Impaired Waterbodies Water Quality Assessment
Monitoring and Implementation Work Plan
BACTERIA
Butler 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 Butler Creek in Richmond County as not supporting the designated use due to violation of Surface Water Quality Bacteria Criteria. The roughly three-mile reach of Lower Butler Creek from its intersection with Phinizy Ditch to Savannah River is listed for Fecal Coliform (FC) bacteria impairment identified as due to nonpoint source & urban runoff. This reach flows through emergent wetlands or forested wetlands with significant riparian vegetation and wildlife. There is no residential or agriculture land use in this subwatershed. Primary land use is grass-covered and open fields frequently used by wildlife; such as muskrats, river otter, coyote, deer, opossum, raccoons, bobcat, waterfowl, reptiles and amphibians.

The listed reach qualifies for delisting per EPD 2018 document "Nine-Element Watershed Management Plan for the Augusta Canal, Butler Creek, Beaverdam Ditch Watershed in Savannah River". It is stated in this document that "Based upon these data, a course of action will be taken to remove the fecal coliform impairment from this lower section of Butler Creek relative to the 500 cfu/100 cfu water quality standard". In addition, data collected by Augusta, GA from March 2020 through December 2023 support listed impaired segment meeting applicable water quality standards and qualifies for delisting from 303d listing of impaired segments. [see attached Exhibit A]

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. 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. Butler Creek flows in southeasterly direction into Phinizy Swamp from an elevation of 340 feet above MSL to an elevation of 110 feet above MSL. The creek flows through forested wetlands with significant, intact riparian vegetation.

WATERSHED DESCRIPTION

The Upper Butler Creek watershed, above the confluence of Butler Creek with Phinizy Ditch, is dominated by low-density urban land use. However, significant portions of riparian areas are vegetated in wetlands or conservation easements forming portions of a 12-mile riparian greenway. The riparian corridor above the Phinizy Ditch confluence also provides connectivity for the movement of wildlife through the WMA and Phinizy Nature Park.

The Lower Butler Creek, from its intersection with Phinizy Ditch to the Savannah, flows through emergent wetlands or forested wetlands with significant, intact riparian vegetation. A primary stream channel carries the majority of flow only during extended dry periods; flow is frequently carried through small distributaries or across flooded wetlands.

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.

Lower Butler Creek watershed is less developed with land use approximately 17% urban, 19% forest, 13% agriculture, 48% wetland.

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 Augusta, GA and Phinizy Center for Water Sciences and Augusta, GA indicate that non-human source is highly likely the primary driver for noted bacteria contamination in listed reach and that non-human bacteria could have contributed to the noted occasionally increased concentrations that lead to the listing of the creek lower segment “not supporting” its designated use (fishing). In addition, Augusta, GA monitored FC on Butler Creek at the Doug Barnard Parkway Bridge a short distance above the confluence with Phinizy Ditch, and at the Phinizy Nature Park located below the Phinizy Ditch confluence. Monthly geometric mean FC concentrations over the extended period (several years) show no exceedances of the applicable FC criterion for the October-March of 1000 cfu/100ml, or the April-September criterion of 500 cfu/100ml where non-human sources such as wildlife are significant (Attached Exhibit A).

It is nearly impossible to determine sources of listed bacteria from watersheds as well as to implement cost-effective Best Management Practices that would reduce listed bacteria loads from this subwatershed. 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 Butler Creek. Georgia 2022 Section 303(d) list identified Lower Segment of Butler Creek in Richmond County as not supporting their designated use of "Fishing" due to violation of Surface Water Quality Bacteria Criteria. The roughly three-mile reach of Lower Butler Creek from its intersection with Phinizy Ditch to Savannah River is listed for Fecal Coliform (FC) bacteria impairment identified as due to nonpoint source & urban runoff.

a) Sampling Location

Sampling will be conducted at one location (at Phinizy Nature Park Bridge) for E. Coli within lower Butler Creek reach as shown on Figure 1. This location is selected based on the ability to assess the reach safely. Listed reach is not safely accessible and sampling poses significant human safety risk to staff conducting sampling. Listed reach is within swamp area and refuge for various wildlife including alligators.

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 (Phinizy Nature Park Bridge). One sample will be collected each month. There is no discharge from Augusta MS4 system within this lower Butler Creek watershed and sampling frequency is representation of MS4 impact on listed reach.

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 (over duration of Augusta MS4 Permit reissued in 2022). 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.

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 IDEXX 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.
6) Nine-Element Watershed Management Plan for the Augusta Canal (HUC-12 #030601060601), Butler Creek (HUC-12 #030601060602) and Beaverdam Ditch (HUC-12 #030601060607) Watershed in Savannah River Basin. Augusta-Richmond County, Columbia County, Environmental Protection Division of the Department of Natural Resources, State of Georgia. July 2018

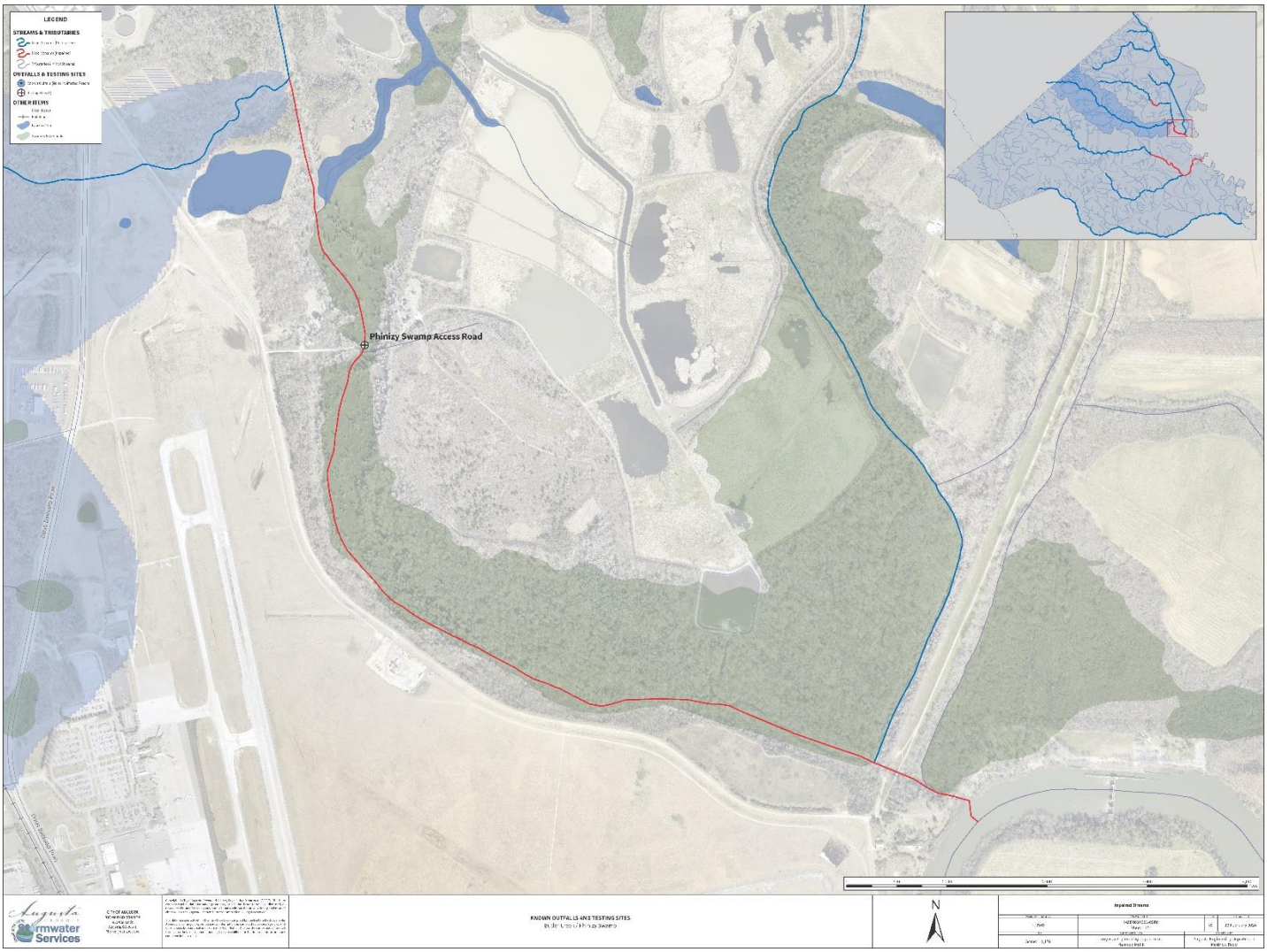

Fig1: Sampling Location
(No MS4 outfall at Butler Creek listed segment)

EXHIBIT A

Butler Creek fecal coliform cfu/100 ml geometric means by month		
Month Year	**Butler Creek at D. Barnard Parkway Bridge**	**Butler Creek at Phinizy Nature Park Bridge**
March 2012	106	79
June 2012	125	87
September 2012	21	52
December 2012	140	26
March 2013	33	14
June 2013	247	162
September 2013	82	30
December 2013	41	53
March 2014	51	22
June 2014	103	66
September 2014	201	98
December 2014	78	61
March 2015	32	26
June 2015	75	87
September 2015	129	168
December 2015	272	251
March 2016	41	56
June 2017	166	152
September 2017	116	158
December 2017	149	92
Source: Augusta Engineering Department		

Sample Date	Weather Event Type	Recreational Standard	SNSA	DB Pkwy	
12/1/22	Wet	1,000	290	260	
12/13/22	Dry	1,000	73	55	
12/20/22	Wet	1,000	36	55	
12/22/22	Wet	1,000	102	184	
Dec. 2022 Geometric Means			94	110	
3/7/23	Dry	1,000	115	147	
3/14/23	Wet	1,000	105	65	
3/21/23	Dry	1,000	45	85	
3/28/23	Wet	1,000	600	>700	
March 2023 Geometric Means			134	93	
6/6/23	Dry	500	56	90	
6/13/23	Wet	500	220	167	
6/20/23	Wet	500	80	244	
6/28/23	Dry	500	227	187	
June 2023 Geometric Means			122	162	
9/7/23	Dry	500	233	173	
9/12/23	Wet	500	460	480	
9/19/23	Wet	500	300	240	
9/26/23	Wet	500	80	92	
Sept. 2023 Geometric Means			225	207	
12/5/23	Wet	265	196	115	E. Coli
12/7/23	Dry	265	172	199	E. Coli
12/12/23	Wet	265	261	191	E. Coli
12/14/23	Dry	265	96	66	
Dec. 2023 Geometric Means			170	130	E. Coli