

YEAR 5 (2020) MONITORING REPORT
AYCOCK SPRINGS
STREAM AND WETLAND MITIGATION SITE
ALAMANCE COUNTY, NORTH CAROLINA
DMS PROJECT No. 96312
FULL DELIVERY CONTRACT No. 5791
NCDWR PROJECT No. 20140335
USACE ACTION ID No. SAW-2014-01711

CAPE FEAR RIVER BASIN
CATALOGING UNIT 03030002

Data Collection – May-October 2020



PREPARED FOR:

NC. DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
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December 2020



Response to Monitoring Year 5 (2020) DMS Comments

Aycock Springs Stream and Wetland Mitigation Site (DMS #96312)
Cape Fear River Basin 03030002, Alamance County
Contract No. 005791

Comments Received (Black Text) & Responses (Blue Text)

- 1) Title Page
 - a) Please add the NCDWR Project Number: 20140335 and the USACE Action ID Number: SAW-2014-01711.
[These items were added to the title page.](#)

- 2) Appendix D
 - a) Please ensure that the Bank Height Ratio is being calculated using the bankfull elevation that generates the MY0 cross sectional area within the MY5 channel. It seems that the bankfull elevation is currently being calculated using the MY2 bankfull area.
[Corrected.](#)

 - b) Please replace BHR value in the cross section summary data for pool features with NA.
[The BHR values for pools were changed to "NA".](#)

- 3) Appendix E
 - a) Groundwater Gauge Graphs – Please add the graphs, they were not included in the Appendix.
[The gauge graphs were included with this submittal.](#)

- 4) As required by contract, specifically RFP#16-005568 Addendum No. 1, RS must submit an updated Monitoring Phase Performance Bond (MPPB) good through Monitoring Year 6 (Task 12) to Jeff Jurek for his approval before DMS approves this deliverable and the associated payment.
[A Draft Year 6 MPPB was submitted via email to Jeff Jurek on 12/7, and approved 12/8. A final will be sent via email once it is received from the bonding company.](#)

Aycock Springs Year 5, 2020 Monitoring Summary

General Notes

- No encroachment was identified in Year 5
- Beaver activity continues along Travis Creek. RS continues to work with the landowner on trapping of beaver and removal of dams. Beaver activity has not affected site tributaries and the restoration work along Travis Creek.

Streams

- Stream monitoring measurements indicate minimal changes in the cross-sections as compared to as-built through year 3 monitoring data. NOTE – stream monitoring was not required in year 4 (2019). Channel geometry compares favorably with the proposed conditions outlined in the Mitigation Plan.
- Across the Site, all in-stream structures are intact and functioning as designed. The remedial repair to replace bed material along UT-1, completed in 2016/2017, remains stable and has naturalized.
- No other stream areas of concern were identified during Year 5 (2020) monitoring. Tables for annual quantitative assessments are included in Appendix D.

Wetlands

- Three of three groundwater gauges met success for the Year 5 (2020) monitoring period. Wetland hydrology data is in Appendix D.

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1* (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)
1	Yes/55 days (29.1 percent)	Yes/26 days (11.0 percent)	Yes/58 days (25.1 percent)	Yes/59 days (27 percent)	Yes/95 days (41 percent)		
2	Yes/46 days (24.3 percent)	Yes/25 days (10.5 percent)	Yes/65 days (28.1 percent)	Yes/66 days (30 percent)	Yes/71 days (30 percent)		
3	Yes/44 days (23.3 percent)	Yes/25 days (10.5 percent)	Yes/46 days (19.9 percent)	No/14 days (6.5 percent)	Yes/34 days (14.5 percent)		

*Due to Site construction activities, groundwater gauges were not installed until May 5th, 2016; therefore, the growing season for Year 1 (2016) is based on the soil survey start date of April 17th. It is expected that all gauges would meet success criteria at the beginning of the growing season.

Vegetation

- Year 5 (2020) stem count measurements were performed in July 2020 and indicated an average of 375 planted stems per acre (excluding livestakes) across the Site. Eleven of the fourteen individual vegetation plots met success criteria based on planted stems alone. When including naturally recruited stems of green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and American sycamore (*Plantanus occidentalis*), Plots 2, 8, and 13 were above success criteria.
- Five temporary vegetation transects were measured, and all met success criteria (average between 485 and 1012 stems per acre).
- Year 5 (2020) vegetation data can be found in Appendix C; both permanent and temporary plot locations are depicted in Figure 2 (Appendix B).

Site Permitting/Monitoring Activity and Reporting History

Activity or Deliverable	Stream Monitoring Complete	Vegetation Monitoring Complete	All Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-005568)	--	--	--	October 2013
DMS Contract No. 5791	--	--	--	February 2014
Mitigation Plan	--	--	October 2014	May 2015
Construction Plans	--	--	--	June 2015
Construction Earthwork	--	--	--	April 6, 2016
Planting	--	--	--	April 8, 2016
As-Built Documentation	April 6th, 2016	April 13th, 2016	April 2016	May 2016
Year 1 Monitoring	October 18th, 2016	October 13th, 2016	October 2016	December 2016
Supplemental Planting	--	--	--	December 2016
Year 2 Monitoring	April 19-20, 2017	July 25th, 2017	October 2017	November 2017
Year 3 Monitoring	April 16-17, 2018	July 19th, 2018	October 2018	October 2018
Year 4 Monitoring	N/A	N/A	October 2019	November 2019
Year 5 Monitoring	March 24th, 2020	July 7th, 2020	November 2020	December 2020

Site Maintenance Report (2020)

Invasive Species Work	Maintenance work
06-01-2020 Cattail, Privet, Russian Olive, Rose 08-18-2020 Cattail, Privet, Rose, Callery Pear, Russian Olive	5-27-2020 Beaver dams were found within the main channel, trapping and removal plan initiated

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Data Collection – May-October 2020



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December 2020

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1.0 PROJECT SUMMARY

The Aycock Springs Stream and Wetland Mitigation Site (Site) encompasses approximately 13 acres located roughly 1.5 miles north of Elon and Gibsonville in western Alamance County within 14-digit Cataloging Unit and Targeted Local Watershed 03030002030010 of the Cape Fear River Basin (Figure 1, Appendix B and Table 4, Appendix A). Before construction, the Site consisted of agricultural land used for livestock grazing, hay production, and timber harvest. Streams were cleared, trampled by livestock, eroded vertically and laterally, and received extensive sediment and nutrient inputs from livestock and timber harvest activities. Stream impacts in Travis Creek also occurred due to a breached dam that impounded water during storm events. In addition, streamside wetlands were drained by channel incision, soil compaction, and forest vegetation loss due to land uses. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A).

Positive aspects supporting mitigation activities at the Site include the following.

- Streams have a Best Usage Classification of WS-V, NSW
- Located in a Targeted Local Watershed and within the NCDMS Travis, Tickle, Little Alamance Local Watershed Planning (LWP) Area
- Travis Creek is listed on the NCDENR 2012 303(d) list for ecological/biological integrity
- Immediately south and abutting the Site is a property identified in the *Little Alamance, Travis, & Tickle Creek Watersheds Restoration Plan* (PTCOG 2008) as a target property for wetland restoration and streambank enhancement/conservation
- Immediately west of the Site is a large tract associated with Guilford County open space

Based on the *Cape Fear River Basin Restoration Priorities Report 2009* (NCEEP 2009) and the *Little Alamance, Travis, & Tickle Creek Watersheds Restoration Plan* (PTCOG 2008), Targeted Local Watershed 03030002030010 is not meeting its designated use of supporting aquatic life. Agricultural land use appears to be the primary source of stress in the Hydrologic Unit, as well as land clearing and poor riparian management. This project will meet the eight priority goals of the Travis, Tickle, Little Alamance Local Watershed Plan (LWP), including the following:

- 1) Reduce sediment loading
- 2) Reduce nutrient loading
- 3) Manage stormwater runoff
- 4) Reduce toxic inputs
- 5) Provide and improve instream habitat
- 6) Provide and improve terrestrial habitat
- 7) Improve stream stability
- 8) Improve hydrologic function

The following six goals were identified by the Stakeholder group of the Travis, Tickle, Little Alamance LWP Phase I assessment, which address the water quality impacts and watershed needs in all of the Little Alamance, Travis, Tickle watersheds in 2006.

- 1) Increase local government awareness of the impacts of urban growth on water resources
- 2) Strengthen watershed protection standards
- 3) Improve water quality through stormwater management
- 4) Identify and rank parcels for retrofits, stream repair, preservation, and/or conservation
- 5) Assess aquatic health to identify stressors that are the most likely causes of poor biological conditions
- 6) Meet requirements of outside funding sources for implementation of projects

The following table summarizes the project goals/objectives and proposed functional uplift based on restoration activities and observations of two reference areas located in the vicinity of the Site. Goals and objectives target functional uplift identified in the Travis, Tickle, Little Alamance LWP, and based on stream/wetland functional assessments developed by the regulatory agencies.

Project Goals and Objectives

Project Goal/Objective	How Goal/Objective will be Accomplished
Improve Hydrology	
Restore Floodplain Access	Building a new channel at the historic floodplain elevation to restore overbank flows
Restore Wooded Riparian Buffer	Planting a woody riparian buffer
Restore Stream Stability	Providing proper channel width and depth, stabilizing channel banks, providing gravel/cobble substrate, planting a woody riparian buffer, and removing cattle
Improve Sediment Transport to Convert the UTs from Sand/Silt Dominated to Gravel/Cobble Dominated Streams	
Improve Stream Geomorphology	
Increase Surface Storage and Retention	Building a new channel at the historic floodplain elevation restoring overbank flows, removing cattle, scarifying compacted soils, and planting woody vegetation
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	Raising the stream bed elevation and rip compacted soils
Improve Water Quality	
Increase Upland Pollutant Filtration	Planting a native, woody riparian buffer
Increase Thermoregulation	Planting a native, woody riparian buffer
Reduce Stressors and Sources of Pollution	Removing cattle and other agricultural inputs
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Raising the stream bed elevation, restoring overbank flows, planting with woody vegetation, removing cattle, increasing surface storage and retention, and restoring appropriate inundation/duration
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Raising the stream bed elevation, restoring overbank flows, and planting with woody vegetation
Restore Habitat	
Restore In-stream Habitat	Building a stable channel with a cobble/gravel bed and planting a woody riparian buffer
Restore Streamside Habitat	Planting a woody riparian buffer
Improve Vegetation Composition and Structure	

Project construction was completed on April 6th, 2016, and planting was completed on April 8th, 2016. Site activities included the restoration of perennial and intermittent stream channels, enhancement (Level II) of a perennial stream channel, and re-establishment of riparian wetlands. Priority I restoration of intermittent channels at the Site is imperative to provide significant functional uplift to Site hydrology, water quality, and habitat and to restore adjacent streamside riparian wetlands. A total of **3581.1 Stream Mitigation Units (SMUs) and 0.5 Riparian Wetland Mitigation Units (WMUs)** are being provided as depicted in the following table.

Stream Mitigation Type	Perennial Stream (linear feet)	Intermittent Stream (linear feet)	Ratio	Stream Mitigation Units
Restoration	3147	90	1:1	3237
Restoration (See Notes below)**		122	1.5:1	81.3
Enhancement (Level II)	657	--	2.5:1	262.8
TOTAL	3804	212		3581.1
Wetland Mitigation Type	Acreage	Ratio	Riparian Wetland Mitigation Units	
Riparian Re-establishment	0.5	1:1	0.5	
Riparian Enhancement	1.5*		--	
TOTAL	2.0		0.5	

* Wetland enhancement acreage is not included in mitigation credit calculations as per RFP 16-005568 requirements.

** Before Site selection, the landowner received a violation for the unauthorized discharge of fill material into Waters of the United States. Fill resulted from unpermitted upgrades to a farm pond dam, including widening the dam footprint, dredging stream channel, and casting spoil material adjacent to the stream channel on jurisdictional wetlands. Before restoration activities, the landowner was required to obtain an after-the-fact permit to resolve Section 301 violations of the Clean Water Act (Action ID: SAW-2014-00665). Stream reaches and wetland areas associated with the violation have been removed from credit generation.

Further, the landowner received a violation for riparian buffer impacts due to the clearing of trees adjacent to streams draining to Jordan Lake (NOV-2013-BV-0001). As a result of this violation, the upper 122 linear feet of UT 3 has a reduced credit ratio (1.5:1). Onsite visits conducted with USACE representatives determined that the functional uplift of project restoration to UT 3 would be satisfactory to generate credit at this ratio.

Stream Success Criteria

Monitoring and success criteria for stream restoration relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving vegetation success criteria. The following table summarizes stream success criteria related to goals and objectives.

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Stream Goals and Success Criteria

Project Goal/Objective	Stream Success Criteria
Improve Hydrology	
Restore Floodplain Access	Two overbank events in separate monitoring years will be documented during the monitoring period
Restore Wooded Riparian Buffer	Attaining Vegetation Success Criteria
Restore Stream Stability	Cross-sections, monitored annually, will be compared to as-built measurements to determine channel stability and maintenance of channel geomorphology
Improve Stream Geomorphology	Convert stream channels from unstable G- and F-type channels to stable E- and C- type stream channels
Increase Surface Storage and Retention	Two overbank events in separate monitoring years, and attaining Wetland and Vegetation Success Criteria
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	Two overbank events will be documented, in separate years, during the monitoring period and documentation of an elevated groundwater table (within 12 inches of the soil surface) for greater than 10 percent of the growing season during average climatic conditions
Improve Sediment Transport to Convert the UTs from Sand/Silt Dominated to Gravel/Cobble Dominated Streams	Pebble counts documenting coarsening of bed material from pre-existing conditions of sand and silt to post-restoration conditions of gravel and cobble
Improve Water Quality	
Increase Upland Pollutant Filtration	Attaining Wetland and Vegetation Success Criteria (Sections 2.3 and 2.2)
Increase Thermoregulation	Attaining Vegetation Success Criteria (Section 2.2)
Reduce Stressors and Sources of Pollution	Fencing maintained throughout the monitoring period, and encroachment within the easement eliminated
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Removal of cattle, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria (Section 2.2)
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Documentation of two overbank events in separate monitoring years and attaining Vegetation Success Criteria (Section 2.2)
Restore Habitat	
Restore In-stream Habitat	Pebble counts documenting coarsening of bed material from pre-existing conditions of sand and silt to post-restoration conditions of gravel and cobble and attaining Vegetation Success Criteria (Section 2.2)
Restore Streamside Habitat	Attaining Vegetation Success Criteria (Section 2.2)
Improve Vegetation Composition and Structure	Attaining Vegetation Success Criteria (Section 2.2)

Vegetation Success Criteria

An average density of 320 planted stems per acre must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4, 260 planted stems per acre in year 5, and 210 planted stems per acre in year 7. Planted vegetation must average 10 feet in height in each plot at year 7 since this Site is located in the Piedmont. Volunteer stems may be considered on a case-by-case basis in determining overall vegetation success; however, volunteer stems should be counted separately from planted stems.

Wetland Success Criteria

Monitoring and success criteria for wetland re-establishment should relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving vegetation success criteria. The following summarizes wetland success criteria related to goals and objectives.

Wetland Goals and Success Criteria

Project Goal/Objective	Wetland Success Criteria
Improve Hydrology	
Restore Wooded Riparian Buffer	Attaining Vegetation Success Criteria
Increase Surface Storage and Retention	Two overbank events in separate monitoring years, and attaining Wetland and Vegetation Success Criteria
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	
Improve Water Quality	
Increase Upland Pollutant Filtration	Attaining Wetland and Vegetation Success Criteria
Reduce Stressors and Sources of Pollution	Fencing maintained throughout the monitoring period and encroachment within the easement eliminated
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Removal of cattle, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria
Restore Habitat	
Restore Streamside Habitat	Attaining Vegetation Success Criteria.
Improve Vegetation Composition and Structure	

According to the *Soil Survey of Alamance County*, the growing season for Alamance County is from April 17th – October 22nd (USDA 1960). However, the start date for the growing season is not typical for the Piedmont region; therefore, for this project, hydrologic wetland success will be determined using data from February 1st - October 22nd to more accurately represent the period of biological activity. This will be confirmed annually by soil temperatures and/or bud burst. The growing season will be initiated each year on the documented date of biological activity. Photographic evidence of bud burst and field logs of date and temperature will be included in the annual monitoring reports.

Target hydrological characteristics include saturation or inundation for 10 percent of the monitored period (February 1-October 22) during average climatic conditions. During years with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

Summary of Monitoring Period/Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	10 Percent of Monitoring Period
2016 (Year 1)	-	April 17th*-October 22nd (198 days)	19 days
2017 (Year 2)	Bud burst on red maple (<i>Acer rubrum</i>) and soil temperature of 58°F documented on February 28th, 2017	February 28-October 22 (237 days)	23 days
2018 (Year 3)	Bud burst and soil temperature of 44°F documented on March 6th, 2018	March 6-October 22 (231 days)	23 days
2019 (Year 4)	March 20th, 2019,**	March 20-October 22 (217 days)	21 days
2020 (Year 5)	March 2nd, 2020,**	March 2-October 22 (234 days)	23 days
2021 (Year 6)	-	-	-
2022 (Year 7)	-	-	-

*Gauges were installed on May 5th during year 1 (2016); therefore, April 17th was used as the start of the growing season (NRCS).

**Based on data collected from a soil temperature data logger located on the Site and observed bud burst.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to various project and monitoring elements' performance can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on the NC Division of Mitigation Services (NCDMS) website. All raw data supporting the tables and figures in the appendices are available from NCDMS upon request.

2.0 METHODOLOGY

Monitoring requirements and success criteria outlined in the latest guidance by the US Army Corps of Engineers (USACE) in April 2003 (*Stream Mitigation Guidelines*) will be followed and are briefly outlined below. Monitoring data collected at the Site should include reference photos, plant survival analysis, channel stability analysis, and biological data if specifically required by permit conditions.

Wetland hydrology is proposed to be monitored for a period of seven years (years 1-7). Riparian vegetation and stream morphology is proposed to be monitored for a period of seven years with measurements completed in years 1-3, year 5, and year 7. Monitoring reports for years 4 and 6 will include photo documentation of stream stability and wetland hydrology monitoring data. If monitoring demonstrates the Site is successful by year 5 and no concerns have been identified, Restoration Systems (RS) may propose to terminate monitoring at the Site and forego monitoring requirements for years 6 and 7. Early closure will only be provided through written approval from the USACE in consultation with the Interagency Review Team (NC IRT). Monitoring will be conducted by Axiom Environmental, Inc (AXE). Annual monitoring reports of the data collected will be submitted to the NCDMS by RS no later than December 31st of each monitoring year data is collected.

2.1 Streams

Annual monitoring of streams will include the development of channel cross-sections and substrate on riffles and pools. Data to be presented in graphic and tabular format will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) bank height ratio, and 7) entrenchment ratio. Longitudinal profiles will not be measured routinely unless monitoring demonstrates channel bank or bed instability, in which case, longitudinal profiles may be required by the USACE along reaches of concern to track changes and demonstrate stability.

Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure. In addition, visual assessments of the entire channel will be conducted in years 1-3, 5, and 7 of monitoring as outlined in NCDMS *Monitoring Requirements and Reporting Standards for Stream and/or Wetland Mitigation*. Areas of concern will be depicted on a plan view figure identifying the location of concern along with a written assessment and photograph of the area.

Year 5 (2020) stream measurements were performed on February 7th and March 24th, 2020. As a whole, monitoring measurements indicate minimal changes in the cross-sections compared to as-built and Year 3 (2018) data.

Before construction, ground cover was fully established, multiple heavy rain events (2+ inches) caused some sedimentation in the streambed. This aggradation can be seen in several Year 1 (2016) cross-sections, and it appears to have reduced and stabilized during Years 2-5 (2017-2020).

The year 1 (2016) measurements for cross-sections 9 and 10 on UT-1 showed stream bed erosion compared with as-built data. Stream bed erosion was noted shortly after as-built measurements were taken and were the result of the above mentioned rain events. It was evident bed material used during construction in this area was finer than it should have been. Two riffles showed bed erosion, totaling approximately 50 feet in length (approximately 1 percent of the project length). RS created and implemented a remedial action plan during the winter of 2016/2017 (see Section 3.0 and Appendix G). These repairs appear stable during Year 5 (2020) monitoring, and they will continue to be monitored during subsequent monitoring years.

Across the Site, all in-stream structures are intact and functioning as designed. No stream areas of concern were identified during Year 5 (2020) monitoring; however, three small areas of bank erosion were observed in the Enhancement (Level II) reach of Travis Creek. The pre-construction condition of Travis Creek included some stream bank erosion, and with the large amount of rainfall the Site received during Year 3 (2018), some of this erosion became more apparent. These areas will continue to be monitored for any significant change, but the erosion is not expected to cause any major stream stability problems. Tables for annual quantitative assessments are included in Appendix D.

2.2 Vegetation

During quantitative vegetation sampling, 14 sample plots (10-meter by 10-meter) were installed within the Site as per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph.

After planting was completed on April 8th, 2016, an initial evaluation was performed to verify planting methods and determine initial species composition and density. At this time, RS decided it was necessary to implement a supplemental planting. Working with Carolina Silvics, RS planted 1030 containerized trees consisting of 755 1-gallon pots and 275 3-gallon pots during the week of December 20th, 2016, which

included the following species: *Betula nigra*, *Fraxinus pennsylvanica*, *Platanus occiendentalis*, *Quercus falcata*, *Quercus nigra*, *Quercus palustris*, *Quercus phellos*, and *Quercus rubra*. A remedial planting plan report detailing the location of planting and density is provided in Appendix G.

Year 5 (2020) stem count measurements were performed in July 2020 and indicated an average of 375 planted stems per acre (excluding livestakes) across the Site; therefore, the Site meets vegetation success criteria. Eleven of the fourteen individual vegetation plots met success criteria based on planted stems alone. When including naturally recruited stems of green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and American sycamore (*Plantanus occidentalis*), Plots 2, 8, and 13 were above success criteria. Additionally, 5 temporary vegetation transects were measured, and all met success criteria. Year 5 (2020) vegetation data can be found in Appendix C; both permanent and temporary plot locations are depicted in Figure 2 (Appendix B).

2.3 Wetland Hydrology

Three groundwater monitoring gauges were installed to take measurements after hydrological modifications were performed at the Site. Hydrological sampling will continue throughout the growing season at intervals necessary to satisfy jurisdictional hydrology success criteria (USEPA 1990). In addition, a surface water gauge was installed in Tributary 3 to monitor the flow regime of the tributary. Approximate locations of gauges are depicted in Figure 2 (Appendix A).

Hydrological sampling will continue throughout the growing season at intervals necessary to satisfy jurisdictional hydrology success criteria (USEPA 1990). In addition, an onsite rain gauge will document rainfall data for comparison of groundwater conditions with extended drought conditions, and floodplain crest gauges will confirm overbank flooding events. All three groundwater gauges were successful in year 5 (2020) (Appendix E).

2.4 Biotic Community Change

Changes in the biotic community are anticipated from a shift in habitat opportunities as tributaries are restored. In-stream, biological monitoring is proposed to track the changes during the monitoring period. The benthic macroinvertebrate community will be sampled using NCDWQ protocols found in the *Standard Operating Procedures for Benthic Macroinvertebrates* (NCDWQ 2006) and *Benthic Macroinvertebrate Protocols for Compensatory Stream Restoration Projects* (NCDWQ 2001). Biological sampling of benthic macroinvertebrates will be used to compare pre-construction baseline data with post-construction restored conditions.

Two benthic macroinvertebrate monitoring locations were established within restoration reaches. Post-restoration collections will occur in the approximate location of the pre-restoration sampling. Benthic macroinvertebrate samples will be collected from individual reaches using the Qual-4 collection method. Sampling techniques of the Qual-4 collection method consist of kick nets, sweep nets, leaf packs, and visual searches. Pre-project biological sampling occurred on June 26th, 2014; post-project monitoring will occur in June of monitoring years 2-5.

Identification of collected organisms will be performed by personnel with North Carolina Division of Water Resources (NCDWR) or by a NCDWR certified laboratory. Other data collected will include D50 values/NCDWR habitat assessment forms. Biological sampling for year 5 (2020) occurred on June 18th, 2020. The samples were sent to Pennington and Associates, a NCDWR certified laboratory, for identification and analysis. Results and Habitat Assessment Dataforms are included in Appendix F.

3.0 REMEDIAL ACTION PLAN

A remedial action plan was developed to address stream and vegetation problem areas observed during Year 1 (2016) monitoring. The completed remedial action report can be found in Appendix G.

3.1 Stream

The degradation observed during Year 1 (2016) in and adjacent to cross-sections 9 and 10 on UT-1 encompasses approximately 12 linear feet and 15 linear feet of stream, respectively (<1 percent of the project length). As noted above, the bed material placed during construction was too fine. All of UT-1 used bed material harvested onsite. The material used along this stream reach was too fine and washed from the riffles during heavy rainfall events, resulting in minor bed scour and a small, less than 6-inch head cut, began to develop at the top of the riffle. Suitable sized channel bed material was installed on February 23rd, 2017, at the proper elevation in the two riffles within UT-1. Bed material was installed such that bank toe protection is provided, and planting with willow stakes occurred. Bank toe protection designates that channel bed material will extend up the lower one-third of the bank. This will be monitored by existing established cross-sections 9 and 10.

3.2 Vegetation

Multiple factors were contributing to poor vegetative success in Year 1 (2016), including a later than desired initial bare-root planting, heavy herbaceous competition primarily from fescue (Site was previously a cattle pasture), and sporadic rain events, which left upland areas of the Site dry for extended periods of the growing season. Greater survival of planted species was observed within riparian areas.

The remedial action plan supplemented the bare-root planting over 5.44 acres with 1030 additional trees (755 1-gallon pots and 275 3-gallon pots). The remedial action plan figure (Appendix G) details the areas that received remedial planting along with density and number of species being placed into vegetation plots. Working with Carolina Silvics, RS acquired and re-planted the identified areas during the week of December 20th, 2016. Species planted included *Betula nigra*, *Fraxinus pennsylvanica*, *Platanus occidentalis*, *Quercus falcata*, *Quercus nigra*, *Quercus palustris*, *Quercus phellos*, and *Quercus rubra*.

Treatment of invasive plant species has occurred each year of monitoring throughout the Site. RS will continue to treat and monitor the Site for invasive species as needed throughout the monitoring period. Previous treatments on the small patch of cattails at the confluence of UT-1 and UT-2 were successful. However, in the Spring of 2019, cattail regeneration was noted within the area of concern. Treatment was conducted in July 2019, and the area continues to be monitored. Additional dense herbaceous vegetation within UT-2, was noted during the spring of 2019. The vegetation appeared to be impeding the natural hydrology of the stream. Treatment was conducted in July 2019.

Beaver activity has been observed along Travis Creek during Year 5 (2020). Restorations Systems continues to work with the landowner to trap beaver, however, several dams remain onsite within Travis Creek. The current beaver dam locations are depicted in Figure 2 (Appendix B).

During Year 5 (2020), it was observed that several upland areas around UT-1 and UT-2 had sparse herbaceous vegetation. Four target areas were identified, totaling approximately 0.8 acres. Restoration Systems applied 500 pounds lime, 200 pounds fertilizer, and 14 pounds seed mix across these areas. The seed mix species are listed in the following table, and the target areas are depicted in Figure 2 (Appendix B).

2020 Seed Mix Species List

Blackeyed Susan (<i>Rudbeckia hirta</i>)	Partridge Pea (<i>Chamaecrista fasciculata</i>)
Blue Vervain (<i>Verbena hastata</i>)	Plains Coreopsis (<i>Coreopsis tinctoria</i>)
Cosmos (<i>Cosmos</i> spp.)	Purple Coneflower (<i>Echinacea purpurea</i>)
Creeping Bentgrass (<i>Agrostis stolonifera</i>)	Purple Top (<i>Tridens flavus</i>)
Crimson-eyed Rosemallow (<i>Hibiscus moscheutos</i>)	Red Top (<i>Agrostis gigantea</i>)
Deertongue (<i>Dichanthelium clandestinum</i>)	Roundhead lespedeza (<i>Lespedeza capitata</i>)
Korean Lespedeza (<i>Kummerowia striata</i>)	Sensitive Pea (<i>Chamaecrista nictitans</i>)
Lanceleaf Coreopsis (<i>Coreopsis lanceolata</i>)	Showy Ticktrefoil (<i>Desmodium canadense</i>)
Marsh Blazing Star (<i>Liatris spicata</i>)	Slender lespedeza (<i>Lespedeza virginica</i>)
Narrowleaf Sunflower (<i>Helianthus angustifolius</i>)	Virginia Wildrye (<i>Elymus virginicus</i>)
Oxeye Daisy (<i>Leucanthemum vulgare</i>)	Winter Bentgrass (<i>Agrostis hyemalis</i>)
Oxeye Sunflower (<i>Heliopsis helianthoides</i>)	

4.0 REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Environmental Laboratory. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). United States Army Engineer Research and Development Station, Vicksburg, Mississippi.

Lee, M.T., R.K. Peet, SD. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2001. Benthic Macroinvertebrate Monitoring Protocols for Compensatory Mitigation. 401/Wetlands Unit, Department of Environment and Natural Resources. Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2006. Standard Operating Procedures for Benthic Macroinvertebrates. Biological Assessment Unit, North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina.

North Carolina Division of Mitigation Services (NCDMS 2009). Cape Fear River Basin Restoration Priorities 2009 (online). Available: http://portal.ncdenr.org/c/document_library/get_file?uuid=864e82e8-725c-415e-8ed9-c72dfcb55012&groupId=60329

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

United States Department of Agriculture (USDA). 1960. Soil Survey of Alamance County, North Carolina. Soil Conservation Service.

United States Environmental Protection Agency (USEPA). 1990. Mitigation Site Type Classification (MiST). EPA Workshop, August 13-15, 1989. EPA Region IV and Hardwood Research Cooperative, NCSU, Raleigh, North Carolina.

APPENDIX A

PROJECT BACKGROUND DATA AND MAPS

Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Prepared for:



Project:

Aycock Springs Stream and Wetland Mitigation Site

Alamance County, NC

Title:

Project Location

Notes:

- Background Imagery sources (provided by ESRI Data and Maps):
1. Physical Map of the United States (2009) created by the U.S. Park Service (upper inset).
 2. DeLorme World Basemap digital mapping (2010, lower inset).
 3. Burlington, NC (1980), Lake Burlington, NC (1969), Gibsonville, NC (1970), and Ossipee, NC (1970) 7.5-minute topographic quadrangles provided by the U.S. Geological Survey.

Drawn by: SGD

Date: May 2016

Scale: As Shown

Project No.: 14-006

FIGURE

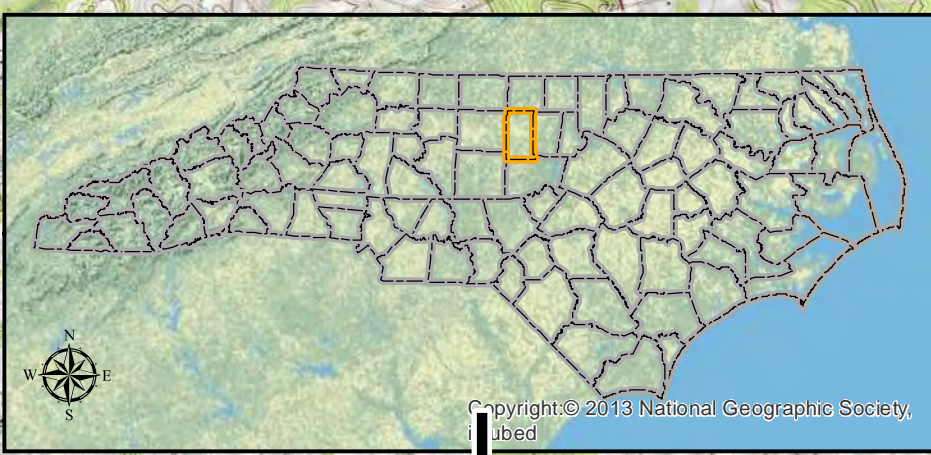
1

Directions to the Site from Interstates 40/85 in Burlington/Elon, NC:

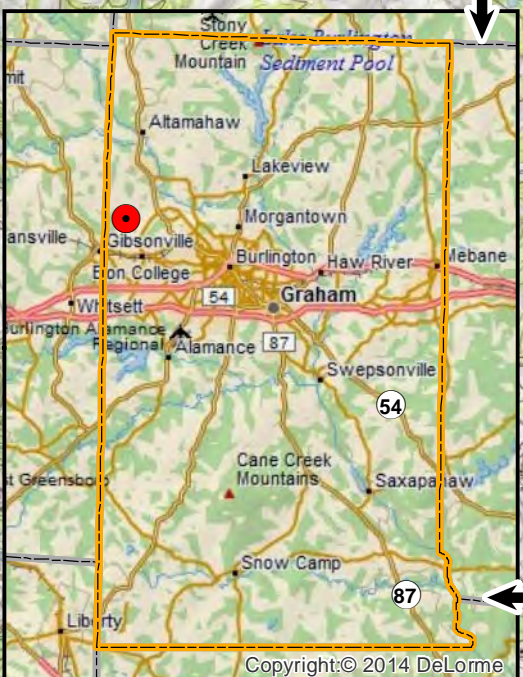
- Exit onto University Drive (I-40/85 Exit 140) and travel north (toward Elon)
- Travel north for 2.8 miles and merge with NC 100
- Continue on University Drive (NC 100) for 0.5 mile and turn left onto Manning Street (SR 1503)
- Travel northwest for 0.8 mile and turn right onto Gibsonville-Ossipee Road (SR 1500)
- Travel north for 0.7 mile and Site is on the right

Aycock Springs Stream and Wetland Mitigation Site

36.127271 N
-79.525214 W



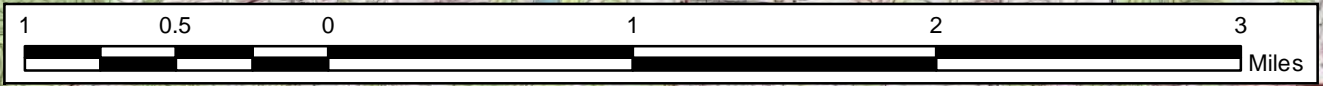
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Copyright © 2014 DeLorme

Legend

- Aycock Springs Stream and Wetland Mitigation Site
- County lines



Copyright © 2013 National Geographic Society, I-cubed

Table 1. Project Components and Mitigation Credits

Mitigation Credits							
Stream	Stream	Riparian Wetland			Nonriparian Wetland		
Restoration	Enhancement	Re-establishment			Re-establishment		
3237	344.1	0.5			--		
Projects Components							
Station Range	Existing Linear Footage/Acreage	Priority Approach	Restoration/Restoration Equivalent	Restoration Linear Footage/Acreage	Mitigation Ratio	Mitigation Credits	Comment
UT 1 Station 10+04 to 23+21	1173	PI	Restoration	$1317-24=1293$	1:1	1293	24 lf of UT 1 is located outside of easement and is not credit generating
UT 2 Station 10+00 to 16+75	723	PI	Restoration	675	1:1	675	
UT 3 Station 10+00 to 11+22	147	PI	Restoration	122	1.5:1	81.3	*** The upper 122 linear feet of channel is in a violation area and is generating credit at a reduced ratio of 1.5:1
UT 3 Station 11+22 to 12+12	16	PI	Restoration	90	1:1	90	
UT 4 Station 10+00 to 14+13	448	PI	Restoration	$413-107=306$	1:1	306	****The upper 107 linear feet of channel is in a violation area and is not credit generating
Travis Creek Station 10+00 to 15+78	578		EII	$578-20=558$	2.5:1	223.2	The upper 20 linear feet of Travis Creek is within a powerline easement and is not credit generating
Travis Creek Station 15+78 to 17+87	274	PII	Restoration	209	1:1	209	
Travis Creek Station 17+87 to 18+86	99		EII	99	2.5:1	39.6	
Travis Creek Station 23+71 to 30+35	936	PI	Restoration	664	1:1	664	

Table 1. Project Components and Mitigation Credits (continued)

Component Summation			
Restoration Level	Stream (linear footage)	Riparian Wetland (acreage)	Nonriparian Wetland (acreage)
Restoration	3237	0.5	--
Enhancement (Level I)	122	--	--
Enhancement (Level II)	657	--	
Enhancement	--	1.5**	
Totals	4016	--	--
Mitigation Units	3581.1 SMUs	0.5 Riparian WMUs	0.00 Nonriparian WMUs

**Wetland enhancement acreage is not included in mitigation credit calculations as per RFP 16-005568 requirements.

*** Before Site selection, the landowner received a violation for riparian buffer impacts due to the clearing of trees adjacent to streams draining to Jordan Lake (NOV-2013-BV-0001). As a result of this violation, the upper 122 linear feet of UT 3 has a reduced credit ratio of 1.5:1. Onsite visits conducted with USACE representatives determined that the functional uplift of project restoration to UT 3 would be satisfactory to generate credit at this ratio.

**** Before Site selection, the landowner received a violation for the unauthorized discharge of fill material into Waters of the United States. Fill resulted from unpermitted upgrades to a farm pond dam, including widening the dam footprint, dredging stream channel, and casting spoil material adjacent to the stream channel on jurisdictional wetlands. Before restoration activities, the landowner was required to obtain an after-the-fact permit to resolve the violations of Section 301 of the Clean Water Act (Action ID: SAW-2014-00665). In addition, stream reaches and wetland areas associated with the violation area have been removed from credit generation – UT 4 begins credit generation at Station 11+07).

Table 2. Project Activity and Reporting History

Activity or Deliverable	Stream Monitoring Complete	Vegetation Monitoring Complete	All Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-005568)	--	--	--	October 2013
DMS Contract No. 5791	--	--	--	February 2014
Mitigation Plan	--	--	October 2014	May 2015
Construction Plans	--	--	--	June 2015
Construction Earthwork	--	--	--	April 6, 2016
Planting	--	--	--	April 8, 2016
As-Built Documentation	April 6th, 2016	April 13th, 2016	April 2016	May 2016
Year 1 Monitoring	October 18th, 2016	October 13th, 2016	October 2016	December 2016
Supplemental Planting	--	--	--	December 2016
Year 2 Monitoring	April 19-20, 2017	July 25th, 2017	October 2017	November 2017
Year 3 Monitoring	April 16-17, 2018	July 19th, 2018	October 2018	October 2018
Year 4 Monitoring	N/A	N/A	October 2019	November 2019
Year 5 Monitoring	March 24th, 2020	July 7th, 2020	November 2020	December 2020

Table 3. Project Contacts Table

Full Delivery Provider Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Worth Creech 919-755-9490	Construction Contractor Land Mechanic Designs 780 Landmark Road Willow Spring, NC 27592 Lloyd Glover 919-639-6132
Designer Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693	Planting Contractor Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932 Mary-Margaret McKinney 252-482-8491
Construction Plans and Sediment and Erosion Control Plans Sungate Design Group, PA 915 Jones Franklin Road Raleigh, NC 27606 Joshua G. Dalton, PE 919-859-2243	As-built Surveyor K2 Design Group 5688 US Highway 70 East Goldsboro, NC 27534 John Rudolph 919-751-0075
	Baseline & Monitoring Data Collection Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table

Project Information				
Project Name	Aycock Springs Restoration Site			
Project County	Alamance County, North Carolina			
Project Area (acres)	15			
Project Coordinates (latitude & longitude)	36.127271°N, 79.525214°W			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
Project River Basin	Cape Fear			
USGS HUC for Project (14-digit)	03030002030010			
NCDEQ Sub-basin for Project	03-06-02			
Project Drainage Area (acres)	26-3008			
Project Drainage Area Percentage of Impervious Area	<2%			
Reach Summary Information				
Parameters	Travis Cr	UT 1/UT2	UT 3	UT 4
Length of reach (linear feet)	1550	1966	212	413
Valley Classification	alluvial			
Drainage Area (acres)	3008	68	26	119
NCDWQ Stream ID Score	--	30.75/25.5	26.75	27.5
NCDWR Water Quality Classification	WS-V, NSW			
Existing Morphological Description (Rosgen 1996)	Cg 5/6-, Eg 5-, and Fc 5-type			
Existing Evolutionary Stage (Simon and Hupp 1986)	IV	IV	III	III
Underlying Mapped Soils	Cecil, Helena, Mixed Alluvial Land, Severely Gullied Land, Worsham			
Drainage Class	Well-drained, moderately well-drained, poorly drained, variable, poorly drained			
Hydric Soil Status	Nonhydric and Hydric			
Slope	0.0023	0.0249	0.0153	0.0093
FEMA Classification	AE	Special Hazard Flood Area		
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest			
Watershed Land Use/Land Cover (Site)	42% forest, 53% agricultural land, <5% low density residential/impervious surface			
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface			
Percent Composition of Exotic Invasive Vegetation	< 5%			

Table 4. Project Attribute Table (Continued)

Wetland Summary Information			
Parameters	Wetlands		
Wetland acreage	1.6		
Wetland Type	Riparian		
Mapped Soil Series	Worsham and Mixed Alluvial Land		
Drainage Class	Poorly drained		
Hydric Soil Status	Hydric		
Source of Hydrology	Groundwater, stream overbank		
Hydrologic Impairment	Incised streams, compacted soils, livestock		
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest		
Percent Composition of Exotic Invasive Vegetation	<5%		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States-Section 401	Yes	Resolved	404 Permit
Waters of the United States-Section 404	Yes	Resolved	401 Certification
Endangered Species Act	No	--	CE Doc.
Historic Preservation Act	No	--	CE Doc.
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	Resolved	CLOMR/LOMR
Essential Fisheries Habitat	No	--	NA

APPENDIX B

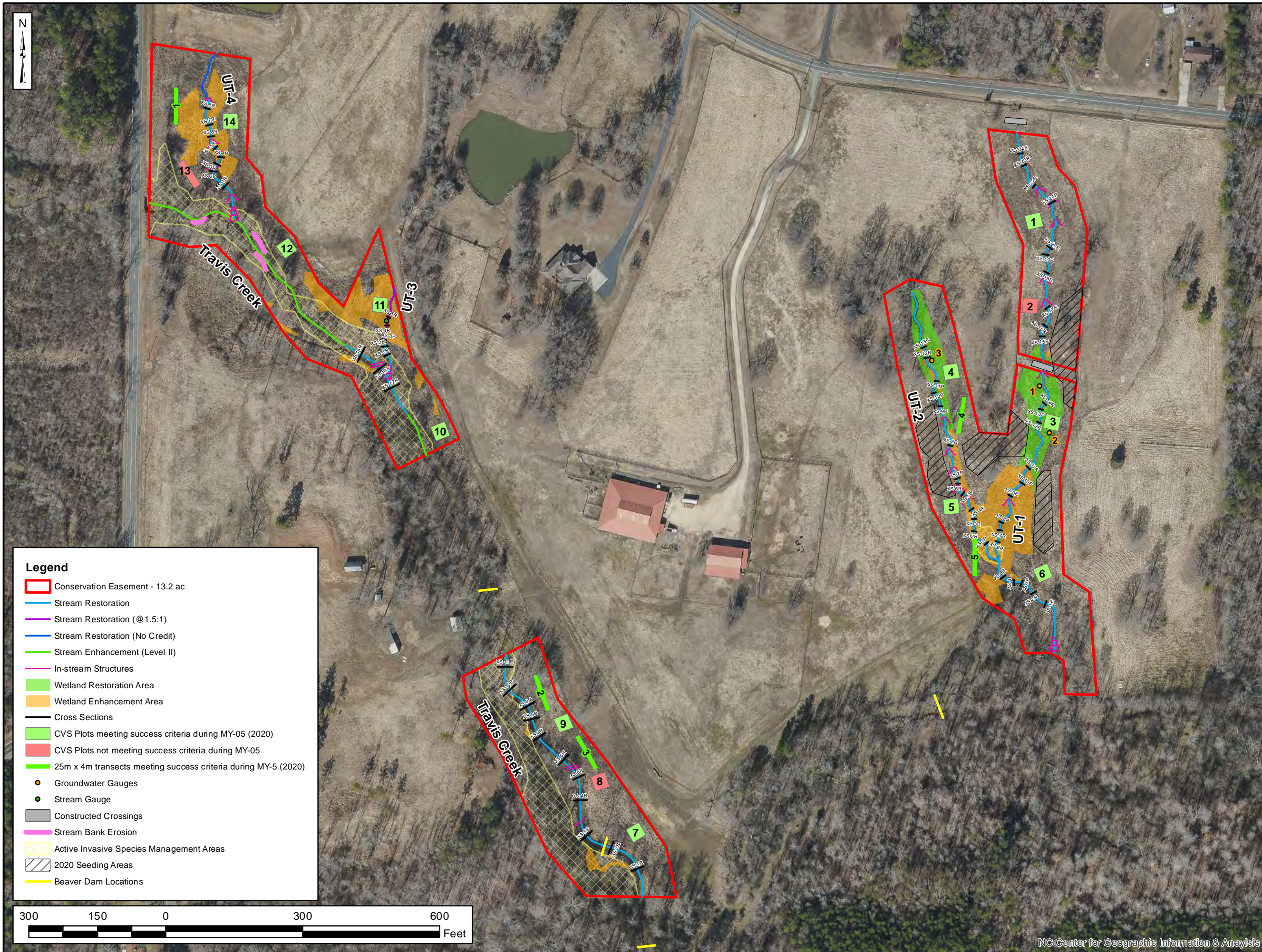
VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View (CCPV)

Tables 5A-5E. Visual Stream Morphology Stability Assessment

Table 6. Vegetation Condition Assessment

Vegetation Plot Photographs



Prepared for:



Project:

Aycock Springs Stream and Wetland Mitigation Site

Alamance County, NC

Title:

Current Conditions Plan View

Notes:

1. Background Imagery source: 2014 aerial photography provided by the NC OneMap Program (online, supported by the NC Geographic Information Coordination Council).

Drawn by: KRJ/CLF

Date: NOV 2020

Scale: 1:2400

Project No.: 14-006

FIGURE

2

- Legend**
- Conservation Easement - 13.2 ac
 - Stream Restoration
 - Stream Restoration (@ 1.5:1)
 - Stream Restoration (No Credit)
 - Stream Enhancement (Level II)
 - In-stream Structures
 - Wetland Restoration Area
 - Wetland Enhancement Area
 - Cross Sections
 - CVS Plots meeting success criteria during MY-05 (2020)
 - CVS Plots not meeting success criteria during MY-05
 - 25m x 4m transects meeting success criteria during MY-5 (2020)
 - Groundwater Gauges
 - Stream Gauge
 - Constructed Crossings
 - Stream Bank Erosion
 - Active Invasive Species Management Areas
 - 2020 Seeding Areas
 - Beaver Dam Locations

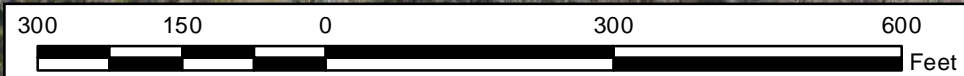


Table 5A
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 Aycock Springs - Travis Creek
 1550

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	10	10			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	9	9			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	9	9			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		2. Thalweg centering at downstream of meander (Glide)	9	9			100%			
	Totals									
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			3	120	96%			96%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	9	9			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	9	9			100%			

Table 5B
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 Aycock Springs UT1
 1317

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	45	45		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	44	44		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	44	44		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	44	44		100%				
		2. Thalweg centering at downstream of meander (Glide)	44	44		100%				
	Totals					0	0			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	10	10			100%			

Table 5C
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 Aycock Springs UT2
 675

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	25	25		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	24	24		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	24	24		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	24	24		100%				
		2. Thalweg centering at downstream of meander (Glide)	24	24		100%				
	Totals					0	0			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	6		100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%				
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6		100%				
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	6	6		100%				
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	6	6		100%				

Table 5D
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 Aycock Springs UT3
 212

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	9	9		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	8	8		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	8	8		100%				
		2. Thalweg centering at downstream of meander (Glide)	8	8		100%				
	Totals					0	0			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	1	1			100%			

Table 5E
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 Aycock Springs UT4
 413

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	9	9		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	8	8		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	8	8		100%				
		2. Thalweg centering at downstream of meander (Glide)	8	8		100%				
	Totals					0	0			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	5		100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5		100%				
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5		100%				
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	5	5		100%				
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	5	5		100%				

Table 6

Vegetation Condition Assessment

Aycock Springs

Planted Acreage¹

11.9

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage	
1. Bare Areas	None	0.1 acres	none	0	0.00	0.0%	
2. Low Stem Density Areas	None	1550	none	0	0.00	0.0%	
2B. Low Planted Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%	
				Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	None	0.25 acres	none	0	0.00	0.0%	
				Cumulative Total	0	0.00	0.0%

Easement Acreage²

13.3

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Ongoing Invasive Species Management Areas ⁴	Management of Chinese privet and multiflora rose is active and ongoing along Travis Creek. There is also ongoing treatment for cattail along UT1 and UT2. 2017-18 invasives management has improved vegetation condition in these areas, however treatment is ongoing.	1000 SF	yellow hatch	3	2.46	18.5%
5. Easement Encroachment Areas ³	None	none	none	0	0.00	0.0%

¹ = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

² = The acreage within the easement boundaries.

³ = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

⁴ = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likely trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly early in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolizing invasives polygons, particularly for situations where the condition for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Aycock Springs
MY-05 (2020) Vegetation Monitoring Photographs
Taken July 2020



Aycock Springs
MY-05 (2020) Vegetation Monitoring Photographs (continued)
Taken July 2020



Aycock Springs
MY-05 (2020) Vegetation Monitoring Photographs (continued)
Taken July 2020



APPENDIX C
VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

Table 10. Supplemental Vegetation Transect Data

Table 7. Vegetation Plot Criteria Attainment Based on Planted Stems

Vegetation Plot ID	Vegetation Survival Threshold Met?	MY 5 (2020) Planted Stems	MY 4 (2020) All Stems	Tract Mean
1	Yes	769	809	78.6%
2	No*	243	728	
3	Yes	283	607	
4	Yes	364	2833	
5	Yes	405	890	
6	Yes	607	728	
7	Yes	526	809	
8	No*	243	526	
9	Yes	283	647	
10	Yes	324	728	
11	Yes	364	607	
12	Yes	364	445	
13	No*	121	405	
14	Yes	364	728	
Total =		375	820	

*These plots did not meet success criteria based on planted stems only; however, when including naturally recruited stems of green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and American sycamore (*Platanus occidentalis*) these plots were above success criteria.

Table 8. CVS Vegetation Plot Metadata

Report Prepared By	Corri Faquin
Date Prepared	7/13/2020 12:50
database name	RS-Aycock_2020.mdb
database location	S:\Business\Projects\14\14-006 Aycock Springs Detailed\2020 YEAR-05\CVS
computer name	PHILLIP-LT
file size	56627200
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	14-006
project Name	Aycock Springs
Description	
River Basin	Cape Fear
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	14

Table 9. Planted and Total Stems
Project Code 14.006. Project Name: Aycock Springs

Scientific Name	Common Name	Species Type	Current Plot Data (MYS 2020)																																
			14.006-01-0001			14.006-01-0002			14.006-01-0003			14.006-01-0004			14.006-01-0005			14.006-01-0006			14.006-01-0007			14.006-01-0008			14.006-01-0009			14.006-01-0010					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Acer negundo	boxelder	Tree																											4			4			
Acer rubrum	red maple	Tree										1			5																				
Betula nigra	river birch	Tree				1	1	1																	1	1	1								
Callicarpa	beautyberry	Shrub																																	
Callicarpa americana	American beautyberry	Shrub																																	
Carpinus caroliniana	American hornbeam	Tree															4	4	4						1	1	1	1	1	1					
Cephalanthus occidentalis	common buttonbush	Shrub																																	
Cornus amomum	silky dogwood	Shrub	9	9	9	3	3	3	3	3	3	3	3	3	3	3	10	10	10	5	5	5	2	2	2	1	1	1	3	3	3				
Cornus florida	flowering dogwood	Tree																																	
Diospyros virginiana	common persimmon	Tree												1																1	1	1			
Fraxinus pennsylvanica	green ash	Tree						11					5	1	1	56	1	1	7							1	1	4	1	1	6	1	1	5	
Liquidambar	sweetgum	Tree																																	
Liquidambar styraciflua	sweetgum	Tree																																	
Nyssa	tupelo	Tree																				3	3	3											
Nyssa sylvatica	blackgum	Tree																				1	1	1	1	1	1								
Pinus taeda	loblolly pine	Tree																																	
Platanus occidentalis	American sycamore	Tree	2	2	3									1	1	1																			
Quercus	oak	Tree																																	
Quercus alba	white oak	Tree	2	2	2																														
Quercus falcata	southern red oak	Tree															3	3	3																
Quercus michauxii	swamp chestnut oak	Tree																																	
Quercus nigra	water oak	Tree															1	1	1																
Quercus pagoda	cherrybark oak	Tree																																	
Quercus phellos	willow oak	Tree																																	
Quercus rubra	northern red oak	Tree	6	6	6	2	2	2	1	1	1						2	2	2																
Salix nigra	black willow	Tree																																	
Sambucus canadensis	Common Elderberry	Shrub																				1	1	1											
Taxodium distichum	bald cypress	Tree																																	
Ulmus	elm	Tree																																	
Ulmus alata	winged elm	Tree																																	
Ulmus americana	American elm	Tree																																	
Stem count			19	19	20	6	6	18	7	7	15	9	9	70	10	10	22	15	15	18	13	13	20	6	6	13	7	7	16	8	8	18			
size (ares)			1			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	4	3	3	5	4	4	8	4	4	6	5	5	7	3	3	5	7	7	9	5	5	7	7	7	8	4	4	7			
Stems per ACRE			768.9	768.9	809.4	242.8	242.8	728.4	283.3	283.3	607	364.2	364.2	2833	404.7	404.7	890.3	607	607	728.4	526.1	526.1	809.4	242.8	242.8	526.1	283.3	283.3	647.5	323.7	323.7	728.4			

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

- PnoLS = Planted excluding livestakes
- P-all = Planting including livestakes
- T = All planted and natural recruits including livestakes
- T includes natural recruits

Table 9. Planted and Total Stems (continued)
 Project Code 14.006. Project Name: Aycock Springs

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2020)												Annual Means																		
			14.006-01-0011			14.006-01-0012			14.006-01-0013			14.006-01-0014			MY5 (2020)			MY4 (2019)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)			
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	
Acer negundo	boxelder	Tree									1						9		2				9			5			7				
Acer rubrum	red maple	Tree									1						8		4				2			5							
Betula nigra	river birch	Tree	1	1	1								2	2	2	5	5	5	5	5	5	7	7	8	5	5	5	5	5	9	9	9	
Callicarpa	beautyberry	Shrub																						1									
Callicarpa americana	American beautyberry	Shrub																									1						
Carpinus caroliniana	American hornbeam	Tree	1	1	1											7	7	7	6	6	7	5	5	5	6	6	6	5	5	5	7	7	7
Cephalanthus occidentalis	common buttonbush	Shrub																						2			4						
Cornus amomum	silky dogwood	Shrub	2	2	2				1	1	1					45	45	45	48	48	49	46	46	46	49	49	49	52	52	52	57	57	57
Cornus florida	flowering dogwood	Tree	1	1	1											1	1	1	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4
Diospyros virginiana	common persimmon	Tree														1	1	10	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2
Fraxinus pennsylvanica	green ash	Tree			4	4	4	6			2	3	3	6	12	12	117	13	13	80	13	13	36	10	10	31	5	5	13	3	3	5	
Liquidambar	sweetgum	Tree																						1									
Liquidambar styraciflua	sweetgum	Tree																															
Nyssa	tupelo	Tree														3	3	3	3	3	3												
Nyssa sylvatica	blackgum	Tree				1	1	1								3	3	3	2	2	2	2	2	2	3	3	3	3	3	3	6	6	6
Pinus taeda	loblolly pine	Tree			1																												
Platanus occidentalis	American sycamore	Tree	1	1	1							1	1	1	7	7	9	7	7	16	7	7	10	7	7	9	1	1	1	5	5	5	
Quercus	oak	Tree																						5	5	5	4	4	4	11	11	11	
Quercus alba	white oak	Tree														2	2	2	2	2	3	1	1	1	1	1	1	1	1	2	2	2	
Quercus falcata	southern red oak	Tree							1	1	1					5	5	5	5	5	5	5	5	5	4	4	4						
Quercus michauxii	swamp chestnut oak	Tree				1	1	1					3	3	3	10	10	10	10	10	10	10	10	10	10	7	7	7	5	5	5		
Quercus nigra	water oak	Tree				1	1	1								3	3	3	2	2	2	2	2	2	1	1	1						
Quercus pagoda	cherrybark oak	Tree														1	1	2						1	1	1	1	1	1	6	6	6	
Quercus phellos	willow oak	Tree	3	3	3	1	1	1	1	1	1					9	9	16	9	9	10	9	9	9	9	9	9	6	6	6	18	18	18
Quercus rubra	northern red oak	Tree				1	1	1								14	14	14	16	16	17	14	14	16	12	12	12	11	11	11	13	13	13
Salix nigra	black willow	Tree																															
Sambucus canadensis	Common Elderberry	Shrub														1	1	2	2	2	6	3	3	3	7	7	7	11	11	11	62	62	62
Taxodium distichum	bald cypress	Tree														1	1	2			2												
Ulmus	elm	Tree																							2								
Ulmus alata	winged elm	Tree																			2												2
Ulmus americana	American elm	Tree			1						2			1			4											3					
Stem count			9	9	15	9	9	11	3	3	10	9	9	18	130	130	284	134	134	229	128	128	158	131	131	171	115	115	141	205	205	216	
size (ares)			1			1			1			1			14			14			14			14			14			14			
size (ACRES)			0.02			0.02			0.02			0.02			0.35			0.35			0.35			0.35			0.35			0.35			
Species count			6	6	9	6	6	6	3	3	8	4	4	6	18	18	23	16	16	20	15	15	16	17	17	23	15	15	20	14	14	16	
Stems per ACRE			364.2	364.2	607	364.2	364.2	445.2	121.4	121.4	404.7	364.2	364.2	728.4	375.8	375.8	820.9	387.3	387.3	662	370	370	456.7	378.7	378.7	494.3	332.4	332.4	407.6	592.6	592.6	624.4	

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

- PnoLS = Planted excluding livestakes
- P-all = Planting including livestakes
- T = All planted and natural recruits including livestakes
- T includes natural recruits

Table 10. Supplemental Vegetation Transect Data – November 5th, 2020

Scientific Name	Common Name	Species Type	Temporary Plot 1 4m x 25m 180°	Temporary Plot 2 4m x 25m 160°	Temporary Plot 3 4m x 25m 150°	Temporary Plot 4 4m x 25m 190°	Temporary Plot 5 4m x 25m 180°
<i>Acer negundo</i>	Boxelder	Tree		3			1
<i>Betula nigra</i>	River birch	Tree			1		2
<i>Carpinus caroliniana</i>	American hornbeam	Tree					5
<i>Celtis laevigata</i>	Sugarberry	Tree		3			
<i>Cornus amomum</i>	Silky dogwood	Tree			1		1
<i>Fraxinus pennsylvanica</i>	Green ash	Tree	5	3	7	34	9
<i>Liquidambar styraciflua</i>	Sweetgum	Tree				1	
<i>Pinus taeda</i>	Loblolly pine	Tree	6				
<i>Platanus occidentalis</i>	Sycamore	Tree	4			1	2
<i>Quercus michauxii</i>	Swamp chestnut oak	Tree				2	
<i>Quercus nigra</i>	Water oak	Tree			3	1	
<i>Quercus phellos</i>	Willow oak	Tree	3	2	1	1	2
<i>Quercus rubra</i>	Northern red oak	Tree	2			1	3
<i>Rhus copallinum</i>	Winged sumac	Shrub				3	
<i>Taxodium distichum</i>	Bald cypress	Tree		1	2		
<i>Ulmus americana</i>	American elm	Tree	1			2	
	Stem Count		21	12	15	46	25
	Size (Ares)		1	1	1	1	1
	Size (Acres)		0.0247	0.0247	0.0247	0.0247	0.0247
	Species count		5	5	6	9	8
	Stems per acre		850.2	485.8	607.3	1862.3	1012.1

APPENDIX D.
STREAM SURVEY DATA

Cross-section Plots

Table 11a-11e. Baseline Stream Data Summary

Table 12a-12f. Monitoring Data

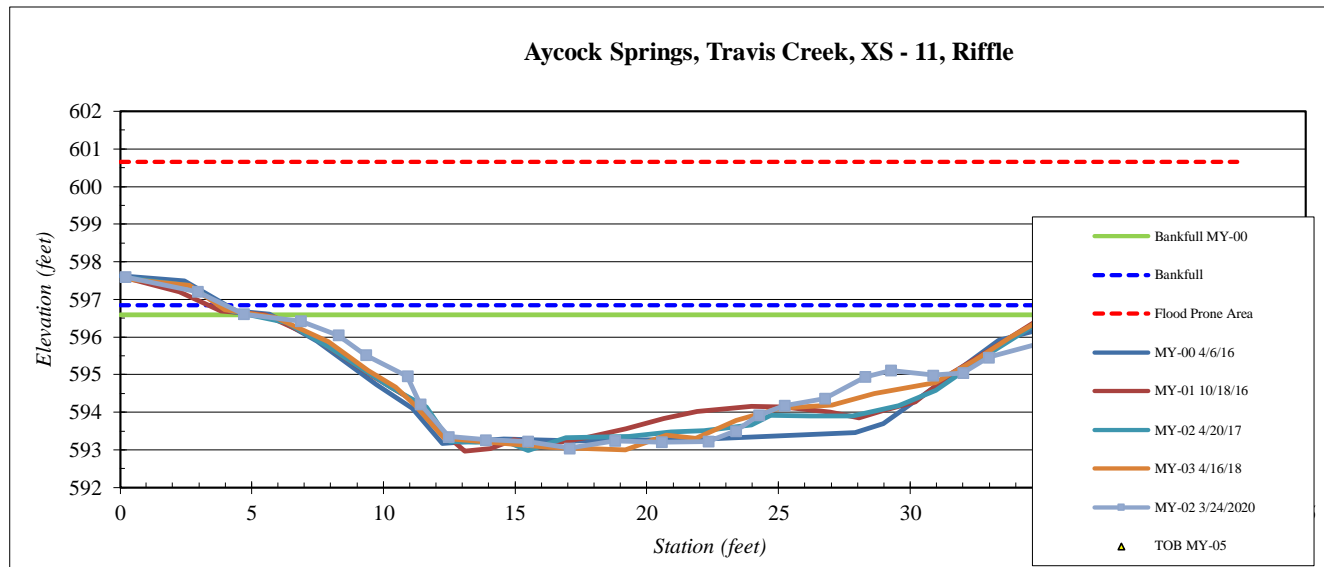
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	Travis Creek, XS - 11, Riffle
Feature	Riffle
Date:	3/24/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.2	597.60
2.9	597.21
4.7	596.61
6.9	596.42
8.3	596.05
9.3	595.52
10.9	594.96
11.4	594.22
12.5	593.35
13.9	593.27
15.5	593.22
17.1	593.05
18.8	593.24
20.6	593.21
22.3	593.22
23.4	593.50
24.2	593.92
25.2	594.18
26.8	594.37
28.3	594.94
29.3	595.1
30.9	595.0
32.0	595.0
33.0	595.5
35.1	595.9
36.6	596.8
39.3	596.9
42.4	597.0

SUMMARY DATA	
Bankfull Elevation:	596.9
Bankfull Cross-Sectional Area:	73.9
Bankfull Width:	34.5
Flood Prone Area Elevation:	600.7
Flood Prone Width:	150.0
Max Depth at Bankfull:	3.8
Low Bank Height:	3.9
Mean Depth at Bankfull:	2.1
W / D Ratio:	16.1
Entrenchment Ratio:	4.3
Bank Height Ratio:	1.01



Stream Type	C/E
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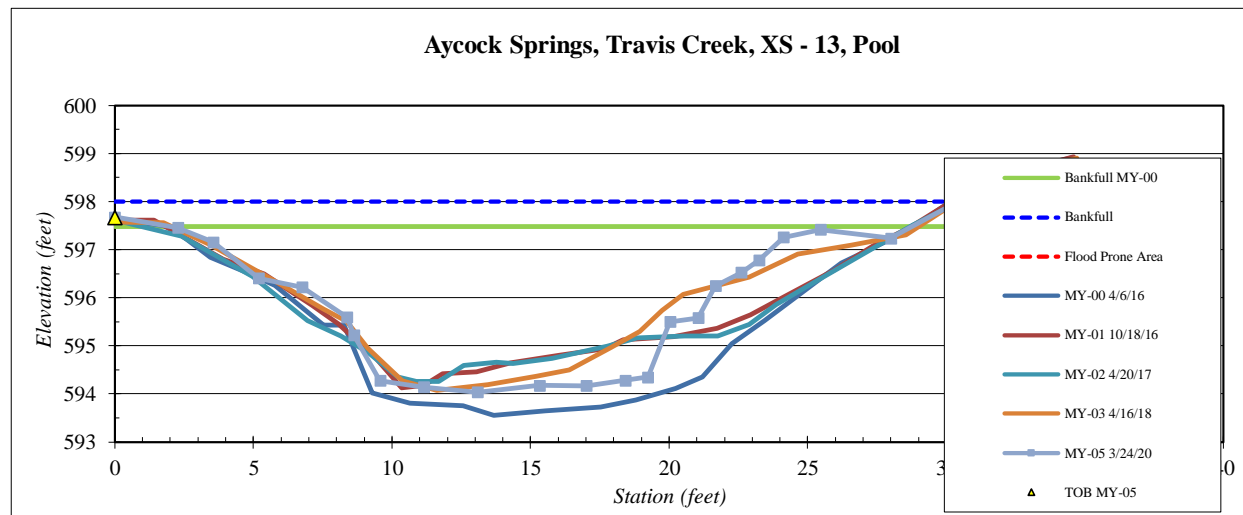
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	Travis Creek, XS - 13, Pool
Feature	Pool
Date:	3/24/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	597.7
2.3	597.5
3.5	597.2
5.2	596.4
6.8	596.2
8.4	595.6
8.6	595.2
9.6	594.3
11.1	594.1
13.1	594.0
15.3	594.2
17.0	594.2
18.4	594.3
19.2	594.4
20.0	595.5
21.0	595.6
21.7	596.2
22.6	596.5
23.2	596.8
24.1	597.3
25.5	597.4
28.0	597.2
30.3	598.0
30.4	597.9
32.8	598.4
35.0	598.8

SUMMARY DATA	
Bankfull Elevation:	598.0
Bankfull Cross-Sectional Area:	64.0
Bankfull Width:	30.7
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	4.0
Low Bank Height:	3.5
Mean Depth at Bankfull:	2.1
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA



Stream Type	C/E
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Note: Sediment Deposition in pool appears natural and is not expected to lead to instability.

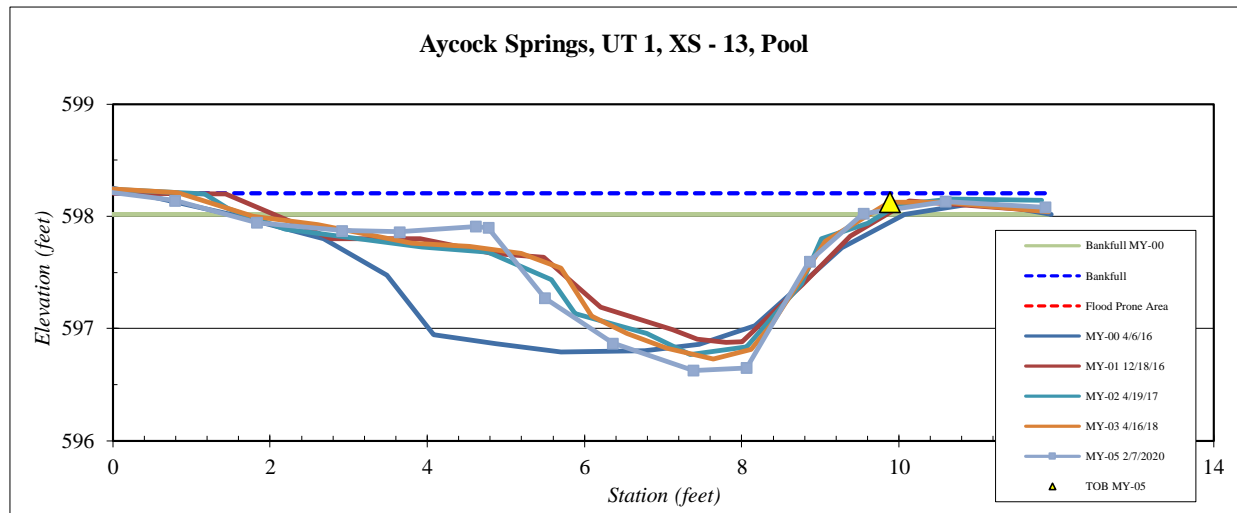
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	UT 1, XS - 13, Pool
Feature	Pool
Date:	2/7/2020
Field Crew:	Perkinson, Keith



Station	Elevation
-0.2	598.3
0.8	598.2
1.8	598.0
2.6	597.9
3.8	597.8
4.5	597.7
5.2	597.7
5.7	597.5
6.1	597.1
6.5	597.0
7.0	596.8
7.6	596.7
8.1	596.8
8.4	597.1
9.1	597.8
9.9	598.1
10.6	598.1
11.9	598.0

SUMMARY DATA	
Bankfull Elevation:	598.2
Bankfull Cross-Sectional Area:	6.5
Bankfull Width:	11.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.6
Low Bank Height:	1.4
Mean Depth at Bankfull:	0.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA

Stream Type	C/E
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Note: Point bar development appears stable through year 5 monitoring.

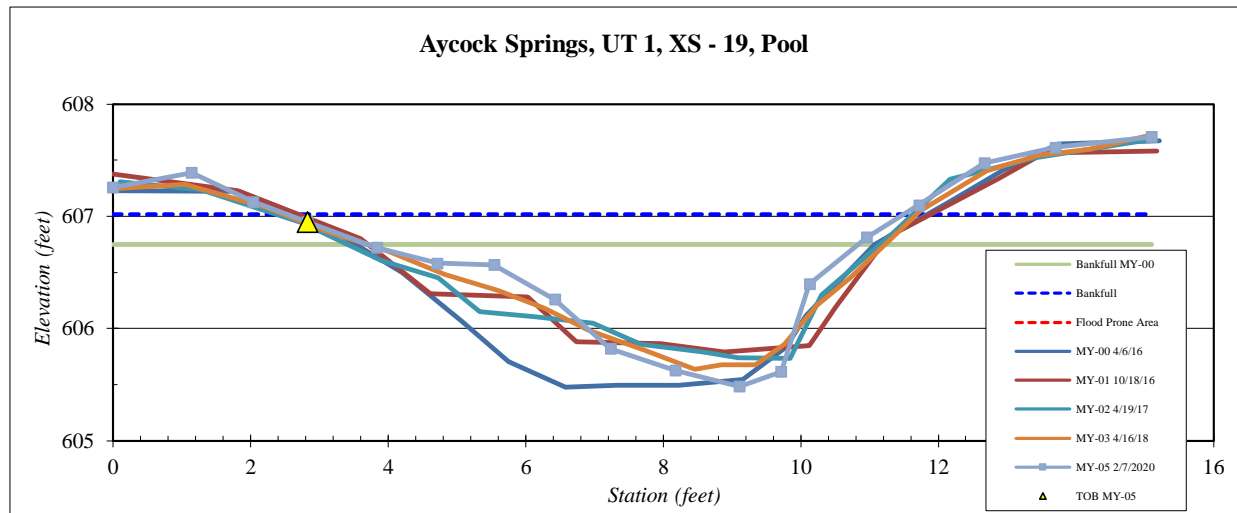
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	UT 1, XS - 19, Pool
Feature	Pool
Date:	2/7/2020
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	607.3
1.1	607.4
2.0	607.1
2.8	607.0
3.8	606.7
4.7	606.6
5.5	606.6
6.4	606.3
7.2	605.8
8.2	605.6
9.1	605.5
9.7	605.6
10.1	606.4
11.0	606.8
11.7	607.1
12.7	607.5
13.7	607.6
15.1	607.7

SUMMARY DATA	
Bankfull Elevation:	607.0
Bankfull Cross-Sectional Area:	6.5
Bankfull Width:	9.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.5
Low Bank Height:	1.5
Mean Depth at Bankfull:	0.7
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA



Stream Type	C/E
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Note: Point bar development appears stable through year 5 monitoring.

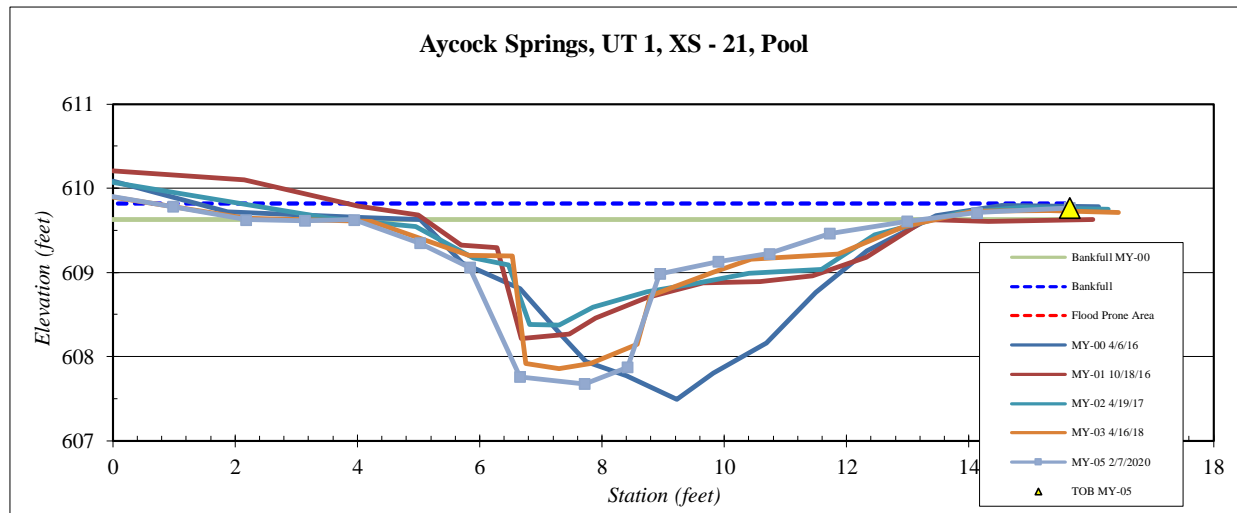
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	UT 1, XS - 21, Pool
Feature	Pool
Date:	2/7/2020
Field Crew:	Perkinson, Keith

Station	Elevation
-0.2	609.9
1.0	609.8
2.2	609.6
3.1	609.6
3.9	609.6
5.0	609.3
5.8	609.1
6.7	607.8
7.7	607.7
8.4	607.9
8.9	609.0
9.9	609.1
10.7	609.2
11.7	609.5
13.0	609.6
14.1	609.7
15.6	609.8

SUMMARY DATA	
Bankfull Elevation:	609.8
Bankfull Cross-Sectional Area:	9.3
Bankfull Width:	15.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.1
Low Bank Height:	2.1
Mean Depth at Bankfull:	0.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA



Stream Type	C/E
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Note: Point bar development appears stable through year 5 monitoring.

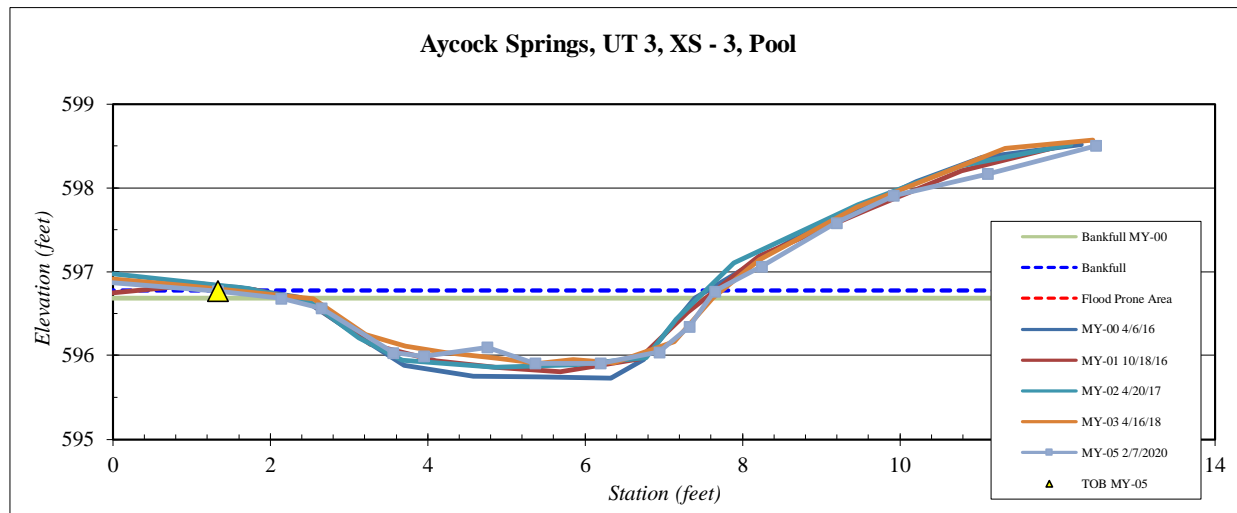
Site	Aycock Springs
Watershed:	Cape Fear, 0303002
XS ID	UT 3, XS - 3, Pool
Feature	Pool
Date:	2/7/2020
Field Crew:	Perkinson, Keith

Station	Elevation
-0.1	596.9
1.3	596.8
2.1	596.7
2.6	596.6
3.6	596.0
3.9	596.0
4.8	596.1
5.4	595.9
6.2	595.9
6.9	596.0
7.3	596.3
7.6	596.8
8.2	597.1
9.2	597.6
9.9	597.9
11.1	598.2
12.5	598.5

SUMMARY DATA	
Bankfull Elevation:	596.8
Bankfull Cross-Sectional Area:	3.6
Bankfull Width:	6.5
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	0.9
Low Bank Height:	0.9
Mean Depth at Bankfull:	0.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA



Stream Type	C/E
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**Table 11A. Baseline Morphology and Hydraulic Summary
Aycock Springs UT 1**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Cedarrock Park			Project Reference Cripple Creek			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension	USGS gage data is unavailable for this project	BF Width (ft)	3.8	9.6	6.7	8	12.1	8.1	3	6.1	4.6	7.2	8.3	7.8	6.4	9.6	8.0	
Floodprone Width (ft)		8	73	30	15	25	18	150	150	150	20	70	50				90	
BF Cross Sectional Area (ft2)				4.3			8				5.9			4.3	3	6.6	3.9	
BF Mean Depth (ft)		0.8	1	0.8	0.8	1	0.8	0.7	1.5	1.1	0.5	0.7	0.6	0.4	0.7	0.5		
BF Max Depth (ft)		1.1	1.4	1.4	1.1	1.4	1.4	1	2.3	1.7	0.7	0.9	0.8	0.6	1.1	0.7		
Width/Depth Ratio		8	15.1	10.1	8	15.1	10.1	4	4.3	4.2	12	16	14	11	19	15		
Entrenchment Ratio		1.9	2.2	2.1	1.9	2.2	2.1	24.6	50	37.3	2.6	9	6.4	9	14	11.3		
Bank Height Ratio		1	1.8	1	1	1.8	1	1	1.5	1.3	1	1.2	1			1		
Wetted Perimeter(ft)				===			===			===			===			===		
Hydraulic radius (ft)				===			===			===			===			===		
Pattern																		
Channel Beltwidth (ft)	No pattern of riffles and pools due to straightening activities			20	38	22.8	15.1	29.2	24.3	23	47	31	23	47	31			
Radius of Curvature (ft)				11	27	16.5	8.9	19.4	13.2	14	31	23	14	31	23			
Meander Wavelength (ft)				44	116	68.4	31	74	47.8	47	94	66	47	94	66			
Meander Width ratio				2.4	4.7	2.8	2.1	4	3.4	3	6	4	3	6	4			
Profile																		
Riffle length (ft)	No pattern of riffles and pools due to straightening activities					===			===			===			9	70	16	
Riffle slope (ft/ft)				1.00%	5.76%	3.16%	0.00%	1.54%	0.83%	2.77%	6.47%	4.16%	0.01%	4.33%	2.23%			
Pool length (ft)						===			===			===			4	23	9	
Pool spacing (ft)				25	69	37.2	14	39.6	32.4	23	62	31	23	62	31			
Substrate																		
d50 (mm)			===			===			===			===			===			
d84 (mm)			===			===			===			===			===			
Additional Reach Parameters																		
Valley Length (ft)			===			===			===			===			===			
Channel Length (ft)			===			===			===			===			===			
Sinuosity			1.02			1.2			1.22			1.1			1.1			
Water Surface Slope (ft/ft)			1.37% 3.61%			2.58%			0.50%			1.27% 3.35%			1.89%			
BF slope (ft/ft)			===			===			===			===			===			
Rosgen Classification			Cg			E			E			E/C			E/C			

**Table 11B. Baseline Morphology and Hydraulic Summary
Aycock Springs UT 2**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Cedarrock Park			Project Reference Cripple Creek			Design			As-built			
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	
Dimension	USGS gage data is unavailable for this project																		
BF Width (ft)		3.8	9.6	6.7	8	12.1	8.1	3	6.1	4.6	7.2	8.3	7.8	4.8	8.6	7.2			
Floodprone Width (ft)		8	73	30	15	25	18	150	150	150	20	70	50						90
BF Cross Sectional Area (ft2)				4.3			8			5.9			4.3	1	4.2	2.3			
BF Mean Depth (ft)		0.8	1	0.8	0.8	1	0.8	0.7	1.5	1.1	0.5	0.7	0.6	0.2	0.6	0.3			
BF Max Depth (ft)		1.1	1.4	1.4	1.1	1.4	1.4	1	2.3	1.7	0.7	0.9	0.8	0.3	0.8	0.6			
Width/Depth Ratio		8	15.1	10.1	8	15.1	10.1	4	4.3	4.2	12	16	14	12	32	22			
Entrenchment Ratio		1.9	2.2	2.1	1.9	2.2	2.1	24.6	50	37.3	2.6	9	6.4	11	19	13			
Bank Height Ratio		1	1.8	1	1	1.8	1	1	1.5	1.3	1	1.2	1			1			
Wetted Perimeter(ft)				===			===			===			===			===			
Hydraulic radius (ft)			===			===			===			===			===				
Pattern																			
Channel Beltwidth (ft)	No pattern of riffles and pools due to straightening activities			20	38	22.8	15.1	29.2	24.3	23	47	31	23	47	31				
Radius of Curvature (ft)				11	27	16.5	8.9	19.4	13.2	14	31	23	14	31	23				
Meander Wavelength (ft)				44	116	68.4	31	74	47.8	47	94	66	47	94	66				
Meander Width ratio				2.4	4.7	2.8	2.1	4	3.4	3	6	4	3	6	4				
Profile																			
Riffle length (ft)	No pattern of riffles and pools due to straightening activities					===			===			===			9	23	14		
Riffle slope (ft/ft)				1.00%	5.76%	3.16%	0.00%	1.54%	0.83%	2.77%	6.47%	4.16%	0.00%	5.24%	2.88%				
Pool length (ft)						===			===			===			5	17	10		
Pool spacing (ft)				25	69	37.2	14	39.6	32.4	23	62	31	23	62	31				
Substrate																			
d50 (mm)			===			===			===			===			===				
d84 (mm)			===			===			===			===			===				
Additional Reach Parameters																			
Valley Length (ft)			===			===			===			===			===				
Channel Length (ft)			===			===			===			===			===				
Sinuosity			1.02			1.2			1.22			1.1			1.1				
Water Surface Slope (ft/ft)			1.37% - 3.61%			2.58%			0.50%			1.27% - 3.35%			3.01%				
BF slope (ft/ft)			===			===			===			===			===				
Rosgen Classification			Cg			E			E			E/C			E/C				

Note: UT 2 is characterized by a spring/seep, with a very small watershed. The channel was constructed with a smaller Bankfull Cross Sectional area to account for the smaller stormwater pulses and controlled discharge. In addition, the lower reaches of the channel are low slope wetlands that elevate the width-to-depth ratio in post construction measurements.

**Table 11C. Baseline Morphology and Hydraulic Summary
Aycock Springs UT 3**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Cedarrock Park			Project Reference Cripple Creek			Design			As-built				
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med		
BF Width (ft)	USGS gage data is unavailable for this project			4.1	5	4.5	8	12.1	8.1	3	6.1	4.6	7.2	8.3	7.8	4.7	7	5.9		
Floodprone Width (ft)				7	18	12	15	25	18	150	150	150	20	70	50	10	20	20	20	
BF Cross Sectional Area (ft ²)						2.2			8					5.9			4.3	1.2	2.7	2.1
BF Mean Depth (ft)				0.4	0.5	0.5	0.8	1	0.8	0.7	1.5	1.1	0.5	0.7	0.6	0.2	0.4	0.4	0.4	
BF Max Depth (ft)				0.8	1.1	1	1.1	1.4	1.4	1	2.3	1.7	0.7	0.9	0.8	0.5	0.6	0.6		
Width/Depth Ratio				8.2	12.5	9.9	8	15.1	10.1	4	4.3	4.2	12	16	14	12	26	20		
Entrenchment Ratio				1.7	3.6	2.5	1.9	2.2	2.1	24.6	50	37.3	2.6	9	6.4	2	4	3.3		
Bank Height Ratio				1	3	2	1	1.8	1	1	1.5	1.3	1	1.2	1			1		
Wetted Perimeter(ft)						===			===			===			===			===		
Hydraulic radius (ft)						===			===			===			===			===		
Pattern																				
Channel Beltwidth (ft)	No pattern of riffles and pools due to straightening activities			20	38	22.8	15.1	29.2	24.3	23	47	31	23	47	31					
Radius of Curvature (ft)				11	27	16.5	8.9	19.4	13.2	14	31	23	14	31	23					
Meander Wavelength (ft)				44	116	68.4	31	74	47.8	47	94	66	47	94	66					
Meander Width ratio				2.4	4.7	2.8	2.1	4	3.4	3	6	4	3	6	4					
Profile																				
Riffle length (ft)	No pattern of riffles and pools due to straightening activities					===			===			===			8	24	14			
Riffle slope (ft/ft)				1.00%	5.76%	3.16%	0.00%	1.54%	0.83%	2.77%	6.47%	4.16%	0.52%	2.54%	1.71%					
Pool length (ft)						===			===			===			6	10	8			
Pool spacing (ft)				25	69	37.2	14	39.6	32.4	23	62	31	23	62	31					
Substrate																				
d50 (mm)			===			===			===			===			===					
d84 (mm)			===			===			===			===			===					
Additional Reach Parameters																				
Valley Length (ft)			===			===			===			===			===					
Channel Length (ft)			===			===			===			===			===					
Sinuosity			1.01			1.2			1.22			1.1			1.1					
Water Surface Slope (ft/ft)			1.53%			2.58%			0.50%			1.27% - 3.35%			0.92%					
BF slope (ft/ft)			===			===			===			===			===					
Rosgen Classification			Eg			E			E			E/C			E/C					

Note: UT 3 is characterized by a pond in the headwaters; therefore, the channel was constructed with a smaller Bankfull Cross Sectional area than other tributaries associated with the project.

**Table 11D. Baseline Morphology and Hydraulic Summary
Aycock Springs UT 4**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Cedarrock Park			Project Reference Cripple Creek			Design			As-built				
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med		
Dimension																				
BF Width (ft)	USGS gage data is unavailable for this project			4.8	11.7	8.3	8	12.1	8.1	3	6.1	4.6	8.7	10	9.4	8	10.9	8.5		
Floodprone Width (ft)				8	70	39	15	25	18	150	150	150	70	200	150					50
BF Cross Sectional Area (ft ²)						6.3			8					5.9			6.3	3.5	5.6	4.3
BF Mean Depth (ft)				0.5	1.3	0.8	0.8	1	0.8	0.7	1.5	1.1	0.6	0.8	0.7	0.4	0.6	0.9	0.5	
BF Max Depth (ft)				0.9	2	1.5	1.1	1.4	1.4	1	2.3	1.7	0.8	1.1	1	0.6	0.9	0.8		
Width/Depth Ratio				3.7	23.4	12.4	8	15.1	10.1	4	4.3	4.2	12	16	14	16	22	19		
Entrenchment Ratio				1.2	11.5	4.9	1.9	2.2	2.1	24.6	50	37.3	7.5	21.3	16	5	6	6		
Bank Height Ratio				1.2	2.4	1.8	1	1.8	1	1	1.5	1.3	1	1.2	1			1		
Wetted Perimeter(ft)						===			===			===			===			===		
Hydraulic radius (ft)						===			===			===			===			===		
Pattern																				
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activities			20	38	22.8	15.1	29.2	24.3	28	56	38	28	56	38		
Radius of Curvature (ft)							11	27	16.5	8.9	19.4	13.2	17	38	28	17	38	28		
Meander Wavelength (ft)							44	116	68.4	31	74	47.8	56	113	80	56	113	80		
Meander Width ratio							2.4	4.7	2.8	2.1	4	3.4	3	6	4	3	6	4		
Profile																				
Riffle length (ft)				No pattern of riffles and pools due to straightening activities					===			===			===	12	35	16		
Riffle slope (ft/ft)							1.00%	5.76%	3.16%	0.00%	1.54%	0.83%	1.12%	2.60%	1.67%	0.61%	2.42%	1.28%		
Pool length (ft)									===			===			===	14	42	22		
Pool spacing (ft)							25	69	37.2	14	39.6	32.4	28	75	38	28	75	38		
Substrate																				
d50 (mm)									===			===			===			===		
d84 (mm)									===			===			===			===		
Additional Reach Parameters																				
Valley Length (ft)									===			===			===			===		
Channel Length (ft)									===			===			===			===		
Sinuosity									1.1			1.22			1.1			1.1		
Water Surface Slope (ft/ft)									0.93%			2.58%			0.93%			0.66%		
BF slope (ft/ft)									===			===			===			===		
Rosgen Classification									Eg			E			E			E/C		

**Table 11E. Baseline Morphology and Hydraulic Summary
Aycock Springs Travis Creek**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Cedarrock Park			Project Reference Cripple Creek			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	USGS gage data is unavailable for this project			30	51.7	41.4	8	12.1	8.1	3	6.1	4.6	25.7	29.6	27.7	25.2	30.3	26.7
Floodprone Width (ft)				68	160	122	15	25	18	150	150	150	200	300	250			150
BF Cross Sectional Area (ft ²)						54.9			8			5.9			54.9	41.3	73.9	51.2
BF Mean Depth (ft)				1.1	1.8	1.4	0.8	1	0.8	0.7	1.5	1.1	1.9	2.1	2	1.6	2.4	2
BF Max Depth (ft)				3.3	4.1	3.7	1.1	1.4	1.4	1	2.3	1.7	2.7	3	2.8	2.3	3.4	2.8
Width/Depth Ratio				16.7	47	32.1	8	15.1	10.1	4	4.3	4.2	12	16	14	12	16	13
Entrenchment Ratio				1.6	5.3	3.2	1.9	2.2	2.1	24.6	50	37.3	7.2	10.8	9	5	6	5.6
Bank Height Ratio				1	1.1	1	1	1.8	1	1	1.5	1.3	1	1.2	1			1
Wetted Perimeter(ft)						===			===			===			===			===
Hydraulic radius (ft)						===			===			===			===			===
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activities			20	38	22.8	15.1	29.2	24.3	83	166	111	83	166	111
Radius of Curvature (ft)							11	27	16.5	8.9	19.4	13.2	55	111	83	55	111	83
Meander Wavelength (ft)							44	116	68.4	31	74	47.8	166	332	236	166	332	236
Meander Width ratio							2.4	4.7	2.8	2.1	4	3.4	3	6	4	3	6	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activities					===			===			===	16	87	54
Riffle slope (ft/ft)							1.00%	5.76%	3.16%	0.00%	1.54%	0.83%	0.28%	0.64%	0.41%	0.00%	0.70%	0.19%
Pool length (ft)									===			===			===	27	70	43
Pool spacing (ft)							25	69	37.2	14	39.6	32.4	83	222	111	83	222	111
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			===
Channel Length (ft)						===			===			===			===			===
Sinuosity						1.05			1.2			1.22			1.05			1.05
Water Surface Slope (ft/ft)						NA			2.58%			0.50%			0.23%			0.10%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Fc			E			E			E/C			E/C

**Table 12A. Morphology and Hydraulic Monitoring Summary
Aycock Travis Creek (Downstream) - Stream and Wetland Restoration Site**

Parameter	XS 1 Riffle (Travis Down)						XS 2 Riffle (Travis Down)						XS 3 Pool (Travis Down)						XS 4 Riffle (Travis Down)						XS 5 Pool (Travis Down)						XS 6 Riffle (Travis Down)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	26	26.7	26.4	27.3	28.5		25.2	26.2	26.3	28.3	27.7		33.7	33.2	35.4	39	43.5		25.5	27	26.5	28.4	29.2		26	26.7	26	25.7	32.5		27.3	27.7	26.8	28.9	29.8	
Floodprone Width (ft)	150	150	150	150	150		150	150	150	150	150		----	----	----	----	----		150	150	150	150	150		----	----	----	----	----		150	150	150	150	150	
BF Cross Sectional Area (ft2)	41.3	40	40.1	40.1	41.3		47.5	47.4	47.9	47.9	47.5		58.7	55.8	57.2	57.2	58.7		47.2	44.6	43.8	43.8	47.2		61.4	58.1	52.3	52.3	61.4		54.9	50.6	50.3	50.3	54.9	
BF Mean Depth (ft)	1.6	1.5	1.5	1.5	1.4		1.9	1.8	1.8	1.7	1.7		1.7	1.7	1.6	1.5	1.4		1.9	1.7	1.7	1.5	1.6		2.4	2.2	2.0	2	1.9		2.0	1.8	1.9	1.7	1.8	
BF Max Depth (ft)	2.3	2.3	2.2	2.3	2.6		2.5	2.5	2.6	2.9	2.8		3.7	3.5	3.7	3.6	4		2.5	2.6	2.6	2.7	2.997		4	3.7	3.2	3.3	3.4		3	2.9	2.8	3	3.1	
Width/Depth Ratio	16.4	17.8	17.4	18.6	19.7		13.4	14.5	14.4	16.7	16.1		----	----	----	----	----		13.8	16.3	16.0	18.4	18.0		----	----	----	----	----		13.6	15.2	14.3	16.6	16.1	
Entrenchment Ratio	5.8	5.6	5.7	5.5	5.3		6.0	5.7	5.7	5.3	5.4		----	----	----	----	----		5.9	5.6	5.7	5.3	5.1		----	----	----	----	----		5.5	5.4	5.6	5.2	5.0	
Low Bank Height (ft)	2.3	2.3	2.3	2.3	2.8		2.5	2.5	2.5	2.5	2.8		3.7	3.7	3.7	3.7	3.9		2.5	2.5	2.5	2.5	2.6		4.0	4.0	4.0	4.0	3.4		3.0	3.0	3.0	3.0	2.9	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.07		1.0	1.0	1.0	<1	1.0		----	----	----	----	----		1.0	1.0	1.0	<1	<1		----	----	----	----	----		1.0	1.0	1.1	1.0	<1	
Wetted Perimeter (ft)	27.1	27.4	27.2	28	29.4		26.4	27.5	27.3	29.5	29.1		34.8	34.4	36.4	40.2	45.1		26.6	28	27.5	29.6	30.4		27.6	28.2	27.3	26.9	33.8		28.7	29.1	27.9	30.4	31.3	
Hydraulic Radius (ft)	1.5	1.5	1.5	1.4	1.4		1.8	1.7	1.8	1.6	1.6		1.7	1.6	1.6	1.4	1.3		1.8	1.6	1.6	1.5	1.6		2.2	2.1	1.9	1.9	1.8		1.9	1.7	1.8	1.7	1.8	
Substrate																																				
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

Parameter	XS 7 Pool (Travis Down)						XS 8 Riffle (Travis Down)						XS 9 Pool (Travis Down)						XS 10 Pool (Travis Down)						XS 11 Riffle (Travis Down)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	25.9	27.7	25.7	25.1	28.9		28.1	28.5	28.6	28	28.9		29.3	29.1	29.7	27.8	27.4		38.6	38.6	39.1	37.5	43.8		30.3	29.8	30.5	30.7	34.5	
Floodprone Width (ft)	----	----	----	----	----		150	150	150	150	150		----	----	----	----	----		----	----	----	----	----		150	150	150	150	150	
BF Cross Sectional Area (ft2)	60	45.8	44.9	44.9	60		64.6	57.4	58.3	58.3	64.6		65.9	63.1	60.8	60.8	65.9		100	91	87.5	87.5	100.1		73.9	66.6	69.6	69.6	73.9	
BF Mean Depth (ft)	2.3	1.7	1.7	1.8	2.1		2.3	2.0	2.0	2.1	2.2		2.2	2.2	2.0	2.2	2.4		2.6	2.4	2.2	2.3	2.3		2.4	2.2	2.3	2.3	2.1	
BF Max Depth (ft)	3.9	2.8	2.5	3	3.5		3.3	3.1	3.1	3.4	3.7		3.7	3.4	3.4	3.8	4.0		4.3	4.2	4.1	4.3	5.003		3.4	3.6	3.6	3.6	3.8	
Width/Depth Ratio	----	----	----	----	----		12.2	14.2	14.0	13.4	12.9		----	----	----	----	----		----	----	----	----	----		12.4	13.3	13.4	13.6	16.1	
Entrenchment Ratio	----	----	----	----	----		5.3	5.3	5.2	5.4	5.2		----	----	----	----	----		----	----	----	----	----		5.0	5.0	4.9	4.9	4.4	
Low Bank Height (ft)	3.9	3.9	3.9	3.9	3.2		3.3	3.3	3.3	3.3	3.7		3.7	3.7	3.7	3.7	4.1		4.3	4.3	4.3	4.3	5.1		3.4	3.4	3.4	3.4	3.9	
Bank Height Ratio	----	----	----	----	----		1.0	1.1	1.1	1.0	1.0		----	----	----	----	----		----	----	----	----	----		1.0	<1	<1	<1	1.01	
Wetted Perimeter (ft)	27.5	29.1	26.8	26.2	30.8		29.5	29.7	29.8	29.8	30.5		30.6	30.3	30.8	29.4	30		40.2	40	40.4	39.1	46		31.8	31.4	32.1	32.1	36.2	
Hydraulic Radius (ft)	2.2	1.6	1.7	1.7	1.9		2.2	1.9	2.0	2	2.1		2.2	2.1	2.0	2.1	2.2		2.5	2.3	2.2	2.2	2.2		2.3	2.1	2.2	2.2	2.0	
Substrate																														
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

**Table 12B. Morphology and Hydraulic Monitoring Summary
Aycock Travis Creek (Upstream) - Stream and Wetland Restoration Site**

Parameter	XS 12 Riffle (Travis Up)						XS 13 Pool (Travis Up)						XS 14 Riffle (Travis Up)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	29	29.6	29.7	31.3	30		26.9	26.9	27.8	27.8	30.7		32.8	32.3	31.9	33.6	36.4	
Floodprone Width (ft)	150	150	150	150	150		----	----	----	----	----		150	150	150	150	150	
BF Cross Sectional Area (ft2)	68.7	66.4	67.9	67.9	68.7		64.0	50.3	51.9	48.2	64.0		104.5	92.4	94.6	94.6	104.5	
BF Mean Depth (ft)	2.4	2.2	2.3	2.2	2.3		2.4	1.9	1.9	1.7	2.1		3.2	2.9	3.0	2.8	2.9	
BF Max Depth (ft)	3.4	3.5	3.5	3.5	4.0		3.9	3.3	3.2	3.5	4.0		4.8	4.1	4.5	4.6	4.8	
Width/Depth Ratio	12.2	13.2	13.0	14.4	13.1		----	----	----	----	----		10.295	11.3	10.8	11.9	12.7	
Entrenchment Ratio	5.2	5.1	5.1	4.8	5.0		----	----	----	----	----		4.6	4.6	4.7	4.5	4.1	
Low Bank Height (ft)	3.4	3.4	3.4	3.4	4.1		3.9	3.9	3.9	3.9	3.5		4.8	4.8	4.8	4.8	4.8	
Bank Height Ratio	1.00	<1	<1	<1	1.02		----	----	----	----	----		1.0	1.2	1.1	1.0	1.0	
Wetted Perimeter (ft)	30.4	30.8	30.9	32.5	31.4		28.8	28.1	28.8	32.5	32.9		35.0	34.2	33.8	35.8	38.5	
Hydraulic Radius (ft)	2.3	2.2	2.2	2.1	2.2		2.2	1.8	1.8	2.1	1.9		3.0	2.7	2.8	2.6	2.6	
Substrate																		
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

Table 12C. Morphology and Hydraulic Monitoring Summary
Aycock UT-1 - Stream and Wetland Restoration Site

Parameter	XS 1 Riffle (UT 1)						XS 2 Riffle (UT 1)						XS 3 Pool (UT 1)						XS 4 Riffle (UT 1)						XS 5 Riffle (UT 1)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
Dimension																														
BF Width (ft)	9.3	9.2	9.7	9.1	11.3		8.8	9.3	9.2	10.2	12.9		8.4	8.4	9.3	9.5	8.6		9.3	9.7	9.3	10.2	10.7		9.6	9.5	9.3	9.2	11.6	
Floodprone Width (ft)	90	90	90	90	90		90	90	90	90	90		---	---	---	---	---		90	90	90	90	90		90	90	90	90	90	
BF Cross Sectional Area (ft2)	5.6	4.7	4.4	4.4	5.6		4.6	3.7	3.7	3.7	4.6		6.7	5.6	6.4	6.4	6.7		6.2	5.5	5.7	5.7	6.2		6.6	5.9	5.8	5.8	6.6	
BF Mean Depth (ft)	0.6	0.5	0.5	0.5	0.5		0.5	0.4	0.4	0.4	0.4		0.8	0.7	0.7	0.7	0.8		0.7	0.6	0.6	0.6	0.6		0.7	0.6	0.6	0.6	0.6	
BF Max Depth (ft)	1.1	0.8	0.9	0.8	0.9		0.7	0.6	0.7	0.6	0.7		1.3	1.2	1.3	1.4	1.4		1	0.9	0.9	0.9	1.1		1.1	1.1	1	1	1.2	
Width/Depth Ratio	15.4	18.0	21.4	18.8	22.7		16.8	23.4	22.9	28.1	36.4		---	---	---	---	---		14.0	17.1	15.2	18.4	18.3		14.0	15.3	14.9	14.8	20.4	
Entrenchment Ratio	9.7	9.8	9.3	9.9	8.0		10.2	9.7	9.8	8.8	7.0		---	---	---	---	---		9.7	9.3	9.7	8.8	8.4		9.4	9.5	9.7	9.8	7.8	
Low Bank Height (ft)	1.1	1.1	1.1	1.1	0.9		0.7	0.7	0.7	0.7	0.6		1.3	1.3	1.3	1.3	1.4		1.0	1.0	1.0	1.0	1.0		1.1	1.1	1.1	1.1	1.2	
Bank Height Ratio	1.0	1.4	1.2	1.4	1.0		1.0	1.2	1.0	1.2	<1		---	---	---	---	---		1.0	1.1	1.1	1.1	<1		1.0	1.0	1.1	1.1	1.01	
Wetted Perimeter (ft)	9.7	9.4	10	9.3	11.5		9	9.4	9.4	10.3	13.1		8.9	8.9	9.8	10	9.3		9.7	10	9.6	10.5	11		10	10	9.8	9.7	12	
Hydraulic Radius (ft)	0.6	0.5	0.4	0.5	0.5		0.5	0.4	0.4	0.4	0.4		0.7	0.6	0.7	0.6	0.7		0.6	0.6	0.6	0.5	0.5		0.7	0.6	0.6	0.6	0.7	
Substrate																														
d50 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	
d84 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	

Parameter	XS 6 Riffle (UT 1)						XS 7 Riffle (UT 1)						XS 8 Pool (UT 1)						XS 9 Riffle (UT 1)						XS 10 Pool (UT 1)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
Dimension																														
BF Width (ft)	6.9	7.5	6.7	6.9	11.4		7.5	7.2	7.3	6.7	9.6		7.8	8.7	7.2	6	11.2		7.9	7.2	7.6	6.7	9.6		7.6	7	6.9	5.5	4.8	
Floodprone Width (ft)	90	90	90	90	90		90	90	90	90	90		---	---	---	---	---		90	90	90	90	90		---	---	---	---	---	
BF Cross Sectional Area (ft2)	3.6	1.9	2.2	2.2	3.6		3.9	2.4	2.4	2.4	3.9		5.7	4.1	3.6	3.6	5.7		3	4.1	1.6	1.6	3		4.7	5.6	5.5	5.5	4.7	
BF Mean Depth (ft)	0.5	0.3	0.3	0.3	0.3		0.5	0.3	0.3	0.4	0.4		0.7	0.5	0.5	0.6	0.5		0.4	0.6	0.2	0.2	0.3		0.6	0.8	0.8	1	1.0	
BF Max Depth (ft)	0.7	0.4	0.4	0.4	0.6		0.7	0.6	0.6	0.7	0.9		1.2	1	0.9	1	1.2		0.7	1.1	0.4	0.6	0.798		1.1	1.3	1.2	1.4	1.38	
Width/Depth Ratio	13.2	29.6	20.4	21.9	36.1		14.4	21.6	22.2	18.9	23.6		---	---	---	---	---		20.8	12.6	36.1	28.1	30.7		---	---	---	---	---	
Entrenchment Ratio	13.0	12.0	13.4	13.1	7.9		12.0	12.5	12.3	13.4	9.4		---	---	---	---	---		11.4	12.5	11.8	13.5	9.4		---	---	---	---	---	
Low Bank Height (ft)	0.7	0.7	0.7	0.7	0.5		0.7	0.7	0.7	0.7	0.9		1.2	1.2	1.2	1.2	0.9		0.7	0.7	0.7	0.7	0.8		1.1	1.1	1.1	1.1	1.5	
Bank Height Ratio	1.0	1.8	1.8	1.8	<1		1.0	1.2	1.2	1.0	1.0		---	---	---	---	---		1.0	0.6	1.8	1.2	1.0		---	---	---	---	---	
Wetted Perimeter (ft)	7.2	7.6	6.8	7	11.6		7.8	7.3	7.5	6.9	9.9		8.3	9.1	7.5	6.6	11.8		8	7.8	7.7	7	9.9		8	7.7	7.7	6.6	6	
Hydraulic Radius (ft)	0.5	0.3	0.3	0.3	0.5		0.5	0.3	0.3	0.3	0.4		0.7	0.5	0.5	0.6	0.5		0.4	0.5	0.2	0.2	0.3		0.6	0.7	0.7	0.8	0.8	
Substrate																														
d50 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	
d84 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	

Parameter	XS 11 Riffle (UT 1)						XS 12 Riffle (UT 1)						XS 13 Pool (UT 1)						XS 14 Riffle (UT 1)						XS 15 Riffle (UT 1)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
Dimension																														
BF Width (ft)	7.4	7	7.8	8.4	8.4		8	7.4	6.4	7.3	9.4		8.6	8	8.3	8.3	11.8		6.4	6.3	6.3	6.2	6.5		7.1	7.2	6.3	5.6	9.1	
Floodprone Width (ft)	90	90	90	90	90		90	90	90	90	90		---	---	---	---	---		90	90	90	90	90		90	90	90	90	90	
BF Cross Sectional Area (ft2)	3.5	3.5	3.5	3.5	3.5		3.7	2.8	2.8	2.8	3.7		6.5	4.3	4.7	4.7	6.5		3.1	2.8	2.8	2.8	3.1		4	3.3	2.4	2.4	4	
BF Mean Depth (ft)	0.5	0.5	0.4	0.4	0.4		0.5	0.4	0.4	0.4	0.4		0.8	0.5	0.6	0.6	0.6		0.5	0.4	0.4	0.4	0.5		0.6	0.5	0.4	0.4	0.4	
BF Max Depth (ft)	0.8	0.8	0.7	0.9	0.9		0.7	0.6	0.6	0.6	0.7		1.2	1.2	1.3	1.3	1.6		0.7	0.6	0.7	0.6	0.7		0.9	0.8	0.7	0.9	0.9	
Width/Depth Ratio	15.6	14.0	17.4	19.8	19.8		17.3	19.6	14.6	18.8	23.9		---	---	---	---	---		13.2	14.2	14.2	14.0	13.6		12.6	15.7	16.5	13.0	20.7	
Entrenchment Ratio	12.2	12.9	11.5	10.8	10.8		11.3	12.2	14.1	12.3	9.6		---	---	---	---	---		14.1	14.3	14.3	14.4	13.8		12.7	12.5	14.3	16.1	9.9	
Low Bank Height (ft)	0.8	0.8	0.8	0.8	1.0		0.7	0.7	0.7	0.7	0.7		1.2	1.2	1.2	1.2	1.4		0.7	0.7	0.7	0.7	0.7		0.9	0.9	0.9	0.9	0.9	
Bank Height Ratio	1.0	1.0	1.1	<1	1.03		1.0	1.2	1.2	1.2	1.03		---	---	---	---	---		1.0	1.2	1.0	1.2	1.0		1.0	1.1	1.3	1.0	1.0	
Wetted Perimeter (ft)	7.8	7.3	8.1	8.9	8.9		8.5	7.6	6.6	7.5	9.6		9.2	8.5	9.0	9.0	12.7		6.8	6.5	6.6	6.5	6.8		7.4	7.6	6.6	6.1	9.5	
Hydraulic Radius (ft)	0.4	0.5	0.4	0.4	0.5		0.4	0.4	0.4	0.4	0.4		0.7	0.5	0.5	0.5	0.5		0.5	0.4	0.4	0.4	0.5		0.5	0.4	0.4	0.4	0.4	
Substrate																														
d50 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	
d84 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

**Table 12C continued. Morphology and Hydraulic Monitoring Summary
Aycock UT-1 - Stream and Wetland Restoration Site**

Parameter	XS 16 Riffle (UT 1)						XS 17 Riffle (UT 1)						XS 18 Riffle (UT 1)						XS 19 Pool (UT 1)						XS 20 Riffle (UT 1)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
Dimension																														
BF Width (ft)	9	8.3	8.5	8.8	11.3		8.5	8.1	7.4	7.4	7.3		7.1	7.2	6.7	6.9	6.4		7.6	7.7	8.1	8.1	9		9.1	8.5	8.7	9.4	9.1	
Floodprone Width (ft)	90	90	90	90	90		90	90	90	90	90		90	90	90	90	90		----	----	----	----	----		90	90	90	90	90	
BF Cross Sectional Area (ft2)	4.6	2.6	2.8	2.8	4.6		3.9	3.6	3.7	3.7	3.9		3.5	3.4	3.6	3.6	3.5		6.5	5.4	5.3	5.3	6.5		5.3	4.4	4.9	4.9	5.3	
BF Mean Depth (ft)	0.5	0.3	0.3	0.3	0.4		0.5	0.4	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.9	0.7	0.7	0.7	0.7		0.6	0.5	0.6	0.5	0.6	
BF Max Depth (ft)	0.8	0.5	0.5	0.5	0.8		0.7	0.7	0.8	0.9	0.9		0.6	0.7	0.8	0.9	1.42		1.3	1	1.1	1.2	1.5		0.9	0.7	0.8	0.8	0.9	
Width/Depth Ratio	17.6	26.5	25.8	27.6	27.8		18.5	18.2	14.8	14.5	13.7		14.4	15.2	12.5	13.5	11.7		----	----	----	----	----		15.6	16.4	15.4	18.1	15.6	
Entrenchment Ratio	10.0	10.8	10.6	10.2	8.0		10.6	11.1	12.2	12.2	12.3		12.7	12.5	13.4	13.0	14.1		----	----	----	----	----		9.9	10.6	10.3	9.6	9.9	
Low Bank Height (ft)	0.8	0.8	0.8	0.8	0.7		0.7	0.7	0.7	0.7	0.9		0.6	0.6	0.6	0.6	1.4		1.3	1.3	1.3	1.3	1.5		0.9	0.9	0.9	0.9	0.9	
Bank Height Ratio	1.0	1.6	1.6	1.6	<1		1.0	1.0	<1	<1	<1		1.0	<1	<1	<1	1.01		----	----	----	----	----		1.0	1.3	1.1	1.1	1.0	
Wetted Perimeter (ft)	9.3	8.4	8.7	9.0	11.5		8.7	8.3	7.7	7.7	7.7		7.4	7.4	7.0	7.4	7.7		8.2	8.3	8.7	8.6	9.8		9.4	8.7	9.0	9.8	9.4	
Hydraulic Radius (ft)	0.5	0.3	0.3	0.3	0.4		0.5	0.4	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.8	0.7	0.6	0.6	0.7		0.6	0.5	0.5	0.5	0.6	
Substrate																														
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

Parameter	XS 21 Pool (UT 1)						XS 22 Riffle (UT 1)						XS 23 Riffle (UT 1)						XS 24 Riffle (UT 1)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
Dimension																								
BF Width (ft)	8.3	8.2	9.7	8.4	15		7.2	7.5	7.3	6.4	7		7.6	6.8	7	7	6.9		8	7.7	7.6	7.8	11.3	
Floodprone Width (ft)	----	----	----	----	----		90	90	90	90	90		90	90	90	90	90		90	90	90	90	90	
BF Cross Sectional Area (ft2)	9.3	5.9	5.4	5.4	9.3		3.6	3.4	3.3	3.3	3.6		3.2	3.2	3	3	3.2		4	3.2	3.4	3.4	4	
BF Mean Depth (ft)	1.1	0.7	0.6	0.6	0.6		0.5	0.5	0.5	0.5	0.5		0.4	0.5	0.4	0.4	0.5		0.5	0.4	0.4	0.4	0.4	
BF Max Depth (ft)	2.1	1.4	1.3	1.7	2.1		0.7	0.7	0.7	1.0	1.2		0.6	0.6	0.7	0.9	0.8		0.7	0.7	0.7	0.7	0.8	
Width/Depth Ratio	----	----	----	----	----		14.4	16.5	16.1	12.4	13.6		18.1	14.5	16.3	16.1	14.9		16.0	18.5	17.0	17.7	31.9	
Entrenchment Ratio	----	----	----	----	----		12.5	12.0	12.3	14.1	12.9		11.8	13.2	12.9	12.9	13.0		11.3	11.7	11.8	11.6	8.0	
Low Bank Height (ft)	2.1	2.1	2.1	2.1	2.1		0.7	0.7	0.7	0.7	1.2		0.6	0.6	0.6	0.6	0.8		0.7	0.7	0.7	0.7	0.8	
Bank Height Ratio	----	----	----	----	----		1.0	1.0	1.0	<1	1.0		1.0	1.0	0.9	<1	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	9.5	9.2	10.4	10	16.6		7.5	7.8	7.5	6.8	7.6		9.3	7.0	7.2	7.4	7.3		9.3	7.8	7.8	8	11.5	
Hydraulic Radius (ft)	1	0.6	0.5	0.5	0.6		0.5	0.4	0.4	0.5	0.5		0.5	0.5	0.4	0.4	0.4		0.5	0.4	0.4	0.4	0.3	
Substrate																								
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

**Table 12D. Morphology and Hydraulic Monitoring Summary
Aycock UT-2 - Stream and Wetland Restoration Site**

Parameter	XS 1 Pool (UT 2)						XS 2 Riffle (UT 2)					XS 3 Riffle (UT 2)					XS 4 Riffle (UT 2)					XS 5 Riffle (UT 2)					XS 6 Riffle (UT 2)					XS 7 Pool (UT 2)										
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	6.5	6.3	6.9	7.3	10.4		4.8	5.6	5.5	5.6	5.1		5.7	5.3	5.8	5.8	8.4		6.4	5.7	5.4	5.4	4.7		8.4	7.7	8.5	9.9	9.2		6.9	7	6.8	6.4	9.9		8.3	9.4	8.2	8.4	10.8	
Floodprone Width (ft)	---	---	---	---	---		90	90	90	90	90		90	90	90	90	90		90	90	90	90	90		90	90	90	90	90		90	90	90	90	90		---	---	---	---	---	
BF Cross Sectional Area (ft2)	3.8	2.1	3.2	3.2	3.8		1	1.1	1	1	1		1.7	1.4	1.2	1.2	1.7		1	0.9	0.9	0.9	1		3.1	2.8	2.9	2.9	3.1		2.3	1.4	1	1	2.3		5.1	4.1	3.8	3.8	5.1	
BF Mean Depth (ft)	0.6	0.3	0.5	0.3	0.4		0.2	0.2	0.2	0.2	0.2		0.3	0.3	0.2	0.2	0.2		0.2	0.2	0.2	0.2	0.2		0.4	0.4	0.3	0.3	0.3		0.3	0.2	0.1	0.2	0.2		0.6	0.4	0.5	0.5	0.5	
BF Max Depth (ft)	1	0.6	0.7	0.6	0.8		0.3	0.3	0.2	0.3	0.3		0.5	0.5	0.5	0.4	0.5		0.4	0.3	0.3	0.3	0.3		0.7	0.6	0.6	0.5	0.8		0.6	0.3	0.3	0.3	0.5		1.1	0.8	0.8	0.9	1.0	
Width/Depth Ratio	---	---	---	---	---		23.0	28.5	30.3	32.3	25.4		19.1	20.1	28.0	26.9	41.5		41.0	36.1	32.4	33.0	22.1		22.8	21.2	24.9	33.2	27.3		20.7	35.0	46.2	40.5	42.6		---	---	---	---	---	
Entrenchment Ratio	---	---	---	---	---		18.8	16.1	16.4	16.2	17.7		15.8	17.0	15.5	15.6	10.7		14.1	15.8	16.7	16.7	19.1		10.7	11.7	10.6	9.1	9.8		13.0	12.9	13.2	14.1	9.1		---	---	---	---	---	
Low Bank Height (ft)	1.0	1.0	1.0	1.0	0.6		0.3	0.3	0.3	0.3	0.4		0.5	0.5	0.5	0.5	0.5		0.4	0.4	0.4	0.4	0.3		0.7	0.7	0.7	0.7	0.8		0.6	0.6	0.6	0.6	0.5		1.1	1.1	1.1	1.1	1.0	
Bank Height Ratio	---	---	---	---	---		1.0	1.0	1.5	1.0	1.09		1.0	1.0	1.0	1.3	1.0		1.0	1.3	1.3	1.3	<1		1.0	1.2	1.2	1.4	1.02		1.0	2.0	2.0	2.0	<1		---	---	---	---	---	
Wetted Perimeter (ft)	6.9	6.5	7.2	7.4	10.6		4.9	5.7	5.6	5.6	5.2		5.8	5.4	6.0	5.9	8.5		6.5	5.7	5.5	5.5	4.7		8.6	7.9	8.6	10.0	9.4		7.0	7.0	6.9	6.4	10.0		8.8	9.5	8.4	8.6	11.0	
Hydraulic Radius (ft)	0.6	0.3	0.4	0.3	0.4		0.2	0.2	0.2	0.2	0.2		0.3	0.3	0.2	0.2	0.2		0.2	0.2	0.2	0.2	0.2		0.4	0.4	0.3	0.3	0.3		0.3	0.2	0.1	0.2	0.2		0.6	0.4	0.5	0.4	0.5	
Substrate																																										
d50 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	
d84 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	

Parameter	XS 8 Riffle (UT 2)						XS 9 Riffle (UT 2)					XS 10 Pool (UT 2)					XS 11 Pool (UT 2)					XS 12 Riffle (UT 2)					XS 13 Riffle (UT 2)									
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	8.6	8.3	8.3	10.1	10.5		7.4	7.9	7.9	8.5	9.6		7.5	7.8	7.6	6.7	9.8		6.2	6.4	5.6	5.8	7.1		8.3	9.2	7.7	7.2	9.2		7.2	7.6	7.4	6.7	7.2	
Floodprone Width (ft)	90	90	90	90	90		90	90	90	90	90		---	---	---	---	---		---	---	---	---	---		90	90	90	90	90		90	90	90	90	90	
BF Cross Sectional Area (ft2)	3.6	3.1	2.8	2.8	3.6		4.2	3.8	4.4	4.4	4.2		5.2	4	4	4	5.2		3.5	2.7	2.5	2.5	3.5		3.2	2.3	1.9	1.9	3.2		2.1	1.7	1.8	1.8	2.1	
BF Mean Depth (ft)	0.4	0.4	0.3	0.3	0.3		0.6	0.5	0.6	0.5	0.4		0.7	0.5	0.5	0.6	0.5		0.6	0.4	0.4	0.4	0.5		0.4	0.3	0.2	0.3	0.3		0.3	0.2	0.2	0.3	0.3	
BF Max Depth (ft)	0.6	0.5	0.5	0.5	0.7		0.8	0.7	0.8	0.9	0.8		1.3	0.9	0.8	1.1	1.0		0.8	0.7	0.7	0.7	0.9		0.7	0.5	0.7	0.5	0.6		0.4	0.3	0.4	0.4	0.4	
Width/Depth Ratio	20.5	22.2	24.6	36.6	30.6		13.0	16.4	14.2	16.5	21.9		---	---	---	---	---		---	---	---	---	---		21.5	36.8	31.2	27.4	26.5		24.7	34.0	30.4	24.8	24.7	
Entrenchment Ratio	10.5	10.8	10.8	8.9	8.6		12.2	11.4	11.4	10.5	9.4		---	---	---	---	---		---	---	---	---	---		10.8	9.8	11.7	12.5	9.8		12.5	11.8	12.2	13.4	12.5	
Low Bank Height (ft)	0.6	0.6	0.6	0.6	0.6		0.8	0.8	0.8	0.8	0.8		1.3	1.3	1.3	1.3	0.9		0.8	0.8	0.8	0.8	0.9		0.7	0.7	0.7	0.7	0.6		0.4	0.4	0.4	0.4	0.4	
Bank Height Ratio	1.0	1.2	1.2	1.2	1.0		1.0	1.1	1.0	<1	1.09		---	---	---	---	---		---	---	---	---	---		1.0	1.4	1.0	1.4	1.0		1.0	1.3	1.0	1.0	<1	
Wetted Perimeter (ft)	8.8	8.5	8.6	10.3	10.6		7.7	8.1	8.2	8.5	9.8		8.1	8.2	8.0	7.2	10.1		6.6	6.6	5.8	6.1	7.1		8.6	9.3	8.0	7.4	9.3		7.3	7.7	7.5	6.8	7.3	
Hydraulic Radius (ft)	0.4	0.4	0.3	0.3	0.3		0.5	0.5	0.5	0.5	0.4		0.7	0.5	0.5	0.6	0.5		0.5	0.4	0.4	0.4	0.5		0.4	0.2	0.2	0.3	0.3		0.3	0.2	0.2	0.3	0.3	
Substrate																																				
d50 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	
d84 (mm)	---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---		---	---	---	---	---	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

Table 12E. Morphology and Hydraulic Monitoring Summary
Aycock UT-3 - Stream and Wetland Restoration Site

Parameter	XS 1 Riffle (UT 3)						XS 2 Riffle (UT 3)						XS 3 Pool (UT 3)						XS 4 Riffle (UT 3)						XS 5 Riffle (UT 3)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	6.5	6.9	6.7	7.2	7		4.7	5.2	5.2	5.1	4.9		5	5.4	5.2	5.7	5		7	6.8	6.9	7.5	8.8		5.3	5.6	5.8	6.5	6.3	
Floodprone Width (ft)	10	11	11	11	10		20	8	8	8	8		----	----	----	----	----		20	20	20	20	20		20	20	20	20	20	
BF Cross Sectional Area (ft ²)	2.7	2.3	2.4	2.4	2.7		1.9	1.6	1.9	1.9	1.9		3.6	3.2	3.2	3.2	3.6		2.2	1.9	1.7	1.7	2.2		1.2	1.1	1.2	1.2	1.2	
BF Mean Depth (ft)	0.4	0.3	0.4	0.3	0.4		0.4	0.3	0.4	0.4	0.4		0.7	0.6	0.6	0.6	0.7		0.3	0.3	0.2	0.2	0.3		0.2	0.2	0.2	0.2	0.2	
BF Max Depth (ft)	0.6	0.6	0.6	0.7	0.7		0.6	0.5	0.6	0.6	0.6		1	0.9	0.8	0.8	0.9		0.5	0.4	0.4	0.4	0.5		0.5	0.4	0.4	0.4	0.3	
Width/Depth Ratio	15.6	20.7	18.7	21.8	18.1		11.6	16.9	14.2	13.9	12.5		----	----	----	----	----		22.3	24.3	28.0	33.7	35.2		23.4	28.5	28.0	35.4	33.6	
Entrenchment Ratio	1.5	1.6	1.6	1.5	1.4		4.3	1.5	1.5	1.6	1.6		----	----	----	----	----		2.9	2.9	2.9	2.7	2.3		3.8	3.6	3.4	3.1	3.2	
Low Bank Height (ft)	0.6	0.6	0.6	0.6	0.6		0.6	0.6	0.6	0.6	0.6		1.0	1.0	1.0	1.0	0.9		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Bank Height Ratio	1.0	1.0	1.0	<1	<1		1.0	1.2	1.0	1.0	1.0		----	----	----	----	----		1.0	1.3	1.3	1.3	1.02		1.0	1.3	1.3	1.3	1.0	
Wetted Perimeter (ft)	6.8	7.1	6.9	7.5	7.2		5.0	5.3	5.4	5.3	5.3		5.7	5.8	5.7	6.2	5.7		7.1	6.9	7.0	7.7	8.9		5.7	5.8	6.0	6.7	6.4	
Hydraulic Radius (ft)	0.4	0.3	0.3	0.3	0.4		0.4	0.3	0.4	0.4	0.4		0.6	0.6	0.6	0.5	0.6		0.3	0.3	0.2	0.2	0.2		0.2	0.2	0.2	0.2	0.2	
Substrate																														
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

Table 12F. Morphology and Hydraulic Monitoring Summary
Aycock UT-4 - Stream and Wetland Restoration Site

Parameter	XS 1 Riffle (UT 4)						XS 2 Pool (UT 4)						XS 3 Riffle (UT 4)						XS 4 Pool (UT 4)						XS 5 Riffle (UT 4)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	8.3	9.4	8.8	9.1	10.2		8.5	9.1	9.5	9.2	11.1		8.6	8.7	8.4	9	12		8.5	10.6	10.7	10.5	11.6		8	8.3	7.8	7.9	8.5	
Floodprone Width (ft)	50	50	50	50	50		----	----	----	----	----		50	50	50	50	50		----	----	----	----	----		50	50	50	50	50	
BF Cross Sectional Area (ft ²)	3.7	3.3	3.3	3.3	3.7		6.4	5.4	5.8	5.8	6.4		4.3	3.4	3.5	3.5	4.3		6.2	5.2	5.6	5.6	6.2		4.3	4.1	3.8	3.8	4.3	
BF Mean Depth (ft)	0.4	0.4	0.4	0.4	0.4		0.8	0.6	0.6	0.6	0.6		0.5	0.4	0.4	0.4	0.4		0.7	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
BF Max Depth (ft)	0.6	0.5	0.6	0.6	0.7		1.5	1	1.1	1	1.1		0.8	0.5	0.6	0.6	0.7		1.2	1	1.1	1.2	1.1		0.7	0.7	0.7	0.7	0.8	
Width/Depth Ratio	18.6	26.8	23.5	25.2	28.1		----	----	----	----	----		17.2	22.3	20.2	23.2	33.5		----	----	----	----	----		14.9	16.8	16.0	16.5	16.8	
Entrenchment Ratio	6.0	5.3	5.7	5.5	4.9		----	----	----	----	----		5.8	5.7	6.0	5.6	4.2		----	----	----	----	----		6.3	6.0	6.4	6.3	5.9	
Low Bank Height (ft)	0.6	0.6	0.6	0.6	0.8		1.5	1.5	1.5	1.5	1.1		0.8	0.8	0.8	0.8	0.7		1.2	1.2	1.2	1.2	1.0		0.7	0.7	0.7	0.7	0.8	
Bank Height Ratio	1.0	1.2	1.0	1.0	1.19		----	----	----	----	----		1.0	1.6	1.3	1.3	<1		----	----	----	----	----		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	8.6	9.5	9.0	9.3	10.4		9.2	9.5	10.0	9.8	11.4		9.0	8.8	8.6	9.1	12.2		9.1	10.9	11.1	11.0	12.0		8.3	8.5	8.1	8.2	8.8	
Hydraulic Radius (ft)	0.4	0.3	0.4	0.4	0.4		0.7	0.6	0.6	0.6	0.6		0.5	0.4	0.4	0.4	0.4		0.7	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Substrate																														
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

Parameter	XS 6 Riffle (UT 4)						XS 7 Riffle (UT 4)						XS 8 Riffle (UT 4)					
	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7	MY 0	MY1	MY2	MY3	MY5	MY7
BF Width (ft)	8.1	8.9	8.9	8.4	9		9.9	11.7	9.1	9.8	11.4		10.9	11.1	11	10.6	11.7	
Floodprone Width (ft)	50	50	50	50	50		50	50	50	50	50		50	50	50	50	50	
BF Cross Sectional Area (ft ²)	3.5	3.3	3.3	3.3	3.5		5.6	4.9	5	5	5.6		5.6	4.9	4.9	4.9	5.6	
BF Mean Depth (ft)	0.4	0.4	0.4	0.4	0.4		0.6	0.4	0.5	0.5	0.5		0.5	0.4	0.4	0.5	0.5	
BF Max Depth (ft)	0.6	0.5	0.6	0.7	0.6		0.9	0.6	0.8	0.7	0.8		0.8	0.7	0.7	0.7	0.9	
Width/Depth Ratio	18.7	24.0	24.0	21.7	23.1		17.5	27.9	16.6	19	23.2		21.2	25.1	24.7	22.9	24.4	
Entrenchment Ratio	6.2	5.6	5.6	5.9	5.6		5.1	4.3	5.5	5.1	4.4		4.6	4.5	4.5	4.7	4.3	
Low Bank Height (ft)	0.6	0.6	0.6	0.6	0.6		0.9	0.9	0.9	0.9	0.8		0.8	0.8	0.8	0.8	0.9	
Bank Height Ratio	1.0	1.2	1.0	<1	1.10		1.0	1.5	1.1	1.3	<1		1.0	1.1	1.1	1.1	1.07	
Wetted Perimeter (ft)	8.4	9.0	9.0	8.9	9.2		10.2	11.9	9.4	10	11.7		11.1	11.3	11.2	10.8	12.1	
Hydraulic Radius (ft)	0.4	0.4	0.4	0.4	0.4		0.6	0.4	0.5	0.5	0.5		0.5	0.4	0.4	0.5	0.5	
Substrate																		
d50 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	
d84 (mm)	----	----	----	----	----		----	----	----	----	----		----	----	----	----	----	

*MY0-2 BHR were calculated using DMS method of "Dmax year x /Dmax year 0". MY3 was calculated using DMS method of area best fit, fixing the cross-sectional area to MY2. MY5-7 BHR were calculated using area best fit, fixing the cross-sectional area to MY0.

APPENDIX E
HYDROLOGY DATA

Table 13. UT3 Channel Evidence

Stream Gauge Graphs

Table 14. Verification of Bankfull Events

Groundwater Gauge Graphs

Table 15. Groundwater Hydrology Data

Table 13. UT3 Channel Evidence

UT3 Channel Evidence	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)
Max consecutive days channel flow	37	110	276	145	152
Presence of litter and debris (wracking)	Yes	Yes	Yes	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes	Yes	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes	Yes	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes	Yes	Yes	Yes
Water staining due to continual presence of water	Yes	Yes	Yes	Yes	Yes
Formation of channel bed and banks	Yes	Yes	Yes	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes	Yes	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes	Yes	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes	Yes	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes	Yes	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No	No	No	No
Other:					



Aycock Springs Surface Gauge UT-3 Year 5 (2020 Data)

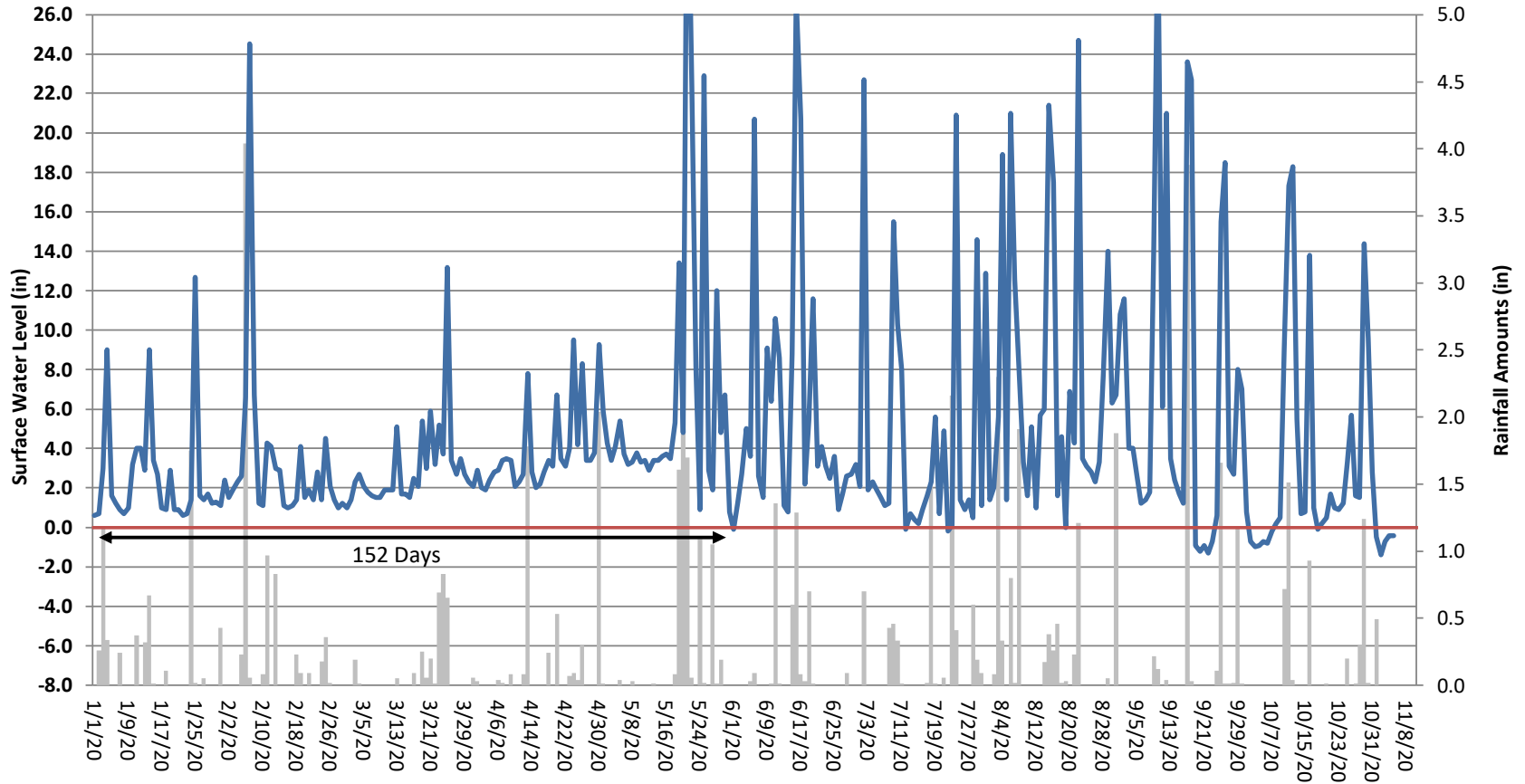


Table 14. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
May 5th, 2016	May 3rd, 2016	Wrack, laid-back vegetation, sediment, and standing water observed in the floodplain after 1.55 inches of rain documented* on May 3rd, 2016, at a nearby rain gauge	1
October 13, 2016	September 28th, 2016	2.05 inches of rain was recorded on September 28th, 2016, at an onsite rain gauge	--
October 13th, 2016	October 8th, 2016	Wrack and laid-back vegetation observed on top of the bank after 3.05 inches of rain was recorded on October 8th, 2016, at an onsite rain gauge	2
June 15, 2017	April 25th, 2017	4.66 inches of rain was recorded between April 23 and 25, 2017, at an onsite rain gauge. Visual observation of wrack and reclining vegetation in the floodplain of UT2	--
October 27th, 2017	June 19th, 2017	Wrack and laid-back vegetation observed in the floodplain of Travis Creek after 1.93 inches of rain was recorded on June 19th, 2017, at an onsite rain gauge	3
October 24, 2018	September 17, 2018	Overbank as the result of Hurricane Florence on September 15-17, 2018	--
October 24th, 2018	October 11th, 2018	Overbank as the result of Hurricane Michael on October 11th, 2018	--
October 16th, 2019	July 7th, 2019	Stream gauge data indicates a bankfull event occurred after 1.82 inches of rain was recorded on July 7th, 2019, at an onsite rain gauge	--
October 16th, 2019	July 23rd, 2019	Stream gauge data indicates a bankfull event occurred after 1.35 inches of rain was recorded on July 23rd, 2019, at an onsite rain gauge	--
November 21st, 2019	October 22nd, 2019	Visual and onsite rain gauge data indicated that a bankfull event occurred after 1.8 inches of rain was recorded on October 22nd, 2019, at an onsite rain gauge	4
February 7, 2020	February 6th, 2020	Wrack and laid-back vegetation observed on top of bank and floodplain after 4.04 inches of rain was recorded on February 6th, 2020, at an onsite rain gauge	5
June 18, 2020	May 20th, 2020	Wrack observed along fencing in the Travis Creek floodplain after 3.70 inches of rain was recorded between May 19-20, 2020, at an onsite rain gauge	6
November 5, 2020	September 17th, 2020	Wrack observed in the floodplain of Travis Creek after 3.88 inches of rain was recorded between September 17th, 2020, at an onsite rain gauge	7

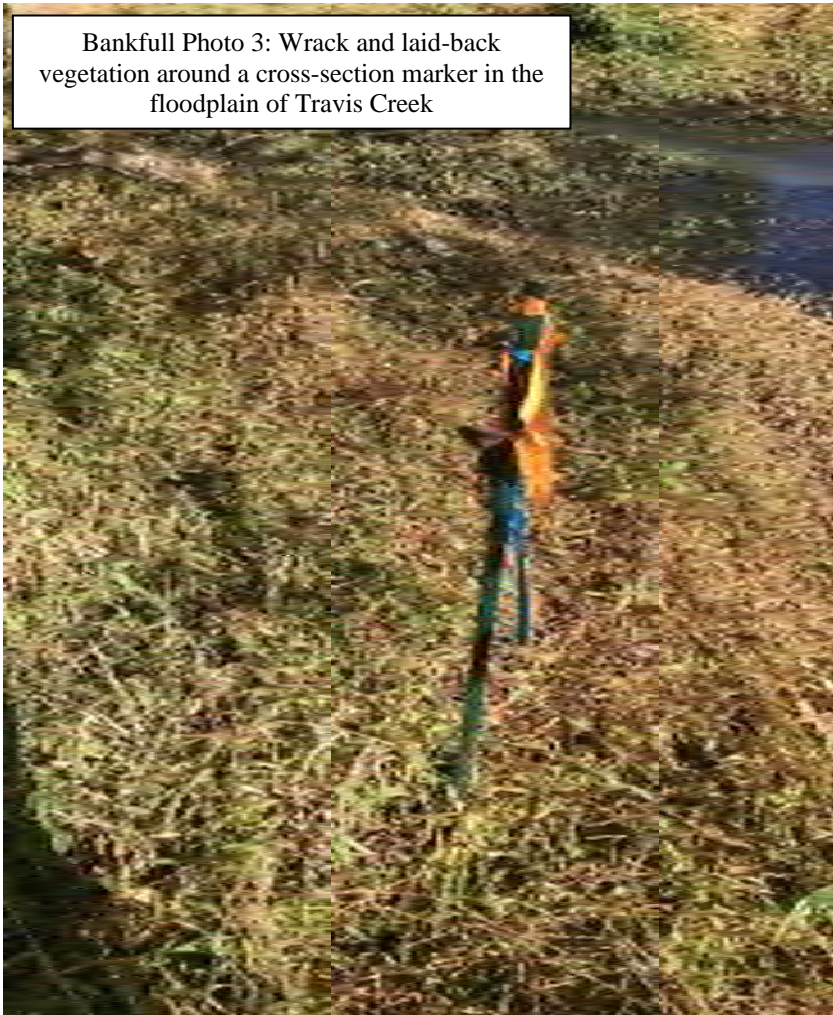
*The onsite rain gauge was installed on May 18th, 2016 – rain data from a nearby Site (Abbey Lamm Stream and Wetland Mitigation Site) was used to confirm this bankfull event.



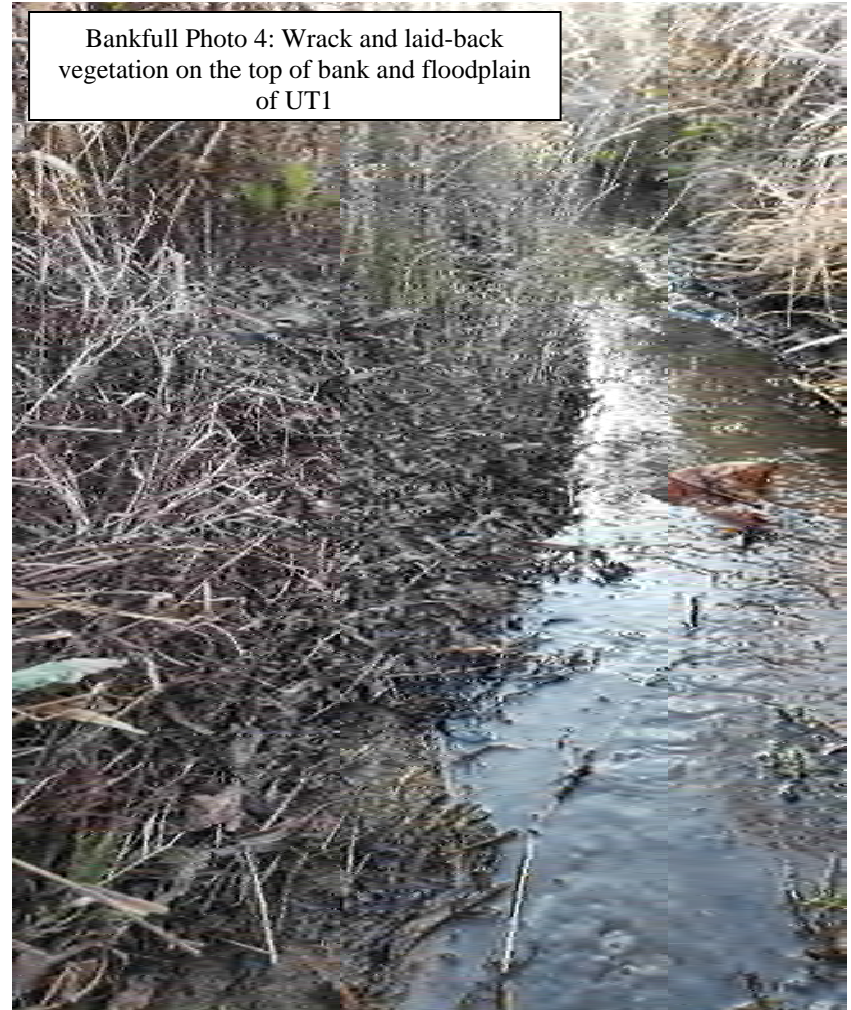
Bankfull Photo 1: Wrack, laid-back vegetation, and sediment in the floodplain of Travis Creek



Bankfull Photo 2: Wrack, laid-back vegetation, on the top of bank of Travis Creek



Bankfull Photo 3: Wrack and laid-back vegetation around a cross-section marker in the floodplain of Travis Creek



Bankfull Photo 4: Wrack and laid-back vegetation on the top of bank and floodplain of UT1

Bankfull Photo 5: Wrack, laid-back vegetation, and sediment in the floodplain of UT1

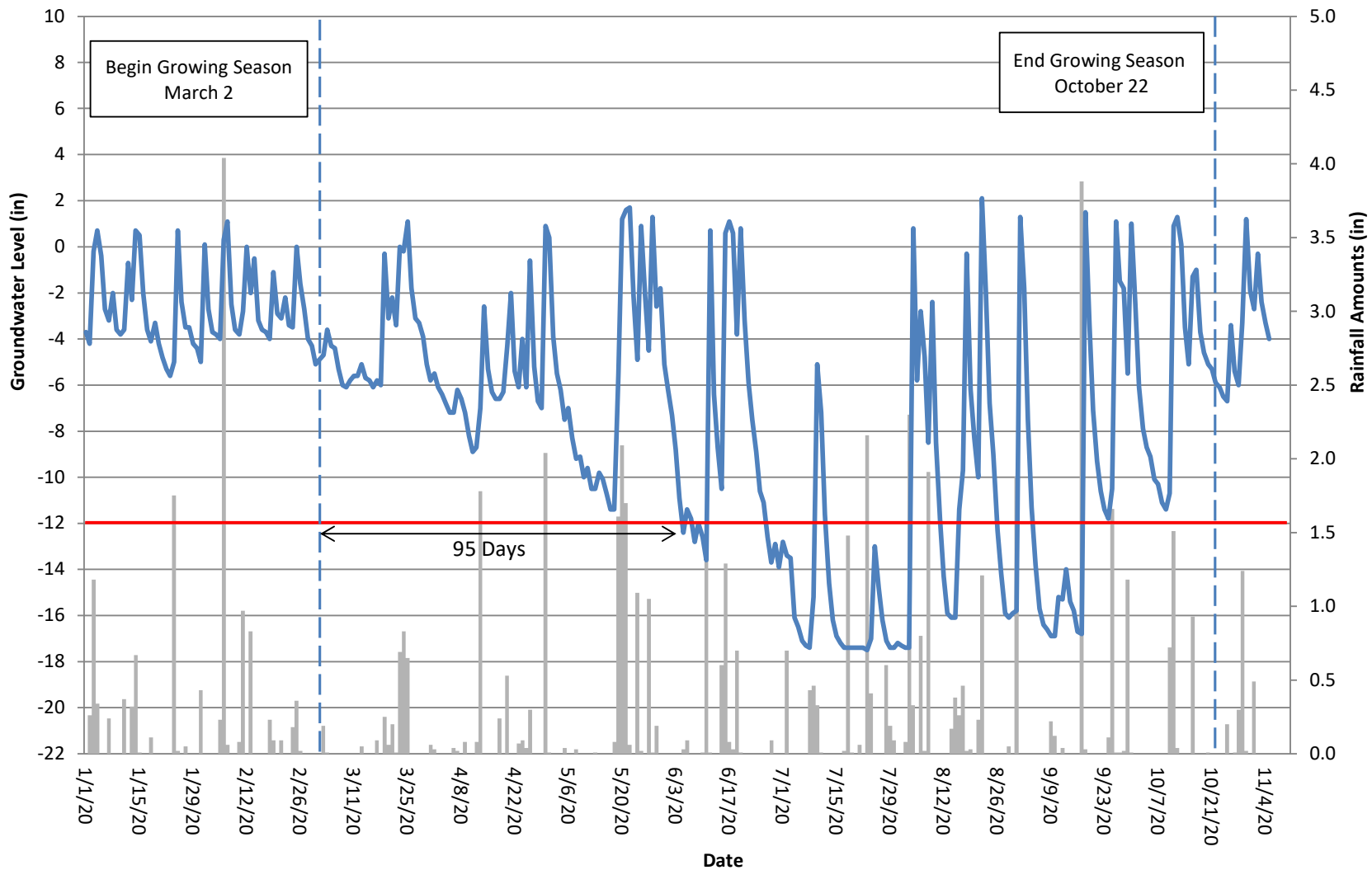


Bankfull Photo 6: Wrack along the UT-2 easement fencing in the floodplain of Travis Creek

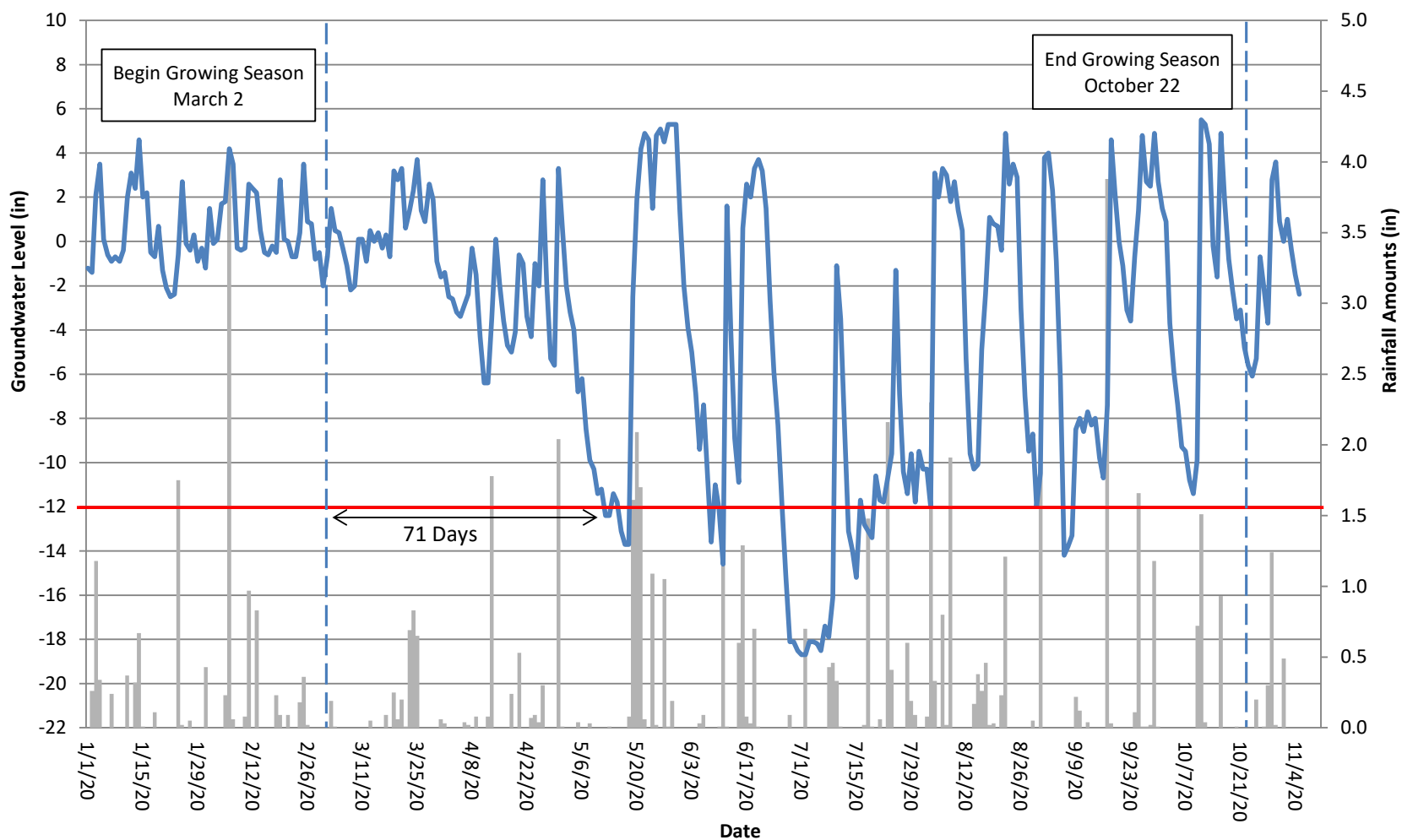




Aycock Springs Groundwater Gauge 1 Year 5 (2020 Data)



Aycock Springs Groundwater Gauge 2 Year 5 (2020 Data)



Aycock Springs Groundwater Gauge 3 Year 5 (2020 Data)

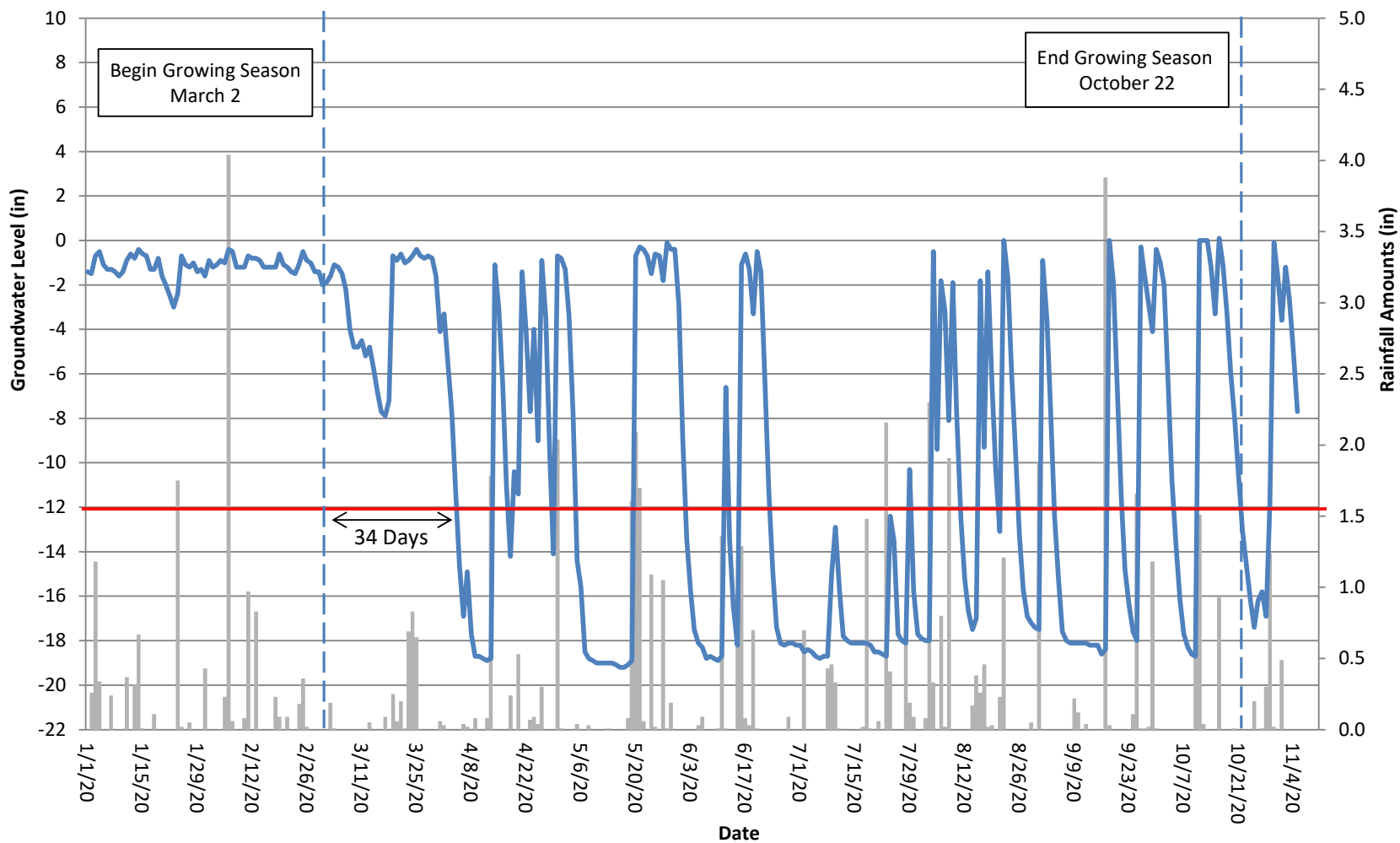


Table 15. Groundwater Hydrology Data

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1* (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)
1	Yes/55 days (29.1 percent)	Yes/26 days (11.0 percent)	Yes/58 days (25.1 percent)	Yes/59 days (27 percent)	Yes/95 days (41 percent)		
2	Yes/46 days (24.3 percent)	Yes/25 days (10.5 percent)	Yes/65 days (28.1 percent)	Yes/66 days (30 percent)	Yes/71 days (30 percent)		
3	Yes/44 days (23.3 percent)	Yes/25 days (10.5 percent)	Yes/46 days (19.9 percent)	No/14 days (6.5 percent)	Yes/34 days (14.5 percent)		

*Due to Site construction activities, groundwater gauges were not installed until May 5th, 2016; therefore, the growing season for Year 1 (2016) is based on the soil survey start date of April 17th. It is expected that all gauges would meet success criteria at the beginning of the growing season.

APPENDIX F
BENTHIC DATA

Results

Habitat Assessment Data Sheets

PAI ID NO			53939	53940	53941
STATION			UT-1	UT-2	UT-3
DATE			6/18/2020	6/18/2020	6/18/2020
SPECIES	T.V.	F.F.G.			
MOLLUSCA					
Bivalvia					
Veneroidea					
Sphaeriidae		FC			1
ANNELIDA					
Clitellata					
Oligochaeta		CG			
Tubificida					
Naididae		CG			
Tubificinae w.h.c.		CG			1
ARTHROPODA					
Crustacea					
Ostracoda					1
Isopoda					
Asellidae		SH			
<i>Caecidotea sp.</i>	8.4	CG	4	9	14
Amphipoda		CG			
Crangonyctidae					
<i>Crangonyx sp.</i>	7.2	CG	1	6	
Decapoda					
Cambaridae					
<i>Procambarus sp.</i>	9.3	SH		1	
Insecta					
Ephemeroptera					
Baetidae		CG			
<i>Callibaetis sp.</i>	9.2	CG	4		
Caenidae		CG			
<i>Caenis sp.</i>	6.8	CG	6		1
Odonata					
Aeshnidae		P			
<i>Aeshna sp.</i>		P	1	2	
Coenagrionidae		P			
<i>Argia sp.</i>	8.3	P	3		
<i>Ischnura sp.</i>	9.5				1
Cordulegastridae		P			
<i>Cordulegaster sp.</i>	5.7	P		2	
Corduliidae					
<i>Neurocordulia sp.</i>	5.3		4		
Libellulidae		P			
<i>Pachydiplax longipennis</i>	9.6			1	
Megaloptera					

PAI ID NO			53939	53940	53941
STATION			UT-1	UT-2	UT-3
DATE			6/18/2020	6/18/2020	6/18/2020
SPECIES	T.V.	F.F.G.			
Sialidae		P			
<i>Sialis sp.</i>	7	P			1
Trichoptera					
Hydropsychidae		FC			
<i>Cheumatopsyche sp.</i>	6.6	FC			10
Coleoptera					
Haliplidae					
<i>Peltodytes sp.</i>	8.4	SH		2	
Hydrophilidae		P			
<i>Tropisternus sp.</i>	9.3	P		1	
Diptera					
Chironomidae					
<i>Ablabesmyia mallochii</i>	7.4	P	2		
<i>Chironomus sp.</i>	9.3	CG		1	1
<i>Conchapelopia sp.</i>	8.4	P	5	6	32
<i>Corynoneura sp.</i>	5.7	CG	1		
<i>Cricotopus sp.</i>		CG			1
<i>Polypedilum flavum</i>	5.7	SH		1	
<i>Polypedilum illinoense gp.</i>	8.7	SH	2		
<i>Rheotanytarsus exiguus gp.</i>	6.5	FC			4
<i>Rheotanytarsus pellucidus</i>	6.5	FC		1	
<i>Tanytarsus sp.</i>	6.6	FC		3	
<i>Zavrelimyia sp.</i>	8.6	P	1		
Culicidae		FC			
<i>Anopheles sp.</i>	8.6	FC	4		
Simuliidae		FC			
<i>Simulium venustum complex</i>	7.3				2
Tipulidae		SH			
<i>Tipula sp.</i>	7.5	SH		2	
TOTAL NO. OF ORGANISMS			38	38	70
TOTAL NO. OF TAXA			13	14	13
EPT INDEX			2	0	2
BIOTIC INDEX ASSIGNED VALUES			7.79	7.77	7.72

Aycock UT1

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ

TOTAL SCORE 91

Directions for use: The observer is to survey a minimum of 100 meters with 200 meters preferred of stream, preferably in an upstream direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream Aycock UT-1 Location/road: _____ (Road Name Aycock) County Alamance

Date 200618 CC# 03030002 Basin Cape Fear Subbasin 03-06-02

Observer(s) P4P Type of Study: Fish Benthos Basinwide Special Study (Describe) _____

Latitude 36.128077 Longitude -79.521127 Ecoregion: MT P Slate Belt Triassic Basin

Water Quality: Temperature 14.1 °C DO 6.21 mg/l Conductivity (corr.) 52.8 µS/cm² pH 7.8

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 10 %Forest _____ %Residential 90 %Active Pasture _____ % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : Forest Agriculture Urban Animal operations upstream

Width: (meters) Stream 15 Channel (at top of bank) 15 Stream Depth: (m) Avg .1 Max .3
 Width variable Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) _____

Bank Angle: 45 ° or NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

Channelized Ditch

- Deeply incised-steep, straight banks Both banks undercut at bend Channel filled in with sediment
- Recent overbank deposits Bar development Buried structures Exposed bedrock
- Excessive periphyton growth Heavy filamentous algae growth Green tinge Sewage smell

Manmade Stabilization: N Y: Rip-rap, cement, gabions Sediment/grade-control structure Berm/levee

Flow conditions : High Normal Low

Turbidity: Clear Slightly Turbid Turbid Tannic Milky Colored (from dyes)

Good potential for Wetlands Restoration Project?? YES NO Details 15-1-02

Channel Flow Status

Useful especially under abnormal or low flow conditions.

- A. Water reaches base of both lower banks, minimal channel substrate exposed
- B. Water fills >75% of available channel, or <25% of channel substrate is exposed.....
- C. Water fills 25-75% of available channel, many logs/snags exposed.....
- D. Root mats out of water.....
- E. Very little water in channel, mostly present as standing pools.....

Weather Conditions: cloudy Photos: N Y Digital 35mm

Remarks: River

4xcock-let-1'

82

I. Channel Modification

- A. channel natural, frequent bends..... 5
- B. channel natural, infrequent bends (channelization could be old)..... 4
- C. some channelization present..... 3
- D. more extensive channelization, >40% of stream disrupted..... 2
- E. no bends, completely channelized or rip rapped or gabioned, etc..... 0

Evidence of dredging Evidence of desnagging=no large woody debris in stream Banks of uniform shape/height

Remarks _____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

0 Rocks 0 Macrophytes 0 Sticks and leafpacks 0 Snags and logs 0 Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70%	40-70%	20-40%	<20%
	Score	Score	Score	Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

No woody vegetation in riparian zone _____ Remarks _____ Subtotal 16

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

- A. substrate with good mix of gravel, cobble and boulders
 - 1. embeddedness <20% (very little sand, usually only behind large boulders)..... 15
 - 2. embeddedness 20-40%..... 12
 - 3. embeddedness 40-80%..... 8
 - 4. embeddedness >80%..... 3
- B. substrate gravel and cobble
 - 1. embeddedness <20%..... 14
 - 2. embeddedness 20-40%..... 11
 - 3. embeddedness 40-80% 6
 - 4. embeddedness >80%..... 2
- C. substrate mostly gravel
 - 1. embeddedness <50%..... 8
 - 2. embeddedness >50%..... 4
- D. substrate homogeneous
 - 1. substrate nearly all bedrock..... 3
 - 2. substrate nearly all sand 3
 - 3. substrate nearly all detritus..... 2
 - 4. substrate nearly all silt/ clay..... 1

Remarks _____ Subtotal 14

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

- A. Pools present
 - 1. Pools Frequent (>30% of 200m area surveyed)
 - a. variety of pool sizes..... 10
 - b. pools about the same size (indicates pools filling in)..... 8
 - 2. Pools Infrequent (<30% of the 200m area surveyed)
 - a. variety of pool sizes..... 6
 - b. pools about the same size..... 4
- B. Pools absent..... 0

Subtotal 10

Pool bottom boulder-cobble=hard Bottom sandy-sink as you walk Silt bottom Some pools over wader depth

Remarks _____

Page Total 45

Arcock UT

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles Frequent Score	Riffles Infrequent Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream...	6	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	
Channel Slope: <input type="checkbox"/> Typical for area <input type="checkbox"/> Steep=fast flow <input type="checkbox"/> Low=like a coastal stream		Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	0	0
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	5	5
3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
Remarks _____		Total 14

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0
Remarks _____	Subtotal 8

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Weeds/old field <input type="checkbox"/> Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone intact (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone not intact (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
Remarks _____		Total 8

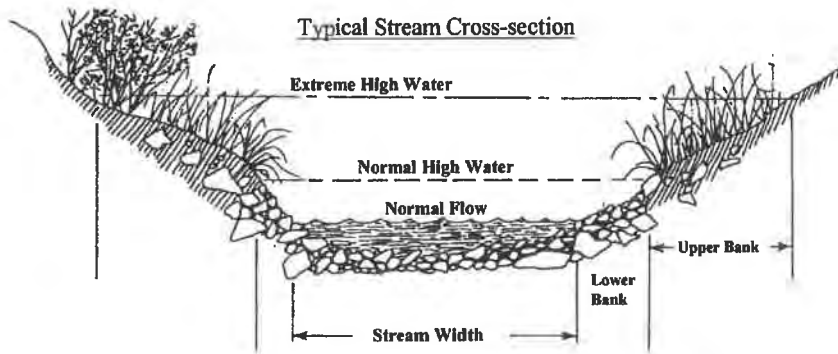
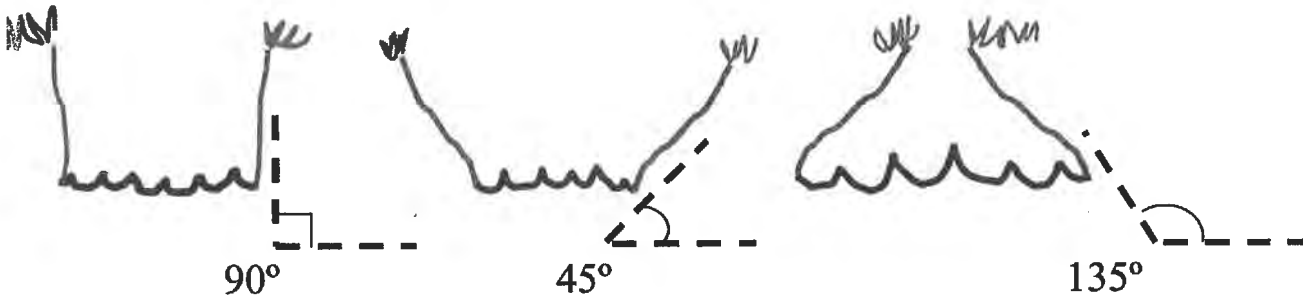
Page Total 46

TOTAL SCORE 41

Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

Other comments:

Ariock UT4

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ

TOTAL SCORE 90

Directions for use: The observer is to survey a minimum of 100 meters with 200 meters preferred of stream, preferably in an upstream direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream Ariock UT-4 Location/road: _____ (Road Name Ariock) County Alamance

Date 200619 CC# 03030002 Basin Cape Fear Subbasin 03-06-02

Observer(s) _____ Type of Study: Fish Benthos Basinwide Special Study (Describe) _____

Latitude 36.129905 Longitude 79.527165 Ecoregion: MT P Slate Belt Triassic Basin

Water Quality: Temperature 22.8 °C DO 4.98 mg/l? Conductivity (corr.) X µS/cm pH 7.14

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 30 %Forest _____ %Residential 70 %Active Pasture _____ % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : Forest Agriculture Urban Animal operations upstream

Width: (meters) Stream 1 Channel (at top of bank) 2 Stream Depth: (m) Avg _____ Max _____
 Width variable Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) _____

Bank Angle: 145 ° or NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

- Channelized Ditch
- Deeply incised-steep, straight banks Both banks undercut at bend Channel filled in with sediment
- Recent overbank deposits Bar development Buried structures Exposed bedrock
- Excessive periphyton growth Heavy filamentous algae growth Green tinge Sewage smell
- Manmade Stabilization: N Y: Rip-rap, cement, gabions Sediment/grade-control structure Berm/levee
- Flow conditions : High Normal Low

Turbidity: Clear Slightly Turbid Turbid Tannic Milky Colored (from dyes)
Good potential for Wetlands Restoration Project?? YES NO Details five year old stream's wetland side

- Channel Flow Status
- Useful especially under abnormal or low flow conditions.
- A. Water reaches base of both lower banks, minimal channel substrate exposed
 - B. Water fills >75% of available channel, or <25% of channel substrate is exposed.....
 - C. Water fills 25-75% of available channel, many logs/snags exposed.....
 - D. Root mats out of water.....
 - E. Very little water in channel, mostly present as standing pools.....

Weather Conditions: cloudy cool Photos: N Y Digital 35mm

Remarks: shrub coverage - acacia

I. Channel Modification

- A. channel natural, frequent bends..... 5
- B. channel natural, infrequent bends (channelization could be old)..... 4
- C. some channelization present..... 3
- D. more extensive channelization, >40% of stream disrupted..... 2
- E. no bends, completely channelized or rip rapped or gabioned, etc..... 0

Evidence of dredging Evidence of desnagging=no large woody debris in stream Banks of uniform shape/height

Remarks _____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

1 Rocks 1 Macrophytes 1 Sticks and leafpacks 1 Snags and logs 1 Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

No woody vegetation in riparian zone Remarks _____ Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

- A. substrate with good mix of gravel, cobble and boulders
 - 1. embeddedness <20% (very little sand, usually only behind large boulders)..... 15
 - 2. embeddedness 20-40%..... 12
 - 3. embeddedness 40-80%..... 8
 - 4. embeddedness >80%..... 3
- B. substrate gravel and cobble
 - 1. embeddedness <20%..... 14
 - 2. embeddedness 20-40%..... 11
 - 3. embeddedness 40-80%..... 6
 - 4. embeddedness >80%..... 2
- C. substrate mostly gravel
 - 1. embeddedness <50%..... 8
 - 2. embeddedness >50%..... 4
- D. substrate homogeneous
 - 1. substrate nearly all bedrock..... 3
 - 2. substrate nearly all sand..... 3
 - 3. substrate nearly all detritus..... 2
 - 4. substrate nearly all silt/ clay..... 1

Remarks _____ Subtotal 11

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

- A. Pools present
 - 1. Pools Frequent (>30% of 200m area surveyed)
 - a. variety of pool sizes..... 10
 - b. pools about the same size (indicates pools filling in)..... 8
 - 2. Pools Infrequent (<30% of the 200m area surveyed)
 - a. variety of pool sizes..... 6
 - b. pools about the same size..... 4
- B. Pools absent..... 0

Pool bottom boulder-cobble=hard Bottom sandy-sink as you walk Silt bottom Some pools over wader depth

Remarks _____ Subtotal 10

Aflock - 479

V. Riffle Habitats

Definition: Riffle is area of reaceration-can be debris dam, or narrow channel area. Riffles Frequent Riffles Infrequent

	Score	Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream...	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: Typical for area Steep=fast flow Low=like a coastal stream Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	5	5
3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 14

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0

Remarks _____ Subtotal 10

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: Trees Shrubs Grasses Weeds/old field Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone intact (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone not intact (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 10

Remarks _____

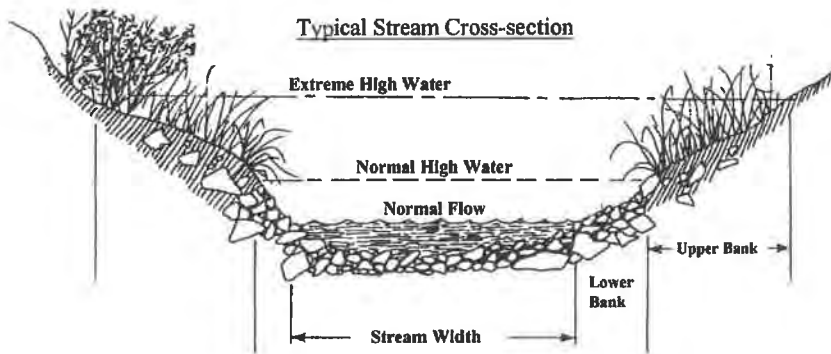
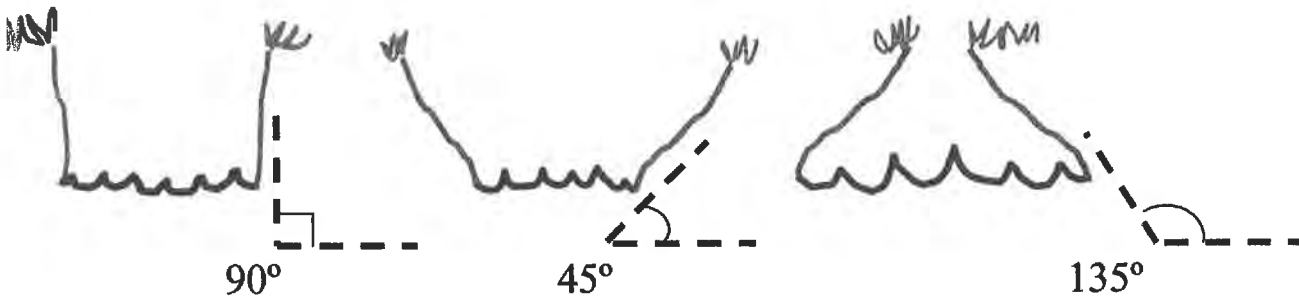
Page Total 50

Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

TOTAL SCORE 40

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

Other comments:

Five horizontal lines for writing comments.

Ayrack UT 2

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ

TOTAL SCORE 90

Directions for use: The observer is to survey a minimum of 100 meters with 200 meters preferred of stream, preferably in an upstream direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream Ayrack UT-2 Location/road: _____ (Road Name Ayrack) County Alamogordo

Date 200616 CC# 03030002 Basin Cape Fear Subbasin 03-06-02

Observer(s) PHP Type of Study: Fish Benthos Basinwide Special Study (Describe) _____

Latitude 36.128128 Longitude -79.521813 Ecoregion: MT P Slate Belt Triassic Basin

Water Quality: Temperature 19.5°C DO 5.66 mg/l Conductivity (corr.) 81 µS/cm pH 7.68

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 15 %Forest 5 %Residential 80 %Active Pasture _____ % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use: Forest Agriculture Urban Animal operations upstream

Width: (meters) Stream _____ Channel (at top of bank) _____ Stream Depth: (m) Avg _____ Max _____
 Width variable Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) _____

Bank Angle: 140 ° or NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

- Channelized Ditch
- Deeply incised-steep, straight banks Both banks undercut at bend Channel filled in with sediment
- Recent overbank deposits Bar development Buried structures Exposed bedrock
- Excessive periphyton growth Heavy filamentous algae growth Green tinge Sewage smell
- Manmade Stabilization: N Y: Rip-rap, cement, gabions Sediment/grade-control structure Berm/levee

Flow conditions: High Normal Low
Turbidity: Clear Slightly Turbid Turbid Tannic Milky Colored (from dyes)

Good potential for Wetlands Restoration Project?? YES NO Details Five year old stream vegetation

- Channel Flow Status
- Useful especially under abnormal or low flow conditions.
- A. Water reaches base of both lower banks, minimal channel substrate exposed
 - B. Water fills >75% of available channel, or <25% of channel substrate is exposed.....
 - C. Water fills 25-75% of available channel, many logs/snags exposed.....
 - D. Root mats out of water.....
 - E. Very little water in channel, mostly present as standing pools.....

Weather Conditions: Cloudy, cool Photos: N Y Digital 35mm

Remarks: Reactive water usage

I. Channel Modification

- A. channel natural, frequent bends..... 5
- B. channel natural, infrequent bends (channelization could be old)..... 4
- C. some channelization present..... 3
- D. more extensive channelization, >40% of stream disrupted..... 2
- E. no bends, completely channelized or rip rapped or gabioned, etc..... 0

Evidence of dredging Evidence of desnagging=no large woody debris in stream Banks of uniform shape/height

Remarks _____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

 Rocks Macrophytes Sticks and leafpacks Snags and logs Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present.....	20	16	12	8
3 types present.....	19	15	11	7
2 types present.....	18	14	10	6
1 type present.....	17	13	9	5
No types present.....	0			

No woody vegetation in riparian zone Remarks _____ Subtotal 15

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

- A. substrate with good mix of gravel, cobble and boulders
 - 1. embeddedness <20% (very little sand, usually only behind large boulders)..... 15
 - 2. embeddedness 20-40%..... 12
 - 3. embeddedness 40-80%..... 8
 - 4. embeddedness >80%..... 3
- B. substrate gravel and cobble
 - 1. embeddedness <20%..... 14
 - 2. embeddedness 20-40%..... 11
 - 3. embeddedness 40-80% 6
 - 4. embeddedness >80%..... 2
- C. substrate mostly gravel
 - 1. embeddedness <50%..... 8
 - 2. embeddedness >50%..... 4
- D. substrate homogeneous
 - 1. substrate nearly all bedrock..... 3
 - 2. substrate nearly all sand 3
 - 3. substrate nearly all detritus..... 2
 - 4. substrate nearly all silt/ clay..... 1

Remarks _____ Subtotal 11

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

- A. Pools present
 - 1. Pools Frequent (>30% of 200m area surveyed)
 - a. variety of pool sizes..... 10
 - b. pools about the same size (indicates pools filling in)..... 8
 - 2. Pools Infrequent (<30% of the 200m area surveyed)
 - a. variety of pool sizes..... 6
 - b. pools about the same size..... 4
- B. Pools absent..... 0

Subtotal 10

Pool bottom boulder-cobble=hard Bottom sandy-sink as you walk Silt bottom Some pools over wader depth

Remarks _____ Page Total 41

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles Frequent Score	Riffles Infrequent Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	
Channel Slope: <input type="checkbox"/> Typical for area <input type="checkbox"/> Steep=fast flow <input type="checkbox"/> Low=like a coastal stream		Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion.	7	7
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	5	5
3. sparse mixed vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
Remarks _____		Total 44

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with good canopy with some breaks for light penetration	10
B. Stream with full canopy - breaks for light penetration absent.....	8
C. Stream with partial canopy - sunlight and shading are essentially equal.....	7
D. Stream with minimal canopy - full sun in all but a few areas.....	2
E. No canopy and no shading.....	0
Remarks <i>Large Salix nigra</i>	Subtotal 10

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: Trees Shrubs Grasses Weeds/old field Exotics (kudzu, etc)

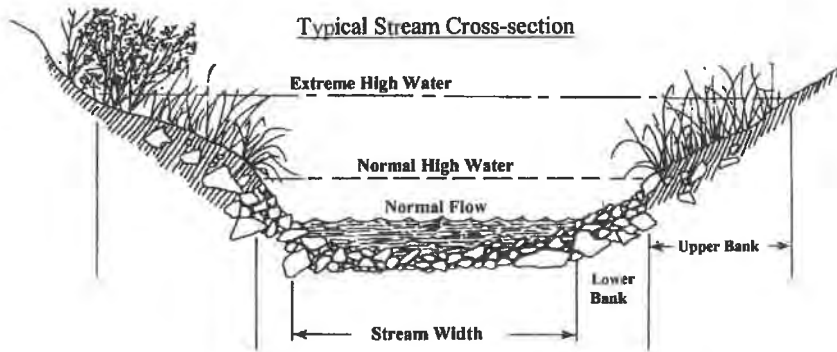
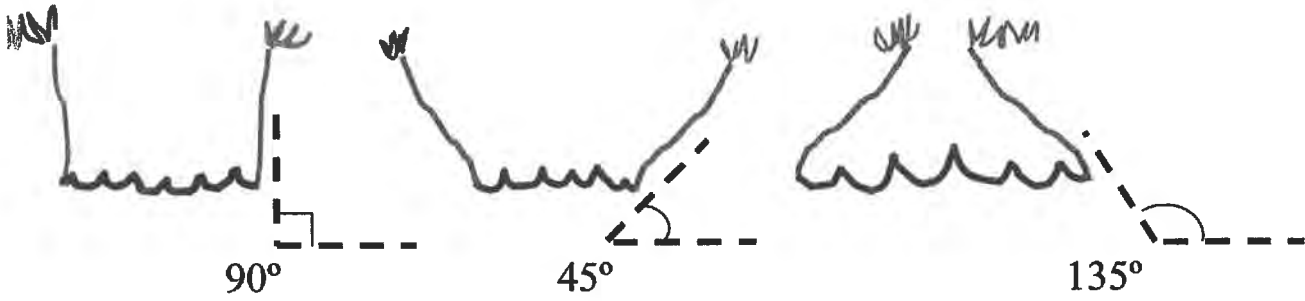
	Lft. Bank Score	Rt. Bank Score
A. Riparian zone intact (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone not intact (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
Remarks _____		Total 10

Page Total 50
TOTAL SCORE 91

Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:



This side is 45° bank angle.

Site Sketch:

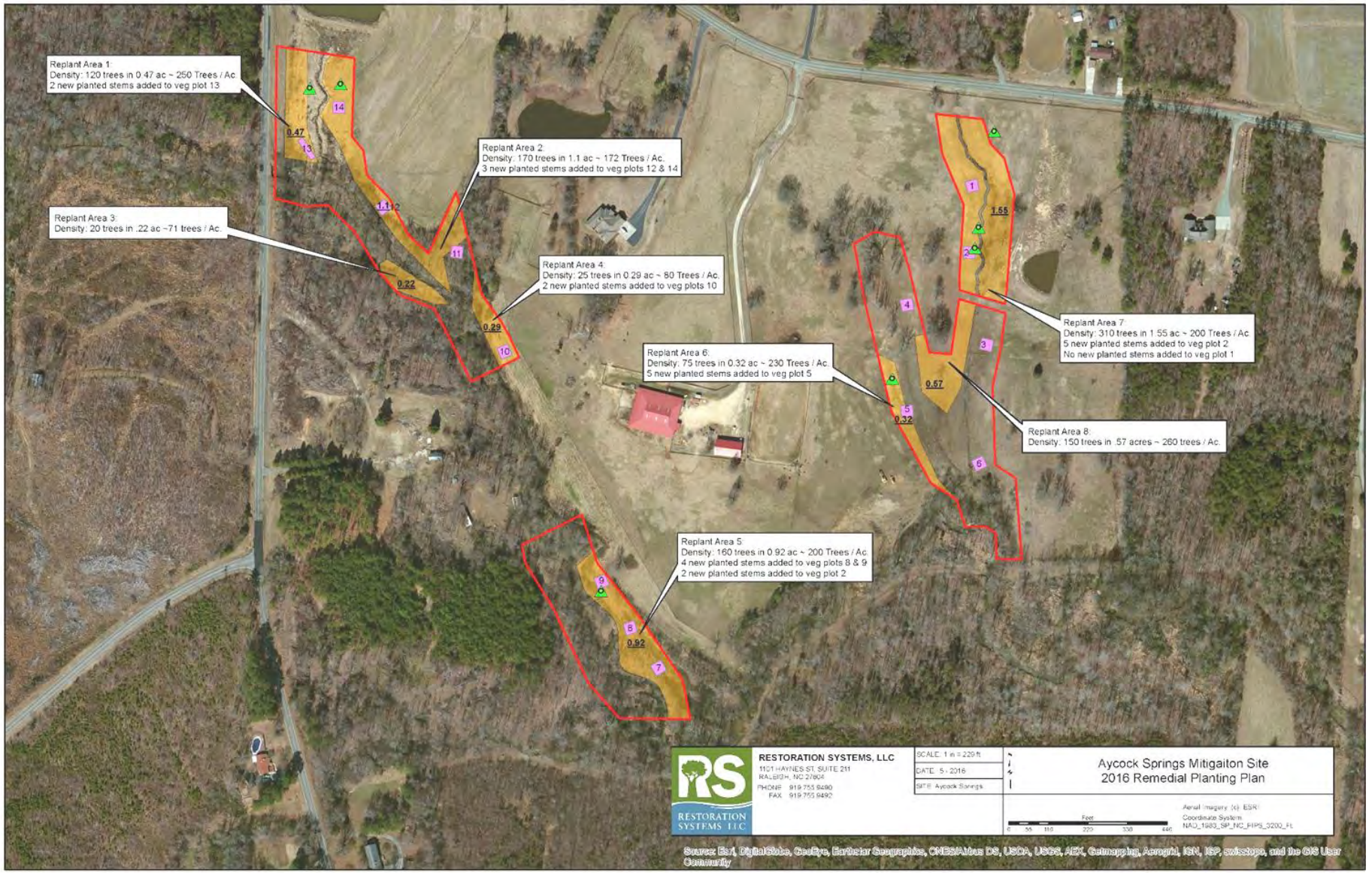
Other comments:

APPENDIX G
MISCELLANEOUS
2016-2017 Remediation

**Aycock Springs Stream and Wetland Mitigation Site
Remedial Action Update March 3, 2017
NC DMS Contract #5791**



Aycock Springs– Remedial Action Plan - Vegetation Update



Map of Replant Areas- green dots indicate approximate location of where photos were taken.



Photo 1: Looking SW. along Replant Area -1

Photo Date: 1-13-2017



Photo 2: Looking S. in Replant Area 2, just N. of veg. plot 14

Photo Date: 1-13-2017



Photo 3: Looking SE. in Replant Area 4, near veg. plot 9

Photo Date: 1-13-2017



Photo 5: Looking S. in Replant Area 5, N. of veg. plot 5

Photo Date: 1-13-2017



Photo 4: Looking S. in Replant Area 6, from outside of the easement

Photo Date: 1-13-2017

Aycock Springs– Remedial Action Plan - Vegetation Update

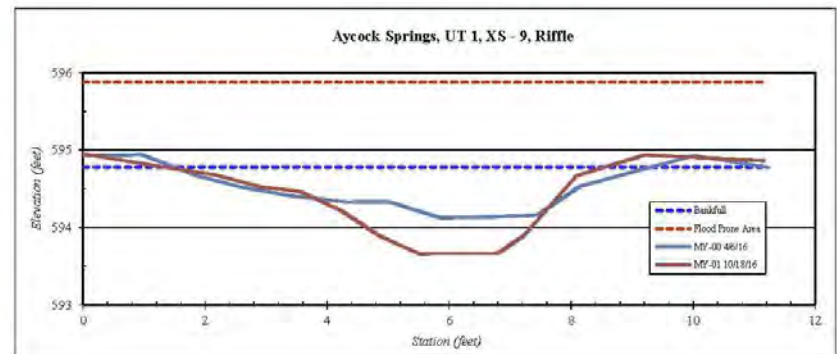
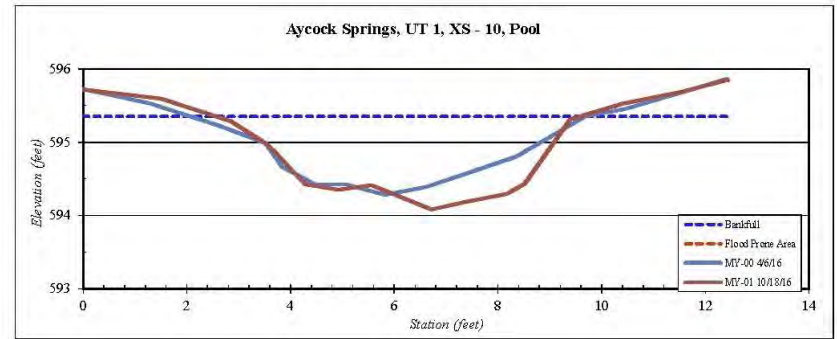
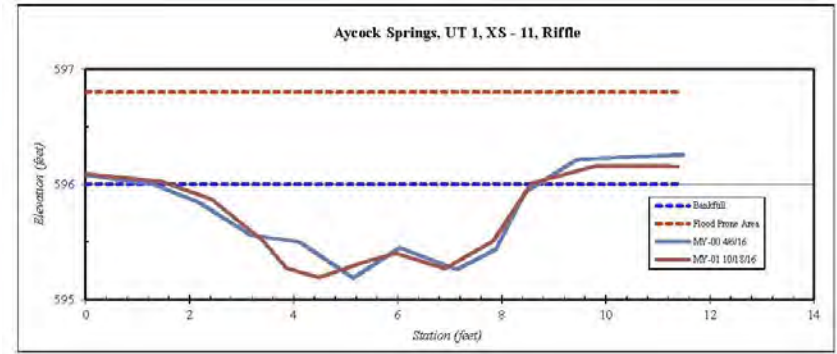
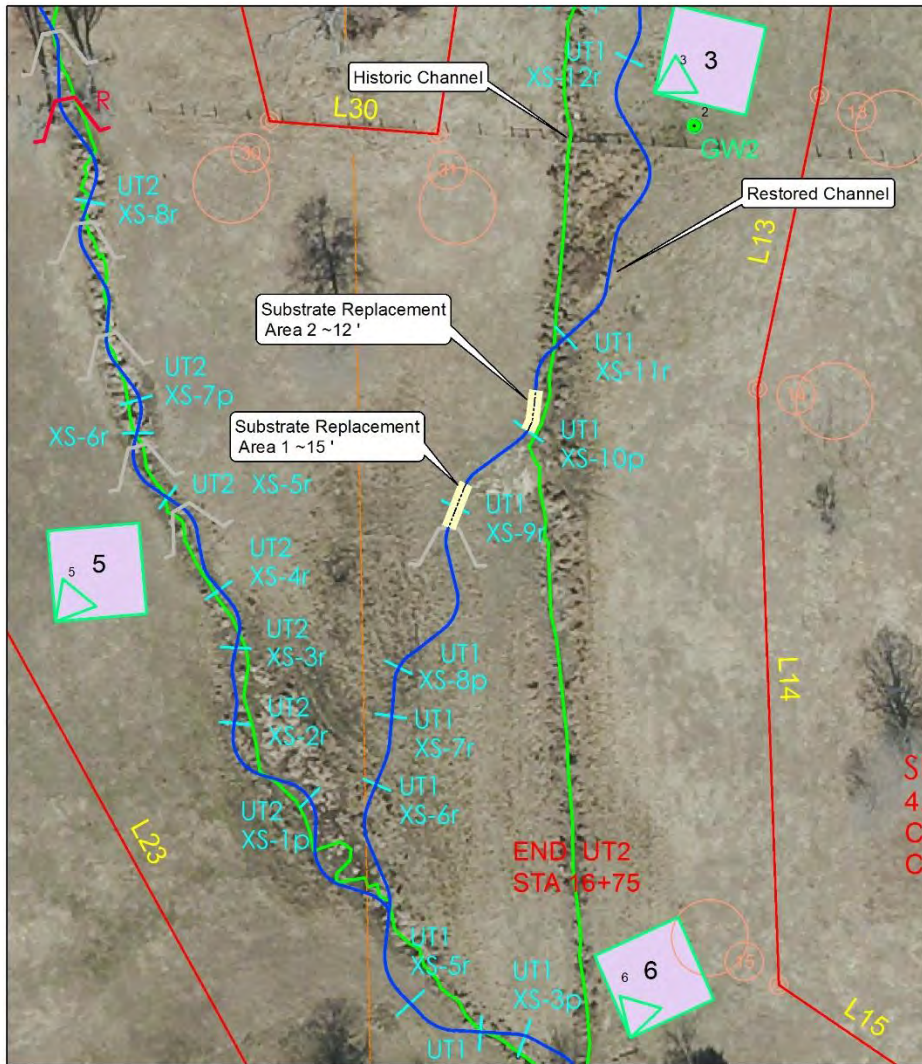


Photo 6 / 7: Live stake establishment on bank in Replant area 6



Photo Date: 1-13-2017

Aycock Springs-- Remedial Action Plan Substrate Replacement - Update



	RESTORATION SYSTEMS, LLC 1101 HAYNES ST, SUITE 211 RALEIGH, NC 27604 PHONE : 919.755.9490 FAX : 919.755.9492	SCALE: 1 in = 42 ft DATE: 2 - 2017 SITE:	Aycock Springs Substrate replacement - 2-23-2017
	<small>This map and all data contained herein are supplied as is with no warranty. Restoration Systems, LLC expressly disclaims responsibility for damages or liability from any claims that may arise out of the use or misuse of this map. It is the sole responsibility of the user to determine if the data on this map is compatible with the user's needs. This map was not created as survey data, nor should it be used as such. It is the user's responsibility to obtain proper survey data, prepared by a licensed surveyor, when required by law.</small>	Aerial Imagery: (c) ESRI Coordinate System: NAD_1983_SP_NC_FIPS_3200_Ft	

Map of Area – UT 1, XC 9, 10, 11



Photo 1: Substrate loss, 6" head-cut at UT 1, XC 9



Photo 2: Pool, upstream of 6" head-cut at UT 1, XC 9 (XC 10 in background)



Photo 3: Substrate replacement at UT 1, XC 9



Photo 3: Substrate loss, upstream riffle of XC 10 (pool)



Photo 4: Substrate replaced, upstream riffle of XC 10 (pool)



Photo 5: post replacement overview



Photo 6: UT-1 looking downstream from XC-11



Photo 7: XC-9 – Post 3-1-2017 0.92 inch rain event (Per USGS Guage at BUFFALO CREEK (SR2819 NR MCLEANSVILLE, NC) ~ 7 miles from Site



Photo 7: XC-10 – Post 3-1-2017 0.92 inch rain event (Per USGS Gauge at BUFFALO CREEK (SR2819 NR MCLEANSVILLE, NC) ~ 7 miles from Site