LIMESTONE VALLEY
RESOURCE CONSERVATION
& DEVELOPMENT COUNCIL

Chattanooga Creek

WATERSHED MANAGEMENT PLAN

Prepared by:

HAWKS
ENVIRONMENTAL

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Executive Summary

The Chattanooga Creek Watershed Management Plan (WMP) has been developed following the United State Environmental Protection Agency (USEPA) Nine Elements of Watershed Planning framework. The intent of this plan is to address water quality issues caused by nonpoint source pollution. The WMP focuses on the Georgia side of the watershed. The plan incorporates historical watershed data and builds upon planning activities completed in the past 10 years for Chattanooga Creek and Walker County. The WMP also contains updated information including watershed characterization, pollutants and stream impairment status, current management measures, proposed management measures and best management practices (BMPs), funding sources including Section 319(h) grants, 10-year milestone and implementation schedule, and BMP monitoring. Limestone Valley Resource Conservation and Development Council (LVRCD) partnered with Walker County to develop this plan with intent to pursue additional funding for the implementation of the plan. The long-term goal of implementing this plan is to improve water quality and habitat with a focus on delisting impaired stream segments.

Introduction

The purpose of this WMP is to characterize Chattanooga Creek and its tributaries and identify actionable as well as appropriate measures to improve the water quality and habitat in this important watershed. Chattanooga Creek originates in Georgia and flows into Tennessee. Community groups in Tennessee have expressed interest in working with Walker County and are seeking funding to improve the watershed on the Tennessee portion. Multiple community groups are interested in education, outreach, and BMPs to improve the Chattanooga Creek Watershed.

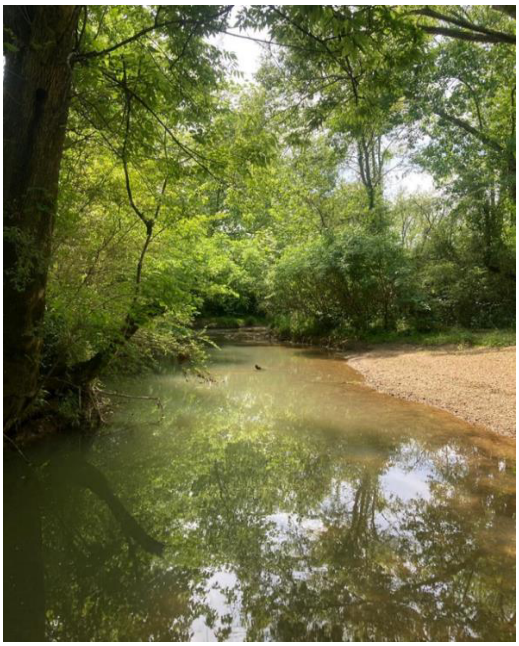


Figure 1 - Chattanooga Creek

LVRCD has successfully written numerous Nine Element watershed management plans (WMP) across North Georgia including several Hydrologic Unit Code (HUC) 10 scale plans and numerous HUC12 scale plans. Recent plans include East Rome Watershed Planning areas (4 HUC 12s), Lookout Creek, South Chickamauga Creek, Salacoa Creek, Lower Oostanaula River, Coahulla Creek, and Pine Log Creek. The completion of these plans have not only resulted in successful grant implementation of Clean Water Act section 319(h) funds but as with the case of Salacoa Creek, East Rome Watershed Planning, and Pine Log Creek WMPs, the plans have been utilized by other organizations to implement best management practices through the National Water Quality Initiative (NWQI).

Led by the planning team at LVRCD, Walker County has helped to facilitate community meetings and share data to support the planning effort. An advisory committee of both technical, agency-based partners, and community members was assembled to review the planning document for accuracy and implementation efficacy. Additionally, Walker County supported the development of this plan financially through matching funds contributed in a successful Georgia Environmental Protection Division (GAEPD)

319(h) funding award.

Walker County and LVRCD are partnered in the preparation of this WMP for Chattanooga Creek to implement watershed scale planning, identify possible projects, resources needed for implementation, and county needs as pertinent for improving water quality. The County has been experiencing growth across the northern part of the county and is undertaking major sewer expansion, maintenance, and rerouting. The majority of this growth and the infrastructural improvements associated with this growth is taking place within the Chattanooga Creek watershed. Stream segments not supporting water quality standards for fecal coliform in the North portion of the county made a planning project on Chattanooga Creek a logical partnership opportunity. Walker County, a member county of the LVRCD Council, committed to partnering in an effort to better understand the watershed and how to improve it. The long-term goal sequence is to write a Nine Element WMP, apply for 319(h) implementation, complete best management practices in the Chattanooga Creek Watershed and work to delist the segments. This will accomplish the greater goal of the county which is to provide a safe and enjoyable place for citizens to live and play.

Walker County currently manages stormwater as part of it's NPDES MS4 Phase II permit. Permit requirements include monitoring, erosion control, and inspection of land disturbing activities. However, BMPs identified in this WMP are "above and beyond" stormwater permit requirements and, when implemented, will help expedite the improvement of impaired stream segments.

This WMP builds on previous studies, collected data, and information gathered working with stakeholders. The multifaceted approach to data collection and community feedback focused on developing a plan that will improve Chattanooga Creek and it's tributaries. The Chattanooga Creek WMP follows the USEPA's Nine Elements of Watershed Planning as outlined below.

In addition, this WMP is consistent with the Walker County Joint Comprehensive Plan (2017) that includes goals to preserve greenspace and natural resources, policies to protect the community's character and sense of place, as well as ensuring safe and adequate supplies of water through protection of surface water sources. This WMP identifies strategies and potential projects that support these community goals. The Walker County Joint Comprehensive Plan can be found at: http://www.nwgrc.org/wp-content/uploads/011317DraftWalkerJointPlanUpdate.pdf

A technical advisory committee reviewed the WMP. The technical advisory committee is made up of the following individuals: Noel Durant, Ani Escobar, Joe Kirsch, Brandon Whitley, Brain Hart, Nick Mooneyham, and Katie Owens.

Background

This WMP builds on previous studies conducted in Walker County and Northwest Georgia. The Chattanooga Creek Watershed was included in a Watershed Assessment conducted in 2008-2009 for streams in Northwest Georgia. The assessment found fecal coliform bacteria above state water quality standards in Chattanooga Creek, an unnamed tributary and Dry Creek, low dissolved oxygen in Dry Creek and low pH in Rock Creek. Impacted benthic macroinvertebrates and fish communities were also identified in the unnamed tributary to Chattanooga Creek and Dry Creek (Walker County Water and Sewerage Authority, 2018). This information provides historical information to help inform the development of the WMP.

In 2018, a Watershed Protection Plan (WPP) was finalized using information from the Watershed Assessment. The WPP was prepared as part of NPDES permit requirements. The plan identifies existing protection efforts, monitoring requirements, and improvement activities such as implementing a Capacity, Management, Operations, and Maintenance (CMOM) program to protect against sewer spills and fully implement the MS4 Phase II stormwater program. These steps will help protect and preserve water resources in Walker County and the surrounding area. The WMP confirms target areas of concern and identifies potential nonpoint source BMPs.

The Coosa North Georgia Regional Water Plan (2017) describes the characteristics of the region, including Walker County and Chattanooga Creek area. Drinking water resources and wastewater assimilative capacity are discussed as well as ecosystem and watershed characteristics. Several high-level implementation activities are listed, including developing water quality trading. This report can be found online at https://waterplanning.georgia.gov/water-planning-regions/coosa-north-georgia-water-planning-region.

Several Total Maximum Daily Load (TMDL) plans were reviewed as part of this WMP development. A 2006 TMDL Implementation Plan for biota/habitat impairment, developed by GAEPD, calls for a 0% reduction in sediment but calls for continued implementation of good management practices for forestry, agriculture, erosion and sediment control, and education and outreach within the watershed.

A 2006 Fecal Coliform TMDL Implementation Plan was developed by GAEPD for Chattanooga Creek. This TMDL plan discusses the need for sources of impairment to be addressed, especially urban sources such as leaking sewer lines, failing septic systems, land application systems and landfills. Wildlife and livestock were also listed as potential sources of fecal coliform bacteria.

Consolidation of these numerous planning efforts, data, and proposed actions into this WMP document will help residents, elected officials, agencies, and community partners better implement needed watershed improvements. Improvements to water quality within the watershed are needed as outlined in the background and introduction and are actionable as will be discussed in the milestones and BMP sections of this plan.

Watershed Characterization

Project Location

The study area is the Chattanooga Creek watershed, located primarily in northern Walker County, Georgia with a small area in Dade County, Georgia. Chattanooga Creek crosses into Tennessee before joining the Tennessee River near Chattanooga, Tennessee. The total watershed area in Georgia and Tennessee is 46,796 acres. The study area will be the Georgia section of the watershed, which is 38,103 acres. See Figure 2 for watershed location.

Population

Walker County is experiencing steady population growth with a population of 68,510 documented during the 2020 US Census and projected to grow to 76,580 by 2030 according to the Walker County Joint Comprehensive Plan. Multiple new housing developments have been identified within the planning area and indicate the population growth curve is steadily increasing.

Environmental and Natural Resources

Hydrology

Chattanooga Creek (HUC10 #0602000110) is a tributary to the Tennessee River, originating in Walker and Dade Counties, Georgia and flowing North into the Chattanooga, Tennessee suburbs before joining the Tennessee River. Chattanooga Creek has two main tributaries in the study area, Rock Creek (HUC12 #060200011002) and Dry Creek (HUC12#060200011003). A short reach of McFarland Branch (HUC12 060200011003) is also within the study area though is more dominant on the Tennessee portion of the watershed.

Ecoregion

According to the USEPA, Chattanooga Creek is located within the Level III Ridge and Valley Ecoregion. Sometimes called the Great Valley in Georgia or the Coosa Valley in Alabama, this is a relatively low-lying region between the Blue Ridge (66) to the east and the Southwestern Appalachians (68) on the west. As a result of extreme folding and faulting events, the roughly parallel ridges and valleys come in a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Land cover is mixed and present-day forests cover about 50% of the region. The ecoregion has great aquatic habitat diversity and supports a diverse fish fauna.
https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/al/alga_front.pdf

Land Use

The National Land Cover Dataset (2016) was used to identify land cover within the study area. This GIS dataset shows a large portion of the study area designated as deciduous forest (56%), interspersed with hay/pasture areas (12%), especially the southern part of the watershed. The northern part of the study area has sections of low to medium developed areas, centered around the urban centers of Rossville, Fairview and Eagle Cliff. See Figure 3 and Table 1. Table 1 is based on HU12 boundaries. In Table 1, McFarland Branch, Dry Creek, and the lower section of Chattanooga Creek are included in the Chattanooga Creek column, the Powder Mill column includes the upper reaches of Chattanooga Creek, and the Rock Creek column includes all of the Rock Creek sub watershed.

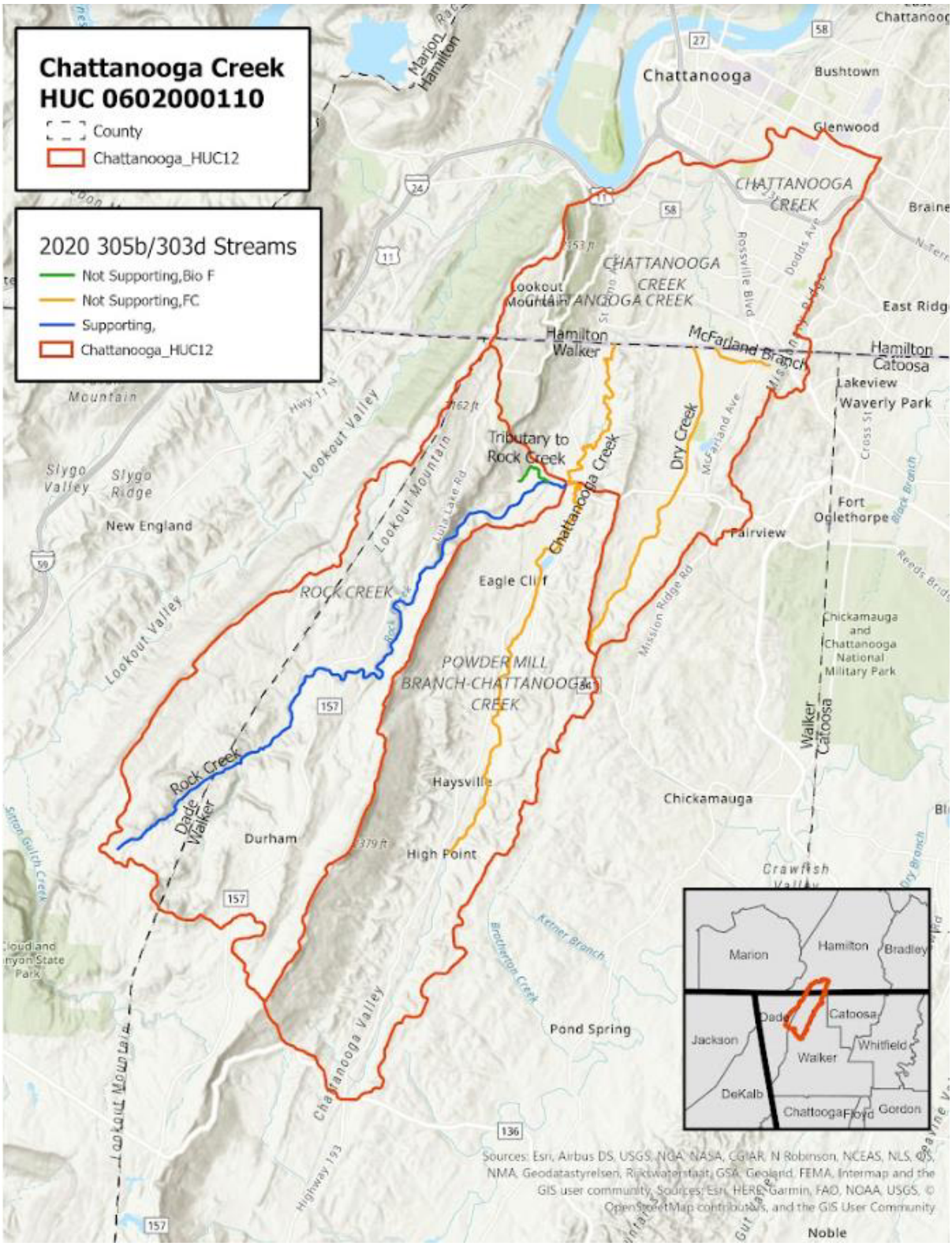


Figure 2 - Chattanooga Creek Watershed (TN and GA shown). 3 Sub watersheds outlined and Impairment Status in key

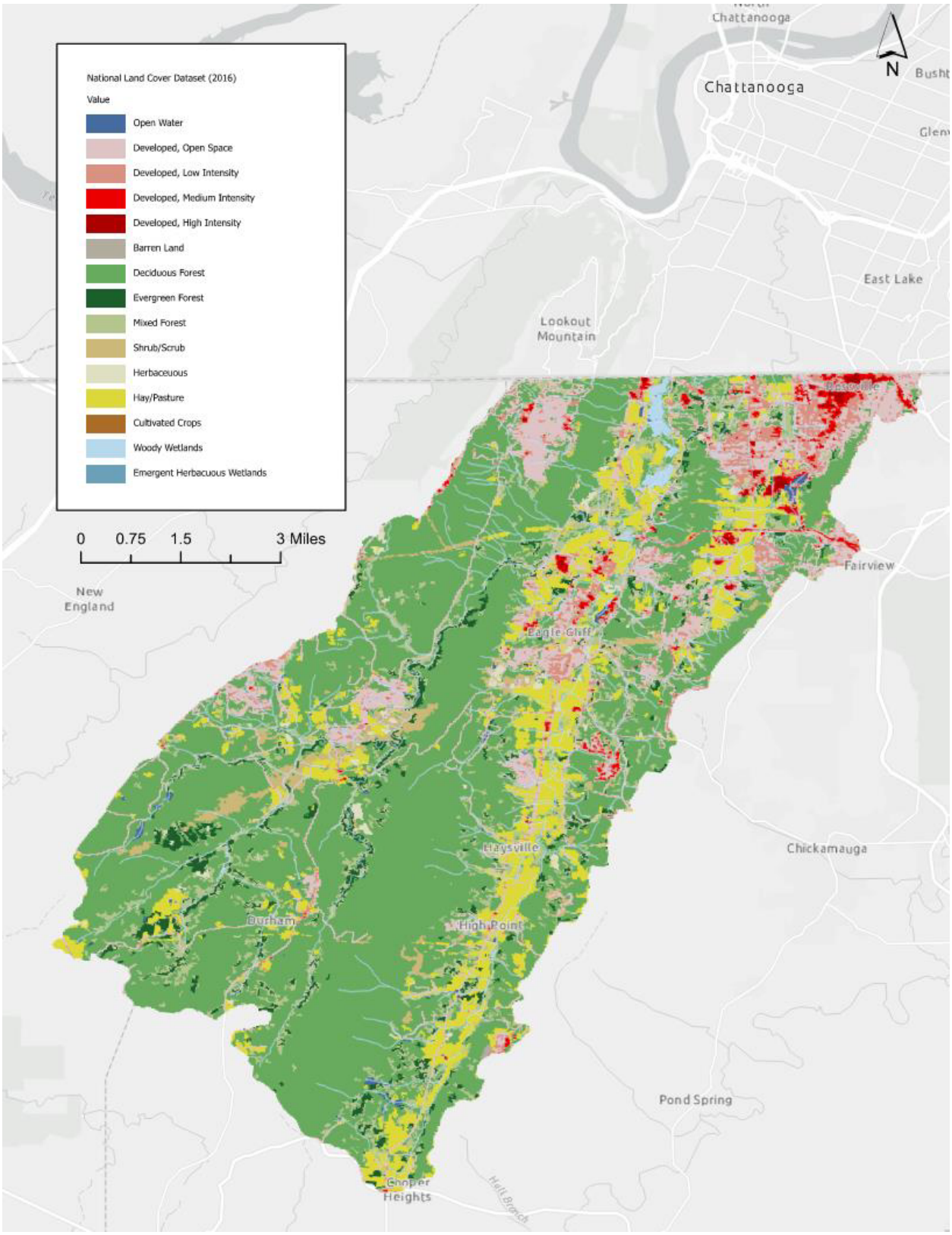


Figure 3 – Land Use Data from National Land Cover Database

Table 1 - Chattanooga Creek Subwatershed Land Use (data rounded to Nearest whole number)

	Chattanooga Creek		Powder Mill Branch		Rock Creek		Total	
Code	Area (Ac)	%	Area (Ac)	%	Area (Ac)	%	Area (Ac)	%
11- Open Water	34	0%	57	0%	37	0%	128	0%
21-Developed, Open Space	1,722	22%	1,298	9%	1,092	7%	4,111	11%
22- Developed, Low Intensity	961	12%	424	3%	176	1%	1,560	4%
23- Developed, Medium Intensity	290	4%	82	1%	27	0%	399	1%
24- Developed, High Intensity	137	2%	6	0%	8	0%	152	0%
31- Barren Land	11	0%	21	0%	1	0%	34	0%
41- Deciduous Forest	2,559	33%	8,118	57%	10,776	68%	21,453	56%
42- Evergreen Forest	140	2%	368	3%	733	5%	1,241	3%
43- Mixed Forest	742	9%	1,336	9%	1,551	10%	3,629	10%
52- Shrub/Scrub	37	0%	264	2%	510	3%	812	2%
71- Grassland/Herbaceous	70	1%	119	1%	125	1%	314	1%
81- Pasture/Hay	975	12%	2,217	15%	892	6%	4,084	11%
82- Cultivated Crops	0	0%	2	0%	1	0%	3	0%
90- Woody Wetlands	156	2%	16	0%	5	0%	178	0%
95- Emergent Herbaceous Wetlands	2	0%	3	0%	1	0%	5	0%
Grand Total	7,836	100 %	14,331	100 %	15,936	100%	38,103	100%

Element A: Identification of Pollutant and Impairment Causes and Sources

In order to evaluate pollution and impairment, existing stream impairment information and Total Maximum Daily Load documents (TMDLs) were reviewed, water quality and fish sampling were also conducted. Table 2 and Figure 2 show the stream segments, impairment status, pollutant of concern.

Stream Impairment Status

According to GAEPD's 2022 Integrated 305(b)/303(d) List for Streams, found at https://epd.georgia.gov/watershed-protection-branch/watershed-planning-and-monitoring-program/water-quality-georgia , the following stream segments are documented as not supporting (impaired) or supporting their designated use.

- Chattanooga Creek (GAEPD ID #060200011013), High Point to Flintstone, is not supporting its designated use of fishing. The cause of impairment is fecal coliform bacteria. The source of impairment is nonpoint source pollution. The length of impairment is 7 miles.

- Chattanooga Creek (GAEPD ID # 060200011015), Flintstone to Stateline, is not supporting its designated use of fishing. The cause of impairment is fecal coliform bacteria. The source of impairment is urban runoff. The length of impairment is 4 miles.

- Rock Creek (GAEPD ID #060200011014), headwaters to Chattanooga Creek in Dade and Walker Counties, supports its designated use of fishing. This length of supporting designation is 11 miles.

- A tributary to Rock Creek (GAEPD ID #060200011017), Rock Creek Court to Rock Creek, is not supporting its designated use of fishing. The cause of impairment is biota impacted - fish community. The source of impairment is nonpoint sources of pollution. The impairment length is 1 mile.

- Dry Creek (GAEPD ID #60200011016), headwaters to Chattanooga Creek at the Georgia/Tennessee State Line, is not supporting its designated use of fishing. The cause for impairment is fecal coliform bacteria. The length of impairment is 5 miles. The source of impairment is urban runoff.

- McFarland Branch (GAEPD ID #GAR060200011012), Rossville to Georgia/Tennessee Stateline, not supporting its designated use of fishing. The cause for impairment is fecal coliform bacteria. The length of impairment is 1 mile. The source of impairment is urban runoff.

Table 2 - Impairment Causes and Sources for Chattanooga Creek and Tributaries

Reach Name	Impairment or Assessment Status	Pollutant of Concern or Cause	Pollutant Source
Chattanooga Creek (7 miles)	Not Supporting	Fecal Coliform	Nonpoint
Chattanooga Creek (4 miles)	Not Supporting	Fecal Coliform	Nonpoint and Urban Runoff
Dry Creek (5 miles)	Not Supporting	Fecal Coliform	Urban Runoff
Rock Creek (14 miles)	Supporting	None	None
Rock Creek tributary (1 mile)	Not Supporting	Biota Impacted - Fish Community	Nonpoint
McFarland Branch	Not Supporting	Fecal Coliform	Urban Runoff

Element B: TMDLs and Pollutant Reduction

The following are applicable GAEPD developed TMDL reports and revised TMDL Implementation Plans with pollutant reduction goals required to meet water quality standards for each.

Sediment TMDL

GAEPD. January 2009.Total Maximum Daily Load Evaluation for Sixteen Stream Segments in the Tennessee River Basin for Sediment (Biota Impacted).

- Dry Creek - Headwaters to Chattanooga Creek at State Line, 87.07% sediment load reduction (This load reduction replaced the original 2004 load reduction.)
- Tributary to Rock Creek – GAEPD plans to have the TMDL completed in 2023.

GAEPD. January 2004. Total Maximum Daily Load Evaluation for Eight Stream Segments in the Tennessee River Basin for Sediment (Biota Impacted).

- Chattanooga Creek - High Point to Flintstone, 0.00% sediment load reduction
    - Steam delisted for Biota Impacted in 2006.
- Rock Creek - Headwaters to Chattanooga Creek, 0.00% sediment load reduction
    - Stream delisted for Biota Impacted in 2004.
- Dry Creek - Headwaters to Chattanooga Creek at State Line, 0.00% sediment load reduction

Fecal Coliform TMDL

GAEPD. January 2004. Total Maximum Daily Load Evaluation for Nineteen Stream Segments in the Tennessee River Basin for Fecal Coliform. Percent reduction required to meet water quality standards.

- Chattanooga Creek - High Point to Flintstone, 74% reduction
- Chattanooga Creek - Flintstone to Stateline, 61% reduction
- Dry Creek - Headwaters to Chattanooga Creek at State Line, 89% reduction
- McFarland Branch - Rossville to Stateline, 99% reduction

Dissolved Oxygen TMDL

GAEPD. January 2004. Total Maximum Daily Load Evaluation for McFarland Branch in Tennessee River Basin for Dissolved Oxygen.

- McFarland Branch - Rossville to Stateline, 0.00% reduction
    - Stream delisted for dissolved oxygen in 2014.

Revised TMDL Implementation Plan for Section 7 of TMDL documents.

GAEPD. April 28, 2006. Revised Tier 2 TMDL Implementation Plan – Revision 1. Chattanooga Creek Watershed, Tennessee River Basin. (Developed by Coosa Valley Regional Development Center)

- Revised TMDL Plan focusing on management measures for fecal coliform impaired streams to meet water quality standards.
    - Chattanooga Creek - High Point to Flintstone, 74% reduction
    - Chattanooga Creek - Flintstone to Stateline, 61% reduction
    - Dry Creek - Headwaters to Chattanooga Creek at State Line, 89% reduction
    - McFarland Branch - Rossville to Stateline, 99% reduction

NPDES Permit Holders

Table 3 presents NPDES permit holders within Walker County and the Tennessee River Basin. NPDES permit holders are a potential source of water quality impairment.

Table 3 - NPDES Permit Holders in Walker County, Tennessee River Basin				
PERMIT_NAME	PERMIT_NO	PERMIT_TYPE	PERMIT_SUBTYPE	FACILITY_ADDR
Dade County Water and Sewer Authority (Canyon Ridge WRF)	GAJ030708	Land Application System	Municipal	14651 Highway 157, Rising Fawn, Georgia, 30738
Shaw Industries, Inc. (Plants SI & SP)	GA0046205	NPDES	Industrial	12454 N Highway 27 Chickamauga, GA 30707
WALKER COUNTY WPCP	GA0020478	NPDES	Municipal	444 Kington Street Chickamauga, GA 30725
Yates Bleachery Company	GAG200018	General Cooling Water	Industrial	503 FLINTSTONE ROAD FLINTSTONE, GA 30725

Water Quality Sampling

Water quality samples were collected at six sites over two different sampling periods to help target critical areas for improvement. A *Targeted Monitoring Sampling Plan for the Chattanooga Creek Watershed* was approved by GAEPD. Sampling was performed according to GAEPD protocols. Four sampling events occurred in September 2021 and December 2021 for a total of eight events.

Sampling site locations are provided in Table 4 and Figure 4. Sample results are provided in Tables 5 through 12. Results show elevated fecal coliform levels during 3 out of 4 September sampling events at all sites, expect for CC3 which had elevated levels for all September sampling events. Fecal coliform counts were elevated levels at all stations, except CCRC1, on December 7, which also had precipitation this day. However, some sites showed more elevated fecal coliform bacteria levels than others during the December sampling events, see Tables 6 and 7.

Fecal Coliform geometric means were not calculated for September events. There were two events in September that had Too Numerous To Count (TNTC) values and communication with the lab indicated that they may not have used the correct dilution methodology. December samples were determined to be acceptable for fecal coliform geometric mean calculation. The following sites should be targeted for improvement due to elevated bacteria levels: CC1, CC2, CC3, and CCMB1. Site CC2 violated state water quality criteria for fecal coliform bacteria. Site CCRC1 had very low fecal coliform bacteria levels in December.

All samples meet state water quality criteria for dissolved oxygen, pH, and temperature for the designated use of fishing. There is no state standard for conductivity or total suspended solids, although these parameters may be useful for targeting areas with high levels of dissolved solids and possibly pollutants.

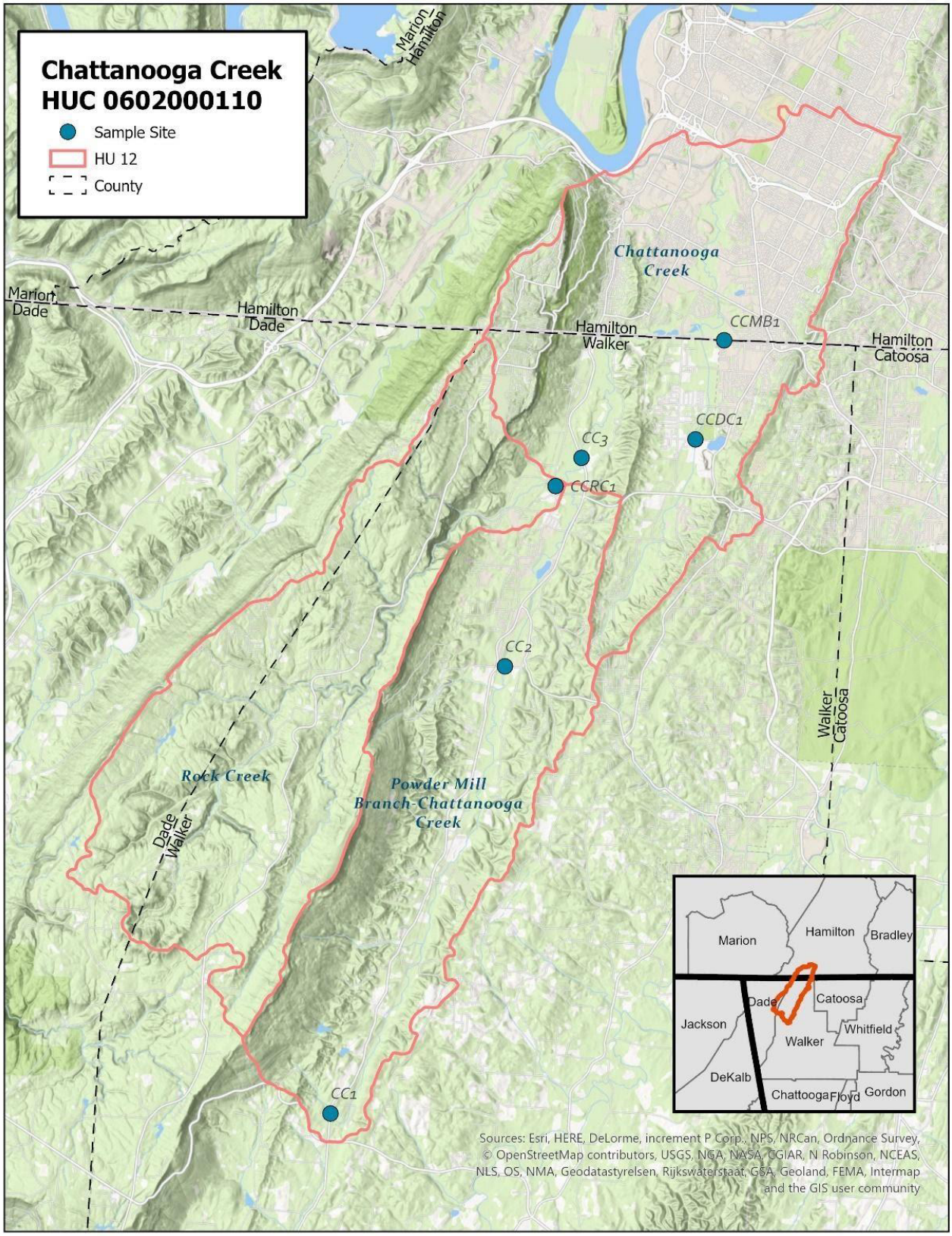


Figure 4 – Water Quality Sampling Locations

Table 4 - Stream Sampling Site Locations				
Site Name	Site Code	Latitude	Longitude	Location
Chattanooga Creek Sample Site 1	CC1	34.81331	-85.38916	Hwy 193 near Hwy 136 Intersection
Chattanooga Creek Sample Site 2	CC2	34.91159	-85.3512	Nick A Jack Lane
Chattanooga Creek Sample Site 3	CC3	34.95735	-85.3347	Hwy 193 near Burnt Mill Rd
Rock Creek Sample Site 1	CCRC1	34.95095	-85.341	Chattanooga Valley Rd
Dry Creek Sample Site 1	CCDC1	34.96287	-85.30529	Salem Rd
McFarland Branch Sample Site 1	CCMB1	34.98444	-85.29927	State Line Road

Table 5 - Precipitation during Sampling Events (inches)								
USGS Gauge 03568400	Chattanooga Creek at GA 193							
	09/09/21	09/21/21	9/23/21	09/29/21	12/07/21	12/09/21	12/14/21	12/16/21
48 Hour Rain Total (inch)	0.05	5.25	0.42	0	0.54	0	0	0
14 Day Rain Total (inch)	4.3	5.9	6.25	6.2	0.65	0.65	1.24	1.24
Discharge (cfs) @ 10AM	33.1	850	285	48.4	43.1	35.3	53.2	45.7

Table 6- Fecal Coliform Bacteria Results (colonies/100 mL)								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/9/21	12/14/21	12/16/21
CC1	1,900	TNTC*	TNTC*	<1	720	<1	760	<1
CC2	1,200	TNTC*	TNTC*	<1	11,000	<1	320	<1
CC3	1,100	TNTC*	TNTC*	4,680	2,800	200	220	<1
CCRC1	1,000	TNTC*	TNTC*	<1	<1	<1	<1	<1
CCDC1	1,000	TNTC*	TNTC*	<1	1,100	<1	160	99
CCMB1	2,100	TNTC*	TNTC*	<1	3,000	180	200	<1

*TNTC = Too Numerous To Count

Table 7 - December Fecal Coliform Geometric Mean (colonies/100 mL)	
Site Code	
CC1	733
CC2	3,383
CC3	766
CCRC1	<1
CCDC1	372
CCMB1	754

Table 8 - Temperature (◦Celsius)								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/09/21	12/14/21	12/16/21
CC1	20.05	17.77	16.12	17.16	8.42	6.94	7.76	11.09
CC2	21.58	19.52	17	18.22	9.72	7.84	7.34	9.77
CC3	20.95	20.1	17.09	17.76	9.91	8.5	7.34	9.35
CCRC1	19.97	19.89	16.68	17.43	9.61	8.67	7.91	10.19
CCDC1	20.8	20.59	17.52	17.62	7.98	7.7	7.12	10.47
CCMB1	22.32	21.84	18.86	19.66	8.8	8.26	8.2	11.65

Table 9 - Conductivity (uS/cm)								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/09/21	12/14/21	12/16/21
CC1	228	207	203	227	264	268	263	275
CC2	306	202	242	285	288	293	291	298
CC3	172	85	89	157	166	169	137	142
CCRC1	119	38	51	117	108	107	78	82
CCDC1	344	235	268	322	310	355	343	283
CCMB1	362	323	348	364	215	329	344	341

Table 10 - Dissolved Oxygen (mg/L)								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/09/21	12/14/21	12/16/21
CC1	7.41	7.63	8.79	8.35	8.54	10.63	10.57	9.45
CC2	6.09	6.95	8.39	7.45	7.97	10.11	10.39	9.23
CC3	5.46	5.8	8.12	6.03	5.47	7.22	7.24	8.04
CCRC1	6.13	7.21	9.04	7.61	8.32	10.19	10.73	9.46
CCDC1	6.54	6.62	8.64	6.84	6.81	8.55	9.93	9.49
CCMB1	6.74	5.36	8.24	7.94	8.58	11.3	10.97	9.55

Table 11 - pH								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/09/21	12/14/21	12/16/21
CC1	8.13	7.83	7.98	8.1	8.22	8.15	8.22	8.12
CC2	8.11	7.81	8.08	8.11	8.09	8.14	8.1	8.15
CC3	7.7	7.86	7.67	7.8	8	8.18	8.14	8.24
CCRC1	7.68	8.06	7.76	7.74	7.98	8.05	8.18	8.23
CCDC1	7.92	7.82	7.96	7.89	7.9	7.96	8.05	8.08
CCMB1	8.15	7.89	8.04	8.17	8.26	8.29	8.26	8.33

Table 12 - Total Suspended Solids (mg/L)								
Site Code	9.9.2021	9.21.21	9.23.21	9.29.21	12/07/21	12/9/21	12/14/21	12/16/21
CC1	3	27	7	4	2	2	<2	<2
CC2	5	34	12	4	2	<2	2	<2
CC3	7	26	10	4	<2	<2	2	<2
CCRC1	3	25	8	2	<2	<2	<2	<2
CCDC1	2	10	3	<2	2	<2	<2	3
CCMB1	4	6	2	<2	<2	<2	<2	<2

Visual Survey

Visual survey of each sampling site was conducted in early December 2021. Using the Georgia Adopt-A-Stream methods the following information was collected: habitat, stream flow, channel cross section, pebble count, visual biological notes, and a site sketch. During the surveys, stream depth at Chattanooga Creek Site 3 was too deep to allow for safe and accurate data collection of certain parameters such as stream flow and channel cross section. Visual survey data sheets for each site can be

found in Attachment C. The visual survey habitat rankings, pebble count results, and photos for each site are shown below.

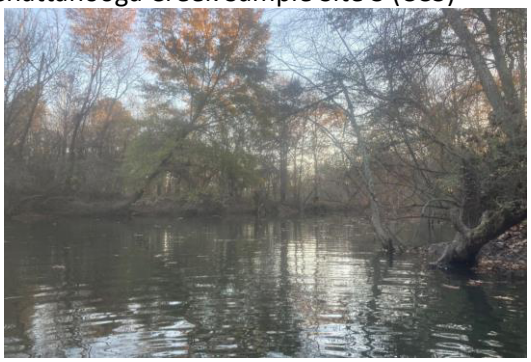
Table 13– Visual Survey Habitat Rankings		
Site	Habitat Score	Ranking
Chattanooga Creek 1	63	Good
Chattanooga Creek 2	42	Fair
Chattanooga Creek 3	38.5	Fair
Rock Creek 1	56	Good
Dry Creek 1	47.5	Good
McFarland Branch 1	51	Good

Table 14 – Wentworth Pebble Count Results						
Site	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
Chattanooga Creek 1	4%	26%	30%	22%	6%	12%
Chattanooga Creek 2	22%	20%	50%	0	0	8%
Chattanooga Creek 3	-	-	-	-	-	-
Rock Creek 1	28%	58%	4%	10%	0	0
Dry Creek 1	2%	2%	86%	2%	0	8%
McFarland Branch 1	6%	32%	56%	6%	0	0

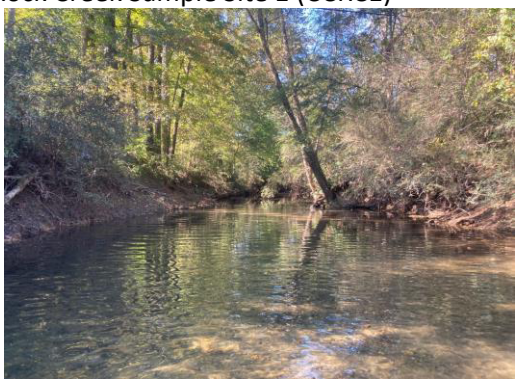
Chattanooga Creek Sample Site 1 (CC1)

Chattanooga Creek Sample Site 2 (CC2)

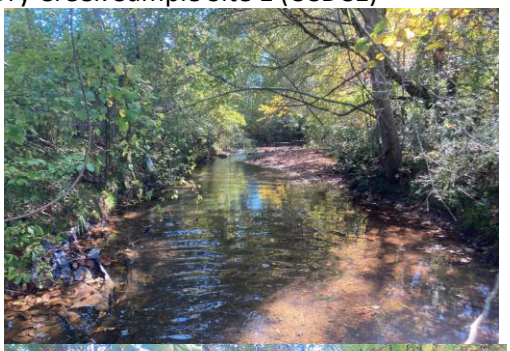
Chattanooga Creek Sample Site 3 (CC3)



Rock Creek Sample Site 1 (CCRC1)



Dry Creek Sample Site 1 (CCDC1)



McFarland Branch Sample Site 1 (CCMB1)

Fish IBI Study

A fish Index of Biological Integrity (IBI) study was performed by The Tennessee Aquarium Conservation Institute. The full report, with fish photos, can be found in Attachment A.

Two streams within the Chattanooga Creek watershed were sampled following Georgia Department of Natural Resources' (GADNR) Standard Operating Procedures for Conducting Biomonitoring on Fish Communities in Wadeable Streams in Georgia. Please see Figure 5. The IBI results are used to help target areas for improvement.

The two streams sampled include:

- Chattanooga Creek downstream of Nick A Jack Lane (34.91335, -85.35173), Walker County, GA, 20 May 2021.
- Dry Creek upstream of Maple Street (34.97808, -85.30283), Walker County, GA, 20 May 2021.

Results for the IBI evaluation show that:

- Overall IBI score for Chattanooga Creek was 34, with a ranking as "Fair".
- Overall IBI score for Dry Creek was 24, with a ranking as "Very Poor".

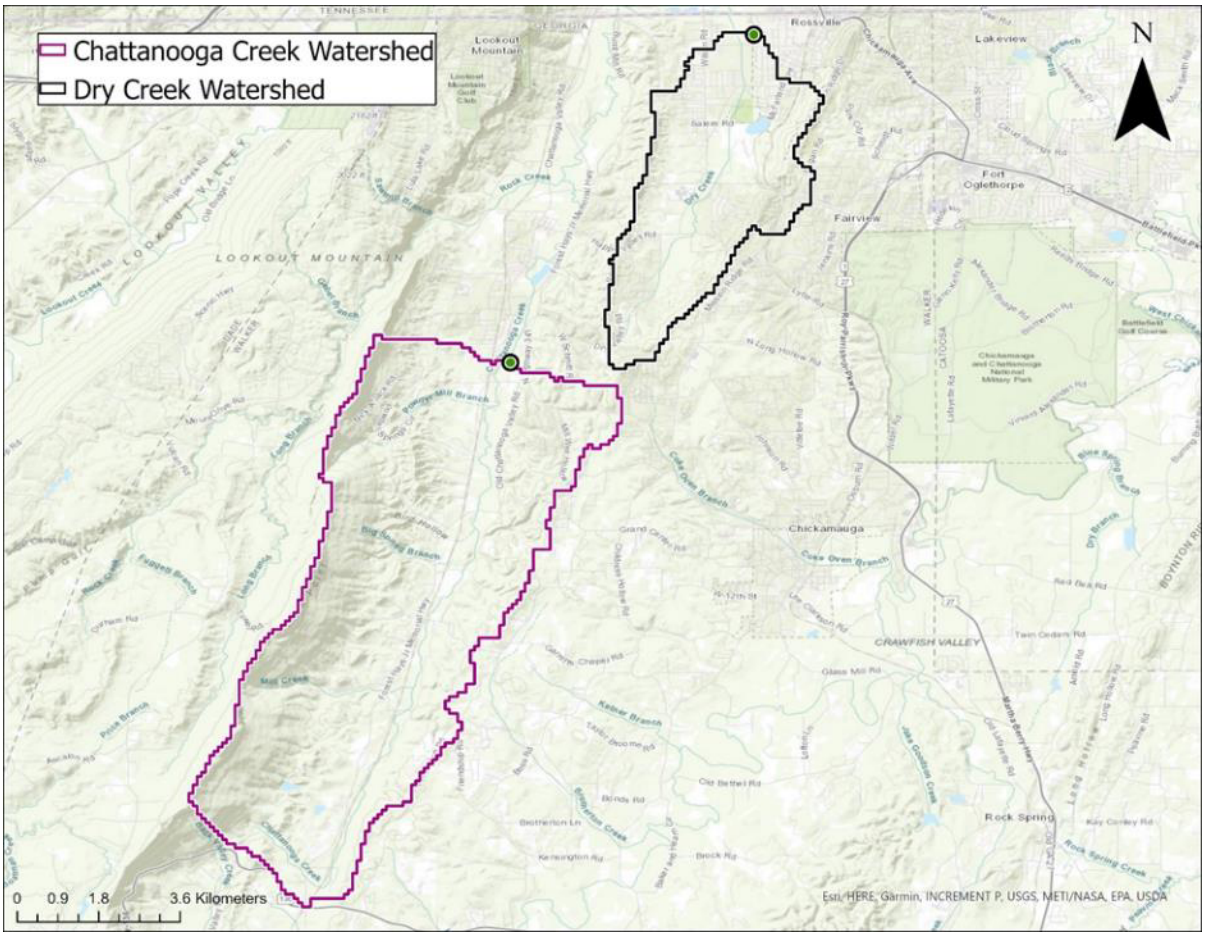


Figure 5 – IBI Sampling Locations

Each stream was sampled at a single site. Backpack shockers and dip nets were used for fish sampling. Fishes were held in containers with fresh creek water and aerators as they were identified to species and counted (Figure 6). Photo vouchers of most fish species were taken. Water quality (temperature (°C) DO (mg/L), conductivity (µS), pH, turbidity (NTU), total dissolved solids (ppm)) was measured using a YSI multiport sonde (electronic probe).

Chattanooga Creek was the largest site sampled, both in stream width (average 6.3 m) and drainage area above the sample site (17.75 sq. miles). The stream depth 0.48 meters. The stream reach sampled for fishes in Chattanooga Creek was 219.8 m long, containing 5 pools, 4 riffles, and 4 bends, which should adequately represent the fish community. The majority of the sampled reach flowed through a continuous riparian zone bordered by fields, and some bank erosion was evident at several locations.

A total of 18 fish species in 8 families were collected, 17 of them native species. Total number of individuals was 209, with one redhorse sucker not identifiable to species and not used in IBI analyses. Overall IBI score for Chattanooga Creek was 34, with a ranking as “Fair”.

Figure 6 – Fish Sample Collection for IBI Study

Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant (or sensitive) species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Chattanooga Creek were 137 and 145 out of 200, respectively, indicating these habitats are somewhat degraded.

Dry Creek was the smallest site sampled in drainage area above the sample site (6.07 sq. miles) and had the lowest average stream width (4.96 m). The stream reach sampled for fishes in Dry Creek was 173.6 m long. This reach contained 3 pools, 2 riffles, and notably 0 bends. Stream width averaged 4.96 m and stream depth averaged 0.165 m. The sampled reach flowed adjacent to a car junk yard on one side,

although there was extensive riparian zone, and a trail was along the other bank. Bank erosion was evident along the side with the trail.

A total of 16 fish species in 6 families were collected, 15 of them native species. Total number of individuals was 487. Overall IBI score for Dry Creek was 24, with a ranking as “Very Poor”.

Attributes for this ranking include most fishes are generalist and poor habitat conditions are present. Dry Creek has been channelized and the stream has recovered very little habitat variability, with no bends, shallow long pools, and short riffle with a chert substrate. Riffle/run and glide/pool habitat assessment scores for Dry Creek were 87 and 113 out of 200, respectively, indicating these habitats are very degraded.

Table 15 - Fish Index of Biotic Integrity Ratings		
Site	Chattanooga Creek	Dry Creek
Fish IBI Scores	34	24
Fish IBI Rank	Fair	Very Poor

Element C: Watershed Management Priority Index

The Watershed Management Priority Index (WMPI) is a GIS model that allows stakeholders to analyze and overlay landscape attributes that affect water quality. The methodology used to create the WMPI for Chattanooga Creek has been implemented previously by the US Forest Service in their “Forest to Faucet” program, the Nature Conservancy, and other various conservation organizations. The WMPI contains two sub-models: A Restoration Priority Index (RPI) map and a Restoration Priority Parcel map are shown in Figure 7 and Figure 8, respectively. These results can help prioritize areas for conservation or restoration that can protect and enhance stream health. The main drivers of these models are land cover classes, soils types, and slopes. If an area with a high Conservation Priority Index (CPI) value is converted from forest to impervious surface, it has potential to degrade water quality. Whereas if an area with a high RPI value is converted from agricultural land cover to natural landcover, it has the potential to improve water quality (i.e., stabilizing streams with riparian vegetation). Together, the CPI and RPI models can be used to analyze parcels for protection and enhancement of stream quality.

To create the WMPI for the Chattanooga Creek watershed, UTC’s IGT Lab collected readily available data for the region. Each of the 7 layers shown in Table 16 were extracted and ranked on a scale of 1-3, with 3 being the most desirable. After processing and analysis, all 7 layers were then compiled in a weighted overlay to create the final index with scores ranging from 1-21, with higher scores being more suitable for conservation and restoration.

The results of this analysis show stream corridors in general having a priority for conservation, with higher potential lower in the watershed (North on the map). This finding is consistent with IBI fish scores, where Dry Creek has greater restoration potential and bacteria levels were elevated in the lower sections of Chattanooga Creek, Dry Creek and McFarland Branch.

Table 16 - Watershed Priority Index input data and weights

Dataset	RPI Attributes (reclassified to 1-3 scale)	CPI Attributes (reclassified to 1-3 scale)	Weights	Source
Landcover Class	barren land, pasture/hay, cultivated crops = 3 shrub/scrub, grassland/herbaceous = 2	All Forest Types = 3	1	https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects
Streams Proximity	0-30m = 3 30-60m = 2 60-90m = 1	0-30m = 3 30-60m = 2 60-90m = 1	1	https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects
Wetlands Proximity	0-30m = 3 30-60m = 2 60-90m = 1	0-30m = 3 30-60m = 2 60-90m = 1	1	https://www.fws.gov/wetlands/
Soil Hydrologic Group	Group A = 1 Group B, C = 2 Group D, A/D = 3	Group A = 1 Group B, C = 2 Group D, A/D = 3	1	https://www.arcgis.com/home/item.html?id=cdc49bd63ea54dd2977f3f2853e07fff
Soil Erodibility-Kfactor	low = 1 moderate = 2 high = 3	low = 1 moderate = 2 high = 3	1	https://www.arcgis.com/home/item.html?id=cdc49bd63ea54dd2977f3f2853e07fff
Slope	high = 3 medium = 2 low = 1	high = 3 medium = 2 low = 1	1	https://www.usgs.gov/core-science-systems/national-geospatial-program/national-map
Active River Areas	material collection zones and FEMA 100-year flood zones = 3	material collection zones and FEMA 100-year flood zones = 3	1	https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/freshwater/floodplains/Pages/default.aspx

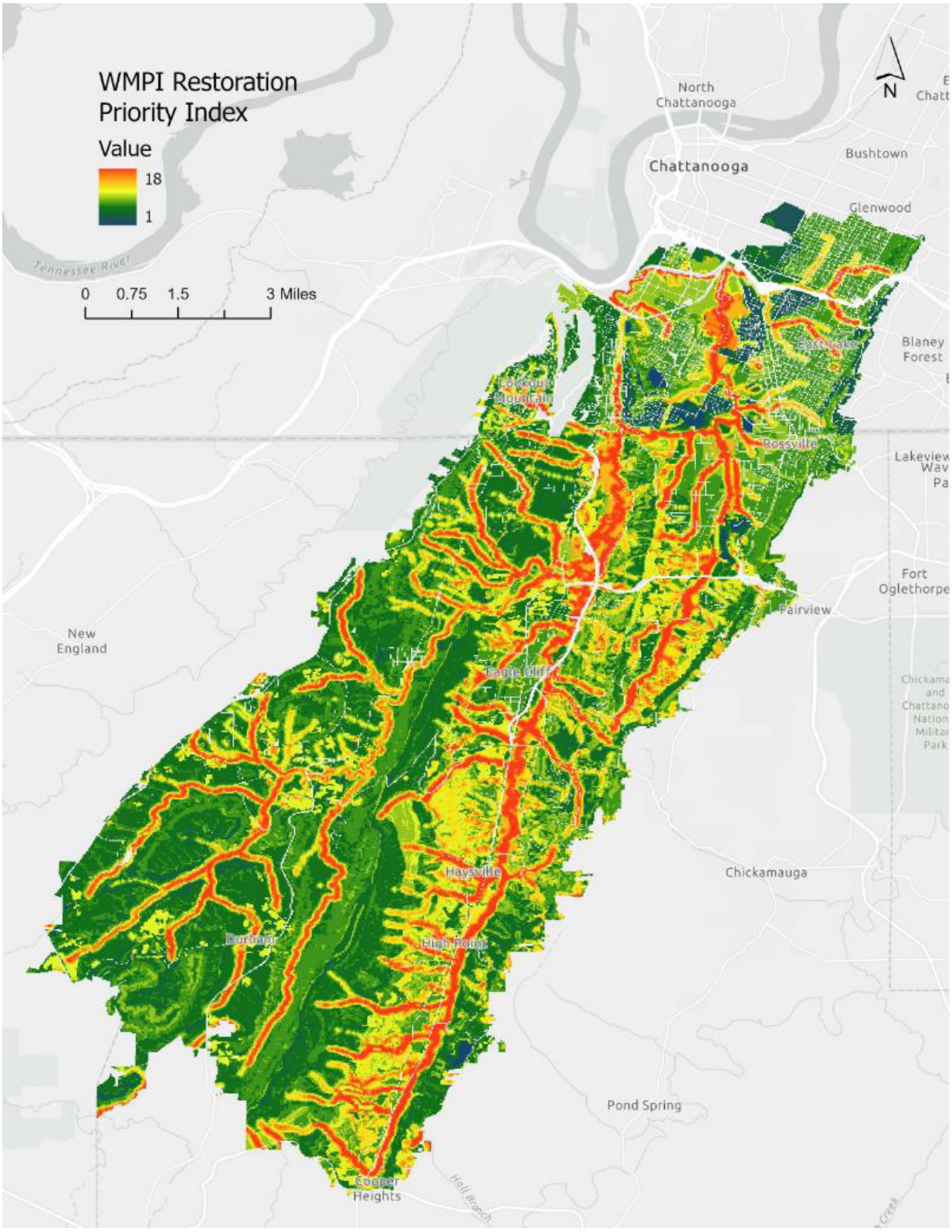


Figure 7 – WMPI Restoration Priority Index

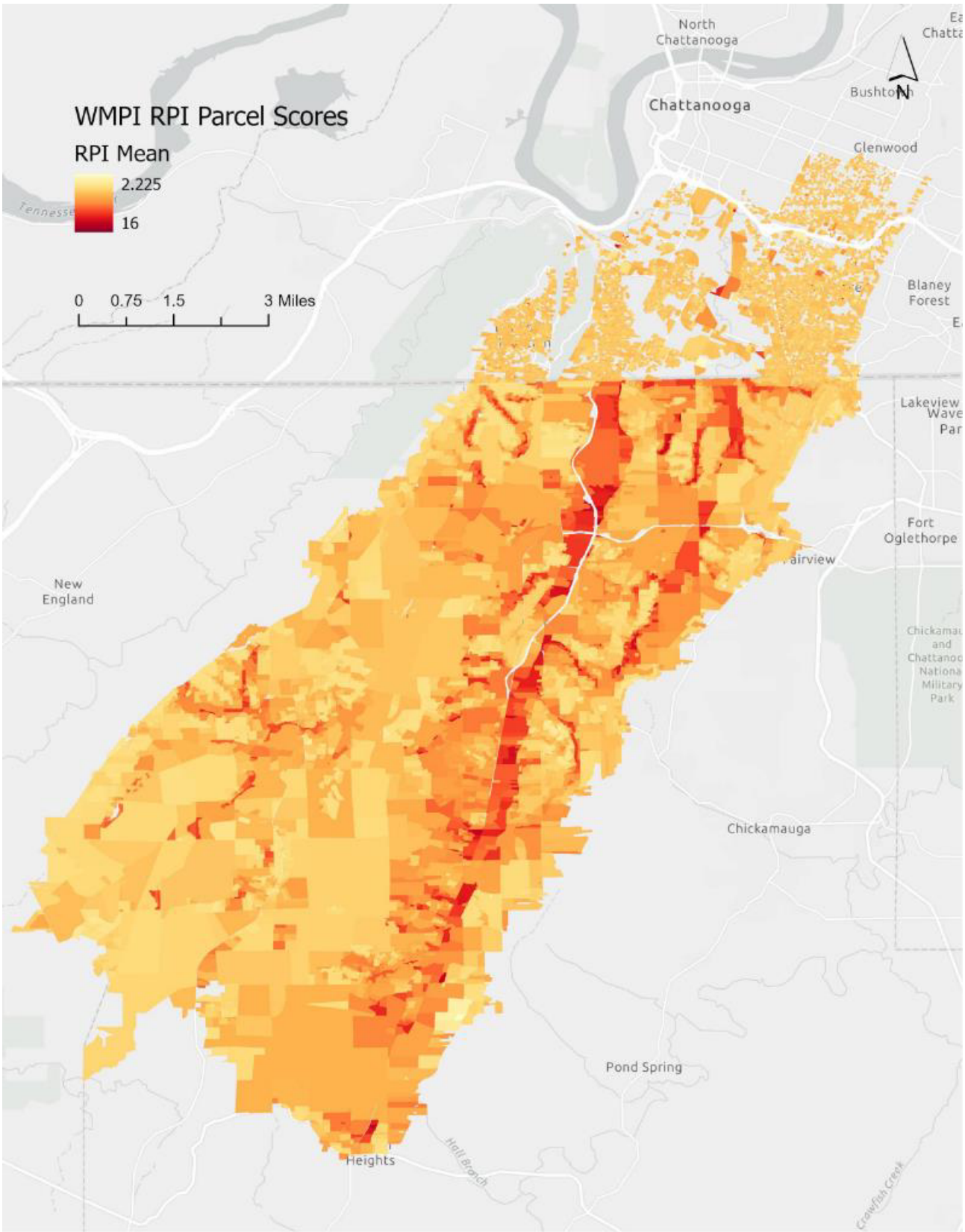


Figure 8 – WMPI Restoration Priority Index Parcels

Watershed Plan

The following plan describes BMPs that will help improve water quality in the study area, identification of critical areas, financial and technical assistance needed to implement the plan, a schedule with milestones, and criteria to evaluate BMPs once selected and implemented.

Current Best Management Practices

Current BMPs in the watershed include agriculture BMPs, development BMPs and sewer service connections.

Walker County is a Phase 2 MS4 permittee. Any proposed new BMP would be above and beyond what is required by Walker County in the MS4 program. The Walker County Planning, Zoning, and Inspections department is a state approved "local issuing authority" and responsible for implementing the Sediment and Erosion Control Ordinance and the Post-Development Stormwater Ordinance for new and redevelopment as required by the Georgia Stormwater Management Manual. Please see this link for more information https://walkercountyga.gov/government/departments/planning-zoning/erosion-control-stormwater-management/

For agriculture BMPs, a query of NRCS records from 2014 to 2021 includes 6 conservation planning projects within the HUC12 area that makes up Chattanooga Creek. One of these was habitat planning for the Conservation Reserve Program along the creek and the other 5 plans were developed in conjunction with requests for technical assistance. While other NRCS Technical assistance may have been implemented during these years, no reports were available to confirm or measure impacts.

Element C: Proposed Best Management Practices

Proposed BMPs include structural and nonstructural BMPs addressing urban and agricultural areas to focus on reducing fecal coliform bacteria and sediment.
Based on previous studies and data collected as part of this WMP, we have identified BMPs to address septic systems, urban runoff, and agricultural land uses that, when implemented, will have an important impact on water quality and stream health. A significant portion of the planning area is forested, putting more emphasis on targeting the urban and agricultural land uses as critical for BMP implementation and watershed improvement. One participant also noted the value of converting agricultural lands to forested land could be impactful.

Urban Areas BMPs

Urban area BMPs include enforcement of the development and erosion and sediment control ordinance and complying with the Georgia Stormwater Management Manual for new development.
In addition, portions of the watershed were identified by analysis as having threats to water quality because of urban growth. These areas are critical locations for the use of green infrastructure BMPs. BMPs such as rain gardens, infiltration basins, bioswales, and other green infrastructure help to reduce the impacts of stormwater, created by impervious surfaces in developed areas. Offering green infrastructure and stormwater BMP cost-share opportunities to local groups, municipalities, businesses, and homeowners would greatly increase the adoption of these practices and could reduce impacts created by developing areas. Demonstration of green infrastructure installations would also assist with community adoption through education while reducing the stormwater impacts at the demonstration site. Specific BMP sites will be identified in cooperation with municipal and community groups in Georgia. Additionally, work with groups interested in working across state lines in Tennessee should be considered as urban areas and development related water quality impacts are concentrated near the

state line.

In addition to installation of green infrastructure to address urban related water quality impacts, it has been noted that the county could explore becoming certified as a "Water First Community". Accomplishing the steps required to achieve the Water First Community designation sets the framework for improved quality of life and access to clean water for all. The designation also comes with financial benefits to the county in the form of state lending program benefits and prioritization for state water grants.

Septic and Sewer BMPs

Failing septic systems have been reported and are likely a potential contributor to the fecal coliform bacteria load in the watershed. Septic tank maintenance and repair, and extending sanitary sewer service within the Chattanooga Creek watershed are two strategies that will likely improve water quality. Septic BMPs and Sewer information is detailed in this section below.

Currently, the planning area is partially covered by municipal sewer service with the waste being routed North to the Moccasin Bend Treatment Facility on the north shore of Chattanooga. This is a costly and inefficient waste management system. Sewer upgrades are planned to route waste currently sent to Moccasin Bend south to Chickamauga with new main lines routed through the planning area. These additional new lines will create opportunities to connect homes and businesses to sanitary sewer in areas that were previously unserved. The sewer route proposal will bring sewer service options to areas of the county that have historically high rates of septic failures, as reported by the local health department. These failures have been attributed a variety of factors including soils, changing home densities, and aging systems. Disconnecting septic systems and connecting homes to sanitary sewer will improve water quality. Target areas will be based on poor soils, failure rates, interest from homeowners, and high-density areas for septic decommission. BMPs such as septic decommissioning and interconnect cost share are prime BMPs for reducing potential fecal contributions to surface waters.

Discussions with Walker County Health Department indicate 30-40 permitted septic tank repairs per year within the watershed. One factor contributing to the rate of failure was soil types not being supportive of infiltration. Cost share programs to address septic tank failures could be a solution to community wide septic problems, addresses ad hoc and case by case, but a cost share to connect to sewer would provide a longer-term solution. There are currently an estimated 30,000 residents in the area potentially affected sewer upgrades. This area of the county represents approximately 10,000 households. An estimated 80% of these homes are on septic. Based on average failure rates, age of systems and soils, there are 400-500 homes that could benefit from a repair or connection to sewer. While the proposed sewer line redirection will not be able to serve all of these homes, a substantial portion would be within connection distances. A BMP to address blocks of interconnection, where the Health Department has identified need, could address fecal contributions in an impactful way while addressing systemic problems with long term results.

A cost-share program, either for sewer interconnection or on-site systems, in the area would incentivize system repairs as needed. Cost-share rates could vary according to the proximity of the failure to surface waters, socioeconomic factors, nature of the cost share program or other factors. Higher rates will generally be offered on projects that more significantly reduce pollutant loads. Funding could be sought from a variety of sources such as Georgia Environmental Finance Authority (GEFA), GAEPA, or other state and federal sources.

Agriculture Area BMPs

There has not been strong interest in the past to implement agriculture BMPs within this watershed based on data from the USDA. Although, with targeted educational outreach in prioritized restoration areas, even a small percentage of participation could have a meaningful impact on water quality. Based on 71% of the watershed being in forest or perennial shrub land cover and 12% being agricultural, the weight of impact agricultural BMPs could contribute is significant. During the development of this plan multiple landowners have engaged with NRCS to consider Conservation implementations. Increased awareness and outreach may build on this engagement. See Figure 9 for agriculture parcels in the watershed

Management practices could include a cost-share program that will help local farmers implement conservation practices. Non-industrial Private Forests (NIPF) make up a more significant portion (71%) of the watershed and are categorized by The United States Department of Agriculture (USDA) as a form of agriculture fiber production. BMPs to improve forest lands include forestry management plans, easements for forest cover protections, access road improvements, and stream crossing enhancements as well as those identified in the Natural Resource Conservation Service (NRCS) list identified below. Notably, much of the NIPF within the planning area either have easement protections already or are held in trust by conservation organizations. Up to date information related to permanent easements can be found on USGS.gov under the protected Areas Database.

Agricultural conservation practices should focus on reduction in fecal coliform and/or sediment contributions to receiving waters. Grazing operations are a dominant agricultural use (11%) in areas of the watershed. Conservation practices focused on this land use should be prioritized for best results in water quality. Practices related to grazing include fencing, heavy use pads, rotational and prescribed grazing methods, alternative watering sources, forage enhancements and others. Projects that address erosion issues may include vegetative practices or structural improvements. Examples of vegetative improvements would be critical area planting, forested buffer, conservation cover, grassed waterways and others listed on the NRCS list of conservation practices found at the following website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/cp/ncps/

Erosion control BMPs include stream bank stabilizations and livestock exclusion fencing. One practice of particular note would be riparian plantings either through riparian forest buffer planting (NRCS code 391) or riparian hedgerow planting (NRCS Code 422). These two practices help to establish shade and filtration that are both needed for stream health and water quality improvements. Buffer improvements have been identified as an area for potential high impact improvements. In addition, stream buffers and corridors have been identified as high restoration priorities according to the WMPI analysis described above. Fish IBI and bacteria data suggest buffers will be valuable to improving water quality and habitat. There is a high percentage of canopy cover in watershed, the visual survey generated a scored buffer at select locations but a watershed wide buffer analysis was not conducted for this study.

Increased use or presence of nutrients are often correlated with agricultural lands. BMPs for addressing nutrients, such as Nutrient Management Plans, should also be considered. Water quality trading guidance has been proposed by the GAEPD and may be a viable option for addressing nutrient loading on saturated fields in a nutrient trading program. Other BMPs that address grazing management also improve nutrient management. Examples include rotational grazing, fencing and management systems that improve agronomic crop utilization of nutrients such as cover cropping and establishment of healthy stands of forage for nutrient uptake.

This map represents the areas of the watershed that have been specifically zoned for agricultural use (19.4% of the watershed). The County tax assessor's office did note that some parcels are generally zoned and may be used for agriculture but have not been specifically designated as agricultural zoning. Based on this information, this map sheds light on agricultural land use but is not all inclusive of agricultural uses.

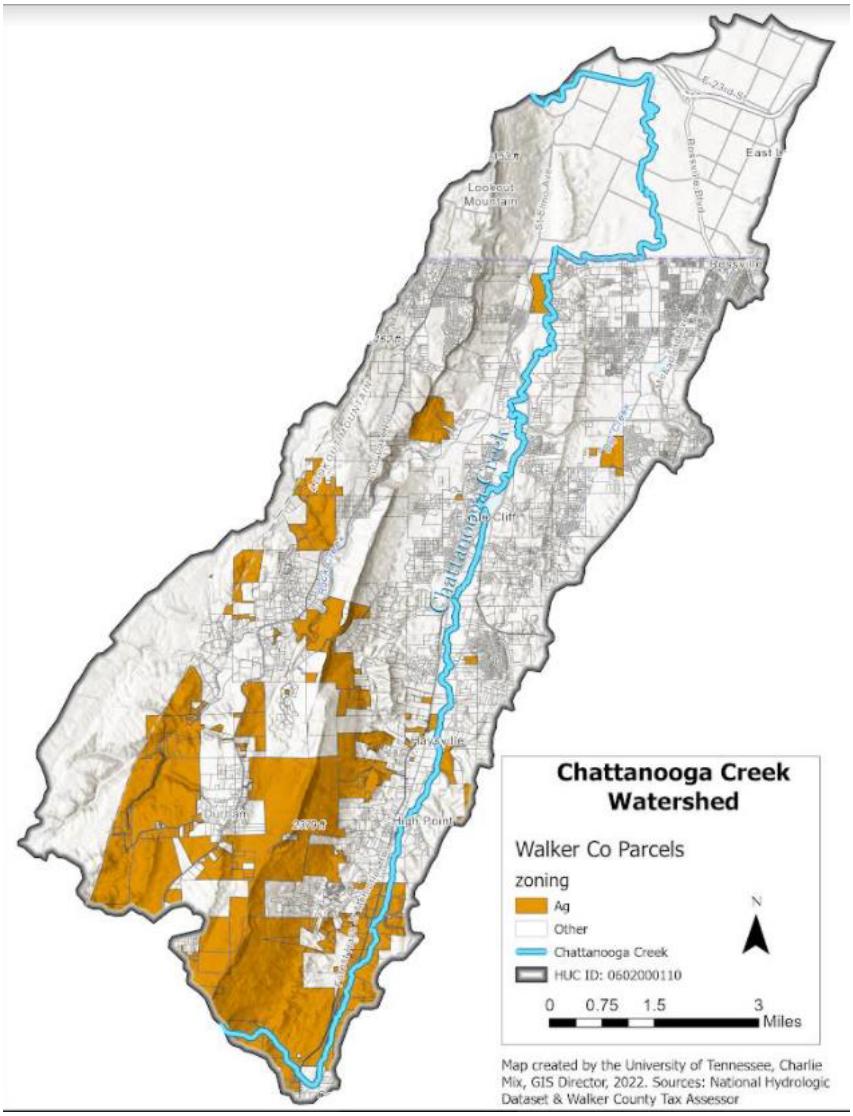


Figure 9 – Agricultural Parcels

Non-Structural BMPs

In order to meet current regional and state regulatory mandates as well as to improve water quality and restore habitat in local watersheds, Walker County will continue to plan and implement effective stormwater management through its MS4 program. Urbanization of undeveloped land accelerates stormwater runoff rates and peak discharges that increase velocities above natural levels. The increased discharge peaks and velocities accelerate erosion and generate increased sediment loads that contribute to the degradation of aquatic habitat and low oxygen levels in the receiving streams as evidenced in the

habitat and biological data presented previously. This problem can be addressed through careful plan reviews, regular inspections, and enforcement, as needed to ensure compliance with stormwater management ordinances.

Another non-structural BMP is monitoring of improvement projects. Evaluating the effectiveness of structural BMPs will provide information of which BMPs are working toward the goal of improving water quality and habitat in the watershed.

Element E: Public Outreach

A public meeting was held on November 16, 2021 at the Walker County Civic Center. The stakeholders present provided feedback on areas of concern including the impact from increased density of development, especially along Hwy 2 corridor near Ridgeland High School. Other concerns include problem areas due to septic issues and questions about impacts on water quality from historic textile industry in Flintstone area. Also, there were questions about historic shale mining near Rossville.

A second meeting to present this plan was held April 20, 2022 at the same location and was publicized in partnership with Walker County. Figure 10 shows a presentation during the meeting. The public meeting was attended by both community and municipal representatives. Information was shared regarding the watershed and currently available data. Following the formal presentation, public comment centered around septic needs in the urban and suburban areas in the north of the county.

A stakeholder group reviewed the draft WMP and also provided comments. Those comments have been addressed and appropriate edits inserted into this document. Some comments were not able to be addressed due to limited scope, funding and resources relative to the development of this plan. Additional GIS modeling and collection of additional data was highlighted as potential areas for future addendums to this WMP.

Figure 10 – LVRCD Executive Director Stephen Bontekoe at Public Meeting, Rock Spring GA

Education and outreach should be a key part of promoting cost-share program benefits and engaging the public. Demonstrating conservation BMPs accomplishes both the conservation outcomes as well as local education. Adoption of BMPs often starts with firsthand knowledge of the practices, processes, and effects. A few examples of successful outreach are local newspaper articles, creek days, and public workshops are all acceptable ways to spotlight the benefits of agricultural BMPs. Other efforts will offer educational opportunities during volunteer workdays (riparian plantings, stream cleanups, etc.).

An outreach plan should be developed for every grant related to improving the watershed. These outreach plans should identify annual or semi-annual events that will be held that encourage public participation in the watershed improvement process. Events could include online presentations and feedback groups, canoe floats, stream cleanups, training or classes, and the establishment of viable Adopt-A-Stream groups. Although many of the streams within this watershed may be too small for floats or too remote for effective cleanups, other opportunities to connect the community to creeks are possible. As a part of an outreach plan, press releases should be periodically issued to local newspapers or on community social media pages to highlight watershed opportunities as well as watershed issues and solutions. Promotions should also include local presentations to stakeholder groups in order to spawn interest in the restoration efforts by reminding local groups of the benefits the implementation effort is seeking to provide (e.g., reduced human health risk and increased financial assistance within the community). An outreach plan should always include promotion of significant progress made in the watershed toward water quality goals. Partners in the Tennessee portion of the watershed have already expressed interest in outreach and cross state line efforts to address outreach.

Conservation Target Areas

Conservation areas were determined using the Southeast Conservation Blueprint, a regional conservation initiative for the Southeast United States and the Caribbean, developed by the US Fish and Wildlife Service. The model is based on available spatial information from federal agencies and private entities. For more information, see Appendix B. Figure 11 illustrates high and medium conservation areas in the Chattanooga Creek watershed. These values are based on various plans and tools developed by the US Fish and Wildlife Service, USGS, South Atlantic Landscape Conservation Cooperative, the Nature Conservancy, and others. The information was derived from the South Atlantic Conservation Blueprint and the Appalachian NatureScape Design. Note that high priority conservation areas are generally high elevation and forested areas (wildlife corridors).

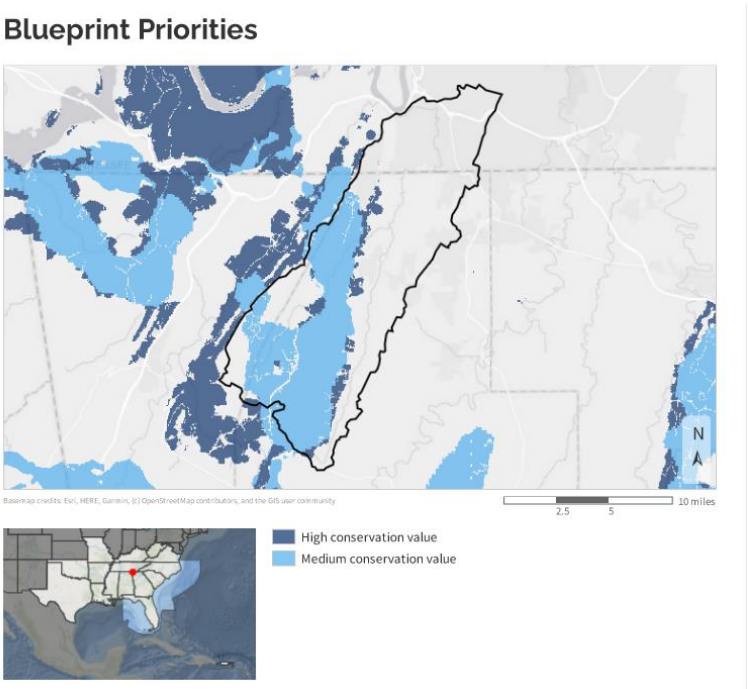


Figure 11 – Conservation Areas

Figure 12 illustrates threats to conservations areas, especially urban growth. Urban development may negatively impact water quality, therefore urban land BMPs are needed in these areas, especially adjacent to stream corridors. Additionally, these areas identified as urban growth areas are opportunities to address green infrastructure and implement water quality focused BMPs related to development.

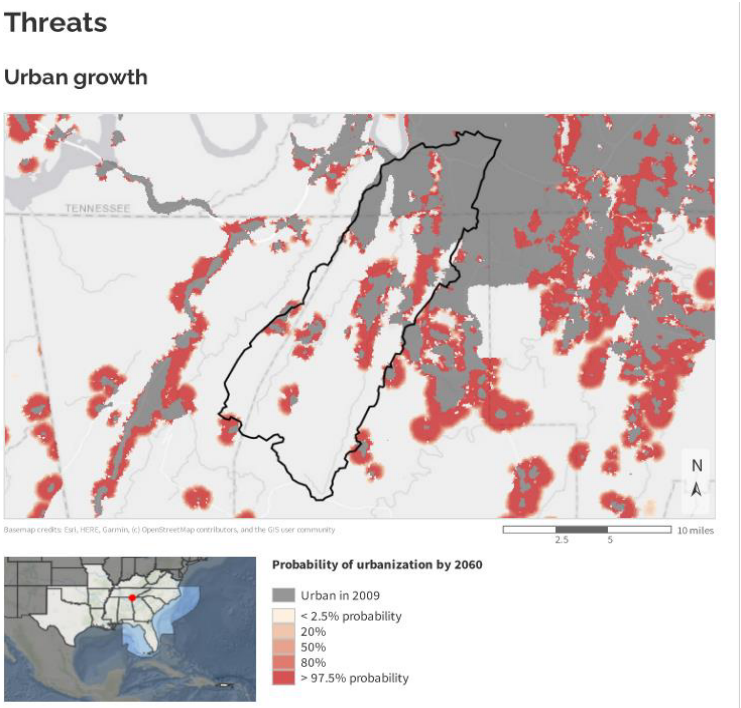


Figure 12 – Urban Growth Areas

Target Areas

Water quality analyses, fish survey, and WMPI analysis, and stakeholder input indicate certain stream segments are more heavily impacted than others in the watershed. The listed segments, for fecal coliform and impacted biota, both are concentrated in the lower watershed. The entire watershed impacts the lower watershed; therefore, BMP installations need to be implemented throughout the watershed in order to have the greatest effect. The highest priority restoration areas are identified in the WMPI modeling and depicted in the map previously shown in Figures 7 and 8. These restoration priority areas should be targeted for structural improvements but not limit the scope of the improvement area. Emphasis should be placed on each of the major sources of pollutants which include agriculture, forestry activities, failing septic systems, and urban stormwater runoff.

Element D: Financial

Once specific BMPs are identified, a cost estimate can be developed. Potential funding sources include USEPA 319 grants, Georgia Environmental Finance Authority loans, Georgia Outdoor Stewardship Grants, the FEMA Flood Hazard Mitigation Program, Regional Water Plan Seed Grants, water quality trading agreement with Walker County, and the various conservation programs that target agriculture and forestry activities. The USEPA Water Finance Clearinghouse also provides numerous sources of potential funding, which can be found at:

https://www.epa.gov/waterdata/water-finance-clearinghouse.

A table of conservation programs and associated managing entities is included in Table 17. These are the known, successful, conservation opportunities. The programs range from forestry to agriculture and also present options for addressing stormwater infiltration measures and septic system rehabilitation. These management measures which assist in controlling pollutant loads resulting in decreased levels of fecal coliform and/or sedimentation. Listed programs allow for the development and implementation of voluntary conservation management plans.

Table 17 - Conservation Programs Available to Help Implement WMP			
Programs	**Responsibility**	**Description**	**Impairment Source Addressed**
Clean Water Act Section 319 Nonpoint Source Grants	US EPA, GAEPD	Makes Federal funding available for impaired watersheds to address nonpoint source pollution concerns and ultimately seek to move toward de-listing impairments.	Agriculture/ Residential/ Urban
Regional Water Plan Seed Grant	GAEPD	Provides cost share funding for implementing elements of the Regional Water Plans.	Urban/Agricultur e
Georgia Outdoor Stewardship Grant	GADNR	stewardship, conservation protection of lands for clean water and wildlife	all land uses
Conservation Reserve Program	FSA, NRCS	Addresses problem areas on farmland through conversion of sensitive acreage to vegetative cover such as establishing vegetative buffers along waterways. Conversion costs are shared with FSA, and the landowner receives an annual payment for maintaining the conversion.	Agriculture
Conservation Tillage Program	LVRCD	Makes conservation tillage equipment available for rent within the watershed, helping producers plant their crops with minimal disturbance to the soil. This reduces erosion from cropland and increases water retention and nutrients.	Agriculture
Environmental Quality Incentives Program (EQIP)	NRCS	Works to address resource concerns on agricultural lands. EQIP is a cost-share program (75% typically but 90% for water quality priority practices) for landowners seeking to implement BMPs on their property.	Agriculture
Conservation Stewardship Program (CSP)	NRCS	A program that incentives conservation management practices with annual payments for completed conservation.	Agriculture
National Fish Passage Program	USFWS, National Fish Passage Program, SARP	Works to address barriers to the movements of aquatic organisms as well as improve aquatic habitats.	Biotic Communities

Septic System Permitting and Inspection Program	North Georgia Health District/ County Health Departments	Septic system repairs and installations are permitted and inspected by North Georgia Health District Staff. This not only ensures that systems are functioning, but also that they are installed by a licensed individual according to state regulations	Urban/Residential
Stream, Riparian Buffer, and Streambank Improvement Efforts	USFWS, Partners for Fish and Wildlife Program	Works to address stream habitat, riparian buffer, and streambank issues on private, city or county lands through a cost-share program aimed at areas key to fish and wildlife habitat improvement.	Agriculture/ Biotic Communities/ Residential

Element H: Criteria to Monitoring and Assess BMPs

Evaluation of BMPs will be determined based on BMP selection and may include water quality monitoring, number of BMPs installed, number of participants in public outreach activities, compliance with existing ordinance and programs, or others. Appropriate monitoring and assessment tasks associated will be developed once specific sites for BMP are identified.

Walker County as an MS4 conducts regular monitoring of the watershed and reports to GAEPD. Improvements in water quality may be captured in these monitoring efforts though monitoring above and below specific installed BMPs would prove more impactful.

No known Adopt a Stream groups are active in the watershed but this could be an outreach opportunity to develop a adopt a stream program for the watershed. Monitoring should focus on fecal and sediment although all parameters are valuable in understanding water quality. Note: GA EPD is transitioning from fecal coliform monitoring to E Coli monitoring and future efforts should comply with the new standard when available.

Element F and G: Schedule and Milestones

The following schedule provides a list of milestones and dates for implementation of the Watershed Management Plan.

Table 18 - Schedule and Milestones of Watershed Plan Implementation												
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Apply for funding	X			x			x			x		
Agricultural BMP installation		x	x	x	x	x	x	x	x	x	x	x
Stormwater BMP installation			x		x		x	x	x	x	x	x
Sewer Service Extension			x	x	x	x	x	x				
Septic Tank Rehab		x	x	x	x	x	x	x	x	x	x	
Streambank stabilization			x			x			x		x	
Nutrient Management plans		x	x	x	x	x	x	x	x	x		
Native species replanting in riparian buffer		x	x	x	x	x	x	x	x	x		
AAS training and network		x		x		x		x		x		x
Rivers Alive Cleanup	x	x	x	x	x	x	x	x	x	x	x	x
Education and Outreach activities	x	x	x	x	x	x	x	x	x	x	x	x
Reevaluate plan and update						x					x	

Element I: Implement and Evaluate Plan

The information found in this WMP will help improve and restore streams in the Georgia section of Chattanooga Creek. The WMP will be updated at regular intervals to reflect changes in funding, BMP opportunities, public input, effectiveness of BMPs, and other factors that may influence implementation of the WMP. The review interval should be no greater than every five years in order to keep the plan relevant to the changing landscape and community needs.

Implementation of community engagement projects such as Rivers Alive clean ups should be organized yearly as a means to keep the community involved in the care and prioritization of the watershed. Adopt-A-Stream trainings may be scheduled less frequently or as more volunteers are involved. Trainings should take place every other year or more often to keep volunteers up to date on sampling skills and matriculate new volunteers into the program.

Funding is also a key to successful watershed improvements. Application for funding should begin immediately and continue as funds become available or as often as every three years. Applications for USEPA 319(h) funding should be considered and once reaches are delisted funding for healthy watershed initiatives should be considered to carry on the positive water quality trends. Demonstration sites for stormwater BMPs should be implemented in multiple years with more emphasis building on those BMPs as development continues. Cost share for demonstration sites should be higher with lower requests being made in later application years as the practices become more widely accepted and adopted in the watershed.

Agricultural implementation of BMPs should be applied for in each funding request and implemented in each year with focus on all types of agricultural impacts including nutrients, sediment, fecal and any aspect related to general agriculture or NIPF.

Septic system (on site sanitation) repairs have been identified as a major need in the watershed. Septic repairs should be prioritized in each year of the implementation. Additionally, septic repairs should be a part of any funding request.

Sewer system connections should take place once mainlines are installed and capacity is ready for additional connections. These connections should take place in groupings of years related to the installation of services within portions of the watershed. The implementation schedule on this aspect is subject to change based on mainline installation schedules.

Overall success of the implementation plan will be based on availability of funding, community engagement, and municipal support. Based on the plan outlined and milestones set, this plan should have positive impacts on the nonpoint contributions to water quality over the 10-year implementation schedule outlined above. Evaluation of BMPs will lead to implementation of the most impactful improvement practices. Walker County may call for public comment or community meetings to update or change this plan at any time with a target to update at least every five years.

References

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GAEPD. January 2009.Total Maximum Daily Load Evaluation for Sixteen Stream Segments in the Tennessee River Basin for Sediment (Biota Impacted).

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GAEPD. April 28, 2006. State of Georgia. Tier 2 TMDL Implementation Plan. Revision 1. Chattanooga Creek Watershed. Tennessee River Basin.

Northwest Georgia Regional Commission. Walker County Joint Comprehensive Plan, 2017 – 2021.

Walker County Water and Sewerage Authority. Watershed Protection Plan, October 2015. Updated June 2018.

Attachments

Attachment A - Chattanooga Creek Watershed 2021 Index of Biological Integrity (IBI) report

Chattanooga Creek Watershed 2021 IBI report

Prepared by:

Bernie Kuhajda and Shawna Fix
Tennessee Aquarium Conservation Institute

For:

Limestone Valley RC&D

26 July 2021

Introduction

The purpose of this project is to provide current fish IBI scores on two sites in two different streams within the Chattanooga Creek watershed in Walker County, GA (Figure 1). Limestone Valley RC&D's mission is to enhance the communities within their eleven county area by promoting conservation, water quality improvement, natural resource education and sustainable agriculture. The Tennessee Aquarium Conservation Institute was contracted by Limestone Valley to assist in these IBI surveys and write a report on the findings. Data will be used to inform management decisions within the Chattanooga Creek watershed.

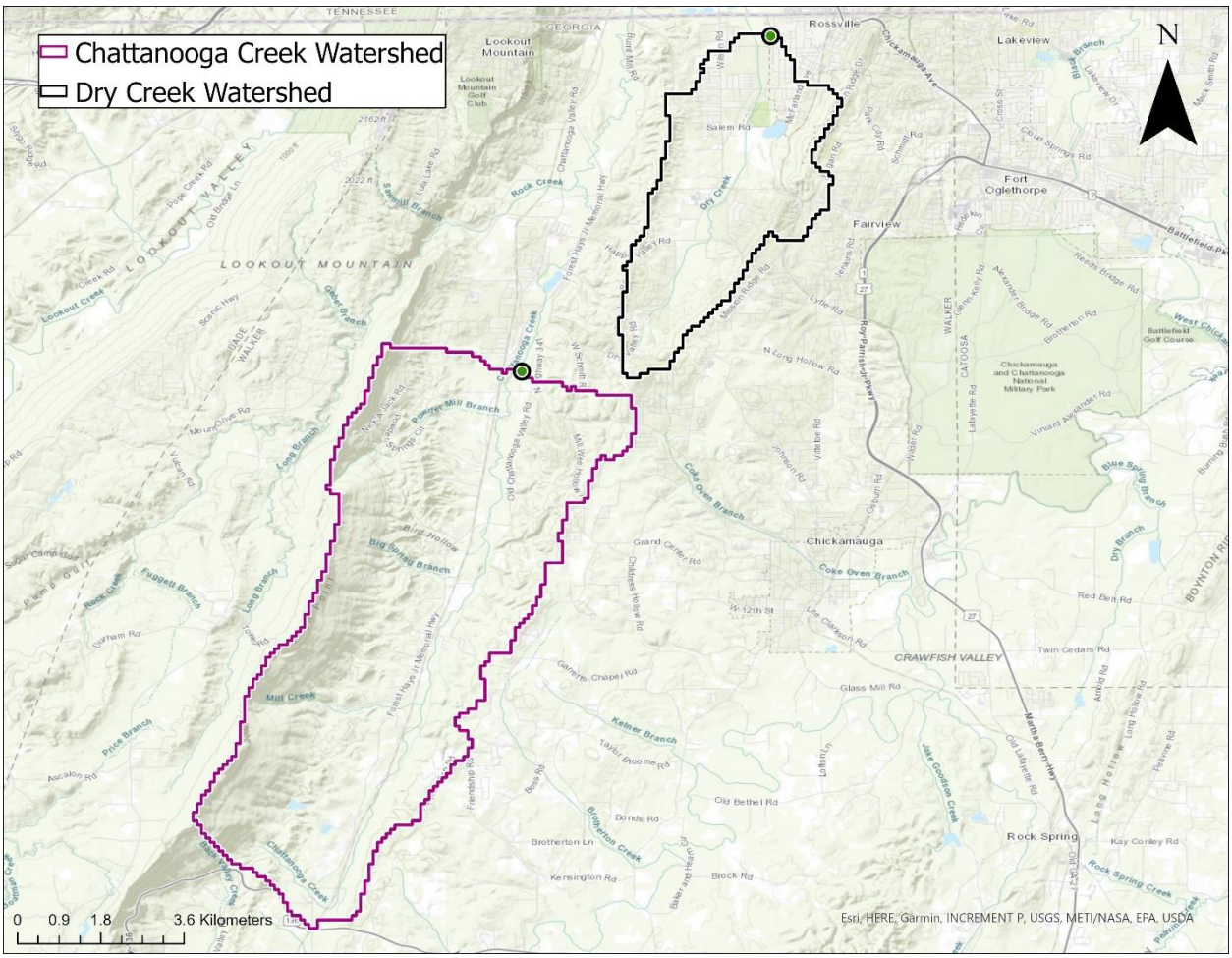

Figure 1. Sites (green and black dots) on two streams within the Chattanooga Creek watershed sampled for this study. Dark lines represent sub-watershed upstream of were sampling occurred.

Methods

Two streams within the Chattanooga Creek watershed (Figure 1) were sampled following Georgia Department of Natural Resources' (GADNR) Standard Operating Procedures for Conducting Biomonitoring on Fish Communities in Wadeable Streams in Georgia (https://georgiawildlife.com/sites/default/files/wrd/pdf/SOP/streamsurvey_Part1.pdf). The Chattanooga Creek watershed is within the Tennessee River drainage in the Ridge and Valley physiographic province/ecoregion. Therefore fish IBI scoring criteria used in this study followed those specifically tailored for this region of Georgia (Scoring Criteria for the Index of Biotic Integrity and the Index of Well-Being to Monitor Fish Communities in Wadeable Streams in the Coosa and Tennessee

Drainage Basins of the Ridge and Valley Ecoregion of Georgia, https://georgiawildlife.com/sites/default/files/wrd/pdf/SOP/streamsurvey_SOP_Part4_RidgeValley.pdf).

Each stream was sampled at a single site. Backpack shockers and dipnets were used for fish sampling. Fishes were held in containers with fresh creek water and aerators as they were identified to species and counted (Figure 2). Photo vouchers of most fish species were taken (Appendix A). Water quality (temperature (°C) DO (mg/L), conductivity (µS), pH, turbidity (NTU), total dissolved solids (ppm)) was measured using a YSI multiport sonde (electronic probe).

Figure 2. Sorting, identification, and enumeration of fishes during IBI study.

Days prior to fish and water quality sampling, five stream transects were established at each site to obtain an average stream width (m). Other measurement taken at these transects included stream depth (m) at 1/4, 1/2, and 3/4 of stream width from a shoreline. Average stream width was needed to determine the length of the stream reach to be sampled for fishes at each site. Within the stream reach, the total number of pools, riffles, and bends, and the deepest pool were recorded. Other habitat assessments (riffle/run and glide/pool habitats) were also scored using GADNR protocols.

The two streams sampled include:
Chattanooga Creek downstream of Nick A Jack Lane (34.91335, -85.35173), Walker County, GA, 20 May 2021.
Dry Creek upstream of Maple Street (34.97808, -85.30283), Walker County, GA, 20 May 2021.

Results and Discussion

Chattanooga Creek downstream of Nick A Jack Lane (34.91335, -85.35173), Walker County, GA, 20 May 2021

Chattanooga Creek was the largest site sampled, both in stream width (average 6.3 m) and drainage area above the sample site (17.75 sq. miles). The stream reach sampled for fishes in Chattanooga Creek was 219.8 m long, containing 5 pools, 4 riffles, and 4 bends, which should adequately represent the fish community. Stream width averaged 6.3 m and stream depth 0.48 m. The majority of the sampled reach flowed through a continuous riparian zone bordered by fields, and some bank erosion was evident at several locations. Water quality parameters are given below in Table 1.

Table 1. Water quality parameters for Chattanooga Creek.

Water Quality Chattanooga Creek	
Elevation (ft)	722
Water Temp (°C)	18.2
DO (mg/L)	7.5
Conductivity (µS)	234.9
pH	8.7
Turbidity (NTU)	4.99
Total Hardness (ppm)	176

Fish sampling occurred from 9:33-10:16 and 10:45-11:30, with the one stop for fish identification and enumeration. Two backpack shockers were used in fish sampling. A total of 18 fish species in 8 families were collected, 17 of them native species. Total number of individuals was 209, with one redhorse sucker not identifiable to species and not used in IBI analyses (Table 2).

Table 2. Fish species and number of specimens collected in Chattanooga Creek. Asterisk = non-native species.

Species	Common Name	Specimen count	Family
Campostoma oligolepis	Largescale Stoneroller	23	Cyprinidae
Luxilus chrysocephalus	Striped Shiner	8	Cyprinidae
Notropis volucellus.	Mimic Shiner	1	Cyprinidae
Hypentelium etowanum	Alabama Hog Sucker	10	Catostomidae
Moxostoma duquesnei	Black Redhorse	2	Catostomidae
Moxostoma erythrurum	Golden Redhorse	1	Catostomidae
Moxostoma sp. juvenile	–	1	Catostomidae
Fundulus olivaceus	Blackspotted Topminnow	2	Fundulidae
Gambusia affinis	Western Mosquitofish	2	Poeciliidae
Cottus carolinae	Banded Sculpin	1	Cottidae
Ambloplites rupestris	Rock Bass	2	Centrarchidae
**Lepomis auritus*	Redbreast Sunfish	17	Centrarchidae
Lepomis cyanellus	Green Sunfish	16	Centrarchidae
Lepomis gulosus	Warmouth	4	Centrarchidae
Lepomis macrochirus	Bluegill	19	Centrarchidae
Micropterus salmoides	Largemouth Bass	2	Centrarchidae
Etheostoma jessiae	Blueside Darter	1	Percidae
Etheostoma rufilineatum	Redline Darter	87	Percidae
Etheostoma tennesseense	Tennessee Darter	10	Percidae
	Total	**209**	

Calculated metrics that are used in scoring for fish IBIs are given in Table 5. Based on these metrics and scoring criteria for the Tennessee River drainage in the Ridge and Valley Ecoregion, the IBI score for this site was 34, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Chattanooga Creek were 137 and 145 out of 200, respectively, indicating these habitats are somewhat degraded (Table 6).

Three historical fish IBI scores are available for Chattanooga Creek in Walker County. On 26 June 2002 the IBI score was 52, which ranks this fish community as Excellent. One year later on 11 Aug 2003 the IBI score and ranking dropped to 46 and Good. Four year later, on 1 Aug 2007, the IBI score was 40, which ranks this fish community as Fair. Even though Chattanooga Creek still ranks as Fair, the IBI score of 34 is at the bottom of the range for this ranking. Hopefully a watershed management plan can reverse this negative trend seen over the last 19 years.

<u>Dry Creek upstream of Maple Street (34.97808, -85.30283), Walker County, GA, 20 May 2021</u>
Dry Creek was the smallest site sampled in drainage area above the sample site (6.07 sq. miles) and had the lowest average stream width (4.96 m). The stream reach sampled for fishes in Dry Creek was 173.6 m long. This reach contained 3 pools, 2 riffles, and notably 0 bends. Stream width averaged 4.96 m and

stream depth averaged 0.165 m. The sampled reach flowed adjacent to a car junk yard on one side, although there was extensive riparian zone, and a trail was along the other bank. Bank erosion was evident along the side with the trail. Water quality parameters are given in Table 3.

Table 3. Water quality parameters for Dry Creek.

Water Quality Dry Creek	
Elevation (ft)	657
Water Temp (°C)	18.6
DO (mg/L)	8.03
Conductivity (µS)	310.8
pH	8.32
Turbidity (NTU)	1.08
Total Hardness (ppm)	229

Fish sampling occurred from 13:55-14:22 and 14:30-?, which included one stop for fish identification and enumeration. Two backpack shockers were used in fish sampling. A total of 16 fish species in 6 families were collected, 15 of them native species. Total number of individuals was 487 (Table 5).

Table 4. Fish species and number of specimens collected in Pine Log Creek. Asterisk = non-native species.

Species	**Common Name**	**Specimen count**	**Family**
Campostoma oligolepis	Largescale Stoneroller	235	Cyprinidae
Hybopsis amblops	Bigeye Chub	1	Cyprinidae
Luxilus chrysocephalus	Striped Shiner	61	Cyprinidae
Pimephales notatus.	Bluntnose Monnow	58	Cyprinidae
Rhinichthys obtusus	Blacknose Dace	19	Cyprinidae
Semotilus atromaculatus	Creek Chub	1	Cyprinidae
Catostomus commersoni	White Sucker	4	Catostomidae
Ameiurus natalis	Yellow Bullhead	10	Catostomidae
Gambusia affinis	Western Mosquitofish	5	Poeciliidae
Cottus carolinae	Banded Sculpin	3	Cottidae
**Lepomis auritus*	Redbreast Sunfish	27	Centrarchidae
Lepomis cyanellus	Green Sunfish	25	Centrarchidae
Lepomis gulosus	Warmouth	6	Centrarchidae
Lepomis macrochirus	Bluegill	27	Centrarchidae
Lepomis punctatus	Spotted Sunfish	4	Centrarchidae
Etheostoma tennesseense	Tennessee Darter	1	Percidae
	Total	**487**	

Calculated metrics that are used in scoring for fish IBIs are given in Table 5. Based on these metrics and scoring criteria for the Tennessee River drainage in the Ridge and Valley Ecoregion, the IBI score for this site was 24, which ranks this fish community as Very Poor (8-24). Attributes for this ranking include most fishes are generalist and poor habitat conditions are present. Dry Creek has been channelized and the stream has recovered very little habitat variability, with no bends, shallow long pools, and short riffle

with a chert substrate. Riffle/run and glide/pool habitat assessment scores for Dry Creek were 87 and 113 out of 200, respectively, indicating these habitats are very degraded (Table 7).

One historical fish IBI score is available for Dry Creek in Walker County. On 29 May 2002 the IBI score was 36, which ranks this fish community as Fair. In 19 years the IBI ranking has fallen to Very Poor, likely due to increased urbanization in the watershed and other disturbances.

Table 5. Calculated metrics used with scoring criteria to determine fish IBI scores for Chattanooga and Dry creek within the Chattanooga Creek watershed.

	Chattanooga	Dry
Physiographic province/ecoregion	Ridge & Valley	Ridge & Valley
Reach Length	219.8	173.6
Grand_Total_specimens	208	487
DBA (drainage basin area upstream of site)	17.75	6.07
log_10_DBA	1.249	0.783
Number of Individuals	208	487
Number of species	18	16
Total number of native fish species	17	15
Total number of benthic invertivore species	4	2
Total number of native sunfish species (DBA < 15 sq. mi)	–	4
Total number of native centrarchid species (DBA >15 sq. mi)	5	–
Total number of native insectivorous cyprinid species	2	3
Total number of round bodied sucker species	3	1
Total number of sensitive species (DBA < 15 sq. mi)	–	0
Total number of intolerant species (DBA > 15 sq. mi)	3	–
Evenness	70.86	64.70
% individuals as *Lepomis* species	26.92	18.28
% individuals as insectivorous cyprinid species	4.32	16.63
% individuals as generalist feeders/herbivore species (DBA < 15 sq. mi)	–	69.20
% individuals as top carnivore species (DBA > 15 sq. mi)	3.85	–
% individuals as benthic fluvial specialist species	54.33	5.75
Number of individuals collected per 200 meters	189.26	561.06
% individuals with external anomalies	0	0
Fish IBI scores	34	24
Fish IBI rank	Fair	Very Poor
	Chattanooga	Dry

Table 6. Riffle/run and glide/pool habitat assessment for Chattanooga Creek, Walker County, GA.

Riffle/Run Habitat Assessment	**Score**	**Max score**
Epifaunal Substrate/Instream Cover	18	20
Embeddedness in Run Areas	12	20
Velocity/ Depth Combinations	10	20
Channel Alteration	16	20
Sediment Deposition	10	20
Frequency of Riffles	14	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	4	10
Bank Vegetative Protection Right Bank	9	10
Bank Stability Left Bank	4	10
Bank Stability Right Bank	9	10
Riparian Vegetative Zone	3	10
Riparian Vegetative Zone	10	10
Total	137	200

Glide/Pool Habitat Assessment	**Score**	**Max score**
Bottom Substrate/Available Cover	19	20
Pool Substrate Characterization	18	20
Pool Variability	12	20
Channel Alteration	16	20
Sediment Deposition	10	20
Channel Sinuosity	13	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	4	10
Bank Vegetative Protection Right Bank	9	10
Bank Stability Left Bank	4	10
Bank Stability Right Bank	9	10
Riparian Vegetative Zone	3	10
Riparian Vegetative Zone	10	10
Total	145	200

Table 7. Riffle/run and glide/pool habitat assessment for Dry Creek, Walker County, GA.

Riffle/Run Habitat Assessment	**Score**	**Max score**
Epifaunal Substrate/Instream Cover	3	20
Embeddedness in Run Areas	14	20
Velocity/ Depth Combinations	3	20
Channel Alteration	11	20
Sediment Deposition	11	20
Frequency of Riffles	10	20
Channel Flow Status	13	20
Bank Vegetative Protection Left Bank	3	10
Bank Vegetative Protection Right Bank	2	10
Bank Stability Left Bank	4	10
Bank Stability Right Bank	1	10
Riparian Vegetative Zone	2	10
Riparian Vegetative Zone	10	10
Total	87	200

Glide/Pool Habitat Assessment	**Score**	**Max score**
Bottom Substrate/Available Cover	17	20
Pool Substrate Characterization	18	20
Pool Variability	5	20
Channel Alteration	11	20
Sediment Deposition	11	20
Channel Sinuosity	0	20
Channel Flow Status	13	20
Bank Vegetative Protection Left Bank	4	10
Bank Vegetative Protection Right Bank	8	10
Bank Stability Left Bank	7	10
Bank Stability Right Bank	5	10
Riparian Vegetative Zone	4	10
Riparian Vegetative Zone	10	10
Total	113	200

Acknowledgements

We acknowledge the GADNR for their guidance on IBI procedures and calculations. We thank Steve Bontekoe, Hunter Terrell, and Tanner Gatlin (Limestone Valley RC&D) with assistance sampling all localities. Funds for this study were provide by Limestone Valley RC&D.

Appendix A

Photo vouchers of fishes collected as part of an IBI study on two streams in the Chattanooga Creek watershed

Largescale Stoneroller *Campostoma oligolepis*, Chattanooga Creek GA, 20 May 2021

Striped Shiner *Luxilus chrysocephalus*, Chattanooga Creek GA, 20 May 2021

Mimic Shiner *Notropis volucellus*, Chattanooga Creek GA, 20 May 2021

Blackspotted Topminnow *Fundulus olivaceus*, Chattanooga Creek GA, 20 May 2021

Redline Darter *Etheostoma rufilineatum*, Chattanooga Creek GA, 20 May 2021

Tennessee Darter *Etheostoma tennesseense*, Chattanooga Creek GA, 20 May 2021

Bluntnose Minnow (breeding male) *Pimephales notatus*, Dry Creek GA, 20 May 2021

Spotted Sunfish *Lepomis punctatus*, Dry Creek GA, 20 May 2021

Attachment B – Southeast Conservation Blueprint Summary for the Chattanooga Creek WMP Limestone Valley

Southeast Conservation Blueprint Summary for Chattanooga Creek WMP_Limestone Valley

Created 03/05/2021

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About the Blueprint

The Southeast Conservation Blueprint is the primary product of the Southeast Conservation Adaptation Strategy (SECAS). It is a living, spatial plan that identifies important areas for conservation and restoration across the Southeast and Caribbean. The Blueprint stitches together smaller subregional plans into one consistent map, incorporating the best available information about key species, ecosystems, and future threats. More than 1,700 people from 500 different organizations have actively participated in its development so far.

The Blueprint stitches together smaller subregional plans into one consistent map, incorporating the best available information about the current condition of key species and habitats, as well as future threats. Where these subregional plans overlap, the following rules were used:

- Only include an input if known uses of that Blueprint input have occurred in the overlap zone
- If an overlap zone has no known use for any Blueprint input, only include the most well-established input

For more information, visit the Blueprint webpage , review the Blueprint 2020 Development Process , or overlay additional datasets and download Blueprint data using the Conservation Planning Atlas (CPA).

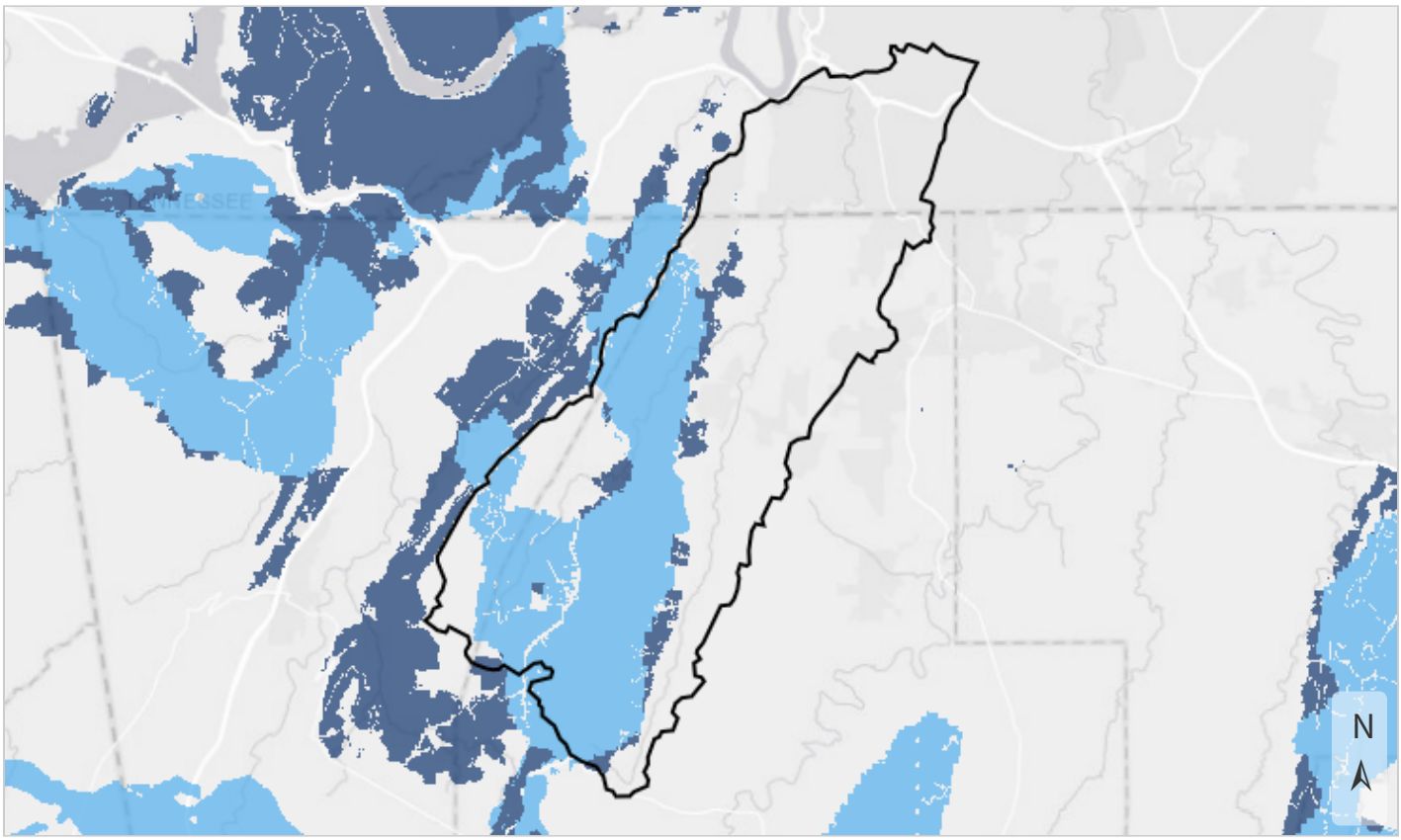
We're here to help!

- Do you have a question about the Blueprint?
- Would you like help using the Blueprint to support a proposal or inform a decision?
- Do you have a suggestion on how to improve the Blueprint? The Blueprint and its inputs are regularly revised based on input from people like you.
- Do you have feedback on how to improve the Simple Viewer interface?

If you need help or have questions, contact Southeast Blueprint staff by reaching out to the user support contact for your state.

We’re here to support you. We really mean it. It’s what we do!

Blueprint Priorities



Basemap credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

2.5 5 10 miles

High conservation value

Medium conservation value

Priority Categories

High conservation value

The most important for ecosystem health, function, and connectivity. This class covers roughly 30% of the Southeast Blueprint geography.

Medium conservation value

Areas that might require more restoration, but are important for buffering high value areas and maintaining connectivity. This class covers an additional 20% of the Southeast Blueprint geography

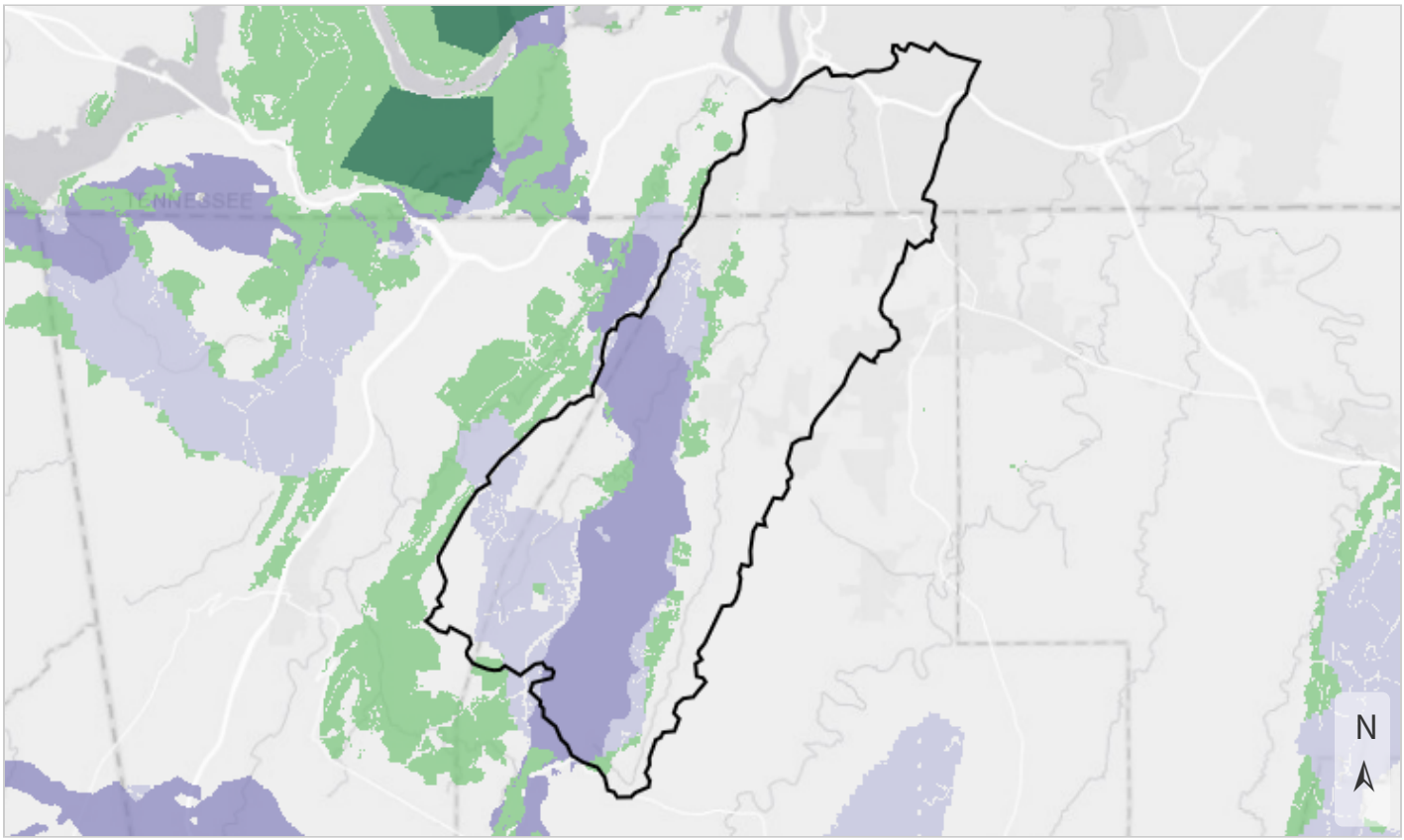
Table 1: Extent of each Blueprint priority category within Chattanooga Creek WMP_Limestone Valley.

Priority Category	Acres	Percent of Area
High conservation value	1,880	4%
Medium conservation value	14,953	32%
Not identified as high or medium	29,959	64%
Total area	**46,793**	**100%**

Appalachian NatureScape Design and TNC Resilient and Connected Landscapes Prioritized Network

(100% of area)

The Appalachian NatureScape Design combined data on ecologically important terrestrial and marine areas with a conservation planning tool to identify large interconnected regions (cores) and broad landscapes that connect them (connectors). The Nature Conservancy's Resilient and Connected Landscapes 'Prioritized Network' dataset integrates data on climate resilience, landscape permeability, and diversity to identify a connected network of sites that represent the full suite of geophysical settings that can also support species movement in response to climate change. Learn more about the Appalachian NatureScape Design and TNC Resilient and Connected Landscapes Prioritized Network. Access and download data.



Basemap credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

2.5 5 10 miles

Priority Area Type

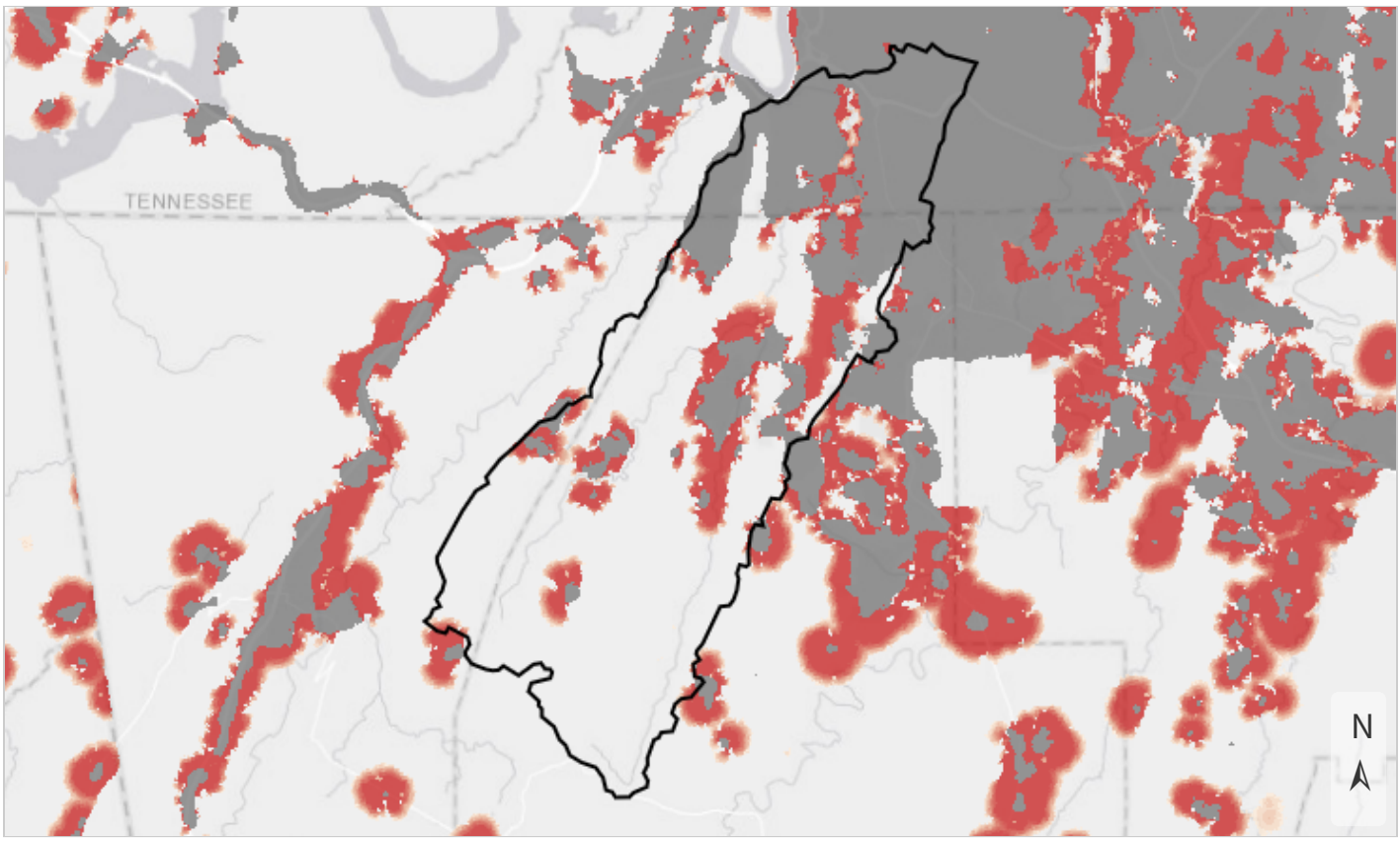
- NatureScape: local / regional cores and other important areas
- TNC Prioritized Network: resilient only with secured lands and resilient area with confirmed diversity
- NatureScape: local and regional connectors
- TNC Prioritized Network: climate corridors and climate flow zones with and without confirmed diversity

Table 2: Extent of each Blueprint input priority category within Chattanooga Creek WMP_Limestone Valley.

Priority Area Type	Acres	Percent of Area
NatureScape: local / regional cores and other important areas	0	0%
TNC Prioritized Network: resilient only with secured lands and resilient area with confirmed diversity	1,880	4%
NatureScape: local and regional connectors	9,078	19%
TNC Prioritized Network: climate corridors and climate flow zones with and without confirmed diversity	5,875	13%
Not a priority	29,959	64%
Total area	**46,793**	**100%**

Threats

Urban growth



Basemap credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

2.5 5 10 miles

Probability of urbanization by 2060

- Urban in 2009
- < 2.5% probability
- 20%
- 50%
- 80%
- > 97.5% probability

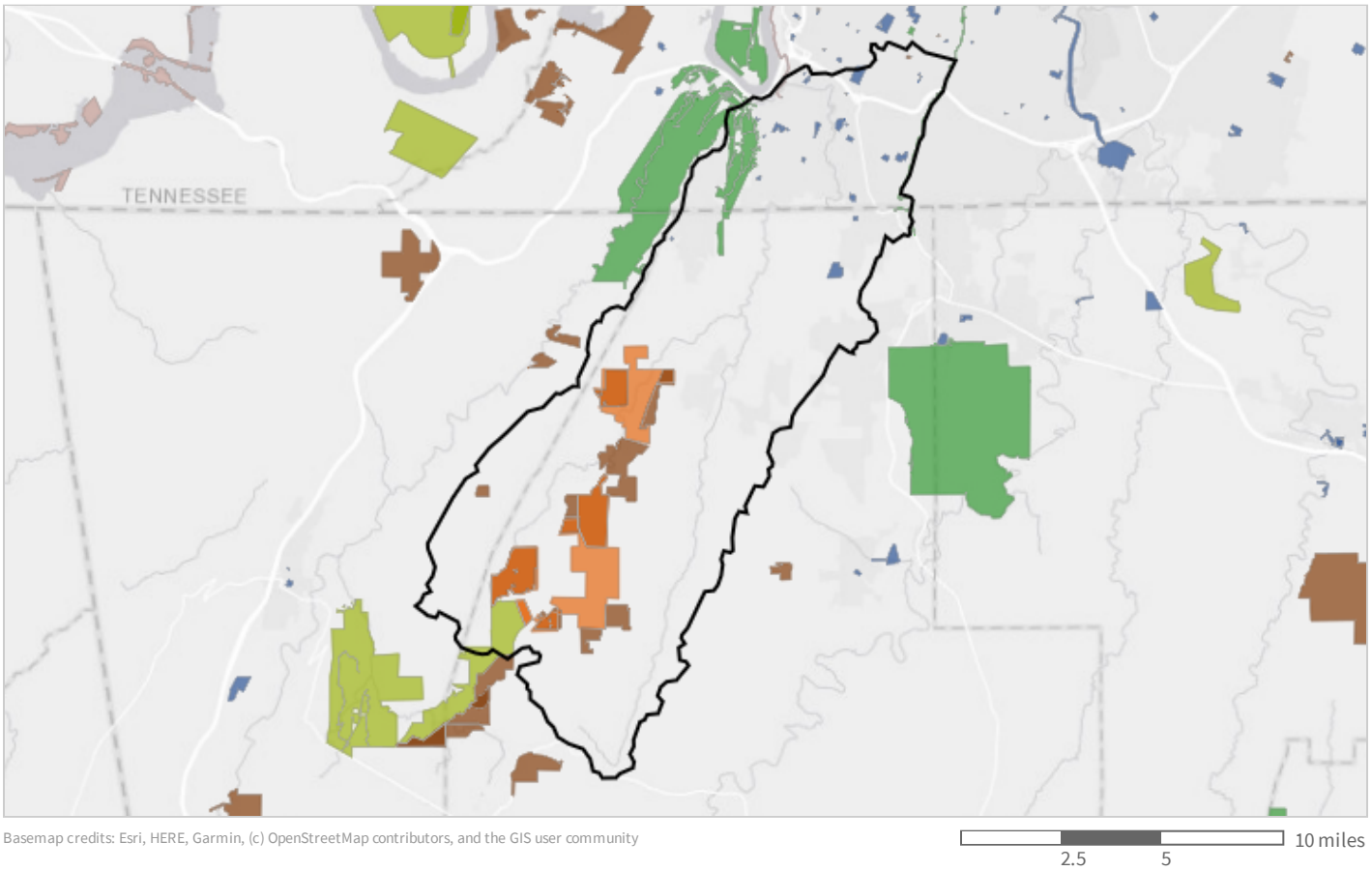
Table 3: Extent of projected urbanization by decade within Chattanooga Creek WMP_Limestone Valley. Values from the SLEUTH urban growth model. Note: areas are based on 60 meter pixels, unlike the 30 meter pixels used for the Blueprint and its inputs; this will cause the total acreage to be different.

Decade	Acres	Percent of Area
Urban in 2009	12,727	27%
2020 projected extent	14,175	30%
2030 projected extent	15,082	32%
2040 projected extent	16,008	34%
2050 projected extent	17,031	36%
2060 projected extent	18,149	39%
Not projected to urbanize by 2060	*28,631*	*61%*
Total area	**46,780**	**100%**

By 2060, urbanization is projected to increase **43%** over 2009 levels.

Ownership and Partners

Conserved lands ownership



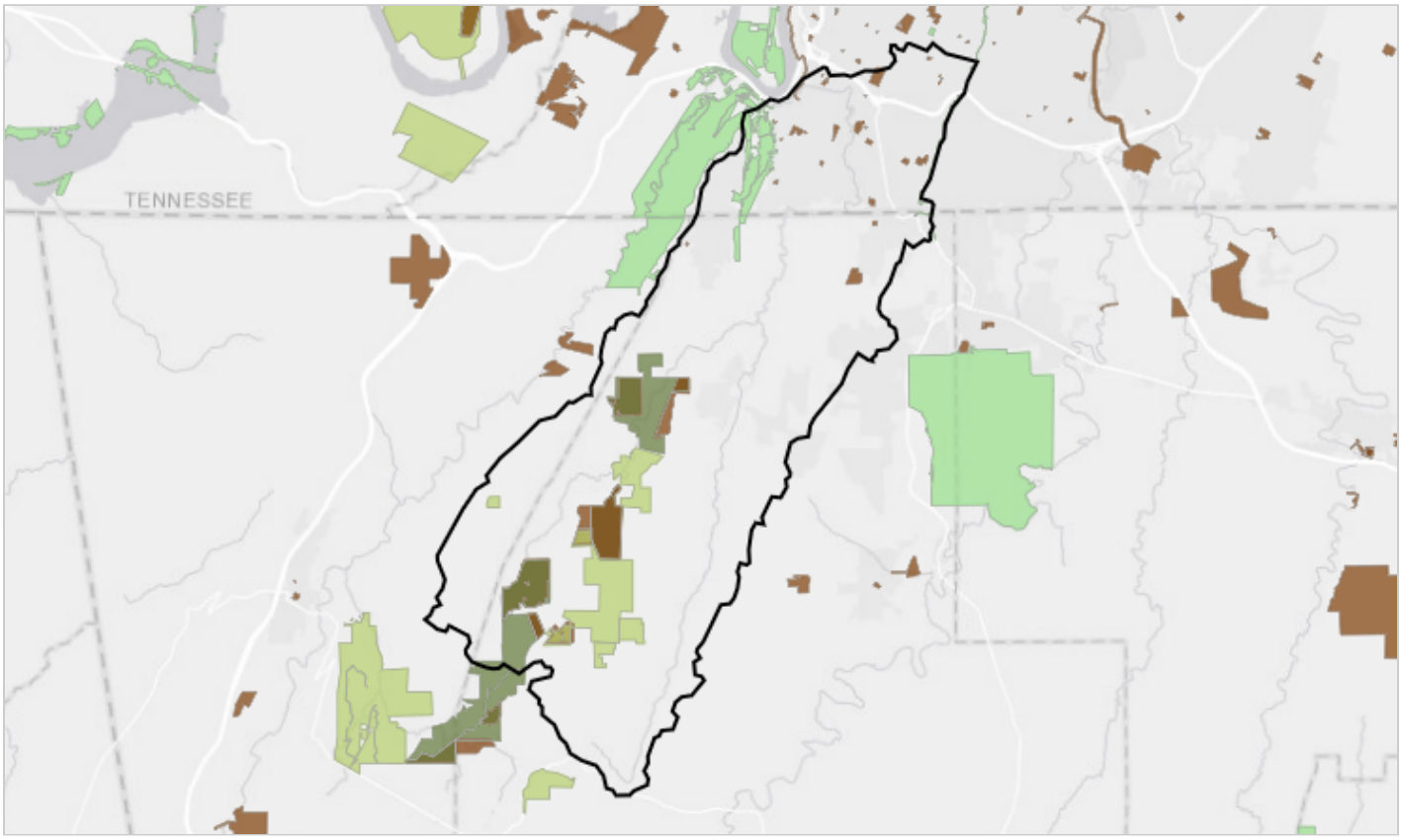
- Federal
- State/province
- Territorial
- Regional
- Local
- Joint
- Private non-profit
- Private
- Tribal
- Designation
- Ownership unknown

Table 4: Extent of ownership class within Chattanooga Creek WMP_Limestone Valley. Protected areas are derived from the derived from the Protected Areas Database of the United States (PAD-US v2.1). Note: areas are based on the polygon boundary of this area compared to protected area polygons, rather than pixel-level analyses used elsewhere in this report.

Ownership	Acres	Percent of Area
Federal	111,909	100%
State/province	449	<1%
Local	195	<1%
Joint	9	<1%
Private non-profit	3,318	7%
Private	2,548	5%
Not conserved	*< 0.01*	*<1%*
Total area	**46,796**	**100%**

Note: due to overlapping protected areas compiled from multiple sources and designations, the sum of areas in above categories is more than 100% of this area.

Land protection status



Basemap credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

2.5 5 10 miles

- Managed for biodiversity
- Managed for biodiversity
- Managed for multiple uses
- No known mandate for biodiversity protection

Table 5: Extent of land protection status within Chattanooga Creek WMP_Limestone Valley. Protected areas are derived from the derived from the Protected Areas Database of the United States (PAD-US v2.1). Note: areas are based on the polygon boundary of this area compared to protected area polygons, rather than pixel-level analyses used elsewhere in this report.

Land Protection Status	Acres	Percent of Area
Managed for biodiversity	2,538	5%
Managed for biodiversity	1,909	4%
Managed for multiple uses	111,909	100%
No known mandate for biodiversity protection	2,071	4%
Not conserved	*< 0.01*	*<1%*
Total area	**46,796**	**100%**

Note: due to overlapping protected areas compiled from multiple sources and designations, the sum of areas in above categories is more than 100% of this area.

Protected Areas

- CHCH (NPS; 111,909 acres)
- Lula Lake Land Trust Site (Lula Lake Land Trust; 2,801 acres)
- Lula Lake Land Trust site (NGO; 517 acres)
- Georgia-Alabama Land Trust Easement #602 / Lulu Lake Land Trust Site (PVT; 481 acres)
- Lula Lake Land Trust site (Lula Lake Land Trust; 463 acres)
- Cloudland Canyon State Park (Georgia Department of Natural Resources; 449 acres)
- Lula Falls Easement 2 (PVT; 442 acres)
- Georgia-Alabama Land Trust Easement #561 (PVT; 363 acres)
- Georgia-Alabama Land Trust Easement #603 / Lulu Lake Land Trust Site (PVT; 263 acres)
- Georgia-Alabama Land Trust Easement #551 (PVT; 154 acres)
- Georgia-Alabama Land Trust Easement #19 (PVT; 110 acres)
- 2012028 (PVT; 101 acres)
- GALT easement (PVT; 72 acres)
- Georgia-Alabama Land Trust Easement #129 / Lulu Lake Land Trust Site (PVT; 60 acres)
- Rossville Recreational Area (Rossville, City of; 48 acres)
- Montague Park (City of Chattanooga; 39 acres)

- Lula Falls Easement 1 (PVT; 38 acres)
- East Lake Park (City of Chattanooga; 19 acres)
- Crabtree Farms (City of Chattanooga; 18 acres)
- Ben Miller Park (Hamilton County/City of Chattanooga; 15 acres)
- Southside Community Park (City of Chattanooga; 11 acres)
- Boulevard Park (City of Chattanooga; 10 acres)
- Tennessee Riverwalk (Hamilton County/City of Chattanooga; 9 acres)
- East Lake Recreation Complex (City of Chattanooga; 8 acres)
- Caruthers Park (City of Chattanooga; 5 acres)
- ... and 13 more protected areas ...

Land Trusts (by county)

- Dade County, Georgia
- Walker County, Georgia
- Hamilton County, Tennessee

Credits

This report was generated by the Southeast Conservation Blueprint Explorer, which was developed by Astute Spruce, LLC in partnership with the U.S. Fish and Wildlife Service under the Southeast Conservation Adaptation Strategy

Data credits

Urbanization data are derived from the SLEUTH urban growth model.

Land ownership and conservation status is derived from the Protected Areas Database of the United States (PAD-US v2.1).

Attachment C – Visual Survey Data

CC1

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Heaton/Lancaster
Event Date: 10/3/21 (MMDDYYYY)
Group ID: G-_____ Site ID: S- CC1
Time Sample Collected: 2:40 pm (HHMM am/pm)
Stream Name: Chattanooga Creek
Time Spent Sampling: _____ (Min)
Monitor(s): _____
Total Time Spent Traveling *(optional)*: _____ (Min)
Number of Participants: 2
Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?

Amount in Inches: _____
In Last Hours/Days: _____
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other: _____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other: _____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other: _____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other: _____

Trash: ☑ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.
Photo point directions can be found in the manuals. Send photos to AAS@gaepd.org.

Reference Location (RL): Latitude (+) 34.8134 (DD.DDDD°) Longitude (-) 85.3893 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 300°NW

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 23 (ft/in)

Camera height at permanent Photo Point location (PPL): Height 5 (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at AdoptAStream.Georgia.gov

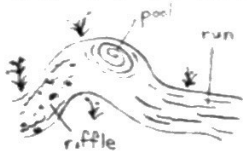
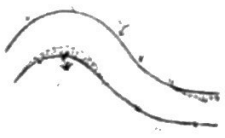
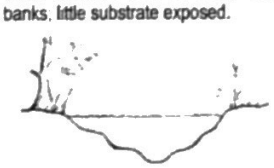
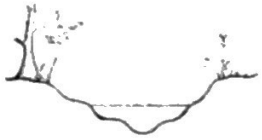
GEORGIA ADOPT-A-STREAM: Stream Habitat Survey

(Also fill out the Basic Visual Form when completing this survey)

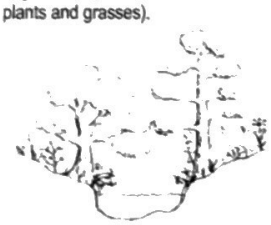
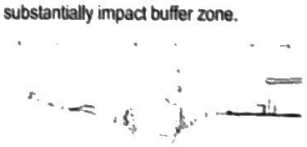
Type of Stream:
- ☑ Rocky bottom
- ☐ Muddy bottom

Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see? 8
	10 9 **(8)** 7 6 5 4 3 2 1 0			
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? 6
	10 9 8 7 **(6)** 5 4 3 2 1 0			
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, all **three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? 7
	10 9 8 **(7)** 6 5 4 3 2 1 0			
4. Sediment Deposition **Are point bars and islands present?**	**Point bars and islands stable** and of small size and frequency with some vegetation. Composed mostly of gravel and cobble. 	**Point bars and islands less stable** and of moderate size and frequency with some sparse vegetation. Composed mostly of some gravel and finer sediment. 	**Point bars and islands unstable** and of a large size with little or no vegetation. Composed almost entirely of fine sediment. 	What did you see? 9
	10 **(9)** 8 7 6 5 4 3 2 1 0			
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks, little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? 8
	10 9 **(8)** 7 6 5 4 3 2 1 0			

Total first side 38

Habitat Parameter	Excellent ---------- Poor			LC1
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see?
	10 9 8 7 **6** 5 4 3 2 1 0			Score 6
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.** 	There are **more bends than straight** sections. 	There are **more straight sections** than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7 **6** 5 4 3 2 1 0			Score 6
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	**Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	**Bank unstable**; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank	5 4.5 4 3.5 **3** 2.5 2 1.5 1 .5 0			Score (Add both 6
Right bank	5 4.5 4 3.5 **3** 2.5 2 1.5 1 .5 0			
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank	5 4.5 4 3.5 3 2.5 **2** 1.5 1 .5 0			Score (Add both banks) 4
Right bank	5 4.5 4 3.5 3 2.5 **2** 1.5 1 .5 0			
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side. 	Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank	5 4.5 4 3.5 3 2.5 2 **1.5** 1 .5 0			Score (Add both banks) 3
Right bank	5 4.5 4 3.5 3 2.5 2 **1.5** 1 .5 0			

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 38
Total first side 25
Total 63

Please submit data at: AdoptAStream.Georgia.gov
Or send to: 2 MLK Jr. Dr. SE, Suite 1462 East, Atlanta, GA 30334
Email: AAS@gaepd.org

CC1

GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA

Area = depth x width

It is advisable to take multiple depth and width measurements Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft	1.0	0.7	0.8	0.3	0.5	0.7	0.3	4.3

Average Depth 0.54 ft = 4.3 / 8 (sum of depth measurements / number of measurements)

Width Measurements	1.	2.	sum
	9.2 ft	10.4	19.6

Average Width 9.8 ft = 19.6 / 2 (sum of width measurements / number of measurements)

Area 5.29 ft² = width 9.8 X depth 0.54

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed
Take measurements from the stream run

length = 20 feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	134 s	142	104	123	503

average time 125.75 s = 503 / 4 (sum of time measurements / number of measurements)

Speed 0.16 ft/s = 20 / 125.75 (length in feet / average time in seconds)

CALCULATE STREAM FLOW

Flow 0.68 cfs = **Area** 5.29 X **Speed** 0.16 X **Coefficient** 0.8

Flow in cubic feet per second

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

CC1

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1	0	0.3	L Pin
2	0.5	2.0	
3	1.0	2.0	
4	1.5	2.0	
5	2.0	2.1	
6	2.5	2.1	
7	3.0	2.2	
8	3.5	2.2	
9	4.0	2.3	
10	4.5	2.2	
11	5.0	2.2	
12	5.5	2.3	
13	6.0	2.3	
14	6.5	2.3	
15	7.0	2.3	
16	7.5	2.2	
17	8.0	2.0	
18	8.5	2.0	
19	9.0	2.0	
20	9.5	0.4	
21	10.0	0.0	R Pin
22			
23			
24			
25			

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
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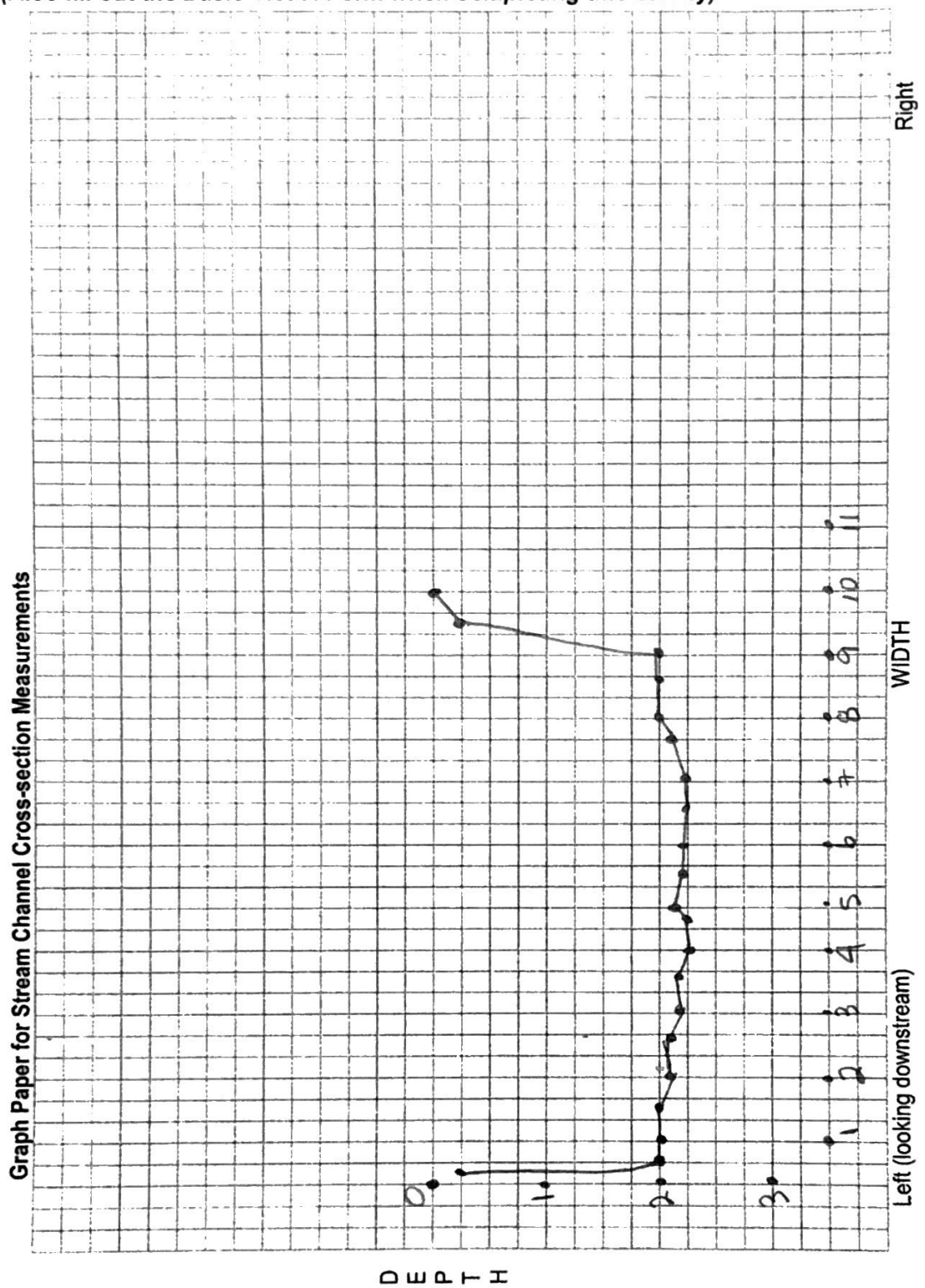
50			

CC1

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



CC1

GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1						✓
2						✓
3						✓
4			✓			
5			✓			
6	✓					
7			✓			
8						✓
9		✓				
10		✓				
11				✓		
12		✓				✓
13						✓
14			✓			
15				✓		
16		✓				
17				✓		
18					✓	
19				✓		
20	✓					
21			✓			
22		✓				
23				✓		
24			✓			
25		✓				
26		✓				
27				✓		
28				✓		
29					✓	
30		✓				
31			✓			
32			✓			
33				✓		
34		✓				
35		✓				
36			✓			
37				✓		
38			✓			
39			✓			
40				✓		
41				✓		
42					✓	
43			✓			
44		✓				
45						✓
46		✓				
47			✓			
48			✓			
49			✓			

GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles mammals mussels/clams/oysters
crustaceans ✓ birds

2. Fish in the stream: *(Check all that apply)*

no ✓ yes, but rare yes abundant
✓ small (1-2") medium (3-6") large (7" and above)

Are there barriers to fish movement?

none beaver dams waterfalls > 1ft
dams road barriers ✓ other: Box Culvert

3. Aquatic plants in the stream: *(Check all that apply)*

☑ none

☐ attached plants	occasional	plentiful
stream margin/edge	☐	☐
pools	☐	☐
near riffle		☐

☐ free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

☑ none

brownish:	occasional	plentiful
light coating		
heavy coating		

greenish:	occasional	plentiful
light coating		
heavy coating		

other: _____	occasional	plentiful
light coating		☐
heavy coating		

b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓	☐	☐
greenish	✓	☐	☐
other: _____	☐	☐	☐

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish	✓	☐	☐
greenish	✓	☐	☐
other_____:	☐	☐	☐

***5.* Presence of naturally occurring organic material in stream:** *(Good habitat for aquatic organisms)*

Logs or large woody debris:	☐ none	✓ occasional	plentiful
Leaves, twigs, root mats, etc.:	☐ none	☐ occasional	✓ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

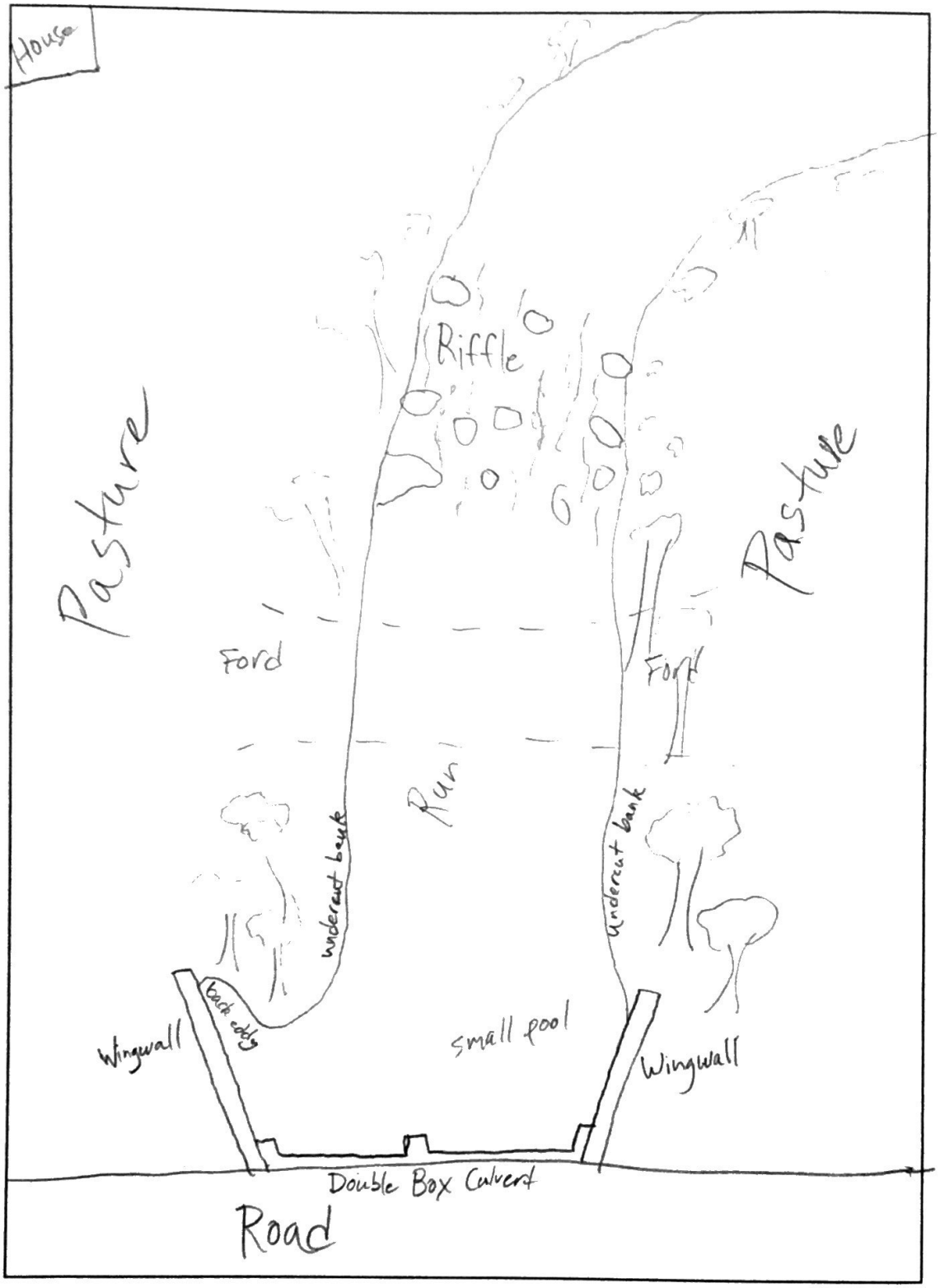
Total shading — No shading

70%

100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0

GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)



CC2
11/1/21

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Heath/Lancaster
Group ID: G-_____ Site ID: S- CC2
Stream Name: Chattanooga Creek
Monitor(s): Heath, Lancaster
Number of Participants: 2

Event Date: 11/1/2021 (MMDDYYYY)
Time Sample Collected: 11:11 AM (HHMM am/pm)
Time Spent Sampling: _____ (Min)
Total Time Spent Traveling *(optional)*: _____ (Min)
Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)
☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?
Amount in Inches: 0.07
In Last Hours/Days: 48 hrs.
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:_____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:_____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other:_____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:_____

Trash: ☑ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.
Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.912238 (DD.DDDD°) Longitude (-) 85.351745 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 195° S

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 21 ft (ft/in)

Camera height at permanent Photo Point location (PPL): Height 6ft (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Riparian buffer was recently cut by machinery.

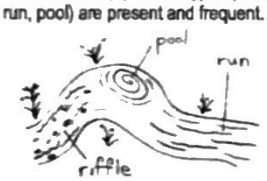
Please submit data to our online database at www.GeorgiaAdoptAStream.org

Stream Habitat Survey: For Rocky and Muddy Bottom Streams (circle one)

Group _____ **Stream name or Site ID** _____ **Investigators** _____ **Date** 11/1/21

Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

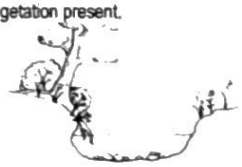
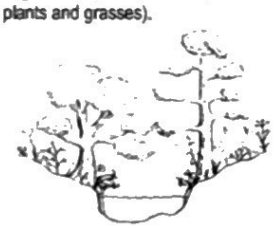
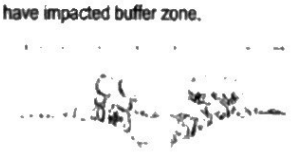
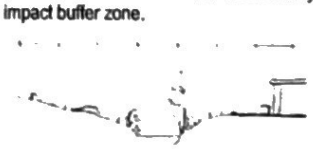
All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks, habitat may move during high flows. 	What did you see? 10 9 8 7 6 5 4 **(3)** 2 1 0 **Score** 3
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? 10 9 8 7 6 **(5)** 4 3 2 1 0 **Score** 5
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, **all three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? 10 9 8 **(7)** 6 5 4 3 2 1 0 **Score** 7
4. Sediment Deposition **Are sand bars and islands present?**	**Little or no** enlargement of vegetated islands or point bars. 	**Some** new bar formation of the channel bottom with new deposition in pools. Some increase in point bar formation. 	**Heavy** deposits of usually fine sediment; channel affected by extensive deposition. Point bars are bare. 	What did you see? 10 9 8 7 6 **(5)** 4 3 2 1 0 **Score** 5
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks; little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? 10 9 8 7 6 **(5 4)** 3 2 1 0 **Score** 4.5

Total first side 24.5

Take two photographs, looking upstream and downstream, capturing banks and riparian zone on both sides.

CC2 11/1/21

Habitat Parameter	Excellent ····· Poor			
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see?
	10 9 8 7 6 5 4 **(3)** 2 1 0			**Score** 3
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.** 	There are **more bends than straight** sections. 	There are **more straight sections** than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7 **(6)** 5 4 3 2 1 0			**Score** 6
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	**Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	**Bank unstable**, many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank	5 4.5 4 3.5 3 2.5 2 **(1.5)** 1 .5 0			**Score** (Add both banks) 3.5
Right bank	5 4.5 4 3.5 3 2.5 **(2)** 1.5 1 .5 0			
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Riparian zone recently cleared Did you see any nonnative vegetation? Check here if YES ☑
Left bank	5 4.5 4 3.5 3 2.5 2 **(1.5)** 1 .5 0			**Score** (Add both banks) 3
Right bank	5 4.5 4 3.5 3 2.5 2 **(1.5)** 1 .5 0			
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side. 	Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☑
Left bank	5 4.5 4 3.5 3 2.5 2 1.5 **(1)** .5 0			**Score** (Add both banks) 2
Right bank	5 4.5 4 3.5 3 2.5 2 1.5 **(1)** .5 0			

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 17.5

Total first side 24.5

Total 42

Please submit data at: www.GeorgiaAdoptAStream.org
Or send to: 4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Fax: 404-675-6245 Phone: 404-675-6240

CG2
11/1/21

GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA

Area = depth x width

It is advisable to take multiple depth and width measurements
Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft	.2	.6	1.2	1.9	2.1	1.7	1.7	9.4

Average Depth 1.34 ft = 9.4 (sum of depth measurements) / 7 (number of measurements)

Width Measurements	1.	2.	sum
	21.2 ft	26.9	48.1

Average Width 24.05 ft = 48.1 (sum of width measurements) / 2 (number of measurements)

Area $32.23 ft^2$ = width 24.05 X depth 1.34

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed
Take measurements from the stream run

length = 20 feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	67 s	78 s	111 s	101 s	357

average time 89.25 s = 357 (sum of time measurements) / 4 (number of measurements)

Speed .22 ft/s = 20 (length in feet) / 89.25 (average time in seconds)

CALCULATE STREAM FLOW

		Area		Speed		Coefficient
Flow	5.67 cfs =	32.23	X	.22	X	.8

Flow in cubic feet per second

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

CC2
11/1/21

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1	1	4.5	
2	2	5.7	
3	3	8.1	
4	4	8.3	
5	5	8.1	
6	6	7.9	
7	7	7.7	
8	8	7.6	
9	9	7.5	
10	10	7.8	
11	11	7.4	
12	12	7.4	
13	13	7.1	
14	14	6.8	
15	15	6.7	
16	16	6.3	
17	17	6.3	
18	18	6.5	
19	19	5.5	
20	20	5.2	
21	21	5.2	
22	22	4.9	
23	23	4.7	
24	24	4.5	
25	25	4.4	

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26	26	4.2	
27	27	4.1	
28	28	3.8	
29	29	3.4	
30	30	3.0	
31	31	2.8	
32	32	2.0	
33	33	0.8	
34	34	0.4	
35	35	Right pin	
36			
37			
38			
39			
40			
41			
42			
43			
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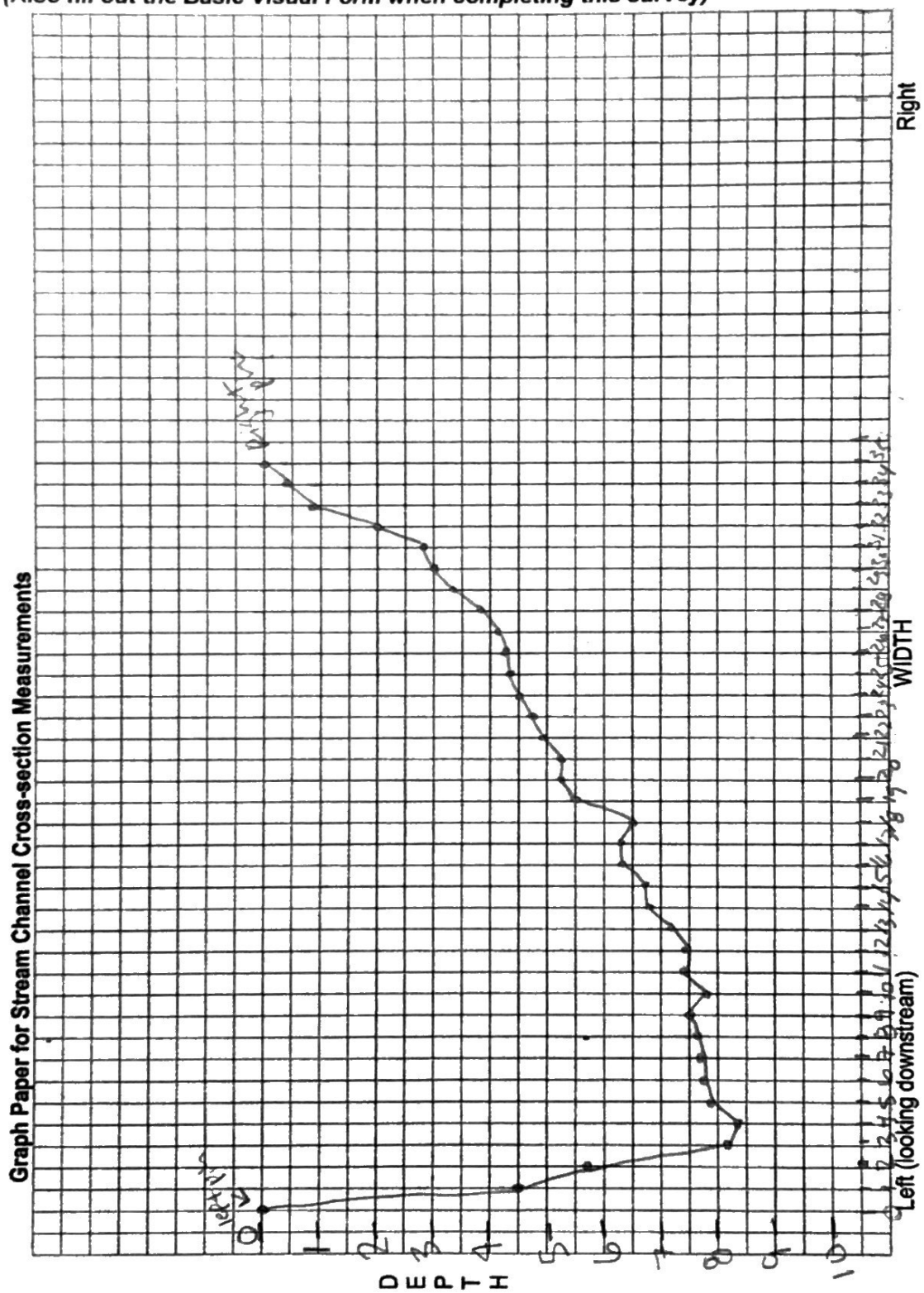
47			
48			
49			
50			

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



CC2
11/1/21

GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1			✓			
2			✓			
3			✓			
4			✓			
5			✓			
6		✓				
7		✓				
8		✓				
9						✓
10		✓				
11		✓				
12		✓				
13			✓			
14	✓					
15			✓			
16			✓			
17	✓					
18	✓					
19			✓			
20			✓			
21			✓			
22			✓			
23			✓			
24			✓			
25	✓					
26	✓					
27			✓			
28			✓			
29			✓			
30	✓					
31	✓					
32						✓
33			✓			
34			✓			
35		✓				
36		✓				
37			✓			
38		✓				
39			✓			
40			✓			
41			✓			
42			✓			
43		✓				
44						✓
45						✓
46	✓					
47	✓					
48	✓					
49	✓					

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11/1/21

b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other: _____			

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish		✓	
greenish			
other _____:			

5. Presence of naturally occurring organic material in stream: *(Good habitat for aquatic organisms)*

Logs or large woody debris:	_ none	✓ occasional	_ plentiful
Leaves, twigs, root mats, etc.:	_ none	✓ occasional	_ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

Total shading — No shading

100% 90% 25% 80% 70% 60% 50% 40% 30% 20% 10% 0

GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles ✓mammals ✓mussels/clams/oysters
✓crustaceans ✓birds

2. Fish in the stream: *(Check all that apply)*

no	✓yes, but rare	yes abundant
✓small (1-2")	✓medium (3-6")	large (7" and above)

Are there barriers to fish movement?

✓none	beaver dams	waterfalls > 1ft
dams	road barriers	other: _____

3. Aquatic plants in the stream: *(Check all that apply)*

✓none

attached plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

none

✓brownish:	occasional	plentiful
light coating	✓	
heavy coating		

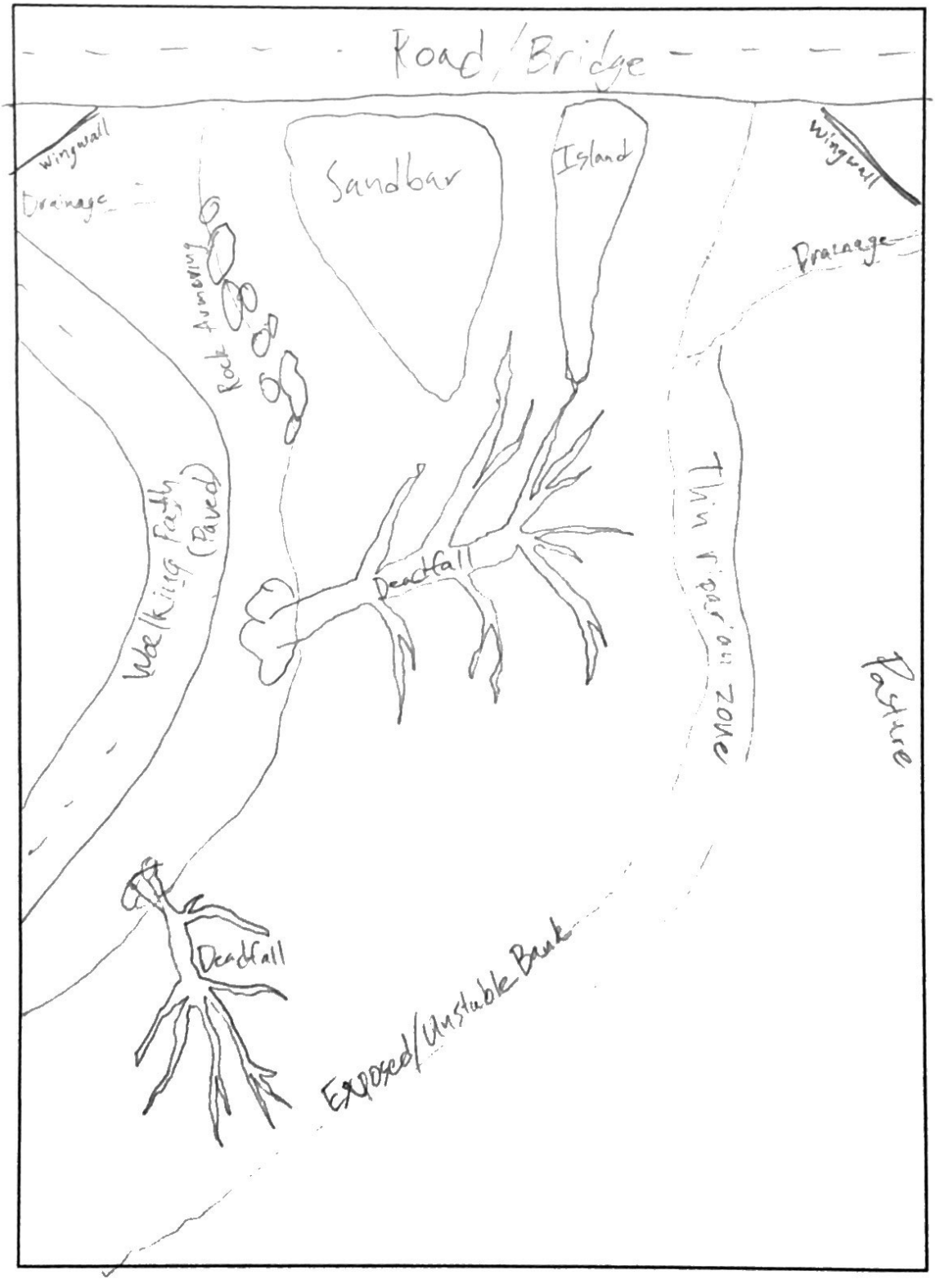
greenish:	occasional	plentiful
light coating		
heavy coating		

other: _____	occasional	plentiful
light coating		
heavy coating		

CC2
11/1/21

GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)



GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Heath/Lancaster Event Date: 12/2/2021 (MMDDYYYY)

Group ID: G-_____ Site ID: S- CC3 Time Sample Collected: _____ (HHMM am/pm)

Stream Name: Chatt. Creek Time Spent Sampling: _____ (Min)

Monitor(s): Heath, Lancaster Total Time Spent Traveling *(optional)*: _____ (Min)

Number of Participants: 2 Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0

In Last Hours/Days: 48 hrs.

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other: _____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other: _____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other: _____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other: _____

Trash: ☑ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.

Photo point directions can be found in the manuals. Send photos to AAS@gaepd.org.

Reference Location (RL): Latitude (+) 34.1573 (DD.DDDD°) Longitude (-) 95.3351 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) _____

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance _____ (ft/in)

Camera height at permanent Photo Point location (PPL): Height 6 ft (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at AdoptAStream.Georgia.gov

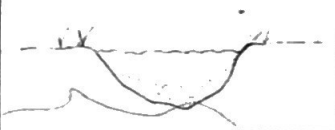
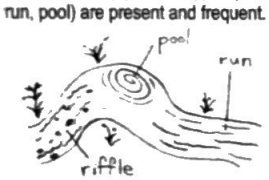
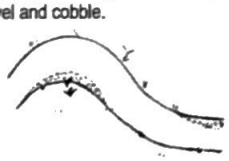
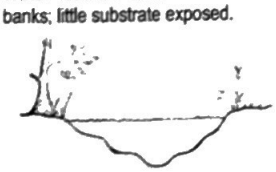
GEORGIA ADOPT-A-STREAM: Stream Habitat Survey

(Also fill out the Basic Visual Form when completing this survey)

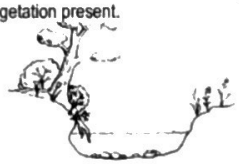
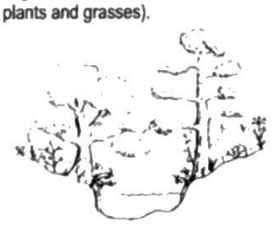
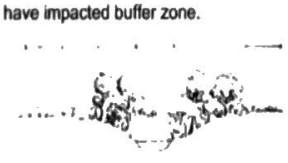
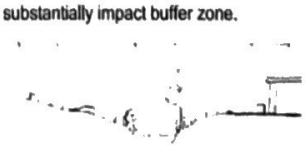
Type of Stream:
☐ Rocky bottom
☐ ~~Muddy bottom~~

Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see? 3
	10 9 8 7 6 5 4 **(3)** 2 1 0			
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? No riffle/ run 1
	10 9 8 7 6 5 4 3 2 1 0			
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, all **three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? 2
	10 9 8 7 6 5 4 3 **(2)** 1 0			
4. Sediment Deposition **Are point bars and islands present?**	**Point bars and islands stable** and of small size and frequency with some vegetation. Composed mostly of gravel and cobble. 	**Point bars and islands less stable** and of moderate size and frequency with some sparse vegetation. Composed mostly of some gravel and finer sediment. 	**Point bars and islands unstable** and of a large size with little or no vegetation. Composed almost entirely of fine sediment. 	What did you see? 9
	10 **(9)** 8 7 6 5 4 3 2 1 0			
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks; little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? 3.5
	10 9 8 7 6 5 4 **(3.5)** 3 2 1 0			

Total first side 18.5

Habitat Parameter	Excellent ---------- Poor	CC3
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities.  **Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities.  **Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities.  10 9 8 7 6 **5** 4 3 2 1 0	What did you see? Score 5
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.**  There are **more bends than straight** sections.  There are **more straight sections** than sections with bends or channel is entirely straight.  10 9 8 7 6 5 4 3 **2** 1 0	What did you see? Score 2
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant.  **Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present.  **Bank unstable**; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present.  Left bank 5 4.5 4 3.5 3 2.5 2 1.5 1 **.5** 0 Right bank 5 4.5 4 3.5 3 2.5 2 **1.5** 1 .5 0	What did you see? Score (Add both 1.5
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses).  Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses).  Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses).  Left bank 5 4.5 4 **3.5** 3 2.5 2 1.5 1 .5 0 Right bank 5 4.5 4 3.5 **3** 2.5 2 1.5 1 .5 0	What did you see? Did you see any nonnative vegetation? Check here if YES ☐ Score (Add both banks) 6.5
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side.  Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone.  Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone.  Left bank 5 4.5 4 3.5 **3** 2.5 2 1.5 1 .5 0 Right bank 5 4.5 4 3.5 3 2.5 **2** 1.5 1 .5 0	What did you see? Did you see any nonnative vegetation? Check here if YES ☐ Score (Add both banks) 5

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 20
Total first side 18.5
Total 38.5

Please submit data at: AdoptAStream.Georgia.gov
Or send to: 2 MLK Jr. Dr. SE, Suite 1462 East, Atlanta, GA 30334
Email: AAS@gaepd.org

GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA Too deep, not safe to wade

Area = depth x width

It is advisable to take multiple depth and width measurements Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft								

Average Depth ____ ft = ____ / ____ (sum of depth measurements / number of measurements)

Width Measurements	1.	2.	sum
	ft		

Average Width ____ ft = ____ / ____ (sum of width measurements / number of measurements)

Area ____ ft^2 = width ____ X depth ____

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed

Take measurements from the stream <u>run</u>

length = ____ feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	s				

average time ____ s = ____ / ____ (sum of time measurements / number of measurements)

Speed ____ ft/s = ____ / ____ (length in feet / average time in seconds)

CALCULATE STREAM FLOW

Flow ____ cfs = **Area** ____ X **Speed** ____ X **Coefficient** ____

<u>Flow in cubic feet per second</u>

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

CC3

Too deep, not safe to wade

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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19			
20			
21			
22			
23			
24			
25			

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
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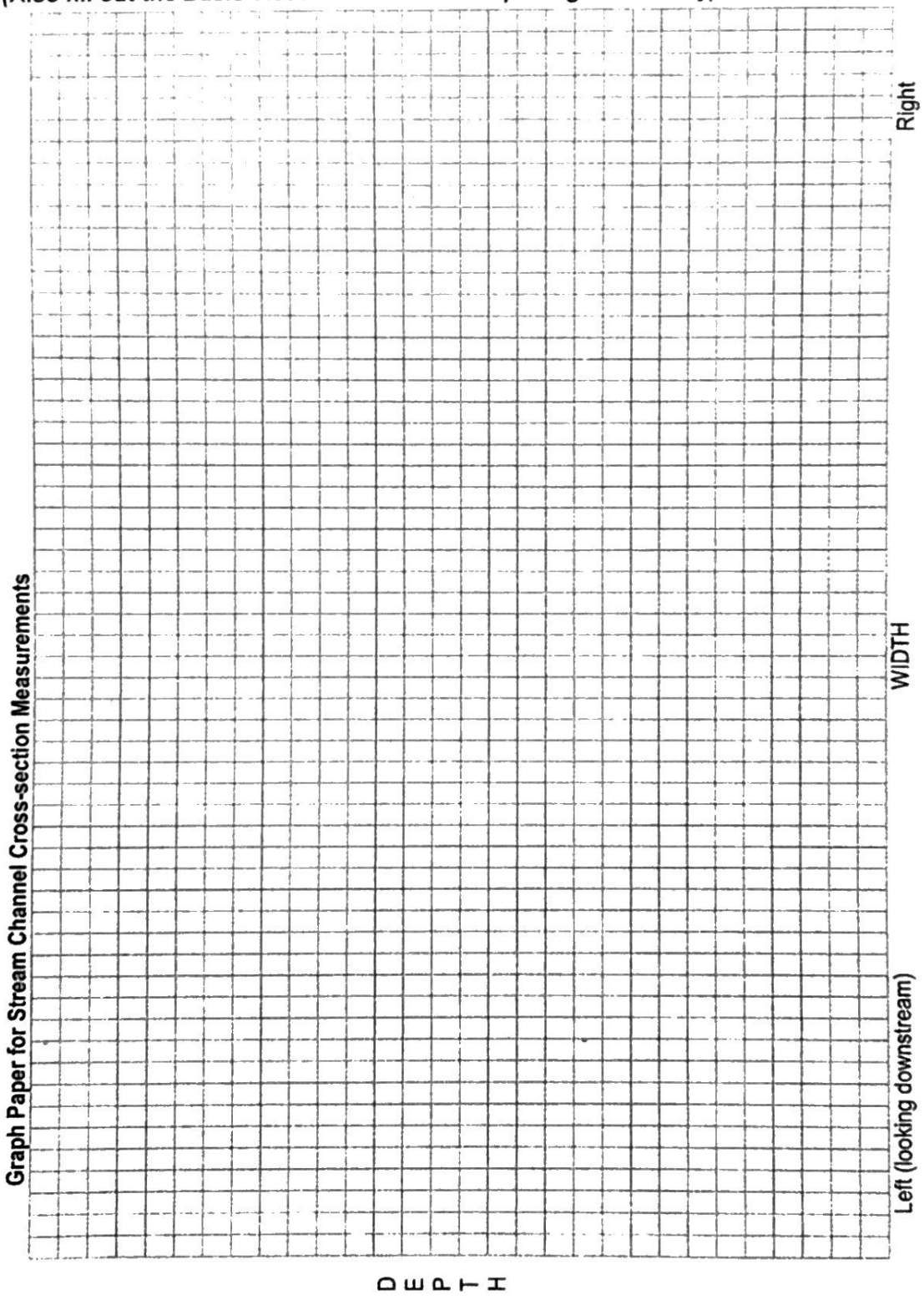
50			

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



C03

GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
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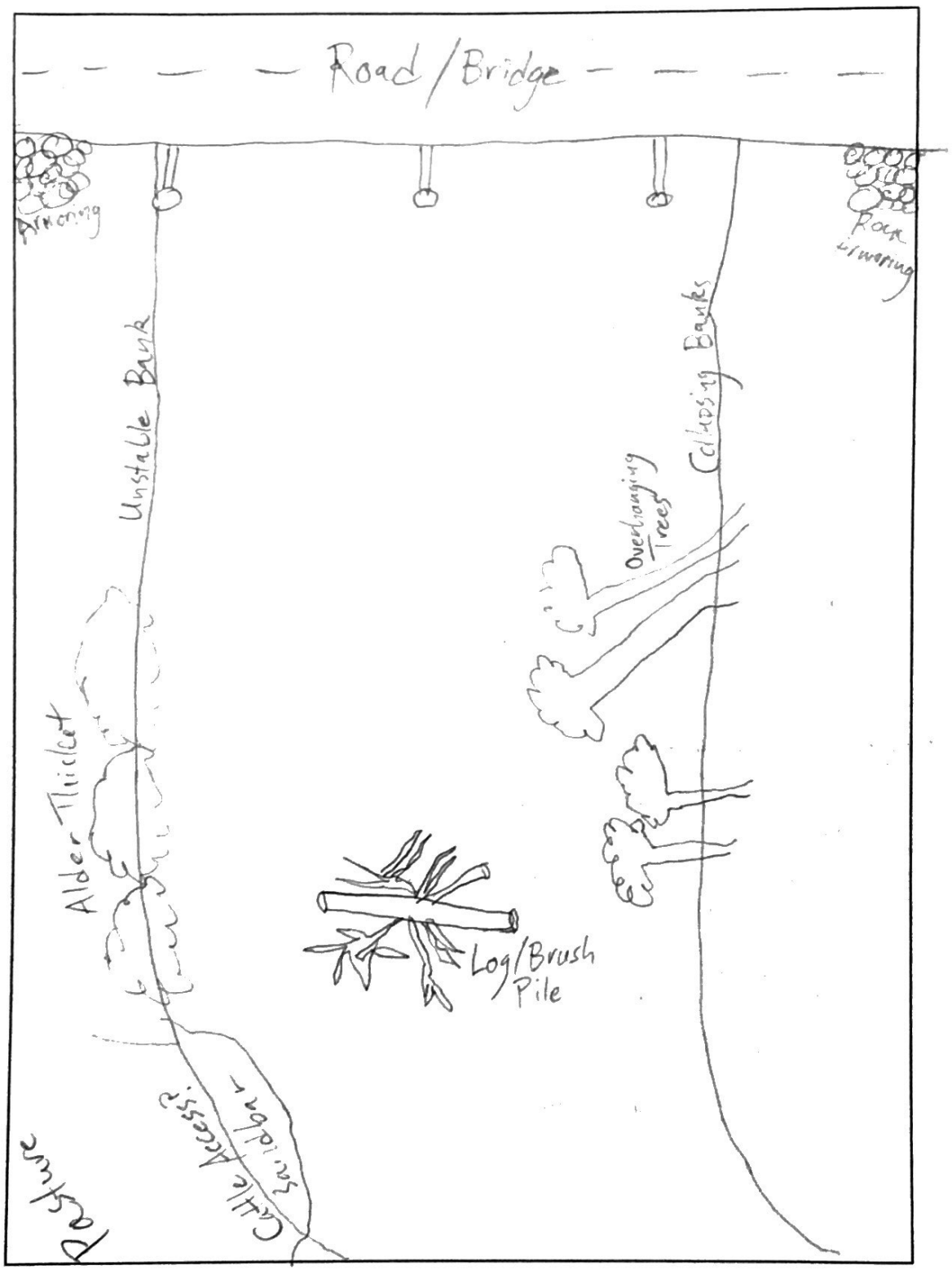
47						
48						
49						

CC3

GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)



GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles mammals mussels/clams/oysters
crustaceans birds

2. Fish in the stream: *(Check all that apply)*

no yes, but rare yes abundant
small (1-2") medium (3-6") large (7" and above)

Are there barriers to fish movement?

none beaver dams waterfalls > 1ft
dams road barriers other: _____

3. Aquatic plants in the stream: *(Check all that apply)*

none

attached plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

none

brownish:	occasional	plentiful
light coating		
heavy coating		

greenish:	occasional	plentiful
light coating		
heavy coating		

other: _____	occasional	plentiful
light coating		
heavy coating		

CC3

b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓	☐	☐
greenish	✓	☐	☐
other: _____	✓	☐	☐

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish	✓	☐	☐
greenish	✓	☐	☐
other_____:	✓	☐	☐

5. Presence of naturally occurring organic material in stream: *(Good habitat for aquatic organisms)*

Logs or large woody debris: ☐ none ☐ ~~occasional~~ ✓ occasional ☐ plentiful

Leaves, twigs, root mats, etc.: ☐ none ☐ ~~occasional~~ ✓ occasional ☐ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

Total shading — No shading

100% 90% 65 ——————————————

80% 70% 60% 50% 40% 30% 20% 10% 0

CCDC1
11/1/21

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Lancaster / Heath
Event Date: 11/1/2021 (MMDDYYYY)
Group ID: G-_____ Site ID: S-CCDC1
Time Sample Collected: 2:05PM (HHMM am/pm)
Stream Name: Dry Creek
Time Spent Sampling: _____ (Min)
Monitor(s): _____
Total Time Spent Traveling *(optional)*: _____ (Min)
Number of Participants: 2
Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)
☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?
Amount in Inches: 0.07
In Last Hours/Days: 48 hrs.
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: (check all that apply) ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:_____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:_____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other:_____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:_____

Trash: ☐ None ☐ Yes, I did a cleanup ☑ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.
Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.978416 (DD.DDDD°) Longitude (-) 85.303194 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 126° SE

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 21 (ft/in)

Camera height at permanent Photo Point location (PPL): Height 6ft (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

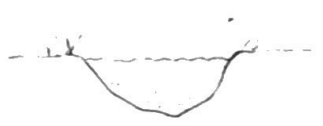
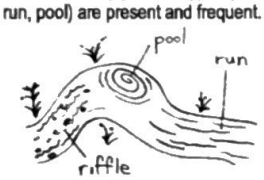
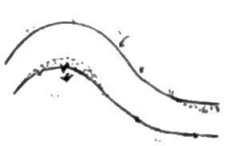
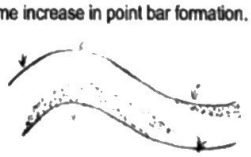
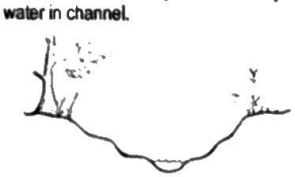
Please submit data to our online database at www.GeorgiaAdoptAStream.org

Stream Habitat Survey: For Rocky and Muddy Bottom Streams (circle one)

Group _____ **Stream name or Site ID** CCDC1 **Investigators** _____ **Date** 11/1/24

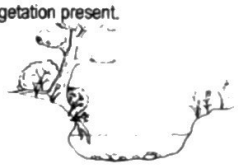
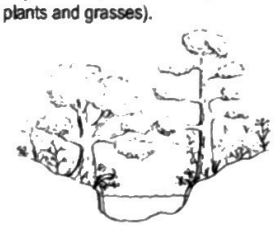
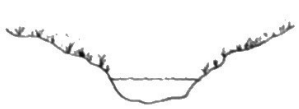
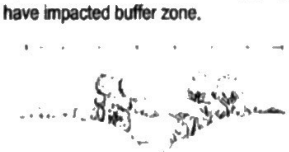
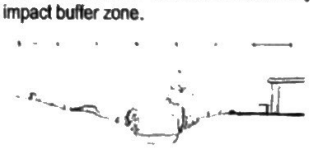
Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see? Score 3
	10 9 8 7 6 5 4 **(3)** 2 1 0			
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? Score 5
	10 9 8 7 6 **(5)** 4 3 2 1 0			
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, **all three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? Score 5
	10 9 8 7 6 **(5)** 4 3 2 1 0			
4. Sediment Deposition **Are sand bars and islands present?**	**Little or no** enlargement of vegetated islands or point bars. 	**Some** new bar formation of the channel bottom with new deposition in pools. Some increase in point bar formation. 	**Heavy** deposits of usually fine sediment; channel affected by extensive deposition. Point bars are bare. 	What did you see? Score 4
	10 9 8 7 6 5 **(4)** 3 2 1 0			
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks; little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? Score 6
	10 9 8 7 **(6)** 5 4 3 2 1 0			

Total first side 23

Take two photographs, looking upstream and downstream, capturing banks and riparian zone on both sides.

Habitat Parameter	Excellent ---------- Poor			
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see? Car parts lot RR Street crossing w/ Bridge Industry RR downstream
	10 9 8 7 6 5 4 **3** 2 1 0			**Score** 2.5
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.** 	There are **more bends than straight** sections. 	There are **more straight sections** than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7 6 5 4 **3** 2 1 0			**Score** 3
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	**Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	**Bank unstable**; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank	5 4.5 4 **3.5** 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 7
Right bank	5 4.5 4 **3.5** 3 2.5 2 1.5 1 .5 0			
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Did you see any nonnative vegetation? Check here if YES ☒
Left bank	5 **4.5** 4 3.5 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 7.5
Right bank	5 4.5 4 3.5 **3** 2.5 2 1.5 1 .5 0			
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side. 	Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☒
Left bank	5 4.5 **4** 3.5 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 4.5
Right bank	5 4.5 4 3.5 3 2.5 2 1.5 1 **.5** 0			

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 24.5

Total first side 23

Total 47.5

Please submit data at: www.GeorgiaAdoptAStream.org
Or send to: 4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Fax: 404-675-6245 Phone: 404-675-6240

CCDC 1

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GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA

Area = depth x width

It is advisable to take multiple depth and width measurements
Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft	.1	.2	.6	1.2	1.2	.7	.3	4.3

Average Depth .61 ft = 4.3 (sum of depth measurements) / 7 (number of measurements)

Width Measurements	1.	2.	sum
	14.3 ft	15.4	29.7

Average Width 14.85 ft = 29.7 (sum of width measurements) / 2 (number of measurements)

Area 9.06 ft^2 = width 14.85 X depth .61

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed
Take measurements from the stream <u>run</u>

length = 20 feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	72 s	54 s	64 s	68 s	260

average time 65 s = 260 (sum of time measurements) / 4 (number of measurements)

Speed .31 ft/s = 20 (length in feet) / 65 (average time in seconds)

CALCULATE STREAM FLOW

Flow 2.25 cfs = **Area** 9.06 X **Speed** .31 X **Coefficient** .8

<u>Flow in cubic feet per second</u>

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1	0	.3	
2	1	1.5	
3	2	3.2	
4	3	3.6	
5	4	3.6	
6	5	3.7	
7	6	3.8	
8	7	4.0	
9	8	4.1	
10	9	4.2	
11	10	4.4	
12	11	4.6	
13	12	4.4	
14	13	3.8	
15	14	3.2	
16	15	2.2	
17	16	Right pin	1.3
18			
19			
20			
21			
22			
23			
24			
25			

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
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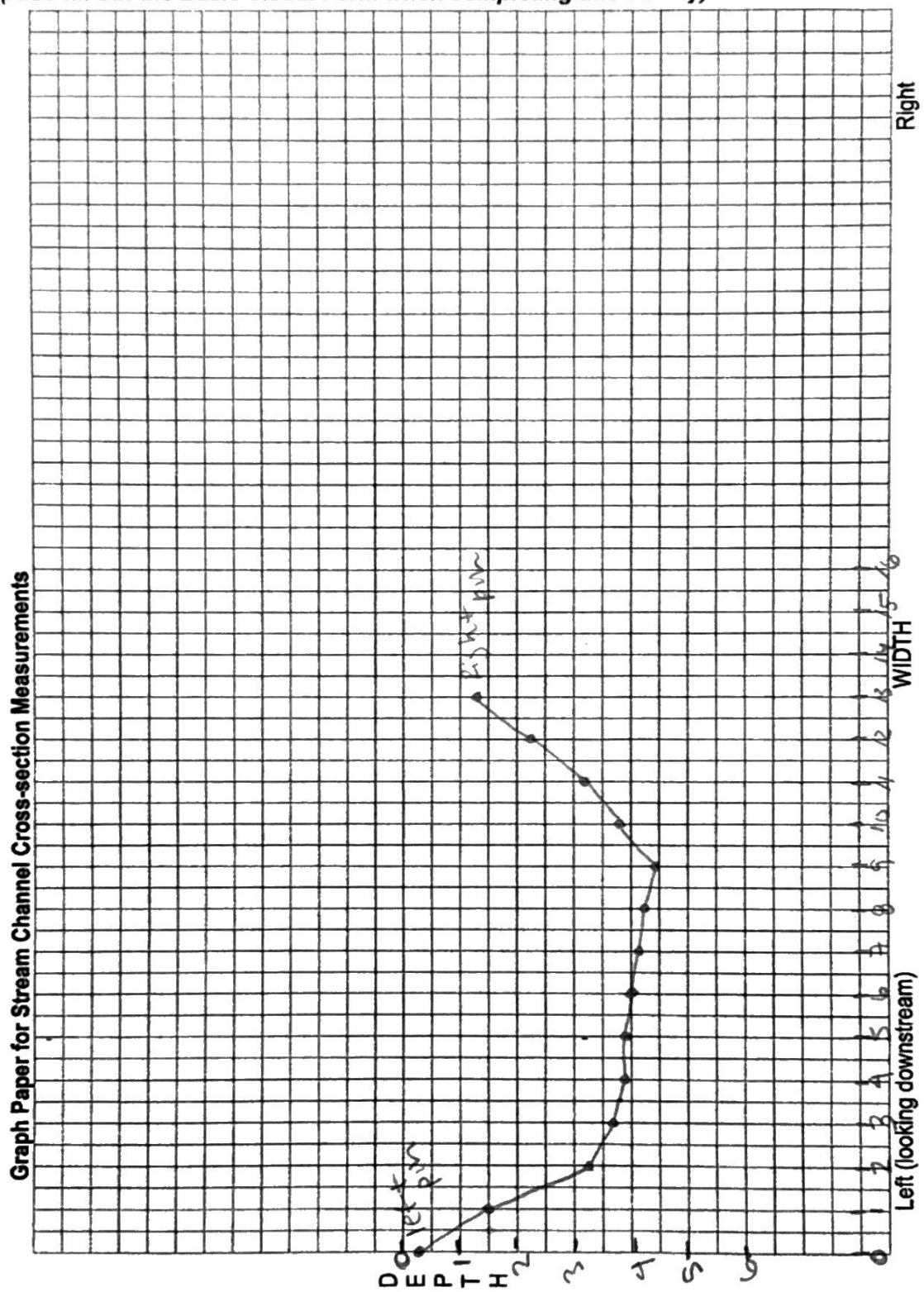
50			

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



CCDC)
11/1/21

GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1			✓			
2			✓			
3			✓			
4			✓			
5			✓			
6			✓			
7			✓			
8			✓			
9	✓					
10						✓
11		✓				
12			✓			
13			✓			
14			✓			
15			✓			
16			✓			
17			✓			
18						✓
19			✓			
20			✓			
21			✓			
22			✓			
23			✓			
24			✓			
25			✓			
26				✓		
27						✓
28			✓			
29			✓			
30			✓			
31			✓			
32			✓			
33			✓			
34			✓			
35			✓			
36			✓			
37			✓			
38						✓
39			✓			
40			✓			
41			✓			
42			✓			
43			✓			
44			✓			
45			✓			
46			✓			
47			✓			
48			✓			
49			✓			

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
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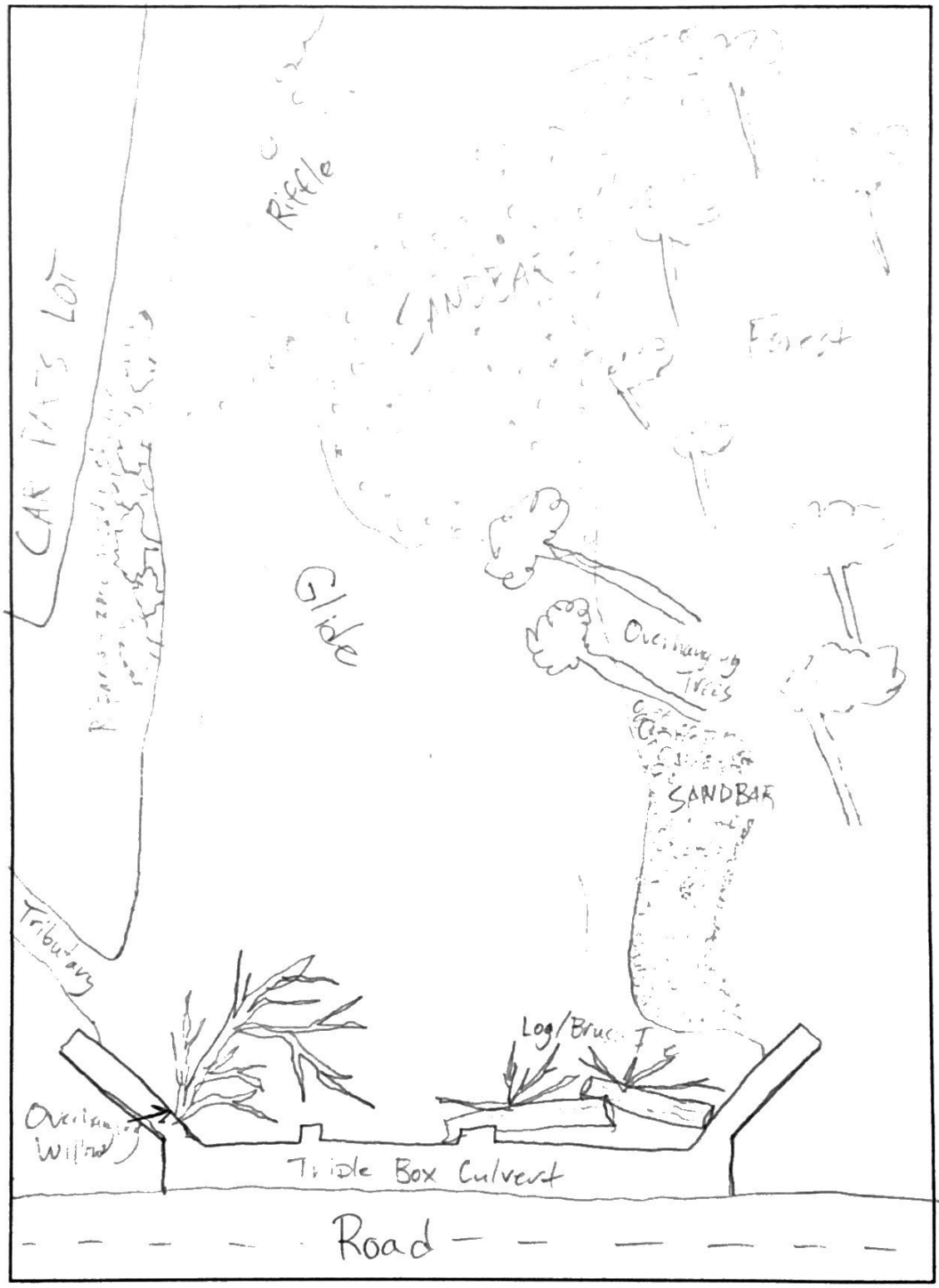
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						
Total in each column (%)						

CCDC1

11/1/21

GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)



GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles mammals mussels/clams/oysters
crustaceans birds

2. Fish in the stream: *(Check all that apply)*

no yes, but rare yes abundant
small (1-2") medium (3-6") large (7" and above)

Are there barriers to fish movement?

none beaver dams waterfalls > 1ft
dams road barriers other: box culvert w/ out to drop

3. Aquatic plants in the stream: *(Check all that apply)*

none

	occasional	plentiful
attached plants		
stream margin/edge		
pools		
near riffle		
free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

none

	occasional	plentiful
brownish:		
light coating		
heavy coating		
greenish:	occasional	plentiful
light coating		
heavy coating		
other: _____	occasional	plentiful
light coating		
heavy coating		

CCDC1
1/1/21

b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other: _____			

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other _____:			

5. Presence of naturally occurring organic material in stream: *(Good habitat for aquatic organisms)*

Logs or large woody debris:	_ none	✓ occasional	_ plentiful
Leaves, twigs, root mats, etc.:	_ none	✓ occasional	_ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

Total shading — No shading

100% 90% 75% ——————————————

80% 70% 60% 50% 40% 30% 20% 10% 0

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Heath / Lancaster
Group ID: G-_____ Site ID: S- CCMB1
Stream Name: McFarland Branch
Monitor(s): Heath, Lancaster
Number of Participants: 2

Event Date: 11/17/21 (MMDDYYYY)
Time Sample Collected: 12:45 PM (HHMM am/pm)
Time Spent Sampling: _____ (Min)
Total Time Spent Traveling *(optional)*: _____ (Min)
Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0
In Last Hours/Days: 48 hrs.
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other:_____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:_____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other:_____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other:_____

Trash: ☐ None ☐ Yes, I did a cleanup ☑ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.9844 (DD.DDDD°) Longitude (-) 85.2993 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 155° SE

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 18 (ft/in)

Camera height at permanent Photo Point location (PPL): Height 6 (ft/in)

COMMENTS

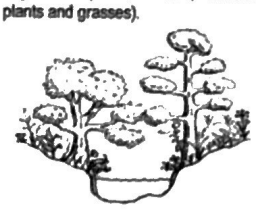
Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at www.GeorgiaAdoptAStream.org

GEORGIA ADOPT-A-STREAM: Stream Habitat Survey

(Also fill out the Basic Visual Form when completing this survey)

Type of Stream:
☑ Rocky bottom
☐ Muddy bottom

Habitat Parameter	Excellent ---------- Poor			
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see?
	10 9 8 7 6 5 **(4)** 3 2 1 0			Score 4
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.** 	There are **more bends than straight** sections. 	There are **more straight sections** than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7 6 5 4 3 **(2)** 1 0			Score 2
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	**Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	**Bank unstable**; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank	5 4.5 4 3.5 3 2.5 2 **(1.5)** 1 .5 0			Score (Add both banks) 3
Right bank	5 4.5 4 3.5 3 2.5 2 **(1.5)** 1 .5 0			
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Did you see any nonnative vegetation? Check here if YES ☑
Left bank	5 4.5 4 3.5 3 2.5 **(2)** 1.5 1 .5 0			Score (Add both banks) 4
Right bank	5 4.5 4 3.5 3 2.5 **(2)** 1.5 1 .5 0			
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side. 	Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☑
Left bank	5 4.5 4 3.5 3 2.5 2 1.5 **(1)** .5 0			Score (Add both banks) 2
Right bank	5 4.5 4 3.5 3 2.5 2 1.5 **(1)** .5 0			

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 15

Total first side 26

Total 51

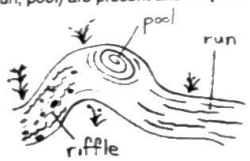
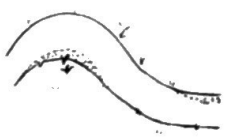
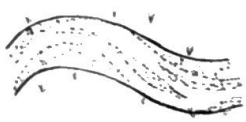
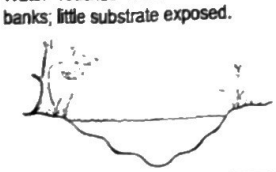
Please submit data at: www.GeorgiaAdoptAStream.org
Or send to: 4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Fax: 404-675-6245 Phone: 404-675-6240

Stream Habitat Survey: For Rocky and Muddy Bottom Streams (circle one)

Group Heath **Stream name or Site ID** CCMBI **Investigators** Heath, Lancaster **Date** 11/17/2

Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see? 10 9 8 7 6 5 4 **(3)** 2 1 0 **Score** 3
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? 10 9 8 7 6 **(5)** 4 3 2 1 0 **Score** 5
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, **all three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? 10 9 8 **(7)** 6 5 4 3 2 1 0 **Score** 7
4. Sediment Deposition **Are sand bars and islands present?**	**Little or no** enlargement of vegetated islands or point bars. 	**Some** new bar formation of the channel bottom with new deposition in pools. Some increase in point bar formation. 	**Heavy** deposits of usually fine sediment; channel affected by extensive deposition. Point bars are bare. 	What did you see? 10 9 8 7 6 5 **(4)** 3 2 1 0 **Score** 4
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks; little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? 10 9 8 **(7)** 6 5 4 3 2 1 0 **Score** 7

Total first side 26

Take two photographs, looking upstream and downstream, capturing banks and riparian zone on both sides.

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1	0	0	L Pin
2	1	0.9	
3	2	2.7	
4	3	6.4	Water Edge
5	4	7.5	
6	5	7.7	
7	6	7.6	
8	7	7.6	
9	8	7.8	
10	9	7.9	
11	10	7.8	
12	11	8.0	
13	12	7.5	
14	13	5.4	
15	14	1.6	
16	15	0.7	R Pin
17			
18			
19			
20			
21			
22			
23			
24			
25			

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
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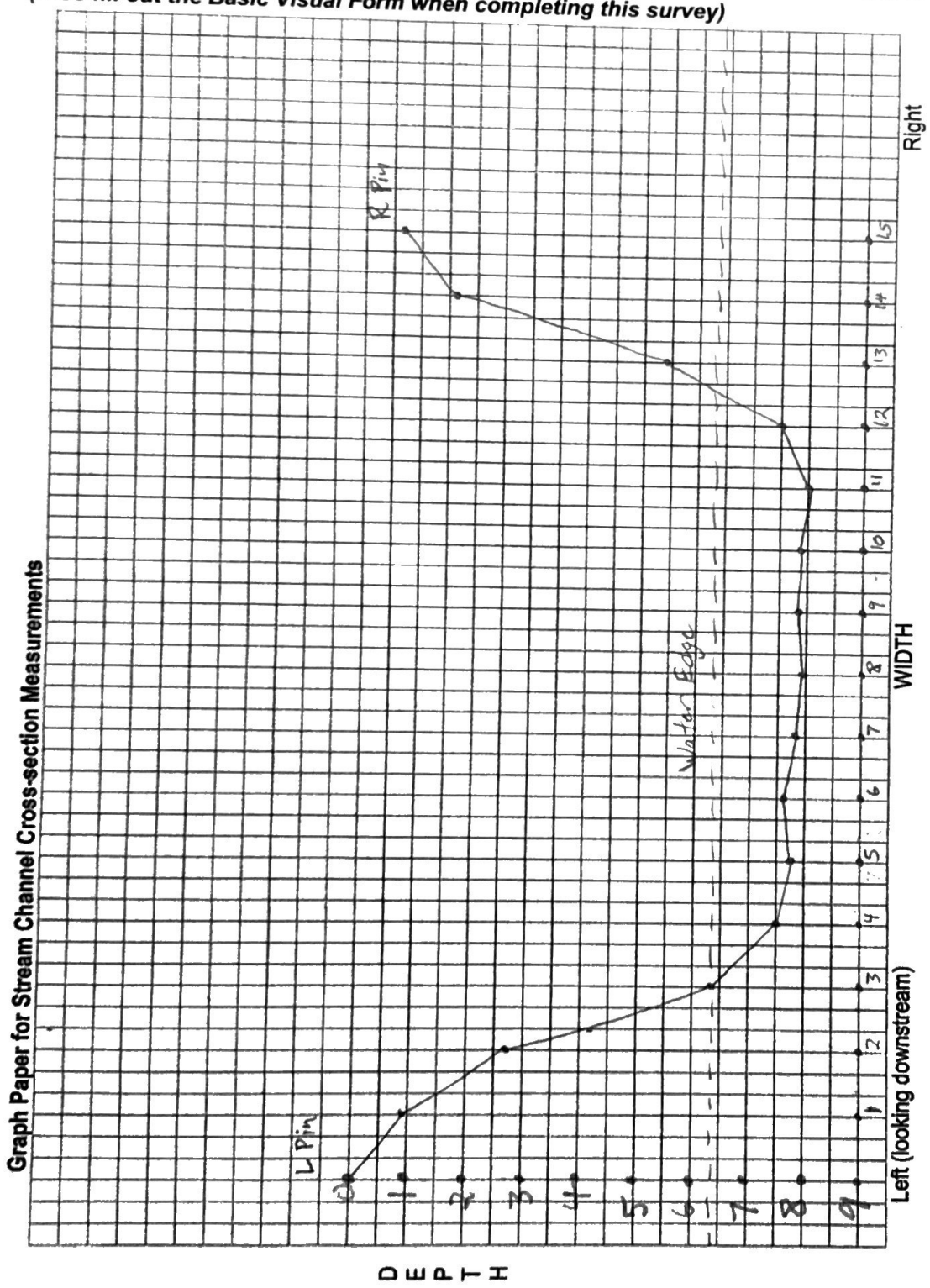
49			
50			

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



MP

GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA

Area = depth x width

It is advisable to take multiple depth and width measurements
Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft	0.3	0.2	0.3	0.4	0.3	0.5	0.6	2.6

Average Depth 0.3 ft = $\frac{2.6}{8}$ (sum of depth measurements / number of measurements)

Width Measurements	1.	2.	sum
	12.2 ft	12.8	25.0

Average Width 12.5 ft = $\frac{25.0}{2}$ (sum of width measurements / number of measurements)

Area 3.75 ft² = width 12.5 X depth 0.3

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed
Take measurements from the stream <u>run</u>

length = 20 feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	72 s	76	79	71	298

average time 74.5 s = $\frac{298}{4}$ (sum of time measurements / number of measurements)

Speed 0.27 ft/s = $\frac{20}{74.5}$ (length in feet / average time in seconds)

CALCULATE STREAM FLOW

Flow 0.81 cfs = **Area** 3.75 X **Speed** 0.27 X **Coefficient** 0.8

<u>Flow in cubic feet per second</u>

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

MBI

GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

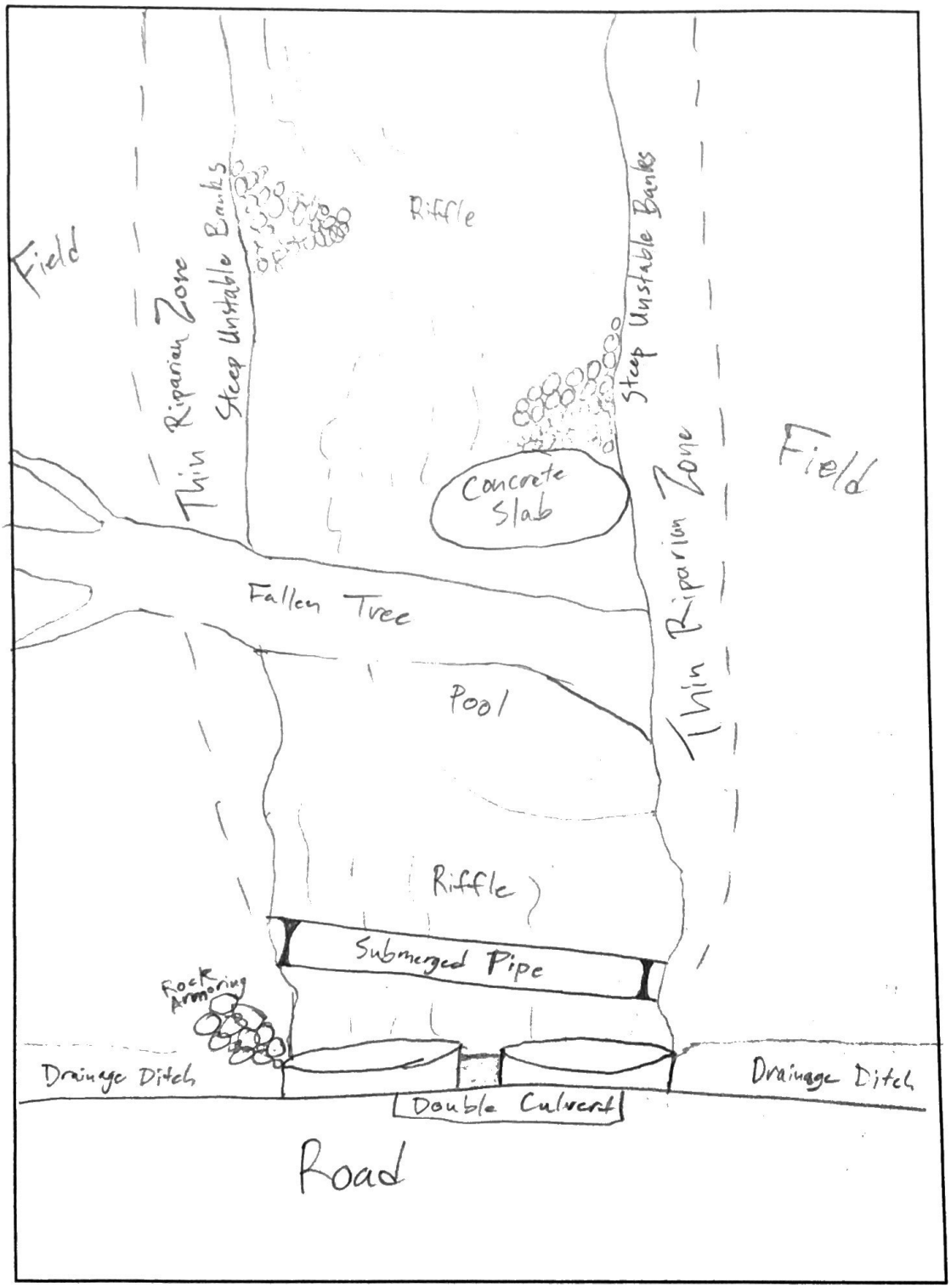
(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1			✓			
2			✓			
3		✓	✓			
4						
5			✓			
6			✓			
7		✓				
8			✓			
9			✓			
10		✓				
11		✓	✓			
12			✓			
13			✓			
14						
15		✓				
16			✓			
17			✓			
18		✓				
19		✓				
20		✓				
21			✓			
22			✓			
23		✓				
24			✓			
25			✓			
26			✓			
27			✓			
28		✓				
29			✓			
30			✓			
31		✓				
32		✓				
33		✓				
34			✓			
35			✓			
36			✓			
37				✓		
38			✓			
39				✓		
40				✓		
41			✓			
42			✓			
43		✓				
44	✓					
45	✓					
46	✓					
47		✓	✓			
48						
49						

MF

GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)



GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles mammals ✓mussels/clams/oysters
✓crustaceans ✓birds

2. Fish in the stream: *(Check all that apply)*

no	yes, but rare	✓yes abundant
✓small (1-2")	✓medium (3-6")	large (7" and above)

Are there barriers to fish movement?

none	beaver dams	waterfalls > 1ft
dams	road barriers	other: _____

3. Aquatic plants in the stream: *(Check all that apply)*

✓none

	occasional	plentiful
attached plants		
stream margin/edge		
pools		
near riffle		
free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

none

	occasional	plentiful
✓brownish:		
light coating	✓	
heavy coating		
greenish:	occasional	plentiful
light coating		
heavy coating		
other: _____	occasional	plentiful
light coating		
heavy coating		

b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other: _____			

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other _____:	✓		

5. Presence of naturally occurring organic material in stream: *(Good habitat for aquatic organisms)*

Logs or large woody debris:	_ none	✓ occasional	_ plentiful
Leaves, twigs, root mats, etc.:	_ none	✓ occasional	_ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

Total shading — No shading

100% 90% 70%
80% 70% 60% 50% 40% 30% 20% 10% 0

GEORGIA ADOPT-A-STREAM: Basic Visual Form

To be used with: Photo Points, Wentworth Pebble Count, Cross Section, Bio Survey, Stream Habitat Survey, Stream Flow and Site Sketch

SITE INFORMATION

Group Name: Lancaster / Heath
Event Date: 11/1/21 (MMDDYYYY)
Group ID: G-_____ Site ID: S- CCRC1
Time Sample Collected: 1pm (HHMM am/pm)
Stream Name: Rock Creek
Time Spent Sampling: _____ (Min)
Monitor(s): _____
Total Time Spent Traveling *(optional)*: _____ (Min)
Number of Participants: 2
Furthest Distance Traveled *(optional)*: _____ (Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain
☐ Overcast ☐ Partly Cloudy ☑ Clear/Sunny

Amount of rain, if known?

Amount in Inches: 0.07 in
In Last Hours/Days: 48 hrs
*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☑ Normal ☐ High ☐ Flood (over banks)

Water Clarity: ☑ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid ☐ Other: _____

Water Color: ☑ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other: _____

Water Surface: ☑ Clear ☐ Oily sheen: Does it break when disturbed? Yes/No (circle one) ☐ Algae
☐ Foam ○ Greater than 3" high ○ It is pure white ☐ Other: _____

Water Odor: ☑ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg
☐ Fishy ☐ Chlorine ☐ Other: _____

Trash: ☑ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

PHOTO POINTS

Photos: Please take images to document your observations and changes in water quality conditions.
Photo point directions can be found in the manuals. Images can be submitted online with your other data.

Reference Location (RL): Latitude (+) 34.951085 (DD.DDDD°) Longitude (-) 85.340994 (DD.DDDD°)

Compass bearing to permanent Photo Point Location (PPL): Degrees (°) 315° NW

Distance to permanent Photo Point Location (PPL) from Reference Location (RL): Distance 23ft. (ft/in)

Camera height at permanent Photo Point location (PPL): Height 6ft (ft/in)

COMMENTS

Any changes since you last sampled at this site? If yes, please describe.

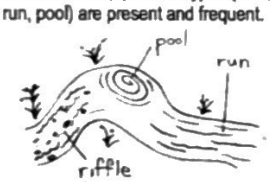
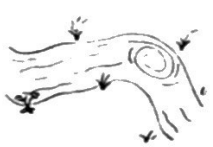
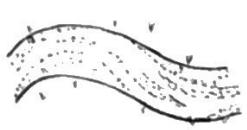
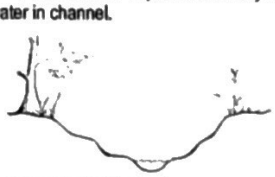
Please submit data to our online database at www.GeorgiaAdoptAStream.org

Stream Habitat Survey: For Rocky and Muddy Bottom Streams (circle one)

Group _____ **Stream name or Site ID** CCRC1 **Investigators** _____ **Date** 11/1/21

Stream habitat will be evaluated looking both upstream and downstream, and includes: channel bottom materials, streamside vegetation, slope, and other channel characteristics. You may choose a value between 0-10 for each parameter. Note #s 8-10 ask you to evaluate each bank separately.

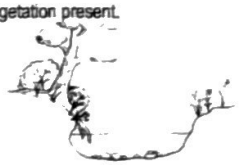
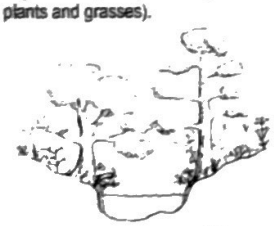
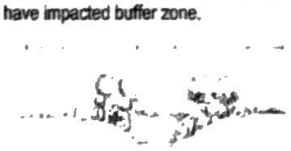
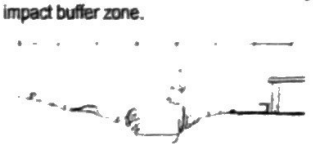
All measurements should be taken during baseflow conditions. Stream reach is defined as 12 times stream width, bankfull to bankfull.

Habitat Parameter	Excellent ---------- Poor			
1. Epifaunal Substrate **What types of submerged materials are on the channel bottom?**	**Abundant stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Adequate stable** habitat cover for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks. 	**Little or no stable** habitat cover available for colonization by macroinvertebrates and fish: submerged roots, woody and vegetative debris, cobbles, leaf packs and undercut banks; habitat may move during high flows. 	What did you see? 10 9 8 7 6 5 4 **(3)** 2 1 0 **Score** 3
2. Embeddedness * For ROCKY BOTTOM streams only **Are fine sediments being deposited in riffle/run area?**	Gravel and cobble are **slightly** embedded in riffle area. 	Gravel and cobble are **partially** embedded in riffle area. 	Gravel and cobble are **completely** embedded in riffle area. 	What did you see? 10 9 8 7 6 5 **(4)** 3 2 1 0 **Score** 4
3. Riffle/Run/Pool **Is a diversity of instream habitats available: riffle, runs and pools?**	Yes, **all three (3)** habitat types (riffle, run, pool) are present and frequent. 	**Two (2)** habitat types are present. 	Only **one (1)** habitat type present and dominant. 	What did you see? 10 9 8 7 6 5 4 **(3)** 2 1 0 **Score** 3
4. Sediment Deposition **Are sand bars and islands present?**	**Little or no** enlargement of vegetated islands or point bars. 	**Some** new bar formation of the channel bottom with new deposition in pools. Some increase in point bar formation. 	**Heavy** deposits of usually fine sediment; channel affected by extensive deposition. Point bars are bare. 	What did you see? 10 **(9)** 8 7 6 5 4 3 2 1 0 **Score** 9.5
5. Channel Flow Status **How much water is in the stream channel?**	Water reaches base **of both lower** banks; little substrate exposed. 	**Some substrate is exposed** and water partially fills channel. 	**Most substrate is exposed** and very little water in channel. 	What did you see? 10 9 8 7 6 **(5)** 4 3 2 1 0 **Score** 5

Total first side 23.5

Take two photographs, looking upstream and downstream, capturing banks and riparian zone on both sides.

CCRC1

Habitat Parameter	Excellent ---------- Poor			11/1/21
6. Channel Alteration **Is the stream channel altered by humans?**	**No evidence** of channelization (straightening) or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Some evidence** of channelization (straightening) and/or alterations such as dredging, agriculture, concrete banks or construction activities. 	**Most of stream reach** channelized and/or many alterations present such as dredging, agriculture, concrete banks or construction activities. 	What did you see? Bridge crossing among on river right bank
	10 9 8 **(7)** 6 5 4 3 2 1 0			**Score** 7
7. Channel Sinuosity * For MUDDY BOTTOM streams only **Does the channel have lots of curves and bends?**	Yes, bends in the channel are **frequent.** 	There are **more bends than straight** sections. 	There are **more straight sections** than sections with bends or channel is entirely straight. 	What did you see?
	10 9 8 7 6 5 4 **(3)** 2 1 0			**Score** 3
8. Bank Stability **How stable are the streambanks?** Determine right/left bank by facing downstream	**Bank stable**; erosion, scouring, undercutting or bank failure absent or minimal. Vegetation overhanging the stream is abundant. 	**Bank moderately stable**; evidence of small areas of erosion, undercutting and scouring, or bank failure present. Moderate amounts of overhanging vegetation present. 	**Bank unstable**; many eroded and scoured areas with undercutting; bank failure present; steep banks. Little over hanging vegetation present. 	What did you see?
Left bank	5 4.5 4 **(3.5)** 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 5.5
Right bank	5 4.5 4 3.5 3 2.5 **(2)** 1.5 1 .5 0			
9. Vegetative Protection **Are streambanks covered & shaded by a variety of vegetation?** Determine right/left bank by facing downstream	Most streambank surfaces covered and shaded by a **large variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Some streambank surfaces covered and shaded by **some variety** of vegetation (trees, shrubs, flowering plants and grasses). 	Few streambank surfaces covered and shaded by vegetation. **Little variety** of vegetation. Streambank dominated by one type of vegetation (trees, shrubs, flowering plants and grasses). 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank	5 4.5 **(4)** 3.5 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 8
Right bank	5 4.5 **(4)** 3.5 3 2.5 2 1.5 1 .5 0			
10. Riparian Vegetative Zone Width **What is the amount of buffer available?** Determine right/left bank by facing downstream	Buffer present; a large variety of vegetation extends at least **three channel widths** on each side. 	Some buffer present; some variety of vegetation extends **two to one channel width** on each side. Human activities have impacted buffer zone. 	Little or no buffer present; vegetation extends **less than one channel width** on each side. Human activities substantially impact buffer zone. 	What did you see? Did you see any nonnative vegetation? Check here if YES ☐
Left bank	5 **(4.5)** 4 3.5 3 2.5 2 1.5 1 .5 0			**Score** (Add both banks) 9
Right bank	5 **(4.5)** 4 3.5 3 2.5 2 1.5 1 .5 0			

Stream Habitat Score: **Excellent (69-90)** **Good (46-68)** **Fair (23-45)** **Poor (0-22)**

Total second side 32.5

Total first side 23.5

Total 56

Please submit data at: www.GeorgiaAdoptAStream.org
Or send to: 4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Fax: 404-675-6245 Phone: 404-675-6240

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GEORGIA ADOPT-A-STREAM: Stream Flow

(Also fill out the Basic Visual Form when completing this survey)

CALCULATE AREA

Area = depth x width

It is advisable to take multiple depth and width measurements
Always start at the water's edge with a first measurement of zero
All data should be recorded in feet, with inches replaced by decimals

Depth Measurements	1.	2.	3.	4.	5.	6.	7.	8.	sum
	0 ft	.6	1.7	2.6	3.2	2.6	1.9	1.3	13.9

Average Depth 1.99 ft = 13.9 (sum of depth measurements) / 7 (number of measurements)

Width Measurements	1.	2.	sum
	40.8ft	36.6	77.4

Average Width 38.7 ft = 77.4 (sum of width measurements) / 2 (number of measurements)

Area 77.01 ft² = width 38.7 X depth 1.99

CALCULATE SPEED- Measure the time it takes a float to travel a desired distance

It is advisable to take at least 2 measurements of current speed
Take measurements from the stream <u>run</u>

length = 20 feet (20 feet is recommended)

time in seconds	1.	2.	3.	4.	sum
	42.8 s	43.3	42.5	36.8	165.4

average time 41.35 s = 165.4 (sum of time measurements) / 4 (number of measurements)

Speed .48 ft/s = 20 (length in feet) / 41.35 (average time in seconds)

CALCULATE STREAM FLOW

Flow 29.57 cfs = **Area** 77.01 X **Speed** .48 X **Coefficient** .8

<u>Flow in cubic feet per second</u>

0.9 coefficient for muddy bottom stream
0.8 coefficient for rocky bottom stream

CCRL 1

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GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 1

(Also fill out the Basic Visual Form when completing this survey)

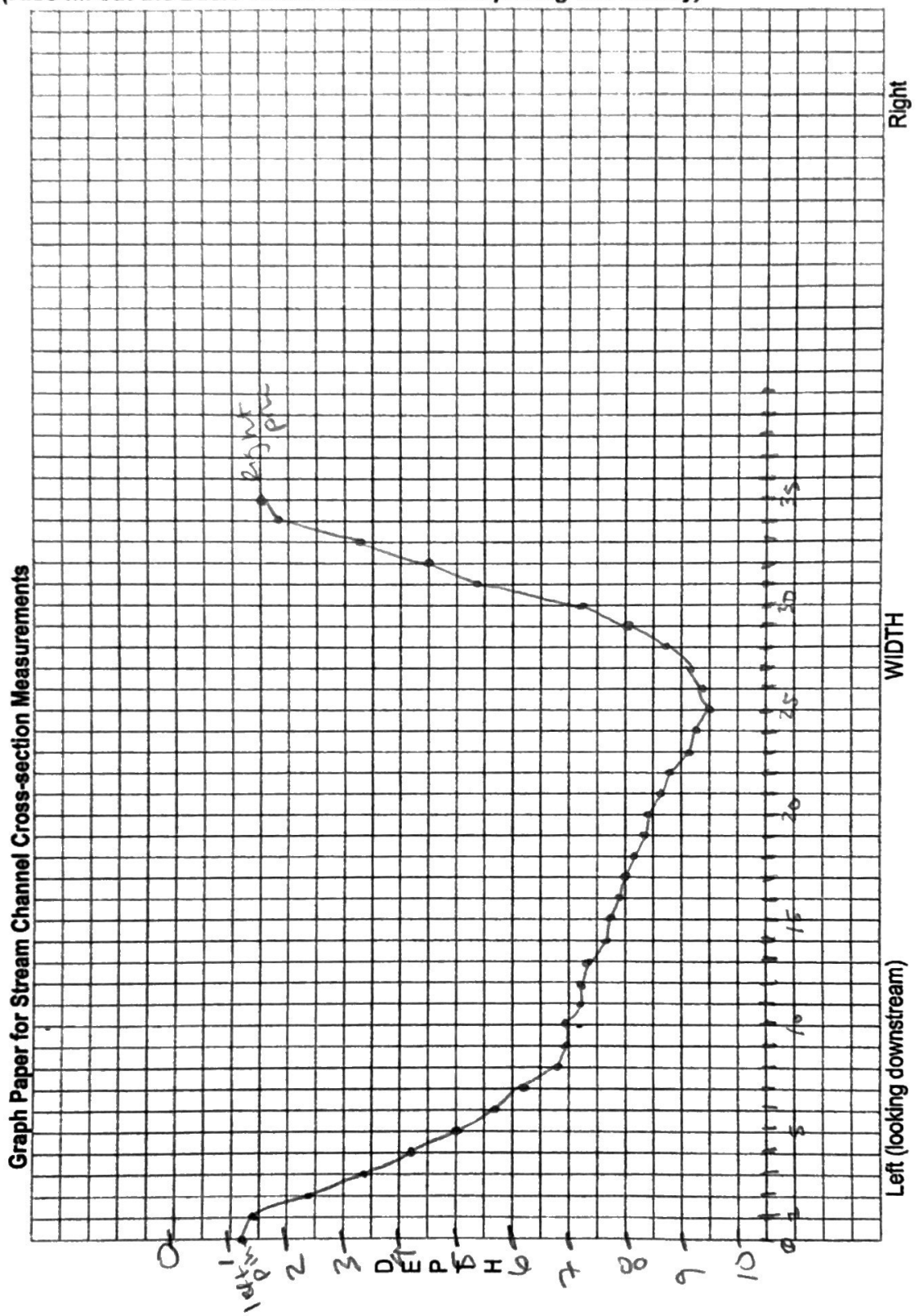
Measurements are always taken from the left stream bank, looking downstream. Depth measurements are taken every two feet and in sections where there is a notable change. Be sure to note left and right bankfull, water edge, and sand bars.

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
1	0	1.1	
2	1	1.3	
3	2	2.4	
4	3	3.4	
5	4	4.2	
6	5	5.0	
7	6	5.6	
8	7	6.1	
9	8	6.8	
10	9	6.9	
11	10	6.9	
12	11	7.2	
13	12	7.2	
14	13	7.3	
15	14	7.6	
16	15	7.7	
17	16	7.9	
18	17	8.0	
19	18	8.2	
20	19	8.3	
21	20	8.4	
22	21	8.6	
23	22	8.8	
24	23	9.1	
25	24	9.3	

CROSS-SECTION			
Distance from LEFT Pin		Measurement Depth	Comments
Point	Ft.	Ft.	
26	25	9.5	
27	26	9.4	
28	27	9.1	
29	28	8.7	
30	29	8.0	
31	30	8.2	
32	31	8.0	
33	32	7.1	
34	33	5.3	
35	34	4.5	
36	35	3.2	
37	36	1.7	
38	37	Right pin	
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

GEORGIA ADOPT-A-STREAM: Channel Cross-Section: Part 2

(Also fill out the Basic Visual Form when completing this survey)



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GEORGIA ADOPT-A-STREAM: Wentworth Pebble Count

(Also fill out the Basic Visual Form when completing this survey)

Count#/Size Class	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
1		✓				
2			✓			
3			✓			
4		✓				
5		✓				
6		✓				
7		✓				
8		✓				
9						
10	✓					
11	✓					
12	✓					
13	✓					
14	✓					
15		✓				
16		✓				
17		✓				
18	✓					
19	✓					
20	✓					
21	✓					
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30		✓				
31		✓				
32				✓		
33				✓		
34		✓				
35				✓		
36	✓					
37				✓		
38		✓				
39		✓				
40				✓		
41	✓					
42		✓				
43		✓				
44		✓				
45		✓				
46		✓				
47		✓				
48		✓				
49		✓				

GEORGIA ADOPT-A-STREAM: Visual Biological Survey

(Also fill out the Basic Visual Form when completing this survey)

1. Wildlife in or around the stream:

amphibians waterfowl reptiles mammals mussels/clams/oysters
crustaceans birds

2. Fish in the stream: *(Check all that apply)*

no yes, but rare yes abundant
small (1-2") medium (3-6") large (7" and above)

Are there barriers to fish movement?

none beaver dams waterfalls > 1ft
dams road barriers other: _____

3. Aquatic plants in the stream: *(Check all that apply)*

none

	occasional	plentiful
attached plants		
stream margin/edge		
pools		
near riffle		
free-floating plants	occasional	plentiful
stream margin/edge		
pools		
near riffle		

4. Extent of algae in the stream:

a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algae? *(Check all that apply)*

none

	occasional	plentiful
brownish:		
light coating		
heavy coating		
greenish:	occasional	plentiful
light coating		
heavy coating		
other: _____	occasional	plentiful
light coating		
heavy coating		

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b) Are there any filamentous (string-like) algae?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other: _____			

c) Are any detached "clumps" or "mats" of algae floating on the water's surface?

	none	occasional	plentiful
brownish	✓		
greenish	✓		
other _____:			

5. Presence of naturally occurring organic material in stream: *(Good habitat for aquatic organisms)*

Logs or large woody debris:	_ none	✓ occasional	_ plentiful
Leaves, twigs, root mats, etc.:	_ none	✓ occasional	_ plentiful

6. Stream shade cover: How well is the water surface shaded by vegetation?

Looking down stream:

Total shading — No shading

100% 90% 85% _____

80% 70% 60% 50% 40% 30% 20% 10% 0

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GEORGIA ADOPT-A-STREAM: Site Sketch

(Also fill out the Basic Visual Form when completing this survey)