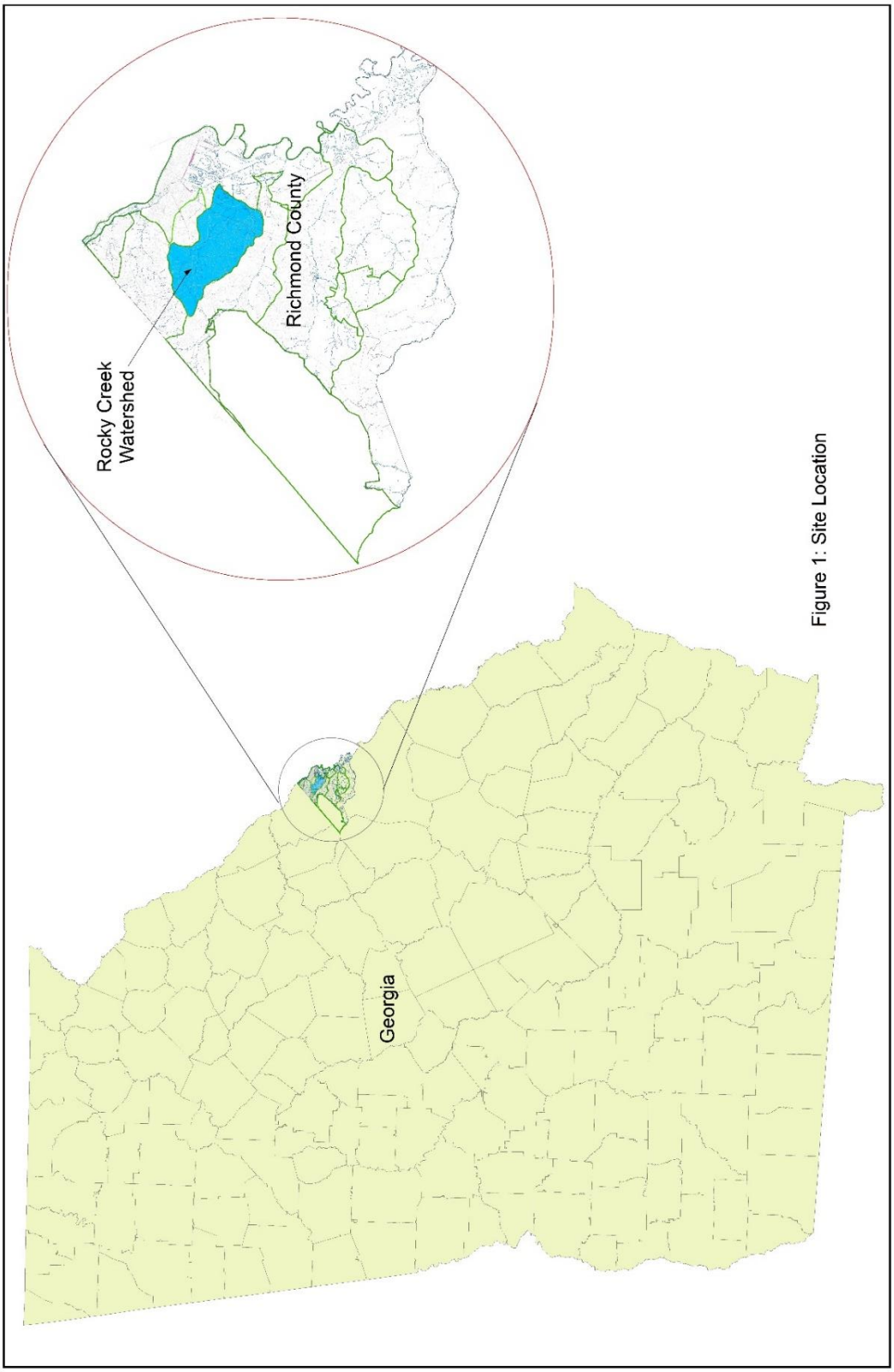

Figure1 – Rocky Watershed Location

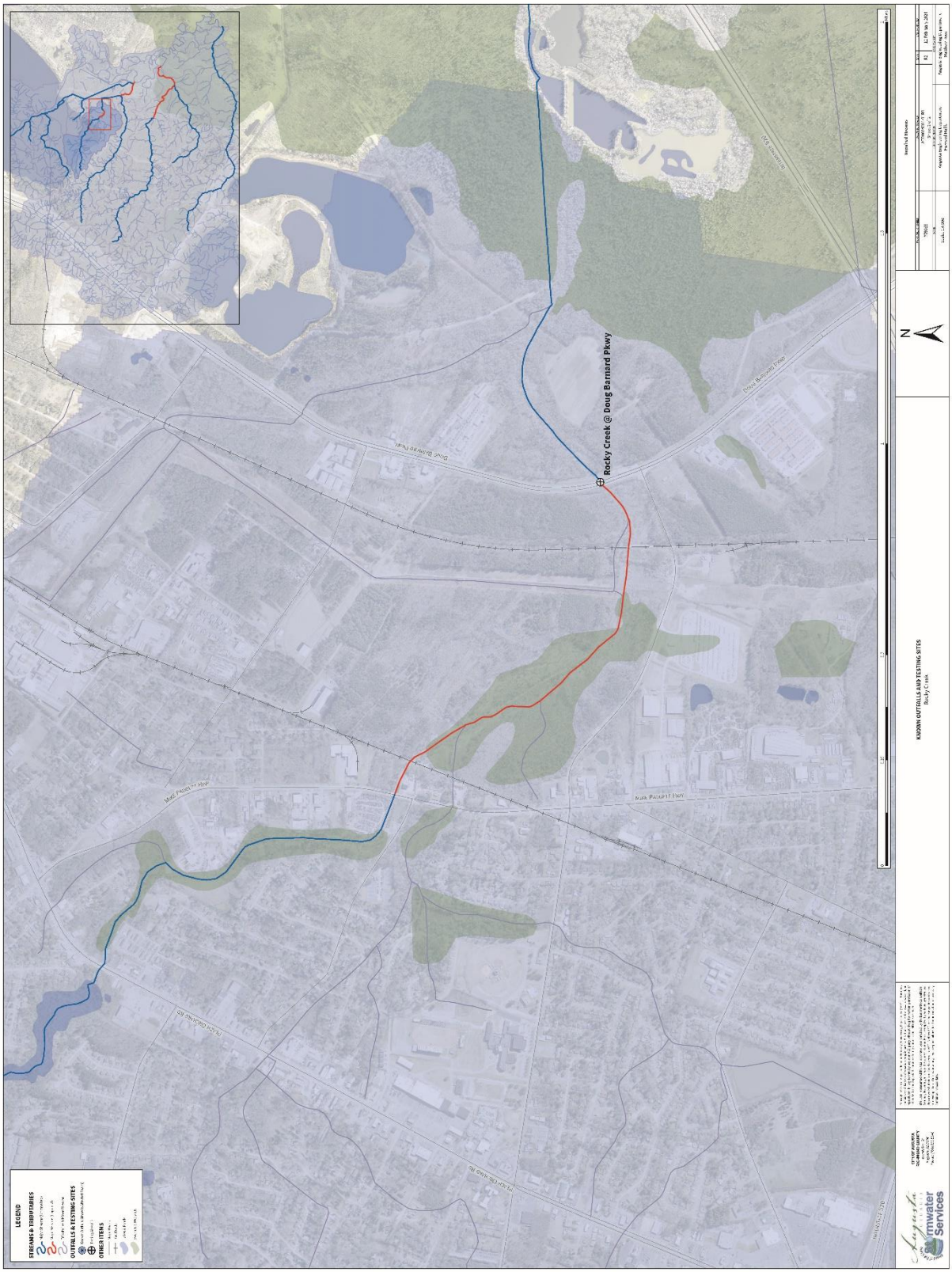

Figure2 – Sampling Location
(No MS4 outfall at Rocky Creek listed segment)