Monitoring Report
FINAL VERSION
Horne Creek Tributaries Mitigation Project
Monitoring Year 4
Calendar Year of Data Collection: 2023

NCDEQ DMS Project Identification # 100026
NCDEQ DMS Contract # 7181
Yadkin River Basin (Cataloging Unit 03040101)
USACE Action ID Number: SAW-2017-01510
NCDEQ DWR Project # 2017-1156
Surry County, NC
Contracted Under RFP # 16-006993, Date of Issue: September 16, 2016
Data Collection Period: April and October 2023
Submission Date: November 2023

Prepared for:

North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:

WATER & LAND SOLUTIONS
7721 SIX FORKS ROAD, SUITE 130, RALEIGH, NC 27615
(919) 614 - 5111 | waterlandsolutions.com

WATER & LAND SOLUTIONS
7721 SIX FORKS ROAD, SUITE 130, RALEIGH, NC 27615
(919) 614 - 5111 | waterlandsolutions.com

December 18, 2023

NC Department of Environmental Quality
Division of Mitigation Services
Attn: Matthew Reid, Project Manager
2090 U.S. 70 Highway
Swannanoa, NC 28778

RE: WLS Responses to NCDEQ DMS Review Comments for Task 10 Submittal, Monitoring Year 4 Report for the Horne Creek Tributaries Mitigation Project, DMS Full-Delivery Project ID #100026, Contract #7181, Yadkin River Basin, Cataloging Unit 03040101, Surry County, NC

Dear Mr. Reid:

Water & Land Solutions, LLC (WLS) is pleased to present the Final Monitoring Year 4 Report for the Horne Creek Tributaries Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). Per the DMS review comments, WLS has updated the Monitoring Year 4 Report and associated deliverables accordingly. The electronic deliverables are organized under the following folder structure as required under the digital submission requirements:

1. Report PDF
2. Support Files
    1_ Background Tables
    2_Visual
    3_Veg Data
    4_Geomorphology
    5_Hydro
    6_Other Data

We are providing our written responses to DMS' review comments on the Draft Monitoring Year 4 Report below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

- **Please ensure the Monitoring Phase Performance Bond has been updated and approved by Kristie Corson before invoicing for Task 10.** WLS Response: WLS will ensure that the Monitoring Phase Performance Bond has been updated and approved prior to invoicing for Task 10.

- **In an effort to identify and resolve property issues early during the monitoring period, please verify that the conservation easement boundary has been walked, marking and signage is up to spec, fencing is intact, and no encroachments have been identified. DMS will conduct a property boundary inspection at this year's monitoring site visit.** WLS Response: The easement boundary has been walked and inspected for fencing and signage compliance in MY4 during the quarterly site visits. No encroachments or issues were identified in MY4. WLS will continue to monitor for compliance during quarterly visits in MY5.

WATER & LAND SOLUTIONS
7721 SIX FORKS ROAD, SUITE 130, RALEIGH, NC 27615
(919) 614 - 5111 | waterlandsolutions.com

- **Title Page: RFP date of issue should be September 16, 2016.** WLS Response: The title page is updated as requested.

- **Table 2: Please add the SPA5 repair that occurred in 2023 to the table.** WLS Response: SPA5 repair has been added to Table 2 for MY4 (2023).

- **Thanks for including pictures of SPA5 repair. Please include update and photos in MY5 report.** WLS Response: WLS will include photos of SPA5 during MY5 to document stabilization of the repair area.

- **Does R3 have documented stream flow in the channel? Recommend adding a camera and/or gauge to document stream flow on this reach to prevent credits from being at risk.** WLS Response: R3 does not have any monitoring devices on the reach but is visually monitored during quarterly site visits. WLS is confident that the reach is preforming as intended and has no concern about the 76 stream credits being at risk. WLS will provide additional photos and video during quarterly MY5 site visits to provide flow documentation.

- **The right floodplain slope shown in photo point 7 appears to have little herbaceous vegetation. Has WLS conducted any additional efforts to increase the slope stability? Are any efforts planned?** WLS Response: WLS did reseed the affected area in MY2 to improve herbaceous cover on the slope. No areas of rilling or slumping were noted during MY4 and tree and herbaceous vegetation is establishing on the slope. This area will continue to be monitored in MY5.

- **At the 2023 Credit Release Meeting, the IRT requested additional winter/dormant season photos to document stream stability throughout the project. Please include any additional photos that WLS may have of the project site. Photos of R2 and R3 would be helpful.** WLS Response: WLS has included all photos taken during MY4. WLS will include additional photos and video with flow dye evidence of R2 and R3 during the MY5.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

Kyle Obermiller
Water & Land Solutions, LLC
7721 Six Forks Road, Suite 130
Raleigh, NC 27615
Office Phone: (919) 614-5111
Mobile Phone: (269) 908-6306
Email: kyle@waterlandsolutions.com

Table of Contents

1 Project Summary 1

1.1 Project Location and Description 1

1.2 Project Goals and Objectives 1

1.3 Project Success Criteria 2

1.3.1 Streams 2

1.3.2 Vegetation 3

1.3.3 Visual Assessment 3

2 Project Mitigation Components 3

2.1 Project Components 3

3 Monitoring Year 4 Assessment and Results 4

3.1 Morphological Assessment 4

3.1.1 Stream Horizontal Pattern & Longitudinal Profile 4

3.1.2 Stream Horizontal Dimension 5

3.2 Stream Hydrology 5

3.2.1 Stream Flow 5

3.2.2 Bankfull Events 6

3.3 Vegetation 6

4 Methods 6

LIST OF APPENDICES

Appendix A Background Tables

Table 1 Project Mitigation Components
Table 2 Project Activity and Reporting History
Table 3 Project Contacts
Table 4 Project Information and Attributes

Appendix B Visual Assessment Data

Figure 1 Current Condition Plan View (CCPV)
Table 5a-g Visual Stream Morphology Stability Assessment
Table 5h Vegetation Condition Assessment
Photos Stream Photo Points (Culvert Crossings, EII Reaches)
Potential Problem Areas

Appendix C Stream Measurement and Geomorphology Data

Table 6a Baseline Stream Data Summary
Table 6b Cross-section Morphology Data
Table 6c Stream Reach Morphology Data

Appendix D Hydrologic Data

Table 7 Verification of Bankfull Events
Figure 3 Surface Flow Data
Figure 4 Flow and Crest Gauge Installation Diagrams
Figure 5 Rainfall Data

1 Project Summary

1.1 Project Location and Description

The Horne Creek Tributaries Mitigation Project ("Project") is a North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) full-delivery mitigation project contracted with Water & Land Solutions, LLC (WLS) in response to RFP 16-006993. The Project construction and planting was completed in April 2020. The Project was built as documented in the approved mitigation plan and record drawings. The Project provides warm stream mitigation credits in the Yadkin River Basin (Cataloging Unit 03040101). The Project is located in Surry County approximately seven miles southwest of the Town of Pilot Mountain (36.282582°, -80.509153°).

The Project restored, enhanced, and permanently protected seven stream reaches (R1, R2, R3, R4, R4a, R4b, and R5) and their riparian buffers, totaling approximately 5,428 linear feet of stream channel. The Project provides significant ecological improvements and functional uplift through stream and aquatic habitat restoration and through decreasing nutrient and sediment loads within the watershed. The mitigation plan provides a detailed project summary and Table 1 provides a summary of project assets.

Monitoring Year 4 (MY4) activities occurred in April and October 2023. This report presents the data for MY4. The Project meets the MY4 success criteria for stream hydrology, stream horizontal and vertical stability, streambed condition and stability, and stream flow. All three flow gauges met the 30-day consecutive flow criteria. Both crest gauges recorded bankfull events. Based on these results, the Project is on trajectory to meet interim and final success criteria. For more information on the chronology of the project history and activity, refer to Appendix A, Table 2. Relevant project contact information is presented in Appendix A, Table 3 and project background information is presented in Appendix A, Table 4.

1.2 Project Goals and Objectives

The Project is on track to meet the goals and objectives described in the Horne Creek Tributaries Final Approved Mitigation Plan and will address general restoration goals and opportunities outlined in the North Carolina Division of Mitigation Services (DMS) Upper Yadkin River Basin Restoration Priority Plan (RBRP) (DEQ 2009). More specifically, watershed goals and management strategies described in the Upper Yadkin Local Watershed Plan (LWP) will be met by:

- Reducing sediment, soil erosion, turbidity, and nutrient inputs such as fecal coliform bacteria, nitrogen, and phosphorus to the Horne Creek Watershed.
- Restoring, enhancing, and protecting headwater streams, wetlands, riparian buffers, and aquatic habitat functions.
- Improving riparian corridor management and targeting restoration of impacted streams and riparian buffer areas.
- Promoting agronomic farm management techniques and implementing agricultural BMPs and water quality features such as livestock exclusion fencing, alternative watering systems, and nutrient management devices.

To accomplish these project-specific goals, the following objectives will be measured to document overall project success:

- Provide a floodplain connection to the incised Project stream reaches by lowering bank height ratios (BHRs) to less than 1.2, thereby promoting more natural or overbank flood flows,
- Improve bedform diversity by increasing scour pool spacing and depth variability,
- Increase native species riparian buffer and vegetation density/composition along streambank and floodplain areas that meet requirements of a minimum 30-foot-wide and 210 stems/acre composition after the monitoring period,
- Improve aquatic habitat and fish species diversity and migration through the addition of in-stream cover and native woody debris,
- Site protection through an 11.87-acre conservation easement in excess of 30 feet from the top of the restored streambanks that will protect all streams, wetlands, and aquatic resources in perpetuity.

1.3 Project Success Criteria

The success criteria for the Project follows the approved performance standards and monitoring protocols from the final approved mitigation plan, which was developed in compliance with the USACE October 2016 Guidance, USACE Stream Mitigation Guidelines (April 2003 and October 2005), and 2008 Compensatory Mitigation Final Rule. Cross-section and vegetation plot data will be collected in Years 0, 1, 2, 3, 5, and 7. Stream hydrology data and visual monitoring will be reported annually. Specific success criteria components and evaluation methods are described below.

1.3.1 Streams

***Stream Hydrology*:** Four separate bankfull or over bank events must be documented within the seven-year monitoring period and the stream hydrology monitoring will continue until four bankfull events have been documented in separate years. Stream hydrology monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to top of bank elevation (Figure 4). Recorded water depth above the top of bank elevation will document a bankfull event.

Stream Profiles, Vertical Stability, and Floodplain Access: Stream profiles, as a measure of vertical stability and floodplain access, will be evaluated by looking at Bank Height Ratios (BHR). In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s). The BHR shall not exceed 1.2 along the restored Project stream reaches. This standard only applies to restored reaches of the channel where BHRs were corrected through design and construction. Vertical stability will be evaluated with visual assessment, cross-sections and, if directed by the IRT, longitudinal profile.

Stream Horizontal Stability: Cross-sections will be used to evaluate horizontal stream stability on restored streams. There should be little change expected from as-built restoration cross-sections. If measurable changes do occur, they should be evaluated to determine if the changes represent a movement toward a more unstable condition (e.g., downcutting, erosion) or a movement towards increased stability (e.g., settling, vegetation establishment, deposition along the streambanks, decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen Stream Classification method, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

Streambed Material Condition and Stability: Pebble counts or streambed material samples will not be collected per the DMS Pebble Count Data Requirements memo sent on October 19, 2021. The IRT reserves the right to request pebble count data/particle distributions if deemed necessary during the monitoring period.

Jurisdictional Stream Flow: Monitoring of stream flow will be conducted to demonstrate that the restored stream systems classified as intermittent exhibit surface flow for a minimum of 30 consecutive days throughout some portion of the year during years with normal or below normal rainfall conditions. Stream flow monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to the downstream top of riffle elevation (diagram in Appendix D). If the pool water depth is at or above the top of riffle elevation, then the channel will be assumed to have surface flow.

1.3.2 Vegetation

Vegetation monitoring will occur in the fall each required monitoring year, typically prior to leaf drop. Plots will be monitored in years 0, 1, 2, 3, 5, and 7. Vegetative success for the Project during the intermediate monitoring years will be based on the survival of at least 320, three-year-old trees per acre at the end of Year 3 of the monitoring period; and at least 260, five-year-old trees per acre that must average six feet in height at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of no less than 210, seven-year-old stems per acre that must average eight feet in height in Year 7 of monitoring. Volunteer species on the approved planting list that meet success criteria standards will be counted towards success criteria.

1.3.3 Visual Assessment

WLS will conduct visual assessments in support of mitigation performance monitoring. Visual assessments of all stream reaches will be conducted twice per monitoring year with at least five months in between each site visit for each of the seven years of monitoring. Photographs will be used to visually document system performance and any areas of concern related to streambank and bed stability, condition of in-stream structures, channel migration, active headcuts, live stake mortality, invasive plant species or animal browsing, easement boundary encroachments, cattle exclusion fence damage, and general streambed conditions. Permanent photo points will be located at cross-sections, culvert crossings, and Enhancement II reaches.

2 Project Mitigation Components

2.1 Project Components

The Project mitigation components include a combination of Stream Restoration and Enhancement activities, as summarized in the table below.

Table 1. Mitigation Plan Stream Mitigation Credits (SMCs)

Project Component	Existing Footage or Acreage	Proposed Reach Stationing	Restored Footage, Acreage, or SF	Creditable Footage, Acreage or SF	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits
R1	1,397	10+00 – 23+40	1,320	1,320	R	PI/PII	1	1,320
R2	286	10+17 – 13+13	296	296	R	PII	1	296
R3	75	11+80 – 12+55	76	76	R	PII	1	76
R4	1,191	13+13 – 25+19	1,167	1,167	R	PI/PII	1	1,167
R4a	124	10+98 – 11+54	57	57	EII	-	2.5	23
R4a	-	11+55 – 12+65	111	111	R	PI	1	111
R4b	89	10+72 – 10+99	27	27	EII	-	2.5	11
R4b	-	10+99 – 12+24	125	125	R	PI	1	125
R5	2,519	25+19 – 48+12	2,249	2,249	R	PI	1	2,249
Totals	**5,681**		**5,428**	**5,428**				**5,378**
							Credit Loss in Required Buffer	-300
							Credit Gain for Additional Buffer	325
							Net Change in Credit from Buffers	+25
							Total Credits per Buffer Calculator	5,403
							Total Adjusted SMCs	**5,389**

3 Monitoring Year 4 Assessment and Results

The dates of Year 4 monitoring activities are detailed in Appendix A, Table 2. All Year 4 monitoring data is presented in this report and in the appendices. The Project is on track for meeting stream interim success criteria. No cross-section or vegetation plot data was collected during MY4 monitoring. Visual assessments of stream stability and vegetation condition were performed in the spring and fall site visits. All monitoring device locations are depicted on the CCPV (Figure 1).

3.1 Morphological Assessment

3.1.1 Stream Horizontal Pattern & Longitudinal Profile

Visual assessment was utilized for assessment of MY4 horizontal and vertical stream stability. The visual assessments for each stream reach concluded that the MY4 stream channel pattern and longitudinal profiles, and in-stream structure location/function, still closely match the profile design parameters and MY0/baseline conditions (Appendix C). The MY4 planform geometry and dimensions fall within acceptable ranges of the design parameters for all restored reaches. Minor channel adjustments in riffle slopes, pool depths and pattern were observed based on natural sediment migration and stream bank vegetation establishment but did not present a stability concern or indicate a need for remedial action.

During the fall visual assessment for MY1, WLS staff noted seven potential problem areas outside the channel. One additional in-channel problem area was noted during MY2. Problem areas 1-4, 6, and 7 from MY2 have all been stabilized and are no longer considered problem areas. The remaining areas are noted on the CCPV (Figures 1a-1c) and photos can be found in Appendix B and the E-Data Submission included with this report. No additional problem areas were identified during MY4.

- **SPA5**- On R5, in the left floodplain area: minor deposition and erosion is occurring adjacent to station 32+60 because of erosion outside of the easement.
    - **MY3 Action**: No action was taken during MY3.
    - **MY4 Action**: Grading activities outside of the conservation easement stabilized the erosion occurring in the pasture. The work was completed using a small excavator in July 2023. Matting and coir wattles were installed to stabilize soil and slow water flow. The area was seeded and mulched. Only minor hand work was completed within the easement to add seed to areas of sediment deposition. Herbaceous cover is establishing well within the easement and no additional erosion was observed outside the easement. WLS will continue to monitor the repair during MY5.
- **SPA8**- On R4, just below two log vanes from approximate station 20+75 to 21+75, an area of the stream has dropped elevation due to migrating riffle material causing stream incision. Coarse riffle substrate is still present, the log vanes directly upstream are stable and functional, and the culvert immediately downstream is holding grade. No additional incision was observed in MY4, and no remedial action is required. This area will continue to be monitored closely in MY5. Cross-section data will be completed again in MY5, and the area will be removed from the problem area list if it is stable.

3.1.2 Stream Horizontal Dimension

Cross-section surveys were not required for MY4 per the mitigation plan. They will be completed in MY5. Visual surveys indicate the project reaches are functioning as designed and stable. WLS will closely monitor any changes to stream reaches during MY5.

3.2 Stream Hydrology

3.2.1 Stream Flow

Two flow gauges (FG-1 and FG-3), installed in May 2020 on R1 and R4 respectively, documented that the stream exhibited surface flow for a minimum of 30 consecutive days throughout MY4 (Appendix D). One additional flow gauge (FG-2) was installed during MY1 further upstream on Reach R2 on September 18th, 2020 in response to IRT comments received during the September 15th, 2020 site visit. FG-2 met the 30-day flow requirement in MY4, recording a maximum flow duration of 37 days. The riffle was resurveyed in MY4 to determine downstream riffle elevations. The flow depth was adjusted from 1.00’ to 0.98’. This adjusted riffle elevation changed the early season flow duration to 37 days. Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from Pilot Mountain Weather Station (CBTN7), approximately five miles north of the site. Rainfall was above normal for 2023 (Appendix D).

Flow Gauge Data

Flow Gauge Name	Flow Gauge Location	Longest Period of Consecutive Flow	Total Days of Cumulative Flow	Total Days of No Flow	Longest Period of Consecutive No Flow
FG-1	R1	284 days 1/1/2023 – 10/11/2023	284 days	0 days	0 days
FG-2	R2	37 days 1/4/2023 – 2/9/2023	80 days	204 days	42 days
FG-3	R4	275 days 1/1/2023 – 10/2/2023	280 days	4 days	1 day

3.2.2 Bankfull Events

During MY4, bankfull events were recorded on both pressure transducer and crest gauges. CG-1 (R1) recorded fifteen events with a maximum event of 0.67' above bankfull. CG-2 (R5) recorded seven events with a maximum event of 0.85' above bankfull. Additionally, the cork crest gauge located adjacent to CG-1 on R1 recorded one bankfull event. The associated data and photographs are located in Appendix D.

3.3 Vegetation

Vegetation plot surveys were not required during MY4 per the mitigation plan; surveys will continue in MY5. The MY4 vegetation monitoring was conducted utilizing visual assessment throughout the easement. Visual assessment of vegetation outside of the monitoring plots indicates that planted stems and the herbaceous vegetation is becoming well established throughout the project.

A small cluster (below the mapping threshold) of princess tree (*Paulownia tomentosa*) is located on the right-side slope of R4 and is actively being cut-stump treated with herbicide. No other areas of significant invasive plant species were observed during monitoring year 4. The site will be monitored closely, and any invasive plant species will be treated as needed. Small populations of narrow-leaved cattail (*Typha latifolia*) are present in some saturated floodplain areas; however, none were observed causing issues within the channels or affecting planted trees.

Invasive Species Treatment Table

Monitoring Year	Species	Date	Treatment
MY4	Princess Tree/Cattail	8/1/2023	Rodeo and Glyphosate foliar spray

4 Methods

The stage recorders include an automatic pressure transducer (HOBO Water Level (13 ft) Logger) set in PVC piping in the channel. The elevation of the bed and top of bank at each stage recorder location was recorded to be able to document presence of water in the channel and out of bank events. Visual observations (i.e. wrack or debris lines) and traditional cork crest gauges will also be used to document out of bank events.

Vegetation success is being monitored at a total of 10 permanent vegetation plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008)

and includes analysis of species composition and density of planted and volunteer species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and rebar at the other corners. Tree species and height will be recorded for each planted stem, and photos of each plot are to be taken from the origin each monitoring year. Vegetation plot monitoring did not occur in MY4 and will continue in MY5.

Benthic macroinvertebrate (BMI) sampling used methods and procedures defined by DWR's *Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates* (NCDWR, 2016) to determine a Biotic Index (BI) value and a bioclassification rating. Sampling was conducted during MY3 and will be conducted again in MY7.

Appendix A:
Background Tables

Table 1: Project Mitigation Components
Table 2: Project Activity and Reporting History
Table 3: Project Contacts
Table 4: Project Information and Attributes

Table 1. Horne Creek Tributaries (ID-100026) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	As-Built Footage or Acreage	Comments
R1	1,397	1,320	Warm	R	PI/PII	1.00000	1,342	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R2	286	296	Warm	R	PII	1.00000	289	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
R3	75	76	Warm	R	PII	1.00000	73	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
R4	1,191	1,167	Warm	R	PI/PII	1.00000	1,181	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
R4A	124	57	Warm	EII	PI	2.50000	57	Supplemental Planting of Buffer, Livestock Exclusion, Permananent Easement
R4A	-	111	Warm	R	PI	1.00000	105	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
R4B	89	27	Warm	EII	PI	2.50000	27	Supplemental Planting of Buffer, Livestock Exclusion, Permananent Easement
R4B	-	125	Warm	R	PI	1.00000	123	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
R5	2,519	2,249	Warm	R	PI	1.00000	2,270	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement.

Project Credits

Restoration Level	Stream			Riparian Wetland		Non-Rip Wetland	Coastal Marsh
	Warm	Cool	Cold	Riverine	Non-Riv		
Restoration	**5344.000**						
Re-establishment							
Rehabilitation							
Enhancement							
Enhancement I							
Enhancement II	**33.600**						
Creation							
Preservation							
Totals	**5377.600**			**0.000**	**0.000**	**0.000**	

Overall Assets Summary	
Asset Category	**Overall Credits**
Stream	**5,378**
RP Wetland	**NA**
NR Wetland	**NA**
Buffer	**NA**
Buffer Loss SMC	**-300**
Buffer Gain SMC	**325**
Total SMU	**5,403**
Total Adjusted SMCs	**5,389**

Table 2. Project Activity and Reporting History Horne Creek Tributaries Mitigation Project #100026		
Elapsed Time Since grading complete:	**3 year 6 months**	
Elapsed Time Since planting complete:	**3 year 6 months**	
Number of reporting Years[1]:	**4**	
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Institution Date	N/A	05/22/17
404 permit date	N/A	01/15/20
Mitigation Plan	N/A	07/29/19
Final Design – Construction Plans	N/A	07/29/19
Construction	N/A	04/30/20
Containerized, bare root and B&B plantings for reach/segments 1&2	N/A	04/30/20
As-built (Year 0 Monitoring – baseline)		
Vegetation Monitoring	5/6/2020	N/A
Stream Survey	5/8/2020	N/A
As-built (Year 0 Monitoring – baseline) Report	5/20/2020	7/1/2020
Year 1 Monitoring		
Stream Survey	11/5/2020	N/A
Vegetation Monitoring	11/10/2020	N/A
Year 1 Monitoring Report	11/10/2020	11/20/2020
Year 2 Monitoring		
Encroachment Planting	N/A	2/4/2021
Livestake Planting and Maintenance	N/A	2/2021
Vegetation Monitoring	10/27/2021	N/A
Stream Survey	10/27/2021	N/A
Year 2 Monitoring Report	10/27/2021	12/23/2021
Year 3 Monitoring		
Invasive Species Treatment	N/A	4/6/2022
Stream Survey	8/3/2022	N/A
Vegetation Monitoring	10/6/2022	N/A
Invasive Species Treatment	N/A	11/23/2022
Year 3 Monitoring Report	10/6/2022	11/30/2022
Year 4 Monitoring		
Stream Survey	4/11/2023	N/A
SPA-5 Repair	NA	7/28/2023
Invasive Species Treatment	N/A	8/1/2023
Vegetation Monitoring	10/11/2023	N/A
Year 4 Monitoring Report	10/11/2023	12/18/2023
Year 5 Monitoring		
Vegetation Monitoring		
Stream Survey		
Year 5 Monitoring Report		
Year 6 Monitoring		
Vegetation Monitoring		
Stream Survey		
Year 6 Monitoring Report		
Year 7 Monitoring/ Close Out		
Vegetation Monitoring		
Stream Survey		
Year 7 Monitoring Report		

Table 3. Project Contacts Horne Creek Tributaries Mitigation Project #100026	
Designer	Water & Land Solutions, LLC
	7721 Six Forks Rd, Ste. 130, Raleigh, NC 27615
Primary project design POC	Christopher Tomsic - (828) 493-3287
Construction Contractor	North State Environmental, Inc.
	2889 Lowery Street, Winston-Salem, NC 27101
Construction contractor POC	Andrew Roten - (336) 406-9078
Survey Contractor	Ascension Land Surveying
	116 Williams Road, Mocksville, NC 27028
Survey contractor POC	Christopher Cole - (704) 579-7197
Planting Contractor	Ripple EcoSolutions, LLC
	215 Moonridge Rd, Chapel Hill, NC 27516
Planting contractor POC	George Morris - (919) 818-3984
Seeding Contractor	North State Environmental, Inc.
	2889 Lowery Street, Winston-Salem, NC 27101
Contractor point of contact	Andrew Roten - (336) 406-9078
Seed Mix Sources	Green Resource
	(336) 588-6363
Nursery Stock Suppliers (Bare Roots)	Native Forest Nursery
	(704) 483-3397
Nursery Stock Suppliers (Bare Roots/plugs)	Mellow Marsh Farm
	(919) 742-1200
Nursery Stock Suppliers (Live Stakes)	Foggy Mountain Nursery
	(336) 384-5323
Monitoring Performers	Water & Land Solutions, LLC
	7721 Six Forks Rd, Ste. 130, Raleigh, NC 27615
Stream Monitoring POC	Leah Farr - (919) 971-4575
Vegetation Monitoring POC	Leah Farr - (919) 971-4575
Wetland Monitoring POC	Leah Farr - (919) 971-4575

Table 4. Project Background Information			
Project Name	Horne Creek Tributaries		
County	Surry		
Project Area (acres)	11.87		
Project Coordinates (latitude and longitude)	36.2851950° N, -80.5032100° W		
Planted Acreage (Acres of Woody Stems Planted)	10.2		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Yadkin		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	03040101110070
DWR Sub-basin	03-07-02		
Project Drainage Area (Acres and Square Miles)	0.06 (R1) and 0.26 (R5)		
Project Drainage Area Percentage of Impervious Area	<1%		
CGIA Land Use Classification	2.01.03, 2.01.01, 3.02 (46% pasture/hay, 24% row crop, 16% mixed forest)		

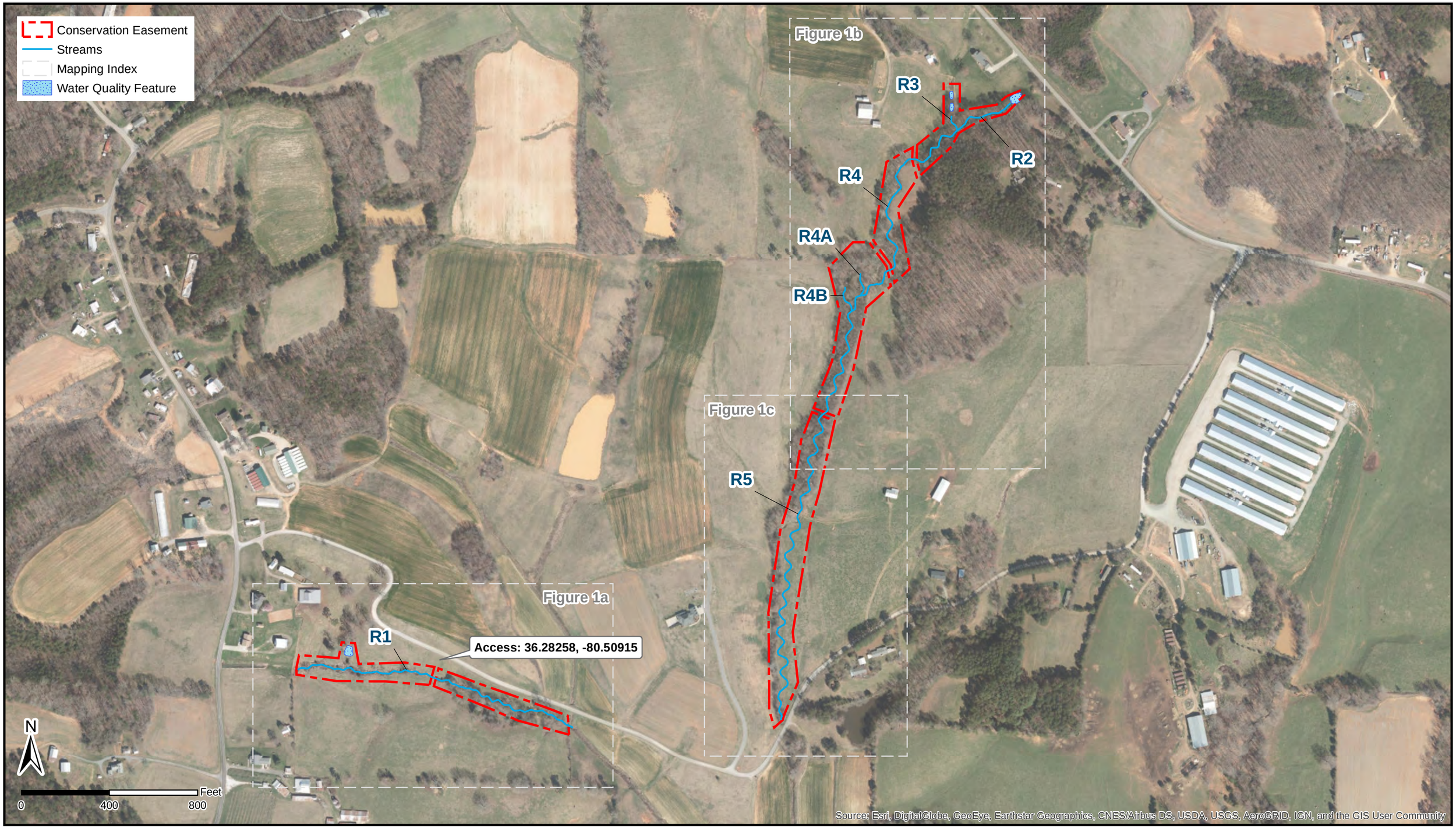
Reach Summary Information							
Parameters	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 4A**	**Reach 4B**	**Reach 5**
Length of reach (linear feet)	1,320	296	76	1,167	168	152	2,249
Valley confinement (Confined, moderately confined, unconfined)	mod confined	mod confined	mod confined	unconfined	unconfined	unconfined	unconfined
Drainage area (Acres and Square Miles)	38 and 0.06	41 and 0.06	29 and 0.05	83 and 0.13	29 and 0.05	2 and 0.003	166 and 0.26
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Intermittent	Perennial	Perennial/Intermittent	Perennial/Intermittent	Perennial
NCDWR Water Quality Classification	C	C, WS-IV	C	C, WS-IV	C	C	C, WS-IV
Stream Classification (existing)	E5b/F5b (incised)	G4 (incised)	E6b (incised)	B4 (incised)	B4c (incised)	G5	B4c/G4c (incised)
Stream Classification (proposed)	B4	B4	B4a	B4/C4b	B4	B4	C4
Evolutionary trend (Simon)	III/IV	III	III	IV/V	I	I	IV/V
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	PCN
Water of the United States - Section 401	Yes	Yes	PCN
Endangered Species Act	Yes	Yes	Categorical Exclusion
Historic Preservation Act	Yes	Yes	Categorical Exclusion
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	Categorical Exclusion

Appendix B:

Visual Assessment Data

Figure 1: Current Condition Plan View (CCPV)
Table 5a-g: Visual Stream Morphology Stability Assessment
Table 5h: Vegetation Condition Assessment
Stream Photo Points (Culvert Crossings, EII Reaches)
Potential Problem Area Photographs



WATER & LAND™ SOLUTIONS

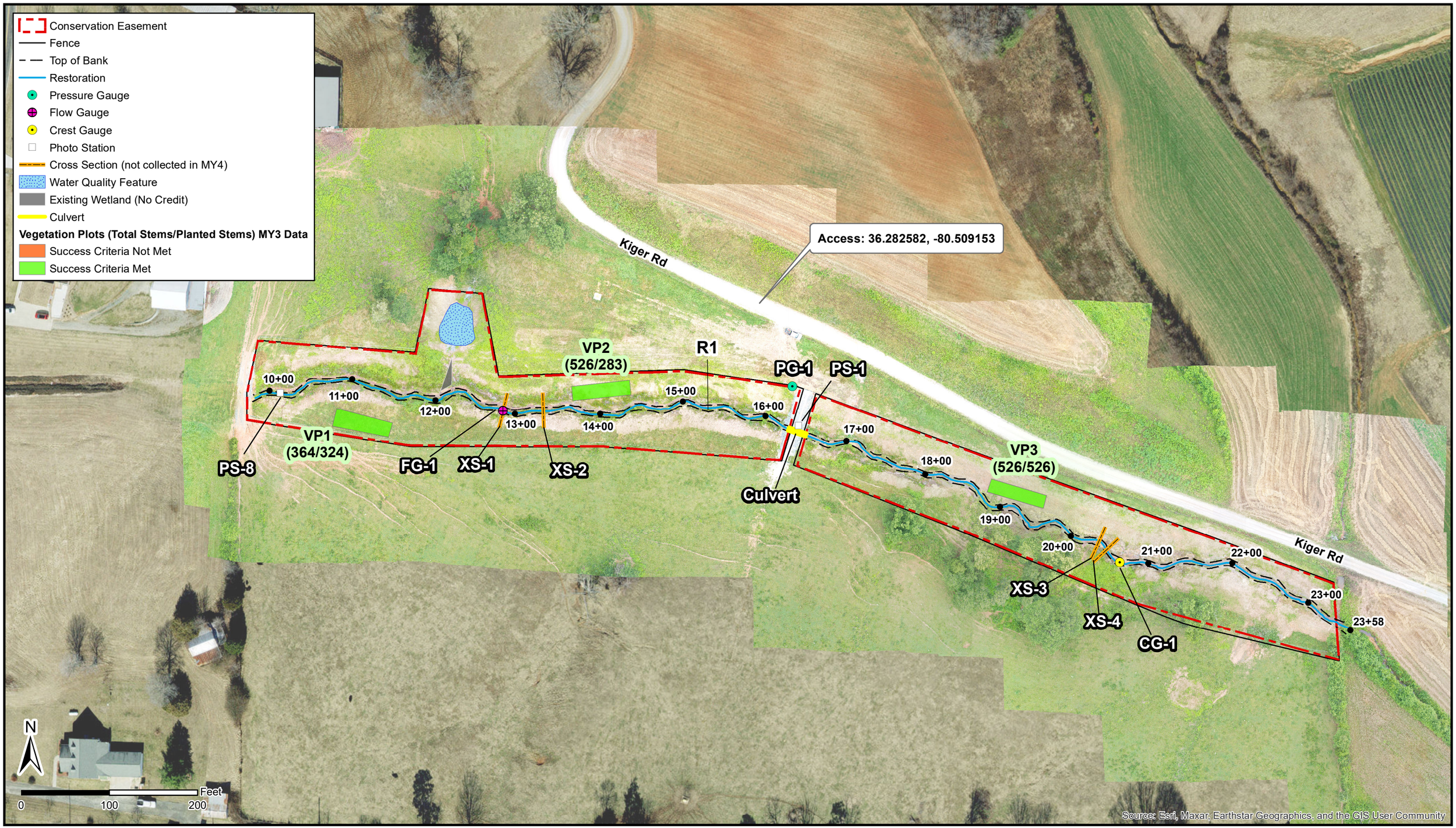
Horne Creek Tributaries Mitigation Project
Surry County, North Carolina

USACE Action ID Number: SAW-2017-01510
DMS project number: 100026
May 2023
MY4

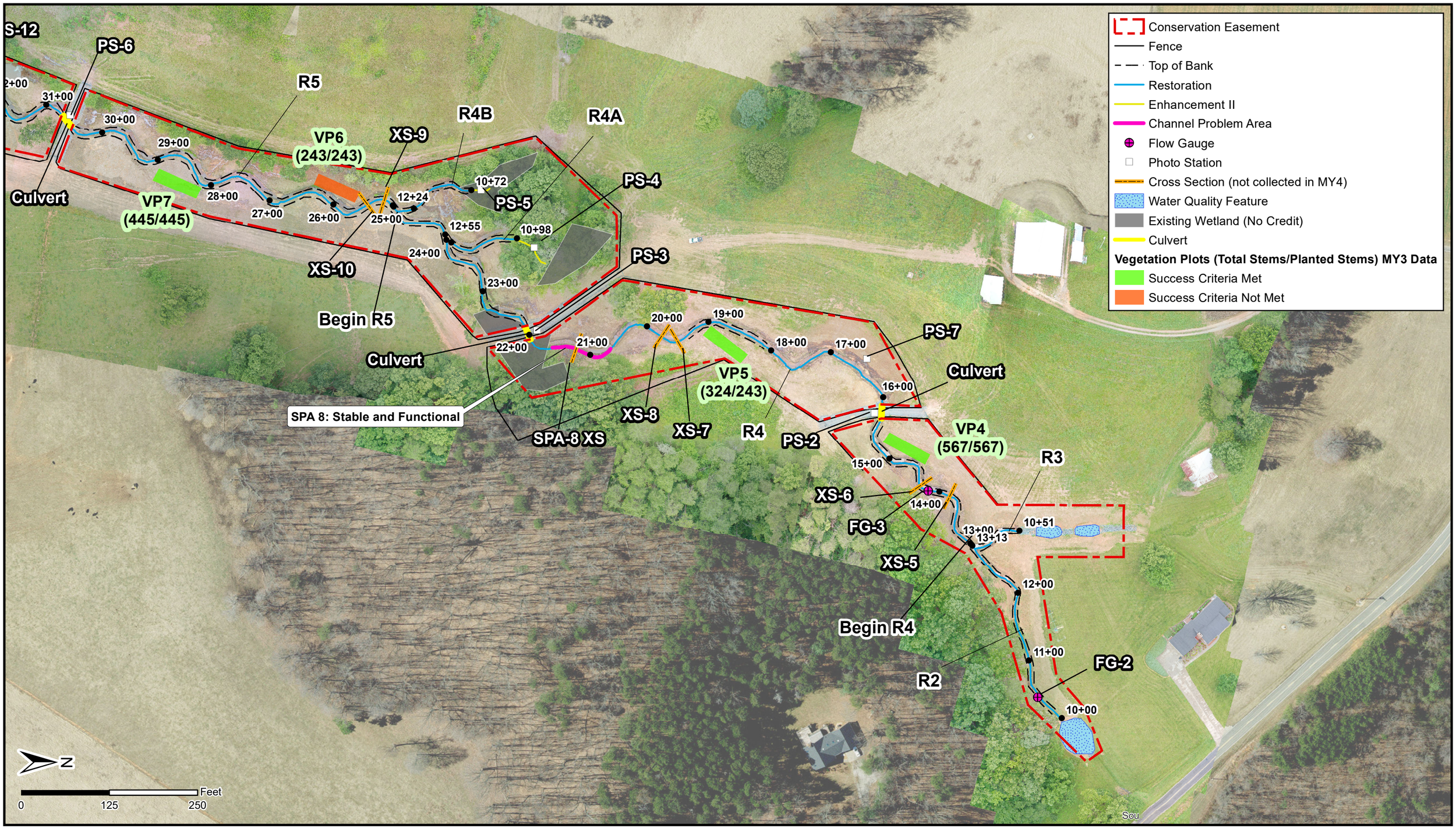
Current Conditions
Plan View
Monitoring Year 4

NAD 1983 2011 State Plane
North Carolina FIPS 3200 FT US

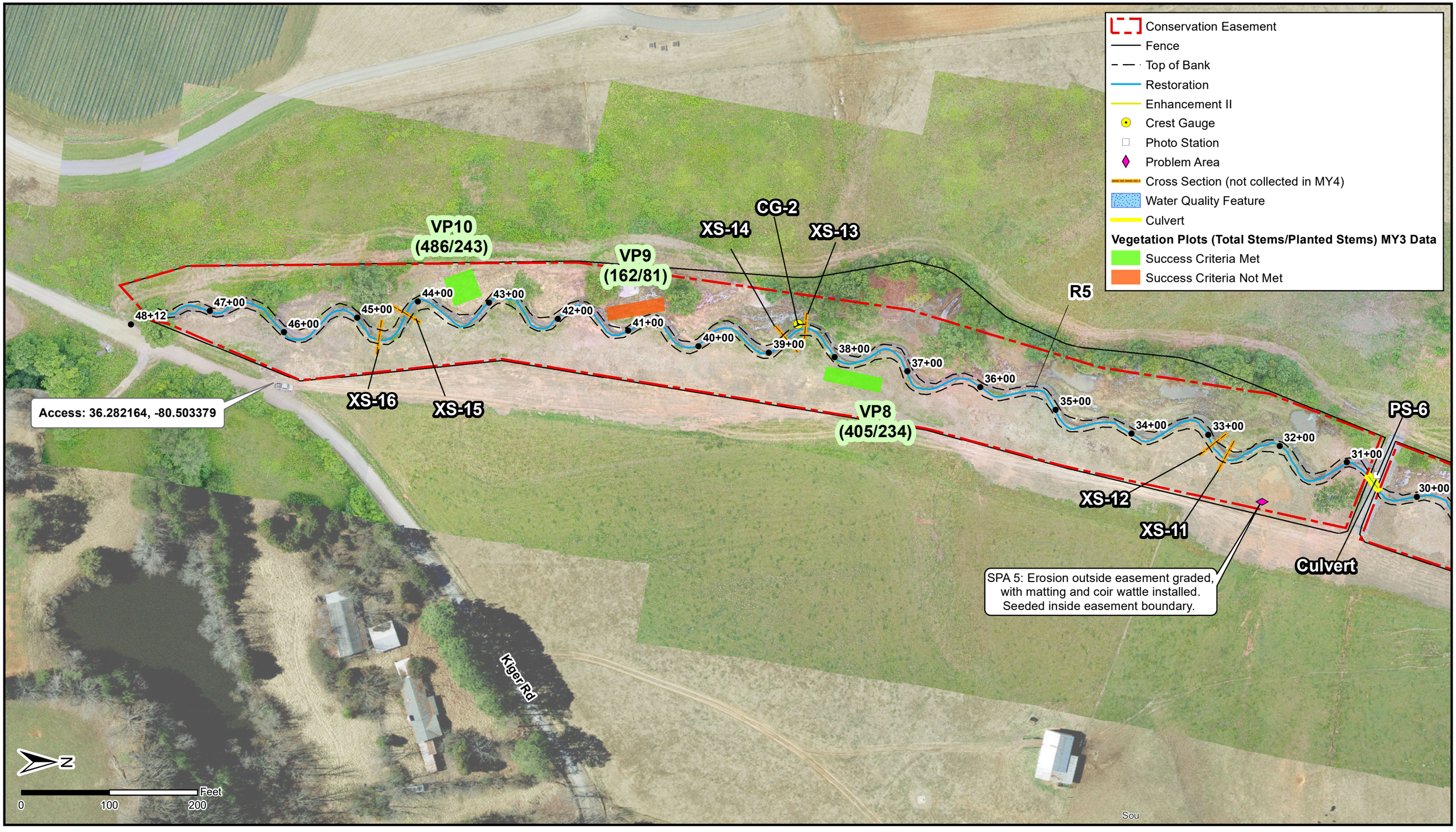
FIGURE
1



WATER & LAND™ SOLUTIONS	**Horne Creek Tributaries Mitigation Project** **Surry County, North Carolina**	USACE Action ID Number: SAW-2017-01510 DMS project number: 100026 October 2023 MY4	Current Conditions Plan View Monitoring Year 4 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE **1a**



WATER & LAND™ SOLUTIONS	**Horne Creek Tributaries Mitigation Project** **Surry County, North Carolina**	USACE Action ID Number: SAW-2017-01510 DMS project number: 100026 October 2023 MY4	Current Conditions Plan View Monitoring Year 4 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE **1b**



WATER & LAND™ SOLUTIONS	**Horne Creek Tributaries Mitigation Project** **Surry County, North Carolina**	USACE Action ID Number: SAW-2017-01510 DMS project number: 100026 October 2023 MY4	Current Conditions Plan View Monitoring Year 4 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE **1c**

Table 5a	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R1									
Assessed Length:	1,342									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank *	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	79	79			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	39	39			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	39	39			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5b	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R2									
Assessed Length:	289									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	22	22			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A			

Table 5c	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R3									
Assessed Length:	73									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A			

Table 5d	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R4									
Assessed Length:	1,181									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	91	96%	0	0	96%
*	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	91	96%	0	0	96%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	52	52			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	22			95%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	25	25			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	14	14			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	14	14			100%			

Table 5e	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R4a									
Assessed Length:	162									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. 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.	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 not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A			

Table 5f	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R4b									
Assessed Length:	150									
Date of Survey	4/11/2023 and 10/11/2023									
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**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjusted % for Stabilizing Woody Vegetation**
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. 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.	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not 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 ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			N/A			

Table 5g	Visual Stream Morphology Stability Assessment									
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)									
Reach ID:	R5									
Assessed Length:	2,270									
Date of Survey	4/11/2023 and 10/11/2023									
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	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	81	81			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.	32	32			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	26	26			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	26	26			100%			

Table 5h	Vegetation Condition Assessment					
Project:	Horne Creek Tributaries Mitigation Project (DMS ID #100026)	Date of Survey: 4/11/2023 and 10/11/2023				
Planted Acreage[1]:	10.2					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	1 acre	Solid light blue	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Transparent light green	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	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%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2]:	11.9					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	orange hatched	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Green dotted line	0	0.00	0.0%

PS-1, R1, Culvert Crossing, Downstream (MY-00)

PS-1, R1, Culvert Crossing, Downstream (MY-04)

PS-1, R1, Culvert Crossing, Upstream (MY-00)

PS-1 , R1, Culvert Crossing, Upstream (MY-04)

PS-2, R2, Culvert Crossing, Downstream (MY-00)

PS-2, R2, Culvert Crossing, Downstream (MY-04)

PS-2, R2 Culvert Crossing, Upstream (MY-00)

PS-2, R2, Culvert Crossing, Upstream (MY-04)

PS-3, R4, Culvert Crossing, Downstream (MY-00)

PS-3, R4, Culvert Crossing, Downstream (MY-04)

PS-3, R4, Culvert Crossing, Upstream (MY-00)

PS-3, R4, Culvert Crossing, Upstream (MY-04)

PS-4, R4A, Downstream (MY-00)

PS-4, R4A, Downstream (MY-04)

PS-4, R4A, Upstream (MY-00)

PS-4, R4A, Upstream (MY-04)

PS-5, R4B, Downstream (MY-00)

PS-5, R4B, Downstream (MY-04)

PS-5, R4B, Upstream (MY-00)

PS-5 , R4B, Upstream (MY-04)

PS-6, R5, Culvert Crossing, Downstream (MY-00)

PS-6, R5, Culvert Crossing, Downstream (MY-04)

PS-6, R5, Culvert Crossing, Upstream (MY-00)

PS-6, R5, Culvert Crossing, Upstream (MY-04)

PS-7, R4, Right Floodplain Slope (MY-01)

PS-7, R4, Right Floodplain Slope (MY-04)

PS-8, R1, Upstream (MY-03)

PS-8, R1, Upstream (MY-04)

PS-8, R1, Downstream (MY-03)

PS-8, R1, Downstream (MY-04)

SPA5, R5 Left Floodplain, R5 Side Slope, Minor deposition and erosion as a result of erosion outside of the easement (MY-01)

SPA5, R5 Side Slope, Minor deposition and erosion as a result of erosion outside of the easement (MY-04)

SPA5, R5 Left Floodplain, R5 Side Slope, Minor deposition and erosion as a result of erosion outside of the easement (MY-01)

SPA5, R5 Side Slope, Minor deposition and erosion as a result of erosion outside of the easement (MY-04)

SPA5, R5 Side Slope, After repair (MY-04)

SPA5, R5 Side Slope, After repair (MY-04)

SPA8, R4, STA 20+75, Channel Bed Incision (MY-02)

SPA8, R4, STA 20+75, Channel Bed Incision (MY-04)

SPA8, R4, STA 20+75, Channel Bed Incision (MY-02)

SPA8, R4, STA 20+75, Channel Bed Incision (MY-04)

Appendix C:

Stream Measurement and Geomorphology Data

Table 6a: Baseline Stream Data Summary
Table 6b: Cross-section Morphology Data
Table 6c: Stream Reach Morphology Data

Table 6a. Baseline Stream Data Summary Horne Creek Tributaries Mitigation Project				
Parameter	**Design**		**Baseline**	
Reach ID: R1				
Dimension (Riffle)	Min	Max	Min	Max
Bankfull Width (ft)	-	7.0	6.2	7.6
Floodprone Width (ft)	28.0	65.0	23.9	34.5
Bankfull Mean Depth (ft)	-	0.4	0.4	0.5
Bankfull Max Depth (ft)	-	0.6	0.7	1.0
Bankfull Cross Sectional Area (ft^2)	-	2.9	2.6	3.9
Width/Depth Ratio	-	17.0	14.7	14.8
Entrenchment Ratio	4.0	9.3	3.9	4.5
Bank Height Ratio	-	1.0	1.0	1.0
Profile				
Riffle Length (ft)	10.0	20.0	10.7	26.1
Riffle Slope (ft/ft)	0.038	0.062	0.040	0.058
Pool Length (ft)	5.0	20.0	6.8	19.8
Pool Max Depth (ft)	0.8	1.4	0.9	1.9
Pool Spacing (ft)	10.5	35.0	10.8	35.5
Pattern				
Channel Beltwidth (ft)	24.5	56.0	12.4	24.3
Radius of Curvature (ft)	14.0	21.0	12.6	20.3
Rc:Bankfull Width (ft/ft)	2.0	3.0	2.0	2.7
Meander Wavelength (ft)	49.0	84.0	49.2	57.2
Meander Width Ratio	3.5	8.0	1.7	7.9
Transport Parameters				
Boundary Shear Stress ($lb/ft^{2)}$	0.79		0.84	
Max part size (mm) mobilized at bankfull	127.00		135.00	
Stream Power ($W/m^{2)}$	47.60		56.93	
Additional Reach Parameters				
Rosgen Classification	B4		B4	
Bankfull Velocity (fps)	4.2		4.6	
Bankfull Discharge (cfs)	12.0		12.0	
Sinuosity	1.07		1.12	
Water Surface Slope (Channel) (ft/ft)	0.037		0.037	
Bankfull Slope (ft/ft)	0.037		0.038	

Parameter	**Design**		**As-Built/**	
Reach ID: R2				
Dimension (Riffle)	Min	Max	Min	Max
Bankfull Width (ft)	-	6.0	-	-
Floodprone Width (ft)	15.0	19.0	-	-
Bankfull Mean Depth (ft)	-	0.5	-	-
Bankfull Max Depth (ft)	-	0.6	-	-
Bankfull Cross Sectional Area (ft^2)	-	2.8	-	-
Width/Depth Ratio	-	13.1	-	-
Entrenchment Ratio	2.5	3.2	-	-
Bank Height Ratio	-	1.0	-	-
Profile				
Riffle Length (ft)	5.0	15.0	5.6	13.1
Riffle Slope (ft/ft)	0.033	0.054	0.047	0.073
Pool Length (ft)	5.0	15.0	8.6	15.3
Pool Max Depth (ft)	0.9	1.6	1.4	2.7
Pool Spacing (ft)	9.0	30.0	11.0	27.1
Pattern				
Channel Beltwidth (ft)	-	-	-	-
Radius of Curvature (ft)	-	-	-	-
Rc:Bankfull Width (ft/ft)	-	-	-	-
Meander Wavelength (ft)	-	-	-	-
Meander Width Ratio	-	-	-	-
Transport Parameters				
Boundary Shear Stress ($lb/ft^{2)}$	0.75		-	
Max part size (mm) mobilized at bankfull	123.00		-	
Stream Power ($W/m^{2)}$	43.31		-	
Additional Reach Parameters				
Rosgen Classification	B4		B4	
Bankfull Velocity (fps)	4.4		4.4	
Bankfull Discharge (cfs)	12.0		12.0	
Sinuosity	1.08		1.11	
Water Surface Slope (Channel) (ft/ft)	0.030		0.042	
Bankfull Slope (ft/ft)	0.030		0.046	

Table 6a. Baseline Stream Data Summary
Horne Creek Tributaries Mitigation Project

Parameter	Design		As-Built/	
Reach ID: R4				
Dimension (Riffle)	Min	Max	Min	Max
Bankfull Width (ft)	-	9.0	7.9	9.6
Floodprone Width (ft)	38.0	79.0	59.0	70.0
Bankfull Mean Depth (ft)	-	0.6	0.5	0.5
Bankfull Max Depth (ft)	-	0.8	0.7	0.8
Bankfull Cross Sectional Area (ft^2)	-	5.2	3.7	5.1
Width/Depth Ratio	-	15.6	17.2	18.2
Entrenchment Ratio	4.2	8.8	4.2	5.0
Bank Height Ratio	-	1.0	1.0	1.0
Profile				
Riffle Length (ft)	10.0	30.0	11.5	33.2
Riffle Slope (ft/ft)	0.032	0.052	0.027	0.063
Pool Length (ft)	10.0	30.0	8.5	25.3
Pool Max Depth (ft)	1.2	2.0	1.4	2.6
Pool Spacing (ft)	13.5	45.0	20.6	57.9
Pattern				
Channel Beltwidth (ft)	31.5	72.0	31.7	48.2
Radius of Curvature (ft)	18.0	27.0	13.4	24.3
Rc:Bankfull Width (ft/ft)	2.0	3.0	1.7	2.5
Meander Wavelength (ft)	63.0	108.0	71.9	111.1
Meander Width Ratio	3.5	8.0	9.1	11.6
Transport Parameters				
Boundary Shear Stress ($lb/ft^{2)}$	0.93		0.75	
Max part size (mm) mobilized at bankfull	144.00		123.00	
Stream Power ($W/m^{2)}$	57.07		46.87	
Additional Reach Parameters				
Rosgen Classification	B4/C4b		B4/C4b	
Bankfull Velocity (fps)	4.2		4.3	
Bankfull Discharge (cfs)	22.0		22.0	
Sinuosity	1.31		1.32	
Water Surface Slope (Channel) (ft/ft)	0.029		0.025	
Bankfull Slope (ft/ft)	0.029		0.025	

Parameter	Design		As-Built/	
Reach ID: R5				
Dimension (Riffle)	Min	Max	Min	Max
Bankfull Width (ft)	-	10.0	10.0	13.3
Floodprone Width (ft)	54.0	134.0	95.0	140.0
Bankfull Mean Depth (ft)	-	0.7	0.5	0.8
Bankfull Max Depth (ft)	-	0.9	0.7	1.2
Bankfull Cross Sectional Area (ft^2)	-	7.2	4.5	8.4
Width/Depth Ratio	-	13.9	14.5	27.7
Entrenchment Ratio	5.4	13.4	3.4	4.0
Bank Height Ratio	-	1.0	1.0	1.0
Profile				
Riffle Length (ft)	15.0	30.0	14.8	39.0
Riffle Slope (ft/ft)	0.030	0.040	0.015	0.043
Pool Length (ft)	15.0	35.0	16.1	41.9
Pool Max Depth (ft)	1.4	2.5	2.0	3.1
Pool Spacing (ft)	15.0	70.0	37.8	59.7
Pattern				
Channel Beltwidth (ft)	35.0	80.0	41.6	56.8
Radius of Curvature (ft)	20.0	30.0	19.3	29.9
Rc:Bankfull Width (ft/ft)	2.0	3.0	1.9	2.2
Meander Wavelength (ft)	70.0	120.0	81.8	107.6
Meander Width Ratio	3.5	8.0	7.6	10.5
Transport Parameters				
Boundary Shear Stress ($lb/ft^{2)}$	0.79		0.75	
Max part size (mm) mobilized at bankfull	128.00		123.00	
Stream Power ($W/m^{2)}$	43.10		42.77	
Additional Reach Parameters				
Rosgen Classification	C4		C4	
Bankfull Velocity (fps)	3.8		3.9	
Bankfull Discharge (cfs)	27.0		27.0	
Sinuosity	1.21		1.23	
Water Surface Slope (Channel) (ft/ft)	0.020		0.020	
Bankfull Slope (ft/ft)	0.020		0.020	

Table 6b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Horne Creek Tributaries Mitigation Project #100026

	Cross Section 1 (Pool)								Cross Section 2 (Riffle)								Cross Section 3 (Pool)								Cross Section 4 (Riffle)							
Parameters	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	8.9	6.7	6.8	6.8	N/A				7.6	6.5	6.4	6.0	N/A				7.9	11.2	8.0	8.1	N/A				6.2	6.0	4.5	5.1	N/A			
Floodprone Width (ft)	36.7	34.7	32.4	31.9	N/A				34.5	34.2	40.0	34.8	N/A				33.3	34.9	33.3	32.8	N/A				23.9	25.5	24.7	27.4	N/A			
Bankfull Mean Depth (ft)	1.2	1.7	1.6	1.6	N/A				0.5	0.6	0.6	0.7	N/A				1.2	0.9	1.2	1.2	N/A				0.4	0.4	0.6	0.5	N/A			
Bankfull Max Depth (ft)	2.1	2.2	2.1	2.1	N/A				1.0	1.2	1.1	1.2	N/A				1.9	2.2	1.9	1.9	N/A				0.7	0.7	0.8	1.0	N/A			
Bankfull Cross Sectional Area (ft^2)	11.1	11.1	11.1	11.1	N/A				3.9	3.9	3.9	3.9	N/A				9.6	9.6	9.6	9.6	N/A				2.6	2.6	2.6	2.6	N/A			
Bankfull Width/Depth Ratio	7.1	4.0	4.2	4.2	N/A				14.8	10.9	10.6	9.1	N/A				6.4	13.0	6.6	6.8	N/A				14.7	14.0	7.8	9.9	N/A			
Bankfull Entrenchment Ratio	4.1	5.2	4.7	4.7	N/A				4.5	5.2	6.2	5.8	N/A				4.2	3.1	4.2	4.1	N/A				3.9	4.2	5.5	5.4	N/A			
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A				1.0	0.9	1.04	1.0	N/A				N/A	N/A	N/A	N/A	N/A				1.0	0.9	1.10	1.0	N/A			
d50 (mm)	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A			
	Cross Section 5 (Riffle)								**Cross Section 6 (Pool)**								**Cross Section 7 (Pool)**								**Cross Section 8 (Riffle)**							
Parameters	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	7.9	8.7	8.2	8.5	N/A				9.6	22.0	12.3	11.6	N/A				9.4	14.0	9.3	9.2	N/A				9.6	8.5	10.5	11.6	N/A			
Floodprone Width (ft)	40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A			
Bankfull Mean Depth (ft)	0.5	0.4	0.5	0.4	N/A				1.2	0.5	0.9	1.0	N/A				1.3	0.9	1.3	1.3	N/A				0.5	0.6	0.5	0.4	N/A			
Bankfull Max Depth (ft)	0.7	0.7	0.7	0.9	N/A				2.2	1.8	2.1	2.1	N/A				2.7	2.1	2.4	2.2	N/A				0.8	1.0	0.9	0.9	N/A			
Bankfull Cross Sectional Area (ft^2)	3.7	3.7	3.7	3.7	N/A				11.6	11.6	11.6	11.6	N/A				12.4	12.4	12.4	12.4	N/A				5.1	5.1	5.1	5.1	N/A			
Bankfull Width/Depth Ratio	17.2	20.6	18.0	19.4	N/A				7.9	41.7	13.1	11.5	N/A				7.1	15.8	7.0	6.8	N/A				18.2	14.2	21.9	26.4	N/A			
Bankfull Entrenchment Ratio	5.0	4.6	4.9	4.7	N/A				4.2	1.8	3.2	3.5	N/A				4.3	2.9	4.3	4.3	N/A				4.2	4.7	3.8	3.4	N/A			
Bankfull Bank Height Ratio	1.0	0.9	1.16	1.1	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				1.0	1.0	0.89	0.9	N/A			
d50 (mm)	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A			
	Cross Section 9 (Pool)								**Cross Section 10 (Riffle)**								**Cross Section 11 (Pool)**								**Cross Section 12 (Riffle)**							
Parameters	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	12.9	14.6	32.9	28.4	N/A				10.0	8.3	7.2	6.8	N/A				17.0	37.9	35.2	33.6	N/A				11.2	8.8	8.0	8.2	N/A			
Floodprone Width (ft)	40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A				38.5	32.5	40.0	40.0	N/A			
Bankfull Mean Depth (ft)	1.3	1.2	0.5	0.6	N/A				0.7	0.8	1.0	1.0	N/A				1.4	0.6	0.7	0.7	N/A				0.5	0.5	0.6	0.5	N/A			
Bankfull Max Depth (ft)	2.5	2.5	1.8	1.8	N/A				1.0	1.2	1.4	1.5	N/A				2.7	2.1	2.0	2.2	N/A				0.7	0.6	1.3	1.3	N/A			
Bankfull Cross Sectional Area (ft^2)	16.8	16.8	16.8	16.8	N/A				6.9	6.9	6.9	6.9	N/A				23.6	23.6	23.6	23.6	N/A				4.5	4.5	4.5	4.5	N/A			
Bankfull Width/Depth Ratio	9.8	12.6	64.2	48.1	N/A				14.5	10.0	7.6	6.6	N/A				12.2	60.8	52.7	47.7	N/A				27.7	17.2	14.0	15.1	N/A			
Bankfull Entrenchment Ratio	3.1	2.7	1.2	1.4	N/A				4.0	4.8	5.5	5.9	N/A				2.4	1.1	1.1	1.2	N/A				3.4	3.7	5.0	4.8	N/A			
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A				1.0	1.3	1.40	1.3	N/A				N/A	N/A	N/A	N/A	N/A				1.0	1.4	1.34	1.3	N/A			
d50 (mm)	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A			
	Cross Section 13 (Pool)								**Cross Section 14 (Riffle)**								**Cross Section 15 (Riffle)**								**Cross Section 16 (Pool)**							
Parameters	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Width (ft)	13.0	15.4	20.7	20.0	N/A				10.2	9.5	9.5	9.6	N/A				13.3	17.8	23.0	14.3	N/A				16.6	28.0	32.0	34.3	N/A			
Floodprone Width (ft)	40.0	40.0	40.0	40.1	N/A				40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A				40.0	40.0	40.0	40.0	N/A			
Bankfull Mean Depth (ft)	1.3	1.1	0.8	0.8	N/A				0.8	0.9	0.9	0.9	N/A				0.6	0.4	0.3	0.5	N/A				1.6	1.0	0.8	0.8	N/A			
Bankfull Max Depth (ft)	2.4	2.3	2.1	2.4	N/A				1.2	1.3	1.5	1.3	N/A				0.9	0.9	1.0	1.0	N/A				2.9	2.9	2.6	2.6	N/A			
Bankfull Cross Sectional Area (ft^2)	*16.4	16.4	16.4	16.4	N/A				8.4	8.4	8.4	8.4	N/A				7.7	7.7	7.7	7.7	N/A				27.1	27.1	27.1	27.1	N/A			
Bankfull Width/Depth Ratio	10.3	14.4	26.1	24.3	N/A				2.4	10.7	10.7	11.0	N/A				22.9	41.2	69.1	26.6	N/A				10.2	29.0	37.8	43.4	N/A			
Bankfull Entrenchment Ratio	3.1	2.6	1.9	2.0	N/A				3.9	4.2	4.2	4.2	N/A				3.0	2.2	1.7	2.8	N/A				2.4	1.4	1.3	1.2	N/A			
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A				1.0	1.0	1.06	1.1	N/A				1.0	0.9	0.90	0.8	N/A				N/A	N/A	N/A	N/A	N/A			
d50 (mm)	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A			

*Due to a calculation error MY0 bankfull was corrected from 19.9 to 16.4 (Cross Section 13 - Pool)

Table 6c. Monitoring Data - Stream Reach Summary Horne Creek Tributaries Mitigation Project												
Parameter	**Baseline**		**MY1**		**MY2**		**MY3**		**MY4**		**MY5+**	
Reach ID: R1												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	10.7	26.1										
Riffle Slope (ft/ft)	0.0395	0.0582										
Pool Length (ft)	6.8	19.8										
Pool Max depth (ft)	0.9	1.9										
Pool Spacing (ft)	10.8	35.5										
Pattern												
Channel Beltwidth (ft)	12.4	24.3										
Radius of Curvature (ft)	12.6	20.3										
Rc:Bankfull width (ft/ft)	2.0	2.7										
Meander Wavelength (ft)	49.2	57.2										
Meander Width Ratio	1.7	7.9										
Additional Reach Parameters												
Rosgen Classification	B4											
Sinuosity (ft)	1.12											
Water Surface Slope (Channel) (ft/ft)	0.0368											
BF slope (ft/ft)	0.038											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from

Parameter	**Baseline**		**MY1**		**MY2**		**MY3**		**MY4**		**MY5+**	
Reach ID: R2												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	5.6	13.1										
Riffle Slope (ft/ft)	0.0473	0.0725										
Pool Length (ft)	8.6	15.3										
Pool Max depth (ft)	1.4	2.7										
Pool Spacing (ft)	11.0	27.1										
Pattern												
Channel Beltwidth (ft)	-	-										
Radius of Curvature (ft)	-	-										
Rc:Bankfull width (ft/ft)	-	-										
Meander Wavelength (ft)	-	-										
Meander Width Ratio	-	-										
Additional Reach Parameters												
Rosgen Classification	B4											
Sinuosity (ft)	1.11											
Water Surface Slope (Channel) (ft/ft)	0.04228											
BF slope (ft/ft)	0.04565											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile

Table 6c. Monitoring Data - Stream Reach Summary
Horne Creek Tributaries Mitigation Project

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5+	
Reach ID: R4												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	11.5	33.2										
Riffle Slope (ft/ft)	0.02734	0.06283										
Pool Length (ft)	8.5	25.3										
Pool Max depth (ft)	1.4	2.6										
Pool Spacing (ft)	20.6	57.9										
Pattern												
Channel Beltwidth (ft)	31.7	48.2										
Radius of Curvature (ft)	13.4	24.3										
Rc:Bankfull width (ft/ft)	1.7	2.5										
Meander Wavelength (ft)	71.9	111.1										
Meander Width Ratio	9.1	11.6										
Additional Reach Parameters												
Rosgen Classification	B4/C4b											
Sinuosity (ft)	1.32											
Water Surface Slope (Channel) (ft/ft)	0.025											
BF slope (ft/ft)	0.02535											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5+	
Reach ID: R5												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	14.8	39.0										
Riffle Slope (ft/ft)	0.01547	0.04344										
Pool Length (ft)	16.1	41.9										
Pool Max depth (ft)	2.0	3.1										
Pool Spacing (ft)	37.8	59.7										
Pattern												
Channel Beltwidth (ft)	41.6	56.8										
Radius of Curvature (ft)	19.3	29.9										
Rc:Bankfull width (ft/ft)	1.9	2.2										
Meander Wavelength (ft)	81.8	107.6										
Meander Width Ratio	7.6	10.5										
Additional Reach Parameters												
Rosgen Classification	C4											
Sinuosity (ft)	1.23											
Water Surface Slope (Channel) (ft/ft)	0.01984											
BF slope (ft/ft)	0.01984											
[3]Ri% / Ru% / P% / G% / S%												
[3]SC% / Sa% / G% / C% / B% / Be%												
[3]d16 / d35 / d50 / d84 / d95 /												
[2]% of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

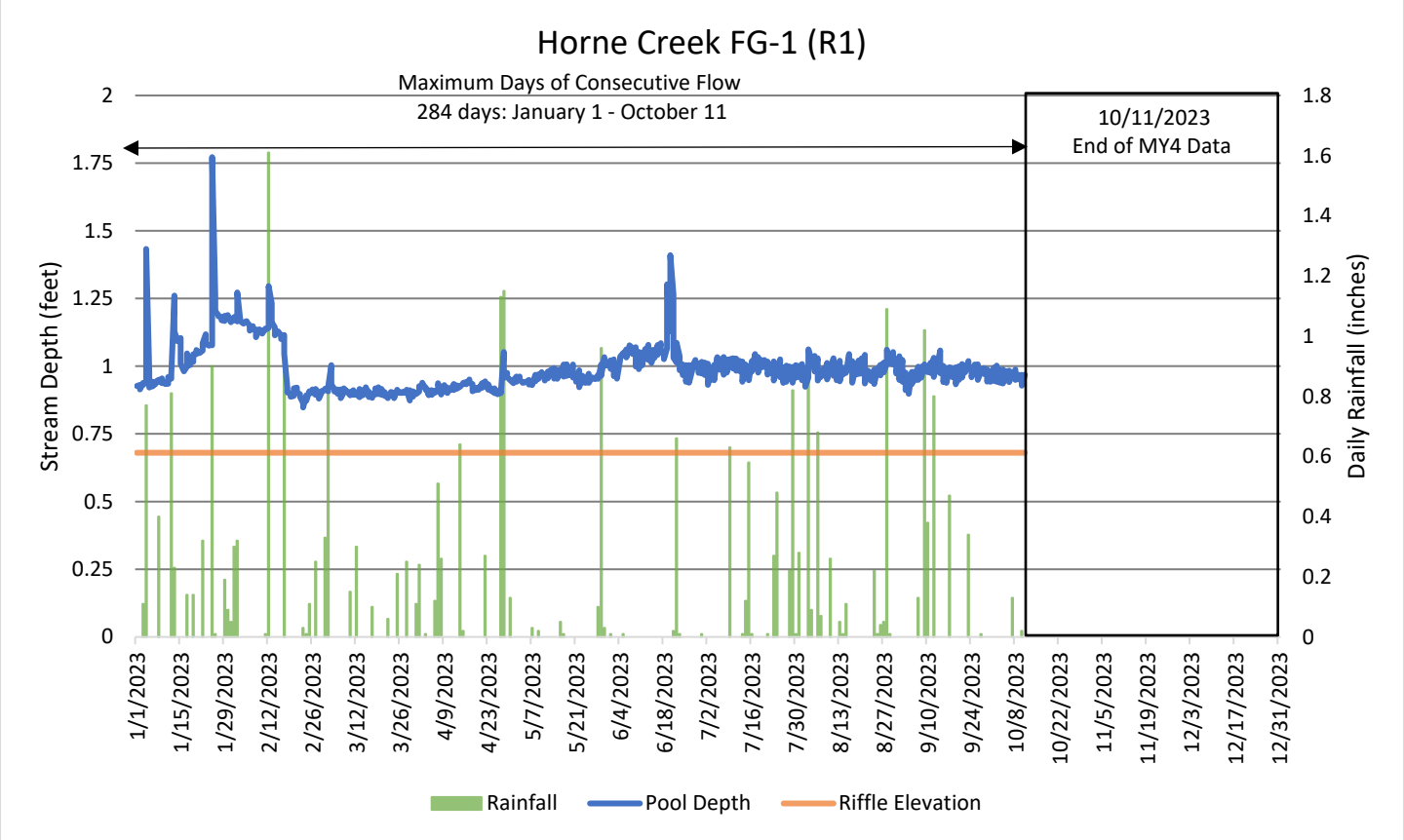
Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations

Appendix D: Hydrologic Data

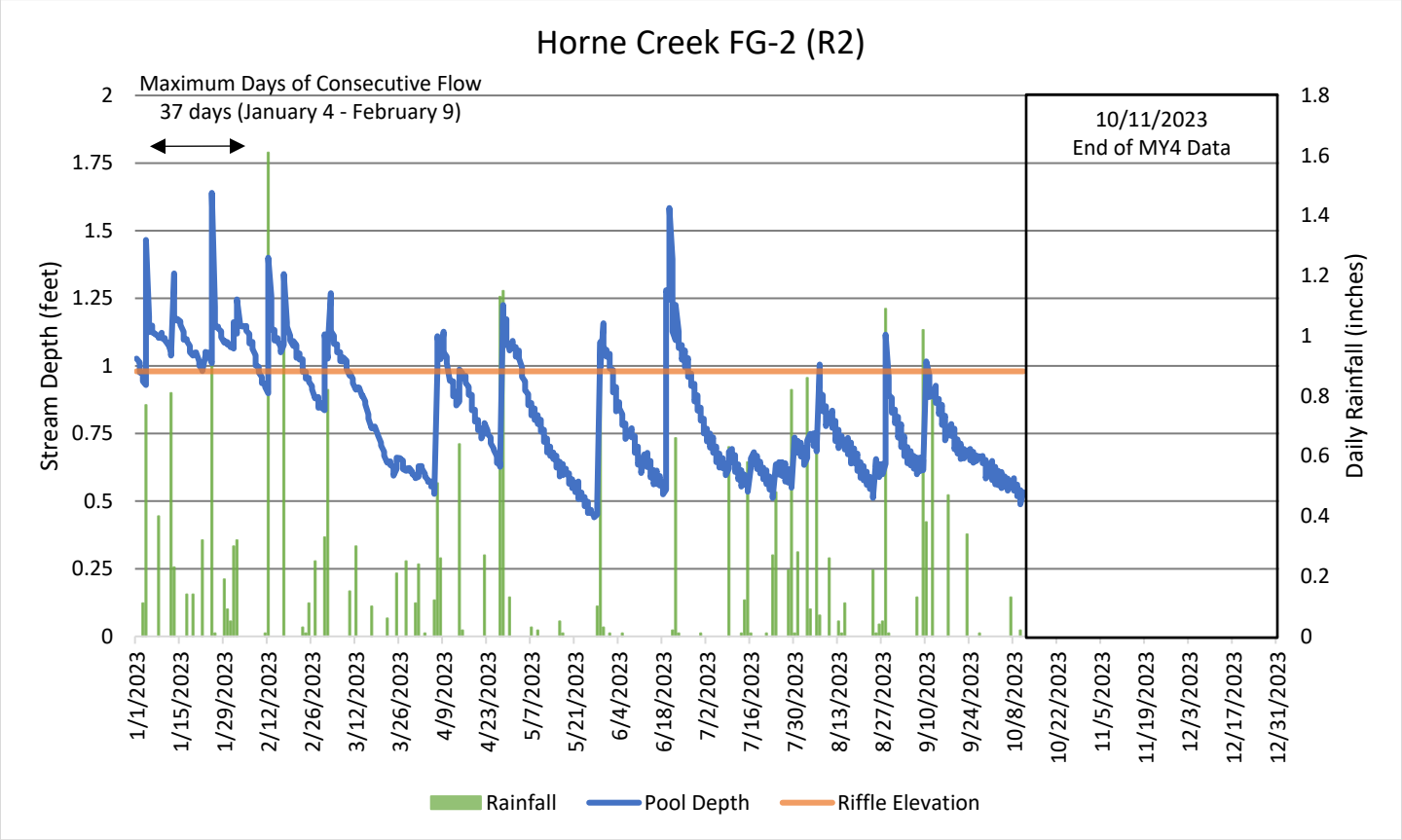
Table 7a and 7b: Verification of Bankfull Events
Figure 3: Surface Flow Events
Figure 4: Flow and Crest Gauge Installation Diagrams
Figure 5: Rainfall Data

Table 7A: Verification of Bankfull Events - R1 Horne Creek Tributaries Mitigation Project					
Monitoring Year	Date of Collection	Date of Occurrence	Method	Photos	Measurement above bankfull (feet)
MY1	9/15/2020	8/21/2020	Pressure Transducer	No	0.18
	11/5/2020	9/17/2020	Pressure Transducer	No	0.18
	11/5/2020	10/11/2020	Pressure Transducer	No	0.28
	11/5/2020	10/29/2020	Pressure Transducer	No	0.11
	8/12/2020	Unknown	Cork Gauge	Yes	0.20
	11/5/2020	Unknown	Cork Gauge	Yes	0.35
MY2	10/26/2021	1/1/2021	Pressure Transducer	No	0.03
	10/26/2021	1/28/2021	Pressure Transducer	No	0.02
	10/26/2021	2/13/2021	Pressure Transducer	No	0.02
	10/26/2021	2/15/2021	Pressure Transducer	No	0.36
	10/26/2021	2/18/2021	Pressure Transducer	No	0.06
	10/26/2021	3/19/2021	Pressure Transducer	No	0.14
	10/26/2021	3/25/2021	Pressure Transducer	No	0.02
	10/26/2021	3/26/2021	Pressure Transducer	No	0.08
	4/30/2021	Unknown	Cork Gauge	Yes	0.35
	10/26/2021	7/2/2021	Pressure Transducer	No	0.71
	10/26/2021	8/7/2021	Pressure Transducer	No	0.51
	10/26/2021	8/16/2021	Pressure Transducer	No	0.009
	10/26/2021	Unknown	Cork Gauge	Yes	1.3
MY3	1/11/2022	1/3/2022	Pressure Transducer	No	0.06
	4/7/2022	2/24/2022	Pressure Transducer	No	0.059
	4/7/2022	3/23/2022	Pressure Transducer	No	0.45
	4/7/2022	4/6/2022	Cork Gauge	Yes	0.35
	8/3/2022	5/2/2022	Pressure Transducer	No	0.07
	8/3/2022	5/26/2022	Pressure Transducer	No	0.10
	8/3/2022	5/27/2022	Pressure Transducer	No	1.00
	8/3/2022	7/9/2022	Pressure Transducer	No	0.26
	10/6/2022	8/6/2022	Pressure Transducer	No	0.34
	10/6/2022	8/22/2022	Pressure Transducer	No	0.26
	10/6/2022	9/5/2022	Pressure Transducer	No	0.32
MY4	1/11/2023	1/4/2023	Pressure Transducer	No	0.23
	4/11/2023	1/13/2023	Pressure Transducer	No	0.20
	4/11/2023	1/26/2023	Pressure Transducer	No	0.40
	4/11/2023	2/13/2023	Pressure Transducer	No	0.17
	4/11/2023	2/18/2023	Pressure Transducer	No	0.60
	4/11/2023	3/4/2023	Pressure Transducer	No	0.67
	4/11/2023	4/7/2023	Pressure Transducer	No	0.1
	4/11/2023	Unknown	Cork Gauge	Yes	0.9
	8/2/2023	4/29/2023	Pressure Transducer	No	0.62
	8/2/2023	5/29/2023	Pressure Transducer	No	0.02
	8/2/2023	6/20/2023	Pressure Transducer	No	0.34
	8/2/2023	7/30/2023	Pressure Transducer	No	0.08
	10/11/2023	8/7/2023	Pressure Transducer	No	0.59
	10/11/2023	8/26/2023	Pressure Transducer	No	0.004
	10/11/2023	8/29/2023	Pressure Transducer	No	0.099
	10/11/2023	9/10/2023	Pressure Transducer	No	0.017

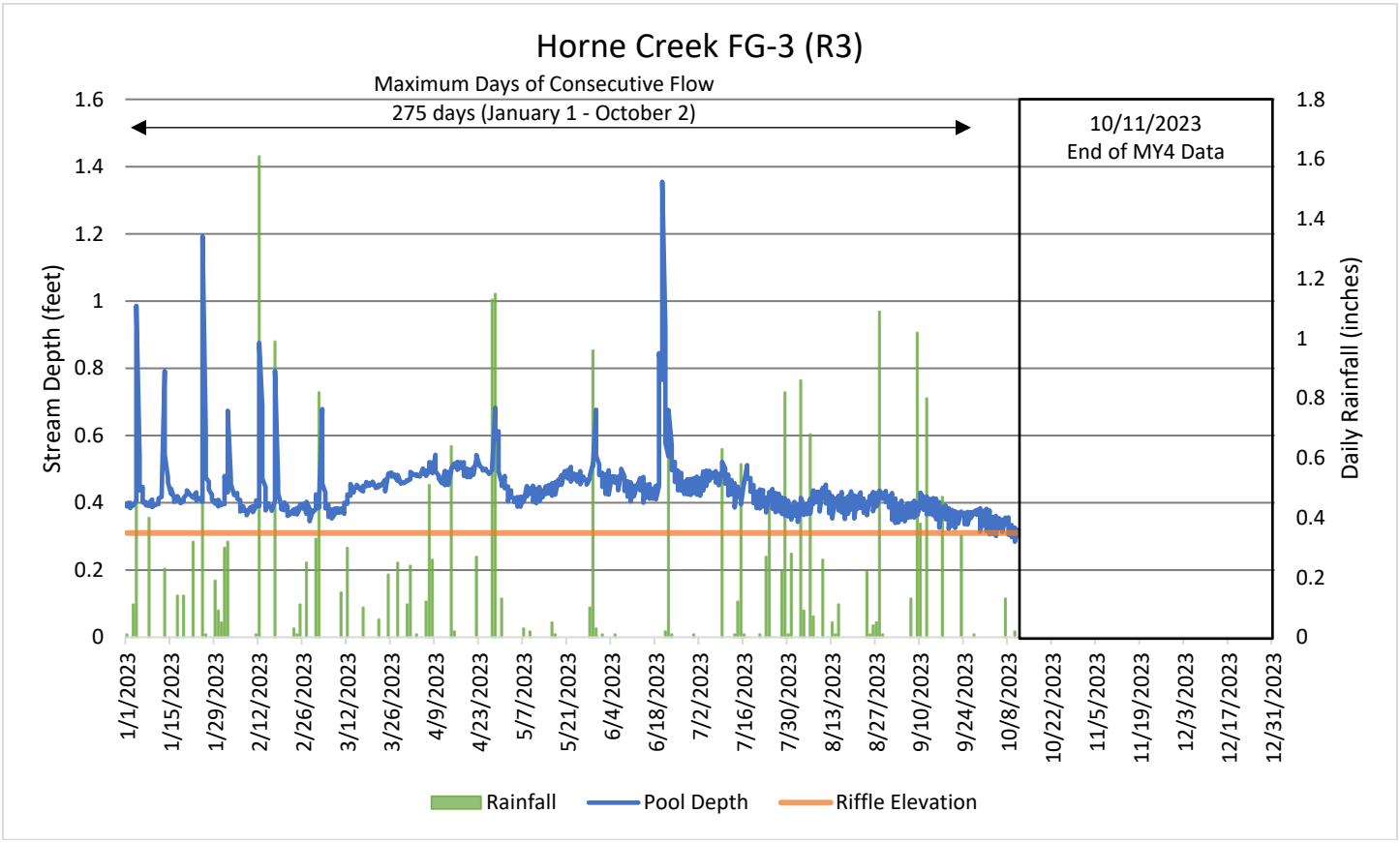
Table 7B: Verification of Bankfull Events - R5 Horne Creek Tributaries Mitigation Project					
Monitoring Year	Date of Collection	Date of Occurrence	Method	Photos	Measurement above bankfull (feet)
MY1	6/17/2020	5/20/2020	Pressure Transducer	No	0.10
	6/17/2020	5/24/2020	Pressure Transducer	No	0.96
MY2	10/26/2021	2/15/2021	Pressure Transducer	No	0.55
	10/26/2021	7/2/2021	Pressure Transducer	No	0.88
	10/26/2021	8/16/2021	Pressure Transducer	No	0.47
	10/26/2021	8/18/2021	Pressure Transducer	No	0.61
	9/2/2021	Unknown	Cork Gauge	Yes	1
	10/26/2021	9/21/2021	Pressure Transducer	No	1.67
	10/26/2021	9/22/2021	Pressure Transducer	No	0.16
	10/27/2021	Unknown	Crest Gauge	Yes	1.4
MY3	4/7/2022	3/23/2022	Pressure Transducer	No	0.233
	8/3/2022	5/27/2022	Pressure Transducer	No	1.16
	8/3/2022	7/9/2022	Pressure Transducer	No	0.269
	10/6/2022	8/22/2022	Pressure Transducer	No	0.1
	10/6/2022	9/5/2022	Pressure Transducer	No	0.203
MY4	4/11/2023	1/25/2023	Pressure Transducer	No	0.178
	4/11/2023	2/17/2023	Pressure Transducer	No	0.427
	4/11/2023	3/3/2023	Pressure Transducer	No	0.221
	8/2/2023	4/28/2023	Pressure Transducer	No	0.332
	8/2/2023	5/29/2023	Pressure Transducer	No	0.084
	8/2/2023	6/20/2023	Pressure Transducer	No	0.85
	8/2/2023	6/22/2023	Pressure Transducer	No	0.029



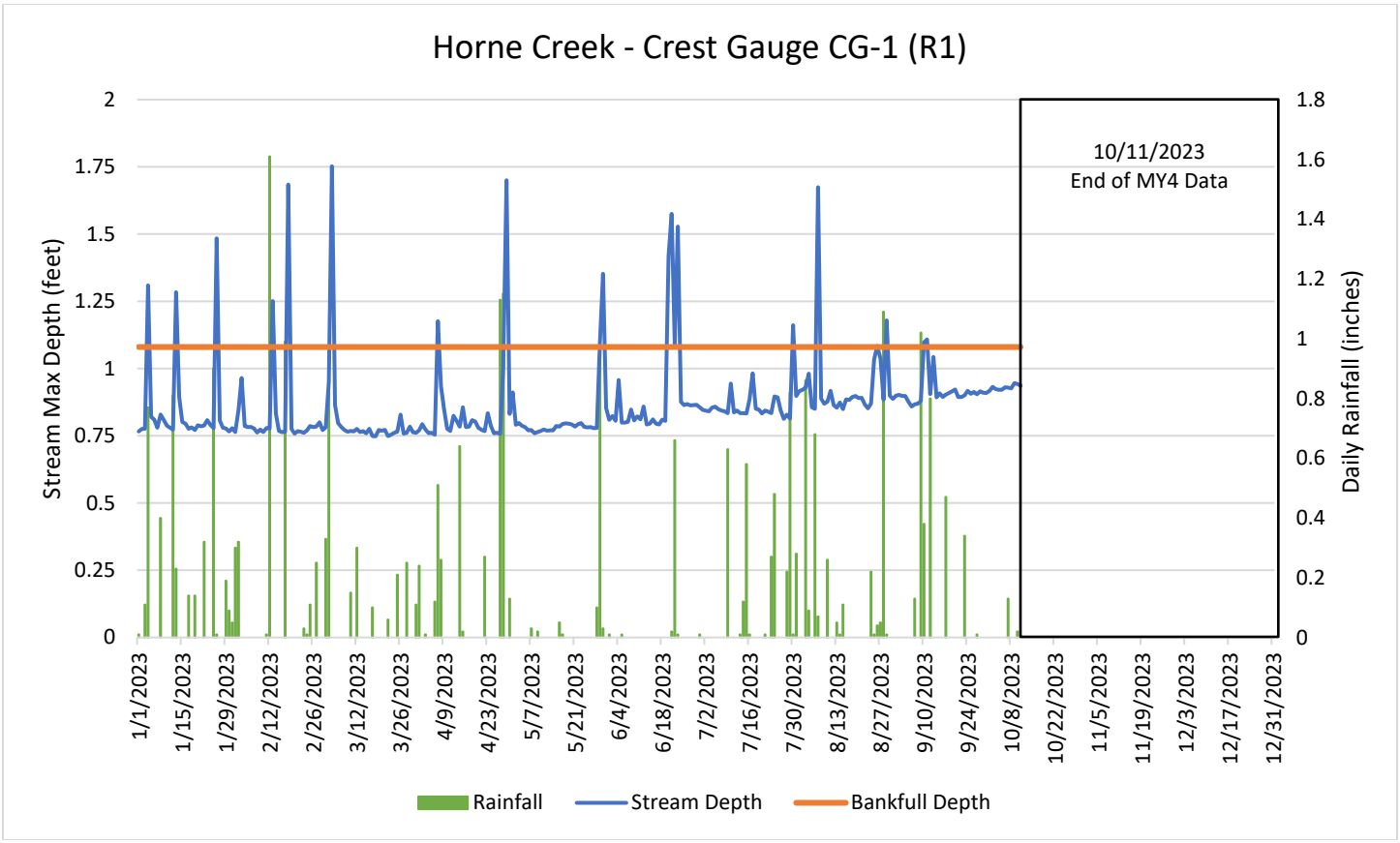
- **284 days of cumulative flow, 0 days of no flow.**



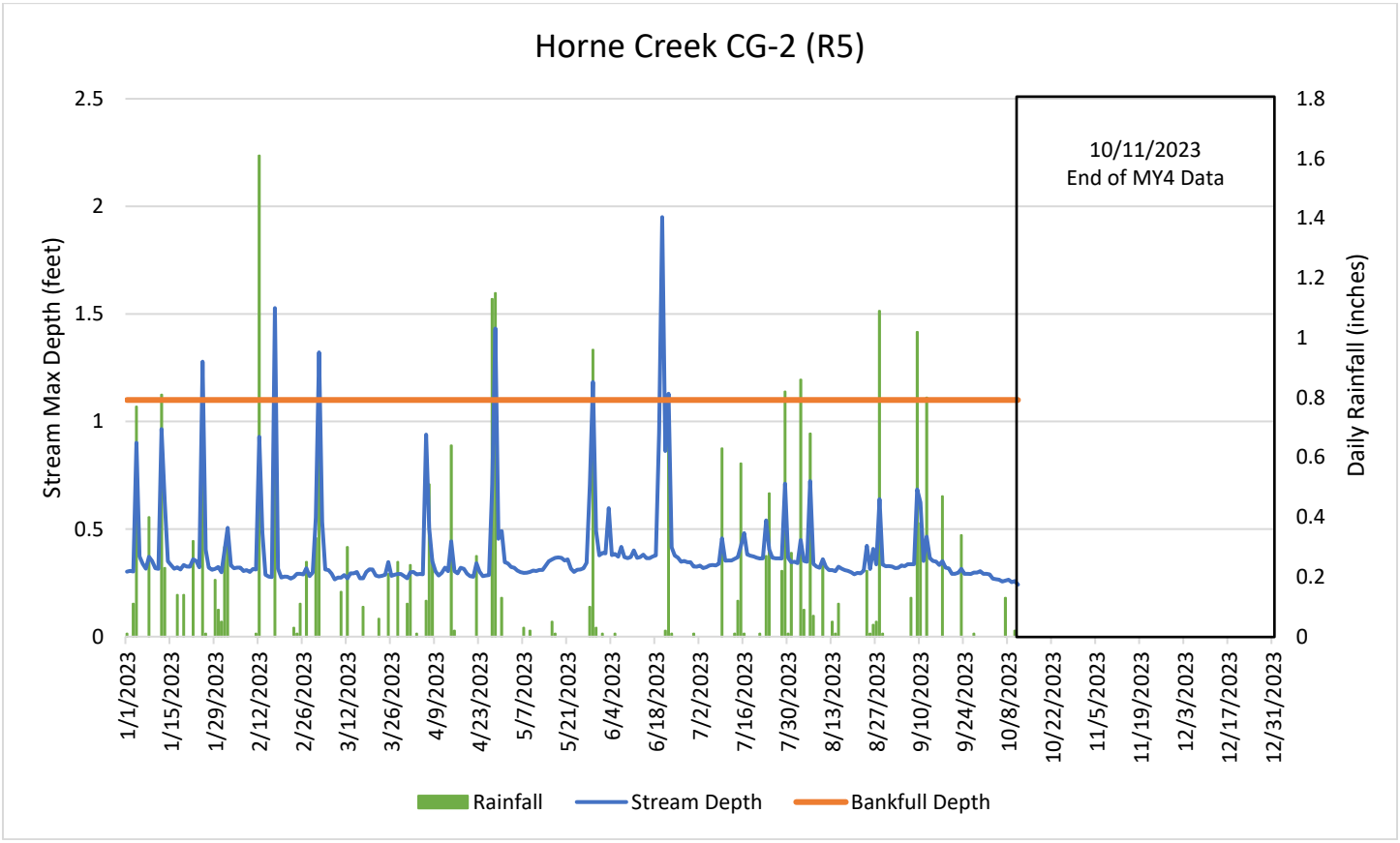
- **80 days of cumulative flow, 204 days of no flow.**



- **280 days of cumulative flow, 4 days of no flow.**

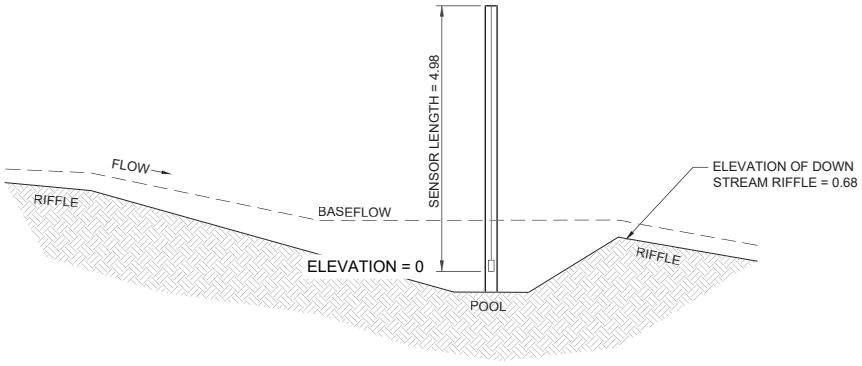


- **15 total events in MY4, 0.67' maximum event above bankfull.**



- **7 total events in MY4, 0.85' maximum event above bankfull.**

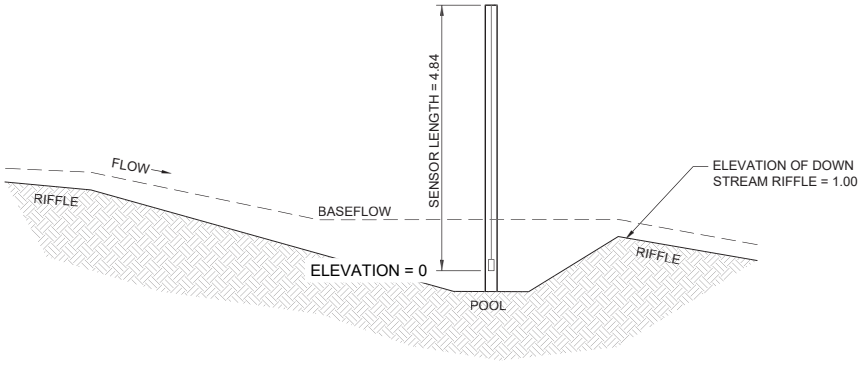
Figure 4: Flow Gauge Installation Diagrams



FLOW GAUGE FG-1 (R1)

Flow Depth = 0.68 Feet

*All elevations relative to sensor depth

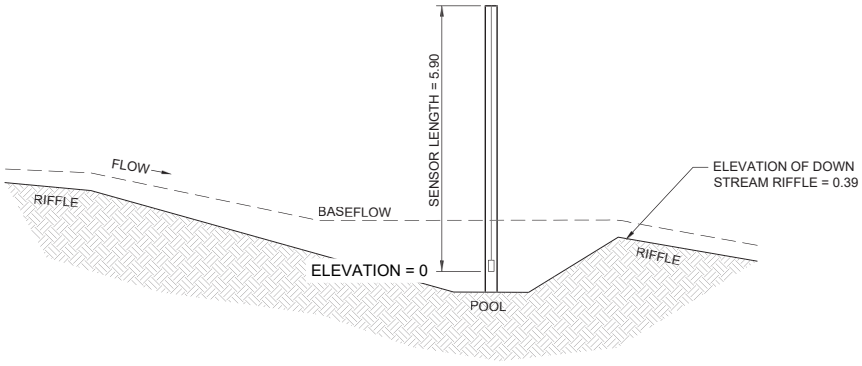


FLOW GAUGE FG-2 (R2)

Flow Depth = 0.98 Feet

*All elevations relative to sensor depth

Figure 4: Flow Gauge Installation Diagrams



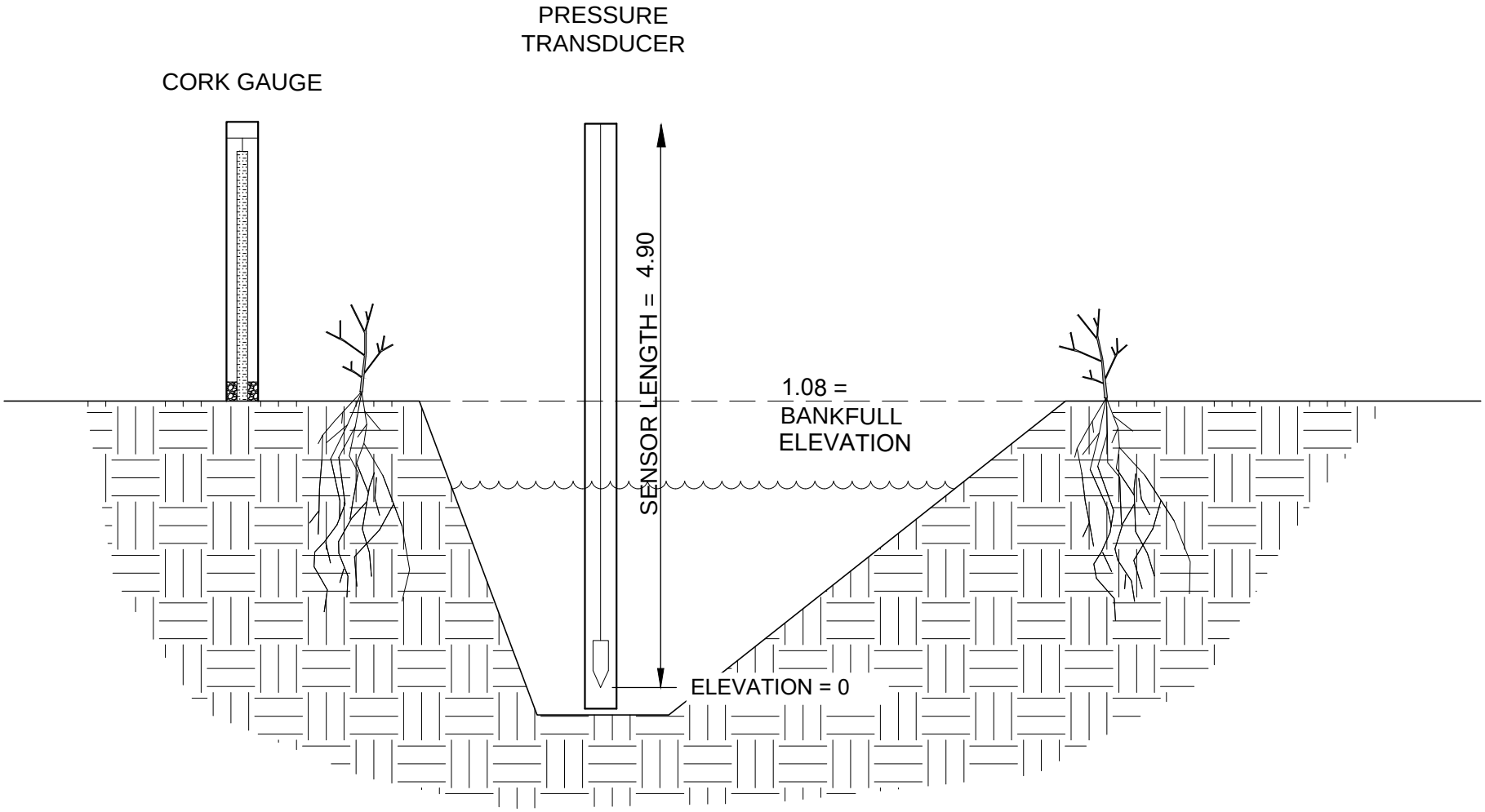
FLOW GAUGE FG-3 (R4)

Flow Depth = 0.31 Feet

*All elevations relative to sensor depth

Figure 4: Crest Gauge Installation Diagrams

CROSS SECTIONAL VIEW OF STREAM



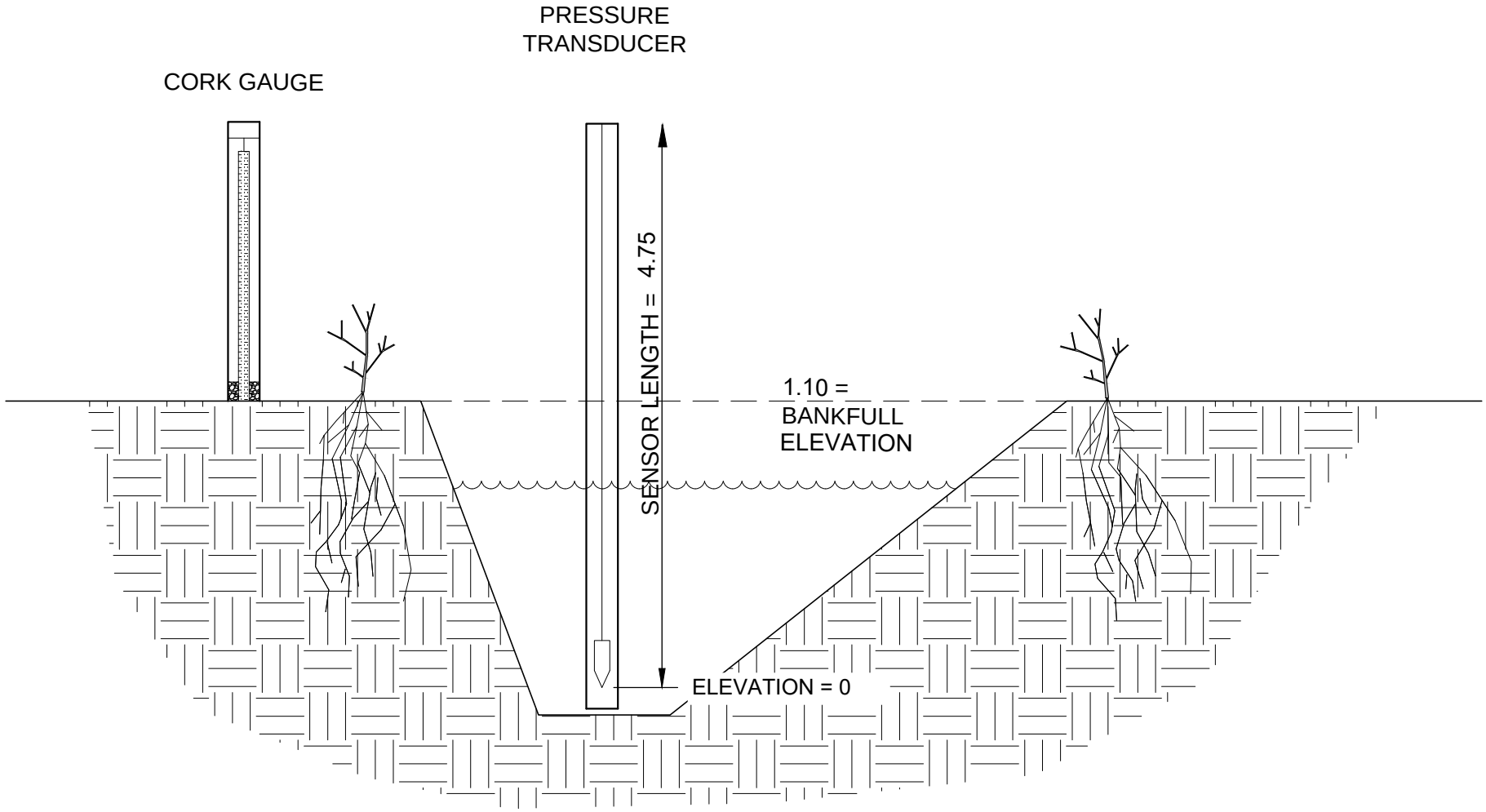
Crest Gauge CG-1 (R1)

Bankfull Event Depth = 1.08 feet

*All elevations relative to sensor depth

Figure 4: Crest Gauge Installation Diagrams

CROSS SECTIONAL VIEW OF STREAM

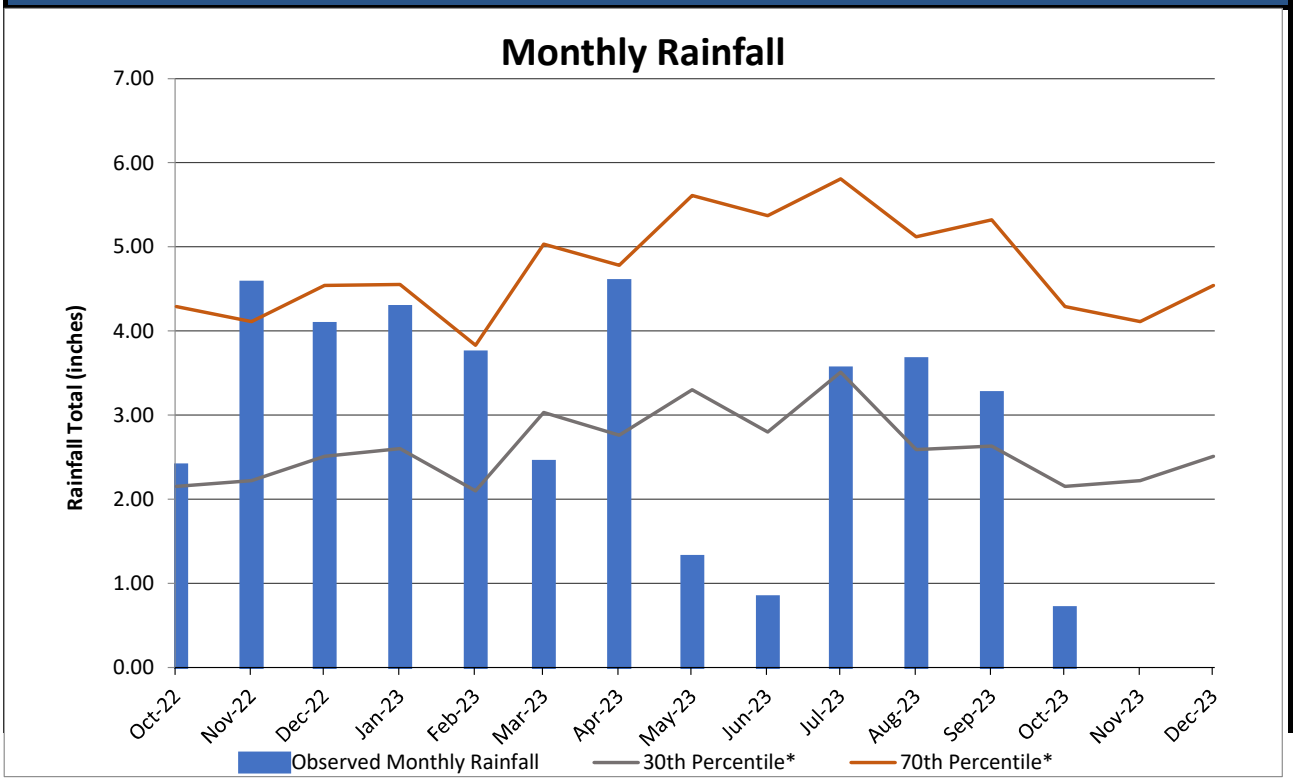


Crest Gauge CG-2 (R5)

Bankfull Event Depth = 1.10 feet

*All elevations relative to sensor depth

Figure 5: Monthly Rainfall Data
Horne Creek Tributaries Mitigation Project
MY4 2023



*30th and 70th percentile data collected from weather station Coop 315890 - Mount Airy, NC
**Incomplete Month

Month	30th Percentile*	70th Percentile*	Observed Monthly Rainfall
Oct-22	2.15	4.29	2.29
Nov-22	2.22	4.11	4.46
Dec-22	2.51	4.54	3.97
Jan-23	2.60	4.55	4.17
Feb-23	2.10	3.83	3.63
Mar-23	3.03	5.03	2.33
Apr-23	2.76	4.78	4.48
May-23	3.30	5.61	1.20
Jun-23	2.80	5.37	0.72
Jul-23	3.51	5.81	3.44
Aug-23	2.59	5.12	3.55
Sep-23	2.63	5.32	3.15
Oct-23	2.15	4.29	0.59
Nov-23	2.22	4.11	**
Dec-23	2.51	4.54	**