Monitoring Report
FINAL VERSION
Horne Creek Tributaries Mitigation Project
Monitoring Year 1
Calendar Year of Data Collection: 2020

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
Data Collection Period: November 2020
Submission Date: December 2020

Prepared for:

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

Prepared by:

Mitigation Project Name	**Home Creek Tributaries**	**USACE Action ID**	**2017-01510**
DMS ID	**100026**	**DWR Permit**	**2017-1156**
River Basin	**Yadkin**	**Date Project Instituted**	**5/25/2017**
Cataloging Unit	**03040101**	**Stream/Wet. Service Area**	**Yadkin 03040101**
County	**Surry**	**Date Printed**	**8/4/2020**

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Date: 2020.10.05 14:56:22 -04'00'

Signature of Official Approving Credit Release

Credit Release Milestone	**Warm Stream Credits**						
Project Credits	**Scheduled Releases %**	**Estimated Scheduled Release #**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	1,616.700	1,616.700	0.000	1,616.700	2020	8/4/2020
3 - Year 1 Monitoring	10.00%	538.900				2021	
4 - Year 2 Monitoring	10.00%	538.900				2022	
5 - Year 3 Monitoring	10.00%	538.900				2023	
6 - Year 4 Monitoring	5.00%	269.450				2024	
7 - Year 5 Monitoring	10.00%	538.900				2025	
8 - Year 6 Monitoring	5.00%	269.450				2026	
9 - Year 7 Monitoring	10.00%	538.900				2027	
Stream Bankfull Standard	10.00%	538.900					
			Totals		1,616.700		

Total Gross Credits	5,389.000
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	1,616.700
Total Percentage Released	30.00%
Remaining Unreleased Credits	3,772.300

Notes

Contingencies (if any)

Project Quantities

Mitigation Type	**Restoration Type**	**Physical Quantity**
Warm Stream	Restoration	5,344.000
Warm Stream	Enhancement II	84.000

Mitigation Project Name	**Horne Creek Tributaries**	**USACE Action ID**	**2017-01510**
DMS ID	**100026**	**DWR Permit**	**2017-1156**
River Basin	**Yadkin**	**Date Project Instituted**	**5/25/2017**
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County	**Surry**	**Date Printed**	**8/4/2020**

Debits

							Warm Stream Restoration Credits
Beginning Balance (mitigation credits)							**5,389.000**
Released Credits							**1,616.700**
Unrealized Credits							**0.000**
Converted Credits							**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**	
Remaining Balance (Released credits)							**1,616.700**
Remaining Balance (Unreleased credits)							**3,772.300**
Total Remaining Balance (Released and Unreleased credits)							**5,389.000**

WATER & LAND SOLUTIONS
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December 7, 2020

NC Department of Environmental Quality
Division of Mitigation Services
Attn: Matthew Reid, Project Manager
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: WLS Responses to NCDEQ DMS Review Comments for Task 7 Submittal, Monitoring Year 1 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 1 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 1 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 1 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 continue monitoring the seven stream problem areas that were identified during MY1 and document any remedial actions taken in the MY2 report.** WLS Response: The seven stream problem areas will continue to be monitored and remedial actions will be noted in the MY2 Report.

- **3.1.2 Stream Horizontal Dimension: The report indicates that four cross-sections (XS-2, XS-4, XS-5, and XS-15) are experiencing minor aggradation. With the exception of XS-15, the cross-section graphs do not support this claim. XS-2, 4 and 5 graphs indicate areas of degradation. Please review and revise as necessary.** WLS Response: WLS has revised 3.1.2 to indicate XS-2, XS-4, and XS-5 are experiencing minor degradation and XS-15 is experiencing minor aggradation. WLS staff noted that XS-2, XS-4, XS-5, and XS-15 are functioning and stable. WLS will continue to monitor all cross sections closely in MY2.

- **Pool cross-section graphs (XS-6, XS-7 and XS-11) indicate aggradation. Is the amount of aggradation within the tolerances WLS would expect to see at this point in the project history? Please continue to monitor and observe changes in MY2.** WLS Response: The amount of aggradation observed is within tolerances expected, given the high rainfall totals measured during MY1. Visual surveys indicate the areas affected are functioning and stable. WLS will continue to monitor and note any changes in the MY2 report.

- **3.22 Bankfull Events: CG-2 recorded two events during MY1. The two events were recorded prior to the gauge being damaged and moved. The new reinstalled location has a new bankfull depth as shown on Figure 4. The new location did not record a bankfull event despite several 2.5-3" rain events. Is WLS confident that the location and calibration of CG- 2 is capturing bankfull events in the new location?** WLS Response: WLS is confident in the location of CG-2. WLS re-surveyed CG-2 on December 7th, 2020 and adjusted the re-installed bankfull height to 1.69'. Since the submittal of the draft monitoring report, CG-2 has recorded a bankfull event. Figure 4 in Appendix E has been updated with the corrected bankfull depth of 1.69'.

- **Conservation easement encroachment was observed during the July 2020 MY0 site visit. During the September 2020 IRT site visit, it was noted that WLS installed horse tape around easement markers to alert the land owner the location of the conservation easement line. There was discussion of using bollards or split rail fence to demarcate this line better. WLS also indicated additional trees/shrubs would be installed this fall. Please update the report to summarize the encroachment and solution.** WLS Response: WLS revised section 3.3 to summarize the encroachment and solutions. As of December 2020, encroachment activities have improved. To further demarcate the line, a supplemental row of trees will be planted immediately inside of the easement during early MY2. There are no plans for additional fencing or bollards at this time, and the landowner prefers to not use split rail fence or bollards. This area will be monitored closely, and any actions will be detailed in the MY2 report.

- **CCPV: The conservation easement is not showing correctly on the R4 section on Sheet 1b. Please update.** WLS Response: The conservation easement boundary is now showing correctly on Sheet 1b.

Electronic Deliverable:

- **During the as-built review, DMS requested that R4A and R4B be segmented to include both R and EII segments, and that these segments be included in the CCPV. It does not appear that the digital files that were submitted resolved this comment, and the CCPV has R4A and R4B symbolized as EII only. Please re-submit features that accurately characterize these segments, and make sure they are appropriately displayed on the CCPV.** WLS Response: The CCPV has been updated to show both R and EII segments on R4A and R4B. These files are also in the updated digital file submission.

- **Please provide the feature for FG-2.** WLS Response: The feature for FG-2 has been added. This flow gauge was added to the site on September 18th, 2020.

- **Please include photos from photo stations as JPEGs.** WLS Response: All photos have been included as JPEGs.

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Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

Cara Conder
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LIST OF APPENDICES

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 at 36.2851950° and -80.5032100°.

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.

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 the appendices in Table 3 and project background information is presented in 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 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. 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 in 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: Representative streambed material samples will be collected in monitoring years 5 and 7 at locations where riffles are installed in restoration reaches. The post-construction riffle substrate samples will be compared to the existing riffle substrate data collected during the design phase. Any significant changes (e.g., aggradation, degradation, embeddedness) will be noted after streambank vegetation becomes established and a minimum of two bankfull flows or greater have

been documented. If significant changes are observed within stable riffles and pools, additional sediment transport analyses may be required.

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 a year 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 E). 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 1, 2, 3, 5, and 7. Vegetative success for the Project during the intermediate monitoring years will be based the survival of at least 320, three-year-old planted trees per acre at the end of Year 3 of the monitoring period; and at least 260, five-year-old, planted 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 planted stems per acre that must average eight feet in height in Year 7 of monitoring.

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**

2.2 Design Approach

2.2.1 Stream

The Project stream design approach included a combination of Stream Restoration and Enhancement activities. Priority Level I Restoration reaches incorporated the design of a single-thread meandering channel, with parameters based on data taken from reference site comparison, published empirical relationships, NC Piedmont Regional Curves, and hydrologic and hydraulic analyses. The restoration of planform and dimension, frequent overbank flows and a restored riparian buffer will provide the appropriate hydrology and sediment transport throughout the project catchments. All non-vegetated areas within the easement were planted with native vegetation and any areas of invasive species were removed and/or treated.

- **Reach R1 –** R1 begins at the upstream western boundary of the Project immediately downstream of an existing stream crossing. The majority of the reach was restored as a Rosgen B4 stream type within its current location and tied into the downstream channel. Work along R1 involved relocating the channel towards the center of the valley and implementing a Priority Level I/II Restoration by raising the bed elevation and reconnecting the stream with its abandoned floodplain. Fencing was installed outside of the easement boundary to permanently exclude livestock and reduce sediment and nutrient inputs. A permanent 20-foot wide culverted crossing was installed to allow for landowner access between pastures. Additionally, one water quality treatment feature was installed inside of the conservation easement to reduce sediment and nutrient inputs that would otherwise enter the riparian buffer as untreated water.

- **Reach R2 –** R2 begins downstream of a roadway culvert under Caudle Road. Work along R2 involved Priority Level II restoration by slightly raising the bed elevation and reconnecting the stream with a constructed floodplain. The reach was restored as a Rosgen B4 stream type using appropriate step-pool morphology with minimal meander planform geometry that accommodated the valley slope and width. One water quality treatment feature was constructed inside of the conservation easement at the beginning of R2 to capture, attenuate, and treat overland flow that would otherwise enter the riparian buffer as untreated water.

- **Reach R3 –** R3 begins at the confluence of R2 and R4. Work along R3 involved Priority Level II restoration by slightly raising the bed elevation and reconnecting the stream with a constructed floodplain. The reach was restored as a Rosgen B4a stream type using appropriate step-pool morphology with minimal meander planform geometry to accommodate the valley slope and width. Two water quality treatment features were constructed in series along R3 to capture, attenuate, and treat overland flow.

- **Reach R4 –** R4 begins at the confluence of R2 and R3. Work along R4 involved a combination of Priority Level I and II Restoration by gradually raising the bed elevation and reconnecting the stream with its adjacent floodplain or a constructed floodplain. A majority of the channel was restored in its current location while the lower 200 feet was relocated to its historic position to meander across the left floodplain before connecting with R5. Two permanent 20-foot wide culverted crossings were installed to allow for landowner access between pastures.

- **Reach R4a –** R4a is a small perennial headwater tributary that begins at a spring head within the upper catchment. R4a consisted of Enhancement Level II practices in the upper 57 linear feet by removing cattle and planting native vegetation to maintain and improve the stability of the channel. The lower 111 feet was restored as a Rosgen B4 stream type using appropriate riffle-pool and step-pool morphology with minimal meander planform geometry. This approach allowed restoration of a stable channel form with appropriate bedform diversity and allowed the channel to be tied into Reach R4.

- **Reach R4b –** R4b is a small perennial headwater tributary that begins at a spring head within the upper catchment. A majority of this reach was stable except for the downstream end where an active head-cut had propagated upstream from R5. Work along R4b involved Enhancement Level

II practices in upper 27 linear feet to maintain and improve the stability of the channel. The lower 125 linear feet was restored as a Rosgen B4 stream type using appropriate riffle-pool and step-pool morphology with minimal meander planform geometry. This approach allowed restoration of a stable channel form with appropriate bedform diversity and allowed the channel to be tied into Reach R4.

- **Reach R5 –** R5 begins at the confluence of R4 and R4b. Work along R5 involved Priority Level I Restoration by raising the bed elevation and reconnecting the stream with its historic floodplain. A majority of the channel was constructed offline and the existing degraded channel was partially to completely filled. A permanent 20-foot culverted crossing was installed to allow for landowner access between pastures.

3 Monitoring Year 1 Assessment and Results

The dates of Year 1 monitoring activities are detailed in Appendix A, Table 2. All Year 1 monitoring data is presented in this report and in the appendices. The Project is on track for meeting stream and vegetation interim success criteria. 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 and cross-section surveys were utilized for assessment of MY1 horizontal and vertical stream stability. The visual assessments for each stream reach concluded that the MY1 stream channel pattern and longitudinal profiles, and in-stream structure location/function, still closely match the profile design parameters and MY0/baseline conditions (Appendix D). The MY1 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. These areas are called out on the CCPV (Figure 1a-1c) and photos can be found in Appendix B and the E-Data Submission included with this report.

- **SPA1**- On R1, adjacent to the right bank at approximate station 10+25: minor slumping is occurring where drainage from the adjacent pasture enters the stream buffer. WLS will monitor this area closely during MY2.
- **SPA2**- On R1, below the culvert crossing at approximate station 17+00: minor floodplain erosion in the stream buffer is occurring adjacent to an area of coir matting. WLS will monitor this area closely in MY2.
- **SPA3**- On R1, along the left floodplain at approximate station 20+25 – 21+60: a minor avulsion has formed causing floodplain erosion and concentrated flow during out-of-bank events and from toe slope seepage. WLS will install live-stakes and coir logs (wattles) and reseed this area during early MY2. This remedial action will stabilize the area, prevent future erosion, and redirect flow back into the stream channel. WLS will note all remedial action taken in the MY2 report.

- **SPA4**- On R4, minor erosion was observed on both the right and left bank side slopes at approximate station 15+75, above the culvert crossing. This area will be closely monitored during MY2.
- **SPA5**- On R5, in the left floodplain area: minor erosion is occurring adjacent to station 32+60. WLS will monitor this area during MY2.
- **SPA6**- On R5, adjacent to vegetation plot 10 near station 43+50: a small secondary channel has formed in the right floodplain between the floodplain depressions. This area and drainage pattern will be closely monitored during MY2.
- **SPA7**- On R5, at the meander bend located at station 47+00: the left bank is at risk of eroding. The bank is currently functioning, but WLS will install additional live stakes in the meander to ensure stability in MY2. Any remedial action taken during MY2 will be photographed and documented in the MY2 report.

Minor piping was noted on R4 during MY0 at the in-stream structure (grade control log j-hook vane) near approximate station 19+55. The minor piping resolved naturally during MY1 and is no longer an issue.

3.1.2 Stream Horizontal Dimension

The MY1 channel dimensions generally match the design parameters and are within acceptable and stable ranges of tolerance. Data for the 16 cross-sections (eight riffle and eight pool) can be found in Appendix D. It is expected over time that some pools may accumulate fine sediment and organic matter, however, this is not an indicator of channel instability. Maximum riffle depths are also expected to fluctuate throughout the monitoring period as the channels adjust to the new flow regime and catchment conditions. Of the eight riffle cross-sections, six experienced minor changes in bank height ratio (BHR) from MY0 to MY1. One cross-section, XS-15, experienced minor aggradation due to sediment migration occurring during MY1. Five cross-sections (XS-2, XS-4, XS-5, XS-10, and XS-12) experienced minor degradation due to bed material entrainment from the riffles during MY1 storm events. Visual surveys indicate the areas affected through aggradation and degradation are functioning and stable. WLS will closely monitor any changes to all stream reaches during MY2.

3.1.3 Substrate

Representative streambed material samples will be collected in years 5 and 7 at the locations where riffles are installed in reaches that were proposed for restoration as part of the Project.

3.2 Stream Hydrology

3.2.1 Stream Flow

Two flow gauges (FG-1 and FG-3), installed in May of 2020 on R1 and R4, documented that the stream exhibited surface flow for a minimum of 30 consecutive days throughout the monitoring year (Appendix E). One additional flow gauge (FG-2) was installed during MY1 on Reach R2 on September 18th, 2020 in response to IRT comments received during the September 15th, 2020 site visit. FG-2 did not exhibit 30 consecutive days of flow for MY1 (only 48 days of data available), with a maximum recorded flow of seven days. Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from Surry County Airport Weather Station (KMWK), approximately fifteen miles north of the site.

3.2.2 Bankfull Events

During MY1, bankfull events were recorded on both pressure transducer crest gauges. CG-1 (R1) recorded four events with a maximum event of 0.28’ above bankfull. CG-2 (R5) recorded two events with a

maximum event of 0.96' above bankfull. CG-2 was subsequently damaged by a storm event on May 24th, 2020. WLS reinstalled the gauge on June 17th, 2020. Additionally, the cork crest gauge located adjacent to CG-1 on R1 recorded two bankfull events. The associated data and photographs are located in Appendix E.

3.3 Vegetation

Monitoring of the 10 permanent vegetation plots was completed during the second week of November 2020. Vegetation data can be found in Appendix C with the associated photos located in Appendix B. The MY1 average planted density is 558 stems per acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. In addition, every permanent vegetation plot also met the interim measure of success and had 486 to 688 stems per acre. Though not tabulated in the results, volunteer species of green ash and persimmon were noted in MY1 and more are expected to establish in upcoming years.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. One area of concern noted during the IRT as-built site visit at the lower end of R1 (approximate station 23+50 right floodplain hillside) continues to lack well-established herbaceous vegetation. WLS staff added additional grass seed (*Brachiaria ramose* and *Lolium multiflorum*) and a native grass/wildflower seed mix (see table below) in September 2020. WLS will monitor this area closely during MY2 for vegetation establishment. Another area was noted during the IRT as-built site visit of having low herbaceous growth on R4 (approximate station 16+50 right floodplain hillside). A photo point (PS-7) has been added to capture this area in future years and this area was also seeded with the species above in September 2020. This area has coir matting and does not have active erosion problems. Both areas lacking vegetation are not on the CCPV as they are below the mapping threshold of one acre.

Common Name	Species	% of Mix
Little Bluestem	*Schizachyriam scoparium*	30
Yellow Indiangrass	*Sorghastrum nutans*	30
Lanced-Leaf Coreopsis	*Coreopsis lanceolata*	9
Narrow-Leaved Sunflower	*Helianthus angustifolius*	5
Spotted Beebalm	*Monarda punctata*	5
Black-Eyed Susan	*Rudbeckia hirta*	5
Purpletop/Greasegrass	*Tridens Flavus*	5
Bur-Marigold	*Bidens aristosa*	4
Goldenmane Tickseed	*Coreopsis basalis*	5
Plains Coreopsis	*Coreopsis tinctoria*	2

No areas of significant invasive plant species were observed during monitoring year 1. 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 in the channels.

An area of minor easement encroachment, along upper R2, was noted during the July 2020 IRT site visit. The landowner was contacted, and his responsibilities and limitations were explained. Horse tape was

installed to demarcate the line and prevent further mowing activities inside of the conservation easement. As of December 2020, encroachment activities have improved. To further demarcate the line, a supplemental row of trees will be planted immediately inside of the easement during early MY2. There are no plans for additional fencing or bollards at this time. This area will be monitored closely, and any actions will be detailed in the MY2 report.

4 Methods

Stream cross-section monitoring was conducted using a Topcon RL-H5 Laser Level. Survey data was imported into Microsoft Excel® for data processing and analysis. 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 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.

5 References

Lee Michael T., Peet Robert K., Roberts Steven D., and Wentworth Thomas R., 2008. CVS-EEP Protocol for Recording Vegetation Level. Version 4.2

(RBRP) North Carolina Ecosystem Enhancement Program (EEP), 2009. Yadkin Pee-Dee River Basin Watershed Restoration Priorities (RBRP). February 2009.

United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers. Wilmington District.

United States Army Corps of Engineers. 2016. Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District, October 2016, U.S. Army Corps of Engineers. Wilmington District.

Water and Land Solutions, LLC (2019). Horne Creek Tributaries Mitigation Plan. NCDMS, Raleigh, NC.

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
Regulatory Correspondence

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: 7 months
Elapsed Time Since planting complete: 7 months
Number of reporting Years[1]: 1

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)	5/20/2020	7/1/2020
Year 1 Monitoring	11/10/2020	11/20/2020
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring/ Close Out		

Table 3. Project Contacts Horne Creek Tributaries Mitigation Project	
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	Kyle Obermiller - (828) 808-2240
Vegetation Monitoring POC	Kyle Obermiller - (828) 808-2240
Wetland Monitoring POC	N/A; Kyle Obermiller - (828) 808-2240

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

Meeting Minutes

Horne Creek Tributaries Mitigation Project, DMS Project ID #100026

USACE Action ID#: SAW-2017-01510

Subject: NCIRT Horne Creek Tributaries As-Built Baseline Site Visit

Date Prepared: September 16th, 2020

Meeting Date and Time: September 15th, 2020 10:30 am – 1:30 pm

Meeting Location: Kiger Road, Pinnacle, NC (36.28257, -80.50831)

Recorded By: Cara Conder

Attendees: USACE: Todd Tugwell

NCDEQ DWR: Erin Davis

DMS: Matthew Reid, Paul Wiesner

WLS: Kayne VanStell, Cara Conder, and Kyle Obermiller

These meeting minutes document notes and discussion points from the North Carolina Interagency Review Team (NCIRT) As-Built Baseline Site Meeting for the Horne Creek Tributaries Mitigation Project (Yadkin River Basin, CU 03040101, Warm Water Thermal Regime). Water & Land Solutions, LLC (WLS) submitted a Final As-Built Baseline Monitoring Report on August 3rd, 2020 and the site visit was held on September 15th, 2020. The meeting began with a general summary of the overall project construction and dates. These meeting minutes proceed in order of discussion.

1. Erin Davis asked for a redline vegetation table in the as-built and also noted that there was not a planting list provided with quantities and species. WLS has corrected the oversight and attached the planting list to these meeting minutes.

2. Erin Davis asked if WLS had maximum depths of the vernal pools on the as-built drawings. Kayne VanStell responded that there are no depths on the as-built drawings, and these are actually floodplain depressions for storage and not vernal pools. Floodplain depression depths range 6-14 inches, but it was noted the contractor installed brush at the bottom and the water surface elevations will fluctuate over time based on seasonal water table and rainfall events.

3. Erin Davis noted that there is riprap on the inlets and outlets on the BMPs. Kayne stated that the stone outlet is added protection for headcutting and erosion.

4. Todd Tugwell and Erin Davis asked if any project areas had buffer widths less than 30 ft. WLS responded that there were a few areas, but this was addressed in the mitigation plan and WLS utilized the non-standard buffer tool, as there are many areas of the site with buffers wider than 30 ft.

5. Todd Tugwell asked when planting was completed. Cara Conder stated April 30th.

6. Erin Davis requested to mention weather/rain delays in future reports as needed. Kayne VanStell did confirm WLS had construction delays due to significant and timely rain events on this site.

7. Erin Davis requested to add all non-credited wetland areas to the CCPV. The revised CPPV is attached to these meeting minutes.

8. Erin Davis stated to address cattails in BMP or buffer (preferably by hand removal) if they become a monoculture.

9. Todd Tugwell said that going forward do not use smooth/non-corrugated pipes in crossings.

10. Todd Tugwell asked if WLS has concerns about vegetation establishing on the steeper side slopes. Kayne VanStell responded yes, WLS does have concerns on excavated side slopes <3:1, but we have not observed any rills after multiple bankfull storm events with overland flows, so we will continue to monitor the vegetation and side slope areas.

11. Todd Tugwell noted that on the lower section of R1 there is a side channel starting to form. WLS will continue to monitor this area and repair/stabilize if needed.

12. Todd Tugwell noted that some of the structure drops on R5 are steep and asked if they match the mitigation design plan. Kayne VanStell said the construction did not deviate from the mitigation plan design.

13. Paul Wiesner asked why the pipes in the crossings are skewed. Kayne VanStell said the easement boundary was finalized before the final design approval and some adjustments were made during construction. WLS noted they will monitor for any scour areas in the channel or side slopes associated with the skew angles.

14. Todd Tugwell noted that the invert of the downstream pipe on R4 was too high. Kayne VanStell agreed and said WLS will monitor and lower the invert (bury the pipe) or raise the downstream rifle invert elevation if needed.

15. Erin Davis requested to add a photo point of the slope on the right side of R4 for vegetation establishment.

16. Erin Davis requested to add a camera or flow gauge to upper portion of R2. WLS will likely install a flow gauge instead of a camera.

17. DMS noted that during their as-built site visit in July there was some minor easement encroachment from mowing on R2/R3. WLS addressed this with the landowner and they now understand that not even fescue can be mowed. WLS had installed horse tape around the easement markers in August and this encroached area is re-establishing. The landowner did not cut down any trees; however, this fall WLS will install another row of trees closer to the easement boundary. WLS will continue to closely monitor this area for any easement encroachment. It was also noted that the landowner requested the wooden markers instead of the t-posts. Todd Tugwell noted that split rail fence can be used to demarcate the easement boundary and Erin Davis mentioned planting additional trees/shrubs could be used as well to help aid with the boundary. Paul Wiesner discussed a new bollard spec that DMS has used recently, which landowners have liked visually. DMS will have Jeff Horton contact WLS with the bollard specs. WLS will discuss other easement demarcation options with the landowner and DMS if needed.

USACE Summary (Todd Tugwell):

- Concerned about the height of structure drops.
- Continue to monitor the crossings/pipes for the angles and smooth material. There is nothing to address right now.
- Monitor the vegetation on the side slopes as herbaceous layer is sparse on some areas.
- There are 1-2 structures piping.
- Monitor the floodplain pool depths, response to rainfall and surface/subsurface flow interaction.

DWR Summary (Erin Davis):

- Apply an additional seed mix to the side slopes.
- The site does not have any major invasive species issues, but continue to monitor cattails and morning glory.
- Erin asked if WLS has any random vegetation plots. There are no random plots on this site and all the plots are permanent. WLS will continue to monitor the vegetation on the site and if there are any issues in the future, WLS may add 1-2 random vegetation plots to monitor vegetation.

Horne Creek Tributaries - Final Plant Quantities

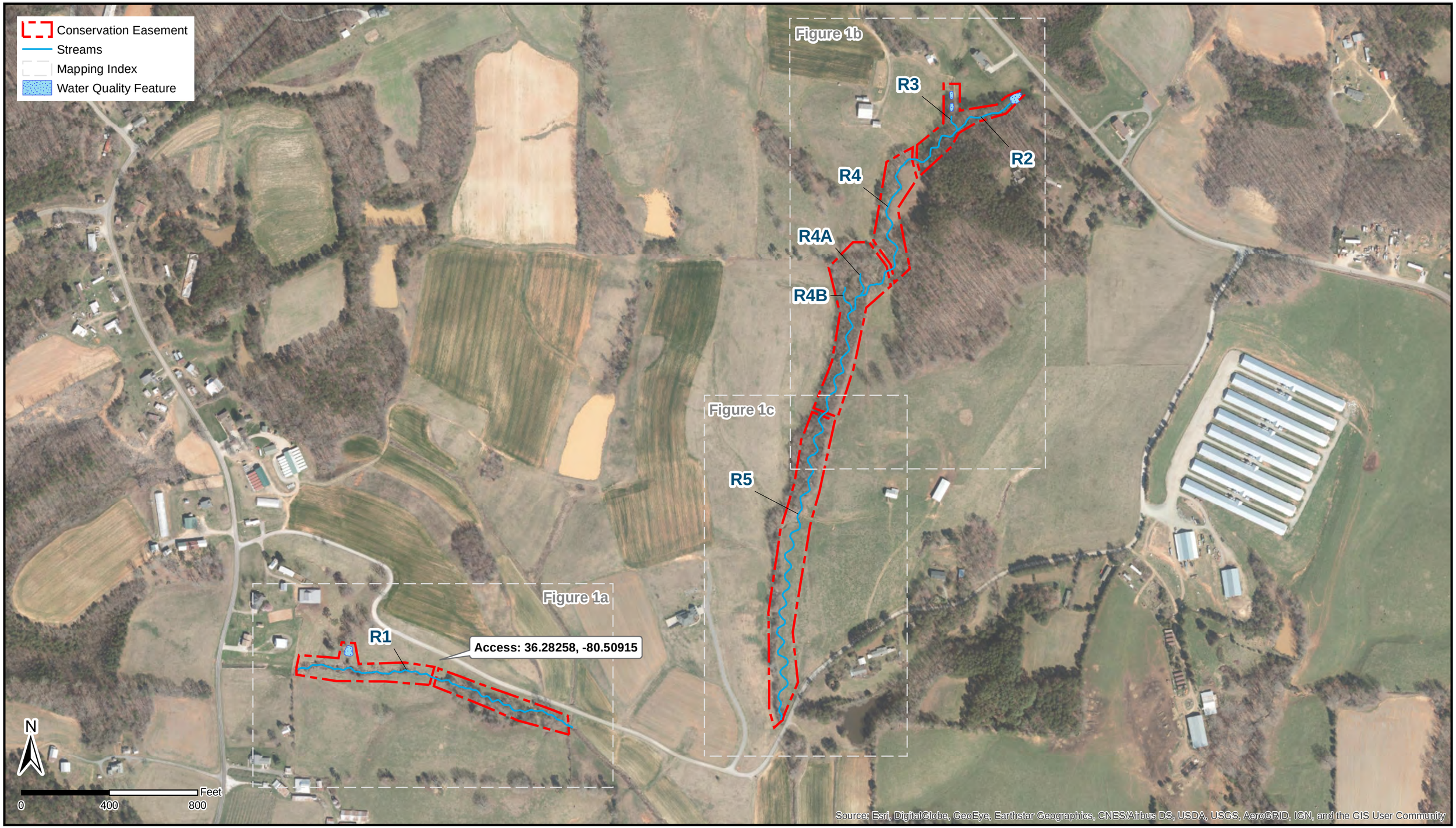
Common Name	Species	Stems	Percent Planted	Mitigation Plan Percent
Green ash	*Fraxinus pensylvanica*	250	3.4%	3.0%
River birch	*Betula nigra*	500	6.7%	7.0%
Basswood	*Tilia americana*	500	6.7%	7.0%
Black gum	*Nyssa sylvatica*	450	6.0%	6.0%
American sycamore	*Platanus occidentalis*	500	6.7%	7.0%
Tulip poplar	*Liriodendron tulipifera*	500	6.7%	7.0%
Northern red oak	*Quercus rubra*	250	3.4%	3.0%
White oak	*Quercus alba*	450	6.0%	6.0%
Persimmon	*Diospyros virginiana*	500	6.7%	7.0%
~~Common serviceberry~~	~~*Amelanchier arborea*~~	~~0~~	~~0.0%~~	~~5.0%~~
~~Umbrella magnolia~~	~~*Magnolia tripetala*~~	~~0~~	~~0.0%~~	~~6.0%~~
Redbud	*Cercis canadensis*	400	5.4%	0.0%
American hornbeam	*Carpinus caroliniana*	450	6.0%	6.0%
Witch hazel	*Hamamelis virginiana*	450	6.0%	6.0%
Pawpaw	*Asimina triloba*	900	12.1%	6.0%
Spicebush	*Lindera benzoin*	450	6.0%	6.0%
Tag alder	*Alnus serrulata*	450	6.0%	6.0%
Hazelnut	*Corylus americana*	450	6.0%	6.0%
	Total Planted	**7,450**	**100.0%**	

*changes from mitigation plan in red

Appendix B:

Visual Assessment Data

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



WATER & LAND™ SOLUTIONS

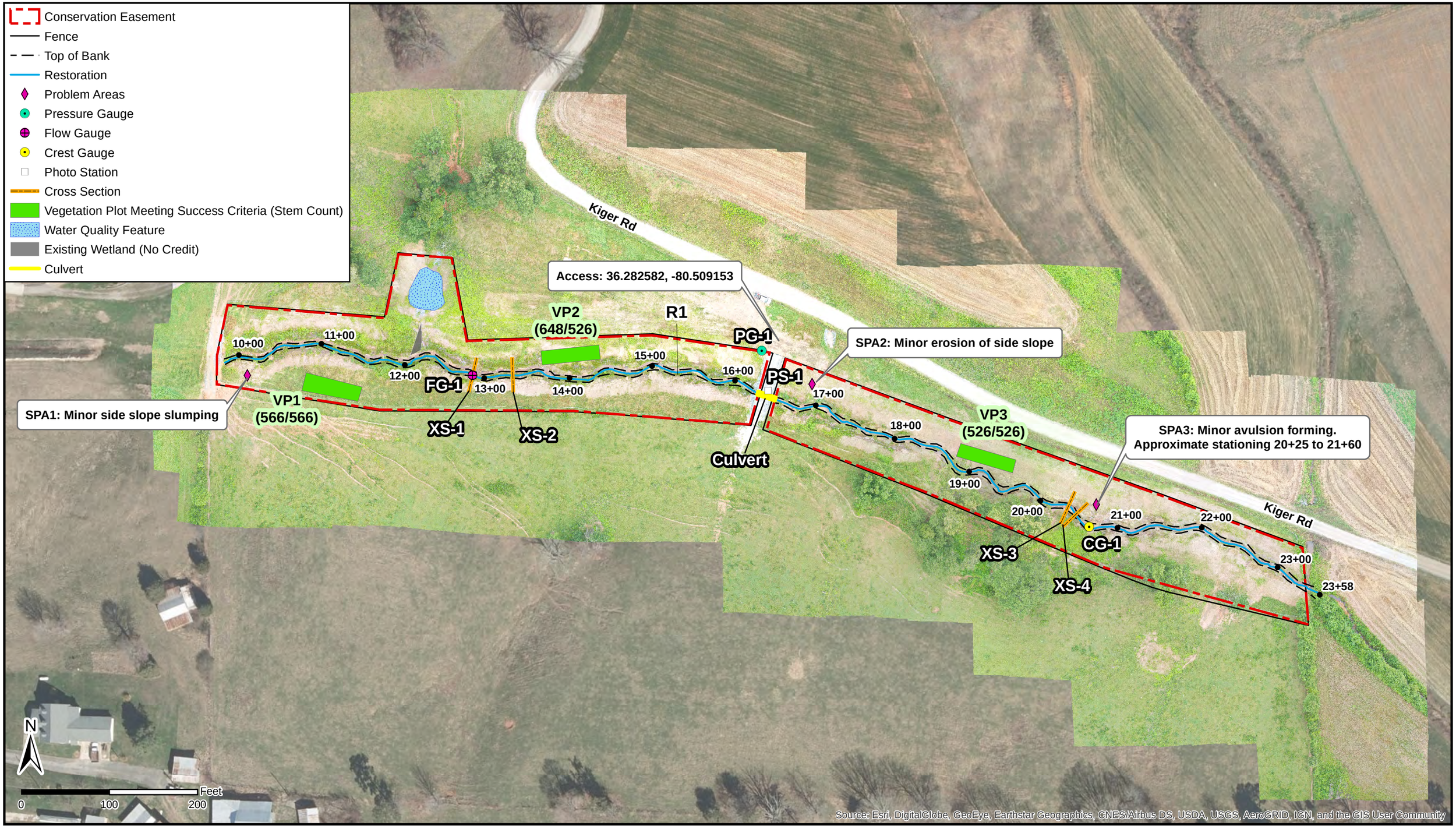
Horne Creek Tributaries Mitigation Project
Surry County, North Carolina

USACE Action ID Number: SAW-2017-01510
DMS project number: 100026
May 2020
MY0

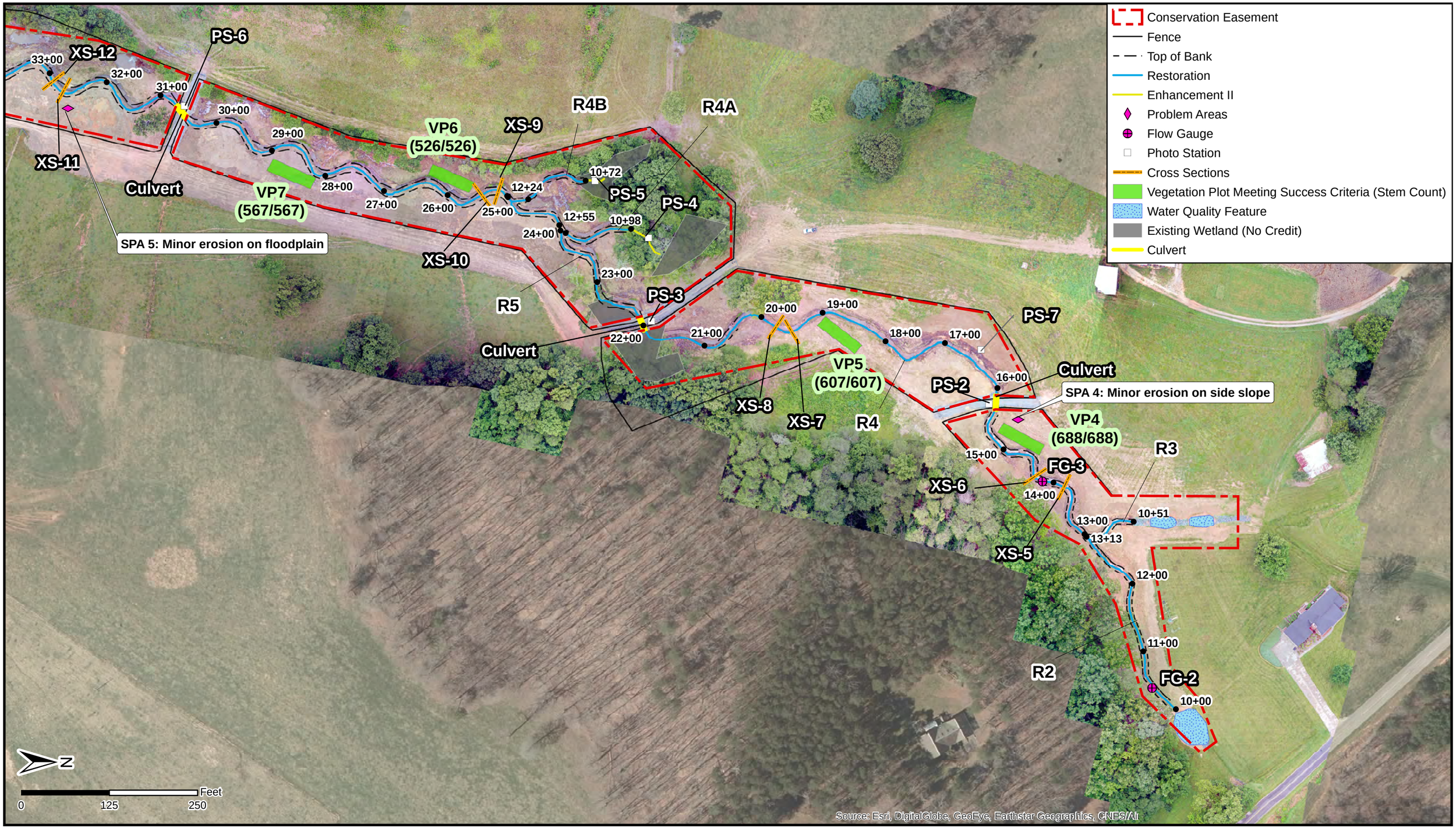
Current Conditions
Plan View
Monitoring Year 0

NAD 1983 2011 State Plane
North Carolina FIPS 3200 FT US

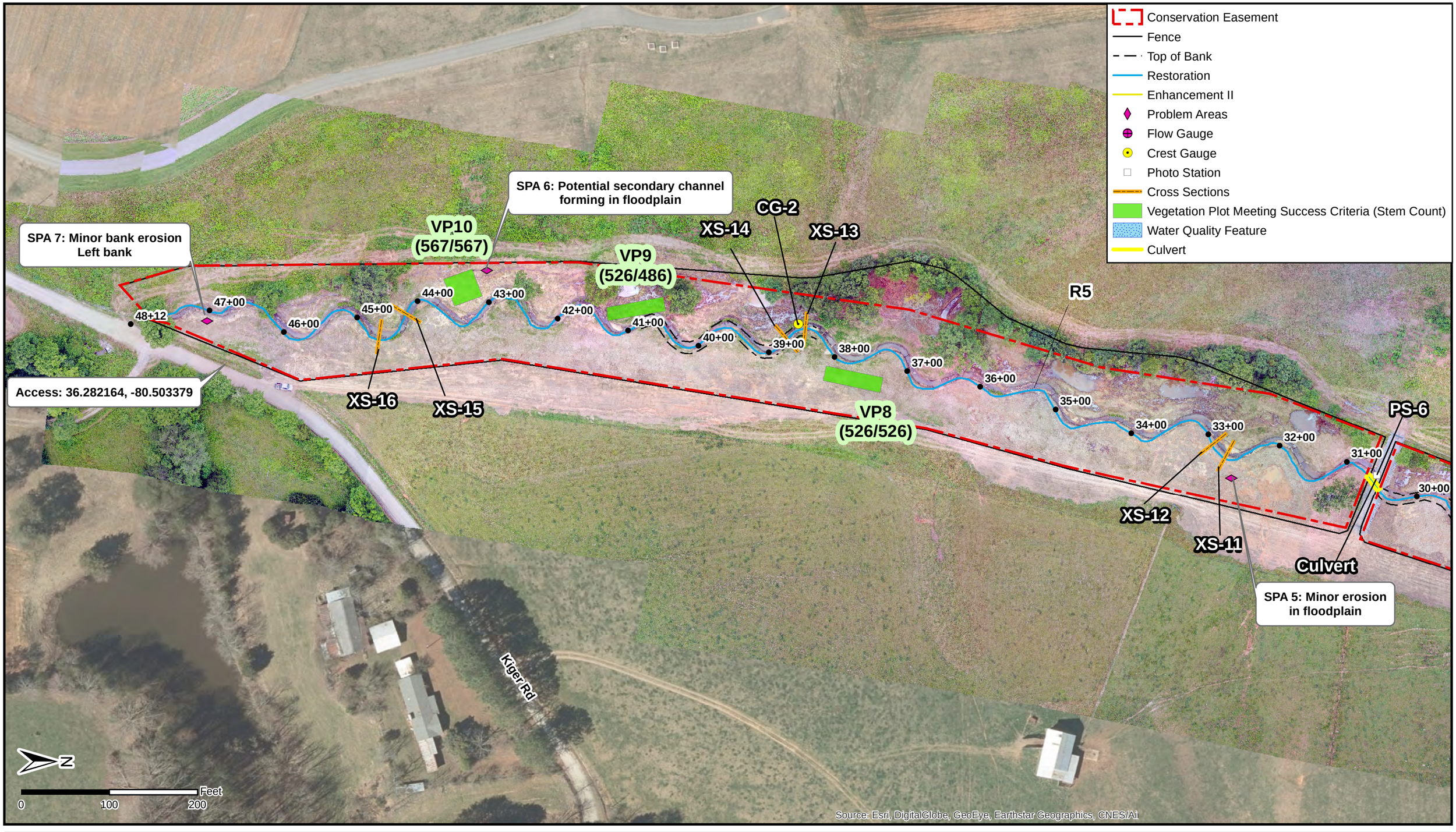
FIGURE
1



WATER & LAND™ SOLUTIONS	**Horne Creek Tributaries Mitigation Project** **Surry County, North Carolina**	USACE Action ID Number: SAW-2017-01510 DMS project number: 100026 November 2020 MY1	Current Conditions Plan View Monitoring Year 1 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 November 2020 MY1	Current Conditions Plan View Monitoring Year 1 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 November 2020 MY1	Current Conditions Plan View Monitoring Year 1 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1 c

Table 5. **Visual Stream Morphology Stability Assessment**
Project **Horne Creek Tributaries Mitigation Project (DMS ID #100026)**
Reach ID **R1, R2, R3, R4, R4a, R4b, R5**
Assessed Length **5428**

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.	257	257			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	111	111			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	117	117			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)	42	42			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	42	42			100%			

Table 5a.	Vegetation Condition Assessment					
Project	Horne Creek Tributaries Mitigation Project (DMS ID #100026)					
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	Pattern and Color	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	yellow hatched	0	0.00	0.0%

R1, XS1, Upstream, (MY-00)

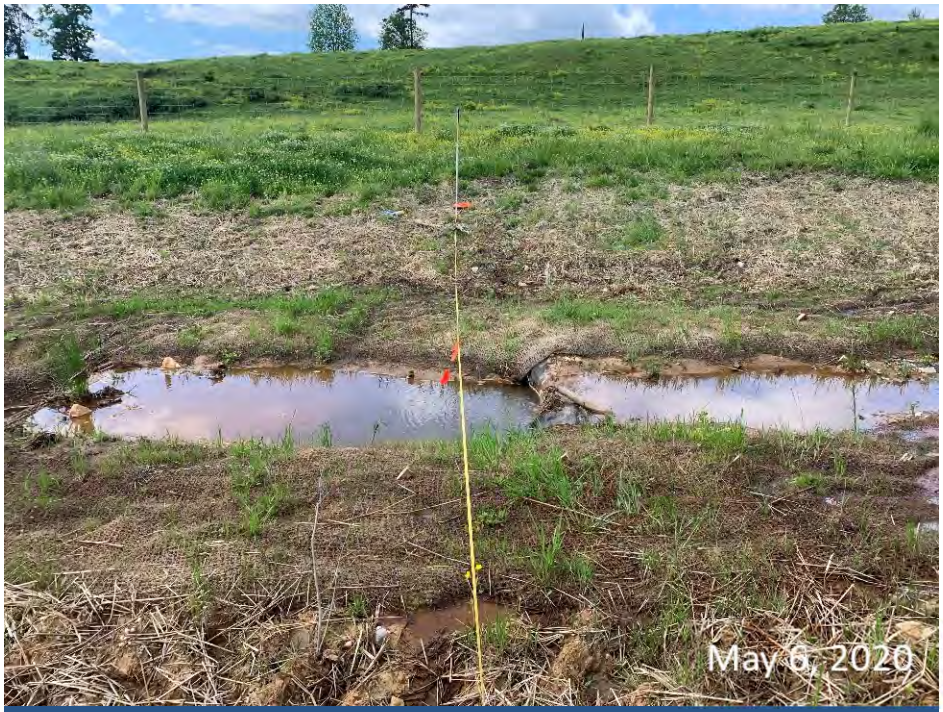
R1, XS1, Upstream (MY-01)

R1, XS1, Downstream (MY-00)

R1, XS1, Downstream (MY-01)

R1, XS1, Left Bank (MY-00)

R1, XS1, Left Bank (MY-01)



R1, XS1, Right Bank (MY-00)

R1, XS1, Right Bank (MY-01)

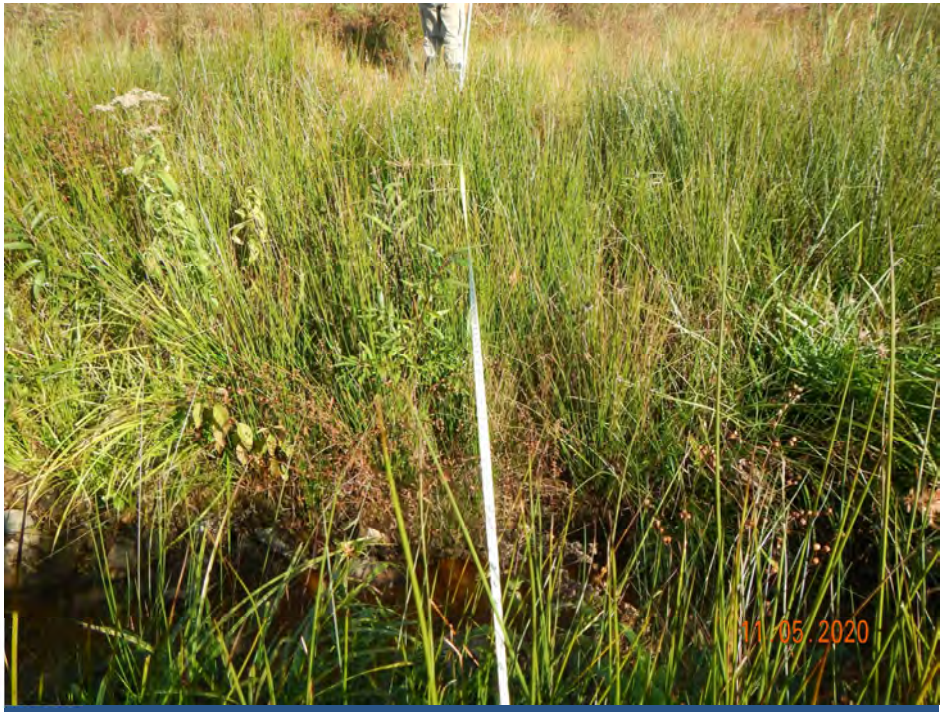
R1, XS2, Upstream (MY-00)

R1, XS2, Upstream (MY-01)

R1, XS2, Downstream (MY-00)

R1, XS2, Downstream (MY-01)

R1, XS2, Left Bank (MY-00)



R1, XS2, Left Bank (MY-01)

R1, XS2, Right Bank (MY-00)

R1, XS2, Right Bank (MY-01)

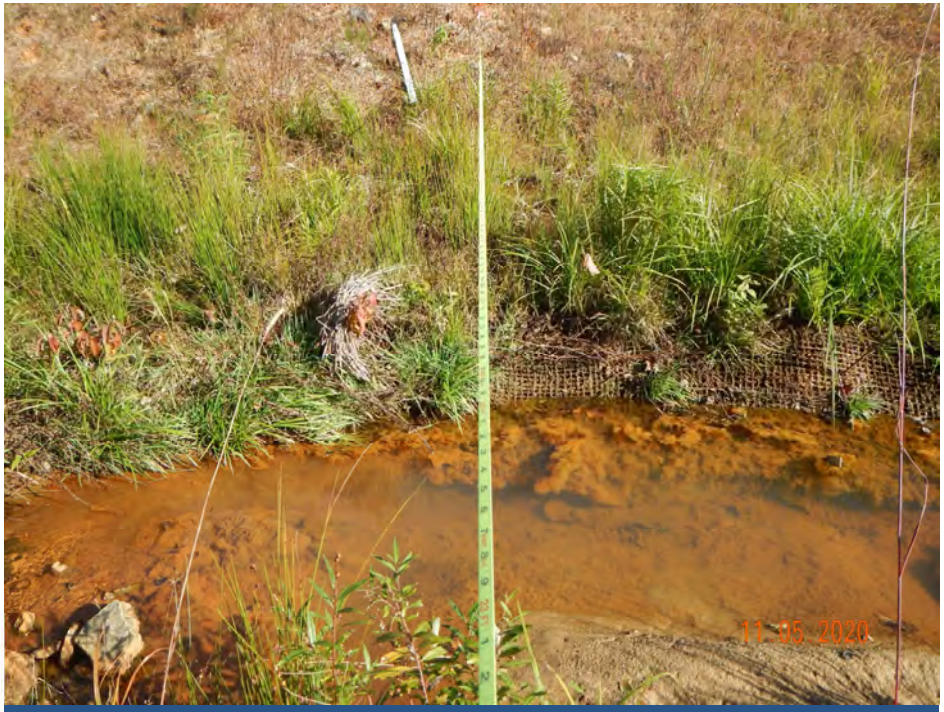
R1, XS3, Upstream (MY-00)

R1, XS3, Upstream (MY-01)

R1, XS3, Downstream (MY-00)

R1, XS3, Downstream (MY-01)

R1, XS3, Left Bank (MY-00)



R1, XS3, Left Bank (MY-01)

R1, XS3, Right Bank (MY-00)

R1, XS3, Right Bank (MY-01)

R1, XS4, Upstream (MY-00)

R1, XS4, Upstream (MY-01)

R1, XS4, Downstream (MY-00)

R1, XS4, Downstream (MY-01)

R1, XS4, Left Bank (MY-00)

R1, XS4, Left Bank (MY-01)

R1, XS4, Right Bank (MY-00)

R1, XS4, Right Bank (MY-01)

R2, XS5, Upstream (MY-00)

R2, XS5, Upstream (MY-01)

R2, XS5, Downstream (MY-00)

R2, XS5, Downstream (MY-01)

R2, XS5, Left Bank (MY-00)

R2, XS5, Left Bank (MY-01)

R2, XS5, Right Bank (MY-00)

R2, XS5, Right Bank (MY-01)

R2, XS6, Upstream (MY-00)

R2, XS6, Upstream (MY-01)

R2, XS6, Downstream (MY-00)

R2, XS6, Downstream (MY-01)

R2, XS6, Left Bank (MY-00)

R2, XS6, Left Bank (MY-01)

R2, XS6, Right Bank (MY-00)

R2, XS6, Right Bank (MY-01)

R4, XS7, Upstream (MY-00)

R4, XS7, Upstream (MY-01)

R4, XS7, Downstream (MY-00)

R4, XS7, Downstream (MY-01)

R4, XS7, Left Bank (MY-00)

R4, XS7, Left Bank (MY-01)

R4, XS7, Right Bank (MY-00)

R4, XS7, Right Bank (MY-01)

R4, XS8, Upstream (MY-00)

R4, XS8, Upstream (MY-01)

R4, XS8, Downstream (MY-00)

R4, XS8, Downstream (MY-01)

R4, XS8, Left Bank (MY-00)

R4, XS8, Left Bank (MY-01)

R4, XS8, Right Bank (MY-00)

R4, XS8, Right Bank (MY-01)

R4, XS9, Upstream (MY-00)

R4, XS9, Upstream (MY-01)

R4, XS9, Downstream (MY-00)

R4, XS9, Downstream (MY-01)

R4, XS9, Left Bank (MY-00)

R4, XS9, Left Bank (MY-01)

R4, XS9, Right Bank (MY-00)

R4, XS9, Right Bank (MY-01)

R4, XS10, Upstream (MY-00)

R4, XS10, Upstream (MY-01)

R4, XS10, Downstream (MY-00)

R4, XS10, Downstream (MY-01)

R4, XS10, Left Bank (MY-00)

R4, XS10, Left Bank (MY-01)

R4, XS10, Right Bank (MY-00)

R4, XS10, Right Bank (MY-01)

R5, XS11, Upstream (MY-00)

R5, XS11, Upstream (MY-01)

R5, XS11, Downstream (MY-00)

R5, XS11, Downstream (MY-01)

R5, XS11, Left Bank (MY-00)

R5, XS11, Left Bank (MY-01)

R5, XS11, Right Bank (MY-00)

R5, XS11, Right Bank (MY-01)

R5, XS12, Upstream (MY-00)

R5, XS12, Upstream (MY-01)

R5, XS12, Downstream (MY-00)

R5, XS12, Downstream (MY-01)

R5, XS12, Left Bank (MY-00)

R5, XS12, Left Bank (MY-01)

R5, XS12, Right Bank (MY-00)

R5, XS12, Right Bank (MY-01)

R5, XS13, Upstream (MY-00)

R5, XS13, Upstream (MY-01)

R5, XS13, Downstream (MY-00)

R5, XS13, Downstream (MY-01)

R5, XS13, Left Bank (MY-00)

R5, XS13, Left Bank (MY-01)

R5, XS13, Right Bank (MY-00)

R5, XS13, Right Bank (MY-01)

R5, XS14, Upstream (MY-00)

R5, XS14, Upstream (MY-01)

R5, XS14, Downstream (MY-00)

R5, XS14, Downstream (MY-01)

R5, XS14, Left Bank (MY-00)

R5, XS14, Left Bank (MY-01)

R5, XS14, Right Bank (MY-00)

R5, XS14, Right Bank (MY-01)

R5, XS15, Upstream (MY-00)

R5, XS15, Upstream (MY-01)

R5, XS15, Downstream (MY-00)

R5, XS15, Downstream (MY-01)

R5, XS15, Left Bank (MY-00)

R5, XS15, Left Bank (MY-01)

R5, XS15, Right Bank (MY-00)

R5, XS15, Right Bank (MY-01)

R5, XS16, Upstream (MY-00)

R5, XS16, Upstream (MY-01)

R5, XS16, Downstream (MY-00)

R5, XS16, Downstream (MY-01)

R5, XS16, Left Bank (MY-00)

R5, XS16, Left Bank (MY-01)

R5, XS16, Right Bank (MY-00)

R5, XS16, Right Bank (MY-01)

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

PS-1, R1, Culvert Crossing, Downstream (MY-01)

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

PS-1 , R1, Culvert Crossing, Upstream (MY-01)

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

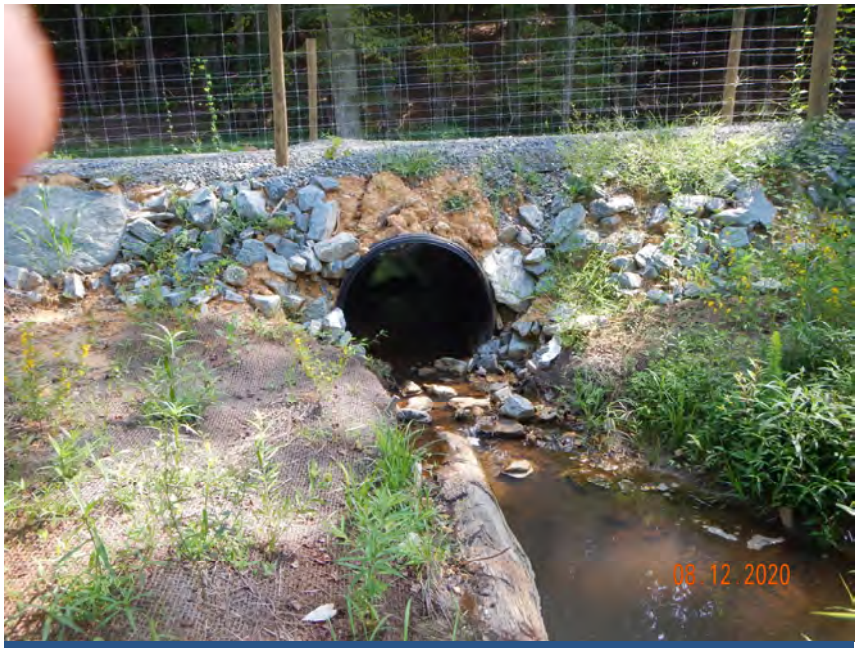
PS-2, R2, Culvert Crossing, Downstream (MY-01)

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

PS-2, R2, Culvert Crossing, Upstream (MY-01)

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

PS-3, R4, Culvert Crossing, Downstream (MY-01)



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

PS-3, R4, Culvert Crossing, Upstream (MY-01)

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

PS-4, R4A, Downstream (MY-01)

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

PS-4, R4A, Upstream (MY-01)

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

PS-5, R4B, Downstream (MY-01)

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

PS-5 , R4B, Upstream (MY-01)

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

PS-6, R5, Culvert Crossing, Downstream (MY-01)

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

PS-6, R5, Culvert Crossing, Upstream (MY-01)

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

Veg Plot 1 (MY-00)

Veg Plot 1 (MY-01)

Veg Plot 2 (MY-00)

Veg Plot 2 (MY-01)

Veg Plot 3 (MY-00)

Veg Plot 3 (MY-01)

Veg Plot 4 (MY-00)

Veg Plot 4 (MY-01)

Veg Plot 5 (MY-00)

Veg Plot 5 (MY-01)

Veg Plot 6 (MY-00)

Veg Plot 6 (MY-01)

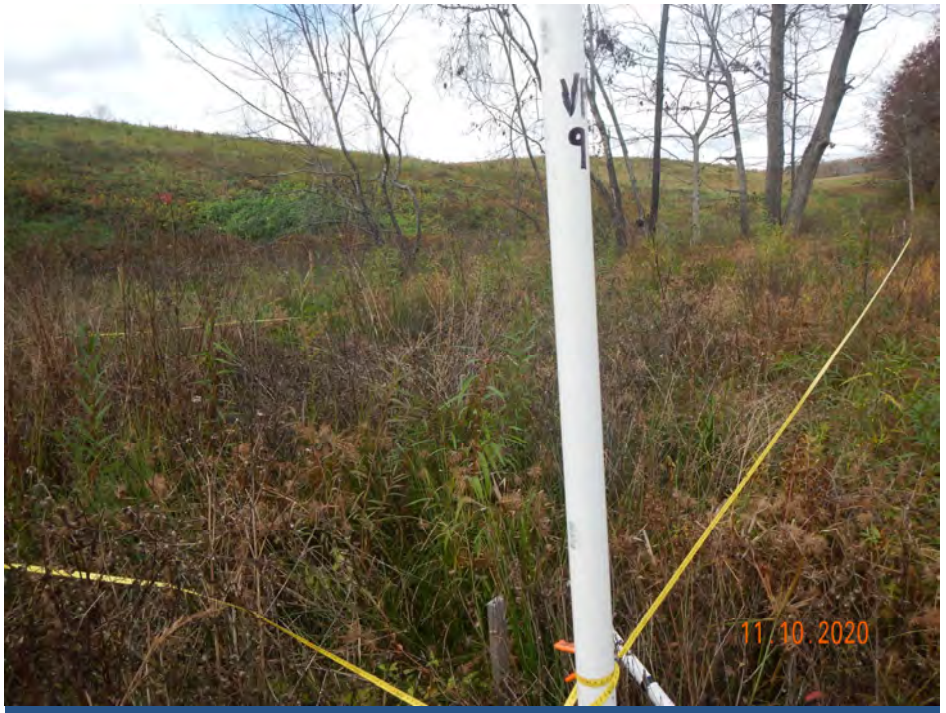
Veg Plot 7 (MY-00)

Veg Plot 7 (MY-01)

Veg Plot 8 (MY-00)

Veg Plot 8 (MY-01)

Veg Plot 9 (MY-00)



Veg Plot 9 (MY-01)

Veg Plot 10 (MY-00)

Veg Plot 10 (MY-01)

SPA1, R1 Right Floodplain, Minor Slumping (MY-01)

SPA2, R1 Left Floodplain, Minor Erosion (MY-01)

SPA3, R1 Left Floodplain, Minor Avulsion (MY-01)

SPA3, R1 Left Floodplain, Minor Avulsion (MY-01)

SPA4, R2 Left Floodplain, Minor Erosion (MY-01)

SPA4, R2 Right Floodplain, Minor Erosion (MY-01)

SPA5, R5 Left Floodplain, Minor Erosion (MY-01)

SPA5, R5 Left Floodplain, Minor Erosion (MY-01)

SPA6, R5 Right Floodplain, VP10, Secondary Channelization (MY-01)

SPA7, R5 Left Bank, Functioning at Risk (MY-01)

Bare Area, R1, Right Floodplain (MY-01)

Appendix C:
Vegetation Monitoring Plot Data

Table 6: Planted and Total Stem Counts
Table 6a: Vegetation Plot Mitigation Success Summary

CVS Project Code 6. Project Name: Horne Creek

Table 6: Planted and Total Stem Counts

			Current Plot Data (MY1 2020)								
			006-01-0001			006-01-0002			006-01-0003		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	hazel alder	Shrub									
Asimina triloba	pawpaw	Tree	2	2	2				1	1	1
Betula nigra	river birch	Tree	2	2	2	2	2	2	1	1	1
Carpinus caroliniana	American hornbeam	Tree				1	1	1			
Cercis canadensis	eastern redbud	Tree							2	2	2
Corylus americana	American hazelnut	Shrub	1	1	1						
Diospyros virginiana	common persimmon	Tree	1	1	1			3			
Fraxinus pennsylvanica	green ash	Tree							1	1	1
Hamamelis virginiana	American witchhazel	Tree									
Lindera benzoin	northern spicebush	Shrub	2	2	2						
Liriodendron tulipifera	tuliptree	Tree	1	1	1	5	5	5	5	5	5
Nyssa sylvatica	blackgum	Tree	2	2	2	1	1	1			
Platanus occidentalis	American sycamore	Tree				1	1	1	2	2	2
Quercus alba	white oak	Tree							1	1	1
Quercus rubra	northern red oak	Tree				2	2	2			
Tilia americana	American basswood	Tree	3	3	3	1	1	1			
		Stem count	14	14	14	13	13	16	13	13	13
		size (ares)	1			1			1		
		size (ACRES)	0.02			0.02			0.02		
		Species count	8	8	8	7	7	8	7	7	7
		Stems per ACRE	566.6	566.6	566.6	526.1	526.1	647.5	526.1	526.1	526.1

CVS Project Code 6. Project Name: Horne Creek

Table 6: Planted and Total Stem Counts

			Current Plot Data MY1 (2020)								
			006-01-0004			006-01-0005			006-01-0006		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	1	1	1	1	1	1	2	2	2
Asimina triloba	pawpaw	Tree				2	2	2	1	1	1
Betula nigra	river birch	Tree	4	4	4	3	3	3			
Carpinus caroliniana	American hornbeam	Tree	1	1	1	3	3	3			
Cercis canadensis	eastern redbud	Tree				1	1	1	1	1	1
Corylus americana	American hazelnut	Shrub									
Diospyros virginiana	common persimmon	Tree				2	2	2	3	3	3
Fraxinus pennsylvanica	green ash	Tree	1	1	1						
Hamamelis virginiana	American witchhazel	Tree									
Lindera benzoin	northern spicebush	Shrub							1	1	1
Liriodendron tulipifera	tuliptree	Tree	3	3	3	1	1	1			
Nyssa sylvatica	blackgum	Tree	1	1	1				1	1	1
Platanus occidentalis	American sycamore	Tree	3	3	3						
Quercus alba	white oak	Tree							1	1	1
Quercus rubra	northern red oak	Tree	2	2	2	1	1	1	2	2	2
Tilia americana	American basswood	Tree	1	1	1	1	1	1	1	1	1
		Stem count	17	17	17	15	15	15	13	13	13
		size (ares)	1			1			1		
		size (ACRES)	0.02			0.02			0.02		
		Species count	9	9	9	9	9	9	9	9	9
		Stems per ACRE	688	688	688	607	607	607	526.1	526.1	526.1

CVS Project Code 6. Project Name: Horne Creek

Table 6: Planted and Total Stem Counts

			Current Plot Data MY1 (2020)								
			006-01-0007			006-01-0008			006-01-0009		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Alnus serrulata	hazel alder	Shrub	2	2	2	2	2	2	3	3	3
Asimina triloba	pawpaw	Tree							2	2	2
Betula nigra	river birch	Tree	2	2	2	1	1	1			
Carpinus caroliniana	American hornbeam	Tree	1	1	1				2	2	2
Cercis canadensis	eastern redbud	Tree									
Corylus americana	American hazelnut	Shrub	1	1	1	1	1	1			
Diospyros virginiana	common persimmon	Tree				2	2	2			
Fraxinus pennsylvanica	green ash	Tree									1
Hamamelis virginiana	American witchhazel	Tree				1	1	1			
Lindera benzoin	northern spicebush	Shrub	1	1	1	3	3	3	1	1	1
Liriodendron tulipifera	tuliptree	Tree	1	1	1				1	1	1
Nyssa sylvatica	blackgum	Tree	3	3	3	3	3	3	1	1	1
Platanus occidentalis	American sycamore	Tree	1	1	1				1	1	1
Quercus alba	white oak	Tree	1	1	1						
Quercus rubra	northern red oak	Tree									
Tilia americana	American basswood	Tree	1	1	1				1	1	1
		Stem count	14	14	14	13	13	13	12	12	13
		size (ares)	1			1			1		
		size (ACRES)	0.02			0.02			0.02		
		Species count	10	10	10	7	7	7	8	8	9
		Stems per ACRE	566.6	566.6	566.6	526.1	526.1	526.1	485.6	485.6	526.1

CVS Project Code 6. Project Name: Horne Creek

Table 6: Planted and Total Stem Counts

Scientific Name	Common Name	Species Type	MY1 (2020) 006-01-0010 PnoLS	P-all	T	Annual Means MY1 (2020) PnoLS	P-all	T	MY0 (2020) PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	3	3	3	14	14	14	14	14	14
Asimina triloba	pawpaw	Tree	2	2	2	10	10	10	18	18	18
Betula nigra	river birch	Tree				15	15	15	4	4	4
Carpinus caroliniana	American hornbeam	Tree	2	2	2	10	10	10	13	13	13
Cercis canadensis	eastern redbud	Tree	1	1	1	5	5	5	10	10	10
Corylus americana	American hazelnut	Shrub	1	1	1	4	4	4	12	12	12
Diospyros virginiana	common persimmon	Tree	1	1	1	9	9	12	12	12	12
Fraxinus pennsylvanica	green ash	Tree				2	2	3	4	4	4
Hamamelis virginiana	American witchhazel	Tree				1	1	1	6	6	6
Lindera benzoin	northern spicebush	Shrub				8	8	8	15	15	15
Liriodendron tulipifera	tuliptree	Tree	1	1	1	18	18	18	29	29	29
Nyssa sylvatica	blackgum	Tree				12	12	12	12	12	12
Platanus occidentalis	American sycamore	Tree	1	1	1	9	9	9	7	7	7
Quercus alba	white oak	Tree	1	1	1	4	4	4	4	4	4
Quercus rubra	northern red oak	Tree				7	7	7	7	7	7
Tilia americana	American basswood	Tree	1	1	1	10	10	10	5	5	5
		Stem count	14	14	14	138	138	142	172	172	172
		size (ares)	1			10			10		
		size (ACRES)	0.02			0.25			0.25		
		Species count	10	10	10	16	16	16	16	16	16
		Stems per ACRE	566.6	566.6	566.6	558.5	558.5	574.7	696.1	696.1	696.1

Table 6a: Vegetation Plot Mitigation Success Summary Table

Plot #	Planted Stems/Acre	Volunteers/ Acre	Total Stems/Acre	Success Criteria Met	Average Stem Height (ft)
1	567	0	567	Yes	1.2
2	526	0	526	Yes	1.6
3	526	0	526	Yes	1.4
4	688	0	688	Yes	1.8
5	607	0	607	Yes	1.1
6	526	0	526	Yes	1.2
7	567	0	567	Yes	1.6
8	526	0	526	Yes	0.8
9	486	0	486	Yes	1.2
10	567	0	567	Yes	1.3
Project Average	558	0	558	Yes	1.3

Appendix D:

Stream Measurement and Geomorphology Data

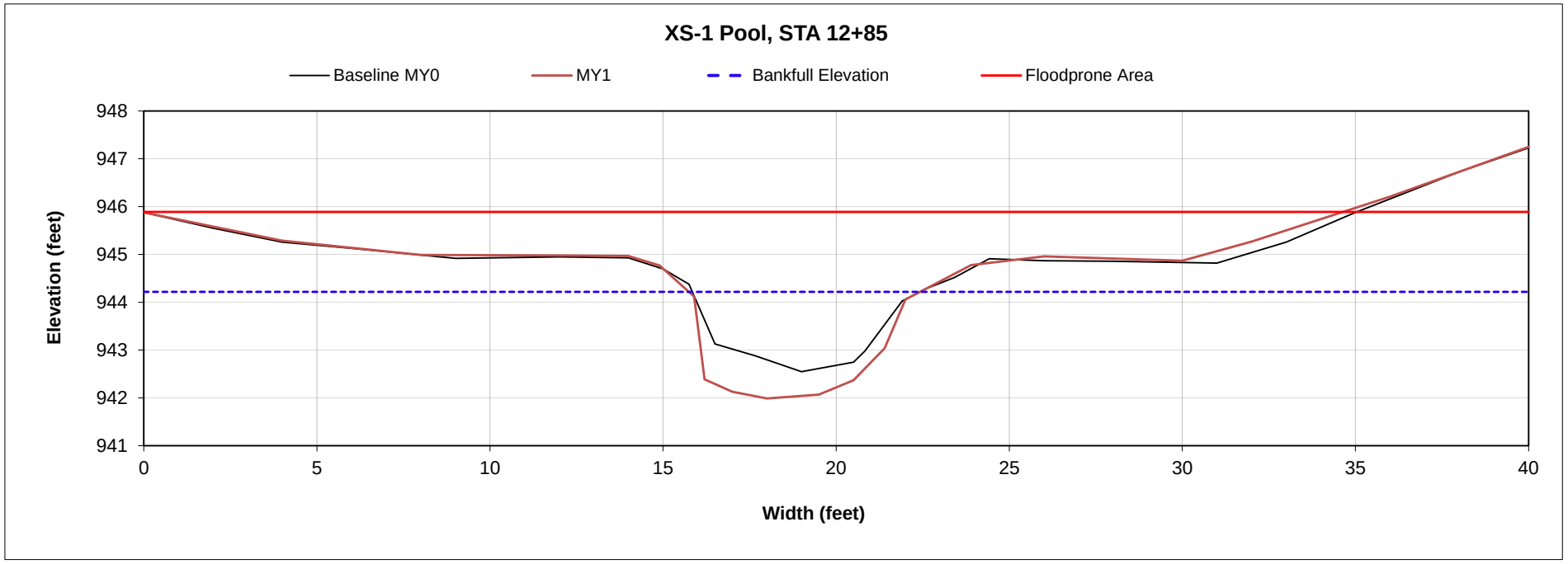
Figure 2: MY1 Cross-Sections
Table 7a: Baseline Stream Data Summary
Table 7b: Cross-section Morphology Data
Table 7c: Stream Reach Morphology Data

Figure 2: MY1 Cross Sections

Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R1
Cross Section ID	XS-1
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	944.2
Low Bank Height Elevation (ft)	944.8
Bankfull Max Depth (ft)	2.2
Low Bank Height (ft)	2.8
Bank Height Ratio	1.2
Bankfull X-section Area (ft²)	11.1
% Change Bank Height Ratio	20.0%

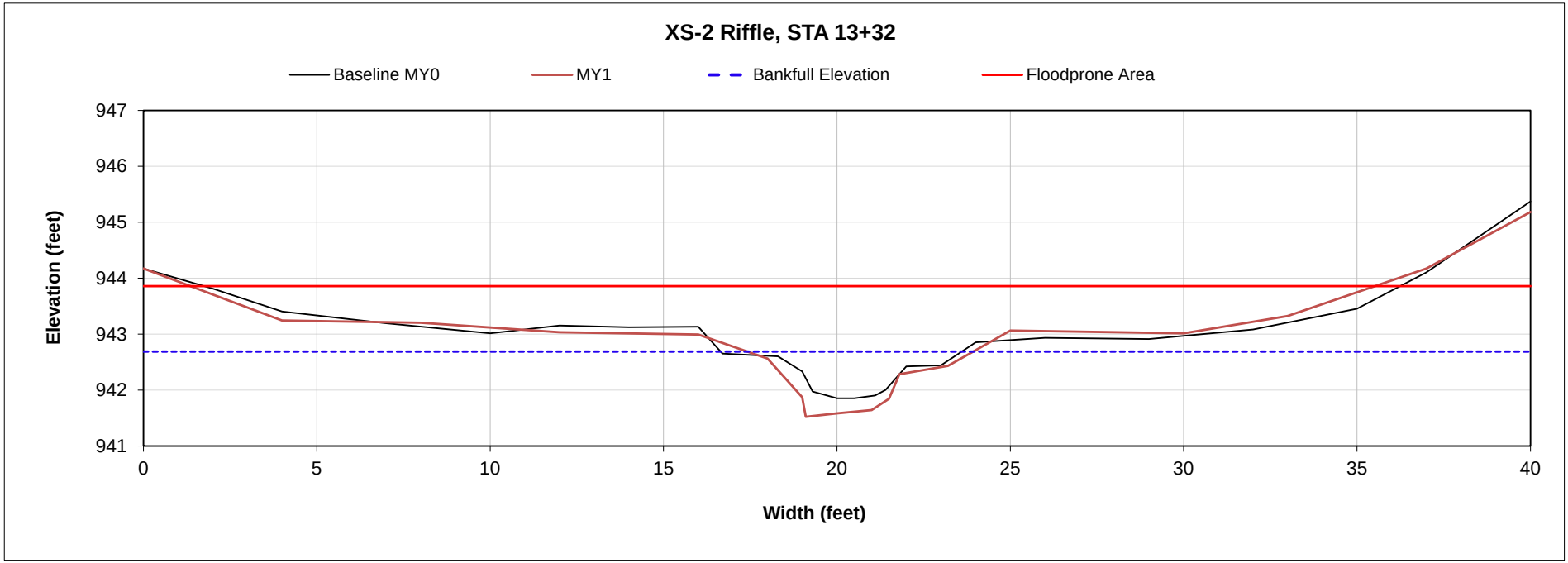
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R1
Cross Section ID	XS-2
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	942.7
Low Bank Height Elevation (ft)	942.6
Bankfull Max Depth (ft)	1.2
Low Bank Height (ft)	1.0
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	3.9
% Change Bank Height Ratio	10.0%

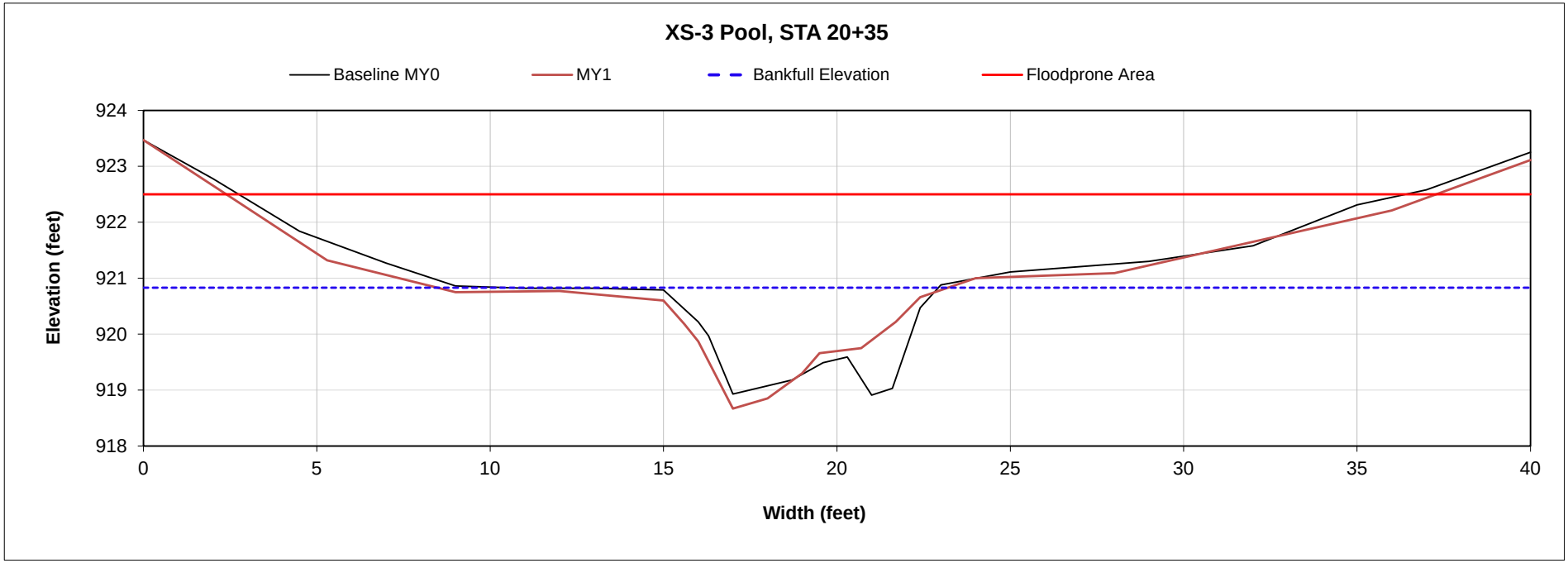
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R1
Cross Section ID	XS-3
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	920.8
Low Bank Height Elevation (ft)	920.6
Bankfull Max Depth (ft)	2.2
Low Bank Height (ft)	2.0
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	9.6
% Change Bank Height Ratio	10.0%

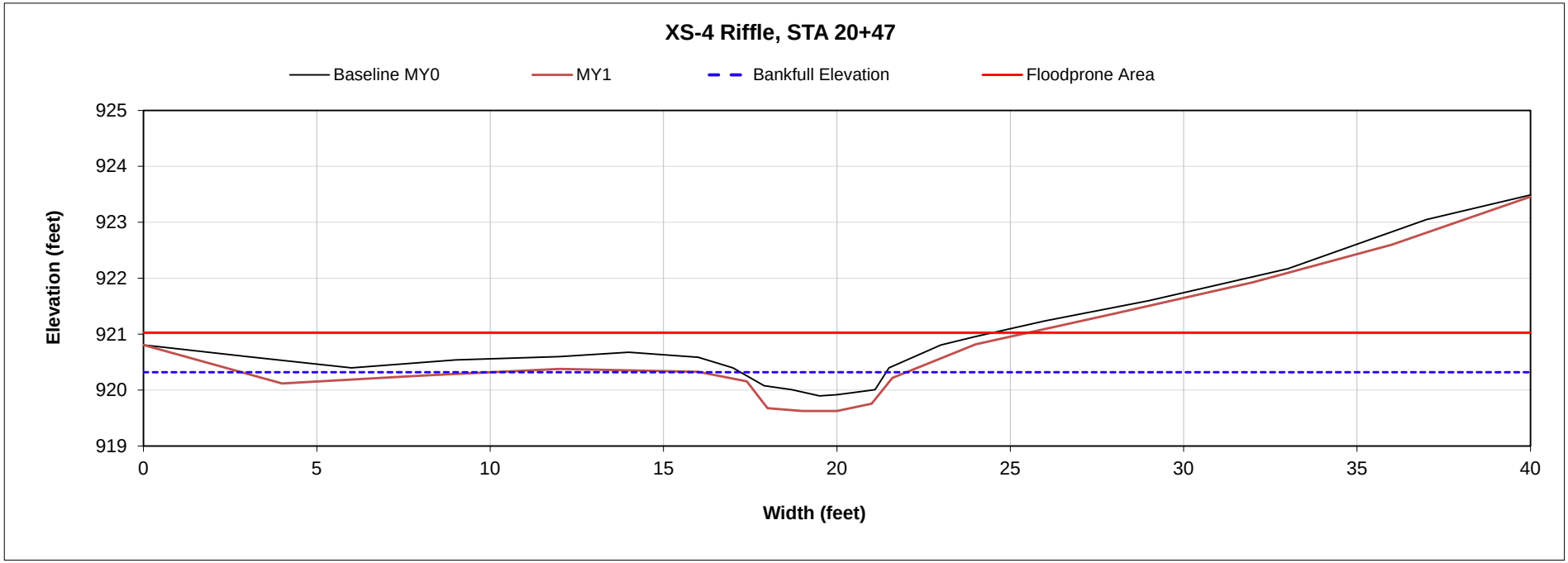
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R1
Cross Section ID	XS-4
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	921.3
Low Bank Height Elevation (ft)	920.2
Bankfull Max Depth (ft)	0.7
Low Bank Height (ft)	0.6
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	2.6
% Change Bank Height Ratio	10.0%

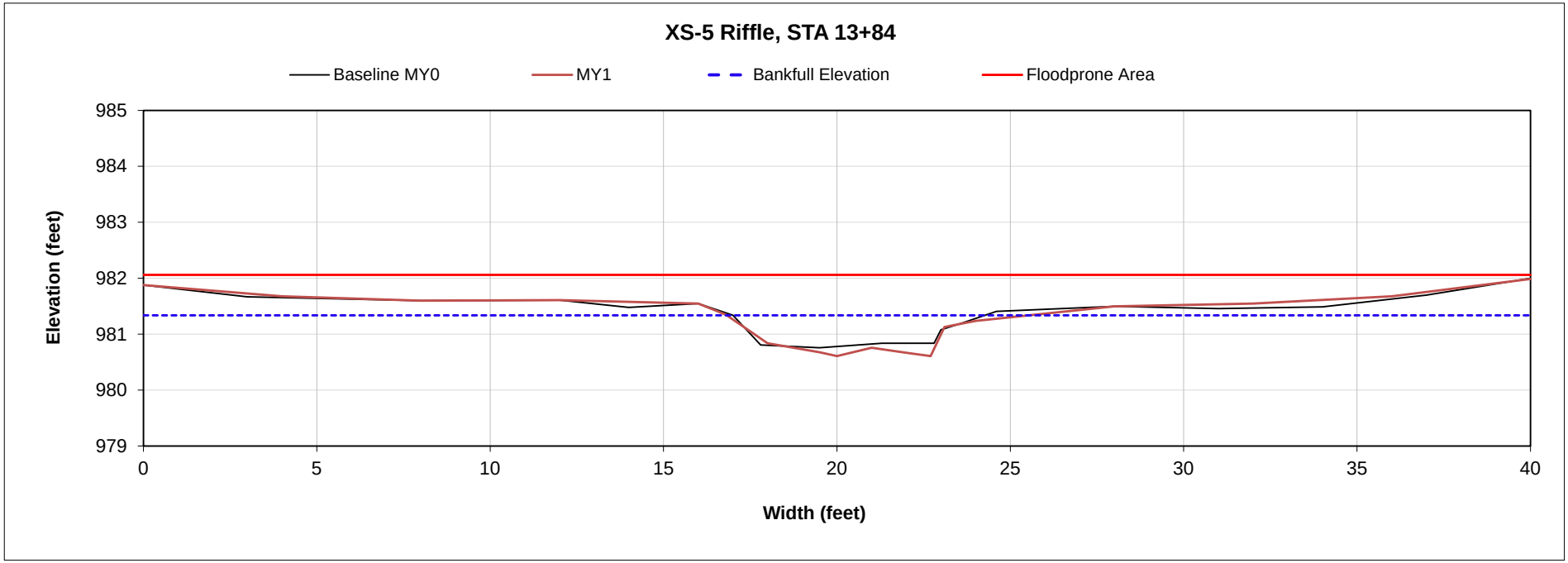
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R4
Cross Section ID	XS-5
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	981.3
Low Bank Height Elevation (ft)	981.2
Bankfull Max Depth (ft)	0.7
Low Bank Height (ft)	0.6
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	3.7
% Change Bank Height Ratio	10.0%

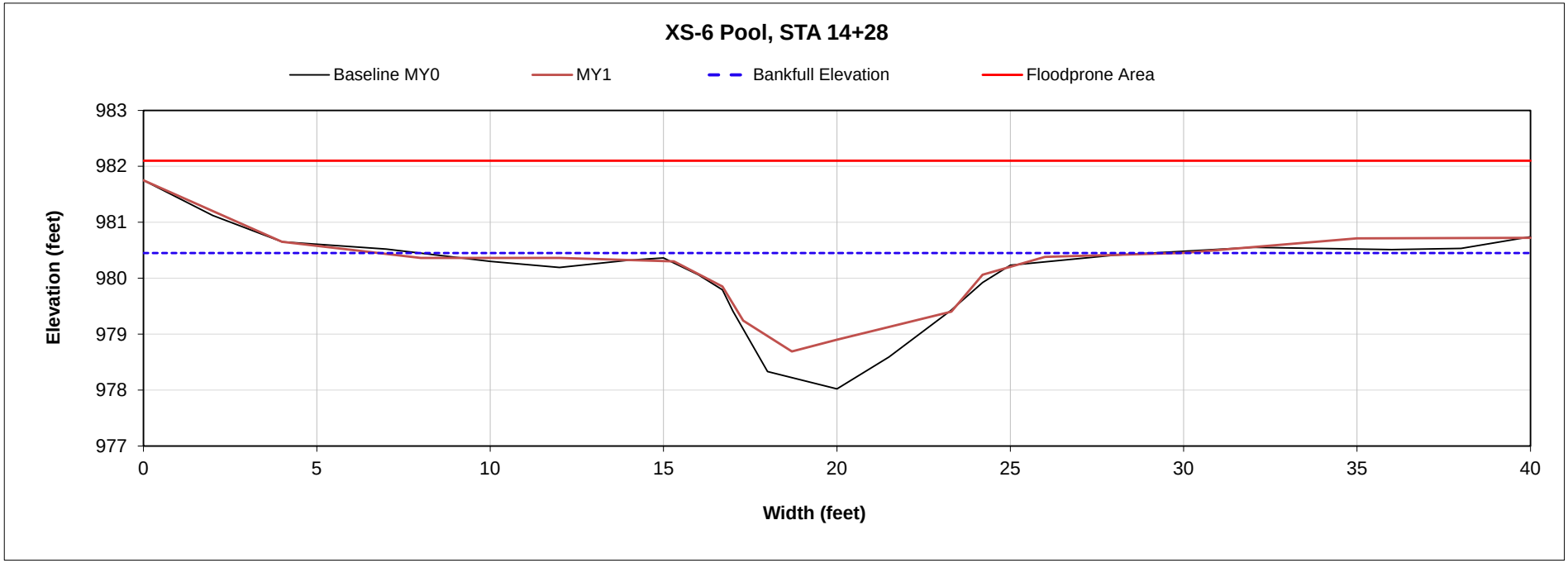
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R4
Cross Section ID	XS-6
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	980.5
Low Bank Height Elevation (ft)	980.3
Bankfull Max Depth (ft)	1.8
Low Bank Height (ft)	1.6
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	11.6
% Change Bank Height Ratio	10.0%

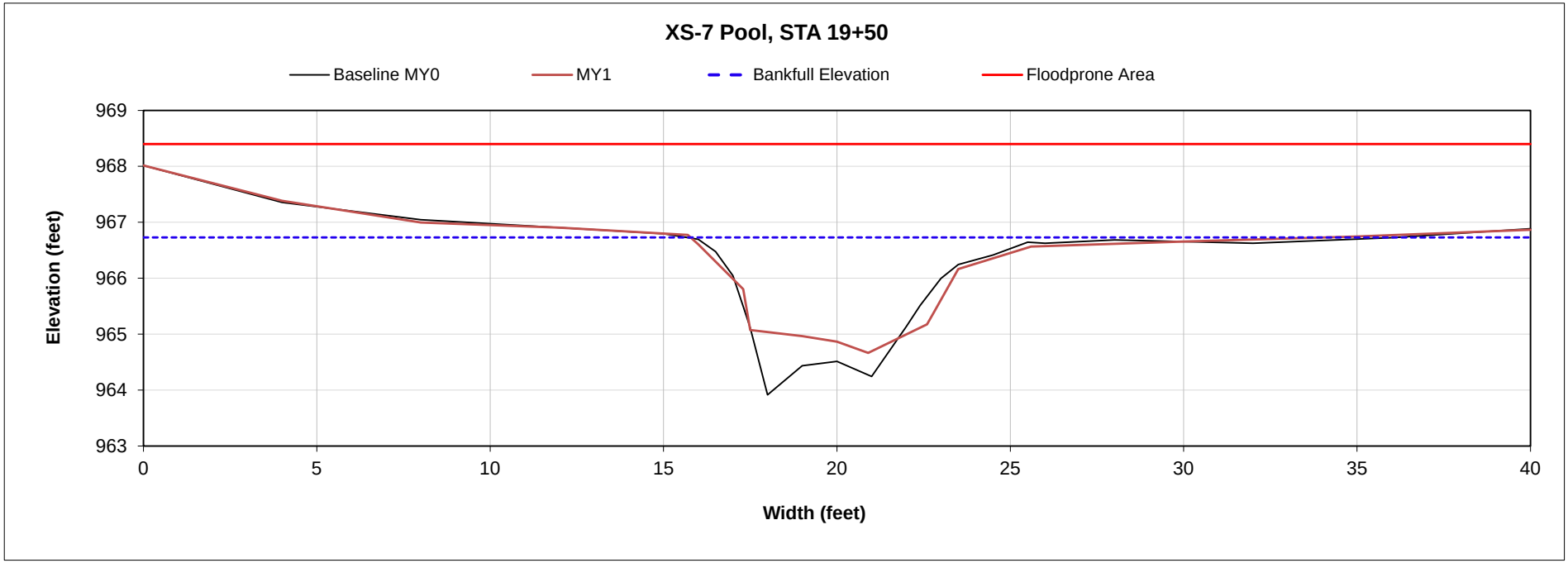
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R4
Cross Section ID	XS-7
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	966.7
Low Bank Height Elevation (ft)	966.6
Bankfull Max Depth (ft)	2.1
Low Bank Height (ft)	2.0
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	12.4
% Change Bank Height Ratio	10.0%

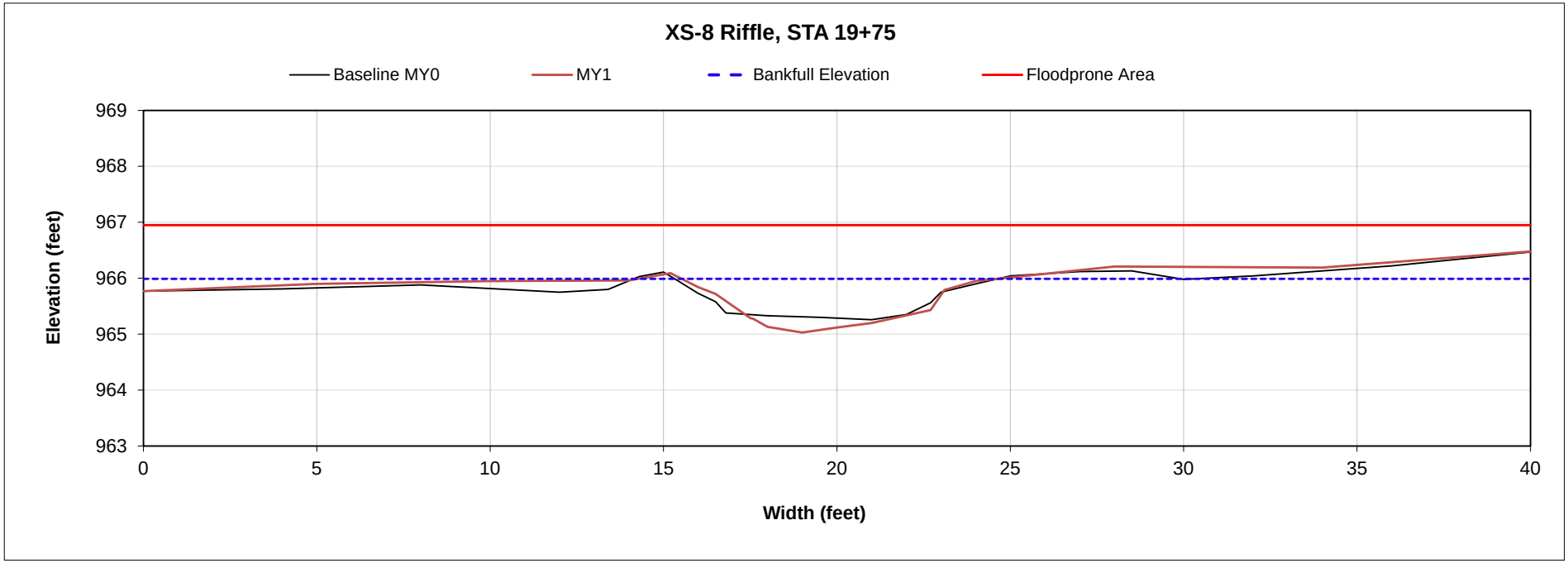
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R4
Cross Section ID	XS-8
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	966.0
Low Bank Height Elevation (ft)	966.0
Bankfull Max Depth (ft)	1.0
Low Bank Height (ft)	1.0
Bank Height Ratio	1.0
Bankfull X-section Area (ft²)	5.1
% Change Bank Height Ratio	0.0%

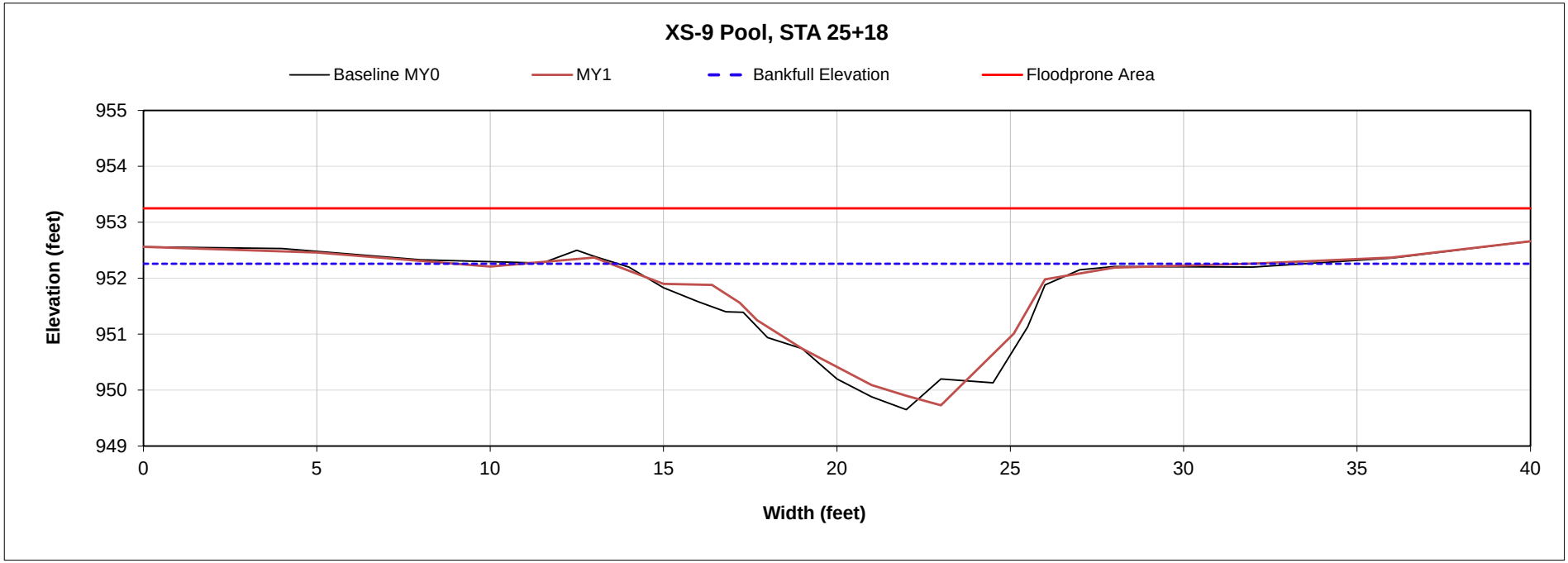
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-9
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	952.2
Low Bank Height Elevation (ft)	952.2
Bankfull Max Depth (ft)	2.5
Low Bank Height (ft)	2.5
Bank Height Ratio	1.0
Bankfull X-section Area (ft²)	16.8
% Change Bank Height Ratio	0.0%

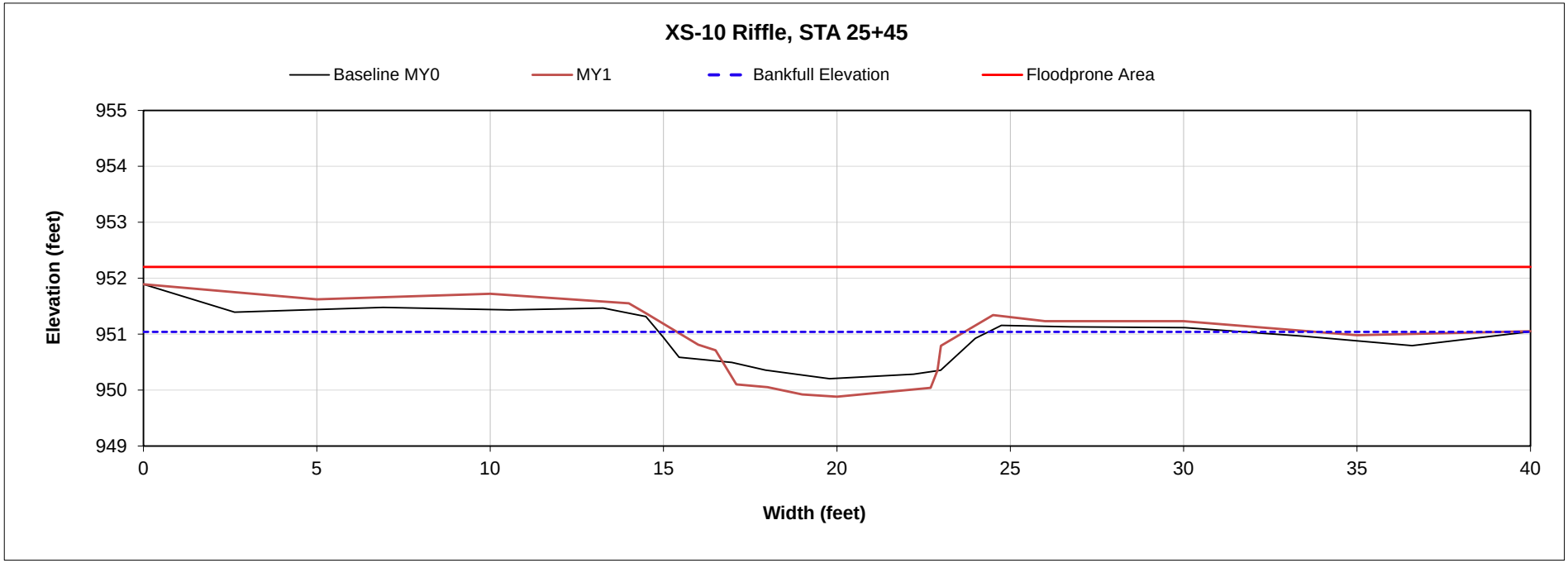
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-10
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	951.0
Low Bank Height Elevation (ft)	951.3
Bankfull Max Depth (ft)	1.2
Low Bank Height (ft)	1.5
Bank Height Ratio	1.3
Bankfull X-section Area (ft²)	6.9
% Change Bank Height Ratio	30.0%

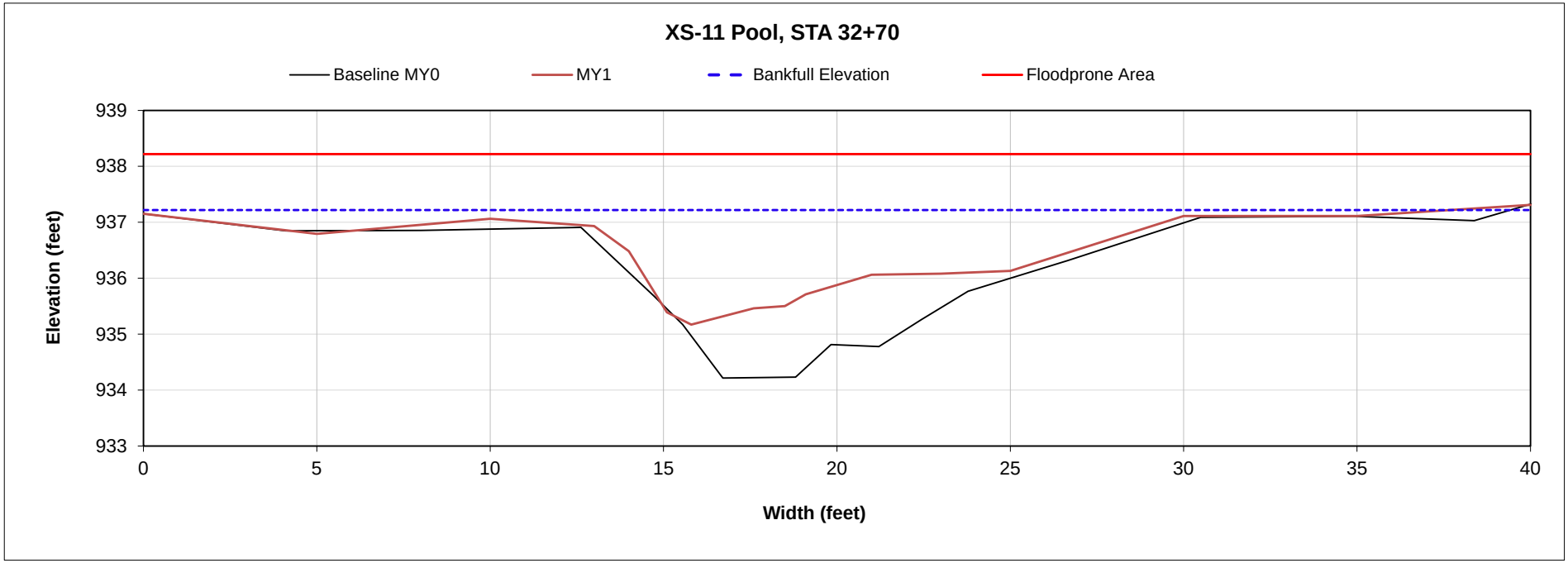
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-11
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	937.2
Low Bank Height Elevation (ft)	937.1
Bankfull Max Depth (ft)	2.1
Low Bank Height (ft)	1.9
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	23.6
% Change Bank Height Ratio	10.0%

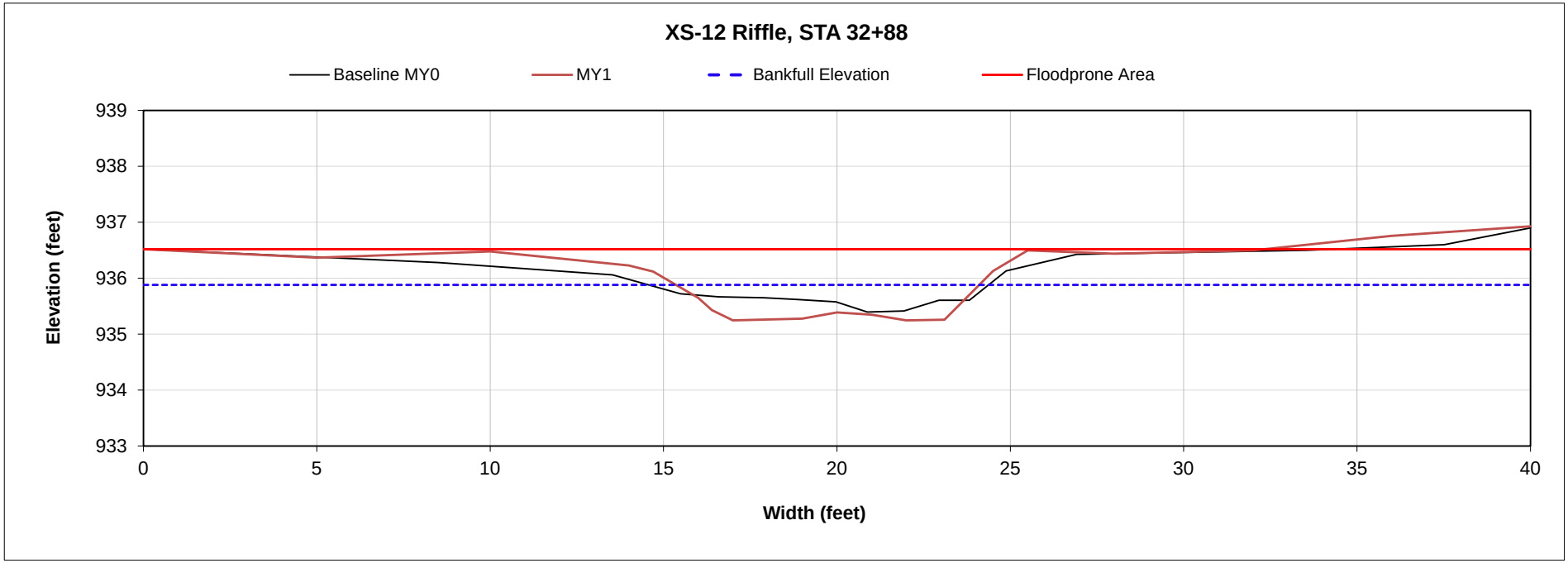
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-12
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	935.9
Low Bank Height Elevation (ft)	936.1
Bankfull Max Depth (ft)	0.6
Low Bank Height (ft)	0.9
Bank Height Ratio	1.4
Bankfull X-section Area (ft²)	4.5
% Change Bank Height Ratio	40.0%

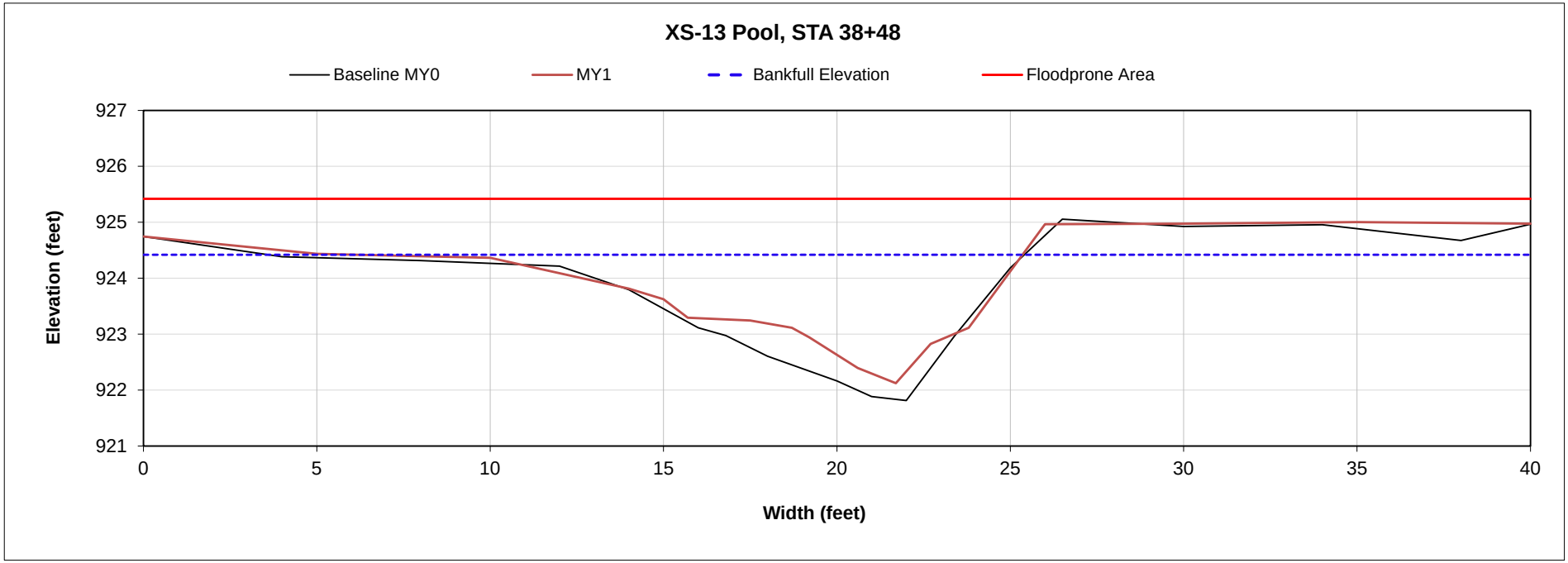
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-13
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	924.4
Low Bank Height Elevation (ft)	924.4
Bankfull Max Depth (ft)	2.3
Low Bank Height (ft)	2.3
Bank Height Ratio	1.0
***Bankfull X-section Area (ft²)**	16.4
% Change Bank Height Ratio	0.0%

Looking Downstream

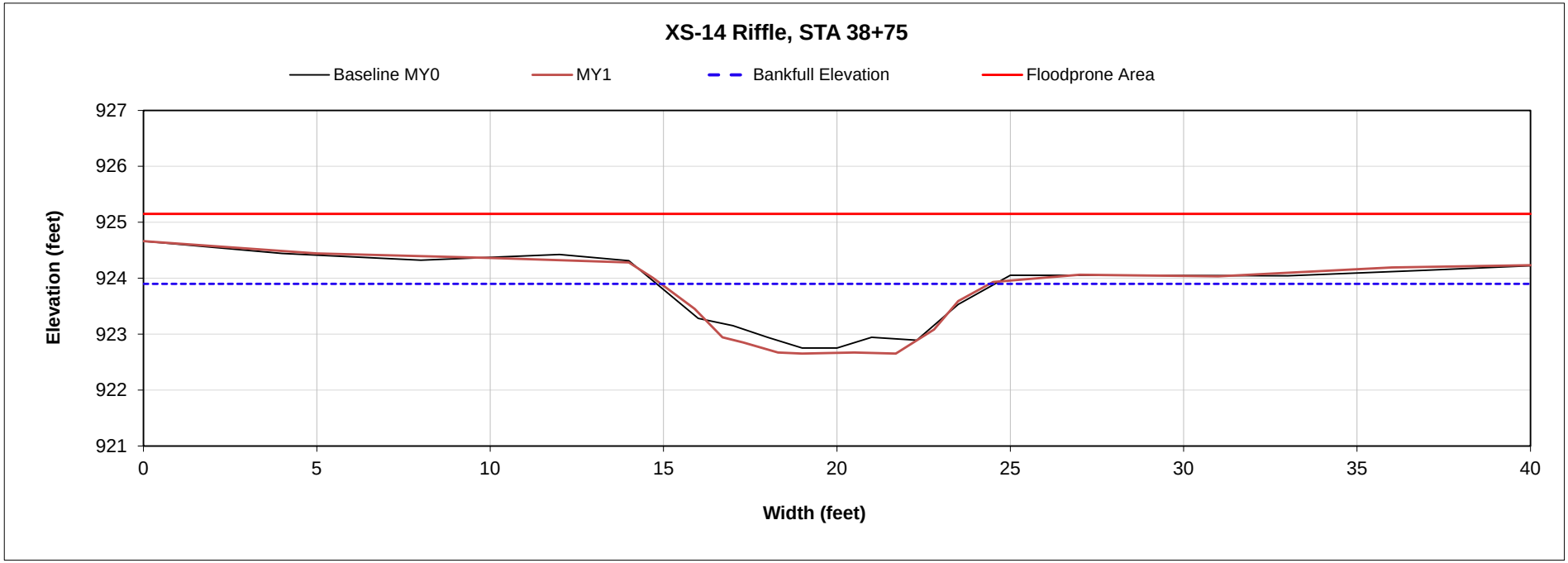


*Due to a calculation error MY0 bankfull was corrected from 19.9 to 16.4

Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-14
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	923.9
Low Bank Height Elevation (ft)	923.9
Bankfull Max Depth (ft)	1.3
Low Bank Height (ft)	1.3
Bank Height Ratio	1.0
Bankfull X-section Area (ft²)	8.4
% Change Bank Height Ratio	0.0%

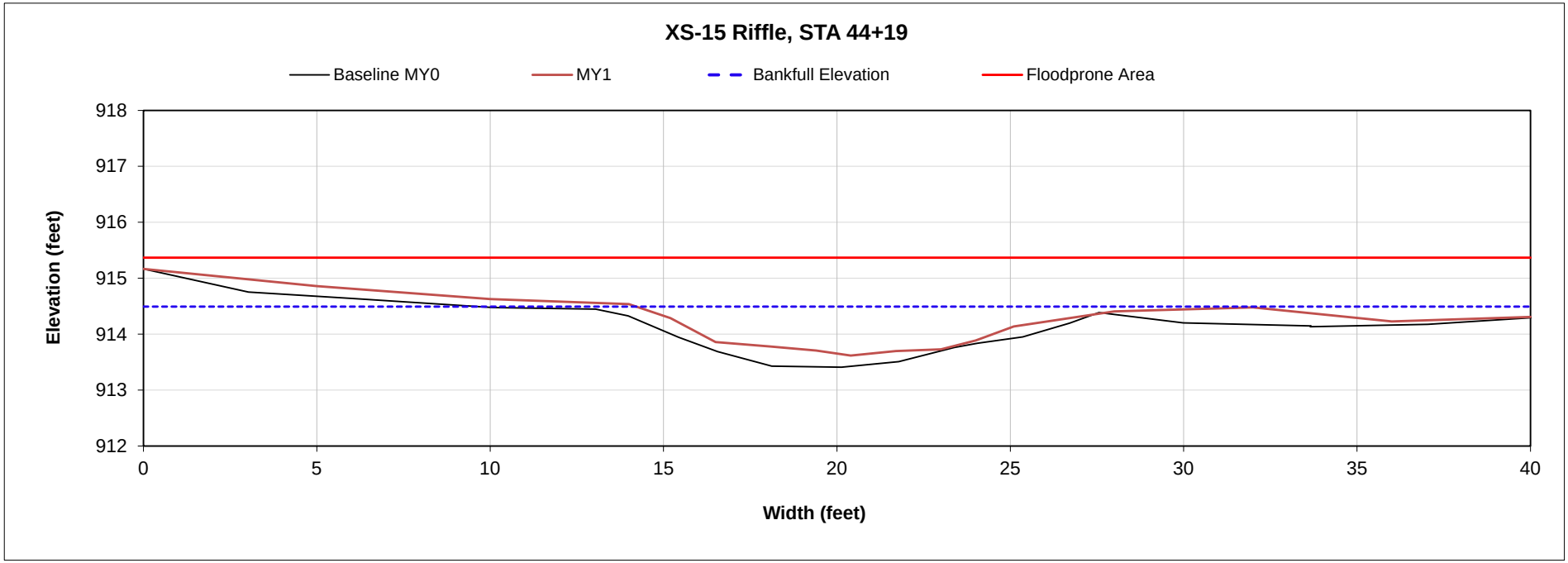
Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-15
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	914.5
Low Bank Height Elevation (ft)	914.4
Bankfull Max Depth (ft)	0.9
Low Bank Height (ft)	0.8
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	7.7
% Change Bank Height Ratio	10.0%

Looking Downstream



Project Name	Horne Creek Tributaries Mitigation Project
Project ID	100026
Reach ID	R5
Cross Section ID	XS-16
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY1 2020	
Bankfull Elevation (ft)	914.1
Low Bank Height Elevation (ft)	913.6
Bankfull Max Depth (ft)	2.9
Low Bank Height (ft)	2.4
Bank Height Ratio	0.9
Bankfull X-section Area (ft²)	27.1
% Change Bank Height Ratio	10.0%

Looking Downstream

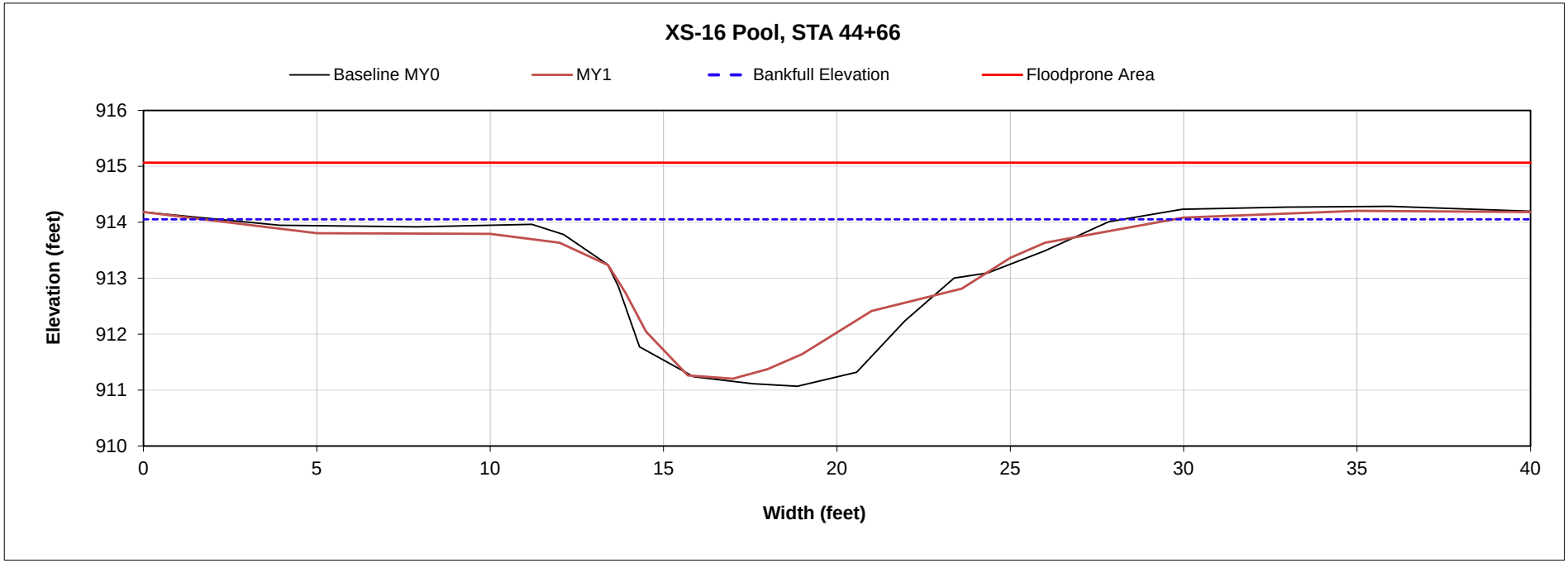


Table 7a. Baseline Stream Data Summary
Horne Creek Tributaries Mitigation Project

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		Baseline	
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	

Parameter	Design		Baseline	
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)	22.00		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		Baseline	
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 7b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Horne Creek Tributaries #100026

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)						
Parameters	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**
Bankfull Width (ft)	8.9	6.7						7.6	6.5						7.9	11.2						6.2	6.0					
Floodprone Width (ft)	36.7	34.7						34.5	34.2						33.3	34.9						23.9	25.5					
Bankfull Mean Depth (ft)	1.2	1.7						0.5	0.6						1.2	0.9						0.4	0.4					
Bankfull Max Depth (ft)	2.1	2.2						1.0	1.2						1.9	2.2						0.7	0.7					
Bankfull Cross Sectional Area (ft^2)	11.1	11.1						3.9	3.9						9.6	9.6						2.6	2.6					
Bankfull Width/Depth Ratio	7.1	4.0						14.8	10.9						6.4	13.0						14.7	14.0					
Bankfull Entrenchment Ratio	4.1	5.2						4.5	5.2						4.2	3.1						3.9	4.2					
Bankfull Bank Height Ratio	1.0	1.2						1.0	0.9						1.0	0.9						1.0	0.9					
d50 (mm)	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**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**
Bankfull Width (ft)	7.9	8.7						9.6	22.0						9.4	14.0						9.6	8.5					
Floodprone Width (ft)	40.0	40.0						40.0	40.0						40.0	40.0						40.0	40.0					
Bankfull Mean Depth (ft)	0.5	0.4						1.2	0.5						1.3	0.9						0.5	0.6					
Bankfull Max Depth (ft)	0.7	0.7						2.2	1.8						2.7	2.1						0.8	1.0					
Bankfull Cross Sectional Area (ft^2)	3.7	3.7						11.6	11.6						12.4	12.4						5.1	5.1					
Bankfull Width/Depth Ratio	17.2	20.6						7.9	41.7						7.1	15.8						18.2	14.2					
Bankfull Entrenchment Ratio	5.0	4.6						4.2	1.8						4.3	2.9						4.2	4.7					
Bankfull Bank Height Ratio	1.0	0.9						1.0	0.9						1.0	0.9						1.0	1.0					
d50 (mm)	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**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**
Bankfull Width (ft)	12.9	14.6						10.0	8.3						17.0	37.9						11.2	8.8					
Floodprone Width (ft)	40.0	40.0						40.0	40.0						40.0	40.0						38.5	32.5					
Bankfull Mean Depth (ft)	1.3	1.2						0.7	0.8						1.4	0.6						0.5	0.5					
Bankfull Max Depth (ft)	2.5	2.5						1.0	1.2						2.7	2.1						0.7	0.6					
Bankfull Cross Sectional Area (ft^2)	16.8	16.8						6.9	6.9						23.6	23.6						4.5	4.5					
Bankfull Width/Depth Ratio	9.8	12.6						14.5	10.0						12.2	60.8						27.7	17.2					
Bankfull Entrenchment Ratio	3.1	2.7						4.0	4.8						2.4	1.1						3.4	3.7					
Bankfull Bank Height Ratio	1.0	1.0						1.0	1.3						1.0	0.9						1.0	1.4					
d50 (mm)	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**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY+**
Bankfull Width (ft)	13.0	15.4						10.2	9.5						13.3	17.8						16.6	28.0					
Floodprone Width (ft)	40.0	40.0						40.0	40.0						40.0	40.0						40.0	40.0					
Bankfull Mean Depth (ft)	1.3	1.1						0.8	0.9						0.6	0.4						1.6	1.0					
Bankfull Max Depth (ft)	2.4	2.3						1.2	1.3						0.9	0.9						2.9	2.9					
Bankfull Cross Sectional Area (ft^2)	*16.4	16.4						8.4	8.4						7.7	7.7						27.1	27.1					
Bankfull Width/Depth Ratio	10.3	14.4						2.4	10.7						22.9	41.2						10.2	29.0					
Bankfull Entrenchment Ratio	3.1	2.6						3.9	4.2						3.0	2.2						2.4	1.4					
Bankfull Bank Height Ratio	1.0	1.0						1.0	1.0						1.0	0.9						1.0	0.9					
d50 (mm)	N/a	N/a						N/a	N/a						N/a	N/a						N/a	N/a					

Table 7c. 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 baseline conditions

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)	0.0423											
BF slope (ft/ft)	0.0457											
[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

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)	0.0273	0.0628										
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)	0.0250											
BF slope (ft/ft)	0.0254											
[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

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)	0.0198											
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 E: Hydrologic Data

Table 8a and 8b: Verification of Bankfull Events
Figure 4: Surface Flow Events and Flow Gauge Installation Diagrams
Figure 5: Rainfall Data

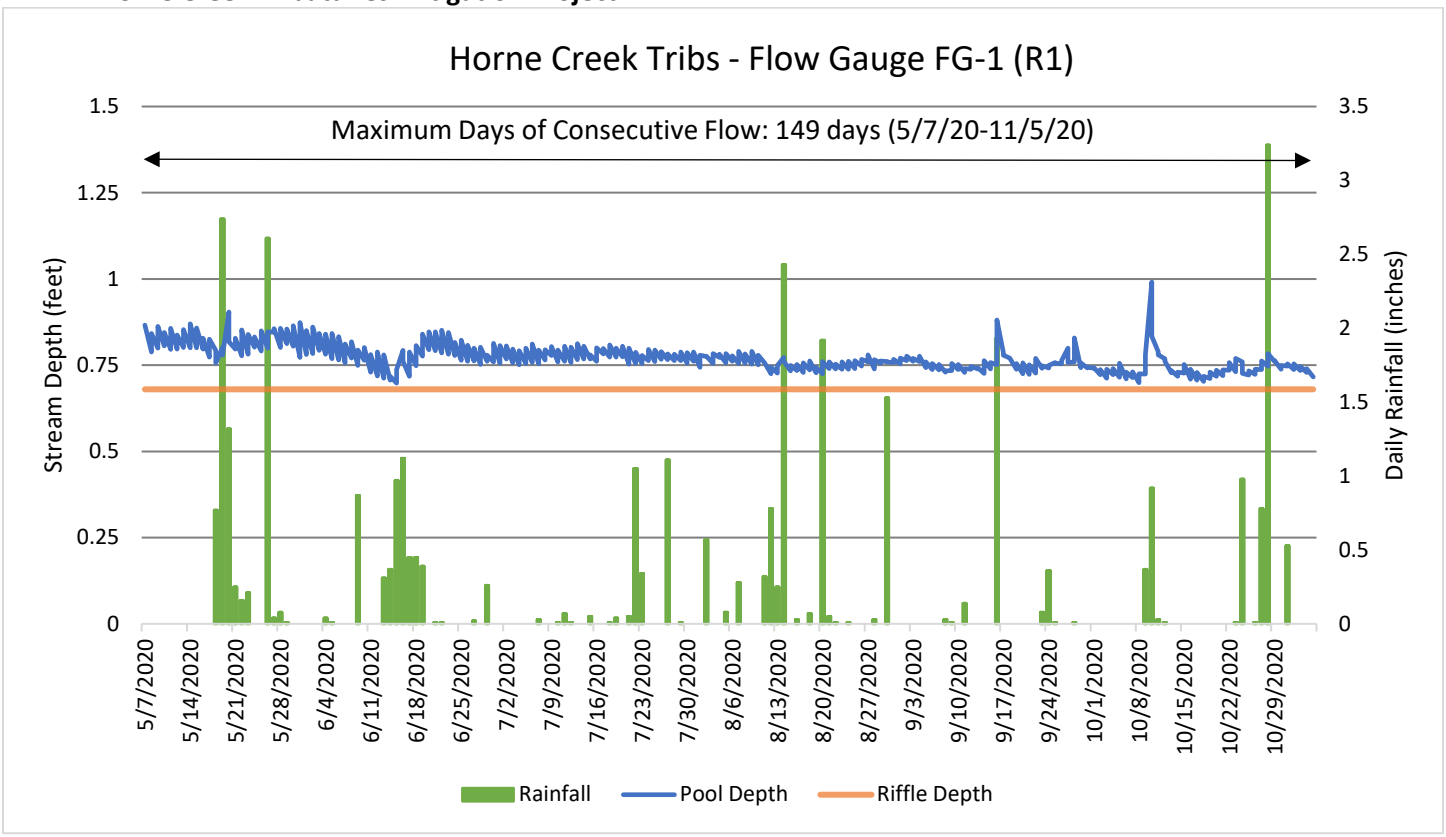
Table 8A: Verification of Bankfull Events - R1 Horne Creek Tributaries Mitigation Project				
Date of Collection	**Date of Occurrence**	**Method**	**Photos**	**Measurement above bankfull (feet)**
9/15/2020	8/21/2020	Pressure Transducer	No	0.18
11/5/2020	9/17/2020	Pressure Transducer	No	0.18
11/5/2020	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

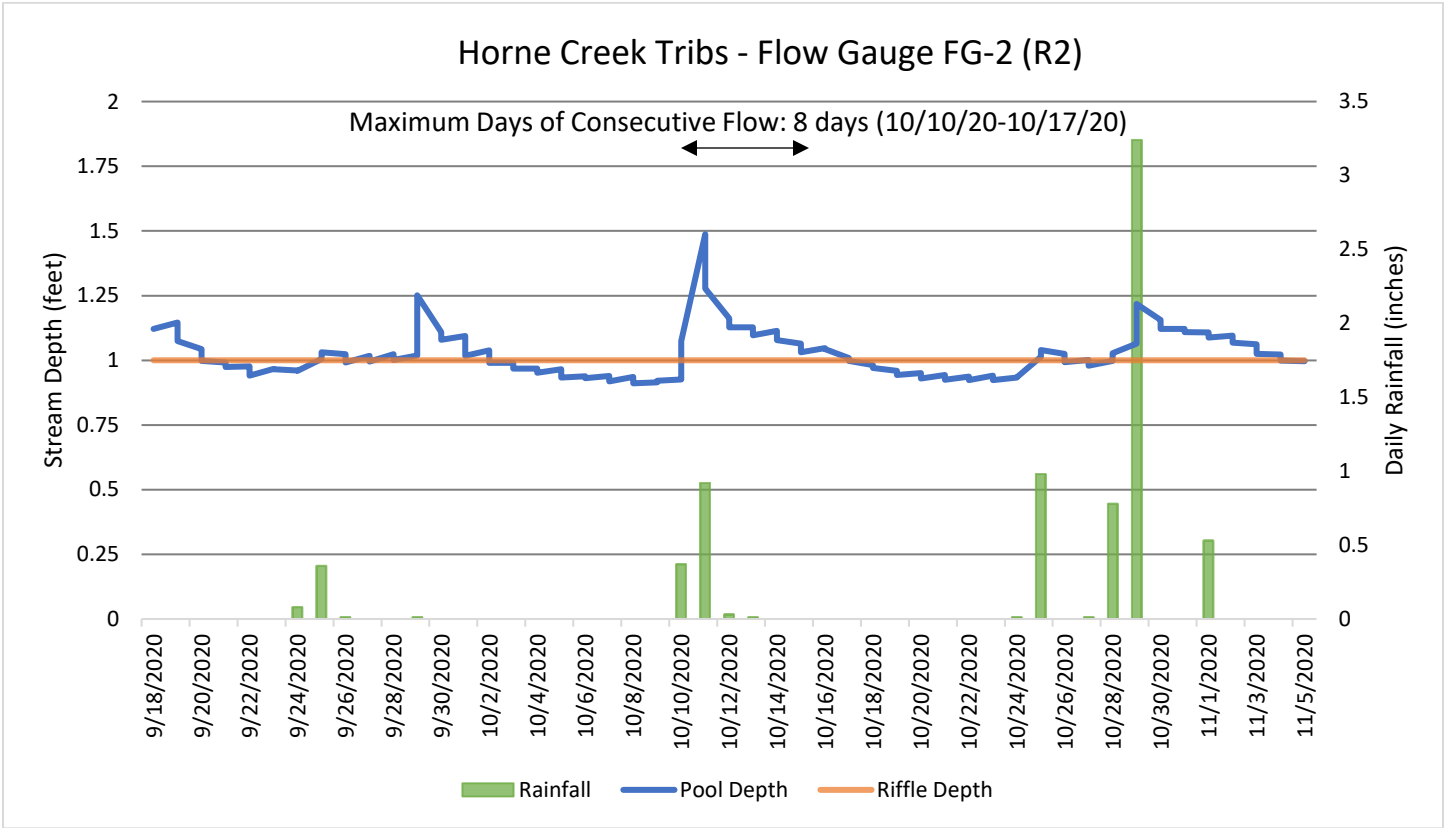
8/12/2020

11/5/2020

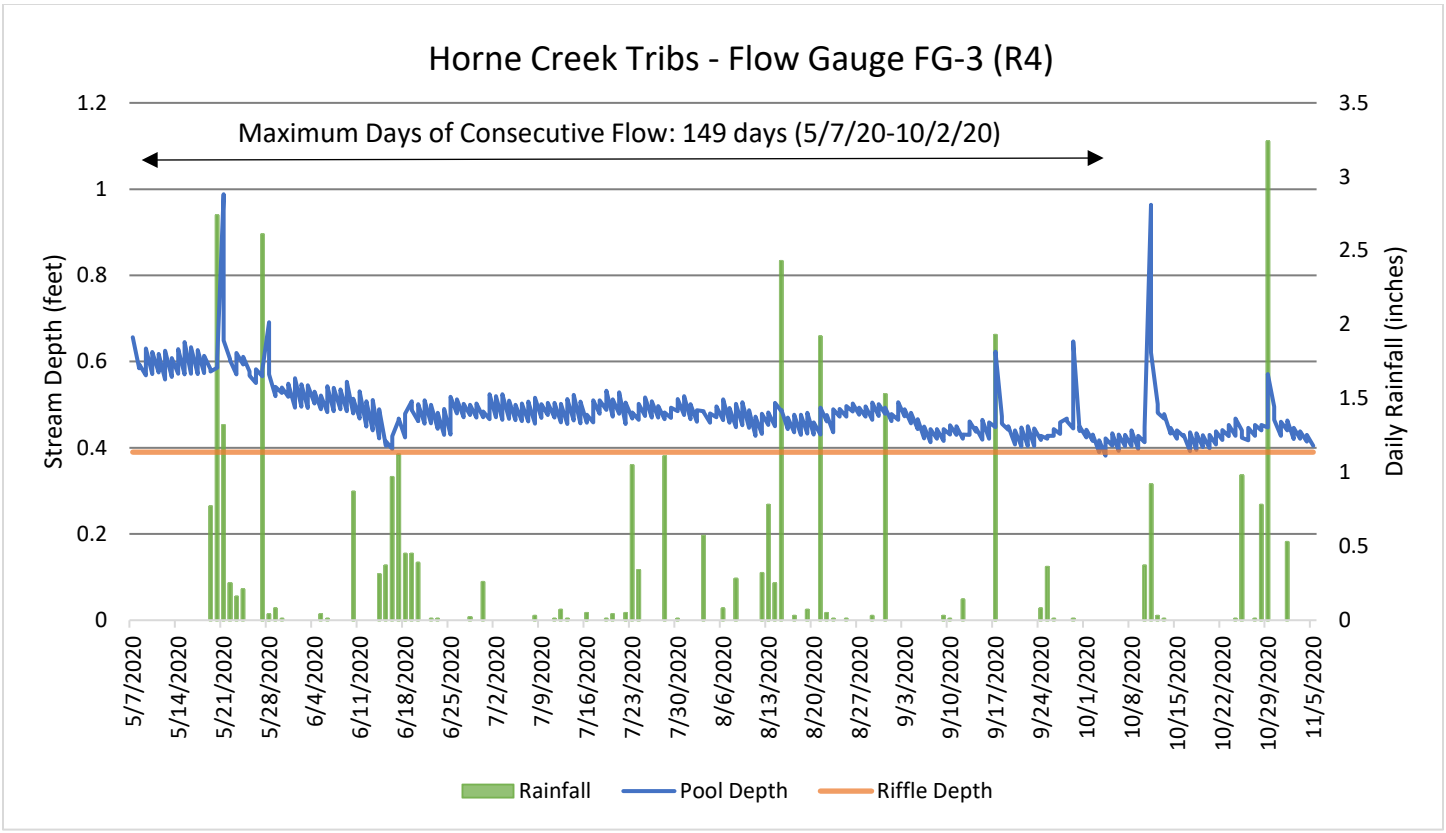
Table 8B: Verification of Bankfull Events - R5 Horne Creek Tributaries Mitigation Project				
Date of Collection	**Date of Occurrence**	**Method**	**Photos**	**Measurement above bankfull (feet)**
6/17/2020	5/20/2020	Pressure Transducer	No	0.10
6/17/2020	5/24/2020	Pressure Transducer	No	0.96

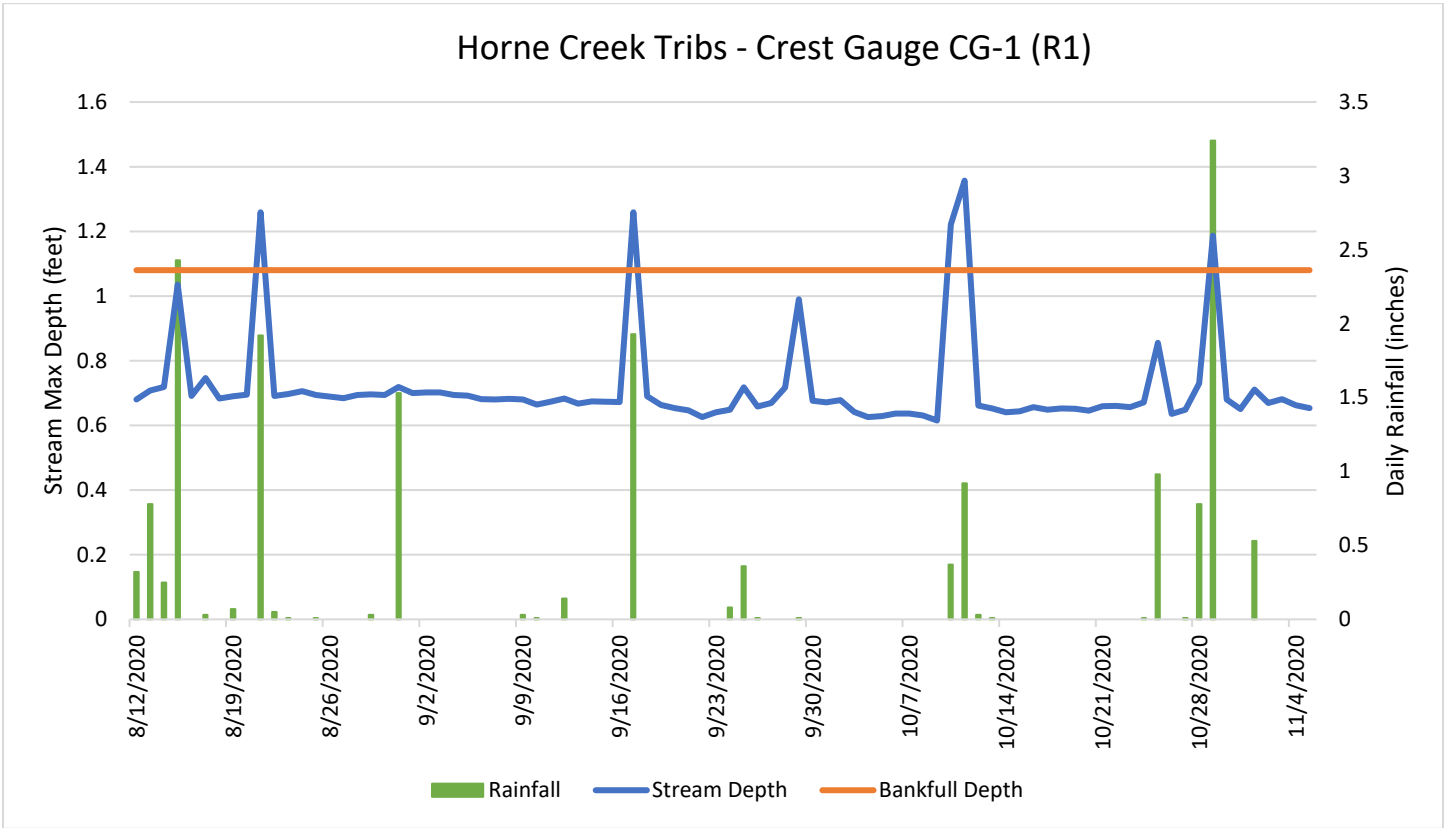
Figure 4: Surface Flow Data
Horne Creek Tributaries Mitigation Project



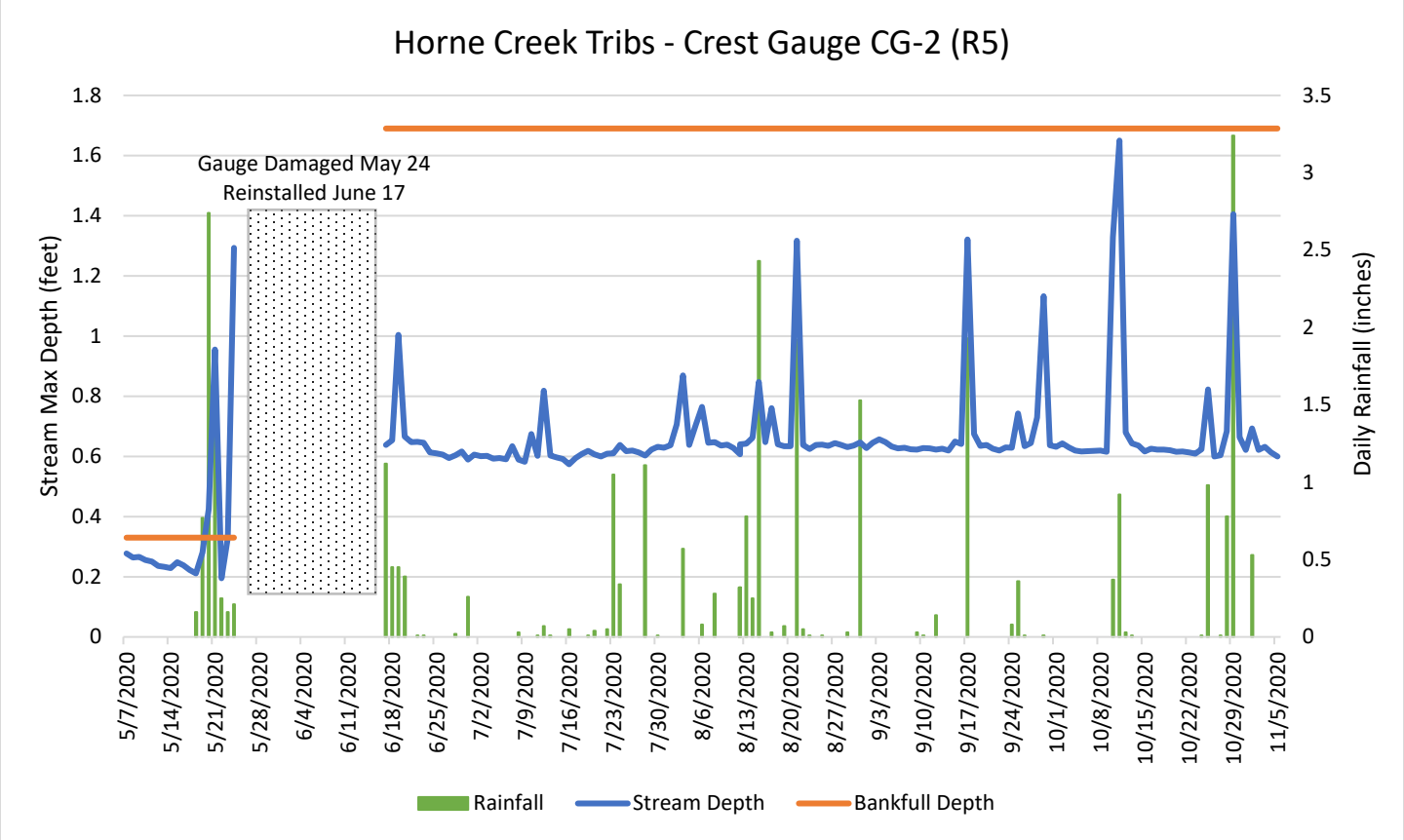


**R2 Flow Gauge installed on 9/18 after IRT as-built (MY0) site visit*



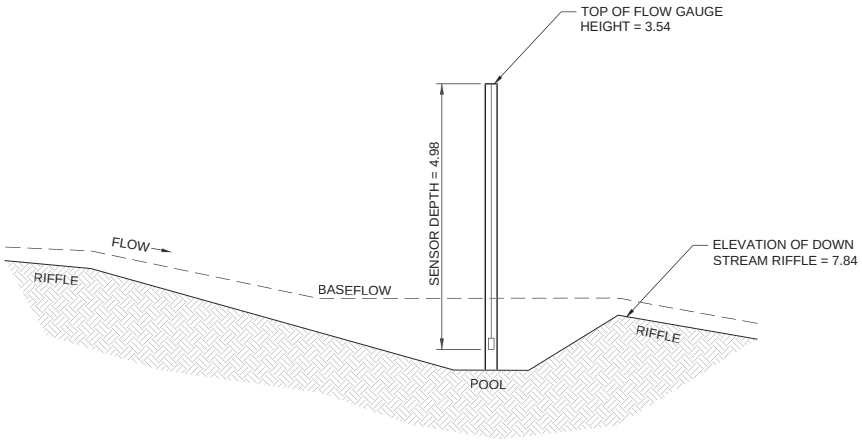


**R1 Crest Gauge installed on 8/12/2020 per request of DMS during as-built (MY0) comments*



**R5 Crest Gauge was damaged during a storm event on 5/24 and was repaired and reinstalled by WLS staff on 6/17*

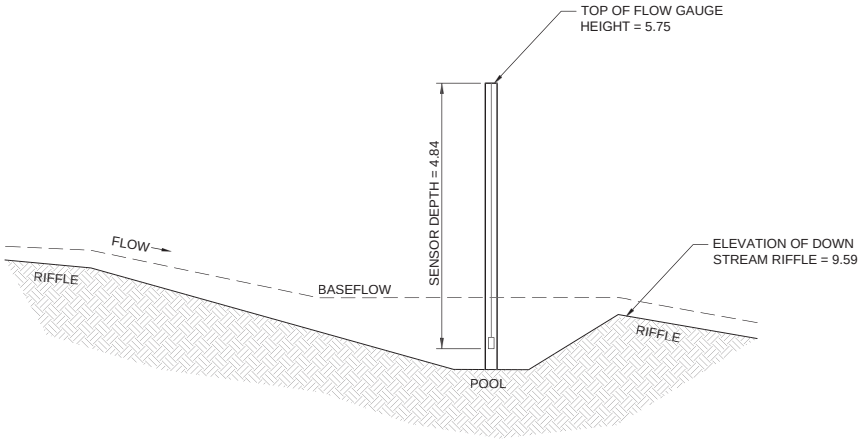
*** CG-2 was re-surveyed in its new location after reinstallation with new bankfull depth of 1.69'*



FLOW GAUGE FG-1 (R1)

Flow Depth = (Sensor Depth + Height) - Elevation of Down Stream Riffle

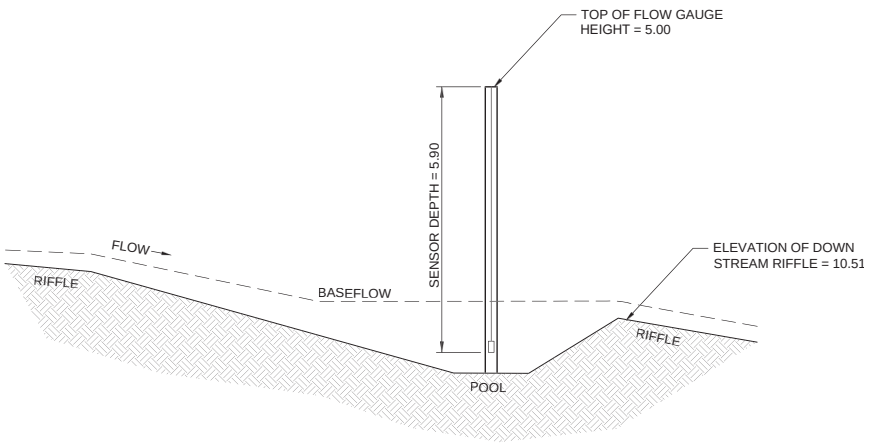
Flow Depth = 0.68 Feet



FLOW GAUGE FG-2 (R2)

Flow Depth = (Sensor Depth + Height) - Elevation of Down Stream Riffle

Flow Depth = 1.00 Feet

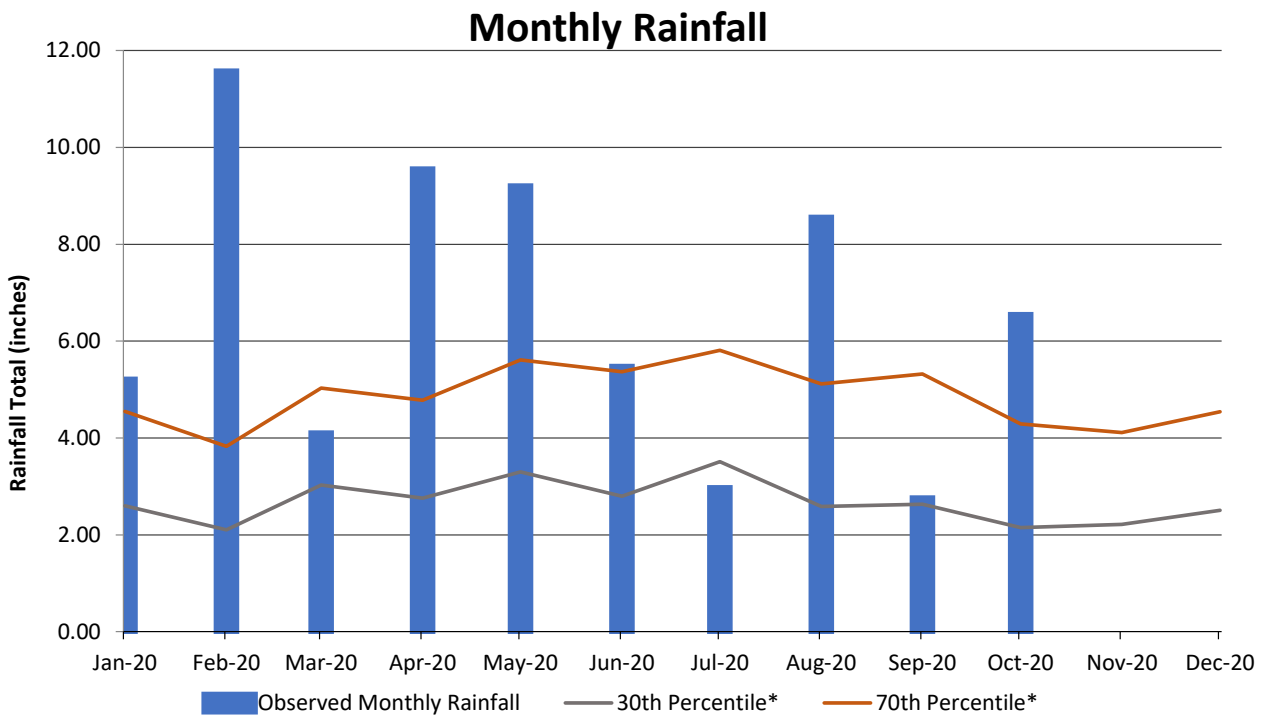


FLOW GAUGE FG-3 (R4)

Flow Depth = (Sensor Depth + Height) - Elevation of Down Stream Riffle

Flow Depth = 0.39 Feet

Figure 5: Monthly Rainfall Data
Horne Creek Tributaries Mitigation Project
MY1 2020



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

Month	30th Percentile*	70th Percentile*	Observed Monthly Rainfall
Jan-20	2.60	4.55	5.02
Feb-20	2.10	3.83	11.38
Mar-20	3.03	5.03	3.91
Apr-20	2.76	4.78	9.36
May-20	3.30	5.61	9.01
Jun-20	2.80	5.37	5.28
Jul-20	3.51	5.81	2.78
Aug-20	2.59	5.12	8.36
Sep-20	2.63	5.32	2.57
Oct-20	2.15	4.29	6.35
Nov-20	2.22	4.11	**
Dec-20	2.51	4.54	**