

# Monitoring Report MY06

**Cedar Branch Restoration Site**

**Monitoring Year 06**

**DMS Contract 6598**

**DMS Project Number 97009**

**RFP# 16-006313**

**Yadkin River Basin - 03040103**

**DWR #: 20150904**

**USACE Action ID: 2003-21395**

**Randolph County, North Carolina**



Prepared for:

NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

**Monitoring Data Collected: 2023**

**Date Submitted: December 2023**

## Monitoring and Design Firm

Prepared by:



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**Project Contact: Adam Spiller**  
**Email: [adam.spiller@kci.com](mailto:adam.spiller@kci.com)**



## MEMORANDUM

Date: February 20, 2024

To: Matthew Reid, DMS Project Manager

From: Adam Spiller, Project Manager  
KCI Associates of North Carolina, PA

Subject: Cedar Branch Stream Restoration Site  
MY-06 Monitoring Report Comments  
Yadkin River Basin CU 03040103  
Randolph County, North Carolina  
NCDMS Project # 97009  
Contract # 006598

Please find below our responses in italics to the MY-06 Monitoring Report comments from NCDMS received on January 16, 2024, for the Cedar Branch Stream Restoration Site.

Please ensure the Monitoring Performance Bond has been received and approved by Kristie Corson prior to invoicing.

➤ *KCI will ensure that this is done prior to invoicing.*

Please include the following information on the cover page:

o RFP# 16-006313 (date of issue: January 21, 2015)

o Yadkin River Basin – 03040103

➤ *This change has been made.*

Vegetation Monitoring: No vegetation data was collected since this is MY6. Recommend adding a statement that previous year's data is included in Appendix C.

➤ *This change has been made.*

Monitoring Results: On June 2, 2023, DMS completed a boundary inspection to verify the integrity of the conservation easement and identify any potential issues on the site. Three action items were identified, and KCI has resolved the issues. Please include this information in the report when discussing the trash removal and fence repair in the first paragraph of the section.

➤ *This change has been made.*

Please include the Boundary Inspection Report in the appendix and reference in the report when discussing the inspection.

➤ *This change has been made.*

Rainfall discussion: Please include the historic average rainfall amount vs. the observed total when discussing below average rainfall for the year.

- *The rainfall discussion should have indicated that the area experienced average rainfall during 2023. This error has been corrected and the appropriate rainfall totals have been added to the report.*

Recommend including previous year's cross-section graphs and adding a statement that cross-section data was not collected in MY6, but previous data is included in Appendix D in the Monitoring Results section.

- *This change has been made.*

The stream gauge on UTCC malfunctioned and did not provide accurate data in 2023. Has the gauge been repaired or replaced? Please update report.

- *The stream gauge will be replaced before the start of the 2024 growing season. A note indicating this has been added to the report.*

Sincerely,



Adam Spiller  
Project Manager

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## **PROJECT SUMMARY**

The Cedar Branch Restoration Site (CBRS) was completed in April 2018 and restored a total of 7,047 linear feet of stream. The CBRS is a riparian system in the Lower Yadkin River Basin (03040103 8-digit cataloging unit) in Randolph County, North Carolina. The site's natural hydrologic regime had been substantially modified through the relocation and straightening of the existing stream channels, impacted by cattle access, and cleared of any riparian buffer. This completed project restored impacted agricultural lands to a stable stream ecosystem with a functional riparian buffer and floodplain access.

The CBRS is protected by a 20.6 acre permanent conservation easement, held by the State of North Carolina. The site is located approximately 2.8 miles west of Sophia, North Carolina. Specifically, the site is 0.5 mile west on Mt. Olive Church Road from its intersection with Edgar Road (SR-1526).

The North Carolina Ecosystem Enhancement Program (NCEEP) publication in 2009 identified HUC 03040103050040 (Caraway Creek) as a Targeted Local Watershed (TLW). The project is also located within the Upper Uwharrie Local Watershed Plan (LWP) study area. The goals and priorities for the CBRS are based on the information presented in the Lower Yadkin River Basin Restoration Priorities: maintaining and enhancing water quality, restoring hydrology, and improving fish and wildlife habitat (NCEEP, 2009). The project will support the following basin priorities:

- Managing stormwater runoff
- Reducing fecal coliform inputs
- Improving/restoring riparian buffers
- Reducing sediment loading
- Improving stream stability
- Reducing nutrient loading
- Excluding livestock and implementing other agricultural BMP's

The goals for the project are to:

- Restore channelized and livestock-impacted streams to stable C/Cb channels.
- Restore a forested riparian buffer to provide bank stability, filtration, and shading.

The project goals will be addressed through the following objectives:

- Relocate a channelized stream to its historic landscape position.
- Install cross-sections sized to the bankfull discharge.
- Create bedform diversity with pools, riffles, and habitat structures
- Fence out livestock to reduce nutrient, bacterial, and sediment impacts from adjacent grazing and farming practices.
- Plant the site with native trees and shrubs and an herbaceous seed mix.

To restore the site, the stream was re-meandered and the bankfull elevation was tied to the historic floodplain where feasible. This restoration is expected to create wetland pockets throughout the new floodplain and bankfull bench. The entire site was planted to establish a forested riparian buffer.

The monitoring components were installed in April 2018. Three groundwater monitoring wells were installed to monitor the development of wetlands in the floodplain along the EI portions of T1 and T3. Three automatically recording pressure transducer stream gauges that take a reading every 10 minutes were installed near the top of T1, T1-1, and T3 to document flow within those reaches. Cameras were installed in the vicinity of each of these gauges and set to record a short video once a day to provide additional verification of flow. An additional stream gauge was installed along UTCC to record the occurrence of bankfull events. Thirteen 10 m x 10 m permanent vegetation monitoring plots were established. The locations of the planted stems relative to the origin within these plots, as well as the species, were recorded and planted stems were grouped into size categories (0-10 cm, 10-50 cm, 50-100 cm, >137 cm). Any

volunteers found within the plots were also grouped into size categories by species, but separate from the planted stems. Twelve permanent photo reference points were established and will be taken annually. Fifteen permanent cross-sections (ten riffle cross-sections and five pool cross-sections) were also established, and a detailed longitudinal profile of the stream was taken. Wolman pebble counts were performed at all of the riffle cross-sections. The cross-section measurements will be repeated in future monitoring years, but the longitudinal profile and the Wolman pebble counts will only be repeated if there are concerns about bed elevation adjustments. Reports will be submitted to DMS each year.

Vegetative success criteria for the site is 320 woody stems/acre after three years, 260 woody stems/acre after five years, and 210 woody stems/acre after seven years. A minimum of two bankfull events in separate years must also be recorded during the monitoring period. Bank height ratios should not exceed 1.2 and the entrenchment ratios should be 2.2 or greater. Visual assessments will also be used to identify problem areas.

### **MONITORING RESULTS**

Vegetation monitoring did not take place during MY06, as stipulated in the Mitigation Plan. Vegetation monitoring will resume in MY07. A treatment of invasive species growing on site was completed in September 2023. This treatment targeted Chinese privet (*Ligustrum sinense*) in areas where preexisting vegetation was not cleared during construction, mainly around the upper reaches of T1. In general, the site is well vegetated, with widespread herbaceous coverage and many large, healthy woody stems. Please see Appendix C – Vegetation Plot Data for a summary of previous years' vegetation monitoring results.

Cross-section monitoring did not take place during MY06, as stipulated in the Mitigation Plan. Visual assessment of the stream showed the stream to be stable and functioning as designed with no areas of bank erosion or bed aggradation/degradation noted. Please see Appendix D for the previous year's cross-section plots.

According to the Randolph County Soil Survey, the growing season at the CBRS extends from March 24 to November 13 (235 days). Daily rainfall data were obtained from the NC State Climate Office for a local weather station in Asheboro, NC. In 2023, April and July experienced above average rainfall, while January, February, March, May, and August experienced average rainfall. The months of July, September, October, and November experienced below average rainfall for the site. Overall, the area experienced average rainfall during the 2023 growing season (annual 30<sup>th</sup> percentile: 30.21", annual 70<sup>th</sup> percentile: 56.20", 2023 total: 41.34").

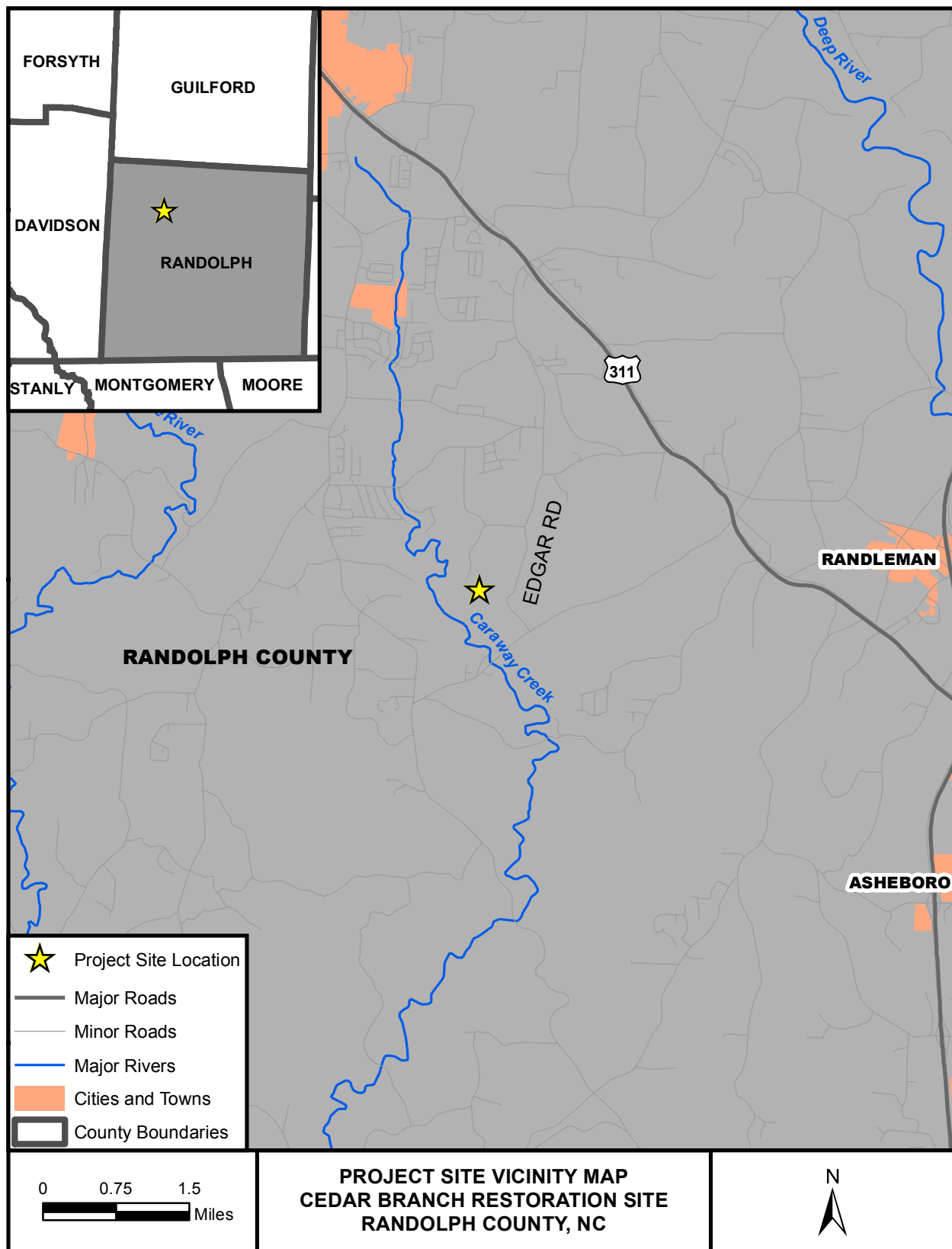
In addition to traditional stream monitoring, there are areas of fringe wetlands that were restored and enhanced along the bankfull benches of some reaches. While these areas do not have success criteria associated with them, they are monitored for informational purposes and help illustrate the overall success of the restoration site. During the site's sixth growing season, the groundwater monitoring well on T1 achieved 27 days (11.3%) of continuous saturation within twelve inches of the soil surface, while the two wells on T3 achieved 60 days (25.4%) and 4 days (1.7%). Several species of hydrophytic vegetation have been noted growing along the floodplains of T1 and T3 in all monitoring years. These species include *Juncus effuses* (FACW), *Cyperus strigosus* (FACW), *Persicaria pensylvanica* (FACW), and *Persicaria sagittata* (OBL).

The stream gauge on UTCC malfunctioned and did not provide accurate data in 2023 and so no bankfull events were recorded this year. This gauge will be replaced before the start of the 2024 growing season. All 3 of the stream flow gauges recorded greater than 30 consecutive days of flow. The gauge on T1 recorded 121 days, the gauge on T1-1 recorded 40 days, and the gauge on T3 recorded 161 days. This data was further backed up by the flow cameras, which recorded 209 consecutive days for T1, 109 consecutive days for T1-1, and 164 consecutive days for T3. The difference in the success rates of the cameras compared to

the gauges can be attributed to the fact that the cameras can provide better evidence of stream flow at the low levels of flow that the project streams experienced in 2023.

On June 2, 2023, DMS completed a boundary inspection to verify the integrity of the conservation easement and identify any potential issues on the site. This inspection identified three action items that needed attention. These items were to remove the trash identified in previous monitoring reports that was within the easement near the beginning of T1, repair the damaged fence also identified in previous monitoring reports near stationing 17+00, and reset a loose corner marker post. All three of these items were addressed at the same time as the September 2023 invasive treatment. Please see Appendix F – Additional Data for a copy of the inspection report from this visit. KCI reviewed the site boundary on December 11, 2023 and no encroachment or other issues were noted. The fence is intact around the T1 portion of the site and signs are present at regular intervals around the entire site boundary.





## REFERENCES

- NCDENR, Ecosystem Enhancement Program. 2009. Broad River Basin Restoration Priorities 2009. Raleigh, NC. Last accessed 1/2016 at:  
[http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=705d1b58-cb91-451e-aa58-4ef128b1e5ab&groupId=60329](http://portal.ncdenr.org/c/document_library/get_file?uuid=705d1b58-cb91-451e-aa58-4ef128b1e5ab&groupId=60329)
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- NC Wetland Functional Assessment Team. 2010. NC Wetland Assessment Method (NC WAM) User Manual, version 4.1. Last accessed 11/2012 at:  
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- Schafale, M.P. and A.S. Weakley. 2012. Guide to the Natural Communities of North Carolina: Fourth Approximation. Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment and Natural Resources. Raleigh, NC.
- Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. *Soil Survey of Randolph County, North Carolina*. 2006

# **APPENDIX A**

## Background Tables

<b>Table 1. Project Components and Mitigation Credits Cedar Branch Restoration Site, DMS Project #97009</b>									
<b>Mitigation Credits</b>									
	<b>Stream</b>		<b>Riparian Wetland</b>		<b>Non-riparian Wetland</b>		<b>Buffer</b>	<b>Nitrogen Nutrient Offset</b>	<b>Phosphorous Nutrient Offset</b>
<b>Type</b>	R	RE	R	RE	R	RE			
<b>Linear Feet/Acres</b>	5,230	1,813							
<b>Credits†</b>	5,234	966							
<b>TOTAL CREDITS</b>	6,200								
<b>Project Components</b>									
<b>Project Component -or- Reach ID</b>	<b>Stationing/ Location</b>		<b>Existing Footage/ Acreage</b>	<b>Approach (PI, PII etc.)</b>	<b>Restoration -or- Restoration Equivalent</b>	<b>Restoration Footage/ Acreage</b>	<b>Mitigation Ratio</b>		
Tributary 1	50+00 to 55+50		550	Enhancement II	220	550	2.5:1		
	55+50 to 58+24		257	Enhancement I	183	274	1.5:1		
	58+24 to 61+17		229	Restoration	294	293	1:1		
Tributary 1-1	70+00 to 73+13		313	Enhancement II	125	313	2.5:1		
Tributary 2	80+00 to 80+49		46	Enhancement II	20	49	2.5:1		
	80+49 to 81+27		77	Restoration	78	78	1:1		
Tributary 3	90+00 to 96+27		624	Enhancement I	418	627	1.5:1		
	96+27 to 101-57		517	Restoration	530	530	1:1		
Tributary 3-1	150+00 to 150+78		68	Restoration	78	78	1:1		
Tributary 4*	250+00 to 257+42		677	Restoration	692	692	1:1		
Tributary 5**	300+00 to 300+95		64	N/A	0	(95)	N/A		
UTCC*	10+00 to 46+09		3,246	Restoration	3,562	3,559	1:1		
<b>Component Summation</b>									
<b>Restoration Level</b>	<b>Stream (linear feet)</b>	<b>Riparian Wetlands (Acres)</b>		<b>Non-Riparian Wetlands (Acres)</b>	<b>Buffer (square feet)</b>	<b>Upland (Acres)</b>			
		Riverine	Non-Riverine						
Restoration	5,234 lf								
Enhancement									
Enhancement I	901								
Enhancement II	912								
<b>TOTAL CREDITS</b>	<b>6,200</b>								

R= Restoration RE= Restoration Equivalent of Creation or Enhancement

\*=Crossings have been removed from creditable linear footage for all project streams.

\*\*=Tributary 5 does not have any mitigation credit, but is included to show its stationing as part of the mitigation project.

†=Changes made during construction resulted in the loss of 4 lf of stream, but per IRT review, this did not result in a loss of credits. Please see Appendix F for additional information.

**Table 2. Project Activity & Reporting History  
Cedar Branch Restoration Sites, DMS Project #97009**

<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Actual Completion or Delivery</b>
Mitigation Plan		May 2017
Final Design - Construction Plans		March 8, 2017
Construction Grading Completed		March 28, 2018
Planting Completed		April 6, 2018
Baseline Monitoring/Report	April 2018	May 2018
<i>Vegetation Monitoring</i>	<i>April 10, 2018</i>	
<i>Stream Survey</i>	<i>April 11, 2018</i>	
Year 1 Monitoring	January 2019	January 2019
<i>Vegetation Monitoring</i>	<i>November 5, 2018</i>	
<i>Stream Survey</i>	<i>January 14, 2019</i>	
Crossing Repair(outside easement)	May 2019	
Year 2 Monitoring	July 2019	December 2019
<i>Vegetation Monitoring</i>	<i>July 9, 2019</i>	
<i>Stream Survey</i>	<i>June 26, 2019</i>	
Year 3 Monitoring	July 2020	December 2020
<i>Vegetation Monitoring</i>	<i>July 31, 2020</i>	
<i>Stream Survey</i>	<i>June 30, 2020</i>	
Invasive Treatment		July 16, 2021
Year 4 Monitoring	November 2021	December 2021
Supplemental Planting		January 4, 2022
Invasive Treatment		July 26, 2022
Year 5 Monitoring	December 2022	January 2023
<i>Vegetation Monitoring</i>	<i>July 19, 2022</i>	
<i>Stream Survey</i>	<i>December 14, 2022</i>	
Invasive Treatment		September 14, 2023
Fence Repair and Debris Removal		September 14, 2023
Year 6 Monitoring	December 2023	December 2023

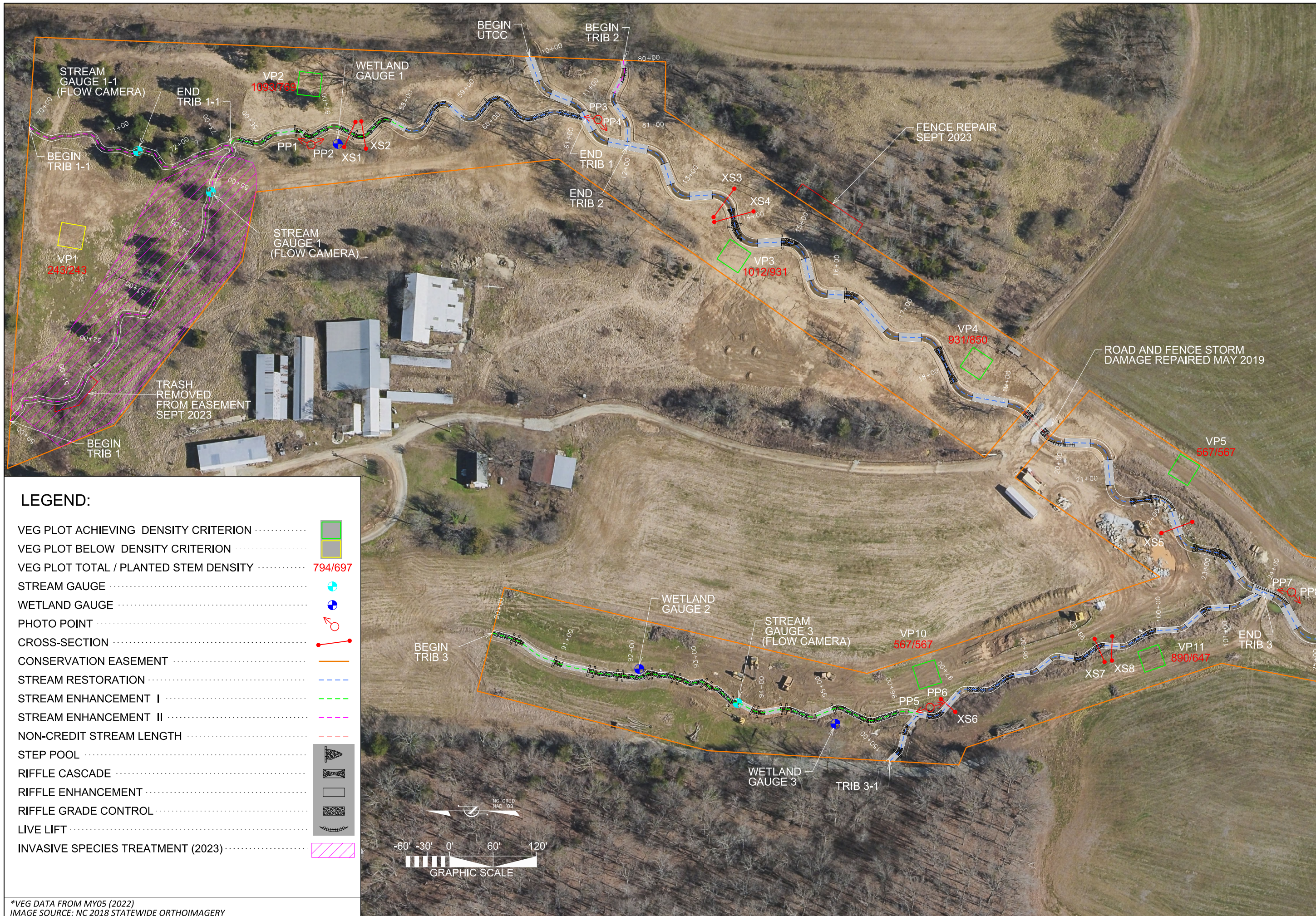
<b>Table 3. Project Contacts Cedar Branch Restoration Site, DMS Project #97009</b>	
<b>Design Firm</b>	KCI Associates of North Carolina 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266
<b>Construction Contractor</b>	KCI Environmental Technologies and Construction 4505 Falls of Neuse Road, Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514
<b>Planting Contractor</b>	Conservation Services Inc. 1620 N. Delphine Ave. Waynesboro, VA 22980 Contact: Mr. David Coleman Phone: (540) 941-0067
<b>Monitoring Performers</b>	KCI Associates of North Carolina 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

<b>Table 4. Project Information</b>						
<b>Cedar Branch Restoration Site, DMS Project #97009</b>						
<b>Project Name</b>	Cedar Branch Restoration Site					
<b>County</b>	Randolph County					
<b>Project Area (acres)</b>	21.3 acres					
<b>Project Coordinates (lat. and long.)</b>	35.823878° N, -79.90855° W					
<b>Project Watershed Summary Information</b>						
<b>Physiographic Province</b>	Piedmont					
<b>River Basin</b>	Yadkin					
<b>USGS Hydrologic Unit 8-digit</b>	03040103	<b>USGS Hydrologic Unit 14-digit</b>	03040103050040			
<b>DWQ Sub-basin</b>	13-2-3					
<b>Project Drainage Area (acres)</b>	294 acres					
<b>Project Drainage Area Percentage of Impervious Area</b>	4%					
<b>CGIA Land Use Classification</b>	Managed Herbaceous Cover 59% (173 ac), Mixed Hardwoods/Conifers 34% (100 ac), Low Density Developed 5% (15 ac), Transportation 2% (6 ac)					
<b>Existing Reach Summary Information</b>						
<b>Parameters</b>	<b>UTCC</b>	<b>T1, T1-1</b>	<b>T2</b>	<b>T3, T3-1</b>	<b>T4</b>	<b>T5</b>
Length of reach (linear feet)	3,038	1,349	124	1,209	627	61
Drainage area (acres)	88 acres	30 acres	18 acres	28 acres	30 acres	31 acres
NCDWQ Water Quality Classification	C	C	C	C	C	C
Rosgen Classification	G4c-E4	G4	G4	E4	G4	C4b
Evolutionary trend	Channelized, Stage III	Channelized, Stage III	Channelized, Stage III	Channelized, Stage III	Channelized, Stage III	Stable
Mapped Soil Series	Mecklenburg Clay Loam	Wynott-Enon Complex	Mecklenburg Clay Loam	Mecklenburg Clay Loam	Mecklenburg Clay Loam	Mecklenburg Clay Loam
Drainage class	Well drained	Well drained	Well drained	Well drained	Well drained	Well drained
Soil Hydric status	Hydric	Hydric	Hydric	Hydric	Hydric	Hydric
Slope	1.5%	3.1%	3.1%	3.7%	3.1%	2.7%
FEMA classification	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X
Existing vegetation community	Pasture, Headwater Forest	Pasture, Headwater Forest	Headwater Forest	Pasture	Pasture	Headwater Forest
<b>Existing Wetland Summary Information</b>						
<b>Parameters</b>						
Size of Wetland (acres)	0.02 (WA)		0.03 (WB and WC)			
Wetland Type	Bottomland Hardwood Forest		Bottomland Hardwood Forest			
Mapped Soil Series	Wynott-Enon Complex		Mecklenburg clay loam			
Drainage class	Well Drained		Well Drained			
Soil Hydric Status	Hydric		Hydric			
Source of Hydrology	Stream Floodplain		Hillside Seepage and Stream Floodplain			
Hydrologic Impairment	Ditching and Grazing		Ditching and Grazing			
Existing vegetation community	Forested Wetland (Headwater Forest)		Emergent Wetland (Non-Tidal Freshwater Marsh)			
<b>Regulatory Considerations</b>						
<b>Regulation</b>	<b>Applicable?</b>		<b>Resolved?</b>		<b>Supporting Documentation</b>	
Waters of the United States – Section 404	Yes		NWP 27		Jurisdictional Determination	
Waters of the United States – Section 401	Yes		NWP 27		Jurisdictional Determination	
Endangered Species Act	No		N/A		N/A	
Historic Preservation Act	No		N/A		N/A	
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No		N/A		N/A	
Essential Fisheries Habitat	No		N/A		N/A	

# **APPENDIX B**

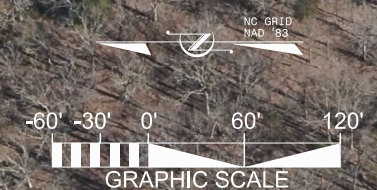
## Visual Assessment Data





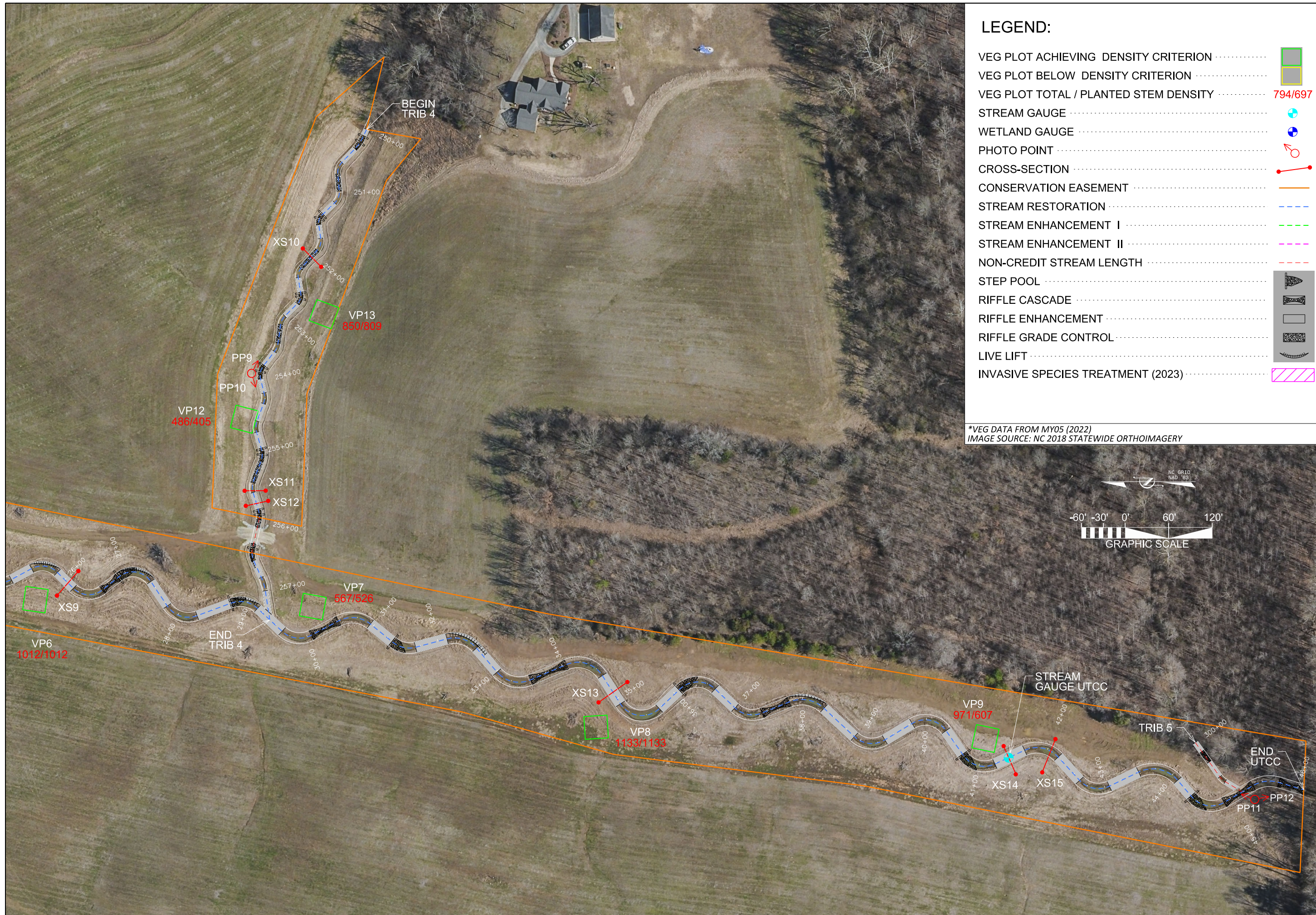
**LEGEND:**

- VEG PLOT ACHIEVING DENSITY CRITERION .....
- VEG PLOT BELOW DENSITY CRITERION .....
- VEG PLOT TOTAL / PLANTED STEM DENSITY ..... **794/697**
- STREAM GAUGE .....
- WETLAND GAUGE .....
- PHOTO POINT .....
- CROSS-SECTION .....
- CONSERVATION EASEMENT .....
- STREAM RESTORATION .....
- STREAM ENHANCEMENT I .....
- STREAM ENHANCEMENT II .....
- NON-CREDIT STREAM LENGTH .....
- STEP POOL .....
- RIFFLE CASCADE .....
- RIFFLE ENHANCEMENT .....
- RIFFLE GRADE CONTROL .....
- LIVE LIFT .....
- INVASIVE SPECIES TREATMENT (2023) .....



\*VEG DATA FROM MY05 (2022)  
 IMAGE SOURCE: NC 2018 STATEWIDE ORTHOIMAGERY

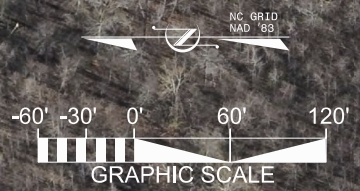
	REVISIONS
 <b>KCI</b> ASSOCIATES OF NC ENGINEERS • PLANNERS • SCIENTISTS 4505 FALLS OF NEUSE ROAD, SUITE 400 RALEIGH, NORTH CAROLINA 27609	
<b>CEDAR BRANCH          STREAM RESTORATION SITE          MONITORING YEAR 6</b> RANDOLPH COUNTY, NORTH CAROLINA	
DATE: NOV 2023 SCALE: GRAPHIC	
<b>CURRENT          CONDITION          PLAN VIEW</b>	
SHEET 1 OF 2	



**LEGEND:**

- VEG PLOT ACHIEVING DENSITY CRITERION ..... [Green Box]
- VEG PLOT BELOW DENSITY CRITERION ..... [Yellow Box]
- VEG PLOT TOTAL / PLANTED STEM DENSITY ..... 794/697
- STREAM GAUGE ..... [Blue Circle with Crosshair]
- WETLAND GAUGE ..... [Blue Circle with Plus]
- PHOTO POINT ..... [Red Circle with Arrow]
- CROSS-SECTION ..... [Red Line with Arrow]
- CONSERVATION EASEMENT ..... [Orange Line]
- STREAM RESTORATION ..... [Blue Dashed Line]
- STREAM ENHANCEMENT I ..... [Green Dashed Line]
- STREAM ENHANCEMENT II ..... [Magenta Dashed Line]
- NON-CREDIT STREAM LENGTH ..... [Red Dashed Line]
- STEP POOL ..... [Grey Triangle]
- RIFFLE CASCADE ..... [Grey Trapezoid]
- RIFFLE ENHANCEMENT ..... [Grey Rectangle]
- RIFFLE GRADE CONTROL ..... [Grey Rectangle with Dots]
- LIVE LIFT ..... [Grey Arch]
- INVASIVE SPECIES TREATMENT (2023) ..... [Pink Hatched Box]

\*VEG DATA FROM MY05 (2022)  
 IMAGE SOURCE: NC 2018 STATEWIDE ORTHOIMAGERY



	REVISIONS
 <b>KCI</b> ASSOCIATES OF NC ENGINEERS • PLANNERS • SCIENTISTS 4805 FALLS OF NEUSE ROAD, SUITE 400 RALEIGH, NORTH CAROLINA 27609	
<b>CEDAR BRANCH          STREAM RESTORATION SITE          MONITORING YEAR 6</b> RANDOLPH COUNTY, NORTH CAROLINA	
DATE: NOV 2023 SCALE: GRAPHIC	
<b>CURRENT          CONDITION          PLAN VIEW</b>	
SHEET 2 OF 2	

Table 5 Visual Stream Morphology Stability Assessment

Cedar Branch Stream Restoration Site, DMS Project#97009

Reach ID UTCC

Assessed Length 3,559

Assessment Date: 12/11/2023

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
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	48	48		100%	
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	47	47		100%	
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	47	47		100%	
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	48	48		100%	
		2. Thalweg centering at downstream of meander (Glide)	47	47		100%	
<b>Totals</b>					0	0	100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	36	36		100%	
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	36	36		100%	
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	36	36		100%	
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	36	36		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.	36	36		100%	

Table 5 Visual Stream Morphology Stability Assessment

Cedar Branch Stream Restoration Site, DMS Project#97009

Reach ID T1

Assessed Length 1,117

Assessment Date: 12/11/2023

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
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	14	14		100%	
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	14	14		100%	
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	14	14		100%	
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	14	14		100%	
		2. Thalweg centering at downstream of meander (Glide)	14	14		100%	
<b>Totals</b>					0	0	100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	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%. (See guidance for this table in EEP monitoring guidance document)	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 5** Visual Stream Morphology Stability Assessment

Cedar Branch Stream Restoration Site, DMS Project#97009

Reach ID T2

Assessed Length 127

Assessment Date: 12/11/2023

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
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	4	4		100%	
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	3	3		100%	
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	3	3		100%	
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	4	4		100%	
		2. Thalweg centering at downstream of meander (Glide)	3	3		100%	
<b>Totals</b>					0	0	100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	0	0		N/A	
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0		N/A	
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0		N/A	
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0		N/A	
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	0	0		N/A	

**Table 5** Visual Stream Morphology Stability Assessment

Cedar Branch Stream Restoration Site, DMS Project#97009

Reach ID T3

Assessed Length 1,157

Assessment Date: 12/11/2023

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
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	27	27			100%
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	37	37			100%
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	37	37			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	27	27			100%
		2. Thalweg centering at downstream of meander (Glide)	37	37			100%
<b>Totals</b>					0	0	100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	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%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
<b>Totals</b>					0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	28	28			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	28	28			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	28	28			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	28	28			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.	28	28			100%

Table 5 Visual Stream Morphology Stability Assessment

Cedar Branch Stream Restoration Site, DMS Project#97009

Reach ID T4

Assessed Length 692

Assessment Date: 12/11/2023

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	
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	19	19			100%	
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	22	22			100%	
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	22	22			100%	
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	19	19			100%	
		2. Thalweg centering at downstream of meander (Glide)	22	22			100%	
					<b>Totals</b>	0	0	100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	
	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%	
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	
					<b>Totals</b>	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	13	13			100%	
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	13	13			100%	
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	13			100%	
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	13	13			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.	13	13			100%	

**Table 6** **Vegetation Condition Assessment**

**Cedar Branch Stream Restoration Site, DMS Project# 97009**

**Planted Acreage**

**20.6**

Assessment Date: 12/11/2023

<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
<b>1. Bare Areas</b>	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
<b>2. Low Stem Density Areas</b>	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.36	1.7%
<b>Total</b>				<b>1</b>	<b>0.36</b>	<b>1.7%</b>
<b>3. Areas of Poor Growth Rates or Vigor</b>	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
<b>Cumulative Total</b>				<b>1</b>	<b>0.36</b>	<b>1.7%</b>
<b>Easement Acreage</b>						
<b>20.6</b>						
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Easement Acreage</b>
<b>4. Invasive Areas of Concern</b>	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
<b>5. Easement Encroachment Areas</b>	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%



## Photo Reference Photos



PP1 – MY-00 – 4/18/18



PP1 – MY-06 – 12/11/23



PP2 – MY-00 – 4/18/18



PP2 – MY-06 – 12/11/23



PP3 – MY-00 – 4/18/18



PP3 – MY-06 – 12/11/23



PP4 – MY-00 – 4/18/18



PP4 – MY-06 – 12/11/23



PP5 – MY-00 – 4/18/18



PP5 – MY-06 – 12/11/23



PP6– MY-00 – 4/18/18



PP6– MY-06 – 12/11/23



PP7 – MY-00 – 4/18/18



PP7 – MY-06 – 12/11/23



PP8 – MY-00 – 4/18/18



PP8 – MY-06 – 12/11/23



PP9 – MY-00 – 4/18/18



PP9 – MY-06 – 12/11/23



PP10 – MY-00 – 4/18/18



PP10 – MY-06 – 12/11/23



PP11 – MY-00 – 4/18/18



PP11 – MY-06 – 12/11/23



PP12– MY-00 – 4/18/18



PP12– MY-06 – 12/11/23

# **APPENDIX C**

## Vegetation Plot Data

Table 7. Stem Count by Plot and Species										
Cedar Branch Restoration Site, DMS Project #97009										
Species	Annual Means									
	MY05 (2022)		MY03 (2020)		MY02 (2019)		MY01 (2018)		MY00 (2018)	
	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
American Elm ( <i>Ulmus americana</i> )		3		1		1				
Baccharis ( <i>Baccharis hamifolia</i> )		1		1						
Black Walnut ( <i>Juglans nigra</i> )		7		1		1				
Black Willow ( <i>Salix nigra</i> )		3		3		3		1		
Eastern Sycamore ( <i>Platanus occidentalis</i> )	47	51	46	48	46	48	46	46		
Green Ash ( <i>Fraxinus pennsylvanica</i> )	37	40	37	37	37	37	36	38		
Oak ( <i>Quercus sp.</i> )									30	30
Persimmon ( <i>Diospyros virginiana</i> )	12	12	12	13	12	13	8	8		
Pin Oak ( <i>Quercus palustris</i> )	8	9	5	5	5	5	5	5		
River Birch ( <i>Betula nigra</i> )	14	14	16	16	16	16	16	16	6	6
Silver Willow ( <i>Salix sericea</i> )				1		1		1		
Smooth Sumac ( <i>Rhus glabra</i> )								1		
Swamp Chestnut Oak ( <i>Quercus michauxii</i> )	40	40	52	52	52	52	68	68		
Sweet Gum ( <i>Liquidambar styraciflua</i> )		8		2						
Tulip Poplar ( <i>Liriodendron tulipifera</i> )	15	15	19	21	19	21	31	31	13	13
White Oak ( <i>Quercus alba</i> )	21	21	20	20	20	20				
Willow Oak ( <i>Quercus phellos</i> )	30	31	30	30	30	30	31	31	1	1
Unknown									280	280
<b>Stem count</b>	224	255	237	251	237	248	241	246	330	330
<b>size (ares)</b>	13		13		13		13		13	
<b>size (ACRES)</b>	0.321		0.321		0.321		0.321		0.321	
<b>Species count</b>	9	14	9	15	9	13	8	11	5	5
<b>Stems per ACRE</b>	697	794	738	781	738	772	750	766	1027	1027

# **APPENDIX D**

## **Stream Measurement and Geomorphology Data**

<b>Table 8. UTCC Baseline Stream Data Summary Cedar Branch Restoration Site, DMS Project #97009</b>																	
<b>Parameter</b>	<b>Pre-Existing Condition</b>					<b>Reference Reach(es) Data</b>					<b>Design</b>			<b>As-built</b>			
<b>Dimension - Riffle</b>	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	UTCC-1	UTCC-2	UTCC-3	Min	Mean	Max	n
Bankfull Width (ft)	7.8	10.5	10.1	13.9	4	9.0	13.3	13.1	17.7	6	11.7	13.2	15.0	11.7	13.4	15.2	5
Floodprone Width (ft)	9.6	31.7	33.5	50.0	4	13.1	55.6	50.0	100.0	6	90	100	105	>40	>40	>50	5
Bankfull Mean Depth (ft)	1.2	1.4	1.4	1.7	4	0.9	1.2	1.2	1.5	6	1.0	1.0	1.1	0.8	1.0	1.1	5
Bankfull Max Depth (ft)	1.7	2.2	2.2	2.8	4	1.3	1.7	1.7	2.0	6	1.5	1.5	1.7	1.4	1.6	1.8	5
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	11.3	14.6	15.1	16.9	4	10.4	16.4	14.0	24.7	6	11.3	13.2	16.9	9.6	12.8	15.8	5
Width/Depth Ratio	5.3	7.6	6.9	11.4	4	7.6	11.1	11.5	13.4	6	12.1	13.2	13.2	10.8	14.3	18.1	5
Entrenchment Ratio	1.2	2.9	2.6	5.0	4	1.3	3.8	3.9	5.9	6	>2.2	>2.2	>2.2	2.9	3.6	4.8	5
Bank Height Ratio	1.0	1.9	2.0	2.5	4	1.0	1.0	1.0	1.0	6	1.0	1.0	1.0	1.0	1.0	1.0	5
<b>Pattern</b>																	
Channel Beltwidth (ft)	*					45					41-54	46-58	53-74	41	54	74	47
Radius of Curvature (ft)	*					13-42					25-35	30-35	35-45	25	34	45	47
Rc:Bankfull width (ft/ft)	*					1.3-4.4					2.1-3.0	2.3-2.7	2.3-3.0	2.1	2.6	3.0	47
Meander Wavelength (ft)	*					93-136					101-150	115-155	153-180	101	142	180	47
Meander Width Ratio	*					4.5-5.0					3.5-4.6	3.5-4.4	3.5-4.9	3.5	4.1	4.9	47
<b>Profile</b>																	
Riffle Length (ft)														4.6	34.7	57.4	48
Riffle Slope (ft/ft)	0.021	0.032	0.03	0.048	4	0.013-0.028					0.020-0.037	0.020-0.035	0.020-0.035	0.039	0.023	0.053	48
Pool Length (ft)	*					3-25					19-42	20-49	36-61	4.3	28.5	55.0	47
Pool Spacing (ft)	*					30-59					50-83	67-91	79-105	37.3	77.5	124.0	47
<b>Substrate and Transport Parameters</b>																	
SC% / Sa% / G% / C% / B% / Be%	0%/23%/63%/13%/1%/0%					0.3%/19%/66%/14%/0.7%/0%								3%/6%/67%/23%/0%/0%			
d16 / d35 / d50 / d84 / d95 (mm)	1.5/5.4/16/55/90					1.7/6.4/19/56/93								10/27/37/78/113			
<b>Channel Characteristics</b>																	
Channel length (ft)	3,246										1,400	512	1,650	3,562			
Drainage Area (SM)	0.45					0.13-0.49					0.22	0.28	0.41	0.41			
Rosgen Classification	G4c-E4					B4c					C4	C4	C4	C4			
Sinuosity	1.0					1.2					1.2	1.2	1.2	1.2			
Water Surface Slope (ft/ft)	0.015					0.013					0.013	0.013	0.013	0.013			

\*No data shown due to channelization/lack of bed diversity



<b>Table 8. T1 Baseline Stream Data Summary</b>																			
<b>Cedar Branch Restoration Site, DMS Project #97009</b>																			
<b>Parameter</b>	<b>Pre-Existing Condition</b>					<b>Reference Reach(es) Data (UTCC)</b>					<b>Design</b>				<b>As-built</b>				
<b>Dimension - Riffle</b>	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Mean	Max	n	Min	Mean	Max	n	
Bankfull Width (ft)	5.8					9.0	13.3	13.1	17.7	6	7.8				8.9				
Floodprone Width (ft)	9.0					13.1	55.6	50.0	100.0	6	50				>40				
Bankfull Mean Depth (ft)	0.9					0.9	1.2	1.2	1.5	6	0.6				0.5				
Bankfull Max Depth (ft)	1.2					1.3	1.7	1.7	2.0	6	1.0				1.0				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	5.0					10.4	16.4	14.0	24.7	6	5.0				4.6				
Width/Depth Ratio	6.7					7.6	11.1	11.5	13.4	6	12.1				17.0				
Entrenchment Ratio	1.5					1.3	3.8	3.9	5.9	6	>2.2				4.2				
Bank Height Ratio	2.3					1.0	1.0	1.0	1.0	6	1.0				1.0				
<b>Pattern</b>																			
Channel Beltwidth (ft)			*					45			29-36				29	33	36	14	
Radius of Curvature (ft)			*					13-42			15-25				15	20	25	14	
Rc:Bankfull width (ft/ft)			*					1.3-4.4			1.9-3.2				1.9	2.6	3.2	14	
Meander Wavelength (ft)			*					93-136			72-80				72	76	80	14	
Meander Width Ratio			*					4.5-5.0			3.7-4.6				3.7	4.2	4.6	14	
<b>Profile</b>																			
Riffle Length (ft)															3.6	20.9	32.9	14	
Riffle Slope (ft/ft)	0.018							0.013-0.028			0.025-0.040				0.019	0.042	0.076	14	
Pool Length (ft)	*							3-25			8-25				5.1	11.8	20.1	14	
Pool Spacing (ft)	*							30-59			42-51				17.1	40.1	58.5	14	
<b>Substrate and Transport Parameters</b>																			
SC% / Sa% / G% / C% / B% / Be%	0%/15%/75%/10%/0%/0%					0.3%/19%/66%/14%/0.7%/0%									1%/14%/79%/6%/0%/0%				
d16 / d35 / d50 / d84 / d95 (mm)	2.1/5/12/50/98					1.7/6.4/19/56/93									2.7/15/24/47/77				
Channel length (ft)	1,036										1,118				1,118				
Drainage Area (SM)	0.05					0.13-0.49					0.05				0.05				
Rosgen Classification	G4					B4c					C4b				C4b				
Sinuosity	1.0					1.2					1.3				1.3				
Water Surface Slope (ft/ft)	0.031					0.013					0.025				0.025				

\*No data shown due to channelization/lack of bed diversity

<b>Table 8. T2 Baseline Stream Data Summary</b>																		
<b>Cedar Branch Restoration Site, DMS Project #97009</b>																		
<b>Parameter</b>	<b>Pre-Existing Condition</b>					<b>Reference Reach(es) Data (UTCC)</b>					<b>Design</b>				<b>As-built</b>			
<b>Dimension - Riffle</b>	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Mean	Max	n	Min	Mean	Max	n
Bankfull Width (ft)	**					9.0	13.3	13.1	17.7	6	7.8				**			
Floodprone Width (ft)	**					13.1	55.6	50.0	100.0	6	30				**			
Bankfull Mean Depth (ft)	**					0.9	1.2	1.2	1.5	6	0.6				**			
Bankfull Max Depth (ft)	**					1.3	1.7	1.7	2.0	6	1.0				**			
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	**					10.4	16.4	14.0	24.7	6	5.0				**			
Width/Depth Ratio	**					7.6	11.1	11.5	13.4	6	12.1				**			
Entrenchment Ratio	**					1.3	3.8	3.9	5.9	6	>2.2				**			
Bank Height Ratio	**					1.0	1.0	1.0	1.0	6	1.0				**			
<b>Pattern</b>																		
Channel Beltwidth (ft)			*					45			N/A				**			
Radius of Curvature (ft)			*					13-42			15-25				**			
Rc:Bankfull width (ft/ft)			*					1.3-4.4			1.9-3.2				**			
Meander Wavelength (ft)			*					93-136			N/A				**			
Meander Width Ratio			*					4.5-5.0			N/A				**			
<b>Profile</b>																		
Riffle Length (ft)	**														9.4	20.0	24.9	4
Riffle Slope (ft/ft)	**							0.013-0.028			0.026-0.027				0.023	0.025	0.027	4
Pool Length (ft)	**							3-25			12-17				6.4	8.1	9.0	3
Pool Spacing (ft)	**							30-59			38				36.4	37.8	39.1	3
<b>Substrate and Transport Parameters</b>																		
SC% / Sa% / G% / C% / B% / Be%			**					0.3%/19%/66%/14%/0.7%/0%								**		
d16 / d35 / d50 / d84 / d95 (mm)			**					1.7/6.4/19/56/93								**		
Channel length (ft)				123									127					127
Drainage Area (SM)				0.03				0.13-0.49					0.03					0.03
Rosgen Classification				G4				B4c					C4					C4
Sinuosity				1.0				1.2					N/A					N/A
Water Surface Slope (ft/ft)				0.031				0.013					0.017					0.016

\*No data shown due to channelization/lack of bed diversity

<b>Table 8. T3 Baseline Stream Data Summary</b>																		
<b>Cedar Branch Restoration Site, DMS Project #97009</b>																		
<b>Parameter</b>	<b>Pre-Existing Condition</b>					<b>Reference Reach(es) Data (UTCC)</b>					<b>Design</b>				<b>As-built</b>			
<b>Dimension - Riffle</b>	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Mean	Max	n	Min	Mean	Max	n
Bankfull Width (ft)	4.7	5.4		6.0	2	9.0	13.3	13.1	17.7	6	7.8				5.9	5.9	6.0	2
Floodprone Width (ft)	11.3	13.5		15.7	2	13.1	55.6	50.0	100.0	6	30				>25	>25	>25	2
Bankfull Mean Depth (ft)	0.8	0.8		0.8	2	0.9	1.2	1.2	1.5	6	0.6				0.4	0.5	0.5	2
Bankfull Max Depth (ft)	1.3	1.3		1.3	2	1.3	1.7	1.7	2.0	6	1.0				0.7	0.8	0.8	2
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	3.9	4.5		5.0	2	10.4	16.4	14.0	24.7	6	5.0				2.5	2.8	3.1	2
Width/Depth Ratio	5.6	6.4		7.1	2	7.6	11.1	11.5	13.4	6	12.1				11.4	12.6	13.8	2
Entrenchment Ratio	1.3	2.4		3.4	2	1.3	3.8	3.9	5.9	6	>2.2				4.4	4.7	5.1	2
Bank Height Ratio	1.6	2.1		2.6	2	1.0	1.0	1.0	1.0	6	1.0				1.0	1.0	1.0	2
<b>Pattern</b>																		
Channel Beltwidth (ft)			*					45			N/A							
Radius of Curvature (ft)			*					13-42			15-25							
Rc:Bankfull width (ft/ft)			*					1.3-4.4			1.9-3.2							
Meander Wavelength (ft)			*					93-136			N/A							
Meander Width Ratio			*					4.5-5.0			N/A							
<b>Profile</b>																		
Riffle Length (ft)															19.7	28.1	68.8	26
Riffle Slope (ft/ft)	0.046	0.067		0.087	2			0.013-0.028			0.025-0.042				0.021	0.034	0.063	26
Pool Length (ft)	*							3-25			11-22				3.6	7.3	11.3	35
Pool Spacing (ft)	*							30-59			32-55				6.8	30.5	85.9	35
<b>Substrate and Transport Parameters</b>																		
SC% / Sa% / G% / C% / B% / Be%	0%/31%/63%/6%/0%/0%					0.3%/19%/66%/14%/0.7%/0%									6%/0%/75%/19%/0%/0%			
d16 / d35 / d50 / d84 / d95 (mm)	1.0/2.4/6.5/33/73					1.7/6.4/19/56/93									18/32/41/71/105			
Channel length (ft)	1,141										1,157				1,157			
Drainage Area (SM)	0.04					0.13-0.49					0.04				0.04			
Rosgen Classification	E4					B4c					C4b				C4b			
Sinuosity	1.0					1.2					N/A				N/A			
Water Surface Slope (ft/ft)	0.037					0.013					0.035				0.035			

\*No data shown due to channelization/lack of bed diversity

<b>Table 8. T4 Baseline Stream Data Summary</b>																			
<b>Cedar Branch Restoration Site, DMS Project #97009</b>																			
<b>Parameter</b>	<b>Pre-Existing Condition</b>					<b>Reference Reach(es) Data (UTCC)</b>					<b>Design</b>				<b>As-built</b>				
<b>Dimension - Riffle</b>	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Mean	Max	n	Min	Mean	Max	n	
Bankfull Width (ft)	6.5					9.0	13.3	13.1	17.7	6	7.8				6.7	6.8	6.9	2	
Floodprone Width (ft)	7.8					13.1	55.6	50.0	100.0	6	30				>30	>30	>30	2	
Bankfull Mean Depth (ft)	0.8					0.9	1.2	1.2	1.5	6	0.6				0.5	0.5	0.5	2	
Bankfull Max Depth (ft)	1.0					1.3	1.7	1.7	2.0	6	1.0				0.8	0.8	0.8	2	
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	5.0					10.4	16.4	14.0	24.7	6	5.0				3.3	3.4	3.5	2	
Width/Depth Ratio	8.5					7.6	11.1	11.5	13.4	6	12.1				12.7	13.6	14.6	2	
Entrenchment Ratio	1.2					1.3	3.8	3.9	5.9	6	>2.2				4.7	4.9	5.1	2	
Bank Height Ratio	4.5					1.0	1.0	1.0	1.0	6	1.0				1.0	1.0	1.0	2	
<b>Pattern</b>																			
Channel Beltwidth (ft)			*					45			N/A								
Radius of Curvature (ft)			*					13-42			15-25								
Rc:Bankfull width (ft/ft)			*					1.3-4.4			1.9-3.2								
Meander Wavelength (ft)			*					93-136			N/A								
Meander Width Ratio			*					4.5-5.0			N/A								
<b>Profile</b>																			
Riffle Length (ft)															5.5	21.5	42.1	19	
Riffle Slope (ft/ft)	0.038							0.013-0.028			0.030-0.040				0.017	0.040	0.121	19	
Pool Length (ft)	*							3-25			13-19				4.0	8.5	12.7	21	
Pool Spacing (ft)	*							30-59			34-48				5.5	32.3	55.1	21	
<b>Substrate and Transport Parameters</b>																			
SC% / Sa% / G% / C% / B% / Be%	0%/23%/72%/5%/0%/0%					0.3%/19%/66%/14%/0.7%/0%					3%/0%/73%/24%/0%/0%								
d16 / d35 / d50 / d84 / d95 (mm)	1.6/4.0/6.4/35/67					1.7/6.4/19/56/93					28/37/44/78/115								
Channel length (ft)	677										692				692				
Drainage Area (SM)	0.05					0.13-0.49					0.05				0.05				
Rosgen Classification	G4					B4c					C4b				C4b				
Sinuosity	1.0					1.2					N/A				N/A				
Water Surface Slope (ft/ft)	0.031					0.013					0.028				0.028				

\*No data shown due to channelization/lack of bed diversity

<b>Table 9. Cross-Section Morphology Data Tables</b>																					
<b>Cedar Branch Stream Restoration Site, DMS Project #97009</b>																					
Dimension and Substrate	Cross-Section 1 (Riffle) Station 57+19, T1							Cross-Section 2 (Pool) Station 57+44, T1							Cross-Section 3 (Pool) Station 13+58, UTCC						
	666.60							665.93							657.32						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Baseline Bankfull Elevation:	666.60							665.93							657.32						
Bankfull Width (ft)	8.9	8.3	8.6	9.8	9.8			11.8	13.5	12.9	13.4	15.6			13.5	13.6	13.8	15.0	15.0		
Floodprone Width (ft)	>40	>40	>40	>40	>35			-	-	-	-	-			-	-	-	-	-		
Bankfull Mean Depth (ft)	0.5	0.6	0.5	0.5	0.5			1.1	1.0	1.0	0.9	0.9			1.5	1.5	1.5	1.3	1.3		
Bankfull Max Depth (ft)	1.0	1.0	1.0	1.1	1.1			2.1	2.0	2.0	2.1	2.1			2.8	2.8	2.9	2.8	2.8		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	4.6	4.6	4.6	4.6	4.6			13.4	13.4	13.4	13.4	13.4			20.2	20.2	20.2	20.2	20.2		
Total Cross-Sectional Area (ft <sup>2</sup> )	4.6	4.3	4.4	3.9	3.9			13.4	11.8	12.2	9.8	9.8			20.2	20.0	20.2	20.1	20.1		
Bankfull Width/Depth Ratio	17.0	14.8	15.9	20.7	20.7			-	-	-	-	-			-	-	-	-	-		
Bankfull Entrenchment Ratio	4.2	4.6	4.0	3.8	3.8			-	-	-	-	-			-	-	-	-	-		
Bankfull Bank Height Ratio	1.0	0.9	1.0	1.0	0.9			-	-	-	-	-			-	-	-	-	-		
d50 (mm)	24	18	2.5	41	-			-	-	-	-	-			-	-	-	-	-		
	Cross-Section 4 (Riffle) Station 13+85, UTCC							Cross-Section 5 (Riffle) Station 22+44, UTCC							Cross-Section 6 (Riffle) Station 96+69, T3						
Baseline Bankfull Elevation:	666.93							656.55							656.12						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Width (ft)	12.1	12.5	12.7	12.0	11.1			14.5	14.3	14.1	14.8	14.8			6.0	6.5	5.8	6.7	5.3		
Floodprone Width (ft)	>50	>50	>50	>50	>50			>45	>45	>45	>45	>45			>30	>30	>30	>30	>25		
Bankfull Mean Depth (ft)	1.0	1.0	1.0	1.1	1.1			1.1	1.1	1.1	1.1	1.1			0.5	0.5	0.5	0.5	0.6		
Bankfull Max Depth (ft)	1.7	1.7	1.8	1.7	1.7			1.7	1.9	1.9	1.8	1.8			0.8	1.0	1.0	1.0	1.0		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	12.6	12.6	12.6	12.6	12.6			15.8	15.8	15.8	15.8	15.8			3.1	3.1	3.1	3.1	3.1		
Total Cross-Sectional Area (ft <sup>2</sup> )	12.6	13.8	12.6	13.3	14.1			15.8	15.7	16.6	14.6	14.6			3.1	3.2	3.0	3.2	2.7		
Bankfull Width/Depth Ratio	11.6	12.3	12.7	11.4	9.8			13.3	13.0	12.6	13.9	13.9			11.7	13.7	10.8	14.4	8.9		
Bankfull Entrenchment Ratio	4.6	4.5	4.1	4.7	4.7			3.1	3.2	3.2	3.1	3.1			4.4	4.1	4.6	3.9	5.0		
Bankfull Bank Height Ratio	1.0	1.0	0.9	0.9	1.0			1.0	1.0	1.0	1.0	1.0			1.0	0.9	0.9	0.9	0.9		
d50 (mm)	33	49	40	18	-			31	40	69	26	-			41	41	54	15	-		

Bank Height Ratios are calculated based on the baseline (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section parameters are calculated based on the current year's low bank height.

**Table 9. Cross-Section Morphology Data Tables**  
**Cedar Branch Stream Restoration Site, DMS Project #97009**

Dimension and Substrate	Cross-Section 7 (Pool) Station 99+07, T3							Cross-Section 8 (Riffle) Station 99+25, T3							Cross-Section 9 (Riffle) Station 26+17, UTCC						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Baseline Bankfull Elevation:	666.60							665.93							657.32						
Bankfull Width (ft)	10.3	8.9	8.5	9.1	10.2			6.0	5.6	6.1	5.4	5.4			13.2	13.0	13.8	13.6	13.6		
Floodprone Width (ft)	-	-	-	-	-			>30	>30	>30	>30	>30			>40	>40	>40	>40	>40		
Bankfull Mean Depth (ft)	0.7	0.8	0.8	0.8	0.7			0.4	0.4	0.4	0.5	0.5			1.0	1.0	0.9	1.0	1.0		
Bankfull Max Depth (ft)	1.8	1.6	1.7	1.7	1.6			0.7	0.9	0.9	0.8	0.8			1.8	1.8	2.0	1.9	1.9		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	6.9	6.9	6.9	6.9	6.9			2.5	2.5	2.5	2.5	2.5			13.0	13.0	13.0	13.0	13.0		
Total Cross-Sectional Area (ft <sup>2</sup> )	6.9	8.7	7.2	7.6	6.8			2.5	2.7	2.7	2.3	2.3			13.0	12.0	12.7	12.1	12.1		
Bankfull Width/Depth Ratio	-	-	-	-	-			14.1	12.6	14.8	11.5	11.5			13.3	12.9	14.7	14.3	14.3		
Bankfull Entrenchment Ratio	-	-	-	-	-			5.0	5.4	4.9	5.7	5.7			3.4	3.5	3.2	3.3	3.3		
Bankfull Bank Height Ratio	-	-	-	-	-			1.0	1.1	1.0	1.0	1.0			1.0	0.9	1.0	0.9	1.0		
d50 (mm)	-	-	-	-	-			40	18	29	10	-			57	50	48	34	-		
	Cross-Section 10 (Riffle) Station 252+25, T4							Cross-Section 11 (Pool) Station 225+97, T4							Cross-Section 12 (Riffle) Station 226+04, T4						
Baseline Bankfull Elevation:	666.93							656.55							656.12						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Width (ft)	7.0	8.7	7.2	7.9	7.9			10.2	9.6	10.0	9.9	9.9			6.7	6.9	7.0	7.3	7.3		
Floodprone Width (ft)	>30	>30	>30	>35	>35			-	-	-	-	-			>30	>30	>30	>30	>30		
Bankfull Mean Depth (ft)	0.5	0.4	0.5	0.4	0.4			1.1	1.1	1.1	1.1	1.1			0.5	0.5	0.5	0.5	0.5		
Bankfull Max Depth (ft)	0.8	1.0	1.0	1.0	1.0			2.1	2.0	2.0	2.1	2.1			0.8	0.8	0.9	0.8	0.9		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	3.3	3.3	3.3	3.3	3.3			10.8	10.8	10.8	10.8	10.8			3.5	3.5	3.5	3.5	3.5		
Total Cross-Sectional Area (ft <sup>2</sup> )	3.3	3.0	2.4	2.4	2.4			10.8	11.9	11.6	11.6	11.6			3.5	3.8	3.1	2.7	2.7		
Bankfull Width/Depth Ratio	14.9	23.0	15.7	18.9	18.9			-	-	-	-	-			12.9	13.6	14.1	15.3	15.3		
Bankfull Entrenchment Ratio	5.1	4.1	5.0	4.5	4.5			-	-	-	-	-			4.7	4.6	4.5	4.3	4.3		
Bankfull Bank Height Ratio	1.0	0.9	1.0	1.0	1.0			-	-	-	-	-			1.0	1.0	1.0	1.0	0.9		
d50 (mm)	42	36	6	6	-			-	-	-	-	-			45	32	22	24	-		

Bank Height Ratios are calculated based on the baseline (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section parameters are calculated based on the current year's low bank height.

<b>Table 9. Cross-Section Morphology Data Tables</b>																					
<b>Cedar Branch Stream Restoration Site, DMS Project #97009</b>																					
<b>Dimension and Substrate</b>	<b>Cross-Section 13 (Riffle) Station 35+12, UTCC</b>							<b>Cross-Section 14 (Riffle) Station 41+94, UTCC</b>							<b>Cross-Section 15 (Pool) Station 42+58, UTCC</b>						
Baseline Bankfull Elevation:	645.24							637.94							637.43						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Width (ft)	12.7	13.8	13.1	12.5	13.0			15.3	13.9	13.8	14.3	14.3			22.5	20.7	21.4	20.8	31.3		
Floodprone Width (ft)	>50	>50	>50	>50	>45			>40	>40	>40	>40	>40			-	-	-	-	-		
Bankfull Mean Depth (ft)	0.8	0.7	0.7	0.8	0.7			0.8	0.9	0.9	0.9	0.9			1.6	1.7	1.7	1.7	1.1		
Bankfull Max Depth (ft)	1.4	1.4	1.5	1.5	1.4			1.7	1.7	1.7	1.7	1.7			3.4	3.3	3.2	3.2	3.2		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	9.6	9.6	9.6	9.6	9.6			12.8	12.8	12.8	12.8	12.8			35.8	35.8	35.8	35.8	35.8		
Total Cross-Sectional Area (ft <sup>2</sup> )	9.6	7.9	7.8	8.5	6.8			12.8	12.6	14.3	12.2	12.2			35.8	32.8	36.2	32.8	29.0		
Bankfull Width/Depth Ratio	16.7	19.8	17.8	16.3	17.7			18.3	15.1	14.8	16.0	16.0			-	-	-	-	-		
Bankfull Entrenchment Ratio	3.8	3.5	3.7	3.9	3.7			2.8	3.1	3.1	3.0	3.0			-	-	-	-	-		
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.1			1.0	1.1	1.0	1.2	1.2			-	-	-	-	-		
d50 (mm)	16	13	61	13	-			61	51	42	23	-			-	-	-	-	-		

Bank Height Ratios are calculated based on the baseline (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section parameters are calculated based on the current year's low bank height.

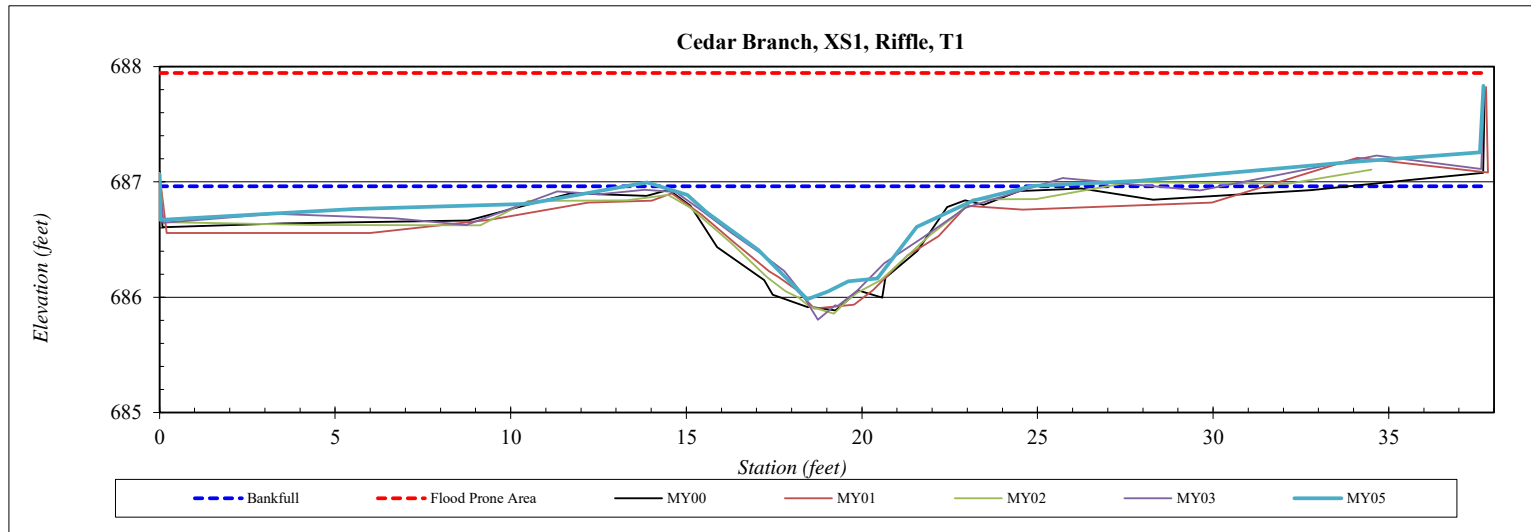
## Cross-Section Plots

<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS1
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	687.07
0.0	686.67
5.6	686.77
10.5	686.81
13.9	687.00
15.0	686.89
15.6	686.74
17.0	686.41
18.0	686.11
18.4	685.98
19.0	686.05
19.6	686.14
20.4	686.16
21.6	686.61
23.2	686.84
24.9	686.96
27.9	687.01
33.9	687.17
37.6	687.26
37.7	687.83

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	686.96
<b>Bankfull Cross-Sectional Area:</b>	4.6
<b>Total Cross-Sectional Area:</b>	3.5
<b>Bankfull Width:</b>	10.6
<b>Flood Prone Area Elevation:</b>	687.9
<b>Flood Prone Width:</b>	37.7
<b>Max Depth at Bankfull:</b>	1.0
<b>Mean Depth at Bankfull:</b>	0.4
<b>W / D Ratio:</b>	24.4
<b>Entrenchment Ratio:</b>	3.5
<b>Bank Height Ratio:</b>	0.9



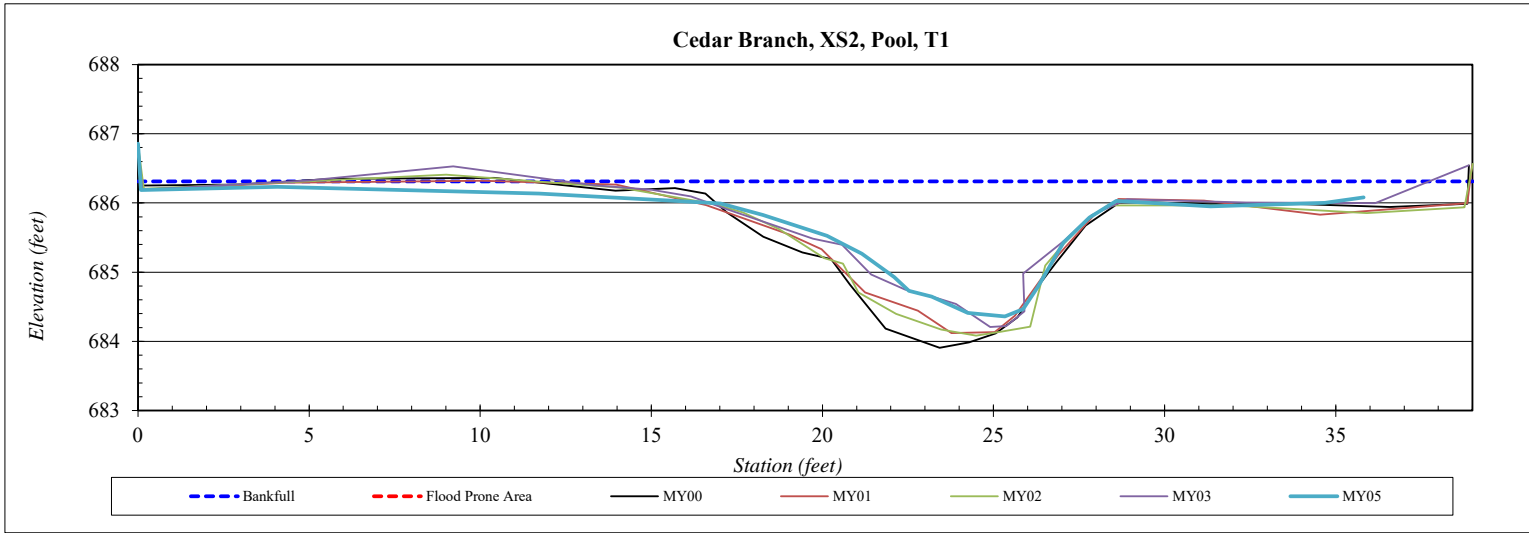


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS2
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	686.86
0.1	686.19
4.1	686.23
11.7	686.14
15.6	686.03
17.0	685.99
18.3	685.82
20.1	685.52
21.2	685.27
22.1	684.93
22.5	684.73
23.2	684.65
24.2	684.41
25.3	684.36
25.9	684.47
26.3	684.78
27.0	685.43
27.8	685.79
28.6	686.03
31.3	685.95
34.7	686.00
35.8	686.08

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	686.32
<b>Bankfull Cross-Sectional Area:</b>	13.4
<b>Total Cross-Sectional Area:</b>	9.4
<b>Bankfull Width:</b>	13.0
<b>Flood Prone Area Elevation:</b>	---
<b>Flood Prone Width:</b>	---
<b>Max Depth at Bankfull:</b>	2.0
<b>Mean Depth at Bankfull:</b>	1.0
<b>W / D Ratio:</b>	---
<b>Entrenchment Ratio:</b>	---
<b>Bank Height Ratio:</b>	---

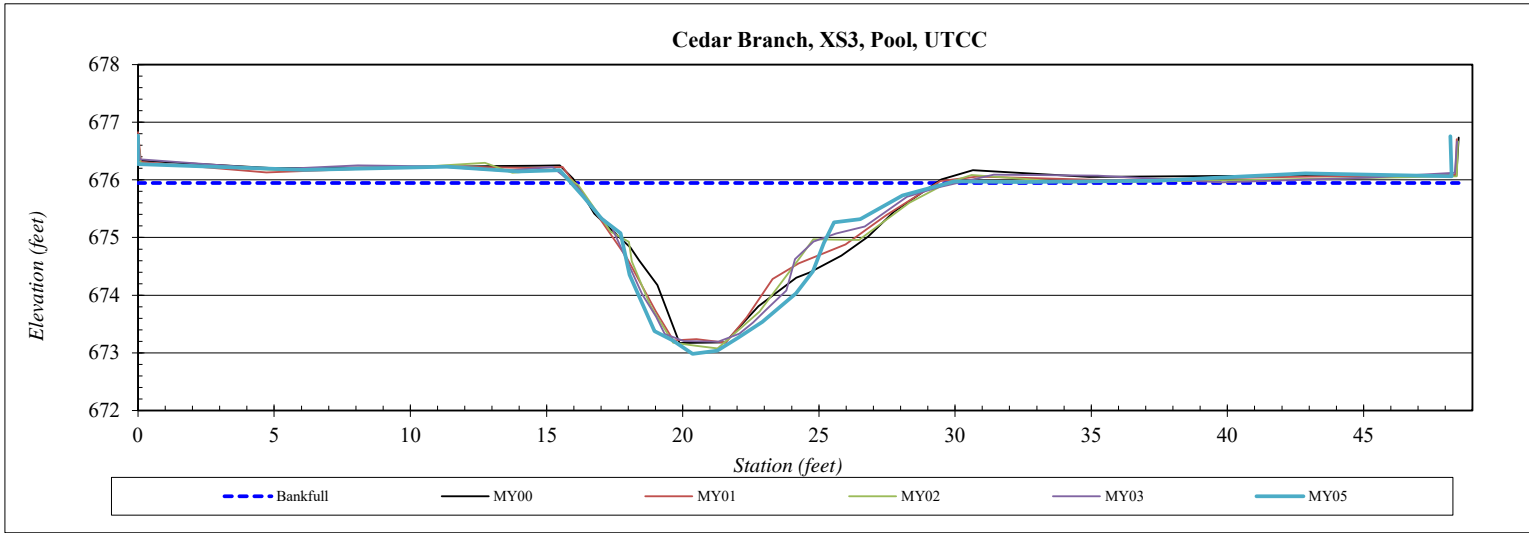


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS3
<b>Drainage Area (sq mi):</b>	0.21
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	676.77
0.0	676.27
6.1	676.18
11.4	676.23
14.0	676.15
15.5	676.17
16.4	675.71
17.0	675.33
17.7	675.08
18.0	674.35
19.0	673.38
19.6	673.22
20.4	672.99
21.3	673.04
22.0	673.25
22.9	673.54
24.2	674.03
24.8	674.41
25.2	674.90
25.6	675.26
26.5	675.32
28.1	675.73
30.0	675.98
32.4	675.97
37.3	675.98
42.9	676.11
48.2	676.06
48.2	676.76

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	675.95
<b>Bankfull Cross-Sectional Area:</b>	20.2
<b>Total Cross-Sectional Area:</b>	21.3
<b>Bankfull Width:</b>	13.9
<b>Flood Prone Area Elevation:</b>	---
<b>Flood Prone Width:</b>	---
<b>Max Depth at Bankfull:</b>	3.0
<b>Mean Depth at Bankfull:</b>	1.5
<b>W / D Ratio:</b>	---
<b>Entrenchment Ratio:</b>	---
<b>Bank Height Ratio:</b>	---

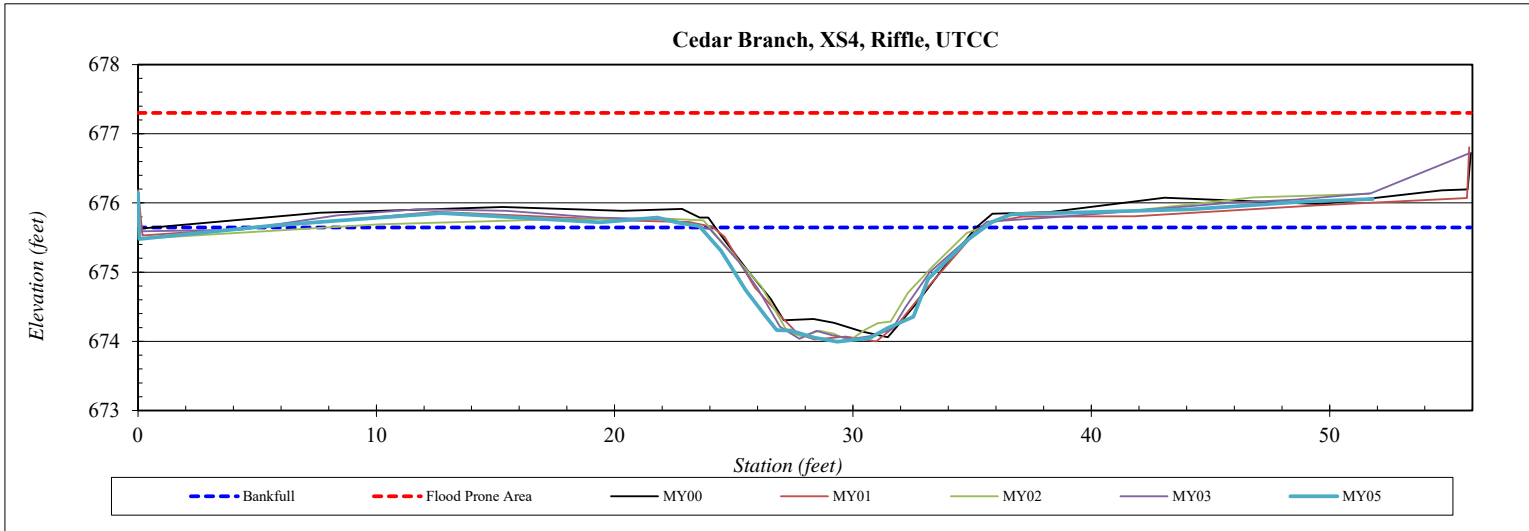


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS4
<b>Drainage Area (sq mi):</b>	0.21
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	676.15
0.0	675.48
5.8	675.68
12.7	675.85
19.4	675.72
21.8	675.79
22.6	675.72
23.6	675.66
24.5	675.31
25.5	674.74
26.3	674.36
26.8	674.16
27.4	674.16
28.4	674.05
29.3	674.00
30.1	674.02
30.7	674.05
31.4	674.19
32.5	674.36
33.2	674.90
34.8	675.48
35.8	675.72
36.7	675.84
38.5	675.86
44.2	675.91
49.0	676.02
51.8	676.06

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	675.65
<b>Bankfull Cross-Sectional Area:</b>	12.6
<b>Total Cross-Sectional Area:</b>	14.5
<b>Bankfull Width:</b>	11.9
<b>Flood Prone Area Elevation:</b>	677.3
<b>Flood Prone Width:</b>	51.8
<b>Max Depth at Bankfull:</b>	1.7
<b>Mean Depth at Bankfull:</b>	1.1
<b>W / D Ratio:</b>	11.3
<b>Entrenchment Ratio:</b>	4.3
<b>Bank Height Ratio:</b>	1.0

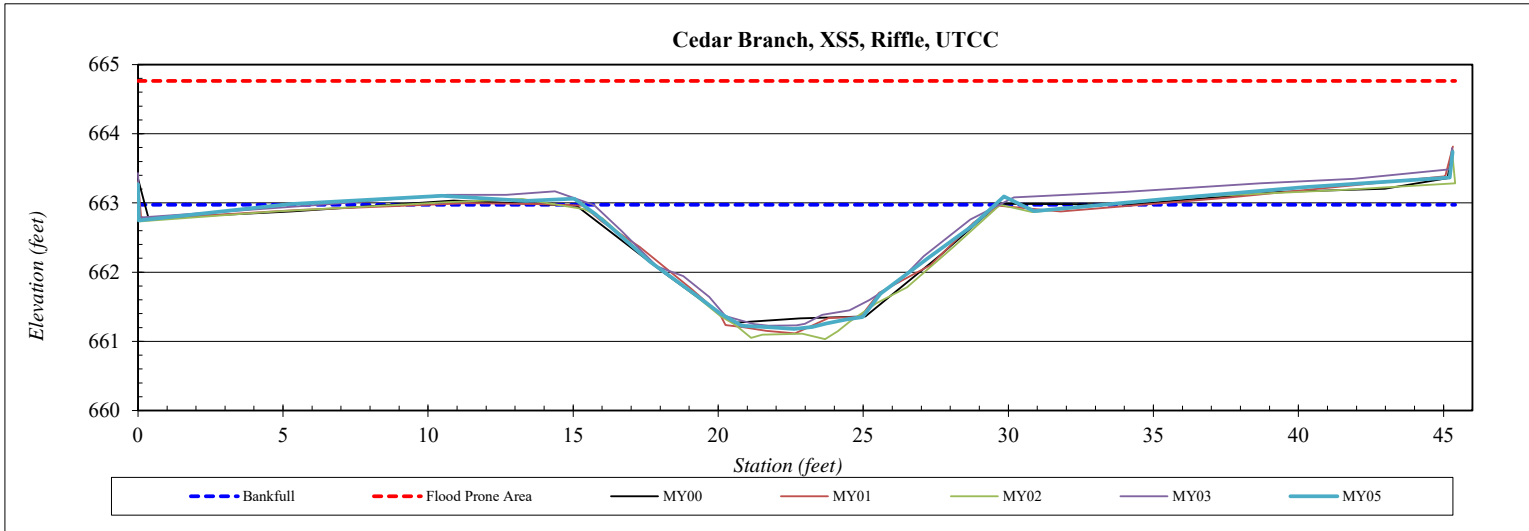


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS5
<b>Drainage Area (sq mi):</b>	0.21
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	663.27
0.0	662.75
5.2	662.98
10.5	663.11
13.4	663.03
15.0	663.06
15.8	662.84
16.3	662.66
17.6	662.15
19.2	661.67
20.1	661.40
20.8	661.23
22.0	661.20
22.6	661.18
23.2	661.21
23.7	661.26
24.4	661.32
25.0	661.35
25.6	661.69
27.3	662.21
28.8	662.67
29.8	663.10
30.9	662.88
35.4	663.06
40.2	663.23
45.2	663.37
45.3	663.74

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	662.97
<b>Bankfull Cross-Sectional Area:</b>	15.8
<b>Total Cross-Sectional Area:</b>	15.6
<b>Bankfull Width:</b>	14.2
<b>Flood Prone Area Elevation:</b>	664.8
<b>Flood Prone Width:</b>	45.3
<b>Max Depth at Bankfull:</b>	1.8
<b>Mean Depth at Bankfull:</b>	1.1
<b>W / D Ratio:</b>	12.8
<b>Entrenchment Ratio:</b>	3.2
<b>Bank Height Ratio:</b>	1.0

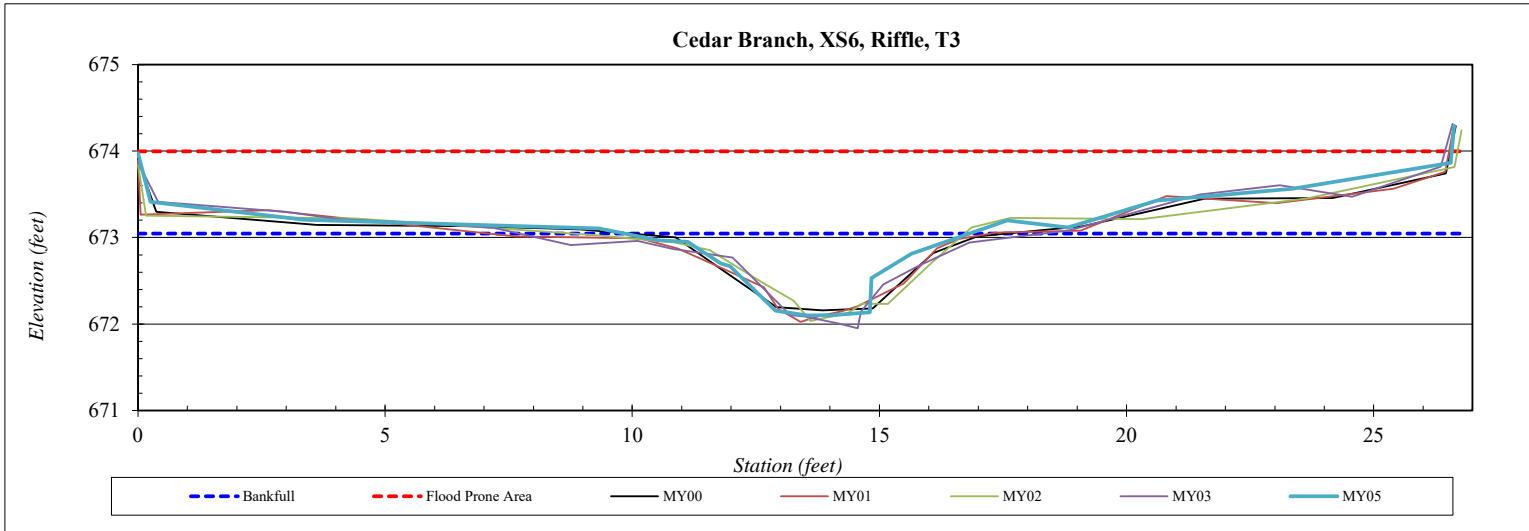


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS6
<b>Drainage Area (sq mi):</b>	0.04
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	673.98
0.3	673.41
3.4	673.20
6.9	673.15
9.3	673.11
10.5	672.97
11.1	672.95
11.8	672.70
12.0	672.67
12.9	672.16
13.5	672.10
13.9	672.10
14.0	672.10
14.8	672.14
14.8	672.53
15.6	672.81
17.6	673.20
18.8	673.12
20.6	673.43
23.4	673.56
26.6	673.86
26.6	674.30

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	673.05
<b>Bankfull Cross-Sectional Area:</b>	3.1
<b>Total Cross-Sectional Area:</b>	2.8
<b>Bankfull Width:</b>	7.0
<b>Flood Prone Area Elevation:</b>	674.0
<b>Flood Prone Width:</b>	26.6
<b>Max Depth at Bankfull:</b>	0.9
<b>Mean Depth at Bankfull:</b>	0.4
<b>W / D Ratio:</b>	15.7
<b>Entrenchment Ratio:</b>	3.8
<b>Bank Height Ratio:</b>	0.9

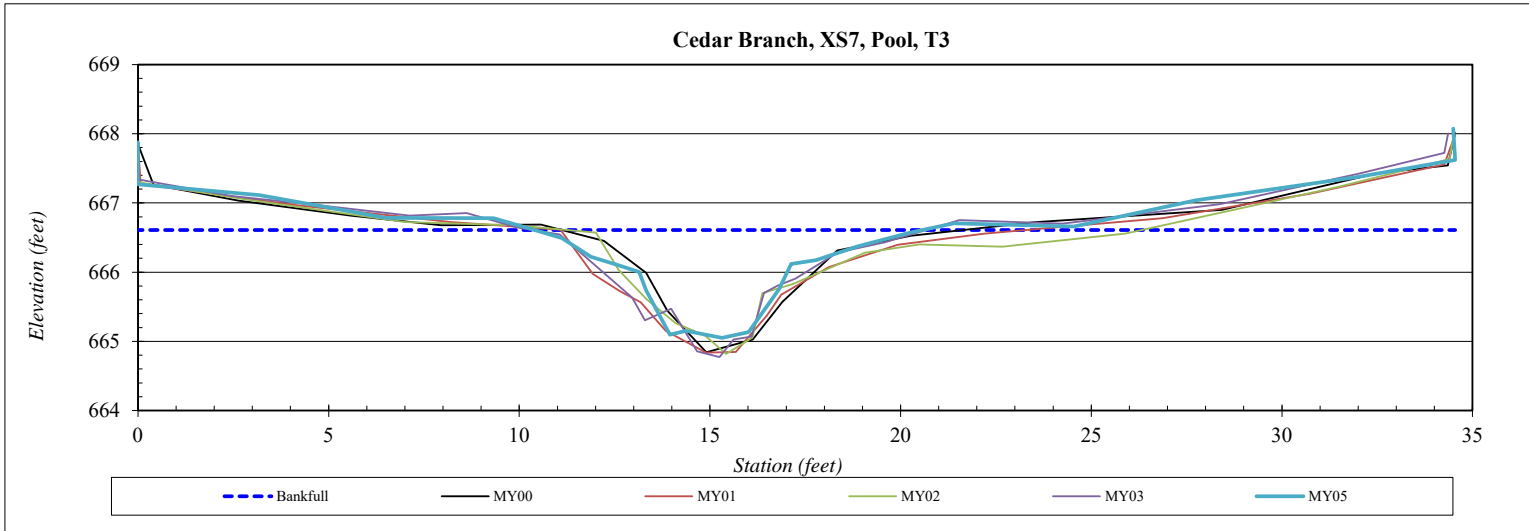


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS7
<b>Drainage Area (sq mi):</b>	0.04
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	667.87
0.0	667.27
3.2	667.11
6.5	666.79
9.3	666.78
10.3	666.63
11.1	666.49
11.9	666.22
12.5	666.11
13.1	666.00
13.3	665.74
13.9	665.10
14.4	665.15
15.3	665.05
16.0	665.13
16.8	665.75
17.1	666.12
17.8	666.17
18.9	666.37
20.3	666.57
21.4	666.70
24.5	666.66
27.7	667.04
32.0	667.38
34.5	667.62
34.5	668.08

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	666.61
<b>Bankfull Cross-Sectional Area:</b>	6.9
<b>Total Cross-Sectional Area:</b>	6.8
<b>Bankfull Width:</b>	10.2
<b>Flood Prone Area Elevation:</b>	---
<b>Flood Prone Width:</b>	---
<b>Max Depth at Bankfull:</b>	1.6
<b>Mean Depth at Bankfull:</b>	0.7
<b>W / D Ratio:</b>	---
<b>Entrenchment Ratio:</b>	---
<b>Bank Height Ratio:</b>	---

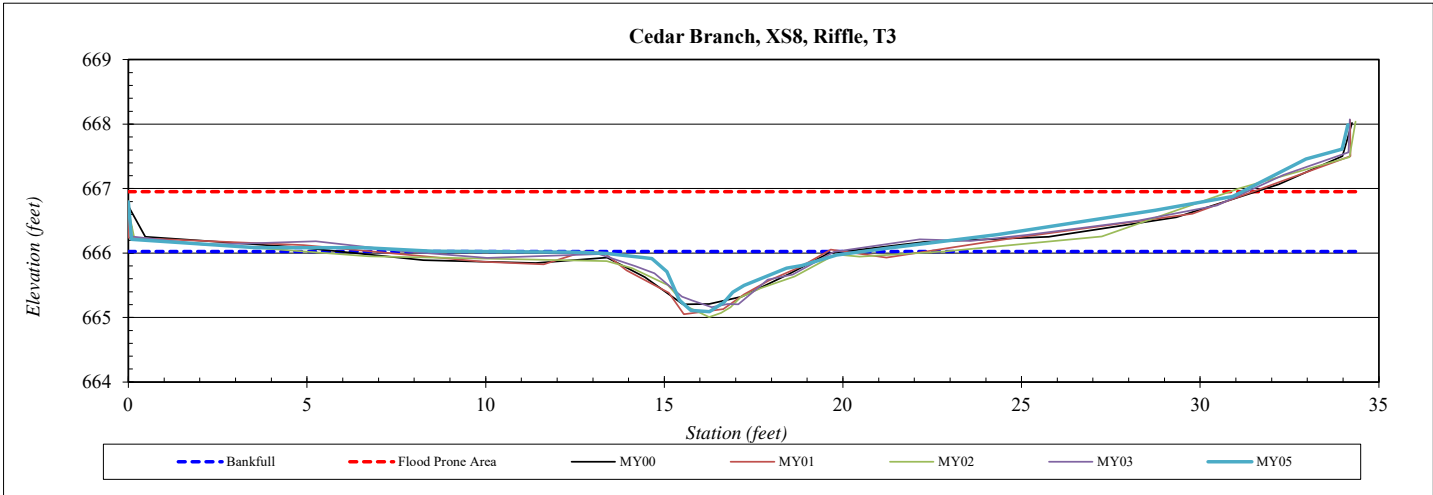


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS8
<b>Drainage Area (sq mi):</b>	0.04
<b>Date:</b>	12/13/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	666.80
0.1	666.21
3.6	666.09
6.6	666.09
8.5	666.03
12.4	666.01
13.4	666.00
14.6	665.91
15.1	665.71
15.4	665.27
15.7	665.11
16.3	665.09
16.7	665.24
16.9	665.39
17.2	665.50
18.4	665.77
18.8	665.81
19.8	665.97
21.2	666.07
24.3	666.29
28.8	666.67
30.9	666.88
33.0	667.46
34.0	667.61
34.1	667.99

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	666.02
<b>Bankfull Cross-Sectional Area:</b>	2.5
<b>Total Cross-Sectional Area:</b>	2.0
<b>Bankfull Width:</b>	7.2
<b>Flood Prone Area Elevation:</b>	667.0
<b>Flood Prone Width:</b>	31.2
<b>Max Depth at Bankfull:</b>	0.9
<b>Mean Depth at Bankfull:</b>	0.4
<b>W / D Ratio:</b>	20.3
<b>Entrenchment Ratio:</b>	4.3
<b>Bank Height Ratio:</b>	0.9

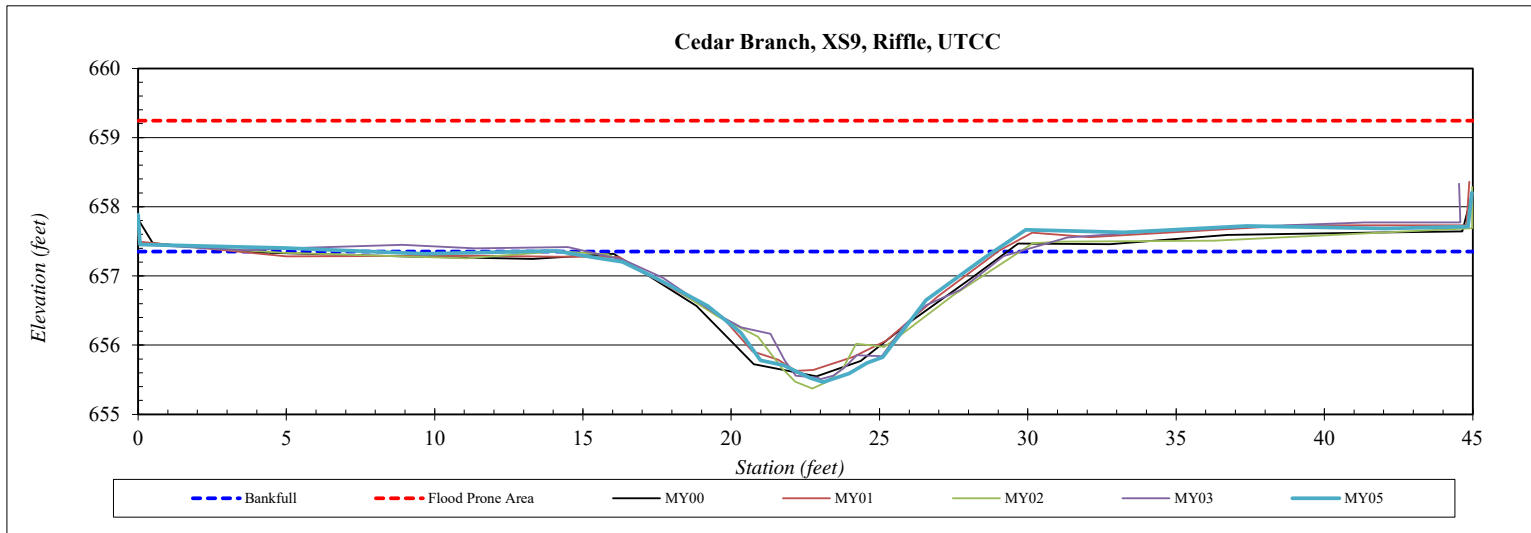


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS9
<b>Drainage Area (sq mi):</b>	0.28
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	657.89
0.1	657.45
5.0	657.41
9.7	657.32
13.0	657.35
14.1	657.36
15.4	657.27
16.3	657.20
17.5	656.97
19.2	656.57
20.3	656.18
21.0	655.78
21.8	655.71
22.7	655.53
23.1	655.47
24.0	655.59
24.6	655.74
25.1	655.82
26.6	656.65
28.5	657.26
29.9	657.67
33.2	657.63
37.4	657.72
42.1	657.68
44.8	657.72
45.0	658.21

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	657.36
<b>Bankfull Cross-Sectional Area:</b>	13.0
<b>Total Cross-Sectional Area:</b>	12.5
<b>Bankfull Width:</b>	14.7
<b>Flood Prone Area Elevation:</b>	659.2
<b>Flood Prone Width:</b>	45.0
<b>Max Depth at Bankfull:</b>	1.9
<b>Mean Depth at Bankfull:</b>	0.9
<b>W / D Ratio:</b>	16.5
<b>Entrenchment Ratio:</b>	3.1
<b>Bank Height Ratio:</b>	1.0



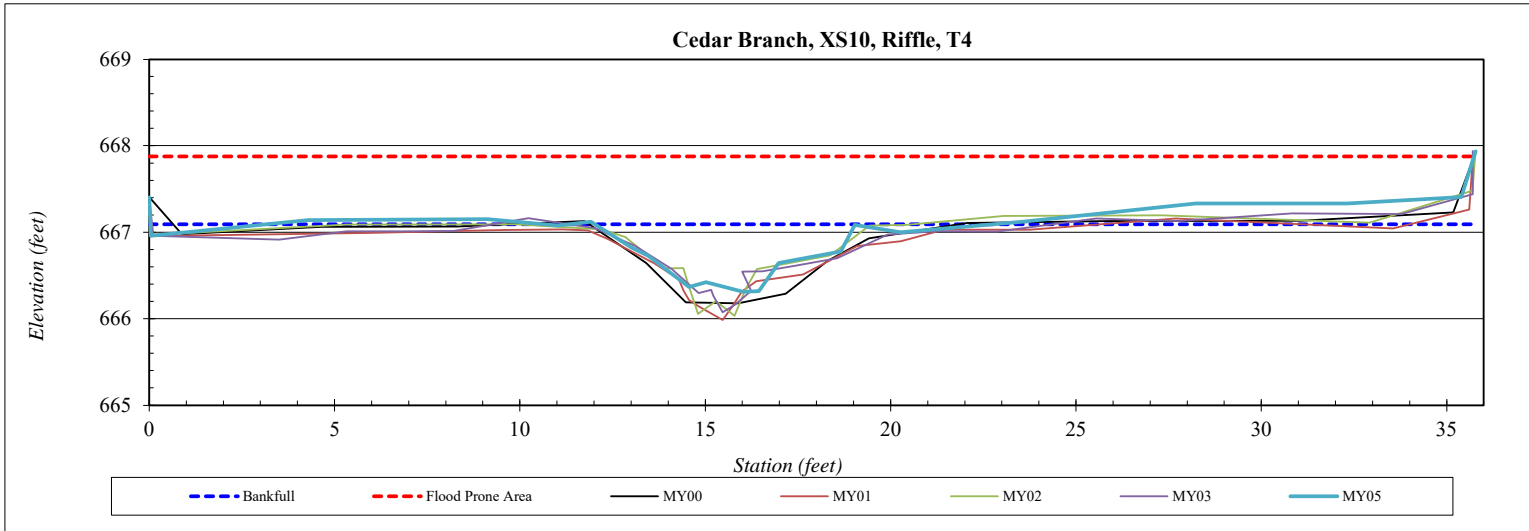


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS10
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	667.40
0.0	666.96
4.3	667.14
9.1	667.15
11.0	667.08
11.9	667.12
13.0	666.83
13.5	666.73
14.6	666.37
15.0	666.42
16.0	666.31
16.4	666.32
17.0	666.64
18.7	666.78
19.0	667.08
20.3	667.00
23.6	667.12
28.2	667.33
32.3	667.33
35.4	667.41
35.8	667.94

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	667.09
<b>Bankfull Cross-Sectional Area:</b>	3.3
<b>Total Cross-Sectional Area:</b>	2.2
<b>Bankfull Width:</b>	7.0
<b>Flood Prone Area Elevation:</b>	667.9
<b>Flood Prone Width:</b>	35.7
<b>Max Depth at Bankfull:</b>	0.8
<b>Mean Depth at Bankfull:</b>	0.5
<b>W / D Ratio:</b>	15.0
<b>Entrenchment Ratio:</b>	5.1
<b>Bank Height Ratio:</b>	1.0

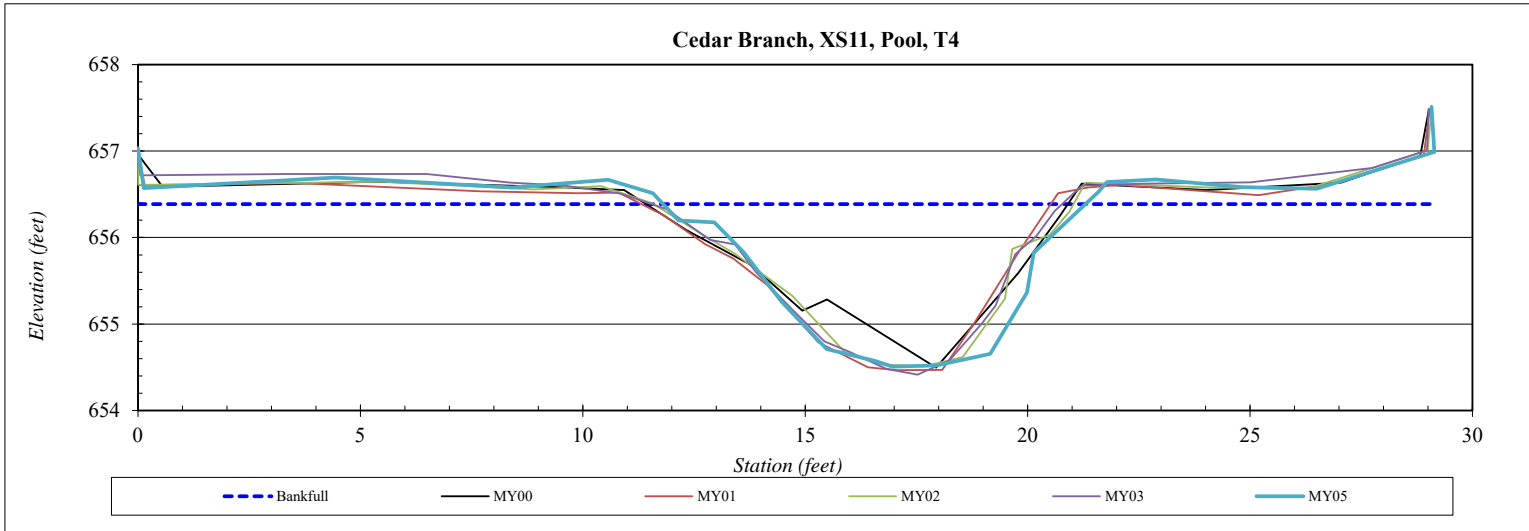


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS11
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	657.03
0.1	656.57
4.4	656.69
8.4	656.58
10.6	656.67
11.6	656.51
12.2	656.20
13.0	656.18
13.6	655.83
14.5	655.26
15.5	654.71
16.6	654.57
17.0	654.51
18.0	654.52
19.2	654.65
20.0	655.37
20.1	655.83
21.6	656.53
21.8	656.64
22.9	656.67
24.8	656.58
26.5	656.57
29.1	656.99
29.1	657.51

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	656.39
<b>Bankfull Cross-Sectional Area:</b>	10.8
<b>Total Cross-Sectional Area:</b>	12.4
<b>Bankfull Width:</b>	9.5
<b>Flood Prone Area Elevation:</b>	---
<b>Flood Prone Width:</b>	---
<b>Max Depth at Bankfull:</b>	1.9
<b>Mean Depth at Bankfull:</b>	1.1
<b>W / D Ratio:</b>	---
<b>Entrenchment Ratio:</b>	---
<b>Bank Height Ratio:</b>	---

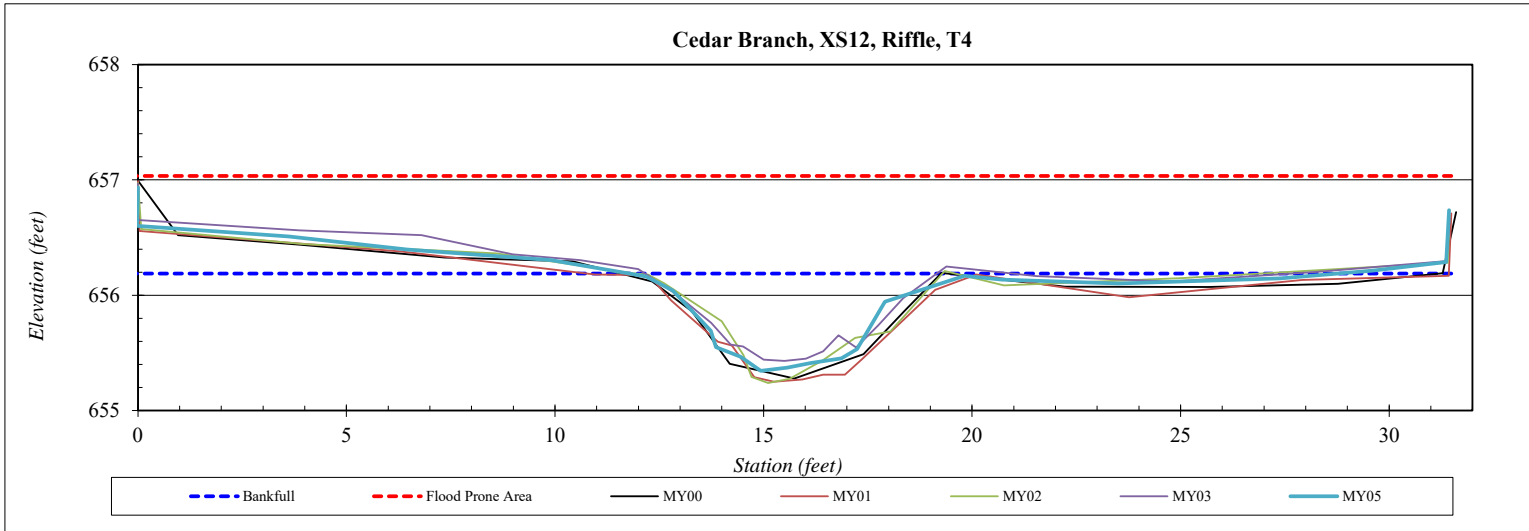


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS12
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	656.94
0.0	656.60
3.6	656.51
6.5	656.40
9.9	656.30
12.2	656.16
12.8	656.04
13.7	655.69
13.9	655.55
14.4	655.47
14.9	655.35
15.6	655.37
16.1	655.41
16.9	655.45
17.2	655.53
17.9	655.94
19.8	656.17
20.7	656.14
23.5	656.10
27.4	656.15
29.6	656.21
31.4	656.29
31.4	656.74

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	656.19
<b>Bankfull Cross-Sectional Area:</b>	3.5
<b>Total Cross-Sectional Area:</b>	3.0
<b>Bankfull Width:</b>	7.0
<b>Flood Prone Area Elevation:</b>	657.0
<b>Flood Prone Width:</b>	31.4
<b>Max Depth at Bankfull:</b>	0.8
<b>Mean Depth at Bankfull:</b>	0.5
<b>W / D Ratio:</b>	14.0
<b>Entrenchment Ratio:</b>	4.5
<b>Bank Height Ratio:</b>	1.0

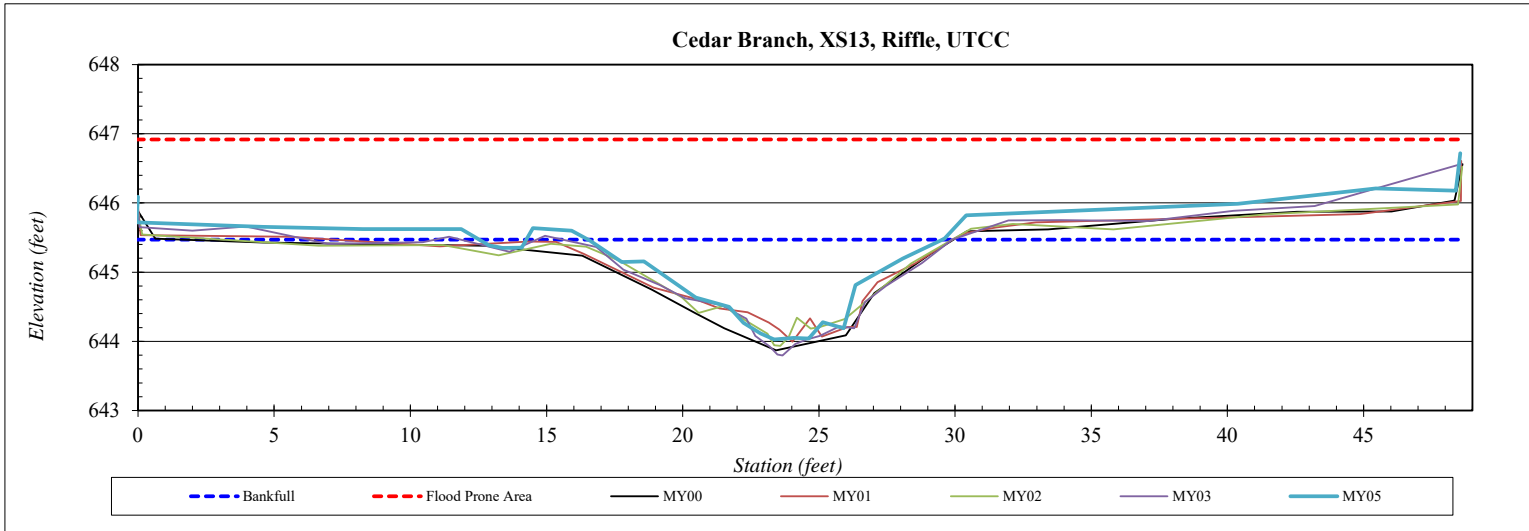


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS13
<b>Drainage Area (sq mi):</b>	0.41
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	646.09
-0.1	645.72
4.6	645.66
8.3	645.62
11.9	645.62
12.9	645.39
13.4	645.35
14.1	645.35
14.5	645.64
15.9	645.60
16.6	645.46
17.8	645.15
18.6	645.16
20.5	644.63
21.7	644.50
22.2	644.27
22.9	644.11
23.4	644.03
24.1	644.05
24.6	644.04
25.1	644.28
25.9	644.19
26.3	644.82
28.1	645.20
29.6	645.48
30.4	645.82
33.5	645.87
40.4	645.99
45.4	646.21
48.4	646.18
48.5	646.72

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	645.47
<b>Bankfull Cross-Sectional Area:</b>	9.6
<b>Total Cross-Sectional Area:</b>	6.8
<b>Bankfull Width:</b>	13.0
<b>Flood Prone Area Elevation:</b>	646.9
<b>Flood Prone Width:</b>	48.5
<b>Max Depth at Bankfull:</b>	1.4
<b>Mean Depth at Bankfull:</b>	0.7
<b>W / D Ratio:</b>	17.7
<b>Entrenchment Ratio:</b>	3.7
<b>Bank Height Ratio:</b>	1.1

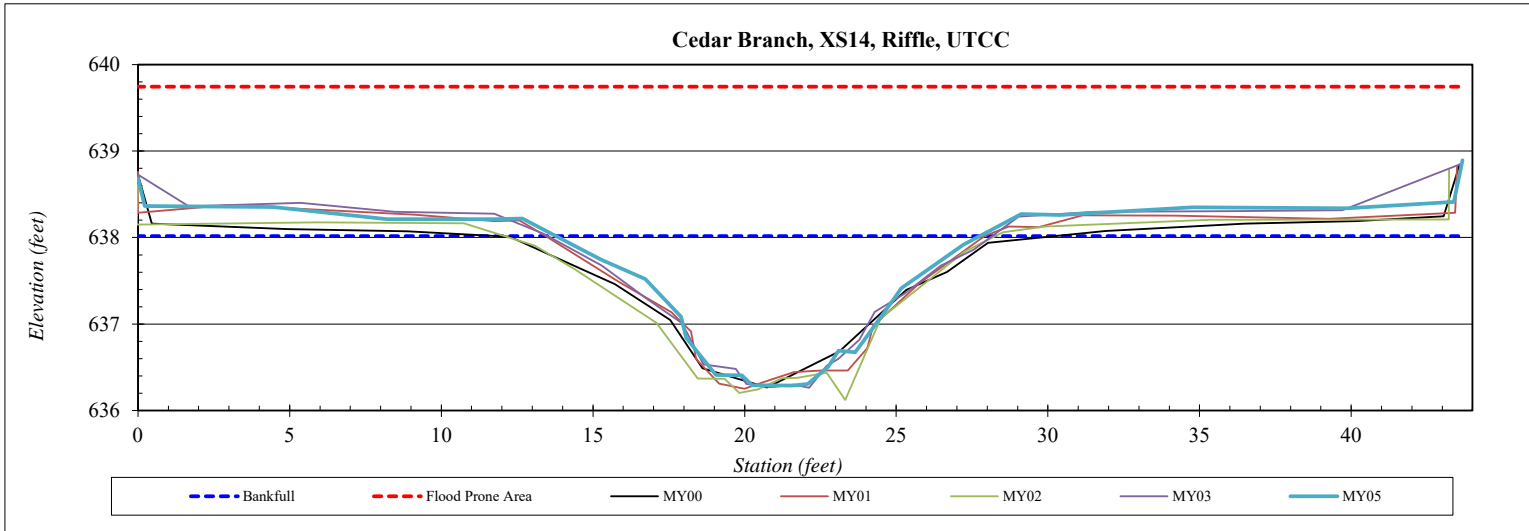


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS14
<b>Drainage Area (sq mi):</b>	0.41
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	638.84
0.2	638.52
4.5	638.50
8.2	638.36
11.8	638.36
12.7	638.37
13.6	638.21
15.3	637.90
16.7	637.67
17.9	637.24
18.1	636.99
19.1	636.56
19.9	636.56
20.3	636.44
21.6	636.44
22.1	636.46
22.8	636.66
23.1	636.84
23.6	636.83
23.9	636.95
24.9	637.42
25.2	637.56
27.2	638.07
29.1	638.42
30.4	638.41
34.8	638.50
39.9	638.49
43.4	638.56
43.7	639.05

SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	638.02
<b>Bankfull Cross-Sectional Area:</b>	12.8
<b>Total Cross-Sectional Area:</b>	11.7
<b>Bankfull Width:</b>	14.0
<b>Flood Prone Area Elevation:</b>	639.7
<b>Flood Prone Width:</b>	43.7
<b>Max Depth at Bankfull:</b>	1.7
<b>Mean Depth at Bankfull:</b>	0.9
<b>W / D Ratio:</b>	15.3
<b>Entrenchment Ratio:</b>	3.1
<b>Bank Height Ratio:</b>	1.2

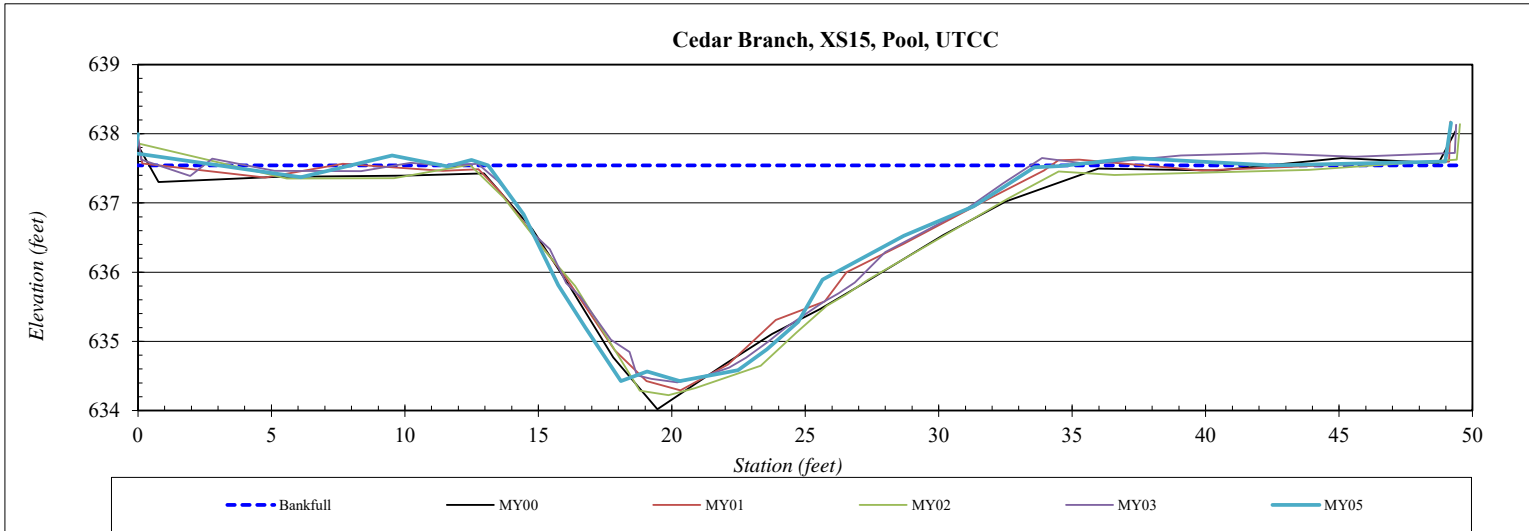


<b>River Basin:</b>	Yadkin River
<b>Site:</b>	Cedar Branch
<b>XS ID</b>	XS15
<b>Drainage Area (sq mi):</b>	0.41
<b>Date:</b>	12/14/2022
<b>Field Crew:</b>	TS, KB



Station	Elevation
0.0	638.15
-0.1	637.87
6.1	637.52
9.5	637.84
11.6	637.68
12.5	637.77
13.1	637.69
14.4	636.98
15.7	635.96
16.8	635.35
18.1	634.58
19.1	634.72
20.3	634.58
22.5	634.73
23.6	635.03
24.7	635.43
25.6	636.04
28.7	636.68
31.3	637.10
33.6	637.67
34.6	637.68
37.3	637.80
42.5	637.69
49.0	637.75
49.2	638.31

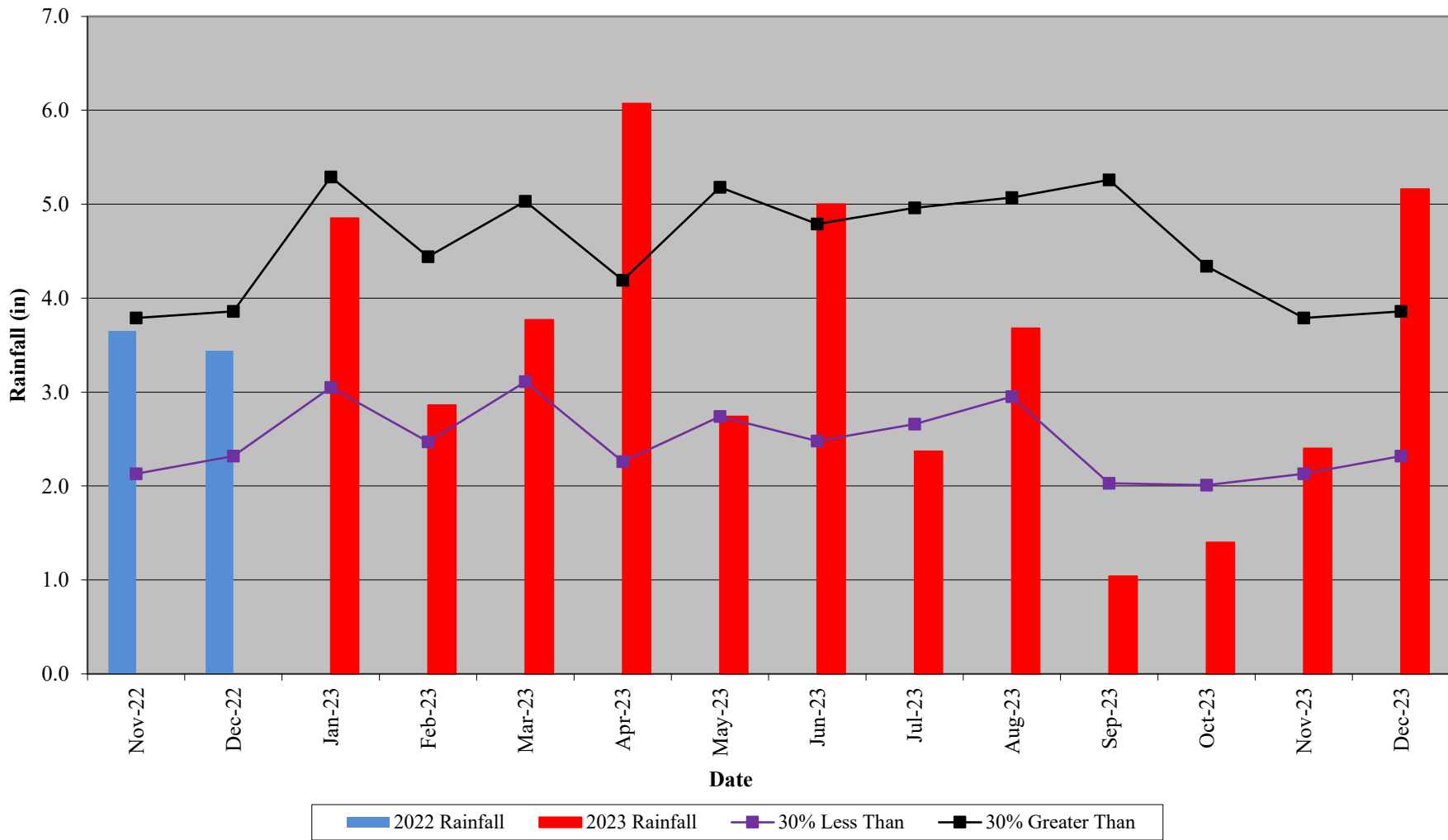
SUMMARY DATA	
<b>Current Bankfull Elevation:</b>	637.55
<b>Bankfull Cross-Sectional Area:</b>	35.8
<b>Total Cross-Sectional Area:</b>	33.3
<b>Bankfull Width:</b>	20.5
<b>Flood Prone Area Elevation:</b>	---
<b>Flood Prone Width:</b>	---
<b>Max Depth at Bankfull:</b>	3.1
<b>Mean Depth at Bankfull:</b>	1.7
<b>W / D Ratio:</b>	---
<b>Entrenchment Ratio:</b>	---
<b>Bank Height Ratio:</b>	---



# **APPENDIX E**

## Hydrologic Data

**Cedar Branch Restoration Site  
30-70 Percentile Graph  
WETS Station Name: Asheboro, NC**





<b>Table 10. Verification of Bankfull Events Cedar Branch Restoration Site, DMS Project #97009</b>							
<b>Gage ID</b>	<b>MY1 2018</b>	<b>MY2 2019</b>	<b>MY3 2020</b>	<b>MY4 2021</b>	<b>MY5 2022</b>	<b>MY6 2023</b>	<b>MY7 2024</b>
UTCC	5	15	17	9	8	0*	

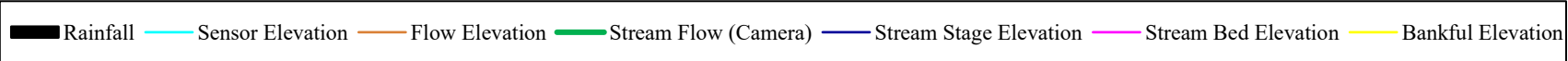
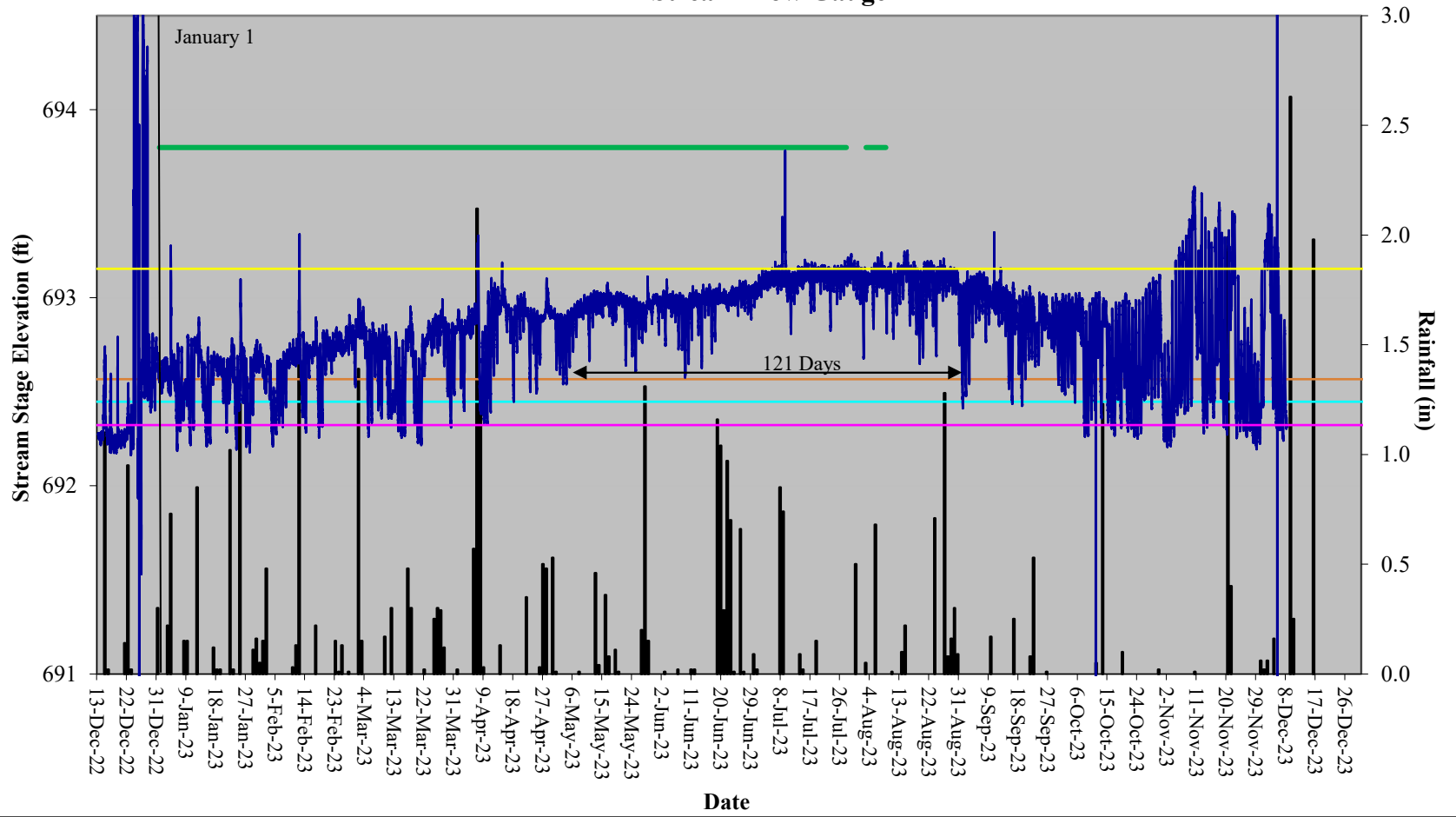
\*Gauge Malfunction

<b>Table 11. Verification of Stream Flow Cedar Branch Restoration Site, DMS Project #97009</b>				
	<b>Gauge</b>		<b>Camera</b>	
<b>Reach</b>	<b>Dates Achieving</b>	<b>Maximum Consecutive Days</b>	<b>Dates Achieving</b>	<b>Maximum Consecutive Days</b>
T1	May 3 – September 1	121	January 1 – July 28	209
T1-1	January 21 – March 1; March 25 – May 3	40	January 1 – April 19	109
T3	January 1 – June 10	161	January 1 – June 13	164

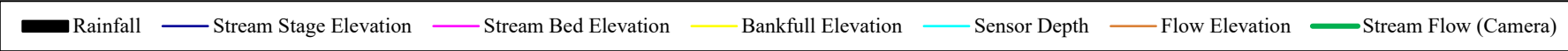
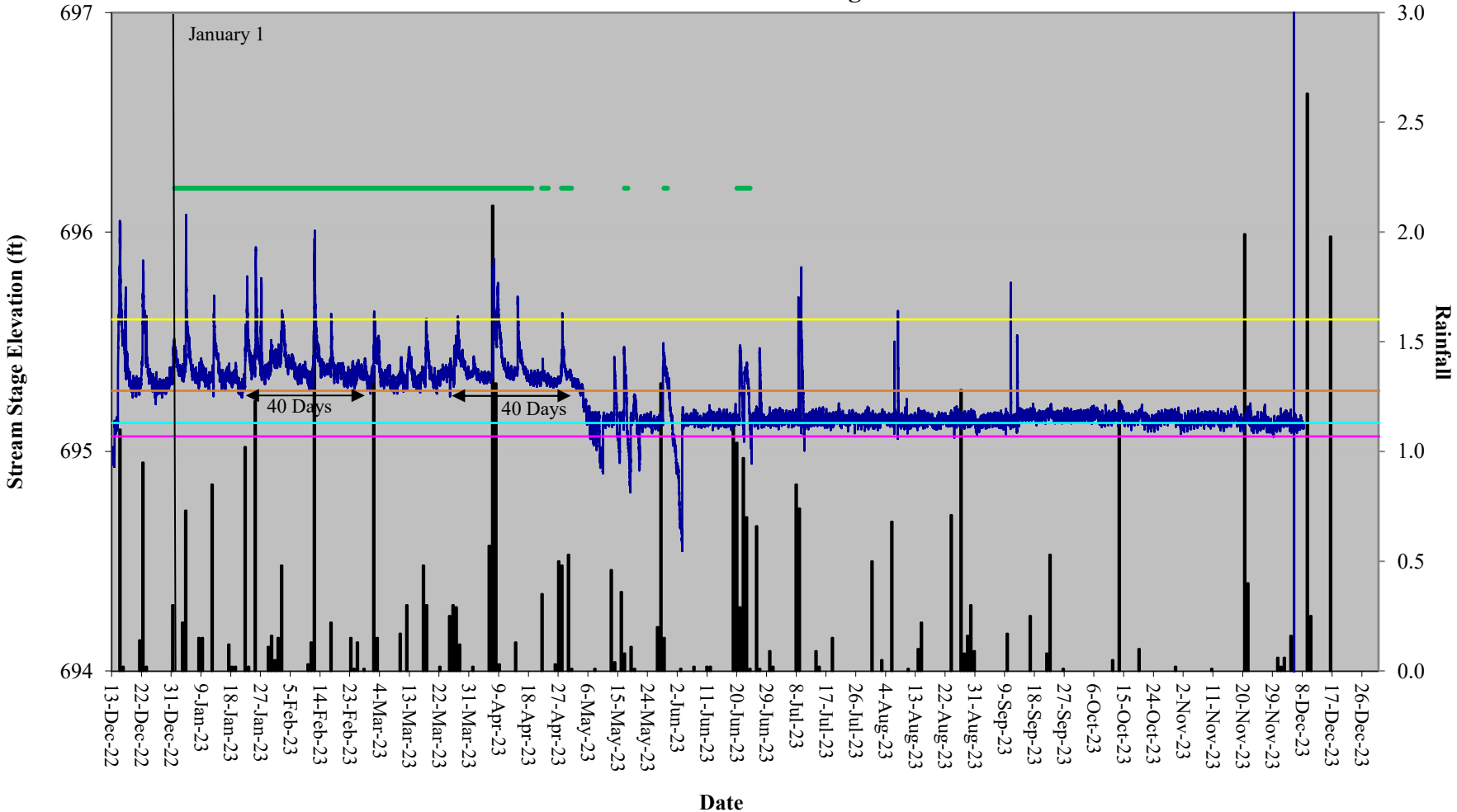
<b>Table 12. Stream Flow Criteria Attainment Cedar Branch Restoration Site, DMS Project #97009</b>							
	<b>Greater than 30 Days of Flow/Max Consecutive Days</b>						
<b>Reach</b>	<b>MY-01 2018</b>	<b>MY-02 2019</b>	<b>MY-03 2020</b>	<b>MY-04 2021</b>	<b>MY-05 2022</b>	<b>MY-06 2023</b>	<b>MY-07 2024</b>
T1 (Gauge)	Yes/60	Yes/46	Yes/142	Yes/242	No/3	Yes/121	
T1 (Camera)	Yes/102	Yes/260	Yes/189	Yes/178	Yes/147	Yes/209	
T1-1 (Gauge)	No/16	Yes/66	Yes/65	Yes/87	No/17	Yes/40	
T1-1 (Camera)	No/7*	Yes/105	Yes/63	No/7*	Yes/115	Yes/109	
T3 (Gauge)	Yes/83	Yes/187	Yes/65	Yes/86	Yes/49	Yes/161	
T3 (Camera)	Yes/93	Yes/252	Yes/174	Yes/61	Yes/173	Yes/164	

\*camera malfunction

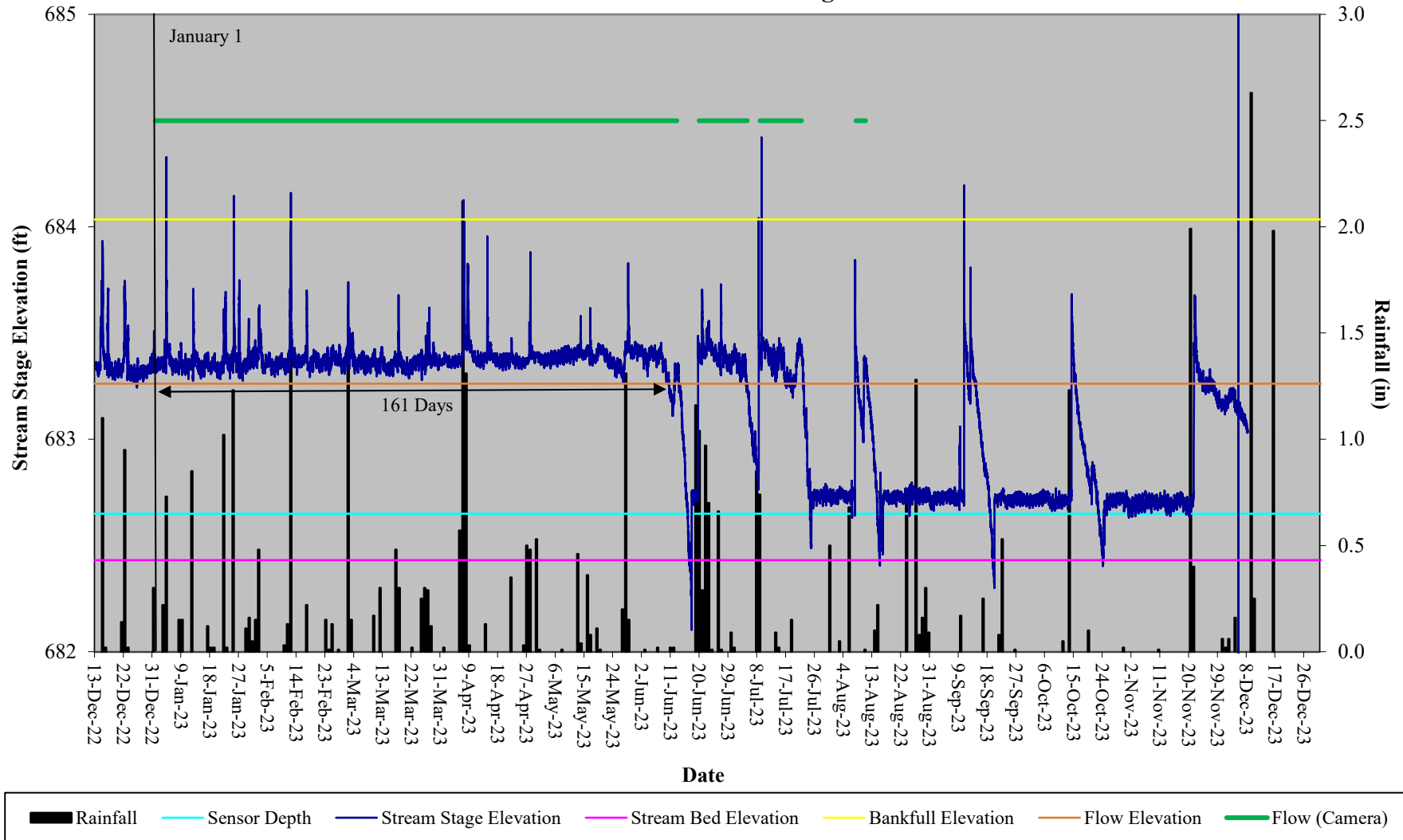
### Cedar Branch Restoration Site Hydrograph T1 Stream Flow Gauge



### Cedar Branch Restoration Site Hydrograph T1-1 Stream Flow Gauge



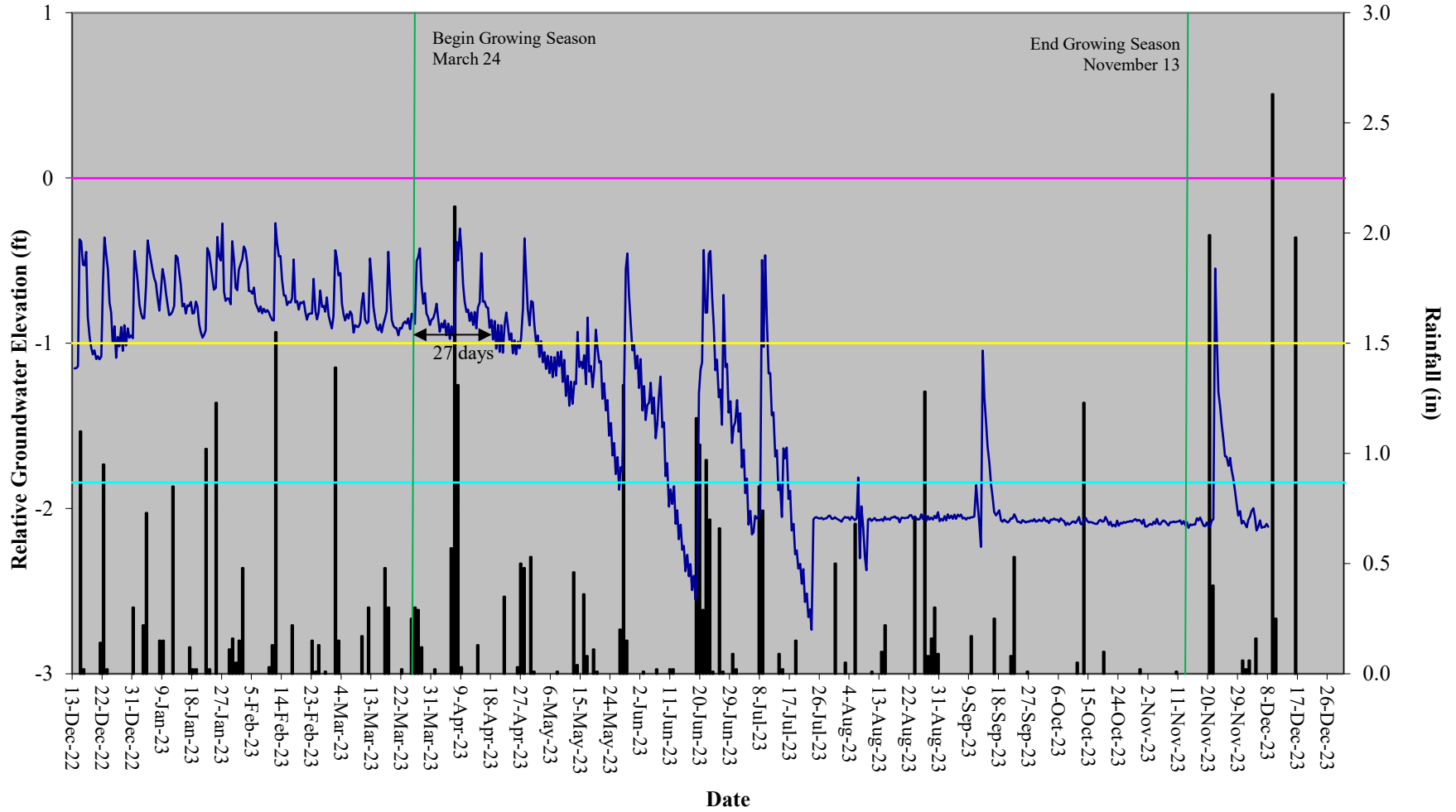
### Cedar Branch Restoration Site Hydrograph T3 Stream Flow Gauge



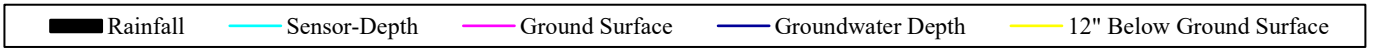
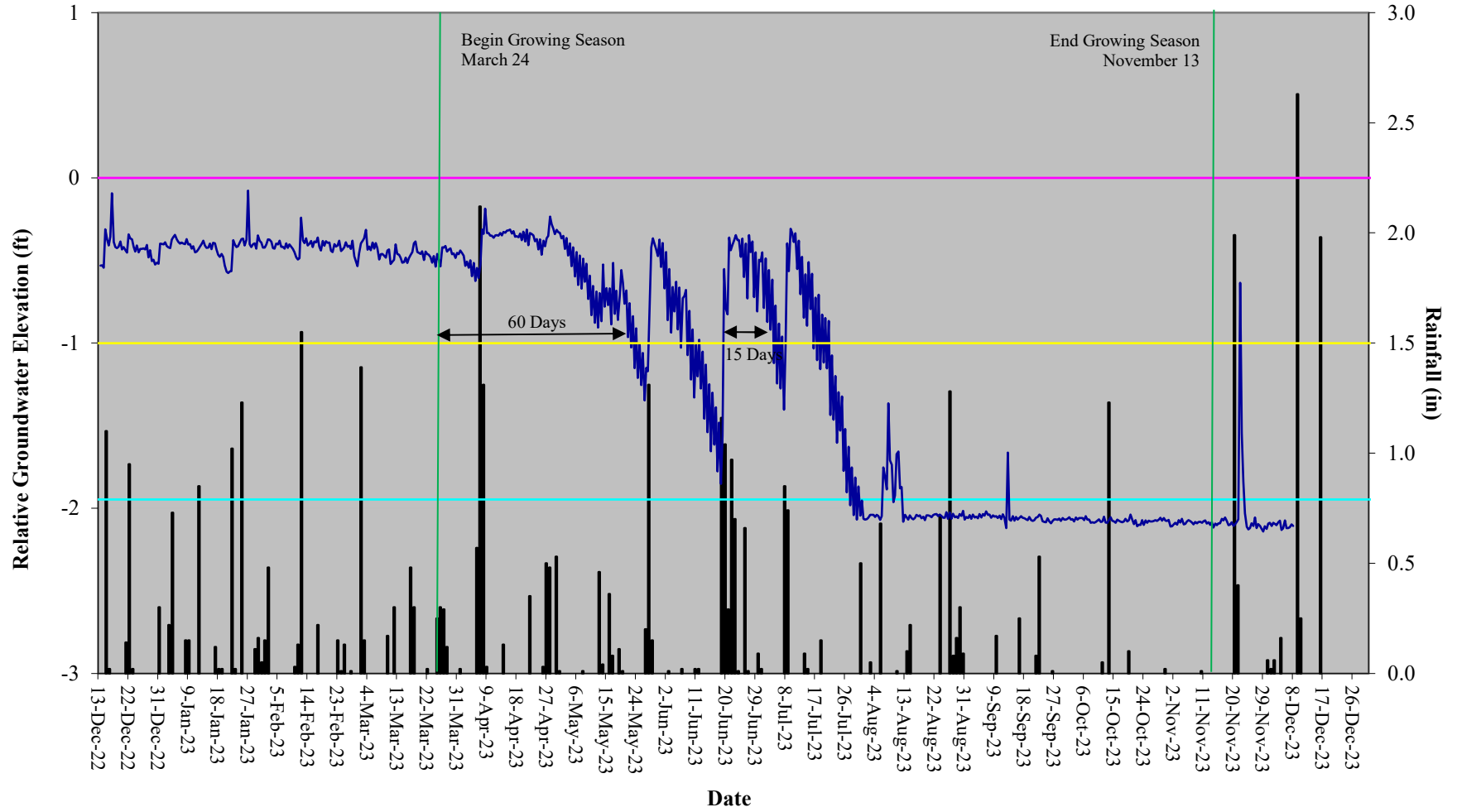
**Table 13. Wetland Hydrology Verification  
Cedar Branch Restoration Site, DMS Project #97009**

		<b>Max Consecutive Days During Growing Season (Percentage)</b>						
<b>Gauge #</b>	<b>Location</b>	<b>MY-01 2018</b>	<b>MY-02 2019</b>	<b>MY-03 2020</b>	<b>MY-04 2021</b>	<b>MY-05 2022</b>	<b>MY-06 2023</b>	<b>MY-07 2024</b>
Gauge 1	T1	64 (27.4%)	63 (26.7%)	55 (23.3%)	57 (24.1%)	3 (1.9%)	27 (11.3%)	
Gauge 2	T3	104 (44.4%)	148 (63.2%)	119 (50.9%)	65 (27.6%)	103 (44.0%)	60 (25.4%)	
Gauge 3	T3	21 (9.0%)	26 (10.9%)	13 (5.3%)	21 (9.0%)	18 (7.7%)	4 (1.7%)	

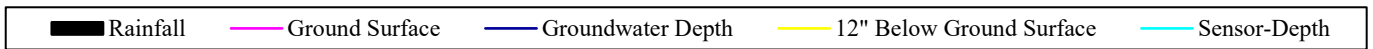
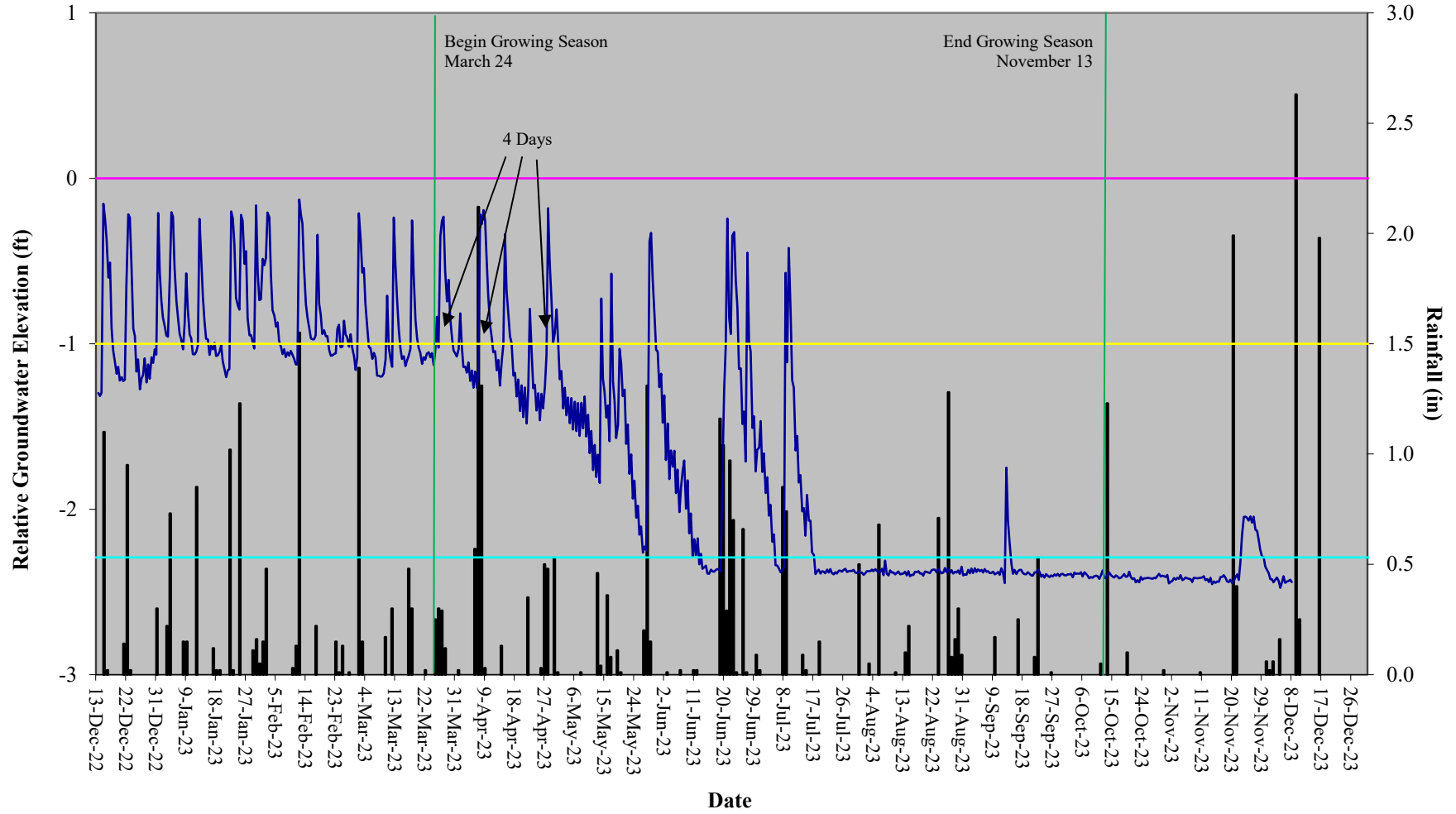
# Cedar Branch Restoration Site Hydrograph Wetland Gauge 1



## Cedar Branch Restoration Site Hydrograph Wetland Gauge 2



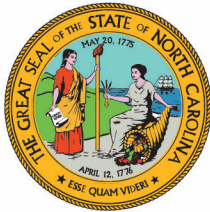
## Cedar Branch Restoration Site Hydrograph Wetland Gauge 3





# **APPENDIX F**

## **Additional Data**



NORTH CAROLINA  
Environmental Quality

ROY COOPER

Governor

ELIZABETH S. BISER

Secretary

MARC RECKTENWALD

Director

June 2, 2023

Matthew Reid  
Project Manager  
NCDEQ - Division of Mitigation Services  
Asheville Regional Office  
2090 U.S. 70 Highway  
Swannanoa, NC 28778-8211

Subject: Boundary Inspection Report – MY6  
Cedar Branch, Randolph County, NC; DMS ID No. 97009

Paul,

The MY6 boundary inspection was conducted by DMS on June 1, 2023. The inspection was conducted in accordance with the DMS Property Checklist which included an office review and a site visit to document site conditions. The entire easement boundary was inspected during the site visit to validate easement integrity and identify any potential issues on the site. This report summarizes the inspection results.

**Office Review:**

- The plat shows internal fencing within the easement in northeast section of the site and was not called out to be removed. The fencing is absent in the As-built figures.
- The MY5 report indicated trash, tires, a metal hay bale feeder and concrete blocks at the top of T1. A section of damaged fence was identified at sta: 17+00. The report also indicated the provider would be addressing the issues.

**Field Inspection:**

- The easement corners were monumented with stamped aluminum caps.
- All corner and in-line markings were within specification except for one in-line marker post near platted corner #24 which was loose.
- The internal fencing shown on the plat had been removed.
- The trash, hay bale and damaged fence identified in the MY5 report appear to be unresolved.
- No mowing, row crop or livestock encroachments were observed.
- The section of damaged fence remains damaged.
- The in-line marker posts were closely spaced making the boundary highly visible and easy to follow. Torx decking screw type fasteners were used to attach the conservation easement signs to the treated posts. All of the signs were firmly attached to the posts and none of the fasteners have failed.

**Action Items**

- Re-set the loose post near platted corner #24.
- Remove trash and other materials located within the easement.
- Repair damaged fence.



North Carolina Department of Environmental Quality | Division of Mitigation Services  
217 West Jones Street | 1652 Mail Service Center | Raleigh, North Carolina 27699-1652  
919.707.8976

Let me know if you have any questions or need additional information.

Sincerely,

*Kelly Phillips*

Property Specialist

NCDEQ-DMS

610 East Center Avenue, Suite 301

Mooresville, NC 28115

Cell: (919) 723-7565

cc: R:\EEP PROJECT LIBRARY FILES\PROJECT DELIVERABLES(REPORTS)\FD PROJECTS\Cedar Branch (#97009)\2.Conservation Easement\DMS Easement Inspections\MY6



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