Monitoring Year 4 FINAL Monitoring Report

Stewarts Creek Tributaries Stream Restoration Project

Surry County, North Carolina

Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101

Data Collection Period:	**Submission Date:**
May, September 2023 – November 2023	December 2023

NCDEQ Contract No. 7183
DMS ID No. 100023
RFP#16-006993 (Issued 9/16/2016)
USACE Action ID No. SAW-2017-01508
DWR ID No. 20171043

Prepared For:

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Mr. Paul Wiesner
NCDEQ – Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

December 27, 2023

RE: Response to Draft Monitoring Year 4 report for the Stewarts Creek Tributaries site Yadkin River Basin – CU# 03040101 – Surry County DMS Project ID No. 100023. Contract # 7183

Dear Mr. Wiesner,

Ecosystem Planning and Restoration (EPR) has reviewed the comments on the Draft MY4 Monitoring Report provided December 15, 2023. The comments have been addressed as described below and the Final MY4 Report and electronic deliverables have been revised in response to this review.

Cover Page: Please include the issuance date of the RFP on the report cover (RFP# 16-006993 (Issued 9/16/2016).

- **The report cover has been updated with the RFP number and date.**

General: Please see the attached project documentation. This project documentation should be included in an Appendix of the revised MY4 (2023) report. Per the 7/25/22 response, EPR committed to the following in MY4 (2023):

- *EPR will monitor all cross-sections, fixed vegetation plots, and 2 random vegetation plots in MY4 for Moores Fork Reach 2 and 3.*
- *One random vegetation plot will be near Moores Fork Reaches 2 and the other random vegetation plot will be near Moores Fork Reach 3 in MY4.*

- **EPR surveyed the remaining cross-sections and vegetation plots on Moores Fork Reach 2 and 3 on 12/19/2023. This data is now included in the final report.**

Please fully review the 2022 AMP and all associated IRT comments, site visit notes, project documentation and EPR responses. The MY4 (2023) report should be updated with all the additional required and agreed upon data and information.

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General: Please ensure that project monitoring equipment is checked prior to the start of the growing season and at least quarterly thereafter to confirm that it is functioning properly and collecting data through the full growing season/ monitoring year.

- **Noted. EPR will check monitoring equipment at the start of the growing season and at least quarterly going forward.**

Section 1.2 Performance Criteria: Please review and update NCDED to NCDEQ.

- **This text has been updated in the final report.**

Table 2. Summary: Goals, Performance, and Results: "*Though repairs were conducted on the lower reaches of Moore's Fork, no longitudinal profile was shot during MY3.*" Please review and update to MY4.

- **This text in Table 2 has been updated in the final report.**

Table 2. Summary: Goals, Performance, and Results: "*Visual assessment of streams indicates that restored channels and in-stream structures within the majority of Stewart's Creek are in good condition and functioning as intended."* What is a majority? Please add context; what percentage of the streams are currently considered stable and functioning?

- **Addressed in Table 2. Summary: Goals, Performance, and Results. 99% of all restored reaches are functioning as intended. Moorse Creek Reach 2 is 96% stable and is currently undergoing repairs as of December 2023.**

Section 2.1.4 Stream Hydrology: "*A tipping bucket rain gauge was also installed at a nearby EPR mitigation site to accurately document rainfall at the Site."* Please discuss the distance of this off-site rain gauge from the project site. Please also discuss the distance of the AgACIS Mount Airy 2 rain gauge from the project site.

- **Information regarding the location of the rain gauges and the distances from the project site has been included in Section 2.1.4 Stream Hydrology.**

Section 2.2.1 Vegetation Monitoring Data: "*In MY3, various instances of easement encroachment were noted by the IRT.*" The numerous easement encroachments, property issues and easement boundary marking deficiencies were identified by DMS during a February 8, 2023, site visit and were documented in the MY3(2022) DMS monitoring report comment letter. Please review and confirm that all issues identified during the February 8, 2023, site visit were fully resolved in MY4 (2023).

- **The easement encroachments from MY3 are addressed in Section 2.2.1 of the final report.**

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General: In the report text, please confirm that EPR conducted a full project site boundary inspection at the end of the MY4 (2023) growing season. Please report the results of the boundary inspection and confirm that no current easement encroachments were observed. Please also report the integrity of the boundary marking and confirm that it currently meets the required DMS specifications.

- **The MY4 easement boundary assessment is addressed in Section 2.2.1 of the final report.**

Cross Section Plots XS4 - Moores Fork Reach 2; XS5 - Moores Fork Reach 2; XS7 - Moores Fork Reach 2: Please update the graphs so the plot lines (MY3 & MY4) are different colors and distinguishable.

- **The colors in the cross-section plots have been updated to distinguish between monitoring years.**

Table 12. Project Activity and Reporting History: Please include the April 2023 (MY4) supplemental planting in the table.

- **The 2023 supplemental planting has been included in Table 12.**

General / Appendix B: In the revised report, please include a supplemental planting list/ table for the April 2023 (MY4) planting effort. The list/ table should include a wetness tolerance column.

- **The 2023 supplemental planting list and map have been included in Appendix B.**

Digital Support File Comments:

None

If you have any questions regarding the Final MY4 Monitoring Report, please contact me at 919-388-0787 or via email at ebennett@eprusa.net.

Sincerely,

Erin M Bennett

Erin M. Bennett, PE

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1.0 PROJECT SUMMARY

Ecosystem Planning and Restoration, PLLC (EPR) implemented the Stewarts Creek Tributaries Stream Restoration Project (Project; Site) for the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS) to provide 10,649.2 stream mitigation credits (SMCs) in the Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101. The Stewarts Creek Tributaries Stream Restoration Project was contracted via NCDEQ-DMS RFP #16-006993. As approved by the North Carolina Interagency Review Team (NCIRT), all projects contracted under the 16-006993 RFP have a cool or warm water thermal regime service type. Penalties will not be assessed for using these project mitigation credits to satisfy cool or warm water thermal regime requirements. The Project restored 9,498 linear feet and enhanced 1,573 linear feet of three Unnamed Tributaries (UTs) to Stewarts Creek and Moores Fork within a 30-acre conservation easement (Figures 1A-E). An adaptive management plan was approved in June 2022 that modified the restored length of stream to 9,339.2 linear feet. Revised mitigation assets are listed in Table 1.

The project is located in the NCDEQ Division of Water Resources (DWR) Sub-basin 03-07-03 and DMS Targeted Local Watershed 03040101100010. The Site was historically utilized for agricultural and cattle practices. As such, wetlands and streams in the Project area were adversely impacted by direct cattle access, farming activities, and stream channelization. The Site is situated on historic pastureland in a WS-IV Watershed that is 49% agricultural land, 37% forest, 11% residential, and 1% impervious. Prior to construction activities, all Project streams were incised, the UTs were straightened and had adjacent row crops, and Moores Fork suffered from cattle damage. Pre-construction, or pre-existing, Site conditions are provided in Table 3 and the Summary Tables in Appendix C. Photos and a more detailed description of Site conditions before restoration are available in the Mitigation Plan.

1.1 Goals and Objectives

The Project goals were established based on an assessment of Site conditions and restoration potential with careful consideration of the stressors identified in the Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) Report (NCEEP, 2009) and Yadkin Pee-Dee Basin wide Water Quality Plan (NCDWQ, 2008). These goals and objectives are presented in Table 2.

Site construction was completed in May 2020 and the as-built survey was completed in June 2020. Planting and baseline vegetation data collection occurred in May – June 2020. Adaptive Management Plan Construction was completed in January 2023. A detailed timeline of the Project activity and reporting history is provided in Appendix E.

1.2 Performance Criteria

Project success criteria were established in accordance with the *NCDEQ DMS Mitigation Plan Template* (ver. 06/2017), and *US Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016). The monitoring plan for the Site will

follow the same guidance as the *NCDEQ DMS Annual Monitoring Report Format, Data, and Content Requirement* (October 2020). Table 2 details the USACE success criteria that evaluate whether Project goals have been met throughout the monitoring period. For more detailed success criteria refer to the Final Mitigation Plan, the As-built Baseline Monitoring Report (Final version submitted October 2020), or the Adaptive Management Plan (Final version submitted June 2022).

Table 1. Revised Project Mitigation Quantities and Credits

Project Component (reach ID, etc.)	Original Mitigation Plan and As-Built (ft/ac)	Proposed AMP (ft/ac)	Original Mitigation Thermal Regime Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Original Mitigation Credits	Revised Mitigation Credits
UT1	2,742	2,742	Cool	R	1.0	2,742	N/A
UT2	1,009	1,009	Cool	R	1.0	1,009	N/A
UT3 R1	944	944	Cool	R	1.0	944	N/A
UT3 R2	2,421	2,421	Cool	R	1.0	2,421	N/A
Moores Fork R1	1,573	1,573	Cool	E2	2.5	629.2*	N/A
Moores Fork R2	1,998	1,839.2	Cool	R	1.0	1,998	**1,839.2**
Moores Fork R3	384	384	Cool	R	1.0	384	384
Net Change In Credit From Buffers	-	-	-	-	-	522	**530.7**
					New Total Assets Summary:		**10,499.1 SMUs**

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	**9,339.2**			
Enhancement				
Enhancement I				
Enhancement II	1,573			
Rehabilitation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	**10,499.1**

*Moores Fork R1 mitigation credits were miscalculated due to a minor rounding error in the IRT approved Mitigation Plan. This has been updated in the baseline and subsequent monitoring reports.

Table 2. Summary: Goals, Performance, and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reduce sediment inputs and stream turbidity;	▪ Reduce the amount of land in active livestock pasture. ▪ Install fencing to exclude livestock from Project buffers and streams. ▪ Increase distance between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff. ▪ Stabilize eroding streambanks and concentrated runoff areas.	▪ Excluding livestock from all streams and buffers. The exclusion of livestock will remove a direct source of nutrients, fecal coliform, and sediment from the system. ▪ Restoring the Project streams to stable, functioning condition. Appropriate channel dimensions and in-stream log and wood structures will ensure channel stability and improve aquatic habitats. ▪ Restoring natural riparian vegetation. Restored riparian buffers will provide a source of woody debris and detritus for aquatic organisms, restore diverse aquatic and terrestrial habitats appropriate for the ecoregion and landscape setting, and provide shade, reduce water temperatures, and increase dissolved oxygen concentrations.	▪ Recordation and protection of a conservation easement meeting DMS guidelines ▪ Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment. ▪ Vegetation success criteria of 320 native stems/ acre in Year 3, 260 native stems/acre in Year 5, and 210 native stems/acre in Year 7. Trees in each plot will average 7 feet in height at MY5 and 10 feet in height at MY7. ▪ Visual documentation of installed watering system and regular checks on its operation during annual monitoring. ▪ Visual inspection of BMP's to ensure proper function during monitoring period. ▪ Geomorphic cross sections indicate stable sections over the monitoring period. ▪ Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach.	<u>Permanent Vegetation Plots</u> 11 permanent vegetation plots, 0.02 acre in size (minimum), surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species, height, planted vs. volunteer, and age.	3 permanent Vegetation Plots were surveyed as requested during MY4. Plot stem densities for VPF-3 were 324, 729 for VPF-4 and 445 for VPF-5. All 3 plots met the success criteria of 320 native stems/acre in Year 3, as well as the Year 5 criteria. No other vegetation plot data was collected in MY4. Site-wide vegetation monitoring will resume in MY5.
Reduce nutrient inputs	▪ Reduce the amount of land in active livestock pasture and row crop agriculture. ▪ Install fencing to exclude livestock from Project buffers and streams. ▪ Increase buffer widths between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff. ▪ Promote higher water table conditions, and thus denitrification, along restored headwaters.				
Reduce Fecal Coliform Inputs	▪ Reduce the amount of land in active livestock pasture. ▪ Exclude livestock from Project streams and buffers. ▪ Increase buffer width between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff.			<u>Annual Random Vegetation Plots</u> 11 randomly selected vegetation plots, 0.02 acre in size (minimum), surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species and height.	2 random vegetation plots were surveyed as requested during MY4. The stem densities for VPR-1 were 405 and 283 for VPR-2. VPR-2 does not meets the success criteria of 320 native stem/acre in MY3 but does meet the criteria for MY5. No other vegetation plot data was collected in MY4. Site-wide vegetation monitoring will resume in MY5.

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Restore / Enhance Degraded Riparian Buffers	▪ Restore riparian buffer vegetation to filter runoff and provide organic matter and shade. ▪ Protect riparian buffers with permanent conservation easement.	▪ Conversion of row crops to forested buffer. ▪ Protecting all areas with conservation easement.	▪ Entrenchment ratio (ER) must be 2.2 or above for all measured riffle cross sections for C/E stream types and 1.4 or above for B stream types. ▪ Documentation of hydrophytic vegetation within vegetation monitoring plots. ▪ Documentation of four bankfull events in different years throughout the monitoring period. ▪ Documentation of 30 days of consecutive stream flow in all reaches each monitoring year	<u>Stream Profile</u> Full longitudinal survey on all restored and enhanced stream channels. Data was collected during As-built survey only (unless otherwise required).	A full longitudinal survey of the Projects streams was conducted during As-built monitoring. Though repairs were conducted on the lower reaches of Moores Fork, no longitudinal profile was shot during MY4.
Implement Agricultural BMPs in Agricultural Watersheds	▪ Construct agricultural conveyance system to filter and reduce agricultural runoff into restored stream systems. ▪ Construct a critical area restoration BMP by removing and decommissioning a heavily eroding forest road and cattle use area.			<u>Cross Sections</u> Cross sections are surveyed during Years 1,2,3,5, and 7. 26 total cross sections, 17 cross sections on the UTs and 9 cross sections on Moores Fork.	6 Cross Sections were conducted throughout repaired sections of Moores Fork during MY4 (XS4, XS5, XS6, XS7, XS8 and XS9). XS4 and XS5 indicated that the stream has continued to adjust after the repairs were made, and some bank erosion is evident in this area. XS7 has remained stable since the repairs were made in early 2023. All other cross sections remained stable. No other cross section data was collected in MY4. Cross section monitoring will resume in MY5.
Reduce Urban/ Suburban Stormwater Runoff	▪ Restore riparian buffers along headwater streams that drain suburban areas. ▪ Protect riparian buffers with permanent conservation easement.			<u>Visual Assessment</u> Conducted yearly on all restored stream channels and in-stream structures.	Visual assessment of streams indicates that 99% of the restored channels and in-stream structures are functioning and stabilized as intended. Moores Fork Reach 2 is the only reach with bank toe erosion. 96% of this reach is stable and functioning as designed.

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
				<u>Additional Cross Sections</u> Only surveyed if instability is documented during monitoring.	No additional cross sections were surveyed during MY4.
Reduce Stream Channel and Streambank Instability	▪ Restore degraded stream channels by establishing appropriate dimension, pattern and profile. ▪ Install in-stream structures to provide stream channel and streambank stability. ▪ Restore and protect riparian buffer to provide bank protection and stability. ▪ Install fencing to exclude livestock from Project streams and buffers.			<u>Stream Hydrology Monitoring</u> 5 pressure transducers and a rain gauge will record precipitation and streamflow data continuously through the monitoring period. Photos of high water indicators will be taken yearly.	Flow gauge data from MY4 indicate that the UTs met the established success criteria of 30 days or more of consecutive flow throughout the year. In addition, 6 –14 bankfull events were recorded for the UTs.

Table 3. Project Attribute Table

Project Background Information				
Project Name		Stewarts Creek Tributaries Stream Restoration Project		
County		Surry		
Project Area (acres)		30		
Project Coordinates (latitude and longitude)		latitude 36 deg 30' 55" N, longitude 80 deg 41' 41" W and latitude 36 deg 30' 37" N, longitude 80 deg 42' 01" W		
Planted Acreage (Acres of Woody Stems Planted)		30		
Project Watershed Summary Information				
Physiographic Province		Piedmont		
River Basin		Yadkin Pee-Dee		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101100010	
Project Drainage Area (Acres and Sq. Mi.)		3,001 acres/ 4.69 Sq.Mi. (Total)		
Project Stream Thermal Regime		Cool		
Project Drainage Area Percentage of Impervious Area		Average 1%		
CGIA Land Use Classification		Average 35% Agriculture 50% Forested/Scrubland 11% Residential		

Reach Summary Information				
Parameters	**Moores Fork**	**UT1**	**UT2**	**UT3**
Length of reach (linear feet)	3,796.2	2,742	1,009	3,365
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres and Square Miles)	4.4 Sq.Mi., 2816 Ac	0.11 Sq.Mi., 70 Ac	0.07 Sq.Mi., 45 Ac	0.11 Sq.Mi., 70 Ac
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV
Stream Classification (existing)	F4	G4 -> F4	Channelized E4	F4
Stream Classification (proposed)	C4	C4	C4	C4
Evolutionary trend (Simon)	V	IV	IV	IV
FEMA classification	AE	AE	AE	AE

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	SAW-2017-01508
Water of the United States - Section 401	Yes	Yes	DWR #17-1043
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	General Permit NCG010000 - ID # SURRY-2020-005
Endangered Species Act	No	Yes	Categorical Exclusion Document; Appendix 10 in Mitigation Plan
Historic Preservation Act	No	Yes	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	CLOMR 19-04-3237R, Floodplain Development Permit PL201900063, LOMR case number 21-04-0390P, and planning approval on 09/22/22
Essential Fisheries Habitat	No	N/A	N/A

2.0 MONITORING DATA ASSESSMENT

This document reports the Monitoring Year 4 data and compares it to the baseline data to determine the success of the Stewarts Creek Stream Restoration Project based on the performance criteria stated above.

2.1 Stream Monitoring

Stream monitoring involved field collection to assess the hydrologic and geomorphic functions of UT1, UT2, UT3, and Moores Fork. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document Site performance related to the Project goals listed in Table 2. The locations of the established monitoring cross sections are shown in Figures 1B-1E (Current Condition Plan View (CCPV)). Construction on the Adaptive Management Plan was completed in January 2023 and shown in Figures 1B-1E.

2.1.1 Stream Profile

A full longitudinal profile was surveyed for the entire length of the restored streams in May - June 2020 to document as-built conditions. This survey was tied to a permanent benchmark and includes thalweg, water surface, right bank, and left bank features. Profile measurements were taken at the head of each feature (e.g. riffle, pool) and at the max depth of pools. The longitudinal profile will not be surveyed during annual monitoring unless vertical channel instability has been observed during monitoring and remedial actions or repairs are needed.

2.1.2 Stream Dimension

Permanent cross sections were installed across the Site to monitor stream stability through dimension change. Of the 26 permanent cross sections installed, 9 were located on Moores Fork and 17 on the UTs with 12 permanent cross sections installed in riffles and 14 in pools. Each cross section was monumented using t-posts on both streambanks. The location and elevation of each pin was located and recorded to facilitate data comparison from year to year. Cross sections were surveyed using a Topcon RL-H5A Self Leveling Laser Level. Reported data includes measurements of Bankfull Elevation (based on as-built bankfull area), Bank Height Ratio (BHR) (based on as-built bankfull area), Thalweg Elevation, Top of Bank Elevation, Top of Bank Max Depth, Top of Bank Cross Sectional Area, and Entrenchment Ratio (ER) (Appendix C). BHR measurements were made by holding the bankfull area recorded in the Baseline As-built report constant and adjusting the bankfull elevation. Reference photos were and will be taken of both streambanks every year to provide a visual assessment of any changes that may occur.

During Year 4 Monitoring, 6 cross sections were surveyed. 4 cross sections on Moores Fork Reach 2 (XS4, XS5, XS6, and XS7) and 2 cross sections on Moores Fork Reach 3 (XS8 and XS9). Cross sections 4 and 5 were relocated due to the adaptive management plan, and cross section 7, which is located in a section of stream that was stabilized with additional toe wood. Cross section 4 exhibits minor bank erosion since the repairs were made, and cross section 5 indicates significant toe erosion. Plans have been made to repair this section of the bank in the winter of

2023-2024. The Channel Problem Area (CPA1) is shown in the CCPV (Figure 1E). The stream bed and banks shown in cross section 7 have remained stable since the MY3 repairs. Cross section 6 follows a similar pattern to XS 7. It has remained stable and only had minor adjustments. Cross section 8 has had no adjustment since construction with similar dimensions to the as-built design. Cross section 9 has remained stable since MY1. It is directly below a rock vane structure that acts as grade control and bank stability. Over the course of the monitoring year, EPR will continue to monitor the cross sections to ensure that they are stable and functioning. No other cross sections were surveyed in MY4, and cross section monitoring will resume in MY5. The cross-section plots, photos, and data summary are included in Appendix C.

2.1.3 Channel Stability

Channel stability is assessed on an annual basis using photographs to visually document the condition of the restored Project streams. Photographs are taken from the same location in the same direction each year. 38 photo points were established during baseline monitoring and are shown in the CCPV (Figures 1B-1E). Visual assessments of channel stability were also made regularly throughout Monitoring Year 4.

Stream photo points and visual assessment indicate that a majority of restored channels and in-stream structures are in good condition and performing as intended.

The only area of channel instability noted in MY4 is the previously mentioned CPA-1, located within the upstream repaired section of Moores Fork Reach 2. The problem area is two separate sections of bank toe erosion, an upstream section on the right bank (50') and a downstream section on the left bank (125'). In both sections, where toe wood was installed as part of the 2022 AMP, the section of streambank immediately downstream of the toe wood eroded immediately after construction was complete but before vegetation had a chance to establish. These areas have been monitored throughout 2023 and have not worsened since the initial event. EPR is planning to reshape the stream channel and install additional toe wood through both of these sections in winter 2023-2024 to match the intended design from the 2022 AMP. No cross sections or vegetation plots will be relocated by these repairs, and as little vegetation will be disturbed as possible. Any disturbed areas will be reseeded and planted with bare root trees from the approved AMP planting list.

While visually assessing the site during MY4, 3 beaver dams were found on the lower end of UT3 Reach 2, as shown in the CCPV (Figure 1C). They were removed and the channel was cleared. No damage was done to the stream bed or banks. A trapping specialist from the USDA APHIS program was contacted and inspected the site. After revisiting the site in the following weeks, the specialist confirmed that these beaver dams were inactive and he suspected the animals were no longer in the area. EPR will continue to visually inspect these areas and take further action if more beaver dams are found in MY5.

2.1.4 Stream Hydrology

Five pressure transducers were installed along the UTs to document stream flow and the occurrence of bankfull events within the monitoring period. The locations of these gauges are shown in the CCPV (Figures 1B–1E). All gauges were installed at the downstream end of pools. The constructed bankfull elevation at each gauge was located and recorded, as well as the elevation of the downstream controlling grade. These elevations will be compared with the gauge readings to determine and document whether the stream is flowing and if a bankfull event has occurred.

A tipping bucket rain gauge was installed 3.5 miles SE at another EPR mitigation site to accurately document rainfall at the Site. The rainfall data can be compared to the flow gauge data to verify that high flows at the Site are correlated with rainfall events. The monitoring gauges were downloaded regularly throughout Monitoring Year 4 and rainfall data is presented in the flow gauge plots in Appendix D. This rainfall data was supplemented with data from the AgACIS Mount Airy 2 rain gauge for several dates when onsite rain data was not available. This rain gauge is located approximately 2.5 miles SE at the Mount Airy Water Treatment Plant.

The final flow gauge download for MY4 occurred on 10/26/2023. Flow gauge data from MY4 indicates that all three Unnamed tributaries met the established success criteria of 30 days or more of consecutive flow throughout the year. According to the gauge in upper UT1 (SG-1), the stream had consistent flow throughout the year (298 consecutive days of flow) and the gauge documented 6 bankfull events. SG-2, located downstream on UT1 had consistent flow throughout the year (298 consecutive days of flow) and the gauge documented 9 bankfull events. SG-3, located on UT3 Reach 1, showed consecutive flow throughout most of the year until the flow gauge battery died on 9/14/23. It was replaced on 10/25/23. Despite the gap in data, the gauge still recorded 256 days of consecutive flow and 6 bankfull events. SG-4, located on UT3 Reach 2, had consecutive flow throughout the entire year (299 consecutive days of flow) and 14 bankfull events. SG-5, located on UT2, documented consistent flow throughout the year (205 consecutive days of flow) and 8 bankfull events until the flow gauge died on 7/25/2023. A new battery was installed on 10/26/2023. Bankfull events were verified by comparison to local rain gauge data. The date and timing of these bankfull events correlated with significant rainfall events recorded by the tipping bucket rain gauge.

2.2 Riparian Vegetation Monitoring

Riparian vegetation monitoring evaluates the growth and development of planted and volunteer vegetation across the Site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document Site performance related to the Project goals listed in Table 2.

2.2.1 Vegetation Monitoring Data

Eleven (11) permanent vegetation monitoring plots are typically monitored across the Site. The corners of the permanent vegetation plots were marked using steel t-posts and the location of each plot was surveyed during the as-built survey. The individual trees within each permanent plot were flagged and identified to facilitate repeat monitoring each year. In addition to the 11 permanent plots, 11 randomly placed vegetation plots are established each year, and the location of these plots is recorded using GPS. All vegetation plots for MY3 and MY4 are shown in the CCPV (Figures 1B – 1E). Annual vegetation data is compiled and summarized using the DMS Vegetation Data Entry Tool.

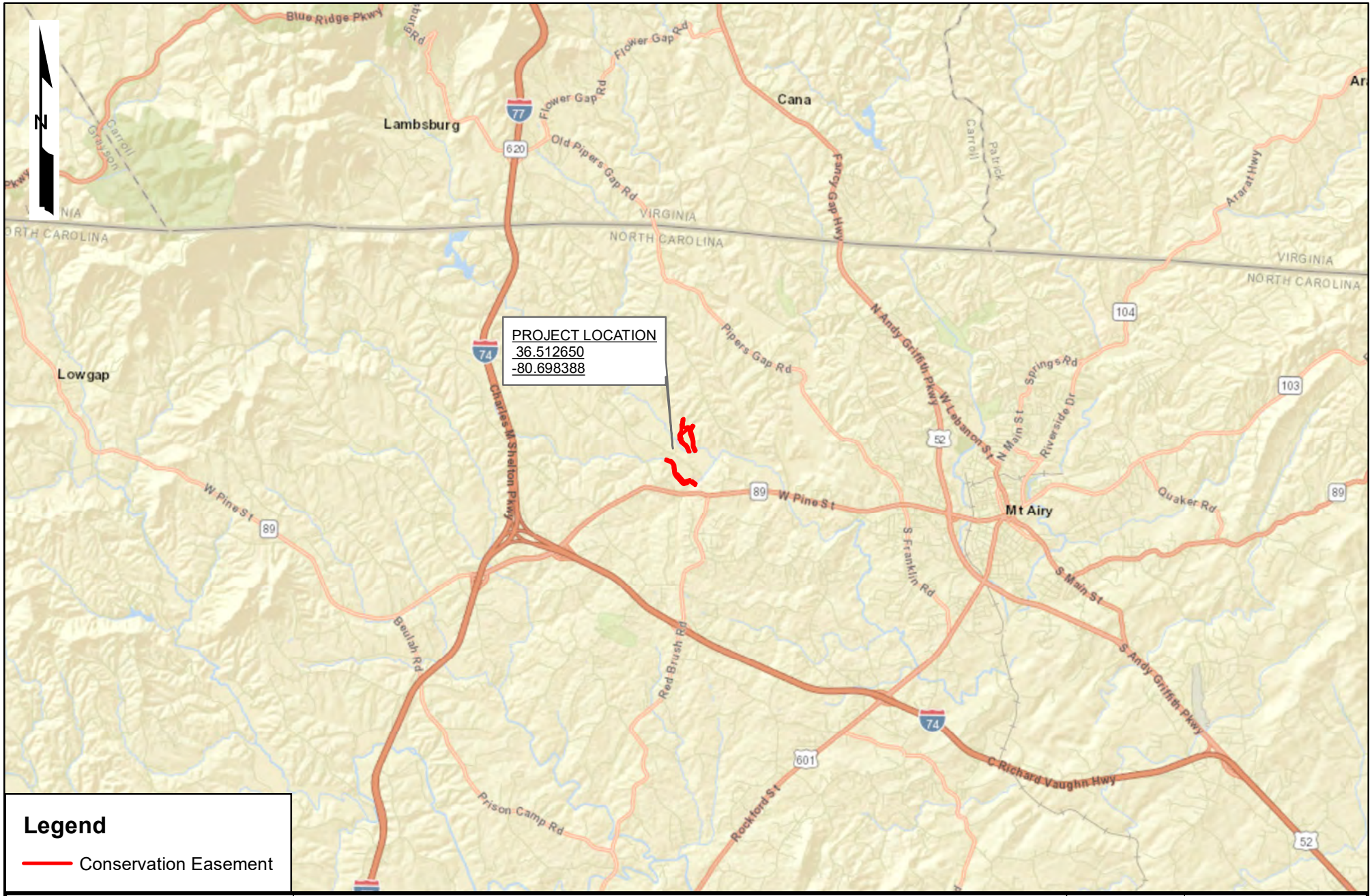
EPR was not required to sample vegetation plots in MY4 per the Mitigation Plan, except for three fixed plots and two random plots that were potentially impacted by the AMP. As requested, vegetation plots 3 and 5 were relocated in MY4. VPF-3 had a stem count of 8 trees with 4 different species. The plot had an average height of 7 feet and stems per acre count of 324. VPF-4 had a stem count of 18 trees with 7 different species. The plot has an average height of 6 feet and 729 stems per acre. VPF-5 had a stem count of 11 with 4 separate species. The average tree height was 6 feet and had a stems per acre of 445. All 3 fixed plots met the interim success criteria for MY3 and MY5. Random vegetation plot (VPR-1) had 12 stems counted which resulted in 405 stems per acre. It had an average height of 7 feet within the plot but only had two different species present, thus did not meet the interim success criteria for species diversity. Random vegetation plot (VPR-2) had a stem count of 7 trees with 4 different species. The plot had an average tree height of 8 which resulted in 283 stems per acre. The plot did not meet the interim success criteria for stem density for Monitoring Year 3 but it did meet for Monitoring Year 5.

Visual assessments of vegetation plots and the conservation easement indicate that both planted trees and herbaceous vegetation are thriving. Streamside willows have begun to shade a sizeable portion of the channels on the tributary side of the project. Vegetation on the tributaries, as well as upper Moores Fork, was supplemented by the replanting effort that occurred April 2023.

EPR spot treated dispersed invasives on Moores Fork April 2023, September 2023, and October 2023. The species treated consisted of kudzu, Chinese Privet, and multiflora rose. The kudzu that had been noted near Moores Fork Reach 3 has been mostly eradicated. EPR will continue to treat invasives as needed in the coming monitoring year.

In MY3, various instances of easement encroachment were noted by the IRT. In April 2023, EPR removed the 5-strand barbed wired fence that had been present inside the easement on the right floodplain of Moores Fork Reach. Over fifty additional t-posts and 300 yards of horse tape were placed along the conservation easement boundary where mowing had occurred on both Moores Fork and the tributaries. The hunting blind that had been partially sitting on the easement is now moved. EPR will continue to monitor the easement to address issues before any other encroachment occurs.

In MY4, EPR staff performed a full boundary site inspection on October 26, 2023. No easement encroachments or damages were observed, and all of the easement signs were intact. The integrity of the boundary marking currently meets the required DMS specifications.



STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

VICINITY MAP

DMS PROJECT ID# 100023

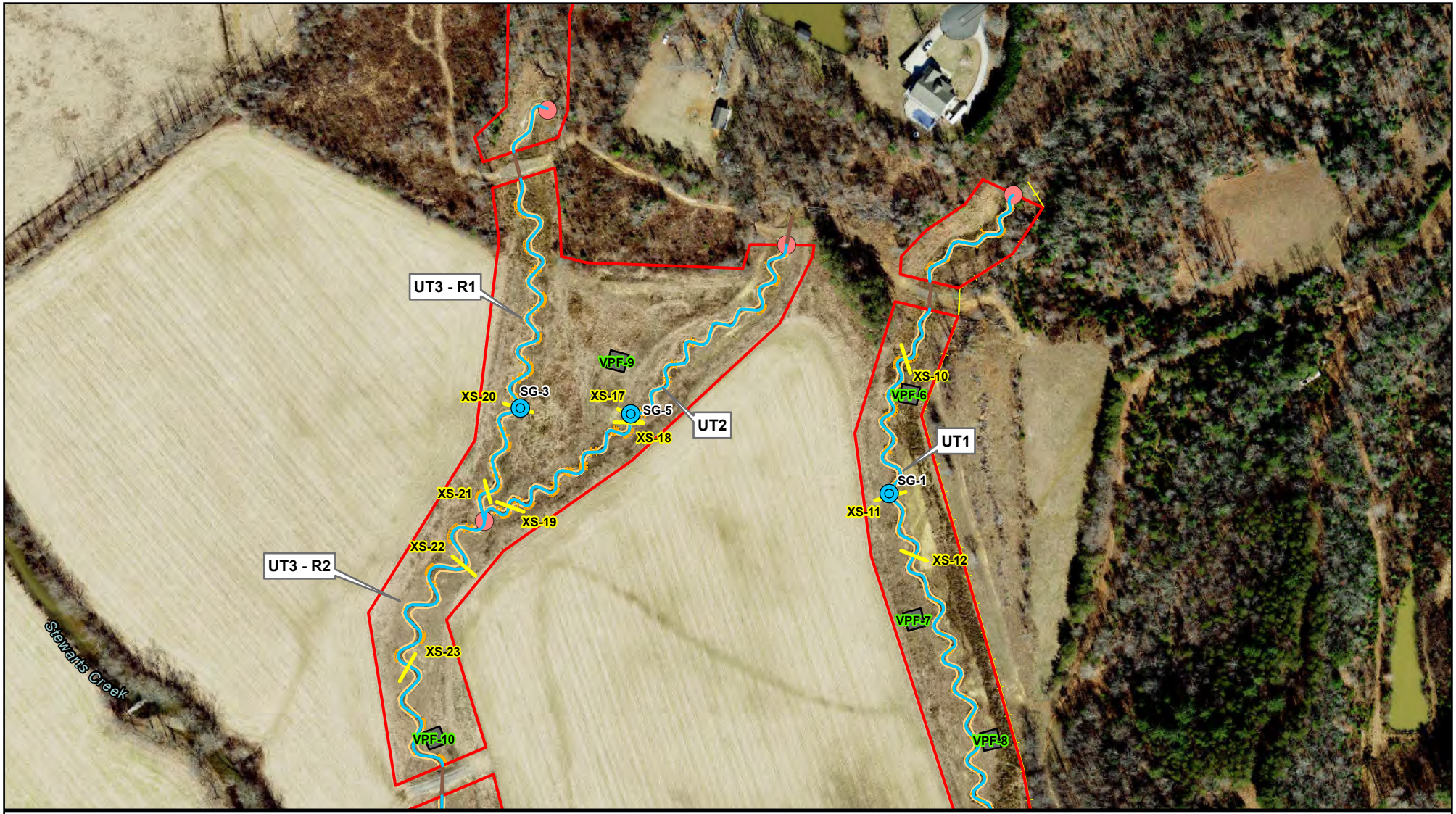
DECEMBER 2023

FIGURE 1A

SURRY COUNTY, NC

Mitigation Services ENVIRONMENTAL QUALITY

ECOSYSTEM PLANNING & RESTORATION



Streams - Restoration
No Credit
Fixed Vegetation Plot
Not Surveyed
Conservation Easement
Cross Sections
Reach Breaks
Fence
Stream Gauges

0 125 250 Feet

1 inch = 250 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY4: 2023

SURRY COUNTY, NC

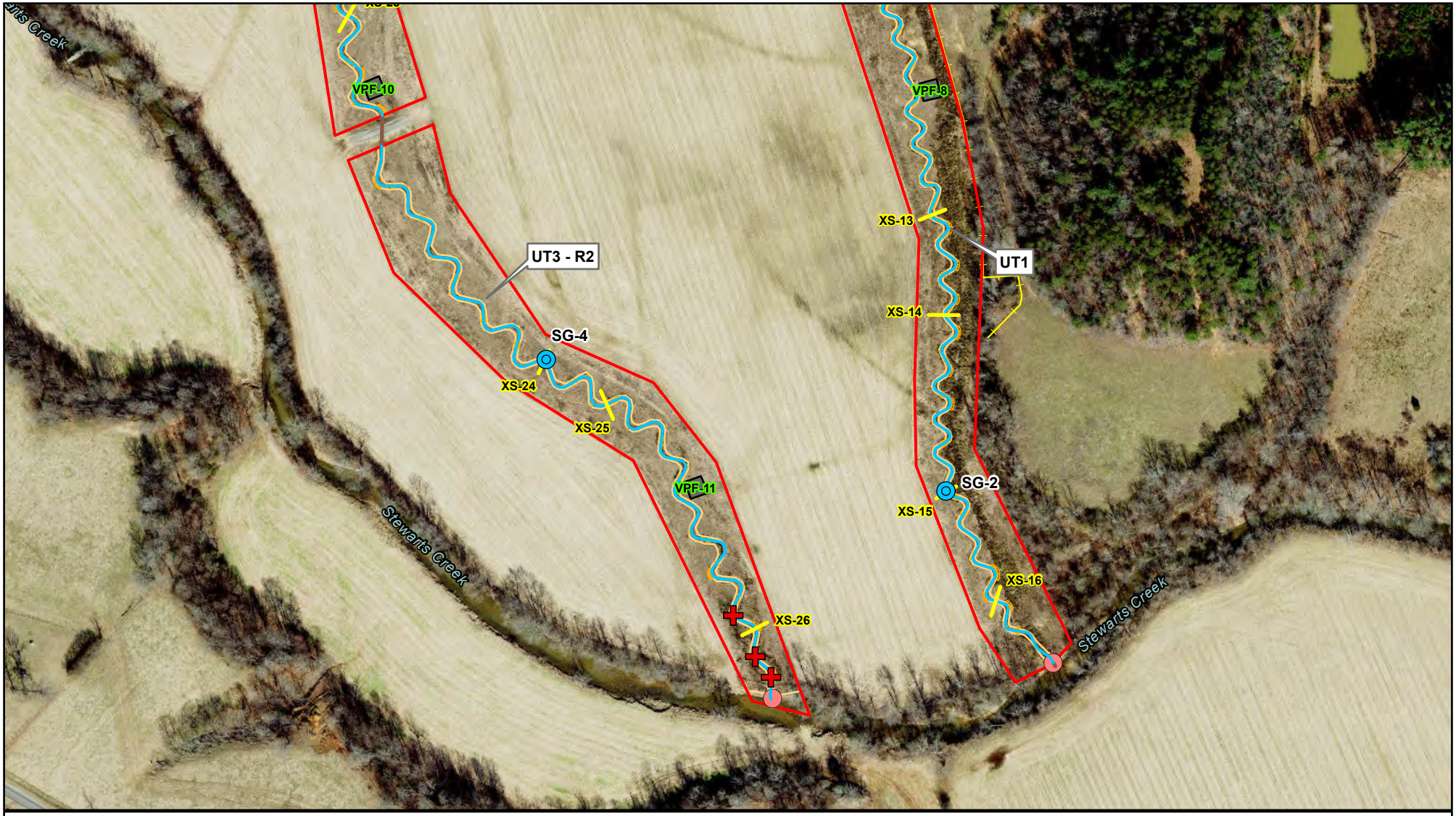
DMS PROJECT ID# 100023

DECEMBER 2023

FIGURE 1B

NC Mitigation Services ENVIRONMENTAL QUALITY

EPR ECOSYSTEM PLANNING & RESTORATION



Streams - Restoration
No Credit
Fixed Vegetation Plot
Not Surveyed
Conservation Easement
Cross Sections
Reach Breaks
Fence
Stream Gauges
MY4 Beaver Dam Locations

0 125 250 Feet

1 inch = 250 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY4: 2023

SURRY COUNTY, NC

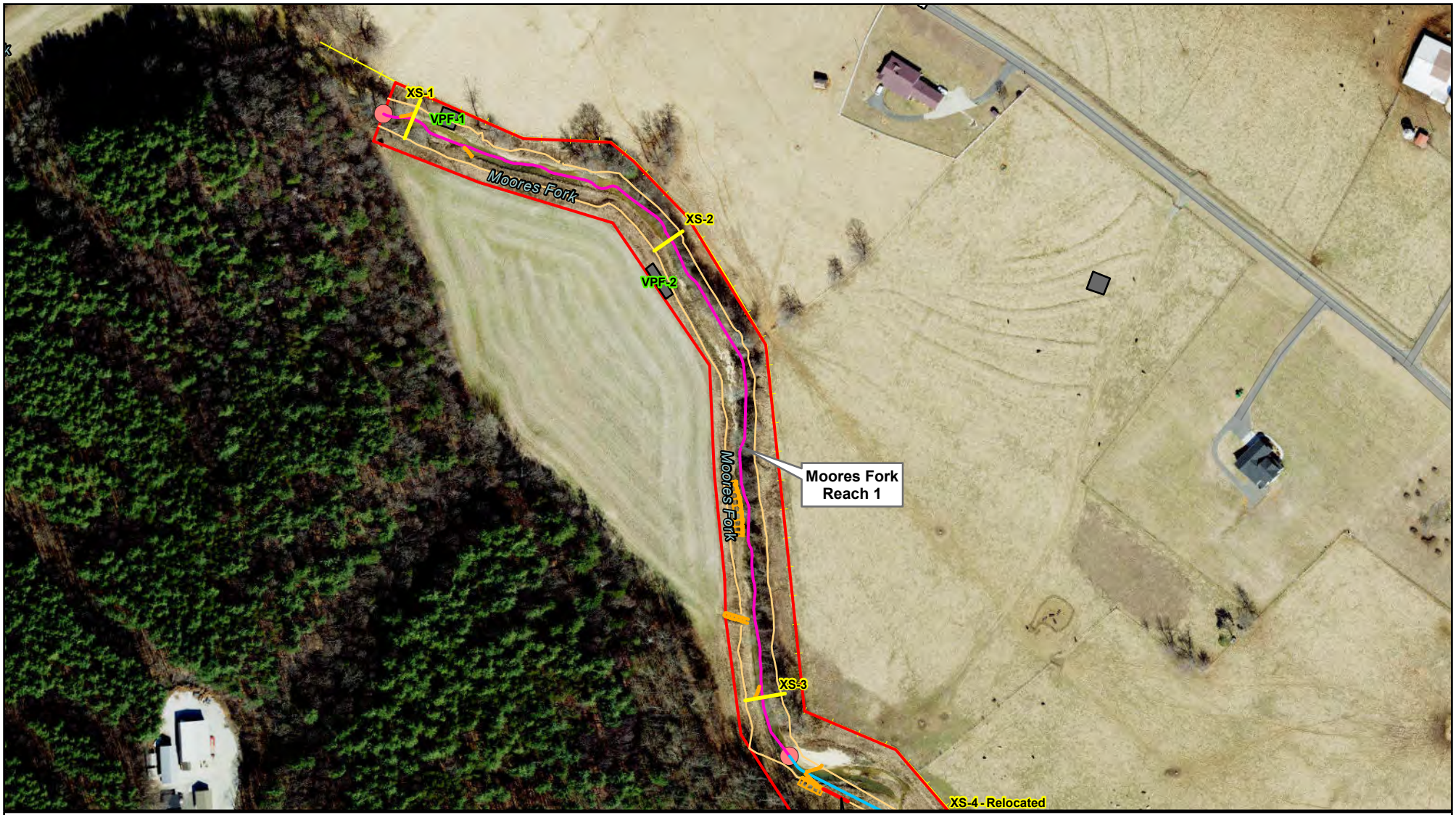
DMS PROJECT ID# 100023

DECEMBER 2023

FIGURE 1C

Mitigation Services ENVIRONMENTAL QUALITY

ECOSYSTEM PLANNING & RESTORATION



Streams - Enhancement
Streams - Restoration
Fixed Vegetation Plot
Not Surveyed
Conservation Easement
Structures
Top of Bank
Cross Sections
Reach Breaks
Fence
Channel Problem Areas

0 125 250 Feet

1 inch = 250 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

Current Condition Plan View: Asset Map
MY4: 2023

Surry County, NC

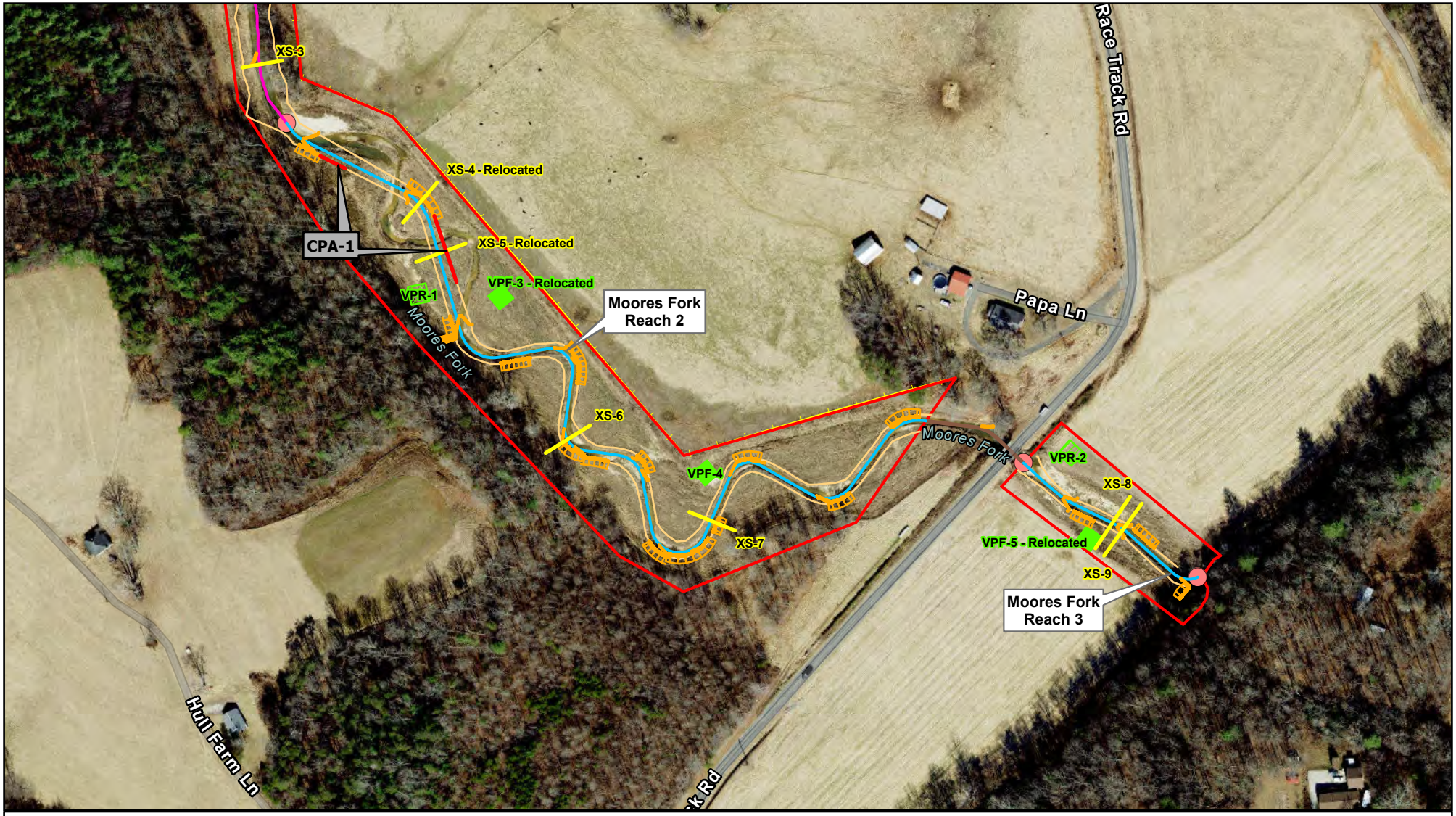
DMS Project ID# 100023

December 2023

FIGURE 1D

Mitigation Services Environmental Quality

Ecosystem Planning & Restoration



Streams - Enhancement
Streams - Restoration
No Credit

Fixed Vegetation Plot
Successful

Random Vegetation Plot
Successful
Conservation Easement

Structures
Top of Bank
Cross Sections

Reach Breaks
Fence
Channel Problem Areas

0 125 250 Feet

1 inch = 250 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

Current Condition Plan View: Asset Map MY4: 2023

Surry County, NC

DMS Project ID# 100023

December 2023

FIGURE 1E

Mitigation Services Environmental Quality

Ecosystem Planning & Restoration

3.0 REFERENCES

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Vegetation Data Entry Tool, October 2020. https://ncdms.shinyapps.io/Veg_Table_Tool/

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Cross Section Tool V.1.0 2020. https://ncdms.shinyapps.io/XS_APP/

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). Annual Monitoring Report Format, Data, and Content Requirements, October 2020.

North Carolina Ecosystem Enhancement Program. 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities.

North Carolina Division of Water Quality. 2008. Yadkin Pee-Dee Basinwide Water Quality Plan.

U.S. Army Corps of Engineers. 2016. Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District.

Appendix A: Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Monitoring Year 4 Photo Log

Monitoring Year 4 Vegetation Photo Log

Table 4a. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT1**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**2800**
Assessed Bank Length (ft)	**5600**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	55	55		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	61	61		100%

Table 4b. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT2**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**1060**
Assessed Bank Length (ft)	**2120**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	22	22		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	25	25		100%

Table 4c. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT3 - Reach 1**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**994**
Assessed Bank Length (ft)	**1988**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	19	19		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	20	20		100%

Table 4d. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT3 - Reach 2**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**2486**
Assessed Bank Length (ft)	**4972**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	25	25		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	31	31		100%

Table 4e. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**Moores Fork - Reach 1**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**1572.5**
Assessed Bank Length (ft)	**3145**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Table 4f. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**Moores Fork - Reach 2**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**2194.5**
Assessed Bank Length (ft)	**4389**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			175	96%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	7	7		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	32	32		100%

Table 4g. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**Moores Fork - Reach 3**
Dates Visually Assessed	**10/26/2023**
Assessed Stream Length (ft)	**386**
Assessed Bank Length (ft)	**772**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	2	2		100%

Table 5. Vegetation Condition Assessment Table
Stewarts Creek Tributaries Mitigation Project (DMS No.100023)

Dates Visually Assessed **10/26/2023**
Planted Acreage **24.2**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.1 acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.25 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **30**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.1 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	None	0.0	0.0%

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 1A – Moores Fork Reach 1, Sta. 11+81
Facing Upstream (10/26/2023)

Photo Point 1B – Moores Fork Reach 1, Sta. 11+81
Facing Downstream (10/26/2023)

Photo Point 2 – Moores Fork Reach 1, Sta. 14+79
Facing Downstream (10/26/2023)

Photo Point 3 – Moores Fork Reach 1, Sta. 23+37
Facing Downstream (10/26/2023)

Photo Point 4 – Moores Fork Reach 1, Sta. 24+96
Facing Upstream (10/26/2023)

Photo Point 5 – Moores Fork Reach 2, Sta. 25+61
Facing Downstream (10/26/2023)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 6 – Moores Fork Reach 2, Sta. 27+97
Facing Downstream (10/26/2023)

Photo Point 7 – Moores Fork Reach 2, Sta. 32+21
Facing Upstream (10/26/2023)

Photo Point 8 – Moores Fork Reach 2, Sta. 33+48
Facing Upstream (10/26/2023)

Photo Point 9 – Moores Fork Reach 2, Sta. 36+47
Facing Upstream (10/26/2023)

Photo Point 10 – Moores Fork Reach 2, Sta. 41+77
Facing Upstream (10/26/2023)

Photo Point 11A – Moores Fork Reach 2, Sta. 45+79
Facing Upstream (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 11B – Moores Fork Reach 2, Sta. 45+79
Facing Downstream (10/26/2023)

Photo Point 12A – Moores Fork Reach 3, Sta. 50+54
Facing Upstream (10/26/2023)

Photo Point 12B – Moores Fork Reach 3, Sta. 50+54
Facing Downstream (10/26/2023)

Photo Point 13 – UT1, Sta. 10+84
Facing Upstream (10/26/2023)

Photo Point 14A – UT1, Sta. 12+91
Facing Upstream (10/26/2023)

Photo Point 14B – UT1, Sta. 12+91
Facing Downstream (10/26/2023)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 14C – UT1, Sta. 12+91
Upstream Invert (10/26/2023)

Photo Point 14D – UT1, Sta. 12+91
Downstream Invert (10/26/2023)

Photo Point 15 – UT1, Sta. 15+52
Facing Upstream (10/26/2023)

Photo Point 16 – UT1, Sta. 18+34
Facing Upstream (10/26/2023)

Photo Point 17 – UT1, Sta. 21+12
Facing Upstream (10/26/2023)

Photo Point 18 – UT1, Sta. 22+81
Facing Upstream (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 19 – UT1, Sta. 27+39
Facing Upstream (10/26/2023)

Photo Point 20 – UT1, Sta. 30+35
Facing Upstream (10/26/2023)

Photo Point 21 – UT1, Sta. 33+42
Facing Upstream (10/26/2023)

Photo Point 22 – UT1, Sta. 36+73
Facing Downstream (10/26/2023)

Photo Point 23A – UT2, Sta. 10+47
Facing Upstream (10/26/2023)

Photo Point 23B – UT2, Sta. 10+47
Facing Downstream (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 23C – UT2, Sta. 10+47
Upstream Invert (10/26/2023)

Photo Point 23D – UT2, Sta. 10+47
Downstream Invert (10/26/2023)

Photo Point 24 – UT2, Sta. 11+57
Facing Upstream (10/26/2023)

Photo Point 25 – UT2, Sta. 14+65
Facing Upstream (10/26/2023)

Photo Point 26 – UT2, Sta. 18+32
Facing Upstream (10/26/2023)

Photo Point 27A – UT3 Reach 1, Sta. 11+51
Facing Upstream (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 27B – UT3 Reach 1, Sta. 11+51
Facing Downstream (10/26/2023)

Photo Point 27C – UT3 Reach 1, Sta. 11+51
Upstream Invert (10/26/2023)

Photo Point 27D – UT3 Reach 1, Sta. 11+51
Downstream Invert (10/26/2023)

Photo Point 28 – UT3 Reach 1, Sta. 13+35
Facing Upstream (10/26/2023)

Photo Point 29 – UT3 Reach 1, Sta. 15+88
Facing Upstream (10/26/2023)

Photo Point 30 – UT3 Reach 1, Sta. 18+28
Facing Upstream (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 31 – UT3 Reach 2, Sta. 20+10
Facing Upstream (10/26/2023)

Photo Point 32 – UT3 Reach 2, Sta. 21+27
Facing Upstream (10/26/2023)

Photo Point 33A – UT3 Reach 2, Sta. 27+44
Facing Upstream (10/26/2023)

Photo Point 33B – UT3 Reach 2, Sta. 27+44
Facing Downstream (10/26/2023)

Photo Point 33C – UT3 Reach 2, Sta. 27+44
Upstream Invert (10/26/2023)

Photo Point 33D – UT3 Reach 2, Sta. 27+44
Downstream Invert (10/26/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Photo Log

Photo Point 34 – UT3 Reach 2, Sta. 30+47
Facing Upstream (10/26/2023)

Photo Point 35 – UT3 Reach 2, Sta. 37+79
Facing Upstream (10/26/2023)

Photo Point 36 – UT3 Reach 2, Sta. 40+06
Facing Upstream (10/26/2023)

Photo Point 37 – UT3 Reach 2, Sta. 42+81
Facing Upstream (10/26/2023)

Photo Point 38 – UT3 Reach 2, Sta. 27+44
Facing Upstream (10/26/2023)

Site Overview – Moore's Fork (10/26/23)

Site Overview – UT1, UT2, UT3 (10/26/23)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 – Channel Problem Areas

CPA-1, upstream section, facing upstream (4/20/2023)

CPA-1, downstream section, facing downstream (10/26/2023)

CPA-1, upstream section, facing downstream (5/10/2023)

CPA-1, downstream section, facing downstream (5/10/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Vegetation Photo Log

Veg Plot 1 – E Corner (10/17/2022)

Veg Plot 2 – NW Corner (10/17/2022)

Veg Plot 3 – N Corner (10/19/2023)

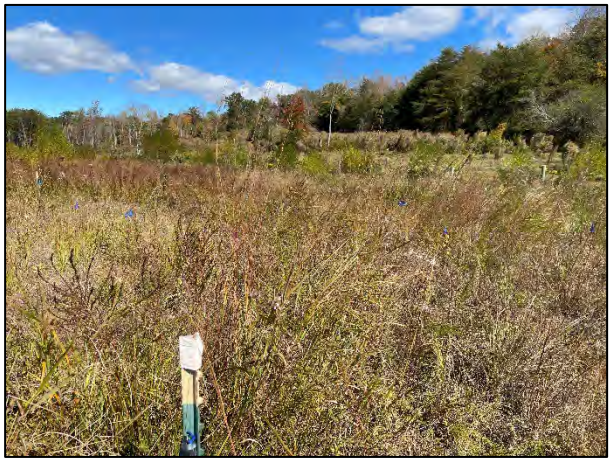
Veg Plot 4 – S Corner (12/19/2023)

Veg Plot 5 – S Corner (10/19/2023)

Veg Plot 6 –SE Corner (10/18/2022)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Vegetation Photo Log

Veg Plot 7 – SE Corner (10/18/2022)



Veg Plot 8 – SW Corner (10/18/2022)

Veg Plot 9 – SE Corner (10/17/2022)

Veg Plot 10 – N Corner (10/18/2022)

Veg Plot 11 – SW Corner (10/18/2022)

Random Veg Plot 1 – (10/19/2023)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Vegetation Photo Log

Random Veg Plot 2 – (12/19/2023)

Random Veg Plot 3 – (10/17/2022)

Random Veg Plot 4 – (10/17/2022)

Random Veg Plot 5 – (10/18/2022)

Random Veg Plot 6 – (10/18/2022)

Random Veg Plot 7 – (10/18/2022)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 4 - Vegetation Photo Log

Random Veg Plot 8 – (10/18/2022)

Random Veg Plot 9 – (1/26/2023)

Random Veg Plot 10 – (1/26/2023)

Random Veg Plot 11 – (1/26/2023)

Appendix B: Vegetation Plot Data

Table 6. Vegetation Plot Data

Table 7. Vegetation Performance Standards Summary Table

Supplemental Planting List and Location Map

Table 6a. Vegetation Performance Standards Summary Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Planted Acreage	24.2
Date of Initial Plant	3/31/2020
Date(s) of Supplemental Plant(s)	11/3/2020, 4/20/2023
Date(s) Mowing	#N/A
Date of Current Survey	10/19/2023 and 12/19/2023
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	VPF-1		VPF-2		VPF-3		VPF-4		VPF-5	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	FACW										
	Betula nigra	river birch	Tree	FACW	2	2	2	2	1	1	6	6	3	3
	Carya glabra	pignut hickory	Tree	FACU										
	Carya tomentosa	mockernut hickory	Tree											
	Cornus amomum	silky dogwood	Shrub	FACW									1	1
	Diospyros virginiana	common persimmon	Tree	FAC	1	1					1	1		
	Fraxinus pennsylvanica	green ash	Tree	FACW			1	1	4	4				
	Liriodendron tulipifera	tuliptree	Tree	FACU										
	Ostrya virginiana	hophornbeam	Tree	FACU										
	other				1	1								
	Platanus occidentalis	American sycamore	Tree	FACW			5	5			2	2	3	3
	Populus deltoides	eastern cottonwood	Tree	FAC										
	Quercus alba	white oak	Tree	FACU	1	1								
	Quercus nigra	water oak	Tree	FAC	1	1					1	1		
	Quercus phellos	willow oak	Tree	FACW	1	1	3	3	1	1	2	2		
	Quercus rubra	northern red oak	Tree	FACU	1	1	1	1						
	Salix nigra	black willow	Tree	OBL	1	1	1	1	2	2	2	2	4	4
	Ulmus americana	American elm	Tree	FAC	1	1					4	4		
Sum	Performance Standard				10	10	13	13	8	8	18	18	11	11
Mitigation Plan Performance Standard	Current Year Stem Count					10		13		8		18		11
	Stems/Acre					405		526		324		729		445
	Species Count					9		6		4		7		4
	Dominant Species Composition (%)					20		38		50		33		36
	Average Plot Height					6		3		7		6		6
	% Invasives					0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					10		13		8		18		11
	Stems/Acre					405		526		324		729		445
	Species Count					9		6		4		7		4
	Dominant Species Composition (%)					20		38		50		33		36
	Average Plot Height					6		3		7		6		6
	% Invasives					0		0		0		0		0

Meets Interim Performance Criteria | **Does Not Meet Interim Performance Criteria**

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6b. Vegetation Performance Standards Summary Table (continued)
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Planted Acreage	24.2
Date of Initial Plant	3/31/2020
Date(s) of Supplemental Plant(s)	11/3/2020, 4/20/2023
Date(s) Mowing	#N/A
Date of Current Survey	10/19/2023 and 12/19/2023
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	VPF-6		VPF-7		VPF-8		VPF-9		VPF-10	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	OBL										
	Betula nigra	river birch	Tree	FACW	1	1	3	3	4	4	2	2	2	2
	Carya glabra	pignut hickory	Tree	FACU							1	1		
	Carya tomentosa	mockernut hickory	Tree											
	Cornus amomum	silky dogwood	Shrub	FACW	3	3	1	1						
	Diospyros virginiana	common persimmon	Tree	FAC							1	1		
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1								
	Liriodendron tulipifera	tuliptree	Tree	FACU										
	Ostrya virginiana	hophornbeam	Tree	FACU										
	other													
	Platanus occidentalis	American sycamore	Tree	FACW	1	1	1	1	5	5	2	2	2	2
	Populus deltoides	eastern cottonwood	Tree	FAC										
	Quercus alba	white oak	Tree	FACU										
	Quercus nigra	water oak	Tree	FAC	3	3	2	2						
	Quercus phellos	willow oak	Tree	FAC	1	1	3	3	1	1	3	3	3	3
	Quercus rubra	northern red oak	Tree	FACU	1	1								
	Salix nigra	black willow	Tree	OBL									1	1
	Ulmus americana	American elm	Tree	FACW					3	3	4	4	5	5
Sum	Performance Standard				11	11	10	10	13	13	13	13	13	13
Mitigation Plan Performance Standard	Current Year Stem Count					11		10		13		13		13
	Stems/Acre					445		405		526		526		526
	Species Count					7		5		4		6		5
	Dominant Species Composition (%)					27		30		38		31		38
	Average Plot Height					3		3		2		2		3
	% Invasives					0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					11		10		13		13		13
	Stems/Acre					445		405		526		526		526
	Species Count					7		5		4		6		5
	Dominant Species Composition (%)					27		30		38		31		38
	Average Plot Height					3		3		2		2		3
	% Invasives					0		0		0		0		0

Meets Interim Performance Criteria | **Does Not Meet Interim Performance Criteria**

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6c. Vegetation Performance Standards Summary Table (continued)
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Planted Acreage	24.2
Date of Initial Plant	3/31/2020
Date(s) of Supplemental Plant(s)	11/3/2020, 4/20/2023
Date(s) Mowing	#N/A
Date of Current Survey	10/19/2023 and 12/19/2023
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	VPF-11		VPR-1	VPR-2	VPR-3	VPR-4	VPR-5	VPR-6	VPR-7	VPR-8	VPR-9	VPR-10	VPR-11
					Planted	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	OBL								1		2			
	Betula nigra	river birch	Tree	FACW	3	3		1	3		3	3	4	1	9	3	1
	Carya glabra	pignut hickory	Tree	FACU													
	Carya tomentosa	mockernut hickory	Tree		1	1											
	Cornus amomum	silky dogwood	Shrub	FACW													
	Diospyros virginiana	common persimmon	Tree	FAC					2	2	2		1	2	4	4	
	Fraxinus pennsylvanica	green ash	Tree	FACW	3	3			2	1	1		3	1	1		
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2											
	Ostrya virginiana	hophornbeam	Tree	FACU							1						
	other								1	4	2	1		2			
	Platanus occidentalis	American sycamore	Tree	FACW	4	4	4	2	5	3	1	4	3	3	3	1	3
	Populus deltoides	eastern cottonwood	Tree	FAC								1					
	Quercus alba	white oak	Tree	FACU													
	Quercus nigra	water oak	Tree	FAC	1	1		1			1		1	1	3	1	
	Quercus phellos	willow oak	Tree	FAC							3	2	1	1		1	
	Quercus rubra	northern red oak	Tree	FACU	1	1			1								
	Salix nigra	black willow	Tree	OBL	1	1	8	3		1		3	1	2			2
	Ulmus americana	American elm	Tree	FACW	1	1							1		5	6	
Sum	Performance Standard				17	17		7	14	11	14	15	15	15	25	16	6
Mitigation Plan Performance Standard	Current Year Stem Count					17	12	7	14	11	14	15	15	15	25	16	6
	Stems/Acre					688	405	283	567	445	567	607	607	607	1012	648	243
	Species Count					9	2	4	6	5	8	7	8	9	6	6	3
	Dominant Species Composition (%)					24	67	43	36	36	21	27	27	20	36	38	50
	Average Plot Height					3	7	8	3	3	3	3	4	5	2	1	7
	% Invasives					0	0	0	0	0	0	0	0	0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					17	12	7	14	11	14	15	15	15	25	16	6
	Stems/Acre					688	405	283	567	445	567	607	607	607	1012	648	243
	Species Count					9	2	4	6	5	8	7	8	9	6	6	3
	Dominant Species Composition (%)					24	67	43	36	36	21	27	27	20	36	38	50
	Average Plot Height					3	7	8	3	3	3	3	4	5	2	1	7
	% Invasives					0	0	0	0	0	0	0	0	0	0	0	0

Meets Interim Performance Criteria | **Does Not Meet Interim Performance Criteria**

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 7a. Vegetation Performance Standards Summary Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Vegetation Performance Standards Summary Table												
	VPF-1				VPF-2				VPF-3			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 4									324	7	4	0
Monitoring Year 3	405	6	9	0	526	3	6	0	445	4	7	0
Monitoring Year 2	405	3	9	0	688	2	6	0	364	3	6	0
Monitoring Year 1	607	2	9	0	243	1	4	0	162	2	3	0
Monitoring Year 0	688	2	9	0	567	1	6	0	324	2	5	0
	VPF-4				VPF-5				VPF-6			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 4	729	6	7	0	445	6	4	0				
Monitoring Year 3	688	4	7	0	445	5	6	0	445	3	7	0
Monitoring Year 2	567	2	7	0	445	3	6	0	364	2	6	0
Monitoring Year 1	607	2	7	0	243	2	5	0	445	1	8	0
Monitoring Year 0	648	2	9	0	445	2	6	0	567	2	7	0
	VPF-7				VPF-8				VPF-9			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	405	3	5	0	526	2	4	0	526	3	6	0
Monitoring Year 2	445	2	6	0	486	2	4	0	445	2	5	0
Monitoring Year 1	324	2	5	0	486	1	4	0	364	2	4	0
Monitoring Year 0	648	2	7	0	405	1	5	0	567	2	6	0
	VPF-10				VPF-11				VPR-1			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 4									405	7	2	0
Monitoring Year 3	526	3	5	0	688	3	9	0	486	7	6	0
Monitoring Year 2	607	2	5	0	688	2	9	0	364	1	7	0
Monitoring Year 1	283	1	4	0	607	2	9	0	405	2	6	0
Monitoring Year 0	526	2	6	0	567	2	8	0				

Meets Interim Performance Criteria | **Does Not Meet Interim Performance Criteria**

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

Table 7b. Vegetation Performance Standards Summary Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Vegetation Performance Standards Summary Table

	VPR-2				VPR-3				VPR-4			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 4	283	8	4	0								
Monitoring Year 3	648	3	4	0	567	3	6	0	445	3	5	0
Monitoring Year 2	324	1	5	0	445	2	4	0	283	2	5	0
Monitoring Year 1	445	2	5	0	283	2	4	0	324	2	4	0
Monitoring Year 0												
	VPR-5				VPR-6				VPR-7			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	567	3	8	0	607	3	7	0	607	4	8	0
Monitoring Year 2	121	1	2	0	567	2	6	0	283	2	5	0
Monitoring Year 1	486	2	5	0	162	1	3	0	364	2	5	0
Monitoring Year 0												
	VPR-8				VPR-9				VPR-10			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	607	5	9	0	1012	2	6	0	648	1	6	0
Monitoring Year 2	405	2	5	0	405	2	6	0	283	2	4	0
Monitoring Year 1	202	1	5	0	324	2	4	0	486	2	6	0
Monitoring Year 0												
	VPR-11											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	243	7	3	0								
Monitoring Year 2	486	2	5	0								
Monitoring Year 1	243	2	4	0								
Monitoring Year 0												

Meets Interim Performance Criteria | **Does Not Meet Interim Performance Criteria**

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

Riparian Vegetation

Riparian vegetation species (bare-roots) shall be planted in the areas designated on the plans using the species mixture and percentages listed below. Riparian species shall be planted at an overall density of **680 stems per acre (8' x 8' spacing)**. All species will be planted according to the plans, details, and construction specifications. Not all of the species listed may be planted. Commercial availability may dictate which species are actually planted.

Scientific Name	Common Name	% by Species	Wetland Indicator Status	Trees Needed	Common Name
Betula nigra	River Birch	15%	FACW	51	River Birch
Carpinus caroliniana	Ironwood	10%	FAC	34	Ironwood
Celtis laevigata	Sugarberry	5%	FACW	17	Sugarberry
Diospryos virginiana	Persimmon	10%	FAC	34	Persimmon
Fraxinus pennsylvanica	Green Ash	5%	FACW	17	Green Ash
Platanus occidentalis	Sycamore	20%	FACW	68	Sycamore
Quercus nigra	Water Oak	10%	FAC	34	Water Oak
Quercus phellos	Willow Oak	15%	FAC	51	Willow Oak
Ulmus americana	American Elm	10%	FACW	34	American Elm
	Total	**100%**		340	

Supplemental Planting Acreage

0.773415

436 TPA Spacing

Assumes 1 row, 5-ft off of easement edge

Zone 3 - Upland Vegetation

Upland vegetation species (bare-roots) shall be planted in the areas designated on the plans using the species mixture and percentages listed below. Species shall be planted at an overall density of **680 stems per acre (8' x 8' spacing)**. All species will be planted according to the plans, details, and construction specifications. Not all of the species listed may be planted. Commercial availability may dictate which species are actually planted.

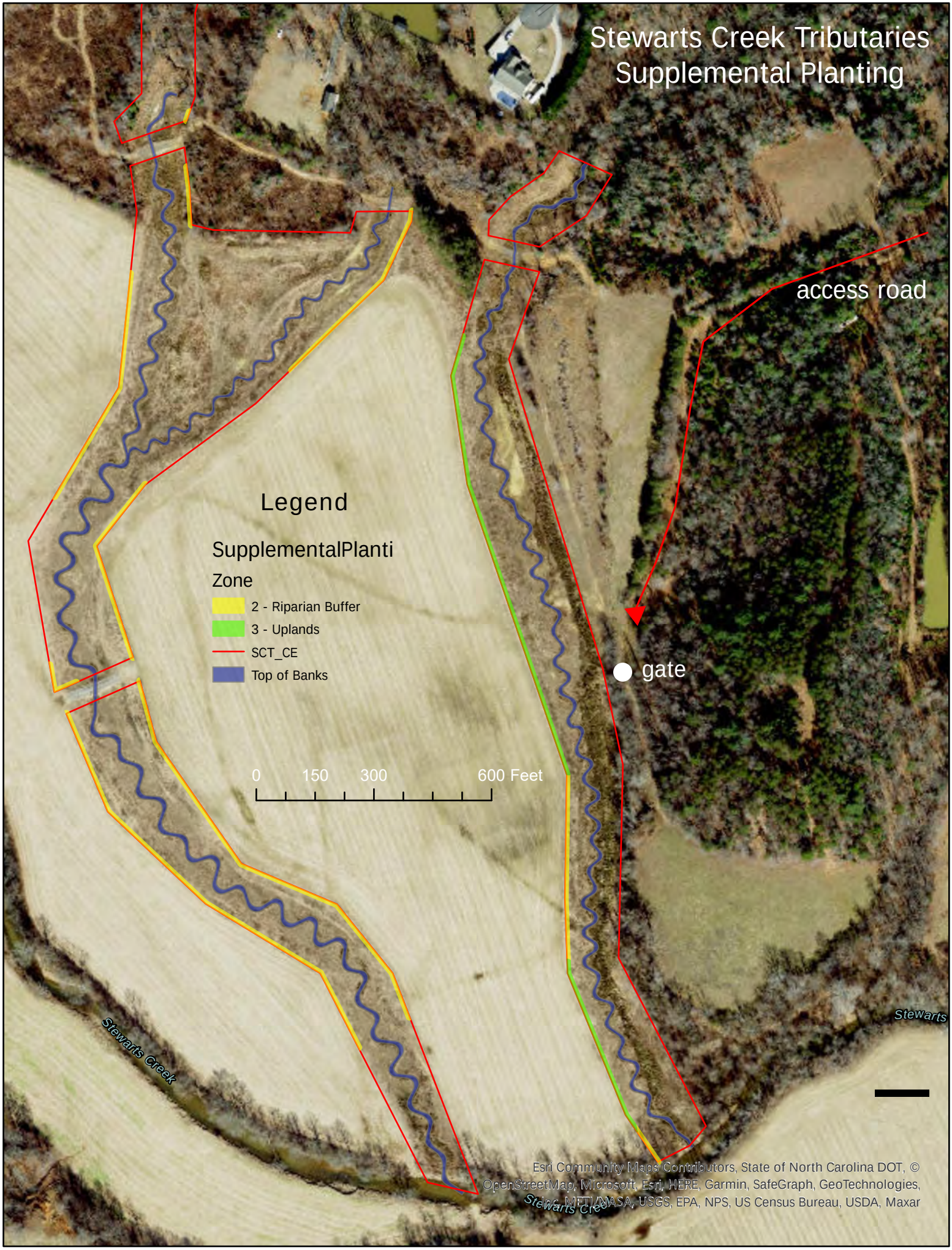
Scientific Name	Common Name	% by Species	Wetland Indicator Status	Trees Needed	Common Name
Carya glabra	Pignut Hickory	10%	FACU	9	Pignut Hickory
Carya tomentosa	Mockernut Hickory	10%	NI	9	Mockernut Hickory
Cercis canadensis	Redbud	5%	FACU	5	Redbud
Cornus florida	Flowering Dogwood	5%	FACU	5	Flowering Dogwood
Diospyros virginiana	Persimmon	10%	FAC	9	Persimmon
Ilex opaca	American Holly	5%	FACU	5	American Holly
Juniperus virginiana	Eastern Red Cedar	5%	FACU	5	Eastern Red Cedar
Liriodendron tulipifera	Tulip Poplar	10%	FACU	9	Tulip Poplar
Oxydendrum arboreum	Sourwood	5%	UPL	5	Sourwood
Prunus serotina	Black Cherry	5%	FACU	5	Black Cherry
Quercus alba	White Oak	10%	FACU	9	White Oak
Quercus falcata	Southern Red Oak	10%	FACU	9	Southern Red Oak
Quercus rubra	Northern Red Oak	10%	FACU	9	Northern Red Oak
NI = No indicator status	**Total**	**100%**		93	

Supplemental Planting Acreage

0.194069

436 TPA Spacing

Assumes 1 row, 5-ft off of easement edge


Stewarts Creek Tributaries
Supplemental Planting
access road
gate
Legend
SupplementalPlanti
Zone
2 - Riparian Buffer
3 - Uplands
SCT_CE
Top of Banks
0
150
300
600 Feet
Stewarts Creek
Stewarts
Esri Community Maps Contributors, State of North Carolina DOT, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Maxar


Moore's Fork
Supplemental Planting
0 150 300 600 Feet
Race Track Rd
Race Track Rd
Moores Fork
0.19 ac
Legend
SupplementalPlanti
Zone
2 - Riparian Buffer
3 - Uplands
SCT_CE
Top of Banks
Moores Fork
Moores Fork
Farm Ln
NC CGIA, Maxar, Microsoft, Esri Community Maps Contributors, State of North Carolina DOT, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Appendix C: Stream Geomorphology Data

Cross Sections with Annual Overlays

Table 8. Baseline Stream Data Summary

Table 9. Cross Section Morphology Monitoring Summary

Note: Cross Sections XS4 through XS9 were surveyed for MY4

The remaining cross section data provided is from MY3

Cross Section Plot - MY3 - October 2022

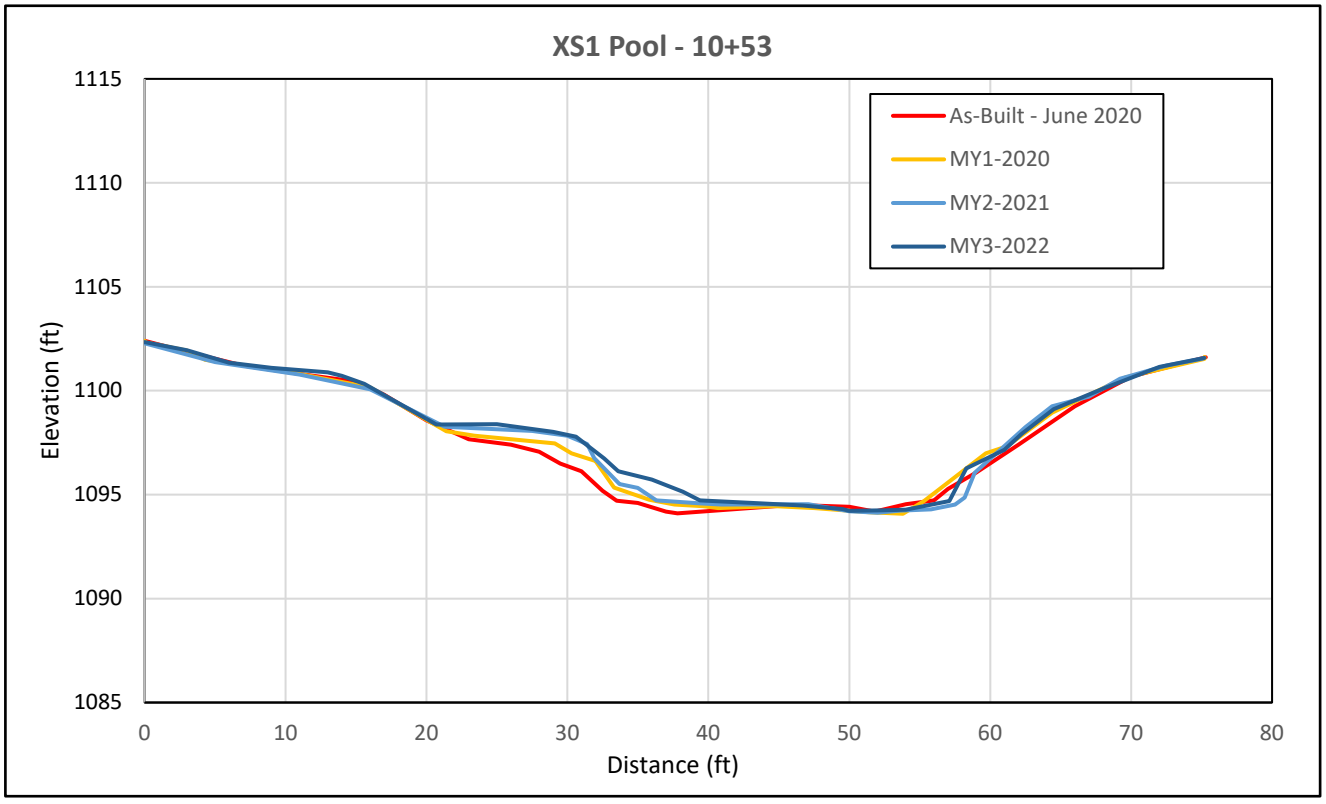
XS1 - Moores Fork Reach 1

Station 10+53 - Pool

XS1 looking upstream

XS1 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.06	1097.29	1097.27	1097.51			
Bank Height Ratio - Based on AB-Bankfull Area	1.20	1.05	1.06	1.09			
Thalweg Elevation	1094.10	1094.08	1094.13	1094.22			
LTOB Elevation	1097.67	1097.46	1097.44	1097.44			
LTOB Max Depth	3.57	3.38	3.31	3.57			
LTOB Cross Sectional Area	93.76	77.33	76.98	80.46			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

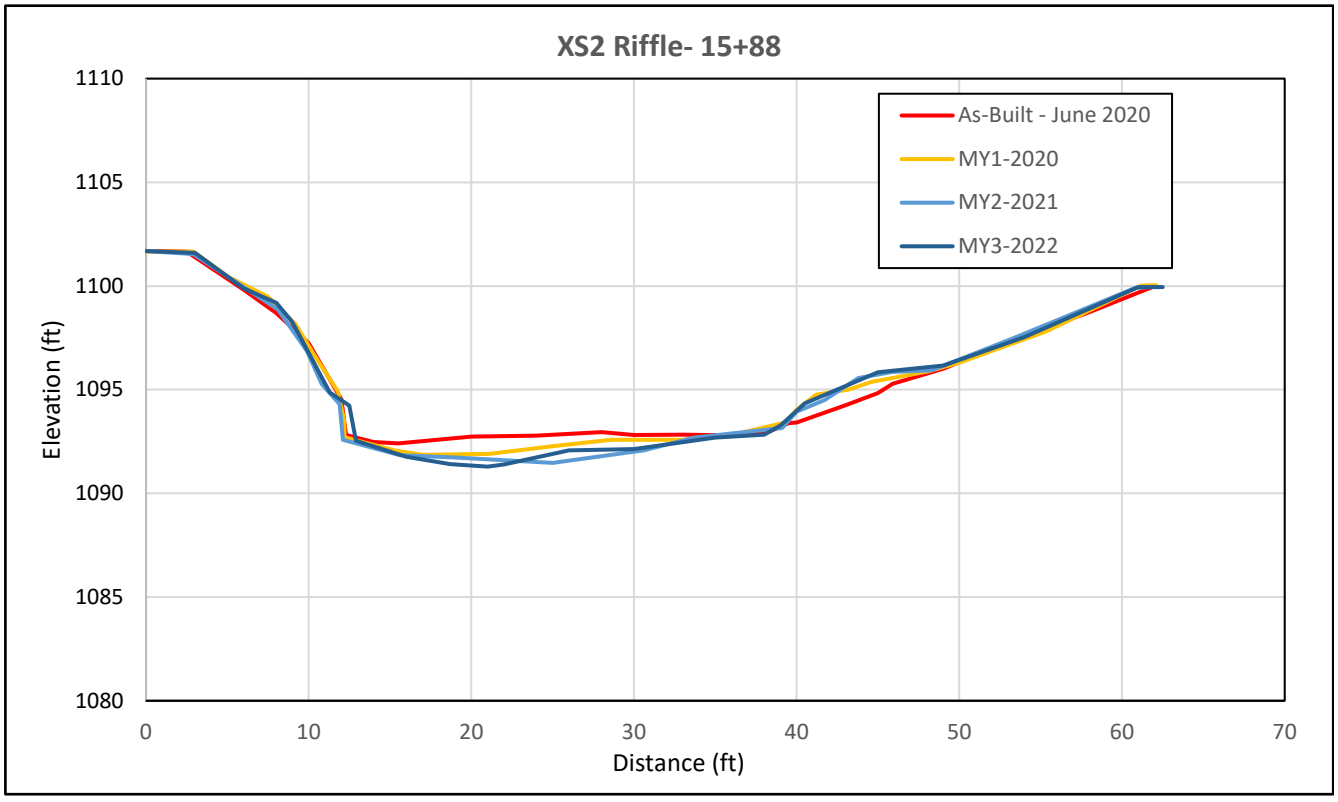
XS2 - Moores Fork Reach 1

Station 15+88 - Riffle

XS2 looking upstream

XS2 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1094.84	1094.64	1094.32	1094.87			
Bank Height Ratio - Based on AB-Bankfull Area	1.18	1.04	1.44	1.27			
Thalweg Elevation	1092.41	1091.86	1091.47	1091.29			
LTOB Elevation	1095.28	1094.76	1095.57	1095.84			
LTOB Max Depth	2.87	2.90	4.1	4.55			
LTOB Cross Sectional Area	75.98	65.20	100.49	107.47			
Entrenchment Ratio	1.29	1.54	1.49	1.56			



Cross Section Plot - MY3 - October 2022

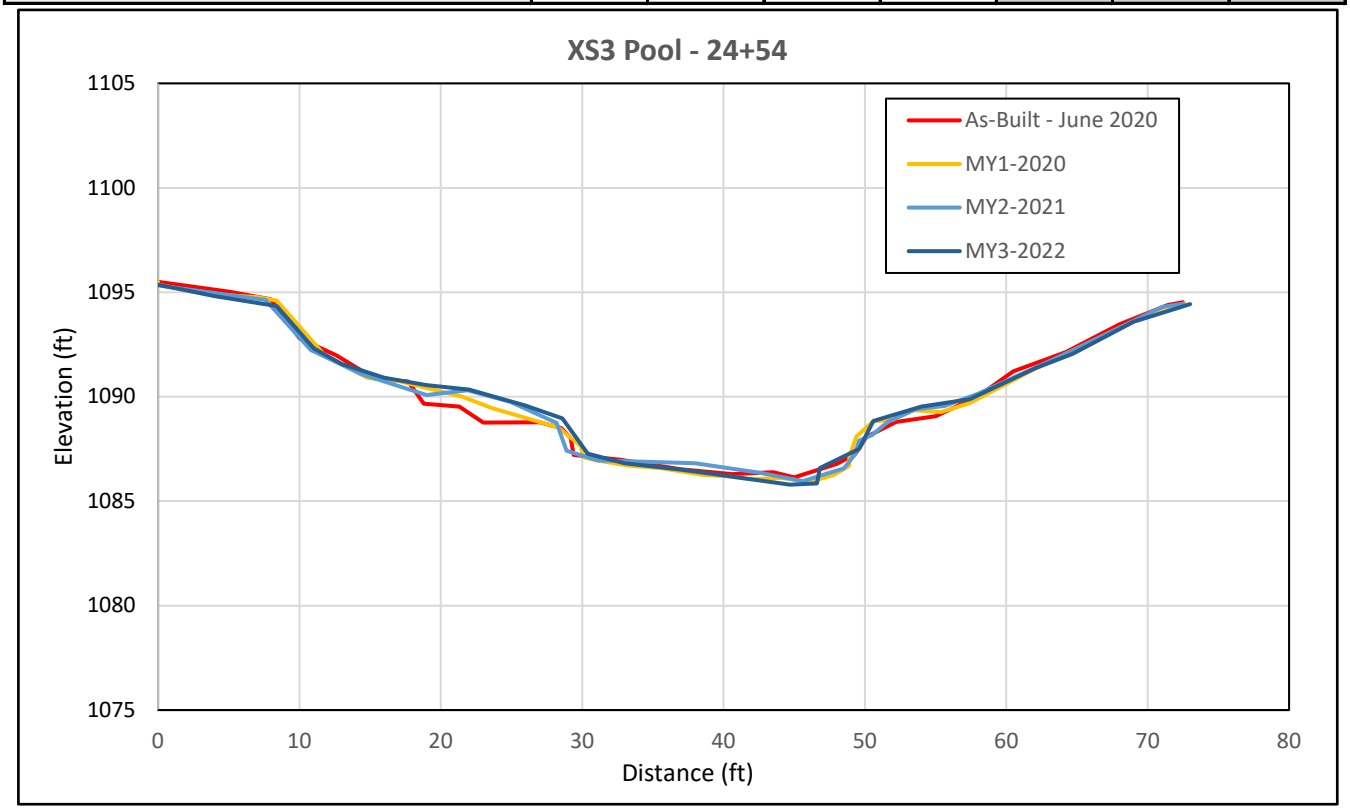
XS3 - Moores Fork Reach 1

Station 24+54 - Pool

XS3 looking upstream

XS3 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1088.77	1088.67	1088.77	1088.74			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.06	1.01	1.03			
Thalweg Elevation	1086.14	1085.92	1085.96	1085.79			
LTOB Elevation	1088.77	1088.82	1088.79	1088.84			
LTOB Max Depth	2.63	2.90	2.83	3.05			
LTOB Cross Sectional Area	45.04	48.74	45.43	47.29			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Data was collected during MY4

Cross Section Plot - MY4 - October 2023

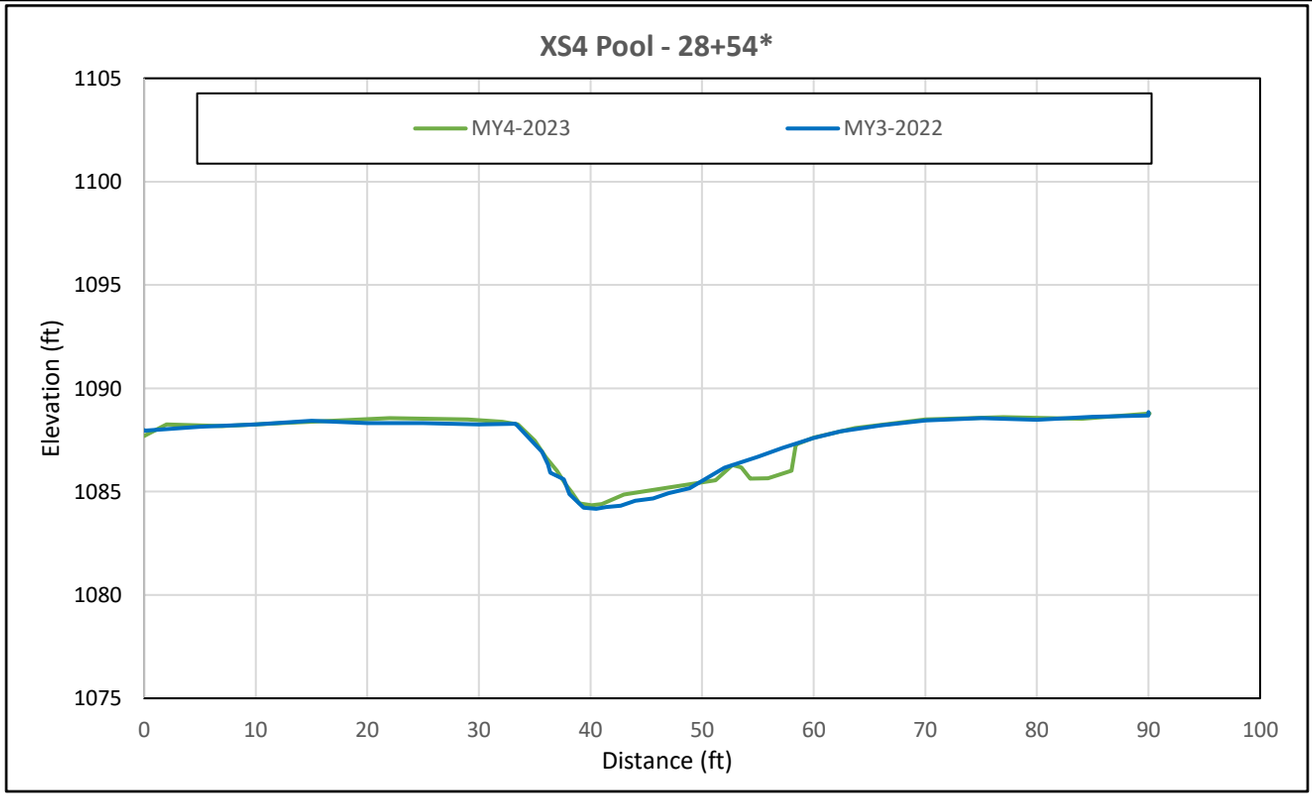
XS4 - Moores Fork Reach 2

Station 28+54 - Pool

XS4 looking upstream

XS4 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	-	-	-	1088.20	1088.15		
Bank Height Ratio - Based on AB-Bankfull Area	-	-	-	1.00	1.03		
Thalweg Elevation	-	-	-	1084.17	1084.34		
LTOB Elevation	-	-	-	1088.20	1088.26		
LTOB Max Depth	-	-	-	4.03	3.92		
LTOB Cross Sectional Area	-	-	-	66.40	69.97		
Entrenchment Ratio	-	-	-	N/A	N/A		



* Stationing from AMP. The cross section location was relocated and stationing has been updated. MY0 through MY2 data not applicable due to the cross section being relocated.

Data was collected during MY4

Cross Section Plot - MY4 - October 2023

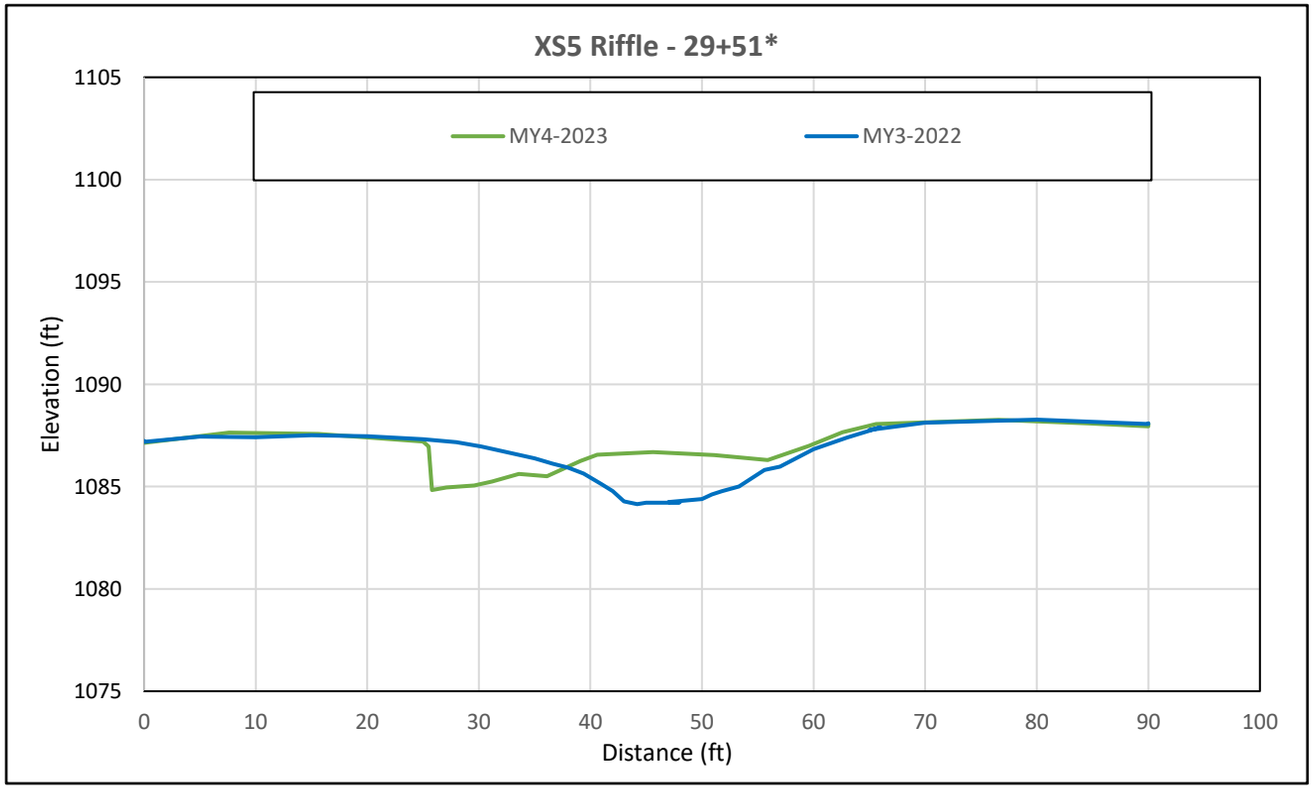
XS5 - Moores Fork Reach 2

Station 29+51 - Riffle

XS5 looking upstream

XS5 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	-	-	-	1087.17	1087.61		
Bank Height Ratio - Based on AB-Bankfull Area	-	-	-	1.00	0.85		
Thalweg Elevation	-	-	-	1084.14	1084.83		
LTOB Elevation	-	-	-	1087.17	1087.20		
LTOB Max Depth	-	-	-	3.03	2.37		
LTOB Cross Sectional Area	-	-	-	52.43	37.91		
Entrenchment Ratio	-	-	-	>3.15	>2.51		



* Stationing from AMP. The cross section location was relocated and stationing has been updated. MY0 through MY2 data not applicable due to the cross section being relocated.

Data was collected during MY4

Cross Section Plot - MY4 - December 2023

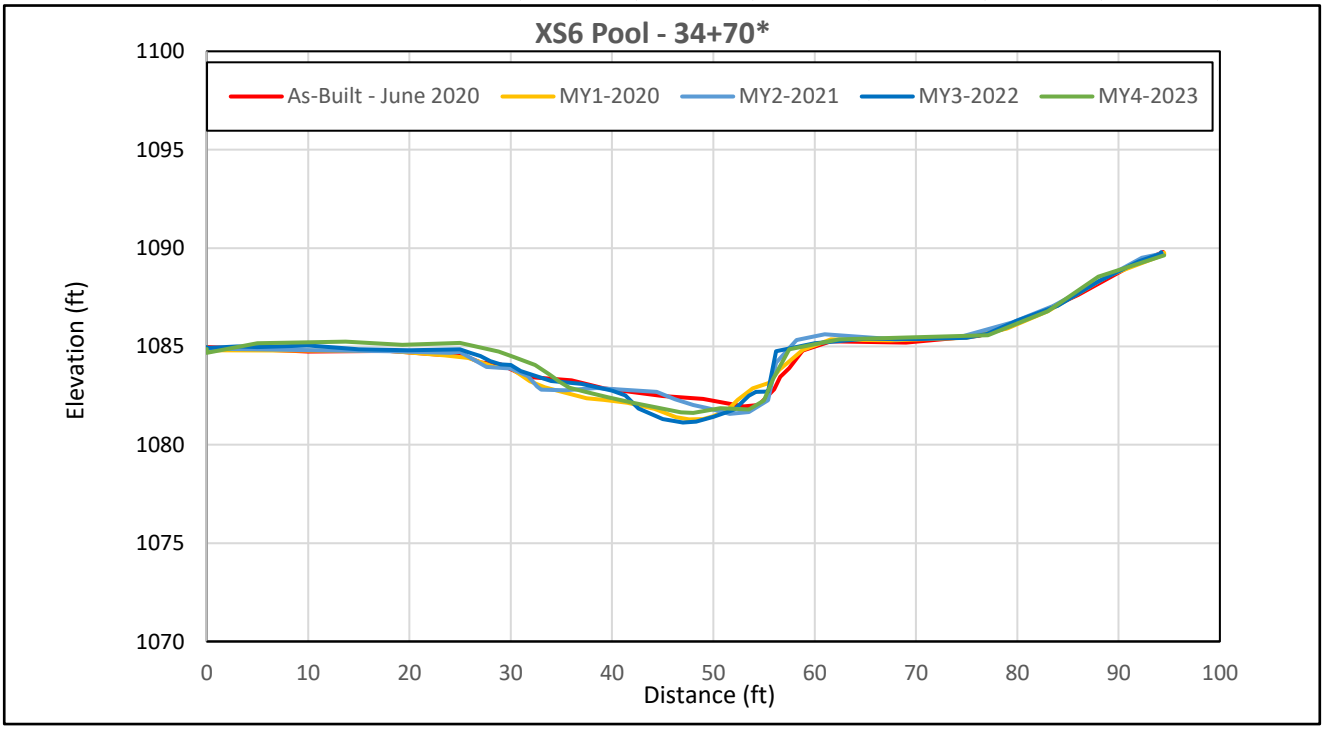
XS6 - Moores Fork Reach 2

Station 34+70 - Pool

XS6 looking upstream

XS6 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1084.62	1084.29	1084.51	1084.44	1083.98		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.08	1.07	1.07	1.33		
Thalweg Elevation	1081.95	1081.29	1081.57	1081.13	1081.65		
LTOB Elevation	1084.62	1084.54	1084.72	1084.68	1085.17		
LTOB Max Depth	2.67	3.25	3.15	3.55	3.52		
LTOB Cross Sectional Area	53.58	61.60	60.33	60.90	73.30		
Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A		



* Stationing from AMP. The stationing has been updated.

Data was collected during MY4

Cross Section Plot - MY4 - October 2023

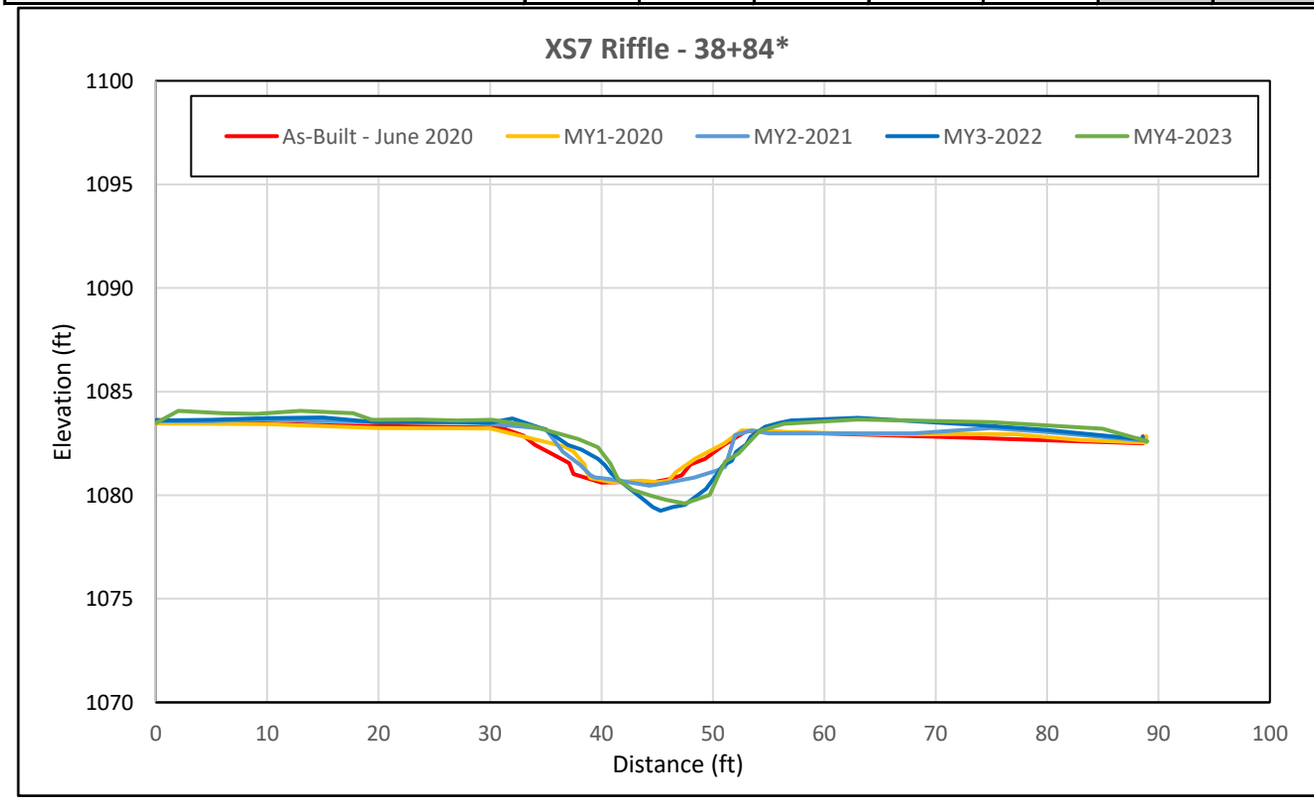
XS7 - Moores Fork Reach 2

Station 38+84 - Riffle

XS7 looking upstream

XS7 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1083.10	1083.29	1083.10	1082.82	1083.00		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.94	1.01	1.09	1.03		
Thalweg Elevation	1080.56	1080.63	1080.46	1079.25	1079.60		
LTOB Elevation	1083.10	1083.13	1083.13	1083.16	1083.10		
LTOB Max Depth	2.54	2.50	2.67	3.91	3.5		
LTOB Cross Sectional Area	33.72	30.17	34.27	39.95	35.65		
Entrenchment Ratio	>4.14	>4.07	>4.88	>5.17	>4.71		



* Stationing from AMP. The stationing has been updated. This cross section was impacted by AMP construction and the right bank was rebuilt with additional toewood.

Data was collected during MY4

Cross Section Plot - MY4 - December 2023

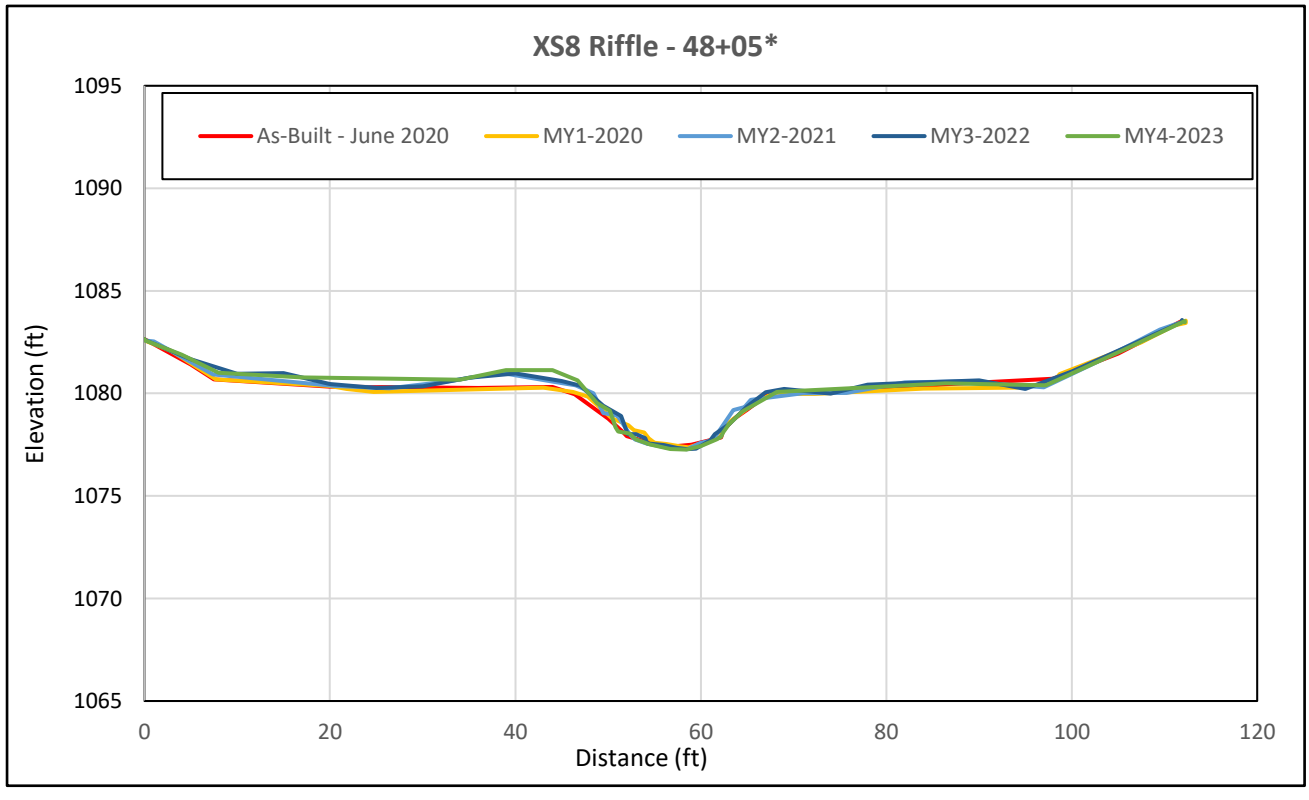
XS8 - Moores Fork Reach 3

Station 48+05 - Riffle

XS8 looking upstream

XS8 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1079.97	1080.11	1080.17	1080.13	1079.98		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95	0.83	0.98	1.04		
Thalweg Elevation	1077.41	1077.37	1077.29	1077.28	1077.26		
LTOB Elevation	1079.97	1079.97	1079.68	1080.06	1080.08		
LTOB Max Depth	2.56	2.60	2.39	2.78	2.82		
LTOB Cross Sectional Area	33.89	31.07	25.77	32.55	35.83		
Entrenchment Ratio	5.12	5.20	6.42	5.46	5.50		



* Stationing from AMP. The stationing has been updated.

Data was collected during MY4

Cross Section Plot - MY4 - December 2023

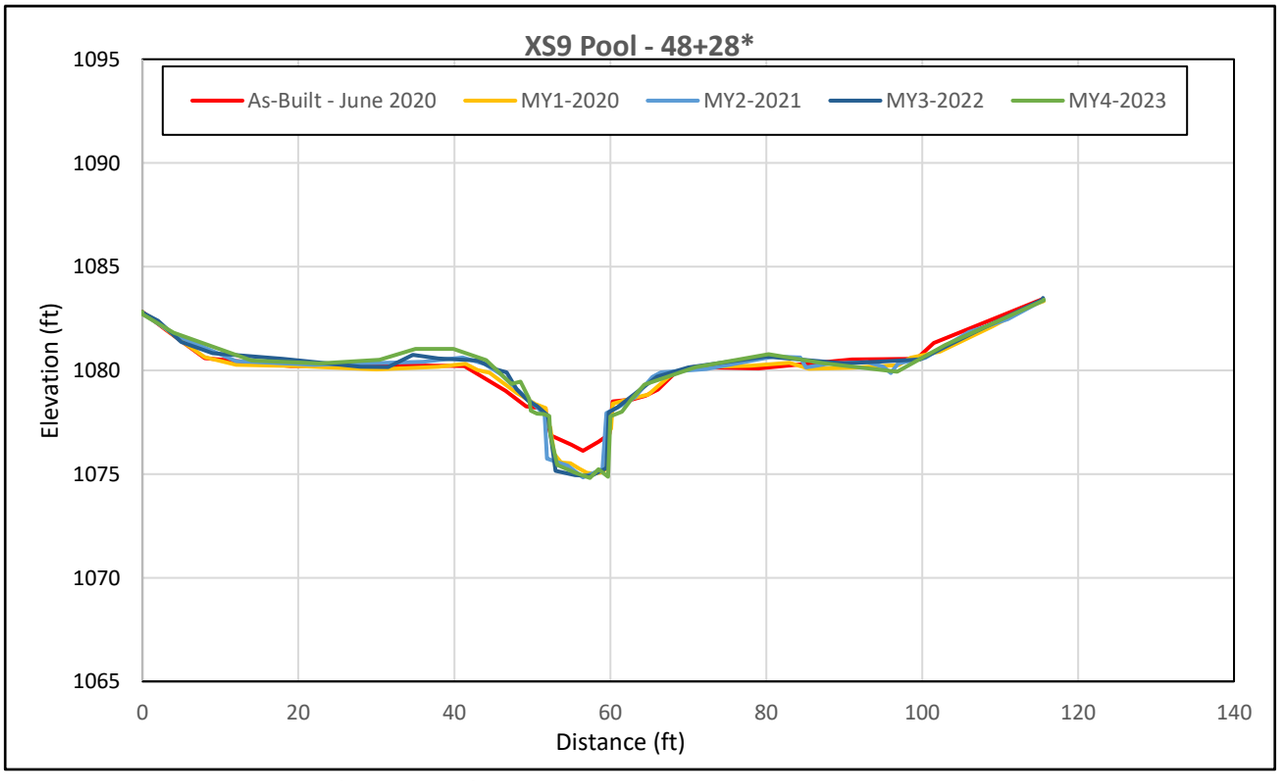
XS9 - Moores Fork Reach 3

Station 48+28 - Pool

XS9 looking upstream

XS9 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1080.16	1079.98	1080.07	1080.04	1079.97		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04	0.97	1.00	1.10		
Thalweg Elevation	1076.12	1075.02	1074.84	1074.91	1074.81		
LTOB Elevation	1080.16	1080.16	1079.90	1080.03	1080.49		
LTOB Max Depth	4.04	5.14	5.06	5.12	5.68		
LTOB Cross Sectional Area	52.58	57.57	49.07	52.42	66.82		
Entrenchment Ratio	N/A	N/A	N/A	N/A	N/A		



* Stationing from AMP. The stationing has been updated.

Cross Section Plot - MY3 - October 2022

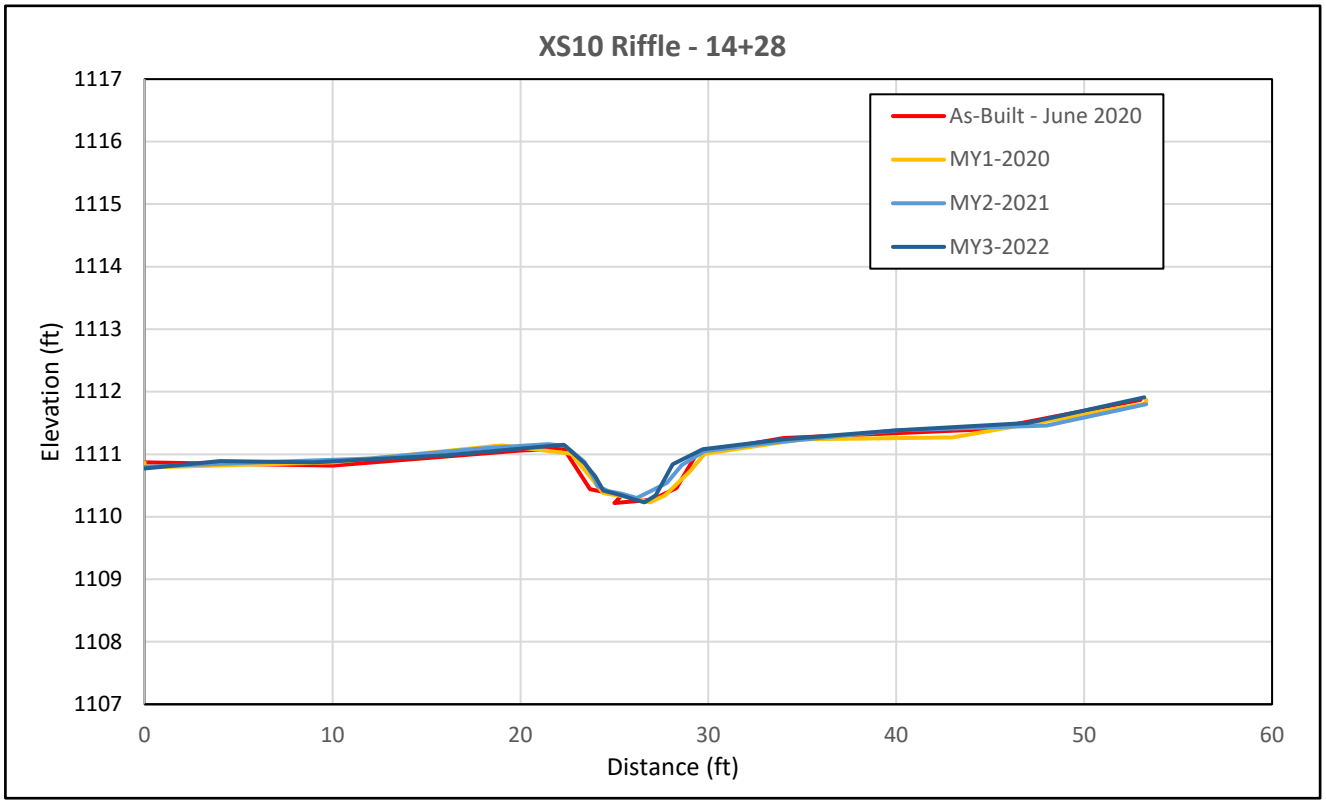
XS10 - UT1

Station 14+28 - Riffle

XS10 looking upstream

XS10 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1111.02	1111.05	1111.14	1111.24			
Bank Height Ratio - Based on AB-Bankfull Area	1.08	0.95	0.99	0.84			
Thalweg Elevation	1110.22	1110.23	1110.30	1110.23			
LTOB Elevation	1111.09	1111.01	1111.13	111.08			
LTOB Max Depth	0.87	0.78	0.83	0.85			
LTOB Cross Sectional Area	4.40	3.60	3.79	3.28			
Entrenchment Ratio	>7.5	>7.45	>7.53	>7.49			



Cross Section Plot - MY3 - October 2022

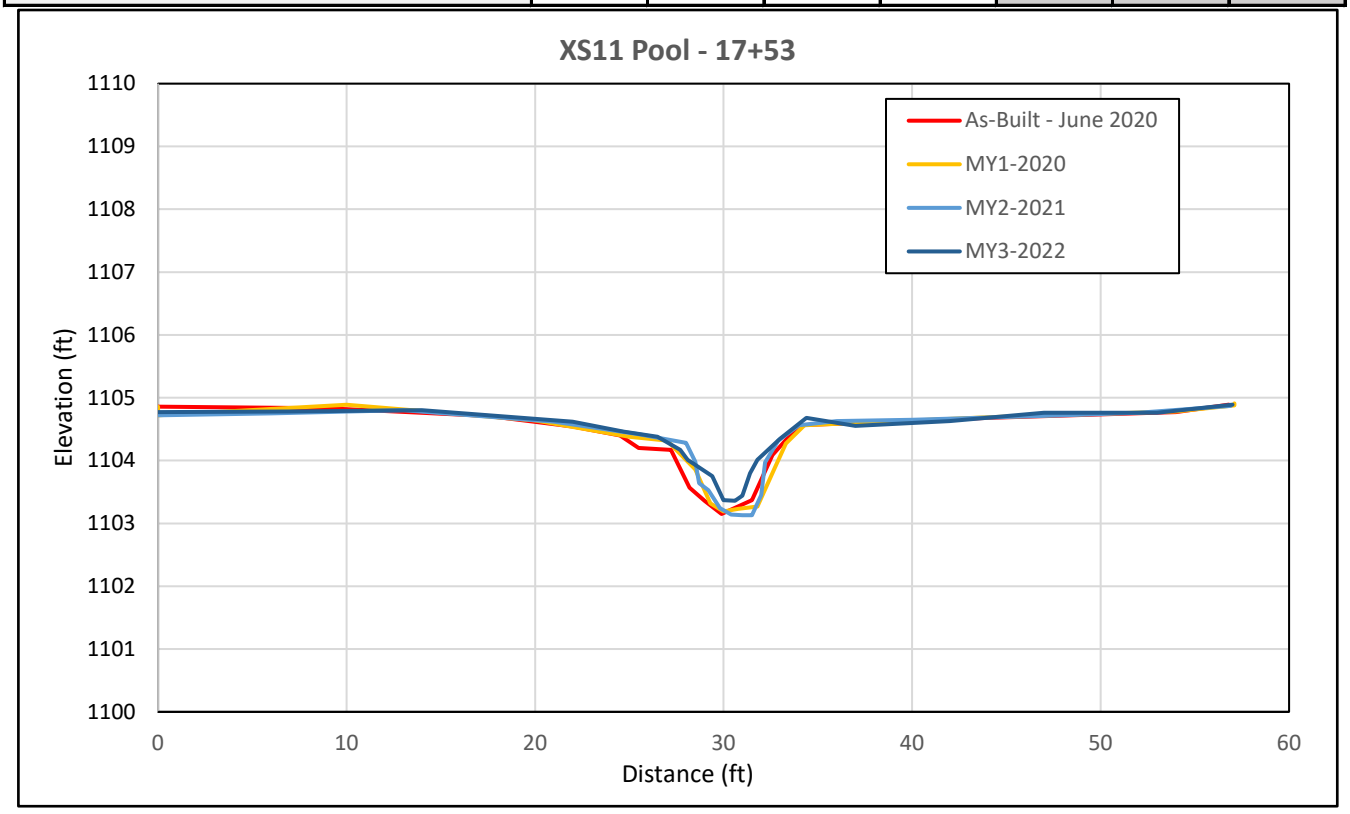
XS11 - UT1

Station 17+53 - Pool

XS11 looking upstream

XS11 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1104.40	1104.45	1104.65	1104.74			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95	0.75	0.74			
Thalweg Elevation	1103.15	1103.19	1103.13	1103.36			
LTOB Elevation	1104.40	1104.38	1104.28	1104.38			
LTOB Max Depth	1.25	1.19	1.15	1.02			
LTOB Cross Sectional Area	5.48	4.92	3.67	3.12			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

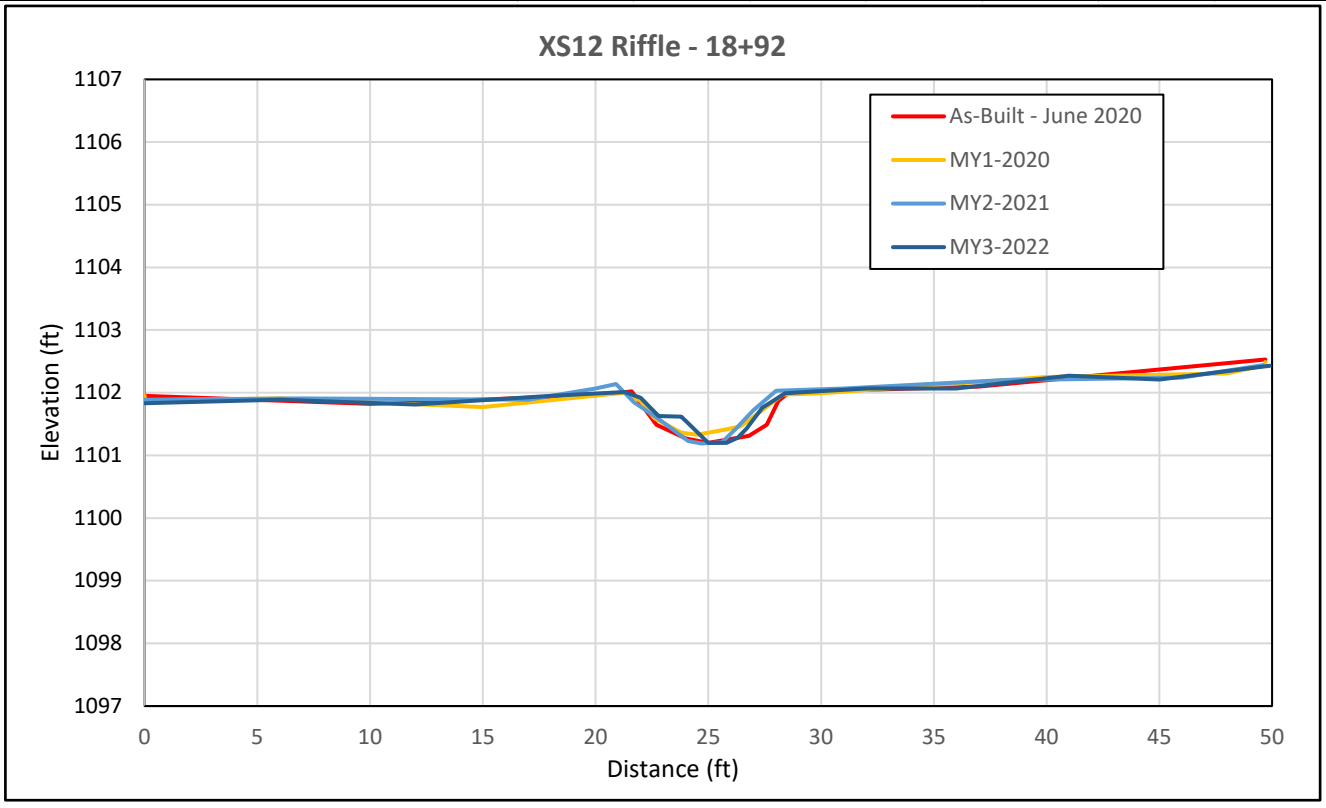
XS12 - UT1

Station 18+92 - Riffle

XS12 looking upstream

XS12 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1102.01	1102.14	1102.11	1102.16			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.79	0.92	0.75			
Thalweg Elevation	1101.20	1101.33	1101.19	1101.20			
LTOB Elevation	1102.01	1101.97	1102.03	1101.92			
LTOB Max Depth	0.81	0.64	0.84	0.72			
LTOB Cross Sectional Area	3.92	2.78	3.39	2.45			
Entrenchment Ratio	>7.12	>7.27	>7.30	>7.57			



Cross Section Plot - MY3 - October 2022

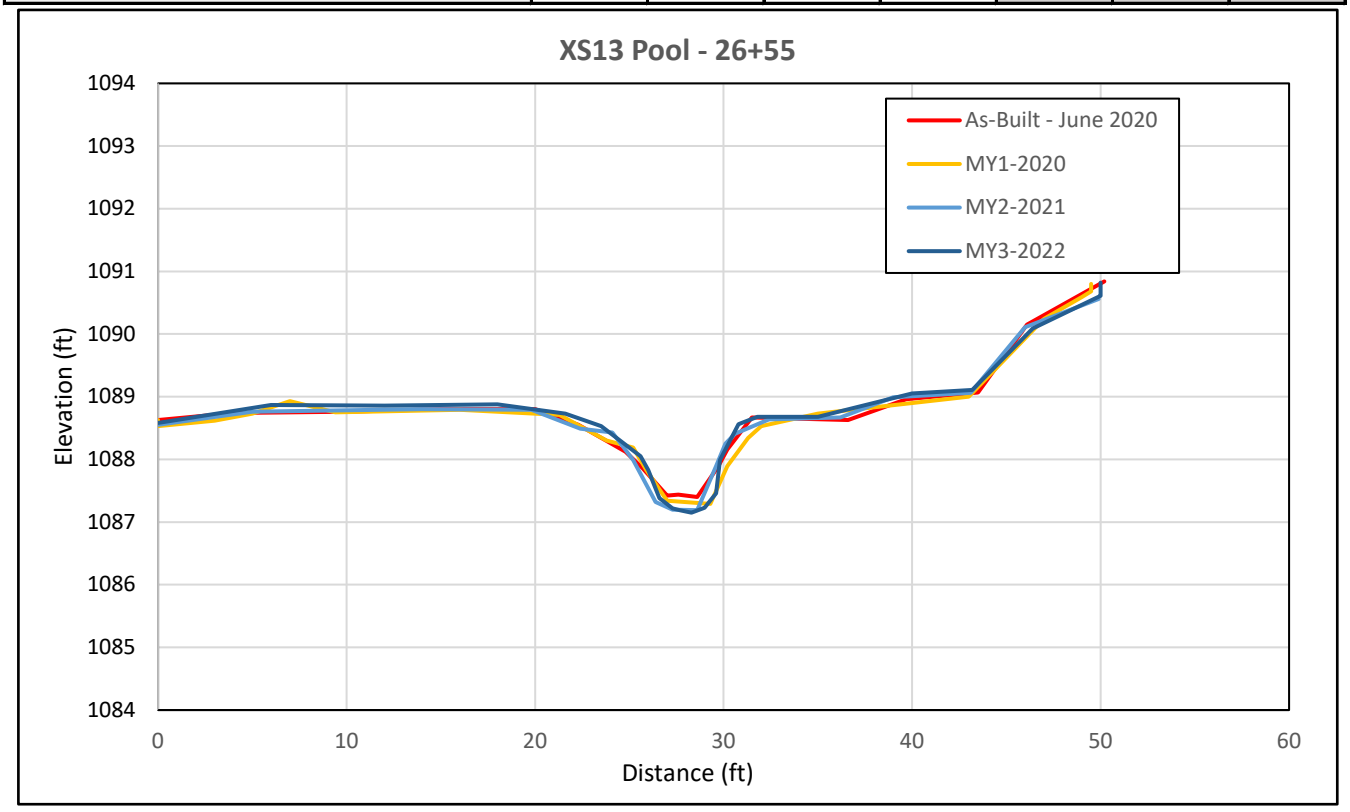
XS13 - UT1

Station 26+55 - Pool

XS13 looking upstream

XS13 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1088.55	1088.46	1088.51	1088.66			
Bank Height Ratio - Based on AB-Bankfull Area	1.10	1.23	0.94	1.01			
Thalweg Elevation	1087.40	1087.29	1087.19	1087.15			
LTOB Elevation	1088.67	1088.73	1088.43	1088.68			
LTOB Max Depth	1.27	1.44	1.24	1.53			
LTOB Cross Sectional Area	6.64	8.60	4.95	6.83			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

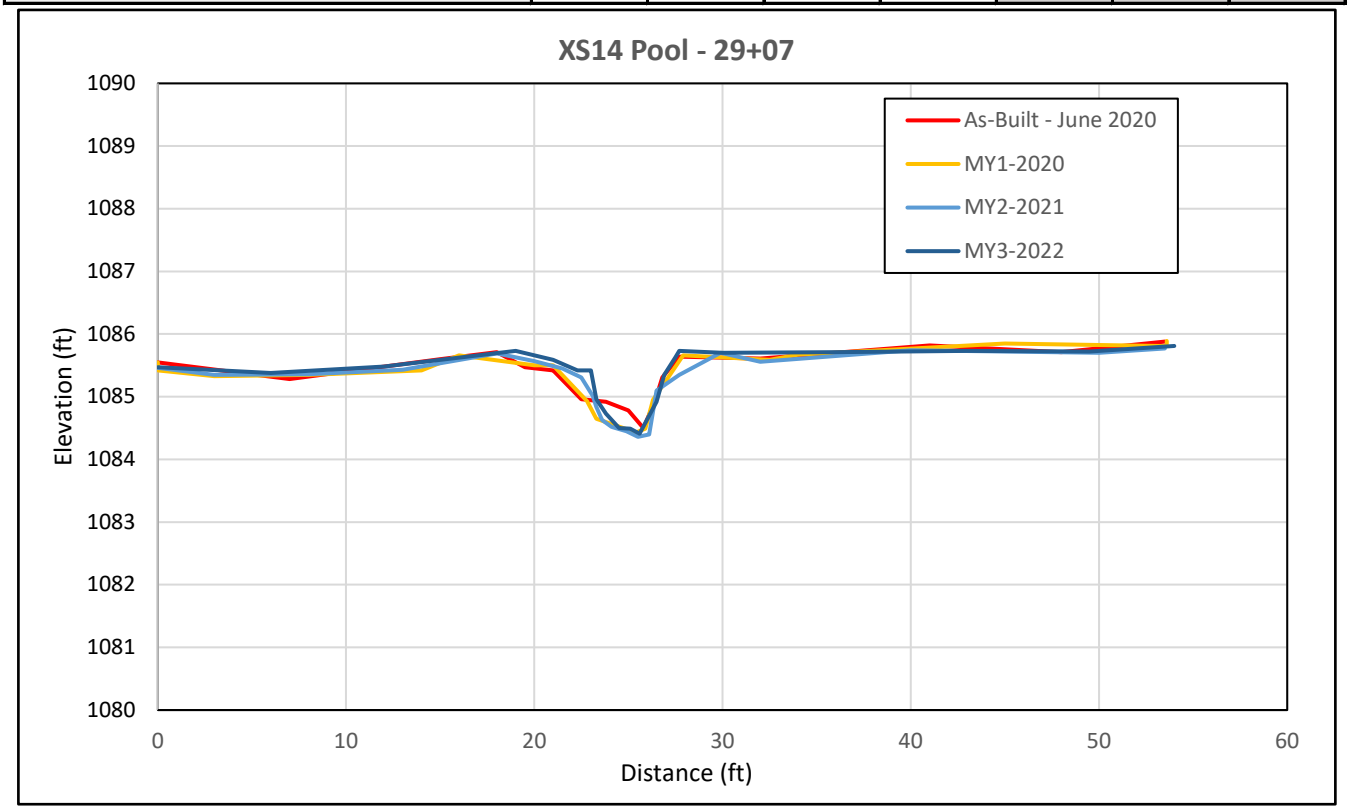
XS14 - UT1

Station 29+07 - Pool

XS14 looking upstream

XS14 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1085.64	1085.57	1085.58	1085.71			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.08	1.09	1.01			
Thalweg Elevation	1084.50	1084.43	1084.36	1084.41			
LTOB Elevation	1085.64	1085.66	1085.69	1085.73			
LTOB Max Depth	1.14	1.23	1.33	1.32			
LTOB Cross Sectional Area	4.63	5.61	5.83	4.77			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

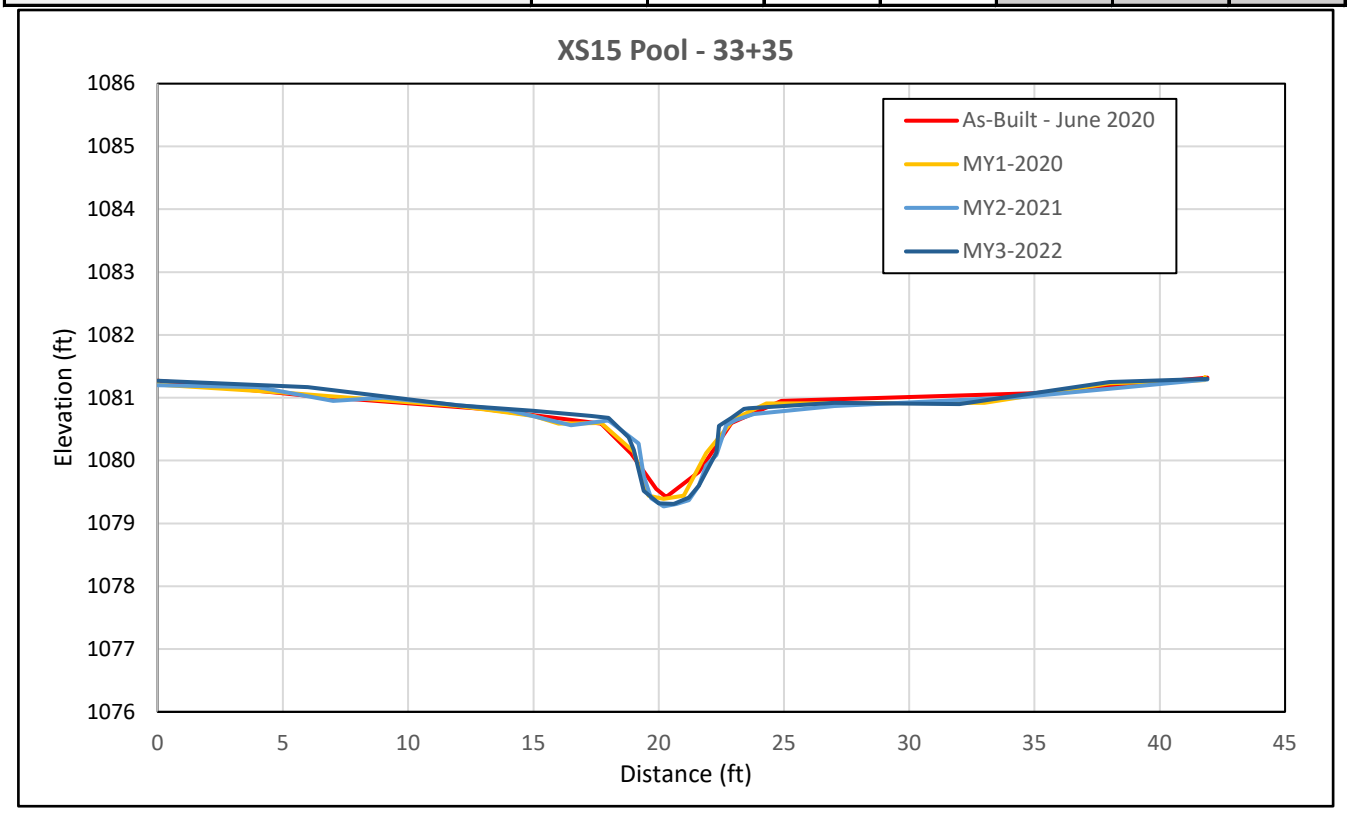
XS15 - UT1

Station 33+35 - Pool

XS15 looking upstream

XS15 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1080.95	1080.95	1081.26	1081.27			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.98	0.69	0.70			
Thalweg Elevation	1079.42	1079.39	1079.27	1079.31			
LTOB Elevation	1080.95	1080.91	1080.64	1080.68			
LTOB Max Depth	1.53	1.52	1.37	1.37			
LTOB Cross Sectional Area	6.90	6.40	3.76	4.01			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

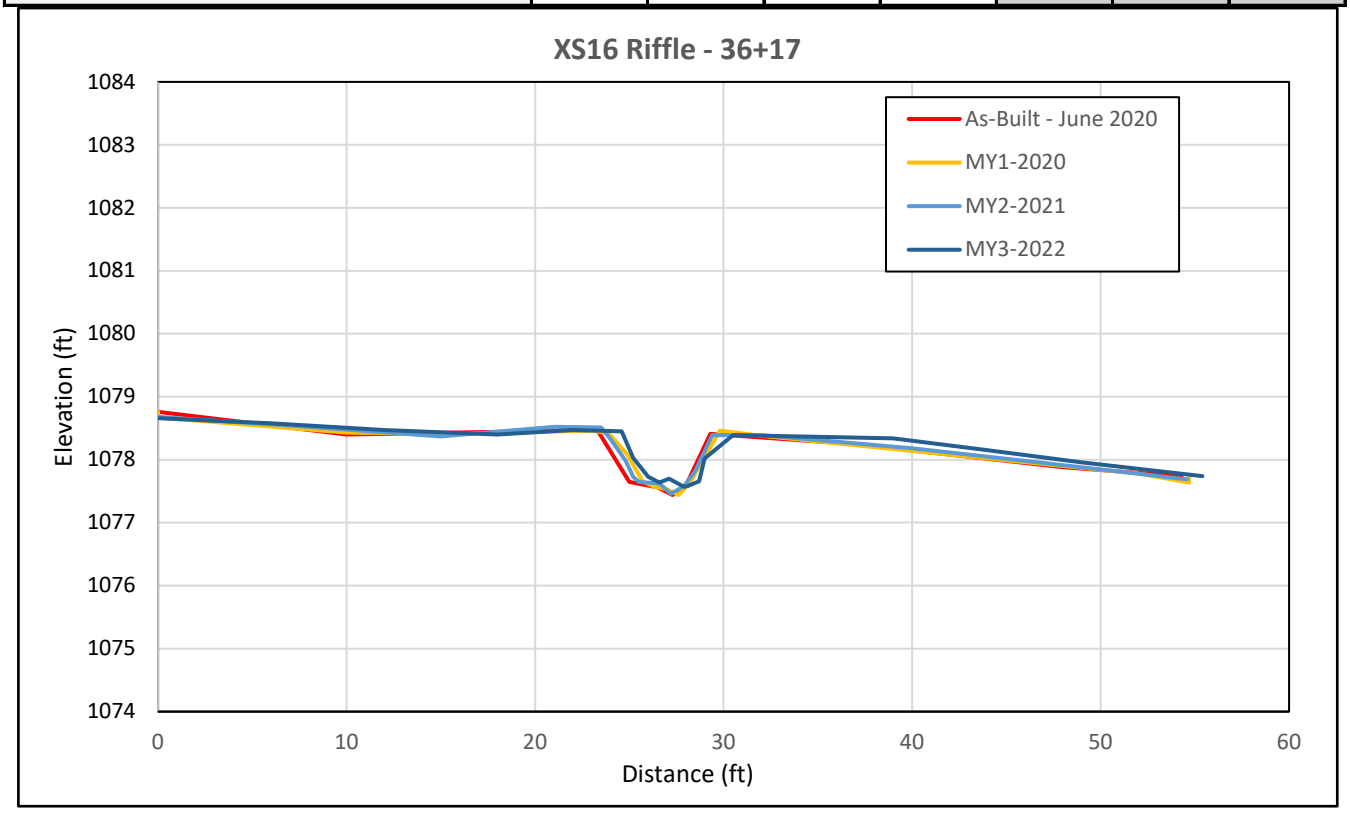
XS16 - UT1

Station 36+17 - Riffle

XS16 looking upstream

XS16 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1078.41	1078.47	1078.47	1078.52			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.99	0.92	0.87			
Thalweg Elevation	1077.44	1077.44	1077.46	1077.57			
LTOB Elevation	1078.41	1078.46	1078.39	1078.39			
LTOB Max Depth	0.97	1.02	0.93	0.82			
LTOB Cross Sectional Area	3.69	3.65	3.23	2.95			
Entrenchment Ratio	>9.12	>9.27	>9.81	>9.17			



Cross Section Plot - MY3 - October 2022

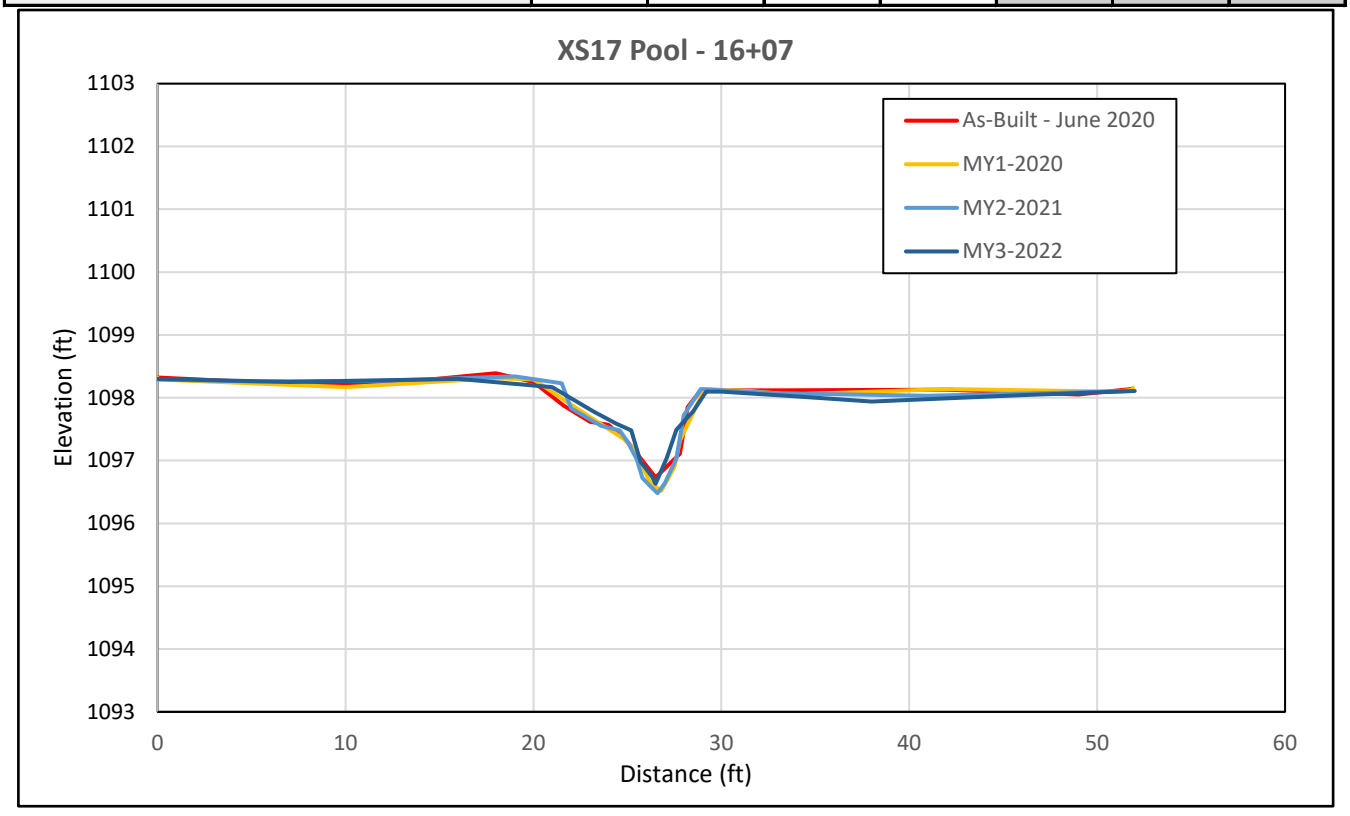
XS17 - UT2

Station 16+07 - Pool

XS17 looking upstream

XS17 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1098.12	1098.08	1098.10	1098.23			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04	1.03	0.92			
Thalweg Elevation	1096.73	1096.52	1096.48	1096.63			
LTOB Elevation	1098.12	1098.14	1098.14	1098.10			
LTOB Max Depth	1.39	1.62	1.66	1.47			
LTOB Cross Sectional Area	5.42	5.90	5.72	4.40			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

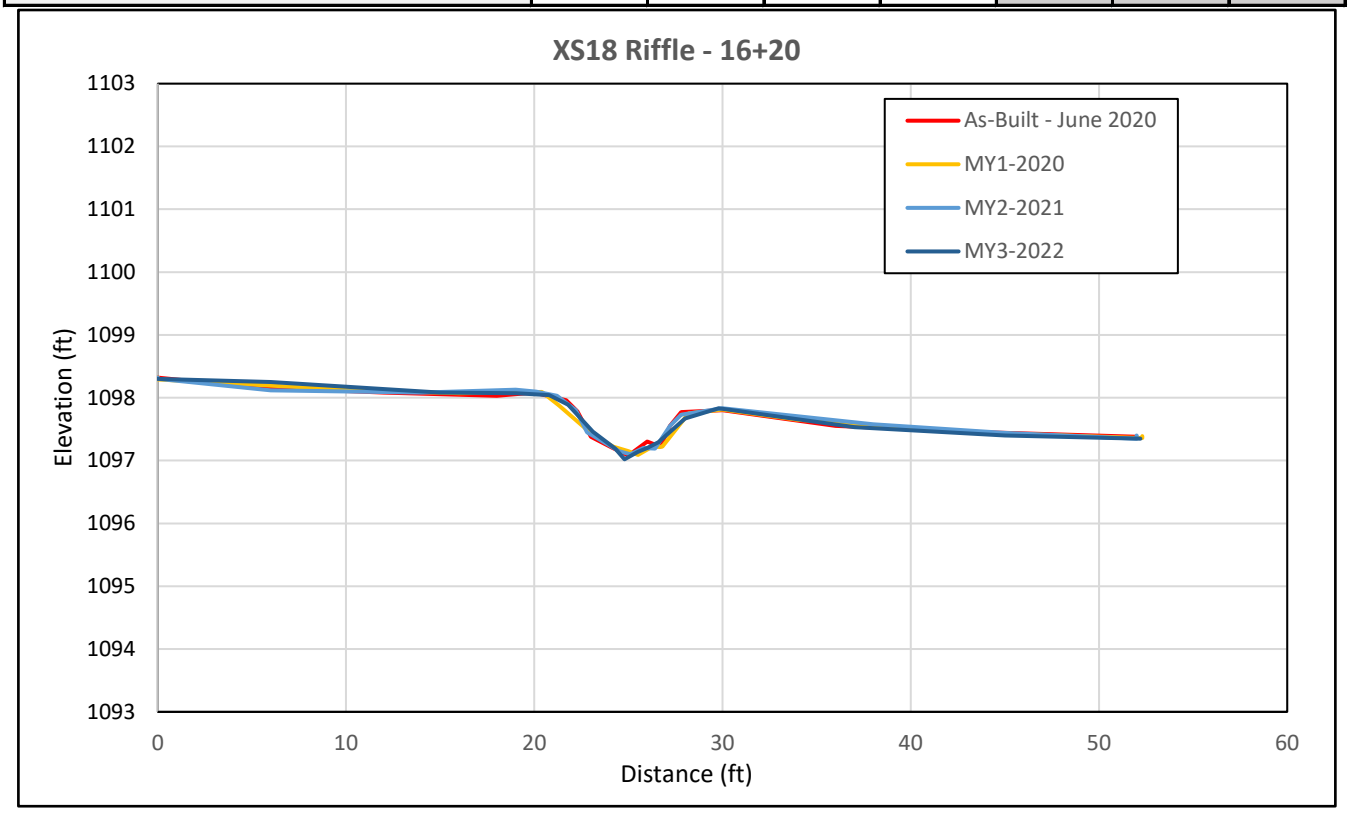
XS18 - UT2

Station 16+20 - Riffle

XS18 looking upstream

XS18 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.77	1097.72	1097.76	1097.78			
Bank Height Ratio - Based on AB-Bankfull Area	1.04	1.13	1.10	1.07			
Thalweg Elevation	1097.08	1097.09	1097.10	1097.10			
LTOB Elevation	1097.80	1097.81	1097.83	1097.87			
LTOB Max Depth	0.72	0.72	0.73	0.73			
LTOB Cross Sectional Area	2.61	3.02	2.90	2.90			
Entrenchment Ratio	>9.48	>8.17	>9.3	>9.17			



Cross Section Plot - MY3 - October 2022

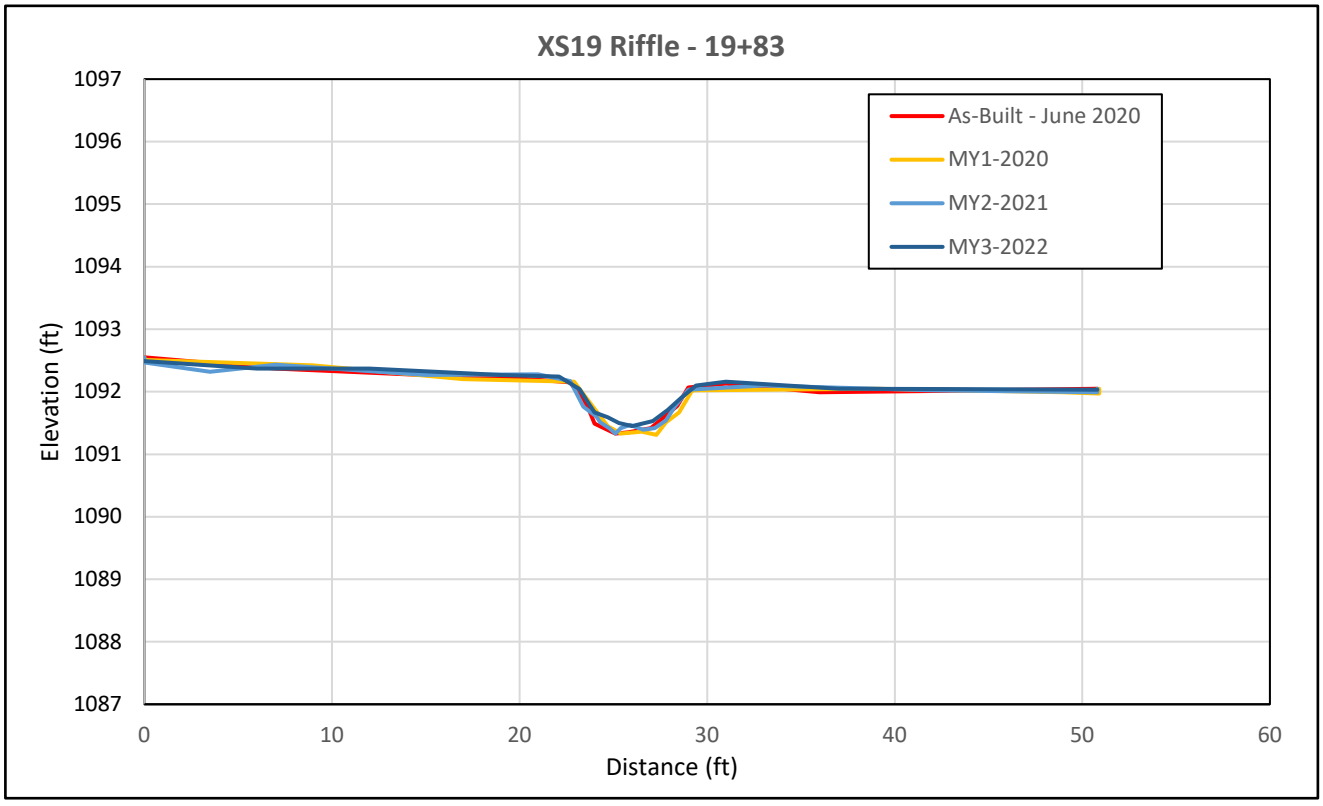
XS19 - UT2

Station 19+83 - Riffle

XS19 looking upstream

XS19 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1092.07	1092.04	1092.07	1092.23			
Bank Height Ratio - Based on AB-Bankfull Area	1.08	1.01	1.04	0.83			
Thalweg Elevation	1091.33	1091.31	1091.33	1091.33			
LTOB Elevation	1092.13	1092.05	1092.10	1092.10			
LTOB Max Depth	0.80	0.74	0.77	0.77			
LTOB Cross Sectional Area	3.52	3.20	3.35	3.35			
Entrenchment Ratio	>8.32	>8.56	>8.32	>8.19			



Cross Section Plot - MY3 - October 2022

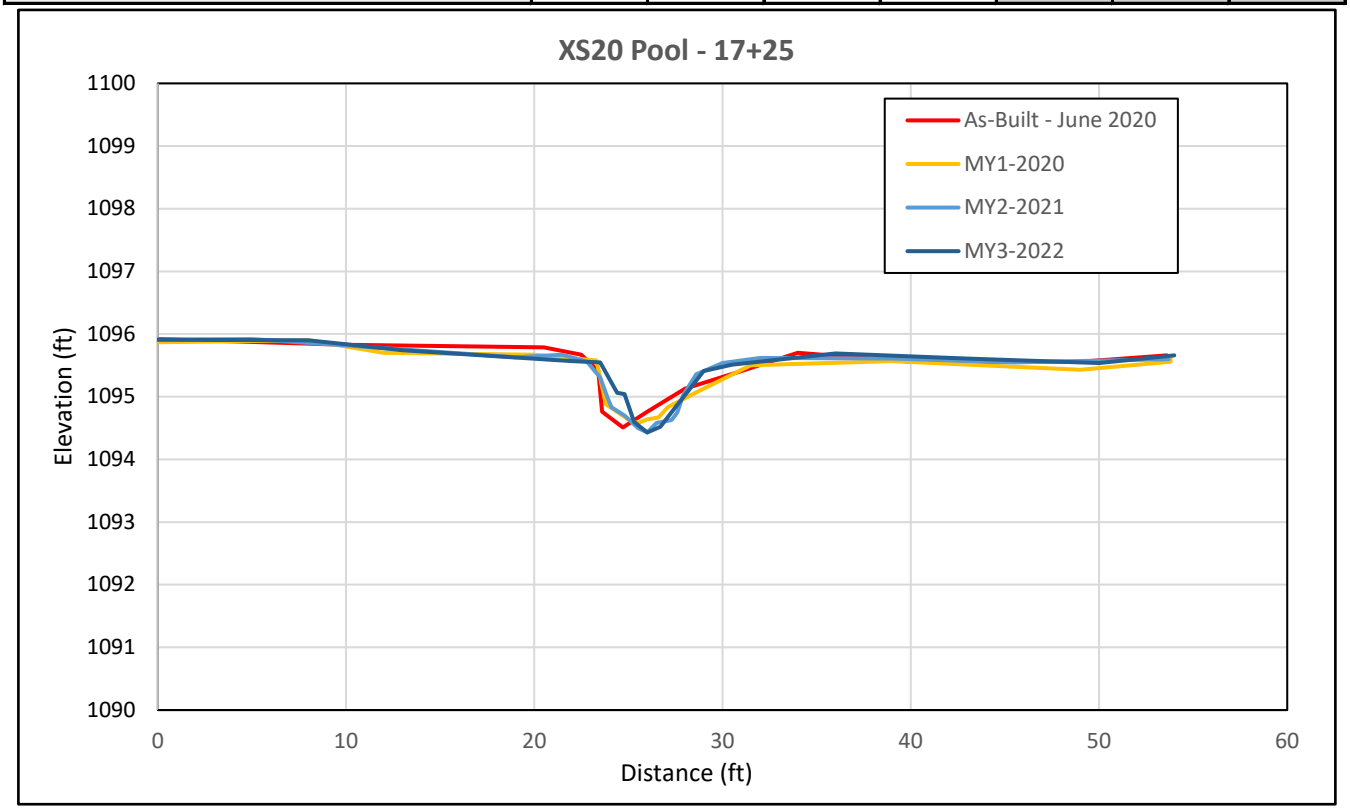
XS20 - UT3 Reach 1

Station 17+25 - Pool

XS20 looking upstream

XS20 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1095.67	1095.56	1095.64	1095.96			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.11	1.03	0.64			
Thalweg Elevation	1094.51	1094.58	1094.43	1094.43			
LTOB Elevation	1095.67	1095.67	1095.67	1095.41			
LTOB Max Depth	1.16	1.09	1.24	0.98			
LTOB Cross Sectional Area	5.72	9.02	6.71	2.86			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

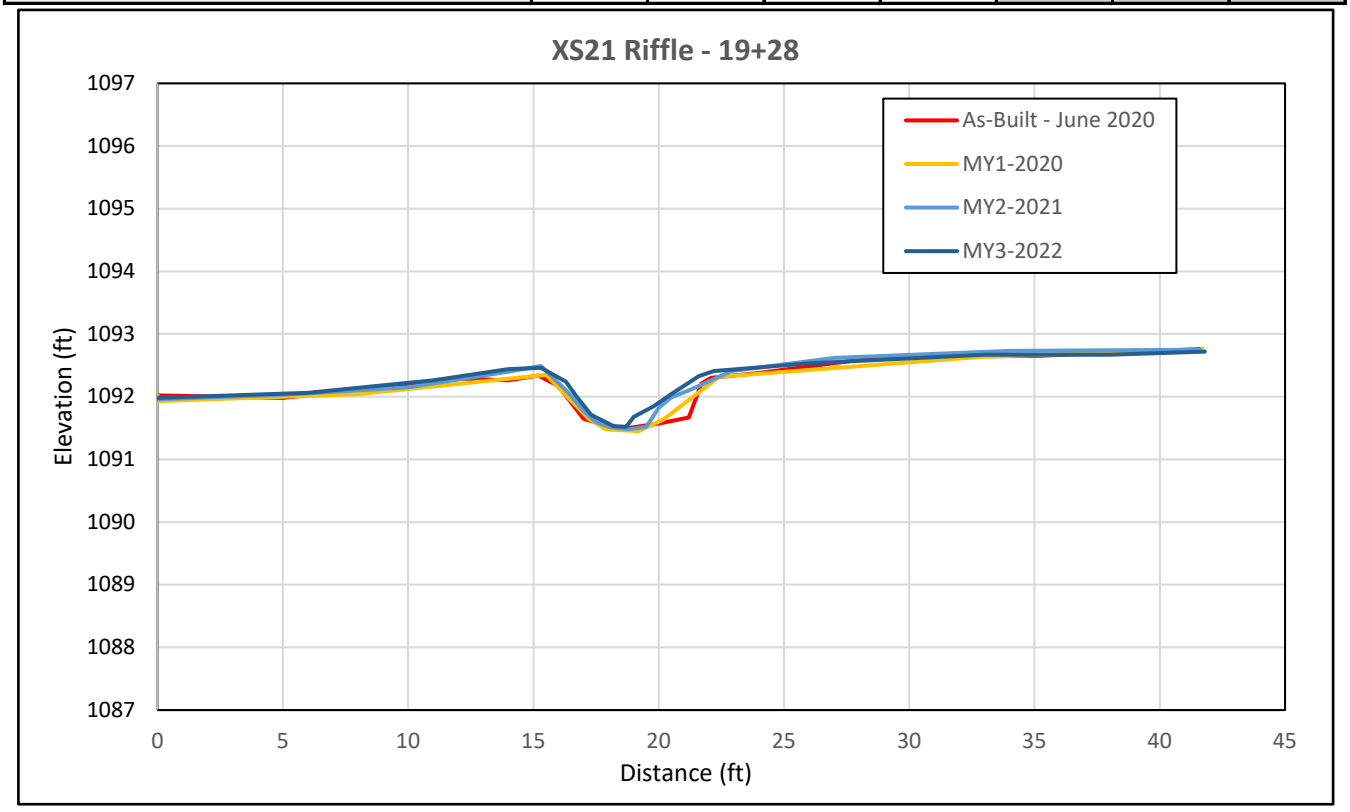
XS21 - UT3 Reach 1

Station 19+28 - Riffle

XS21 looking upstream

XS21 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1092.21	1092.24	1092.32	1092.51			
Bank Height Ratio - Based on AB-Bankfull Area	1.12	1.11	1.10	0.90			
Thalweg Elevation	1091.48	1091.45	1091.48	1091.52			
LTOB Elevation	1092.30	1092.32	1092.41	1092.41			
LTOB Max Depth	0.82	0.87	0.93	0.89			
LTOB Cross Sectional Area	3.71	3.71	3.75	3.02			
Entrenchment Ratio	>7.06	>6.11	>7.1	>6.17			



Cross Section Plot - MY3 - October 2022

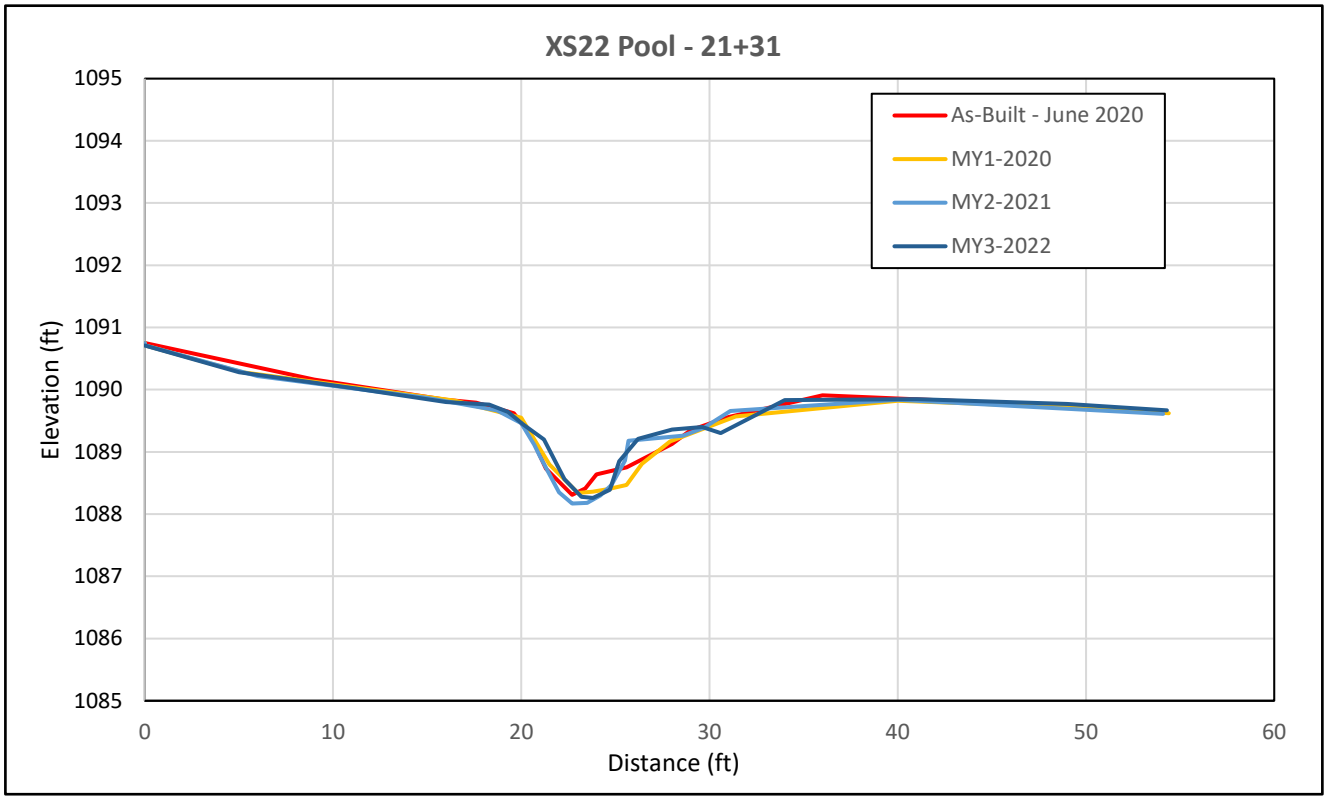
XS22 - UT3 Reach 2

Station 21+31 - Pool

XS22 looking upstream

XS22 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1089.56	1089.52	1089.55	1089.62			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04	1.08	1.02			
Thalweg Elevation	1088.31	1088.34	1088.17	1088.26			
LTOB Elevation	1089.56	1089.57	1089.66	1089.64			
LTOB Max Depth	1.25	1.23	1.49	1.38			
LTOB Cross Sectional Area	6.88	7.47	8.19	7.21			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

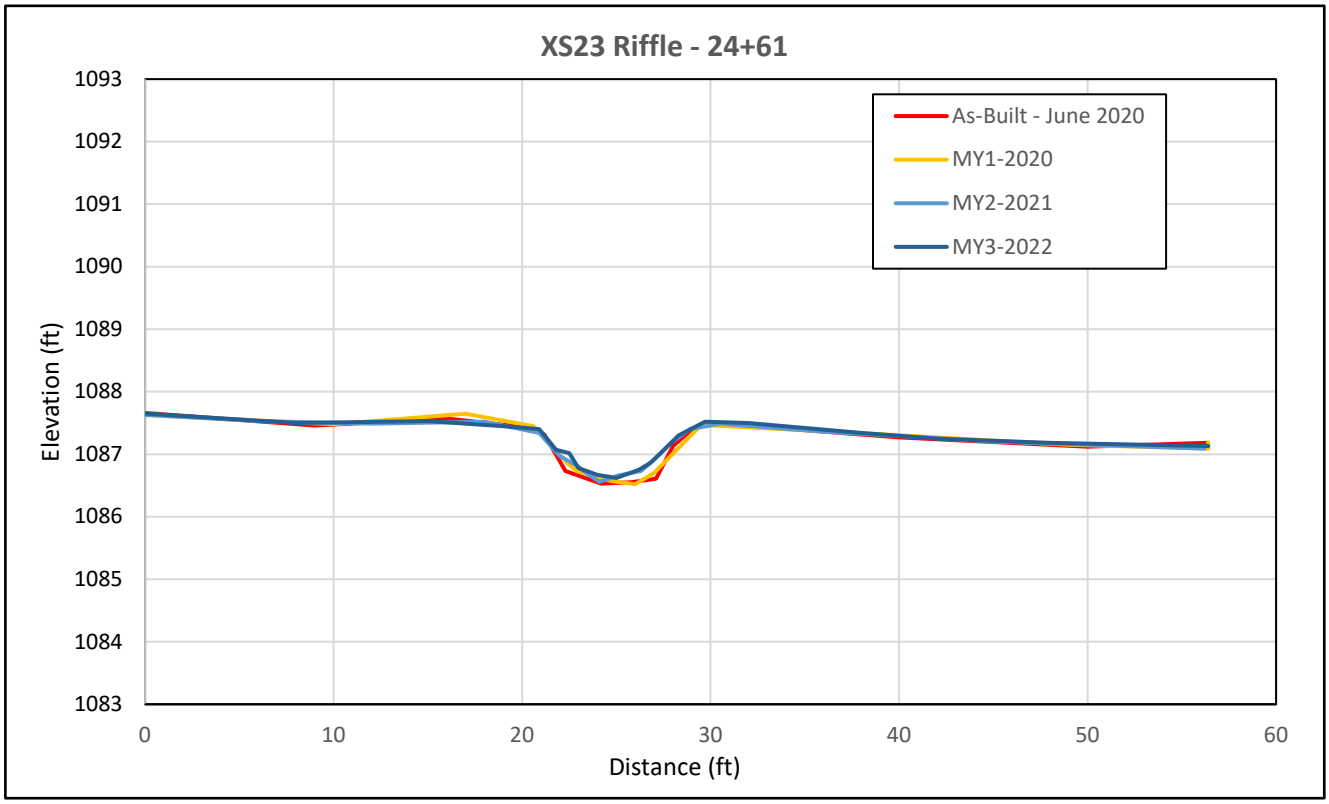
XS23- UT3 Reach 2

Station 24+61 - Riffle

XS23 looking upstream

XS23 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1087.39	1087.41	1087.48	1087.67			
Bank Height Ratio - Based on AB-Bankfull Area	1.13	1.06	1.01	0.74			
Thalweg Elevation	1086.53	1086.52	1086.56	1086.62			
LTOB Elevation	1087.50	1087.47	1087.49	1087.40			
LTOB Max Depth	0.97	0.95	0.93	0.78			
LTOB Cross Sectional Area	5.95	5.40	5.03	3.81			
Entrenchment Ratio	>6.85	>6.34	>6.42	>6.22			



Cross Section Plot - MY3 - October 2022

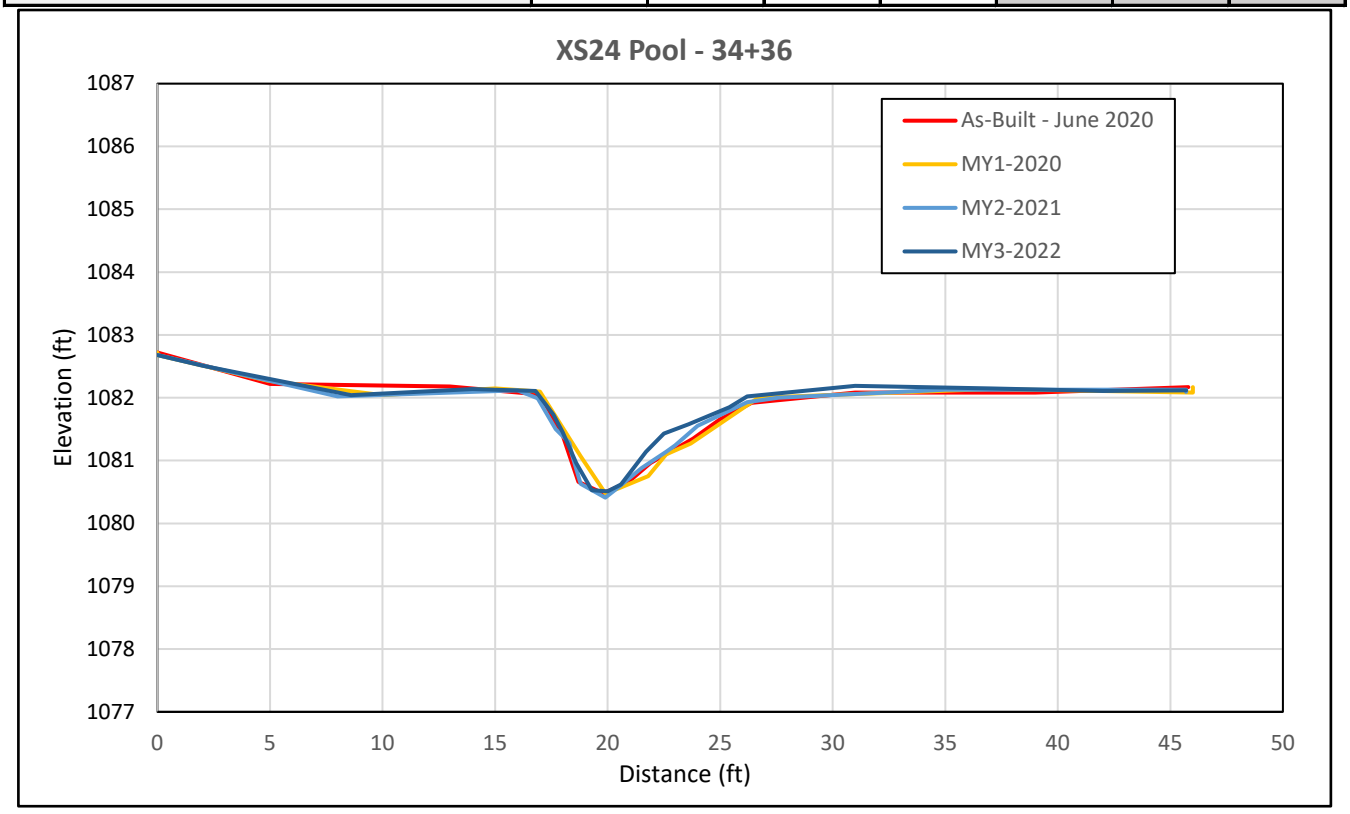
XS24 - UT3 Reach 2

Station 34+36 - Pool

XS24 looking upstream

XS24 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1081.92	1081.94	1081.95	1082.27			
Bank Height Ratio - Based on AB-Bankfull Area	1.11	1.04	1.03	0.86			
Thalweg Elevation	1080.48	1080.48	1080.41	1080.51			
LTOB Elevation	1082.08	1082.00	1082.00	1082.00			
LTOB Max Depth	1.60	1.52	1.59	1.51			
LTOB Cross Sectional Area	8.93	7.59	7.54	6.59			
Entrenchment Ratio	N/A	N/A	N/A	N/A			



Cross Section Plot - MY3 - October 2022

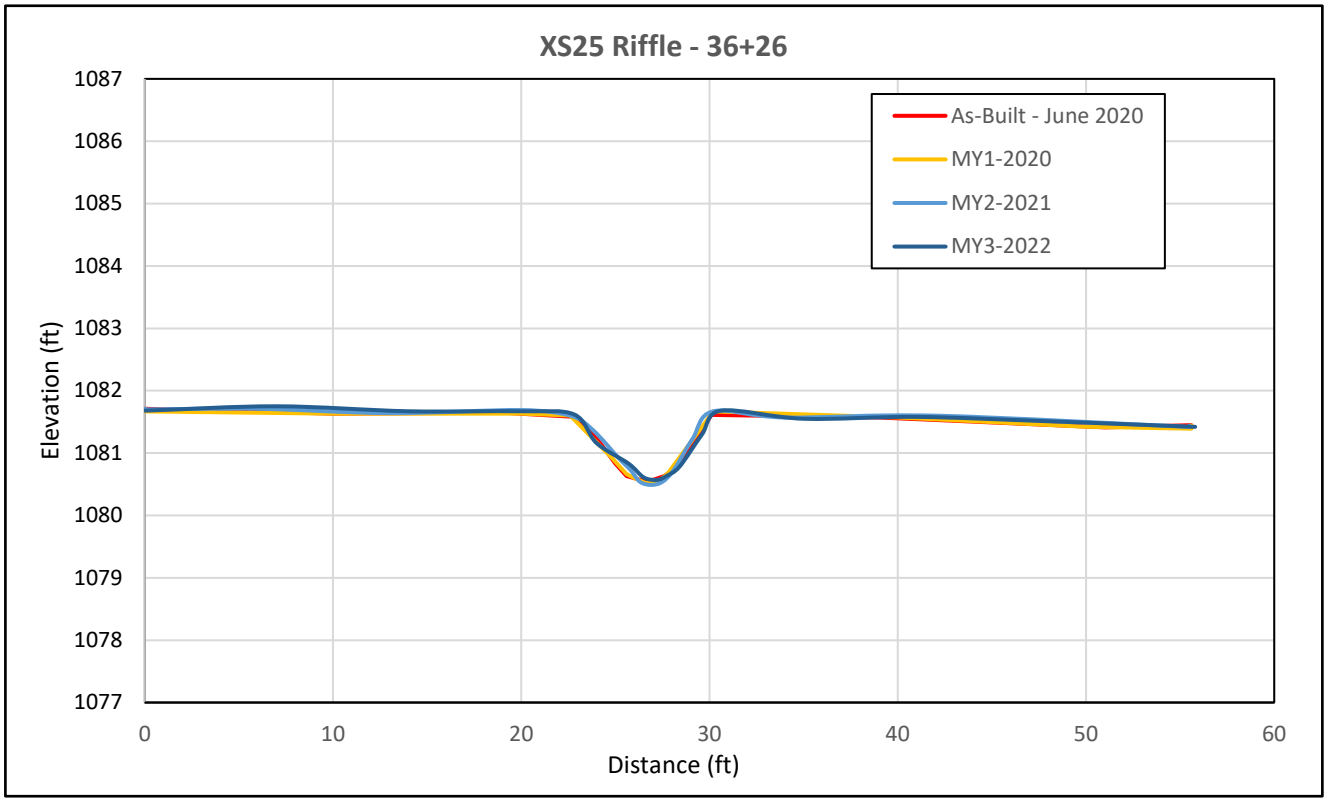
XS25 - UT3 Reach 2

Station 36+26 - Riffle

XS25 looking upstream

XS25 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1081.58	1081.59	1081.62	1081.59			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01	0.98	1.03			
Thalweg Elevation	1080.54	1080.52	1080.49	1080.57			
LTOB Elevation	1081.58	1081.60	1081.60	1081.62			
LTOB Max Depth	1.04	1.08	1.11	1.05			
LTOB Cross Sectional Area	4.54	4.65	4.41	4.76			
Entrenchment Ratio	>7.7	>7.48	>7.63	>7.57			



Cross Section Plot - MY3 - October 2022

XS26 - UT3 Reach 2

Station 43+26 - Pool

XS26 looking upstream

XS26 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1077.31	1077.29	1077.20	1077.33			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01	1.10	0.99			
Thalweg Elevation	1075.90	1075.60	1075.84	1075.79			
LTOB Elevation	1077.31	1077.31	1077.34	1077.31			
LTOB Max Depth	1.41	1.71	1.5	1.52			
LTOB Cross Sectional Area	7.58	7.84	9.12	7.41			
Entrenchment Ratio	N/A	N/A	N/A	N/A			

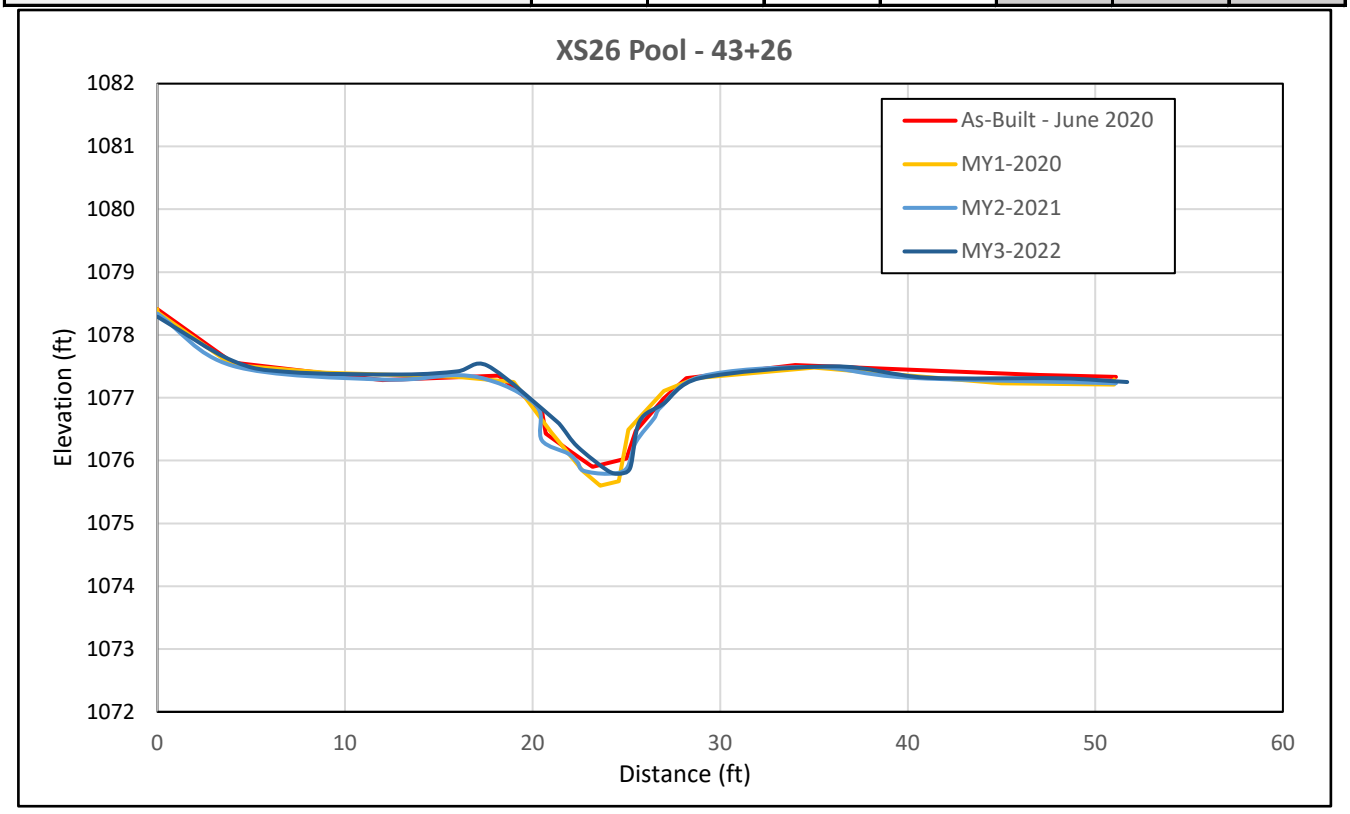


Table 8a. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 1 (2742 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	4.6	4.3	5.0	5.1	5.7	0.6	4	5.6	6.1	-	6.6	-	-	5.6	6.1	6.6	6.0	6.6	7.0	7.0	-	3
Floodprone Width (ft)				5.7	7.3	7.0	9.7	1.9	4	13.4	18.9	-	24.4	-	-	13.4	18.9	24.4	49.7	52.1	52.2	54.3	-	3
Bankfull Mean Depth (ft)	0.5	0.8	0.7	0.5	0.5	0.5	0.6	0.1	4	0.4	0.6	-	0.7	-	-	0.4	0.5	0.7	0.6	0.6	0.6	0.6	-	3
[1]Bankfull Max Depth (ft)				0.7	0.7	0.7	0.8	0.1	4	1.2	1.3	-	1.4	-	-	0.6	0.7	0.8	0.8	0.9	0.8	1.0	-	3
Bankfull Cross Sectional Area (ft^2)	3.1	4.8	3.1	2.0	2.6	2.7	3.1	0.5	4	2.2	3.4	-	4.6	-	-	3.2	3.2	3.2	3.7	3.8	3.9	3.9	-	3
Width/Depth Ratio				8.5	10.0	9.7	12.0	1.5	4	10.0	12.0	-	14	-	-	10.0	12.0	14.0	9.6	11.6	12.5	12.6	-	3
Entrenchment Ratio				1.2	1.5	1.4	1.9	0.3	4	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	7.1	7.9	7.5	9.1	-	3
[1]Bank Height Ratio				5.6	8.4	7.7	12.5	3.1	4	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.0	1.0	1.1	-	3
Profile																								
Riffle Length (ft)				5.0	26.2	20.7	94.4	23.0	13	Total riffle length 60-70% of reach length						5.0	29.0	41.0	5.3	15.1	14.3	39.1	6.2	56
Riffle Slope (ft/ft)				0.012	0.044	0.038	0.084	0.025	13	-	-	-	-	-	-	0.009	0.024	0.075	0.008	0.037	0.034	0.086	0.019	56
Pool Length (ft)				5.8	11.3	9.5	22.0	4.6	13	Total pool length 30-40% of reach length						3.0	11.0	16.0	7.4	21.2	20.9	39.1	8.0	56
Pool Max depth (ft)				0.8	1.0	1.0	1.4	0.1	4	0.8	1.6	-	2.5	-	-	1.1	1.2	1.9	1.0	1.5	1.4	2.2	0.3	57
Pool Spacing (ft)				9.6	24.00	20.3	59.9	12.7	25	18	33.5	-	49	-	-	18.0	33.5	49.0	19.0	38.4	40.0	71.3	8.8	72
Pattern																								
Channel Beltwidth (ft)				6.2	16.9	16.5	34.1	7.5	18	18.3	27.5	-	36.6	-	-	18.3	27.5	36.6	12.7	28.4	30.4	37.0	6.5	67
Radius of Curvature (ft)				5.3	11.1	12.3	18.3	3.6	20	12.2	16.8	-	21.4	-	-	12.2	16.8	21.4	9.3	14.8	14.3	21.3	2.1	69
Rc:Bankfull width (ft/ft)				1.1	2.2	2.4	3.6	0.7	20	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	1.4	2.2	2.2	3.2	0.4	69
Meander Wavelength (ft)				24.3	45.7	41.8	79.0	14.2	18	42.7	58.0	-	73.2	-	-	30.5	51.9	73.2	35.7	60.0	61.4	73.4	8.9	71
Meander Width Ratio				4.8	9.1	8.3	15.7	14.2	18	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	1.9	4.3	4.6	5.6	1.5	67
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.66												0.56			0.65					
Max part size (mm) mobilized at bankfull				72												72			111					
Stream Power (transport capacity) lb/s				10												9			9					
Additional Reach Parameters																								
Rosgen Classification				G4->F4						C4						Cb4			C4					
Bankfull Velocity (fps)	1.0	10.8	5.8	3.2												2.5			2.1					
Bankfull Discharge (cfs)	4	40	18.1	8 to 16												8								
Valley length (ft)				1840						-						2158								
Channel Thalweg length (ft)				2373						-						2805			2805					
Sinuosity (ft)				1.29						1.2-1.4						1.3			1.3					
Water Surface Slope (Channel) (ft/ft)				0.021						-						0.018			0.018					
BF slope (ft/ft)				0.021						-						0.018			0.018					
[3]Bankfull Floodplain Area (acres)				0.310						-						0.9			0.9					
[4]% of Reach with Eroding Banks				80%						-														
Channel Stability or Habitat Metric				0.58						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8b. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 2 (1009 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	3.8	2.5	3.5	3.5	4.5	-	2	4.7	5.1	-	5.5	-	-	4.7	5.1	5.5	5.5	5.8	5.8	6.1	-	2
Floodprone Width (ft)				6.5	9.3	9.3	12.0	-	2	11.2	15.8	-	20.4	-	-	11.2	15.8	20.4	50.8	51.4	51.4	52.0	-	2
Bankfull Mean Depth (ft)	0.5	0.8	0.6	0.5	0.7	0.7	0.9	-	2	0.3	0.5	-	0.6	-	-	0.3	0.4	0.6	0.4	0.5	0.5	0.5	-	2
[1]Bankfull Max Depth (ft)				0.7	0.9	0.9	1.0	-	2	1.1	1.8	-	2.4	-	-	0.5	0.6	0.7	0.7	0.7	0.7	0.7	-	2
Bankfull Cross Sectional Area (ft^2)	2	3	2.2	2.1	2.2	2.2	2.3	-	2	1.4	2.4	-	3.3	-	-	11.2	15.8	20.4	2.4	2.8	2.8	3.1	-	2
Width/Depth Ratio				2.8	6.2	6.2	9.5	-	2	10.0	12.0	-	14	-	-	10.0	12.0	14.0	12.0	12.2	12.2	12.5	-	2
Entrenchment Ratio				1.5	3.2	3.2	4.8	-	2	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	8.3	8.9	8.9	9.5	-	2
[1]Bank Height Ratio				4.0	7.5	7.5	10.9	-	2	1.0	1.0	-	1.0	-	-	1.0	1.0	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)				6.6	19.3	14.0	35.9	11.8	7	Total riffle length 60-70% of reach length						22.0	25.0	32.0	5.0	16.4	18.0	27.1	6.0	25
Riffle Slope (ft/ft)				0.015	0.027	0.023	0.047	0.011	7	-	-	-	-	-	-	0.011	0.027	0.045	0.02	0.045	0.043	0.083	0.017	25
Pool Length (ft)				7.1	10.6	8.5	20.3	4.7	8	Total pool length 30-40% of reach length						6.0	10.0	21.0	5.1	14.5	14.3	21.9	4.2	26
Pool Max depth (ft)				0.7	0.8	0.8	1.5	0.3	2	0.6	1.4	-	2.1	-	-	0.9	1.0	1.6	0.8	1.2	1.1	1.8	0.2	26
Pool Spacing (ft)				13.3	23.6	18.9	44.8	10.3	15	20.4	28.1	-	35.7	-	-	15.3	28.1	40.8	24.9	36.0	35.0	42.0	2.8	27
Pattern																								
Channel Beltwidth (ft)				4.8	7.9	7.3	12.3	2.2	15	15.3	23.0	-	30.6	-	-	15.3	23.0	30.6	23.2	27.2	27.5	32.6	2.5	27
Radius of Curvature (ft)				4.8	8.0	7.8	13.8	2.1	16	10.2	14.0	-	17.9	-	-	10.2	14.1	17.9	10.6	12.7	12.4	15.9	1.7	28
Rc:Bankfull width (ft/ft)				1.4	2.3	2.2	3.9	0.6	16	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	1.8	2.2	2.1	2.7	0.3	28
Meander Wavelength (ft)				13.6	37.4	37.0	68.3	18.7	15	35.7	48.5	-	61.2	-	-	25.5	43.4	61.2	40.4	54.4	52.9	92.0	9.2	28
Meander Width Ratio				3.9	10.7	10.6	19.5	18.7	15	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	4.0	4.7	4.7	5.6	1.5	27
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				1.1												0.5			0.62					
Max part size (mm) mobilized at bankfull				67												67			107					
Stream Power (transport capacity) lb/s				13												10			10					
Additional Reach Parameters																								
Rosgen Classification				Channelized E4						Cb						Cb4			Cb4					
Bankfull Velocity (fps)	1.0	10.8	5.9	3.7												3.6			2.9					
Bankfull Discharge (cfs)	4	40	13.0	8												8								
Valley length (ft)				374						-						1358								
Channel Thalweg length (ft)				397						-						1060			1060					
Sinuosity (ft)				1.06						1.2 to 1.4						1.34			1.3					
Water Surface Slope (Channel) (ft/ft)				0.026						-						0.022			0.0208					
BF slope (ft/ft)				0.026						-						0.022			0.0208					
[3]Bankfull Floodplain Area (acres)				0.1						-						0.5			0.5					
[4]% of Reach with Eroding Banks				70%						-														
Channel Stability or Habitat Metric				0.24						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8c. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 3 R1 (994 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	4.6	4.1	4.9	4.9	5.8	-	3	4.7	5.1	-	5.5	-	-	5.6	6.1	6.6	5.9	5.9	5.9	5.9	-	1
Floodprone Width (ft)				5.8	11.4	7.6	20.7	-	3	11.2	15.8	-	20.4	-	-	13.4	18.9	24.4	41.6	41.6	41.6	41.6	-	1
Bankfull Mean Depth (ft)	0.5	0.8	0.7	0.4	0.6	0.7	0.7	-	3	0.3	0.5	-	0.6	-	-	0.4	0.5	0.7	0.5	0.5	0.5	0.5	-	1
[1]Bankfull Max Depth (ft)				0.6	1.0	1.0	1.4	-	3	1.1	1.8	-	2.4	-	-	0.6	0.7	0.8	0.7	0.7	0.7	0.7	-	1
Bankfull Cross Sectional Area (ft^2)	3.1	4.8	3.1	2.3	3.0	2.9	3.7	-	3	1.4	2.4	-	3.3	-	-	3.2	3.2	3.2	3.2	3.2	3.2	3.2	-	1
Width/Depth Ratio				5.9	9.0	6.6	14.4	-	3	10.0	12.0	-	14	-	-	10.0	12.0	14.0	11.1	11.1	11.1	11.1	-	1
Entrenchment Ratio				1.0	2.5	1.6	5.0	-	3	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	7.1	7.1	7.1	7.1	-	1
[1]Bank Height Ratio				2.7	4.2	4.0	5.8	-	3	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.1	1.1	1.1	1.1	-	1
Profile																								
Riffle Length (ft)				9.1	34.4	32.4	89.8	25.6	10	Total riffle length 60-70% of reach length						11.0	31.0	46.0	6.4	16.6	14.7	32.3	8.1	22
Riffle Slope (ft/ft)				0.001	0.029	0.030	0.051	0.015	10	-	-	-	-	-	-	0.016	0.027	0.064	0.020	0.047	0.044	0.089	0.018	22
Pool Length (ft)				7.7	17.9	16.3	29.8	7.5	10	Total pool length 30-40% of reach length						7.0	11.0	18.0	5.0	13.6	13.1	25.6	5.3	23
Pool Max depth (ft)				0.9	1.0	1.0	1.0	0.2	3	0.6	1.4	-	2.1	-	-	1.1	1.2	1.9	0.8	1.3	1.3	1.7	0.3	23
Pool Spacing (ft)				14.5	27.2	22.8	55.6	12.2	23	20.4	28.1	-	35.7	-	-	18.0	33.5	49.0	33.0	45.1	44.0	56.0	6.1	18
Pattern																								
Channel Beltwidth (ft)				6.0	12.8	8.7	37.0	8.6	21	15.3	23.0	-	30.6	-	-	18.3	27.5	36.6	16.4	31.0	32.4	39.3	5.5	20
Radius of Curvature (ft)				5.7	11.0	11.7	22.7	4.1	27	10.2	14.0	-	17.9	-	-	12.2	16.8	21.4	12.4	15.0	14.9	20.9	2.2	21
Rc:Bankfull width (ft/ft)				1.2	2.2	2.4	4.6	0.8	27	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.1	2.6	2.5	3.6	0.4	21
Meander Wavelength (ft)				16.7	34.9	31.7	68.3	14.7	23	35.7	48.5	-	61.2	-	-	30.5	51.9	73.2	57.6	73.3	70.0	117.0	14.3	20
Meander Width Ratio				3.4	7.1	6.4	13.8	14.7	23	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	2.8	5.3	5.5	6.7	2.3	20
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.58												0.62			0.69					
Max part size (mm) mobilized at bankfull				62												62			116					
Stream Power (transport capacity) lb/s				9												11			12					
Additional Reach Parameters																								
Rosgen Classification				F4						Cb						Cb4			Cb4					
Bankfull Velocity (fps)	1.0	10.8	4.2	3												2.8			2.9					
Bankfull Discharge (cfs)	4	40	13.0	9												9								
Valley length (ft)				1385						-						802								
Channel Thalweg length (ft)				1814						-						994			994					
Sinuosity (ft)				1.31						1.2 to 1.4						1.24			1.2					
Water Surface Slope (Channel) (ft/ft)				0.016						-						0.02			0.0209					
BF slope (ft/ft)				0.016						-						0.02			0.0209					
[3]Bankfull Floodplain Area (acres)				0.4						-						0.3			0.3					
[4]% of Reach with Eroding Banks				60%						-														
Channel Stability or Habitat Metric				0.55						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8d. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 3 R2 (2421 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	5	9	5.7							4.7	5.1	-	5.5	-	-	6.8	7.3	7.8	7.2	7.7	7.7	8.2	-	2
Floodprone Width (ft)										11.2	15.8	-	20.4	-	-	16.1	22.6	29.2	55.6	56.0	56.0	56.3	-	2
Bankfull Mean Depth (ft)	0.8	1.2	0.9							0.3	0.5	-	0.6	-	-	0.5	0.6	0.8	0.6	0.6	0.6	0.6	-	2
[1]Bankfull Max Depth (ft)										1.1	1.8	-	2.4	-	-	0.7	0.8	0.9	0.9	1.0	1.0	1.0	-	2
Bankfull Cross Sectional Area (ft^2)	4	5	4.4							1.4	2.4	-	3.3	-	-	4.4	4.4	4.4	4.5	4.7	4.7	4.9	-	2
Width/Depth Ratio										10.0	12.0	-	14	-	-	10.0	12.0	14.0	11.5	12.7	12.7	13.9	-	2
Entrenchment Ratio										2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	6.9	7.3	7.3	7.7	-	2
[1]Bank Height Ratio										1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)										Total riffle length 60-70% of reach length						12.0	41.0	57.0	5.0	18.1	16.2	39.3	9.8	40
Riffle Slope (ft/ft)										-	-	-	-	-	-	0.004	0.01	0.018	0.004	0.022	0.018	0.063	0.016	40
Pool Length (ft)										Total pool length 30-40% of reach length						8.0	15.0	22.0	7.9	17.4	16.2	38.3	6.4	41
Pool Max depth (ft)										0.6	1.4	-	2.1	-	-	1.3	1.4	2.2	1.2	1.6	1.6	2.5	0.2	41
Pool Spacing (ft)										20.4	28.1	-	35.7	-	-	29.2	86.0	58.4	43.0	55.6	56.0	70.0	6.0	43
Pattern																								
Channel Beltwidth (ft)										15.3	23.0	-	30.6	-	-	25.6	42	58.4	26.5	42.1	42.1	56.6	6.9	43
Radius of Curvature (ft)										10.2	14.0	-	17.9	-	-	14.6	20.1	25.6	15.7	18.6	19.0	23.0	1.7	45
Rc:Bankfull width (ft/ft)										2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.0	2.4	2.5	3.0	0.3	45
Meander Wavelength (ft)										35.7	48.5	-	61.2	-	-	51.1	69.4	87.6	66.9	81.9	81.2	130.3	10.9	44
Meander Width Ratio										3.0	4.5	-	6.0	-	-	3.5	5.8	8.0	3.4	5.4	5.5	7.3	1.8	43
Transport parameters																								
Reach Shear Stress (competency) lb/f^2																0.25			0.24					
Max part size (mm) mobilized at bankfull																62			54					
Stream Power (transport capacity) lb/s																7			7					
Additional Reach Parameters																								
Rosgen Classification										C4						C4			C4					
Bankfull Velocity (fps)	2.3	22.5	5.9													3.9			3.6					
Bankfull Discharge (cfs)	9	90	25.8													17								
Valley length (ft)										-						1802								
Channel Thalweg length (ft)										-						2523			2523					
Sinuosity (ft)										1.2 to 1.4						1.4			1.4					
Water Surface Slope (Channel) (ft/ft)										-						0.0067			0.0063					
BF slope (ft/ft)										-						0.0067			0.0063					
[3]Bankfull Floodplain Area (acres)										-						0.9			0.9					
[4]% of Reach with Eroding Banks										-														
Channel Stability or Habitat Metric										-														
Biological or Other										-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8e. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R1 (1573 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	30.7	30.7	30.7	30.7	-	1	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	33.2	33.2	33.2	33.2	-	1
Floodprone Width (ft)				35.0	35.0	35.0	35.0	-	1	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	43.0	43.0	43.0	43.0	-	1
Bankfull Mean Depth (ft)	1.8	3	2.4	1.7	1.7	1.7	1.7	-	1	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.8	1.8	1.8	1.8	-	1
[1]Bankfull Max Depth (ft)				2.7	2.7	2.7	2.7	-	1	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.4	2.4	2.4	2.4	-	1
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	51.6	51.6	51.6	51.6	-	1	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	61.1	61.1	61.1	61.1	-	1
Width/Depth Ratio				18.2	18.2	18.2	18.2	-	1	10.0	12.0	-	14	-	-	10.0	12.0	14.0	18.1	18.1	18.1	18.1	-	1
Entrenchment Ratio				1.1	1.1	1.1	1.1	-	1	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	1.3	1.3	1.3	1.3	-	1
[1]Bank Height Ratio				3.2	3.2	3.2	3.2	-	1	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.2	1.2	1.2	1.2	-	1
Profile																								
Riffle Length (ft)				20.3	48.1	32.0	126.8	36.5	8	Total riffle length 60-70% of reach length						20.3	32.0	126.8	79	108.3	89	190	38.77	7
Riffle Slope (ft/ft)				0.002	0.013	0.013	0.025	0.007	8	-	-	-	-	-	-	0.002	0.013	0.025	0.002	0.005	0.004	0.009	0.002	7
Pool Length (ft)				30.9	61.8	55.4	98.0	20.8	8	Total pool length 30-40% of reach length						30.9	55.4	98.0	40	94.57	97	150	30.77	7
Pool Max depth (ft)				0.8	3.4	3.4	1.4	-	1	3.2	6.2	-	9.1	-	-	0.8	3.4	1.4	5.11	6.14	6.17	7.28	0.792	7
Pool Spacing (ft)				16.3	76.5	64.6	199.2	41.0	21	95.6	131.5	-	167.3	-	-	16.3	64.6	199.2	111	206.1	187.2	330.6	71.09	6
Pattern																								
Channel Beltwidth (ft)				31.2	37.9	35.5	85.1	8.1	44	83.7	137.4	-	191.2	-	-	31.2	35.5	85.1	31.2	37.9	35.5	85.1	8.1	44
Radius of Curvature (ft)				18.1	32.0	26.6	85.1	15.9	47	47.8	65.7	-	83.7	-	-	18.1	26.6	85.1	18.1	32.0	26.6	85.1	15.9	47
Rc:Bankfull width (ft/ft)				0.6	1.0	0.9	2.8	0.5	47	2.0	2.8	-	3.5	-	-	0.6	0.9	2.8	0.6	0.96	0.9	2.8	0.5	47
Meander Wavelength (ft)				14.8	76.4	52.6	281.1	66.0	45	167.3	227.1	-	286.8	-	-	14.8	52.6	281.1	14.8	76.4	52.6	281.1	66.0	45
Meander Width Ratio				0.5	2.5	1.7	9.2	2.1	45	3.5	5.8	-	8.0	-	-	0.5	1.7	9.2	0.5	2.3	1.7	9.2	2.0	45
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.26					
Max part size (mm) mobilized at bankfull				90												90			56					
Stream Power (transport capacity) lb/s				37												35			22					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			B4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			2.5					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				1470						-						1470								
Channel Thalweg length (ft)				1573						-						1573			1573					
Sinuosity (ft)				1.07						1.2 to 1.4						1.07			1.07					
Water Surface Slope (Channel) (ft/ft)				0.003						-						0.003			0.0023					
BF slope (ft/ft)				0.003						-						0.003			0.0023					
[3]Bankfull Floodplain Area (acres)				1.2						-						2.5			2.5					
[4]% of Reach with Eroding Banks				33%						-														
Channel Stability or Habitat Metric				0.20						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8f. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R2 (2035.7 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	28.5	30.8	30.8	33.0	-	2	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	20.2	20.7	20.7	21.3	-	2
Floodprone Width (ft)				45.0	45.5	45.5	46.0	-	2	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	81.2	>88.6	>88.6	>88.6	-	2
Bankfull Mean Depth (ft)	1.8	3	2.4	1.4	1.6	1.6	1.7	-	2	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.6	1.6	1.6	1.7	-	2
[1]Bankfull Max Depth (ft)				2.1	2.3	2.3	2.5	-	2	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.4	2.5	2.5	2.5	-	2
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	47.0	47.9	47.9	48.8	-	2	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	33.7	33.9	33.9	34.1	-	2
Width/Depth Ratio				16.6	19.9	19.9	23.2	-	2	10.0	12.0	-	14	-	-	10.0	12.0	14.0	12.0	12.7	12.7	13.4	-	2
Entrenchment Ratio				1.4	1.5	1.5	1.6	-	2	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	4.0	>4.14	>4.14	>4.14	-	2
[1]Bank Height Ratio				2.7	2.9	2.9	3.0	-	2	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)				15.3	66.6	53.7	179.0	50.1	9	Total riffle length 60-70% of reach length						29.0	121.0	167.0	73.6	113.0	118.1	169.4	28.7	13
Riffle Slope (ft/ft)				0.006	0.011	0.007	0.024	0.007	9	-	-	-	-	-	-	0.004	0.005	0.007	0.004	0.005	0.006	0.007	7.7E-04	13
Pool Length (ft)				15.3	71.2	71.6	147.0	38.6	9	Total pool length 30-40% of reach length						26.0	45.0	67.0	38.0	57.5	59.0	67.0	7.1	13
Pool Max depth (ft)				0.8	3.1	3.1	1.4	0.2	2	3.2	6.2	-	9.1	-	-	4.2	4.6	7.3	2.7	3.3	3.4	3.8	0.3	13
Pool Spacing (ft)				54.0	122.7	89.1	287.6	70.2	13	95.6	131.5	-	167.3	-	-	96.0	143.5	191.0	134.0	178.7	173.0	271.0	36.6	12
Pattern																								
Channel Beltwidth (ft)				47.4	85.9	75.3	174.1	40.2	9	83.7	137.4	-	191.2	-	-	83.7	137.5	191.2	83.7	126.2	126.7	176.7	24.8	10
Radius of Curvature (ft)				33.7	86.3	88.7	159.1	37.1	9	47.8	65.7	-	83.7	-	-	47.8	65.8	83.7	46.4	60.8	60.4	81.4	12.0	13
Rc:Bankfull width (ft/ft)				1.1	2.8	2.9	5.2	1.2	9	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.2	2.9	2.9	3.9	0.6	13
Meander Wavelength (ft)				214.5	296.9	303.9	414.1	75.2	9	167.3	227.1	-	286.8	-	-	167.3	138.1	286.8	188.0	246.7	243.5	304.0	33.2	10
Meander Width Ratio				7.0	9.7	9.9	13.5	2.4	9	3.5	5.8	-	8.0	-	-	3.5	5.8	8.0	4.0	6.1	6.1	8.5	1.6	10
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.39					
Max part size (mm) mobilized at bankfull				90												90			76					
Stream Power (transport capacity) lb/s				37												35			37					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			C4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			3.1					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				1808						-						1700								
Channel Thalweg length (ft)				2007						-						2017.3			2176					
Sinuosity (ft)				1.11						1.2 to 1.4						1.19			1.19					
Water Surface Slope (Channel) (ft/ft)				0.004						-						0.004			0.004					
BF slope (ft/ft)				0.004						-						0.004			0.004					
[3]Bankfull Floodplain Area (acres)				1.9						-						2.9			2.9					
[4]% of Reach with Eroding Banks				30%						-														
Channel Stability or Habitat Metric				0.26						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8g. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R3 (384 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	22.8	22.8	22.8	22.8	-	1	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	20.9	20.9	20.9	20.9	-	1
Floodprone Width (ft)				144.4	144.4	144.4	144.4	-	1	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	106.9	106.9	106.9	106.9	-	1
Bankfull Mean Depth (ft)	1.8	3	2.4	2.3	2.3	2.3	2.3	-	1	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.6	1.6	1.6	1.6	-	1
[1]Bankfull Max Depth (ft)				3.2	3.2	3.2	3.2	-	1	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.6	2.6	2.6	2.6	-	1
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	52.4	52.4	52.4	52.4	-	1	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	33.7	33.7	33.7	33.7	-	1
Width/Depth Ratio				9.9	9.9	9.9	9.9	-	1	10.0	12.0	-	14	-	-	10.0	12.0	14.0	13.0	13.0	13.0	13.0	-	1
Entrenchment Ratio				6.3	6.3	6.3	6.3	-	1	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	5.0	5.0	5.0	5.0	-	1
[1]Bank Height Ratio				1.4	1.4	1.4	1.4	-	1	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.0	1.0	1.0	-	1
Profile																								
Riffle Length (ft)				24.5	45.0	44.1	67.2	21.3	4	Total riffle length 60-70% of reach length						29.0	121.0	167.0	20.0	63.7	54.2	126.7	41.7	4
Riffle Slope (ft/ft)				0.003	0.009	0.008	0.016	0.006	4	-	-	-	-	-	-	0.004	0.005	0.007	0.004	0.006	0.005	0.011	0.003	4
Pool Length (ft)				16.4	41.4	33.6	92.0	30.0	5	Total pool length 30-40% of reach length						26.0	45.0	67.0	30	40	40	50	8.6	4
Pool Max depth (ft)				0.8	4.6	4.6	1.4	-	1	3.2	6.2	-	9.1	-	-	4.2	4.6	7.3	2.1	3.2	3.4	4.0	0.7	4
Pool Spacing (ft)				21.6	67.1	70.2	101.5	30.6	8	95.6	131.5	-	167.3	-	-	96.0	143.5	191.0	77.0	107.5	100.0	153.0	28.5	4
Pattern																								
Channel Beltwidth (ft)				23.2	30.8	28.1	53.7	8.9	10	83.7	137.4	-	191.2	-	-	83.7	137.5	191.2	63.9	63.9	63.9	63.9	-	1
Radius of Curvature (ft)				17.0	26.5	26.5	47.1	7.5	13	47.8	65.7	-	83.7	-	-	47.8	65.8	83.7	50.5	63.8	70.5	70.5	-	3
Rc:Bankfull width (ft/ft)				0.7	1.2	1.2	2.1	0.3	13	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.4	3.1	3.4	3.4	-	3
Meander Wavelength (ft)				18.0	82.0	84.2	139.5	36.6	12	167.3	227.1	-	286.8	-	-	167.3	138.1	286.8	241.0	241.0	241.0	241.0	-	1
Meander Width Ratio				0.8	3.6	3.7	6.1	1.6	12	3.5	5.8	-	8.0	-	-	3.5	5.8	8.0	3.1	3.1	3.1	3.1	-	1
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.27					
Max part size (mm) mobilized at bankfull				90												90			58					
Stream Power (transport capacity) lb/s				37												35			25					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			C4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			4.5					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				373						-						373								
Channel Thalweg length (ft)				380						-						384			384					
Sinuosity (ft)				1.02						1.2 to 1.4						1.03			1.03					
Water Surface Slope (Channel) (ft/ft)				0.0076						-						0.0037			0.0027					
BF slope (ft/ft)				0.0076						-						0.0037			0.0027					
[3]Bankfull Floodplain Area (acres)				1.2						-						0.6			0.6					
[4]% of Reach with Eroding Banks				25%						-														
Channel Stability or Habitat Metric				0.14						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Stewarts Creek Mitigation Project (DMS No. 100023)

	Moores Fork Reach 1																			Moores Fork Reach 2						
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1097.06	1097.29	1097.29	1097.51				1094.84	1094.64	1094.32	1094.87				1088.77	1088.67	1088.77	1088.74							1088.20	1088.15		
Bank Height Ratio_Based on AB Bankfull[1] Area	1.20	1.05	1.06	1.09				1.18	1.04	1.44	1.27				1.00	1.06	1.01	1.03							1.00	1.03		
Thalweg Elevation	1094.10	1094.08	1094.13	1094.22				1092.41	1091.86	1091.47	1091.29				1086.14	1085.92	1085.96	1085.79							1084.17	1084.34		
LTOB[2] Elevation	1097.67	1097.46	1097.44	1097.44				1095.28	1094.76	1095.57	1095.84				1088.77	1088.82	1088.79	1088.84							1088.20	1088.26		
LTOB[2] Max Depth (ft)	3.57	3.38	3.31	3.57				2.87	2.90	4.10	4.55				2.63	2.90	2.83	3.05							4.03	3.92		
LTOB[2] Cross Sectional Area (ft^2)	93.76	77.33	76.98	80.46				75.98	65.20	100.49	107.47				45.04	48.74	45.43	47.29							66.40	69.97		

	Moores Fork Reach 3																										
	Cross Section 5 (Riffle)							Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area				1087.17	1087.61			1084.62	1084.29	1084.51	1084.44	1083.98			1083.10	1083.29	1083.10	1082.82	1083.00			1079.97	1080.11	1080.17	1080.13	1079.98		
Bank Height Ratio_Based on AB Bankfull[1] Area				1.00	0.85			1.00	1.08	1.07	1.07	1.33			1.00	0.94	1.01	1.09	1.03			1.00	0.95	0.83	0.98	1.04		
Thalweg Elevation				1084.14	1084.83			1081.95	1081.29	1081.57	1081.13	1081.65			1080.56	1080.63	1080.46	1079.25	1079.60			1077.41	1077.37	1077.29	1077.28	1077.26		
LTOB[2] Elevation				1087.17	1087.20			1084.62	1084.54	1084.72	1084.68	1085.17			1083.10	1083.13	1083.13	1083.16	1083.10			1079.97	1079.97	1079.68	1080.06	1080.08		
LTOB[2] Max Depth (ft)				3.03	2.37			2.67	3.25	3.15	3.55	3.52			2.54	2.50	2.67	3.91	3.50			2.56	2.60	2.39	2.78	2.82		
LTOB[2] Cross Sectional Area (ft^2)				52.43	37.91			53.58	61.60	60.33	60.90	73.30			33.72	30.17	34.27	39.95	35.65			33.89	31.07	25.77	32.55	35.83		

	Moores Fork Reach 3							UT1																			
	Cross Section 9 (Pool)							Cross Section 10 (Riffle)							Cross Section 11 (Pool)							Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1080.16	1079.98	1080.07	1080.04	1079.97			1111.02	1111.05	1111.14	1111.24				1104.40	1104.45	1104.65	1104.74				1102.01	1102.14	1102.11	1102.16			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04	0.97	1.00	1.10			1.08	0.95	0.99	0.84				1.00	0.95	0.75	0.74				1.00	0.79	0.92	0.75			
Thalweg Elevation	1076.12	1075.02	104.84	1074.91	1074.81			1110.22	1110.23	1110.30	1110.23				1103.15	1103.19	1103.13	1103.36				1101.20	1101.33	1101.19	1101.2			
LTOB[2] Elevation	1080.16	1080.16	1079.90	1080.03	1080.49			1111.09	1111.01	0.83	111.08				1104.40	1104.38	1104.28	1104.38				1102.01	1101.97	1102.03	1101.92			
LTOB[2] Max Depth (ft)	4.04	5.14	5.06	5.12	5.68			0.87	0.78	3.79	0.85				1.25	1.19	1.15	1.02				0.81	0.64	0.84	0.72			
LTOB[2] Cross Sectional Area (ft^2)	52.58	57.57	49.07	52.42	66.82			4.40	3.60	7.53	3.28				5.48	4.92	3.67	3.12				3.92	2.78	3.39	2.45			

	UT1																										
	Cross Section 13 (Pool)							Cross Section 14 (Pool)							Cross Section 15 (Pool)							Cross Section 16 (Riffle)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1088.55	1088.46	1088.51	1088.66				1085.64	1085.57	1085.58	1085.71				1080.95	1080.95	1081.26	1081.27				1078.41	1078.47	1078.47	1078.52			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.10	1.23	0.94	1.01				1.00	1.08	1.09	1.01				1.00	0.98	0.69	0.7				1.00	0.99	0.92	0.87			
Thalweg Elevation	1087.40	1087.29	1087.19	1087.15				1084.50	1084.43	1084.36	1084.41				1079.42	1079.39	1079.27	1079.31				1077.44	1077.44	1077.46	1077.57			
LTOB[2] Elevation	1088.67	1088.73	1088.43	1088.68				1085.64	1085.66	1085.69	1085.73				1080.95	1080.91	1080.64	1080.68				1078.41	1078.46	1078.39	1078.39			
LTOB[2] Max Depth (ft)	1.27	1.44	1.24	1.53				1.14	1.23	1.33	1.32				1.53	1.52	1.37	1.37				0.97	1.02	0.93	0.82			
LTOB[2] Cross Sectional Area (ft^2)	6.64	8.60	4.95	6.83				4.63	5.61	5.83	4.77				6.90	6.40	3.76	4.01				3.69	3.65	3.23	2.95			

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Stewarts Creek Mitigation Project (DMS No. 100023)

	UT2																				UT3 Reach 1						
	Cross Section 17 (Pool)							Cross Section 18 (Riffle)							Cross Section 19 (Riffle)							Cross Section 20 (Pool)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1098.12	1098.08	1098.10	1098.23				1097.77	1097.72	1097.76	1097.78				1092.07	1092.04	1092.07	1092.23				1095.67	1095.56	1095.64	1095.96			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04	1.03	0.92				1.04	1.13	1.10	1.07				1.08	1.01	1.04	0.83				1.00	1.11	1.03	0.64			
Thalweg Elevation	1096.73	1096.52	1096.48	1096.63				1097.08	1097.09	1097.10	1097.1				1091.33	1091.31	1091.33	1091.33				1094.51	1094.58	1094.43	1094.43			
LTOB[2] Elevation	1098.12	1098.14	1098.14	1098.1				1097.80	1097.81	1097.83	1097.873				1092.13	1092.05	1092.10	1092.1				1095.67	1095.67	1095.67	1095.41			
LTOB[2] Max Depth (ft)	1.39	1.62	1.66	1.47				0.72	0.72	0.73	0.73				0.80	0.74	0.77	0.77				1.16	1.09	1.24	0.98			
LTOB[2] Cross Sectional Area (ft^2)	5.42	5.90	5.72	4.4				2.61	3.02	2.90	2.9				3.52	3.20	3.35	3.35				5.72	9.02	6.71	2.86			

	UT3 Reach 1							UT3 Reach 2																			
	Cross Section 21 (Riffle)							Cross Section 22 (Pool)							Cross Section 23 (Riffle)							Cross Section 24 (Pool)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1092.21	1092.24	1092.32	1092.51				1089.56	1089.52	1089.55	1089.62				1087.39	1087.41	1087.48	1087.67				1081.92	1081.94	1081.95	1082.27			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.12	1.11	1.10	0.9				1.00	1.04	1.08	1.02				1.13	1.06	1.01	0.74				1.11	1.04	1.03	0.86			
Thalweg Elevation	1091.48	1091.45	1091.48	1091.52				1088.31	1088.34	1088.17	1088.26				1086.53	1086.52	1086.56	1086.62				1080.48	1080.48	1080.41	1080.51			
LTOB[2] Elevation	1092.3	1092.32	1092.41	1092.41				1089.56	1089.57	1089.66	1089.64				1087.50	1087.47	1087.49	1087.4				1082.08	1082.00	1082	1082			
LTOB[2] Max Depth (ft)	0.82	0.87	0.93	0.89				1.25	1.23	1.49	1.38				0.97	0.95	0.93	0.78				1.60	1.52	1.59	1.51			
LTOB[2] Cross Sectional Area (ft^2)	3.71	3.71	3.75	3.02				6.88	7.47	8.19	7.21				5.95	5.40	5.03	3.81				8.93	7.59	7.54	6.59			

	UT3 Reach 2													
	Cross Section 25 (Riffle)							Cross Section 26 (Pool)						
	MY0	MY1	MY2	MY3	MY4	MY5	MY7	MY0	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1081.58	1081.59	1081.62	1081.59				1077.31	1077.29	1077.20	1077.33			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.01	0.98	1.03				1.00	1.01	1.10	0.99			
Thalweg Elevation	1080.54	1080.52	1080.49	1080.57				1075.90	1075.60	1075.84	1075.79			
LTOB[2] Elevation	1081.58	1081.60	1081.60	1081.62				1077.31	1077.31	1077.34	1077.31			
LTOB[2] Max Depth (ft)	1.04	1.08	1.11	1.05				1.41	1.71	1.50	1.52			
LTOB[2] Cross Sectional Area (ft^2)	4.54	4.65	4.41	4.76				7.58	7.84	9.12	7.41			

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

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2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Appendix D: Hydrologic Data

Table 10. Verification of Bankfull Events

Figure 2. Monthly Rainfall Summary

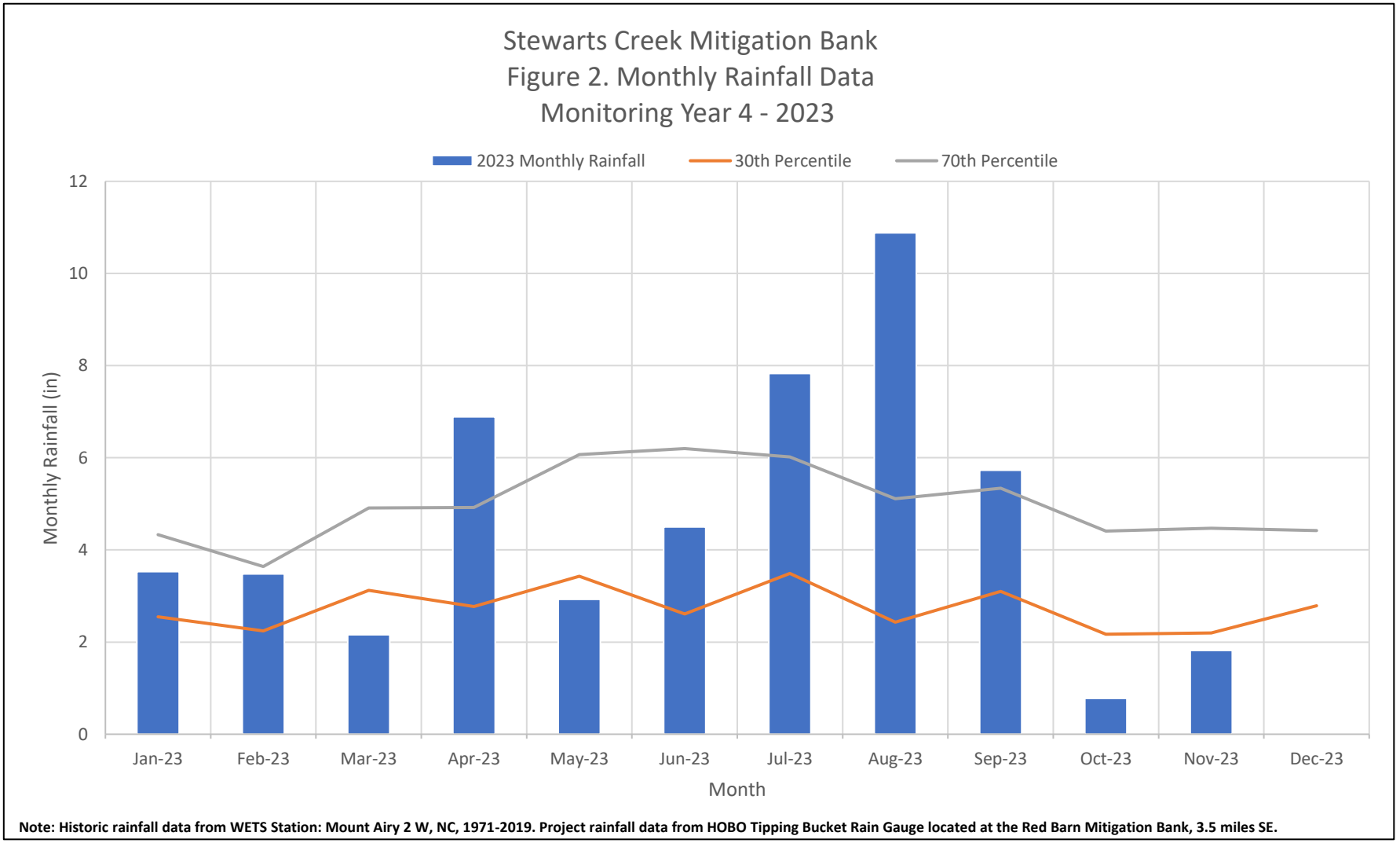
Precipitation and Water Level Hydrographs

Table 11. Streamflow Summary Data

Table 10. Bankfull Event Verification
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023)

Overbank Events							
Gage ID	**MY1 (2020)**	**MY2 (2021)**	**MY3 (2022)**	**MY4 (2023)**	**MY5 (2025)**	**MY6 (2026)**	**MY7 (2027)**
UT1 - SCTSG1	5 separate events: 4/30/2020 5/27/2020-5/28/2020 8/15/2020 10/11/2020 10/29/2020	1 event 8/18/2021	4 separate events: 1/3/2022 5/26/2022 7/8/2022 8/22/2022	**6 separate events:** 3/3/2023 4/28/2023 6/19/2023-6/20/2023 7/16/2023 7/29/2023 8/28/2023	-	-	-
UT1 - *SCTSG2	2 separate events: 4/30/2020 10/29/2020	8 separate events 3/19/2021 4/10/2021 5/28/2021 6/12/2021 7/2/2021 7/17/2021 8/18/2021 9/22/2021	1 event: 8/22/2022	**9 separate events:** 2/12/2023 3/3/2023 4/28/2023 5/28/2023 6/19/2023 7/15/2023 7/29/2023 8/3/2023 8/28/2023	-	-	-
UT3 Reach 1 - SCTSG3	4 separate events: 7/29/2020-8/1/2020 8/5/2020-8/6/2020 10/13/2020-10/15/2020 10/29/2020	3 separate events 3/19/2021 6/12/2021 8/18/2021	5 separate events: 1/3/2022 3/24/2022 5/26/2022 7/13/2022 8/22/2022	**6 separate events:** 2/12/2023 3/3/2023 4/28/2023 6/19/2023 8/3/2023 8/28/2023	-	-	-
UT3 Reach 2 - *SCTSG4	11 separate events: 4/30/2020 5/23/2020 5/27/2020-5/28/2020 7/10/2020 8/3/2020 8/5/2020 8/15/2020 9/11/2020 9/29/2020 10/11/2020 10/29/2020	6 separate events 3/19/2021 4/10/2021 6/12/2021 7/18/2021 8/18/2021 9/22/2021	4 separate events: 8/22/2022 9/8/2022 11/11/2022 12/15/2022	**14 separate events:** 1/14/2023 1/25/2023 2/12/2023 3/3/2023-3/4/2023 4/22/2023 4/28/2023 5/28/2023-5/29/2023 6/19/2023-6/20/2023 6/22/2023 7/9/2023 7/16/2023 7/29/2023 8/3/2023-8/4/2023 8/28/2023	-	-	-
UT2 - SCTSG5	No bankfull events	1 event 8/18/2021	3 separate events: 1/3/2022 11/6/2022 11/11/2022	**8 separate events:** 2/12/2023-2/14/2023 2/17/2023 3/3/2023-3/4/2023 4/1/2023-4/2/2023 4/4/2023-4/6/2023 4/11/2023-4/14/2023 4/28/2023 6/19/2023-6/20/2023	-	-	-

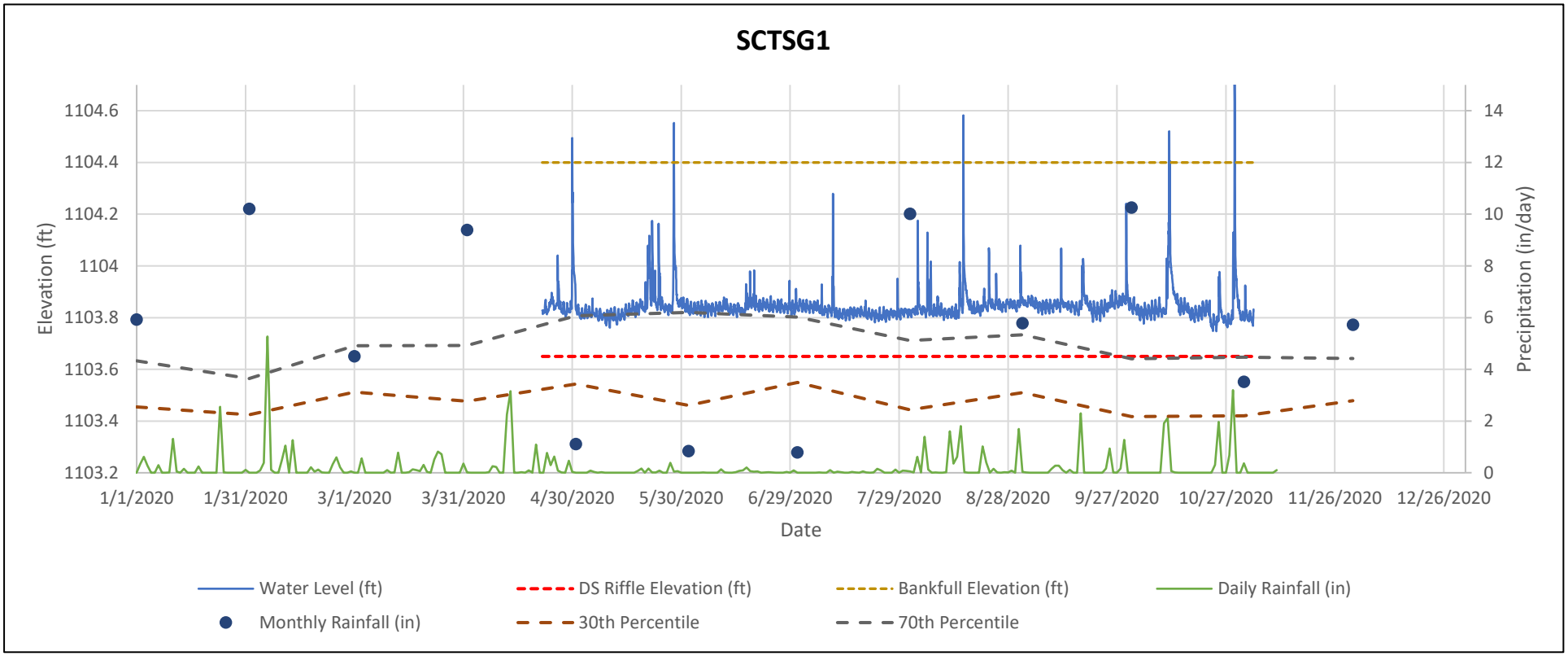
***Note:** SCTSG5 suffered gauge malfunctions from 7/25/2023 - 10/25/2023 in MY4. Corrupted data was not included in stream gauge plots.
SCTSG3 suffered gauge malfunctions from 9/13/2023 - 10/25/2023 in MY4. Corrupted data was not included in stream gauge plots.



Note: Historic rainfall data from WETS Station: Mount Airy 2 W, NC, 1971-2019. Project rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Rainfall Summary							
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Annual Precip Total	67.90	49.25	60.4	50.53	-	-	-
WETS 30th Percentile	43.95	43.95	43.95	43.95	-	-	-
WETS 70th Percentile	52.86	52.86	52.86	52.86	-	-	-
Normal	Y	Y	Y	Y	-	-	-

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

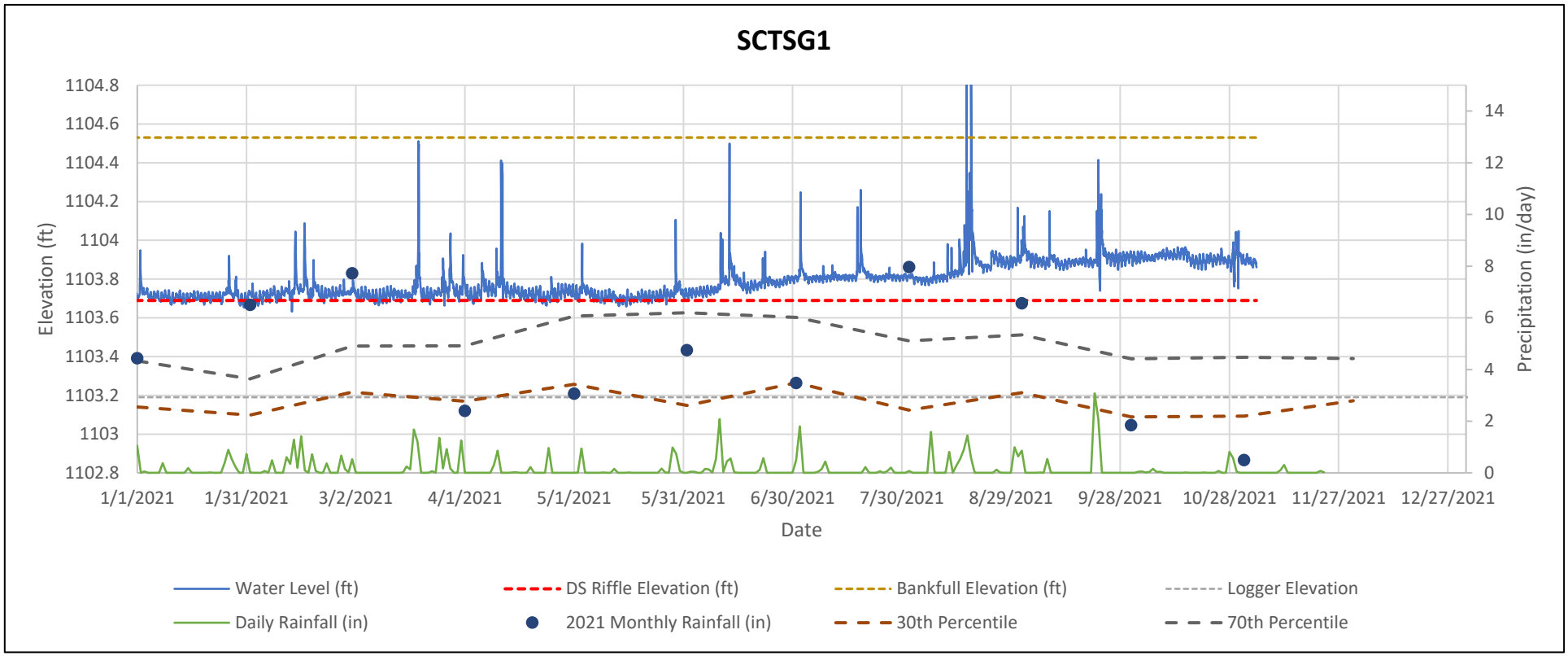


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20727103
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG1
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1103.23
Controlling Grade Elevation (ft)	1103.65
Bankfull Elevation (ft)	1104.4
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.35
Bankfull Events	6
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 2 (2021) Streamflow Data

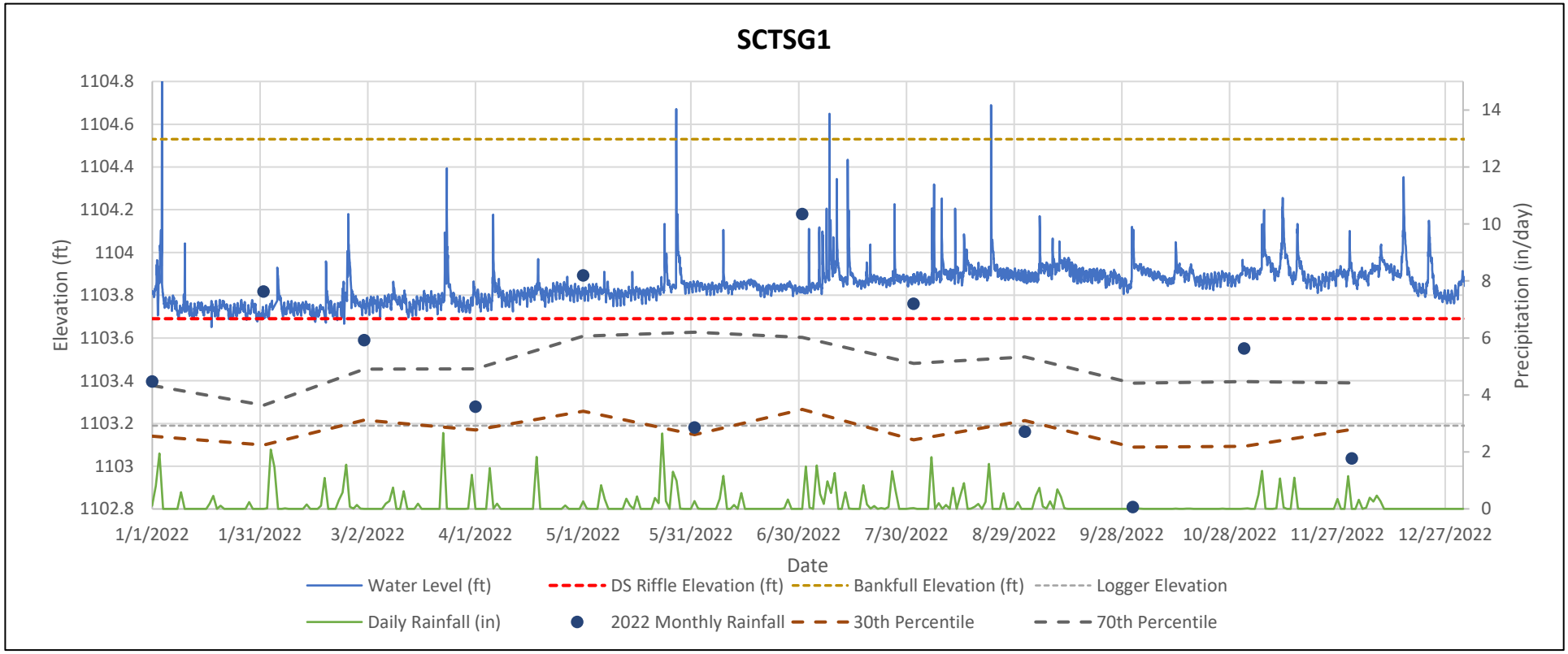


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20727103
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 2 (2021) Streamflow Data	
Gauge ID	SCTSG1
Start Date	1/1/2021
End Date	12/31/2021
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1103.19
Controlling Grade Elevation (ft)	1103.69
Bankfull Elevation (ft)	1104.53
Most Consecutive Days of Flow	308
Total Days of Flow	308
Max High Water Level Above Bankfull (ft)	0.50
Bankfull Events	1
Meets Flow Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 3 (2022) Streamflow Data



Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20727103
Reach Type	Perennial

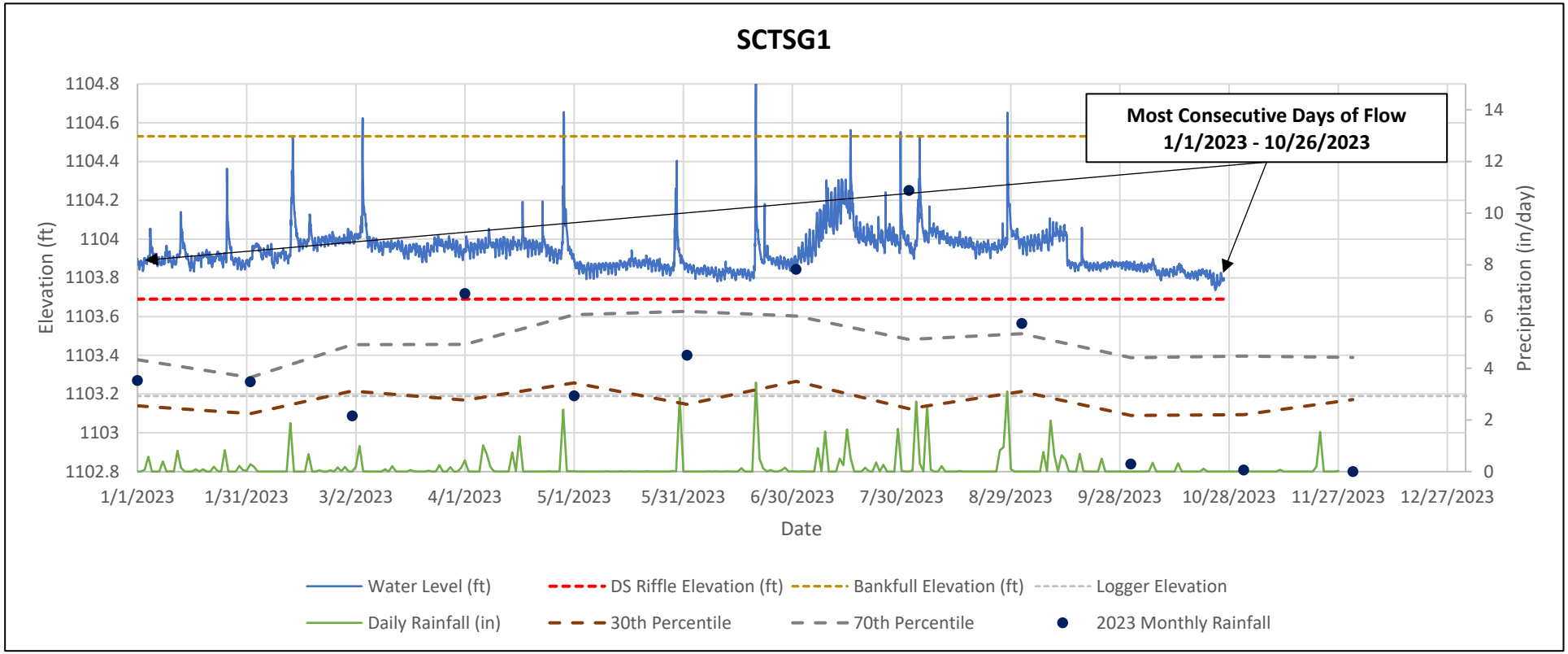
*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Site, 0.75 miles SE.

Most Consecutive Days of Flow: 1/1/2022 - 12/31/2022

Note: Barometric Erroneous Data 1/23/2022 (1100-1400), 2/3/2022 (1100-2400), 2/4/2022 (0000-1800), 2/17/2022 (1500-2400), 2/18/2022 (0000-0700), 2/22/2022 (1400-1900), 2/23/2022 (1100-1400), 2/25/2022 (1200-

Year 3 (2022) Streamflow Data	
Gauge ID	SCTSG1
Start Date	1/1/2022
End Date	12/31/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1103.19
Controlling Grade Elevation (ft)	1103.69
Bankfull Elevation (ft)	1104.53
Most Consecutive Days of Flow	365
Total Days of Flow	365
Max High Water Level Above Bankfull (ft)	0.39
Bankfull Events	4
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 4 (2023) Streamflow Data

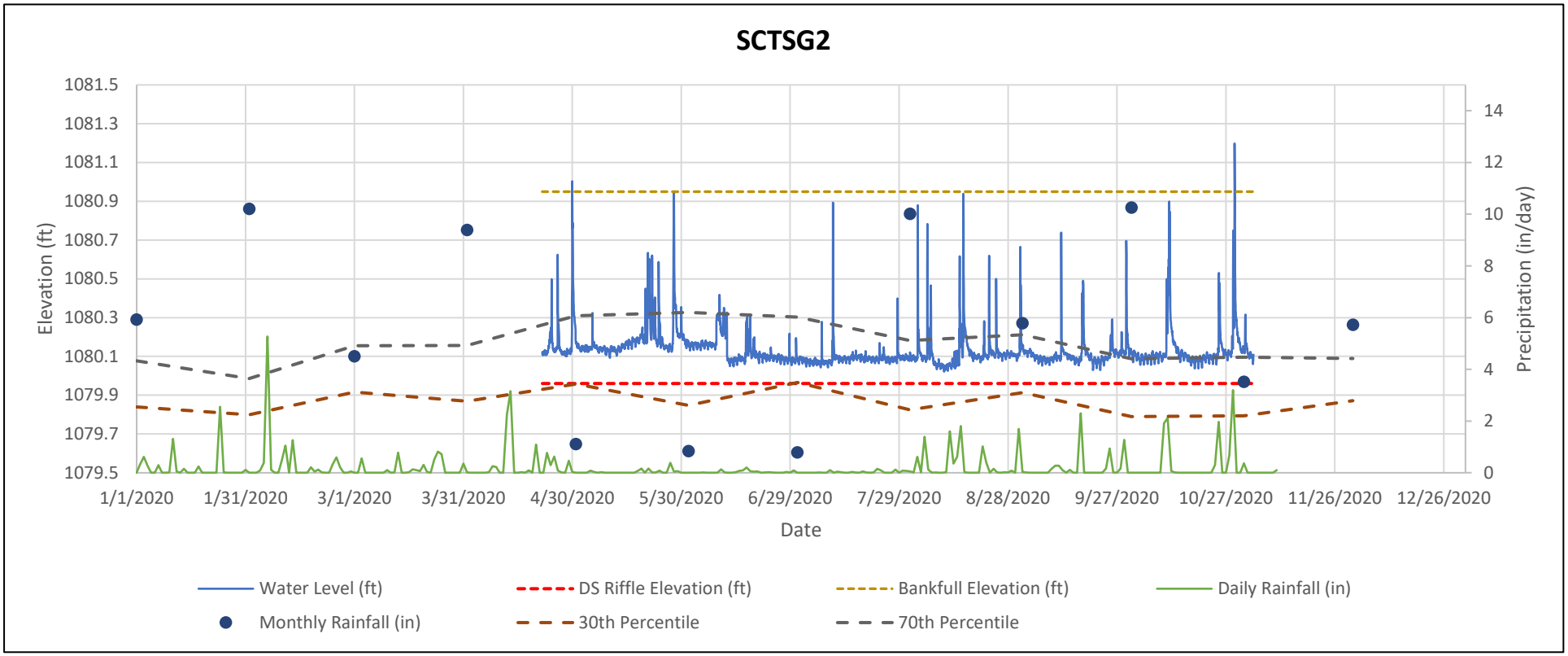


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20727103
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.
*Rainfall data was supplimented fom AGACIS Mount Airy 2 West from 06/14/2023-06/27/2023, 05/30/2023, 04/28/2023, 10/7/2023-11/28/2023

Year 4 (2023) Streamflow Data	
Gauge ID	SCTSG1
Start Date	1/1/2023
End Date	10/26/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1103.19
Controlling Grade Elevation (ft)	1103.69
Bankfull Elevation (ft)	1104.53
Most Consecutive Days of Flow	298
Total Days of Flow	298
Max High Water Level Above Bankfull (ft)	0.37
Bankfull Events	6
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

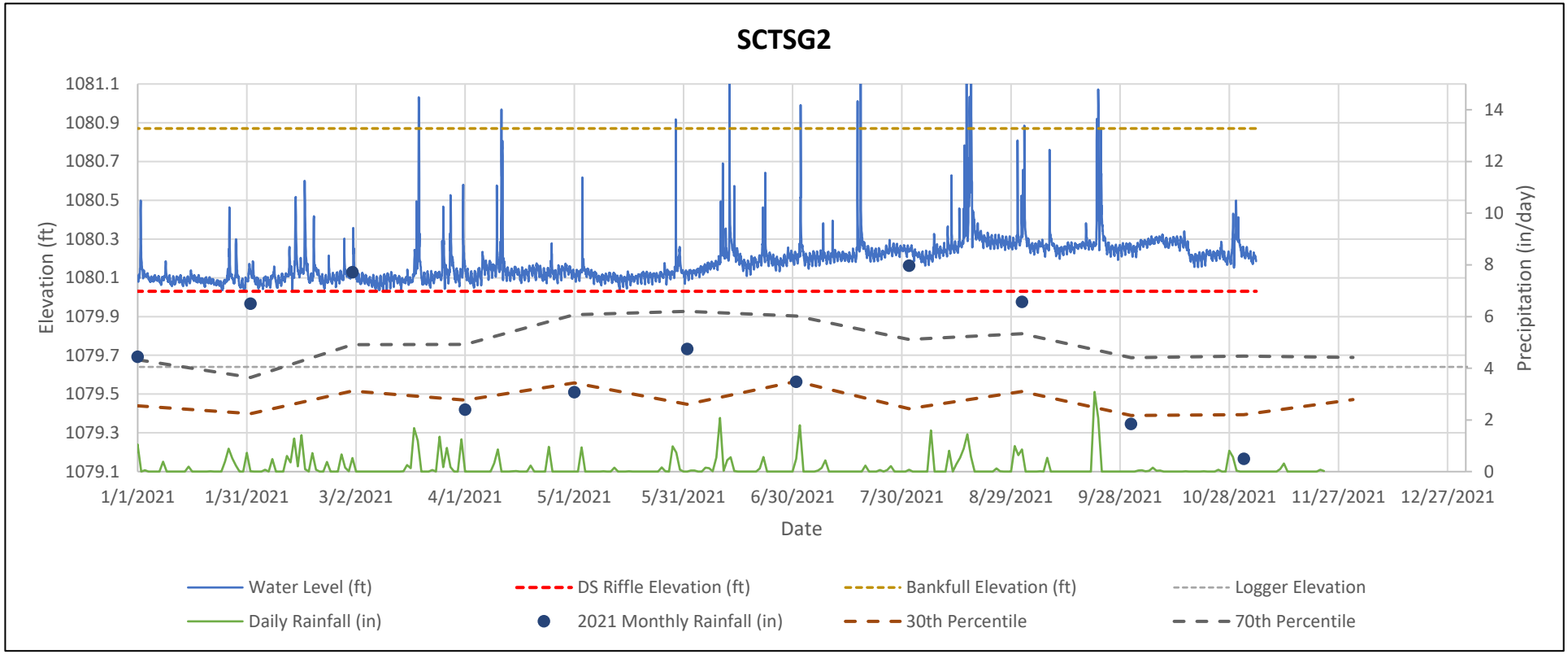


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20234981
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG2
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1079.65
Controlling Grade Elevation (ft)	1079.96
Bankfull Elevation (ft)	1080.95
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.25
Bankfull Events	2
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 2 (2021) Streamflow Data

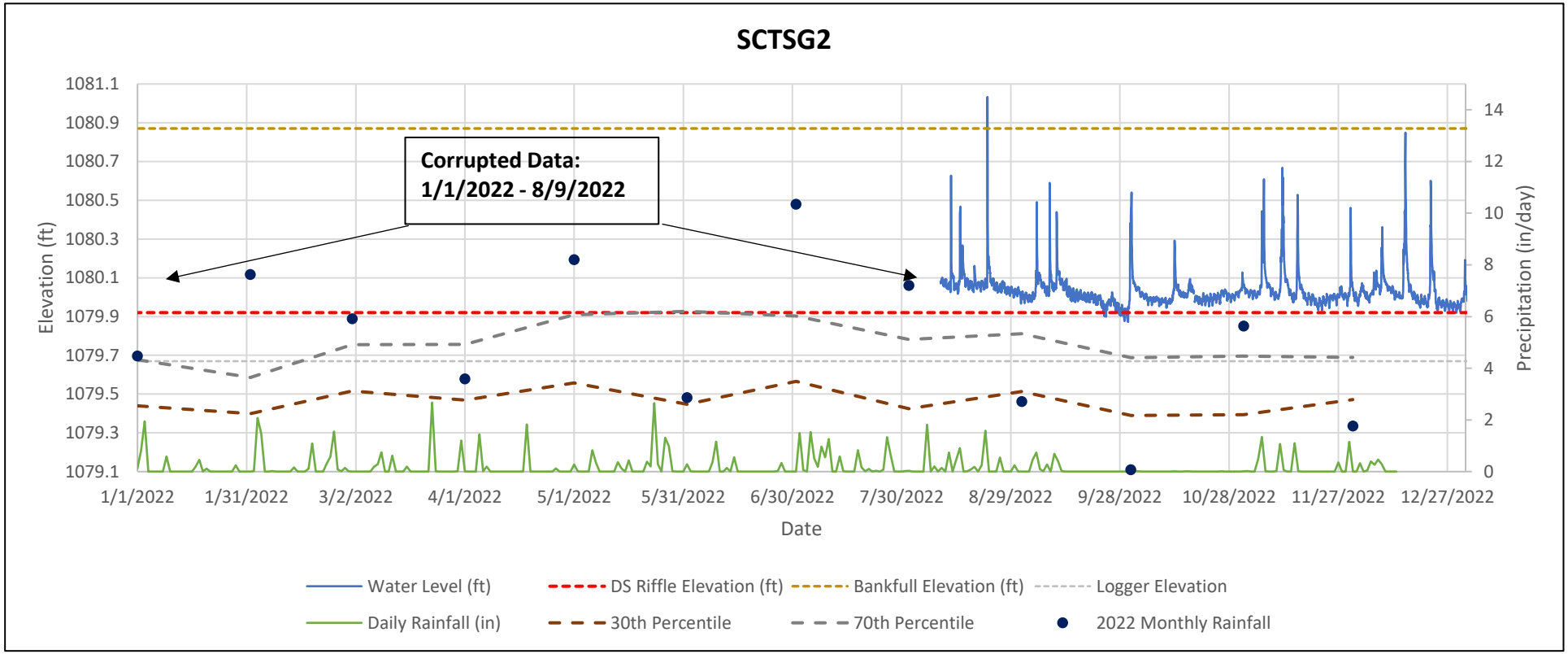


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20234981
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 2 (2021) Streamflow Data	
Gauge ID	SCTSG2
Start Date	1/1/2021
End Date	12/31/2021
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1079.64
Controlling Grade Elevation (ft)	1080.03
Bankfull Elevation (ft)	1080.87
Most Consecutive Days of Flow	308
Total Days of Flow	308
Max High Water Level Above Bankfull (ft)	0.88
Bankfull Events	8
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 3 (2022) Streamflow Data



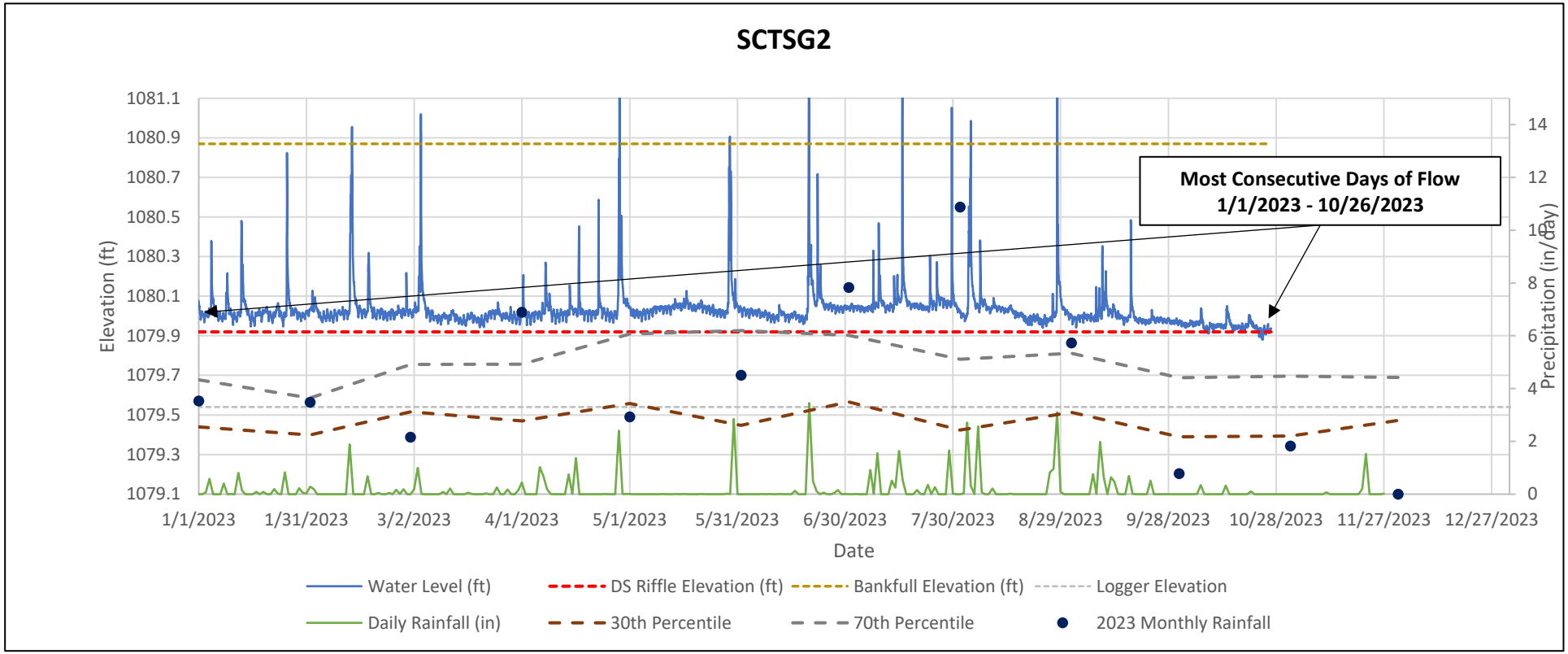
Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20234981
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Most Consecutive Days of Flow: 8/10/22 - 12/31/22
Note: SCTSG2 was resurveyed 2/1/2023

Year 3 (2022) Streamflow Data	
Gauge ID	SCTSG2
Start Date	1/1/2022
End Date	12/31/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1079.67
Controlling Grade Elevation (ft)	1079.92
Bankfull Elevation (ft)	1080.87
Most Consecutive Days of Flow	145
Total Days of Flow	145
Max High Water Level Above Bankfull (ft)	0.16
Bankfull Events	1
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 4 (2023) Streamflow Data

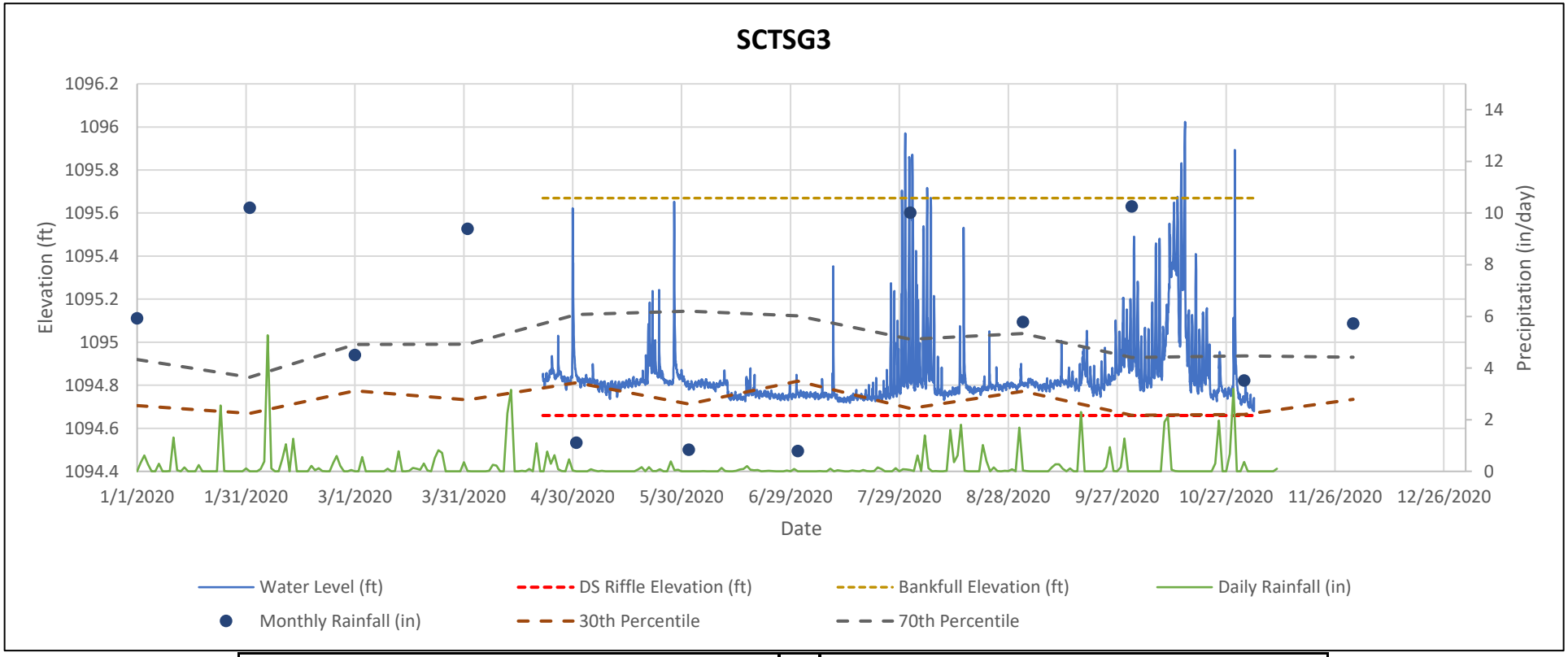


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20234981
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.
*Rainfall data was supplimented fom AGACIS Mount Airy 2 West from 06/14/2023-06/27/2023, 05/30/2023, 04/28/2023, 10/7/2023-11/28/2023.

Year 4 (2023) Streamflow Data	
Gauge ID	SCTSG2
Start Date	1/1/2023
End Date	10/26/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1079.67
Controlling Grade Elevation (ft)	1079.92
Bankfull Elevation (ft)	1080.87
Most Consecutive Days of Flow	298
Total Days of Flow	298
Max High Water Level Above Bankfull (ft)	0.77
Bankfull Events	9
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

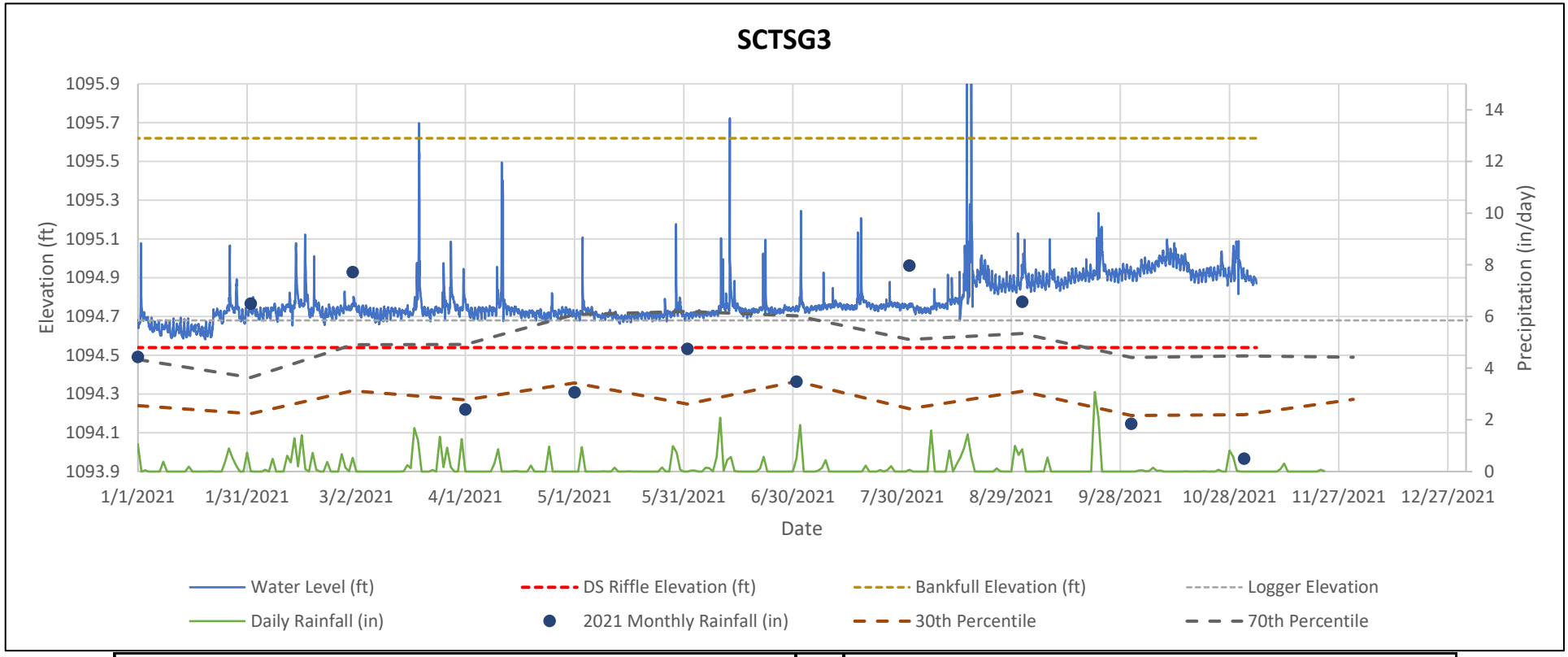


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 1
Date Installed	4/21/2020
Serial Number	20234982
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG3
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1094.68
Controlling Grade Elevation (ft)	1094.66
Bankfull Elevation (ft)	1095.67
Most Consecutive Days of Flow	167
Total Days of Flow	197
Max High Water Level Above Bankfull (ft)	0.35
Bankfull Events	10
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 2 (2021) Streamflow Data

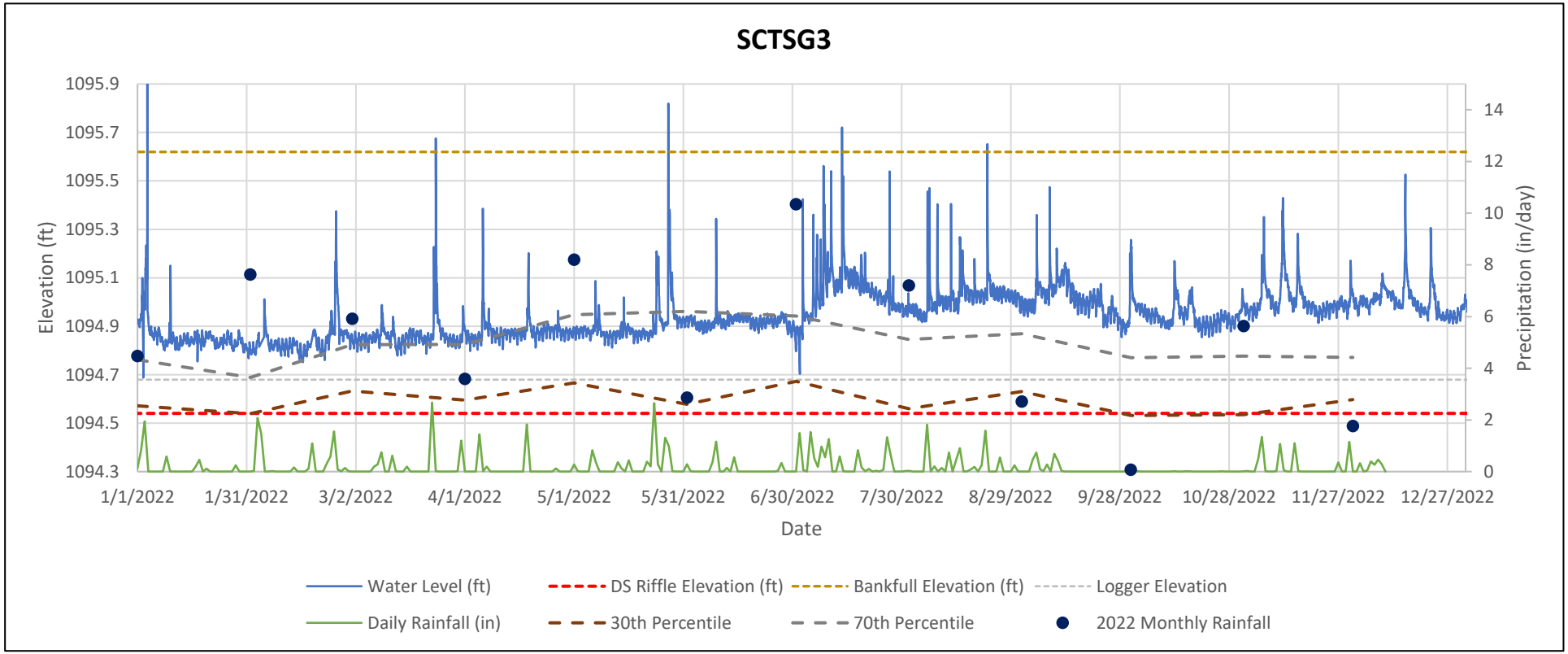


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 1
Date Installed	4/21/2020
Serial Number	20234982
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 2 (2021) Streamflow Data	
Gauge ID	SCTSG3
Start Date	1/1/2021
End Date	12/31/2021
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1094.55
Controlling Grade Elevation (ft)	1094.54
Bankfull Elevation (ft)	1095.62
Most Consecutive Days of Flow	290
Total Days of Flow	305
Max High Water Level Above Bankfull (ft)	0.53
Bankfull Events	3
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 3 (2022) Streamflow Data



Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 1
Date Installed	4/21/2020
Serial Number	20234982
Reach Type	Perennial

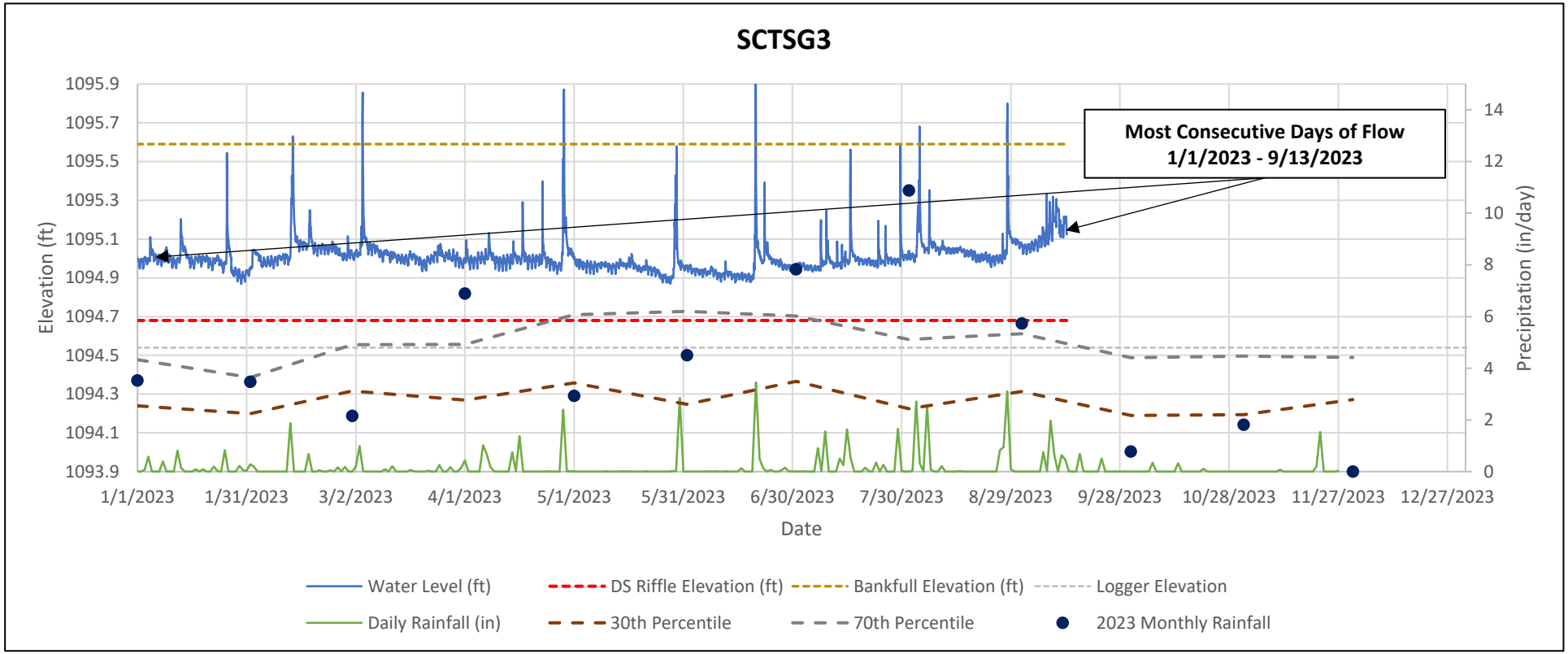
*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Most Consecutive Days of Flow: 1/1/2022 - 12/31/2022

Note: Barometric Erroneous Data 1/23/2022 (1100-1400), 2/3/2022 (1100-2400), 2/4/2022 (0000-1800), 2/17/2022 (1500-2400), 2/18/2022 (0000-1000), 2/22/2022 (1400-2000), 2/23/2022 (1000-1400), 2/25/2022 (1200-

Year 3 (2022) Streamflow Data	
Gauge ID	SCTSG3
Start Date	1/1/2022
End Date	12/31/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1094.55
Controlling Grade Elevation (ft)	1094.54
Bankfull Elevation (ft)	1095.62
Most Consecutive Days of Flow	365
Total Days of Flow	365
Max High Water Level Above Bankfull (ft)	0.42
Bankfull Events	5
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 4 (2023) Streamflow Data

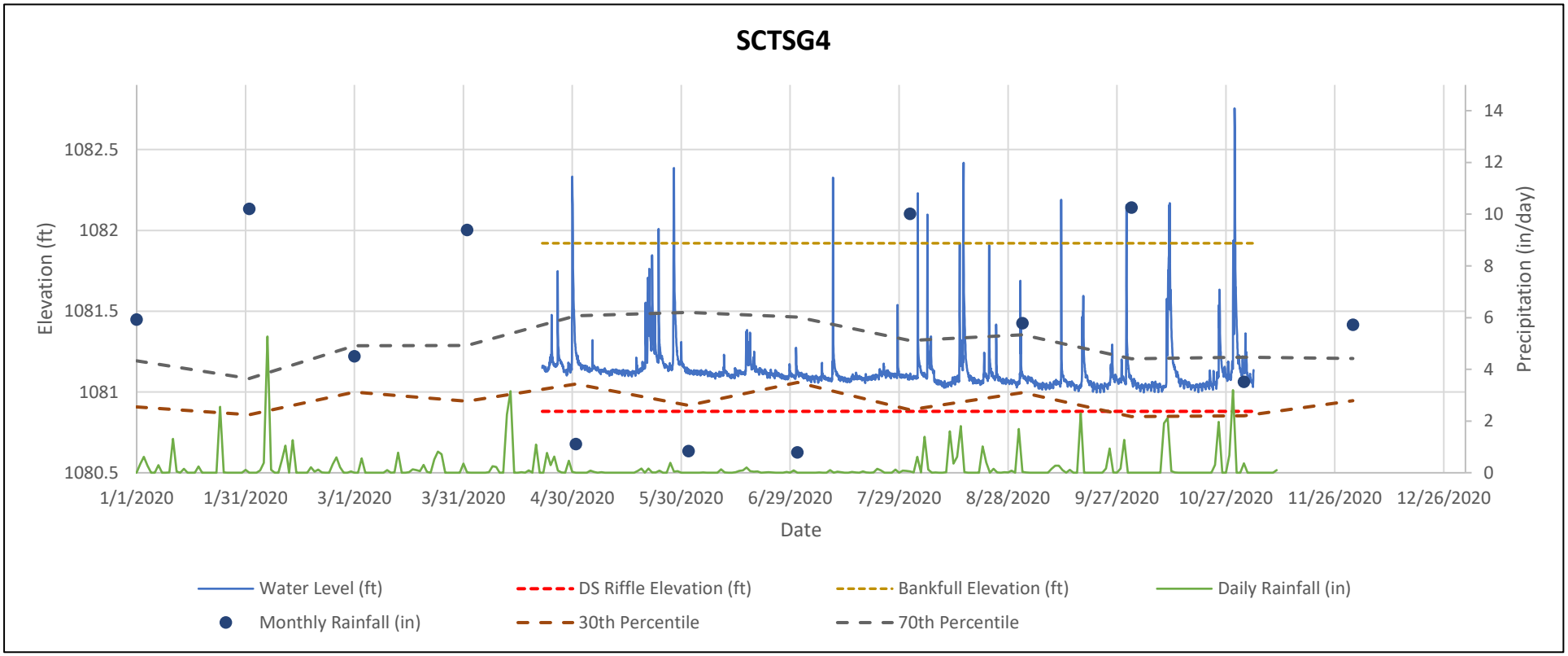


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 1
Date Installed	4/21/2020
Serial Number	20234982
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.
*This gauge was dead from 9/14/23-10/25/23 and was replaced on 10/26/23.
*Rainfall data was supplimented fom AGACIS Mount Airy 2 West from 06/14/2023-06/27/2023, 05/30/2023, 04/28/2023, 10/7/2023-11/28/2023.

Year 4 (2023) Streamflow Data	
Gauge ID	SCTSG3
Start Date	1/1/2023
End Date	9/13/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1094.54
Controlling Grade Elevation (ft)	1094.68
Bankfull Elevation (ft)	1095.59
Most Consecutive Days of Flow	256
Total Days of Flow	256
Max High Water Level Above Bankfull (ft)	0.40
Bankfull Events	6
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

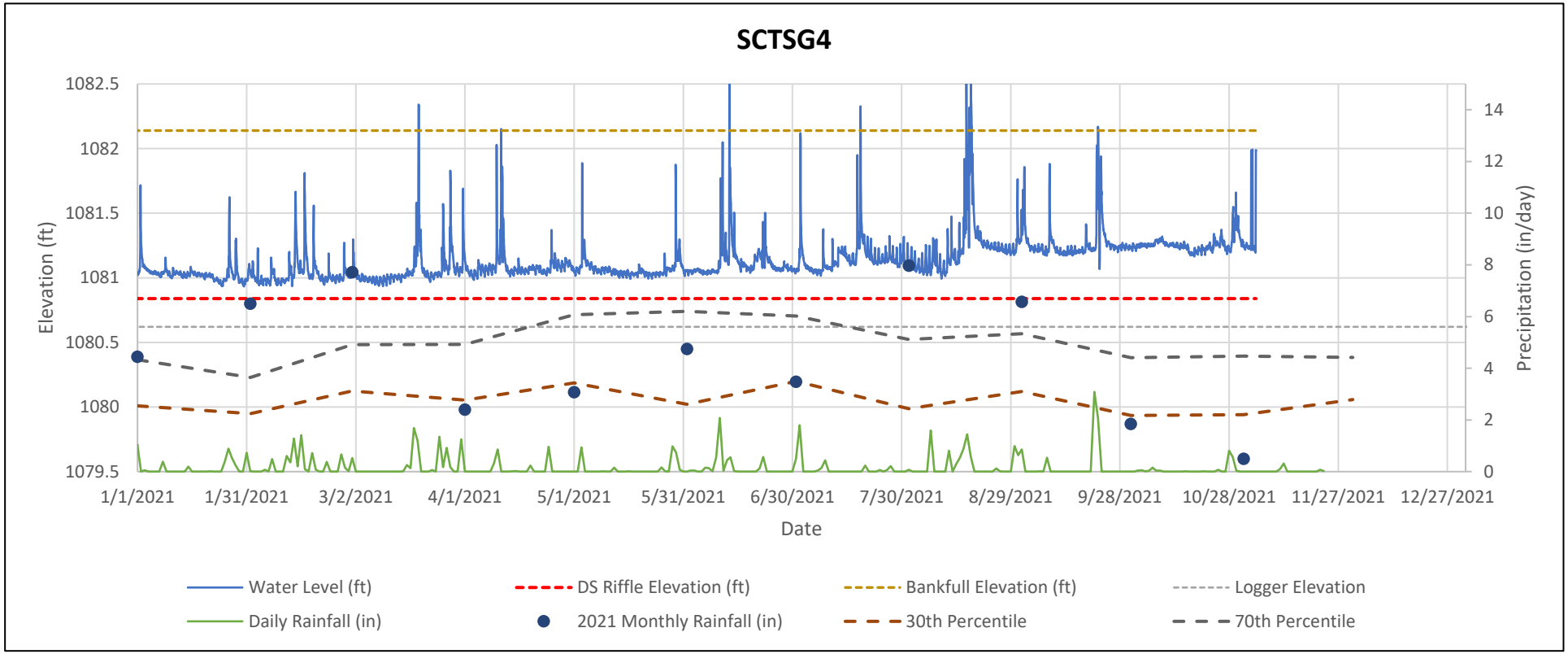


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 2
Date Installed	4/21/2020
Serial Number	20234980
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG4
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1080.63
Controlling Grade Elevation (ft)	1080.88
Bankfull Elevation (ft)	1081.92
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.84
Bankfull Events	13
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 2 (2021) Streamflow Data

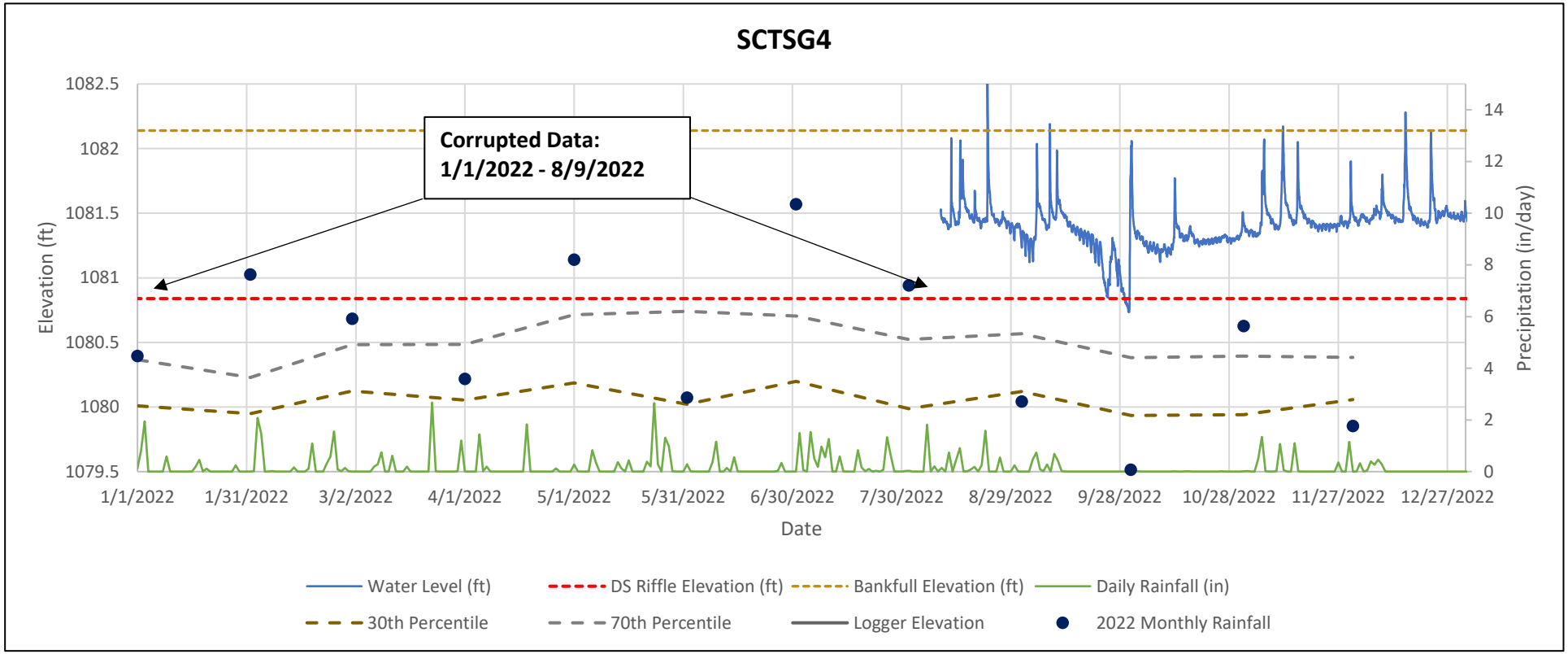


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 2
Date Installed	4/21/2020
Serial Number	20234980
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 2 (2021) Streamflow Data	
Gauge ID	SCTSG4
Start Date	1/1/2021
End Date	12/31/2021
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1080.62
Controlling Grade Elevation (ft)	1080.84
Bankfull Elevation (ft)	1082.14
Most Consecutive Days of Flow	308
Total Days of Flow	308
Max High Water Level Above Bankfull (ft)	0.71
Bankfull Events	6
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 3 (2022) Streamflow Data



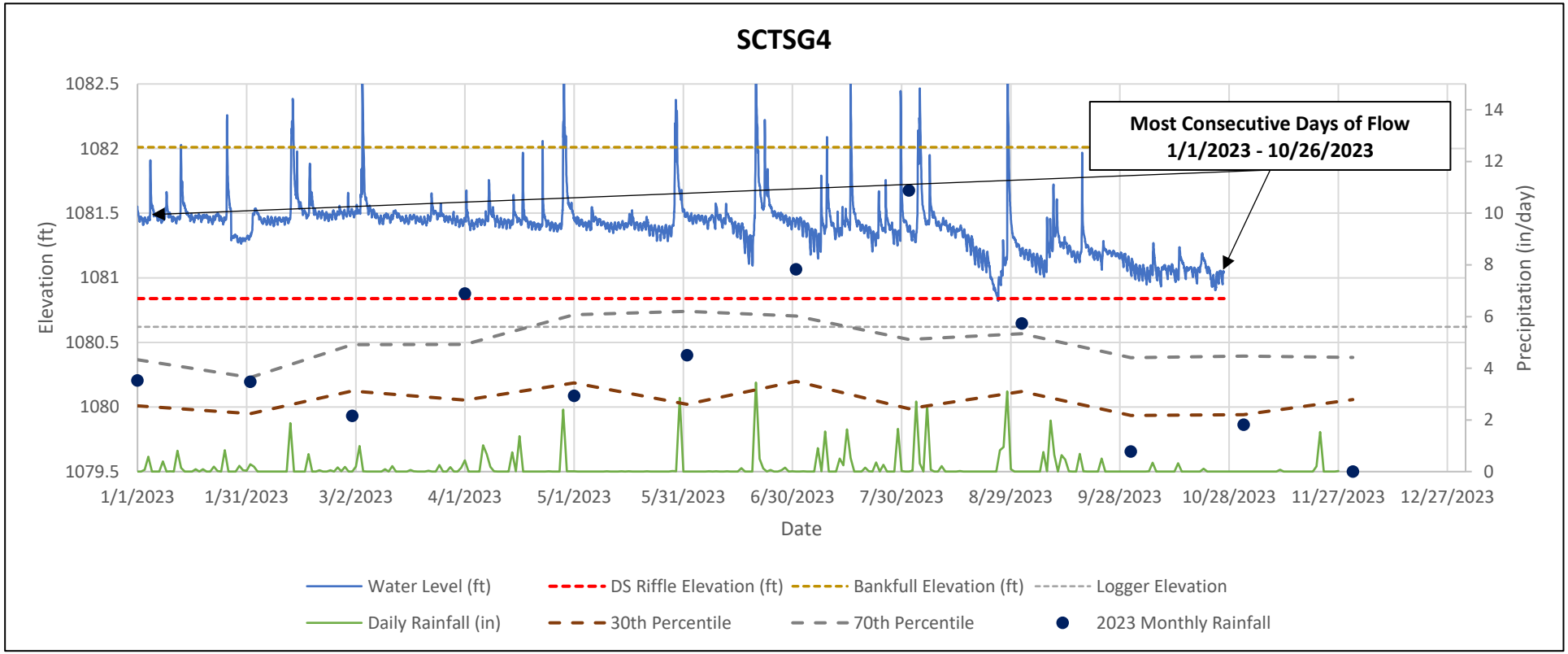
Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 2
Date Installed	4/21/2020
Serial Number	20234980
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Most Consecutive Days of Flow: 10/1/2022 - 12/31/2022

Year 3 (2022) Streamflow Data	
Gauge ID	SCTSG4
Start Date	1/1/2022
End Date	12/31/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1080.62
Controlling Grade Elevation (ft)	1080.84
Bankfull Elevation (ft)	1082.14
Most Consecutive Days of Flow	91
Total Days of Flow	144
Max High Water Level Above Bankfull (ft)	0.48
Bankfull Events	4
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 4 (2023) Streamflow Data

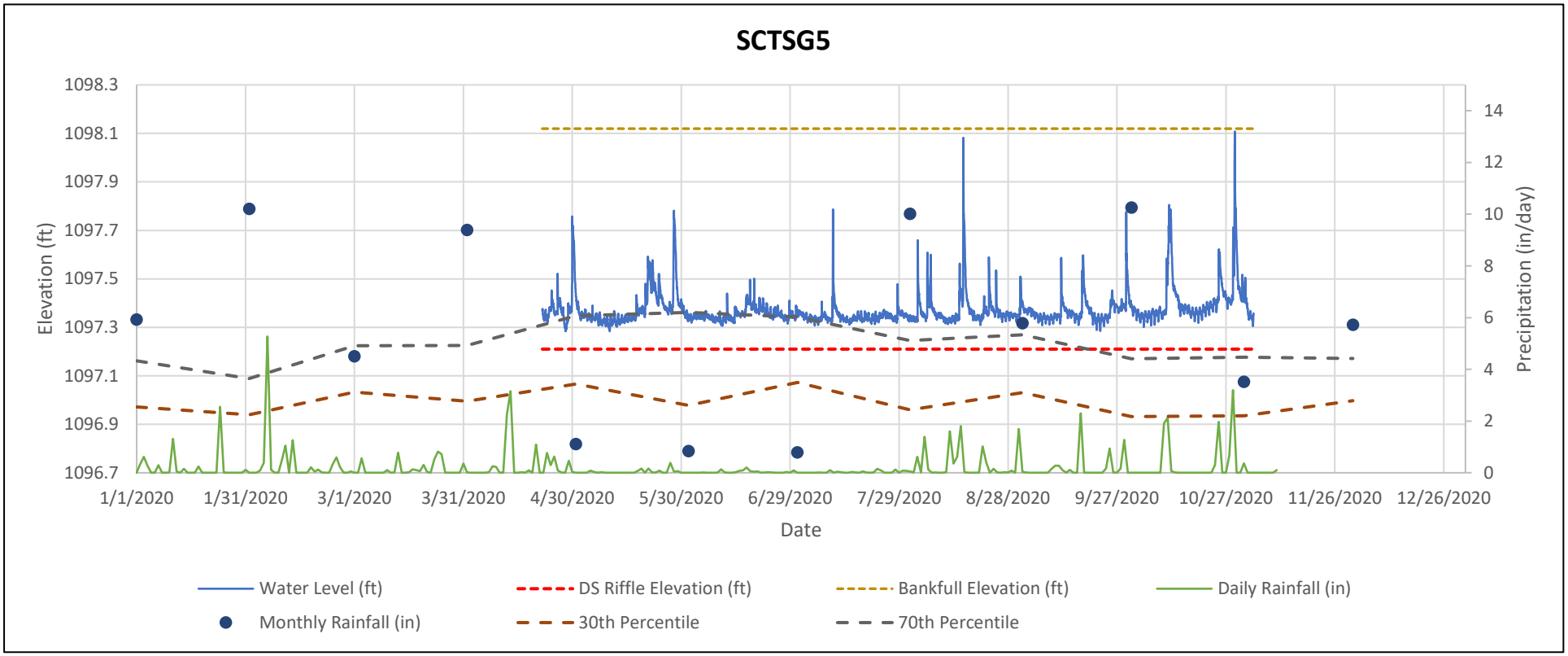


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 2
Date Installed	4/21/2020
Serial Number	20234980
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.
*Rainfall data was supplimented fom AGACIS Mount Airy 2 West from 06/14/2023-06/27/2023, 05/30/2023, 04/28/2023, 10/7/2023-11/28/2023.

Year 4 (2023) Streamflow Data	
Gauge ID	SCTSG4
Start Date	1/1/2023
End Date	10/26/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1080.62
Controlling Grade Elevation (ft)	1080.84
Bankfull Elevation (ft)	1082.01
Most Consecutive Days of Flow	299
Total Days of Flow	299
Max High Water Level Above Bankfull (ft)	1.17
Bankfull Events	14
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

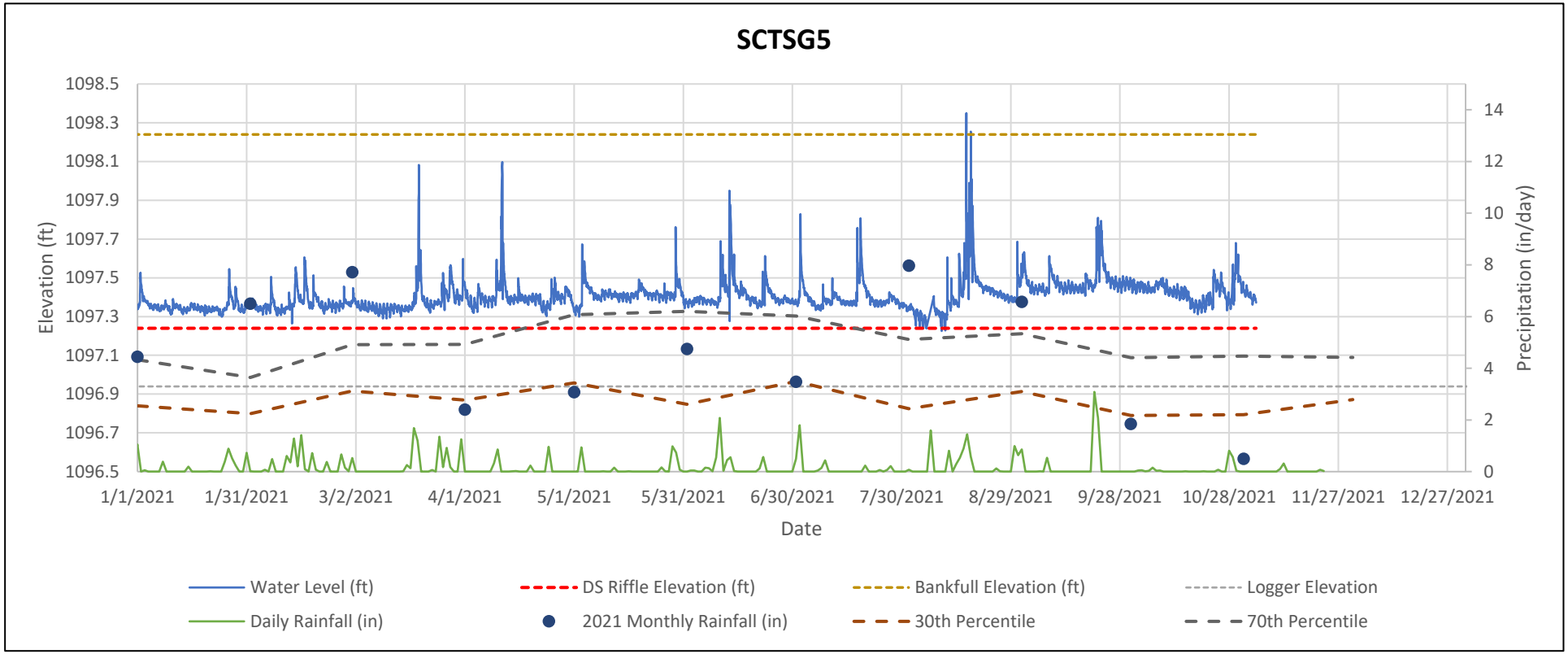


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT2
Date Installed	4/21/2020
Serial Number	20727118
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Site, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG5
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1096.96
Controlling Grade Elevation (ft)	1097.21
Bankfull Elevation (ft)	1098.12
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	-0.01
Bankfull Events	0
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 2 (2021) Streamflow Data

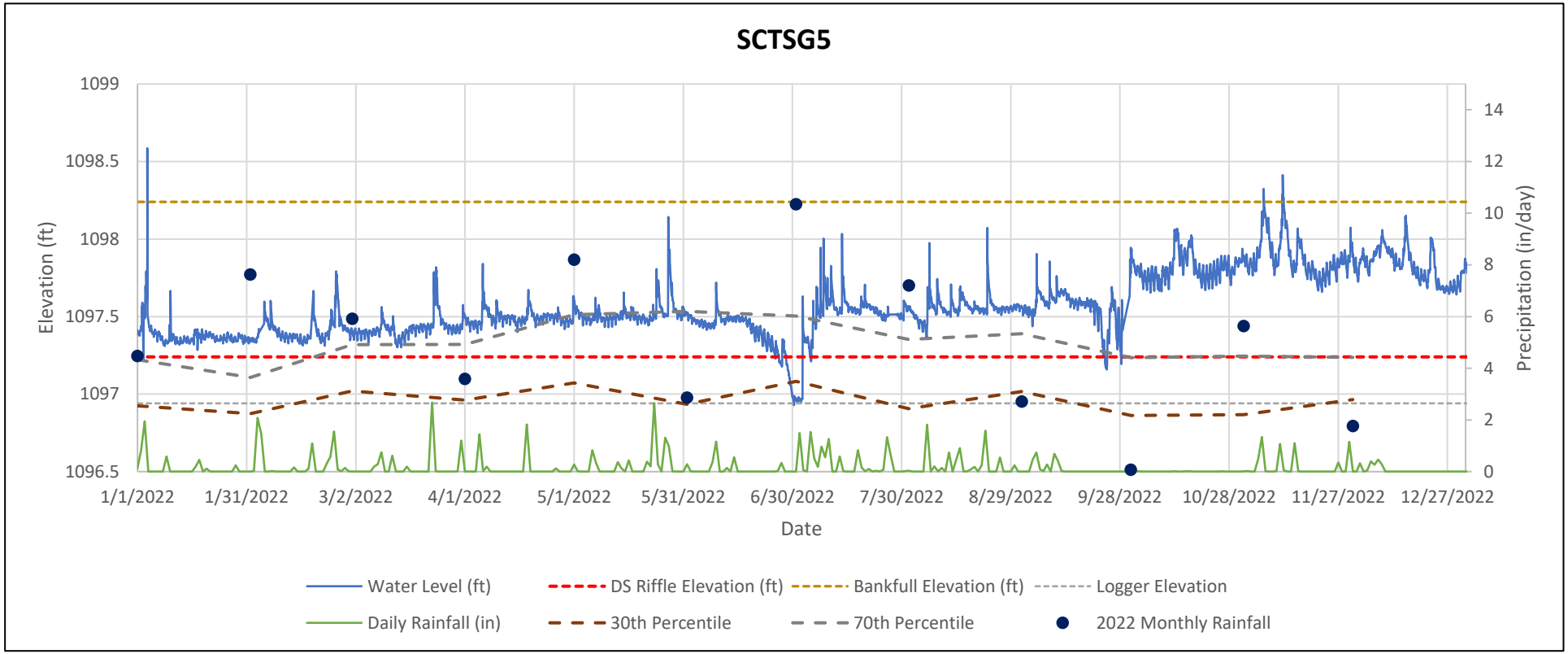


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT2
Date Installed	4/21/2020
Serial Number	20727118
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Site, 3.5 miles SE.

Year 2 (2021) Streamflow Data	
Gauge ID	SCTSG5
Start Date	1/1/2021
End Date	12/31/2021
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1096.94
Controlling Grade Elevation (ft)	1097.24
Bankfull Elevation (ft)	1098.24
Most Consecutive Days of Flow	217
Total Days of Flow	307
Max High Water Level Above Bankfull (ft)	0.11
Bankfull Events	1
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 3 (2022) Streamflow Data



Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT2
Date Installed	4/21/2020
Serial Number	20727118
Reach Type	Perennial

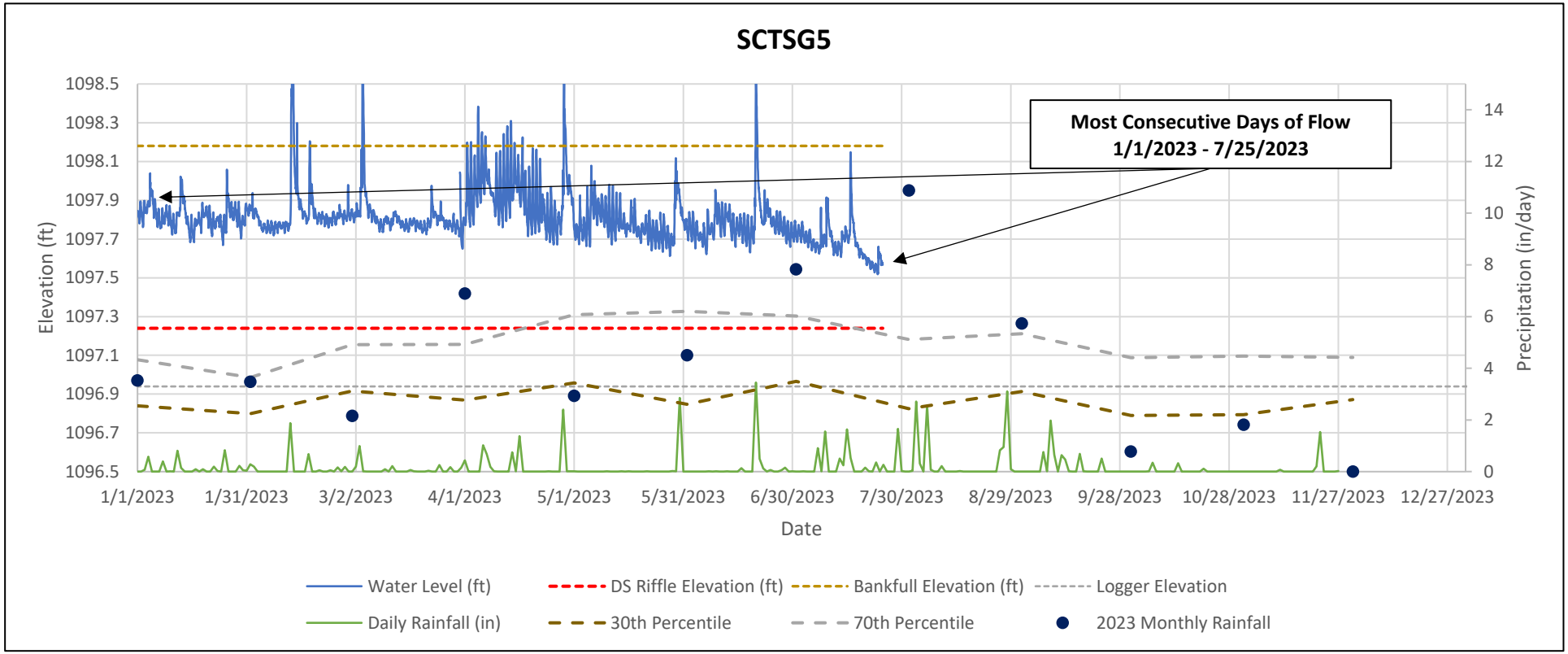
*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Most Consecutive Days of Flow: 1/1/2022 - 6/28/2022

Note: Barometric Erroneous Data: 1/23/2022 (1100-1400), 2/3/2022 (1100-2400), 2/4/2022 (0000-1800), 2/17/2022 (1500-2400), 2/18/2022 (0000-0800), 2/22/2022 (1400-2000), 2/23/2022 (1000-1400), 2/25/2022 (1200-1300), 3/24/2022 (1000-1200), 10/18 (1300-1400), 9/28/2022 (1800-2400), 9/29 (0000-2400), 9/30 (0000-1500)

Year 3 (2022) Streamflow Data	
Gauge ID	SCTSG5
Start Date	1/1/2022
End Date	12/31/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1096.94
Controlling Grade Elevation (ft)	1097.24
Bankfull Elevation (ft)	1098.24
Most Consecutive Days of Flow	179
Total Days of Flow	360
Max High Water Level Above Bankfull (ft)	0.35
Bankfull Events	3
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 4 (2023) Streamflow Data



Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT2
Date Installed	4/21/2020
Serial Number	20727118
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.
*Stream gauge 5 died starting on 7/25/23-10/25/23 causing no data to be recorded. A new battery was put in on 10/26/23.
*Rainfall data was supplimented fom AGACIS Mount Airy 2 West from 06/14/2023-06/27/2023, 05/30/2023, 04/28/2023, 10/7/2023-11/28/2023.

Year 4 (2023) Streamflow Data	
Gauge ID	SCTSG5
Start Date	1/1/2023
End Date	7/25/2023
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1096.94
Controlling Grade Elevation (ft)	1097.24
Bankfull Elevation (ft)	1098.18
Most Consecutive Days of Flow	205
Total Days of Flow	205
Max High Water Level Above Bankfull (ft)	0.65
Bankfull Events	8
Meets Success Criteria	Yes

Table 11. Streamflow Summary Data
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023)

Most Consecutive Days of Flow							
Gage ID	**MY1 (2020)**	**MY2 (2021)**	**MY3 (2022)**	**MY4 (2023)**	**MY5 (2025)**	**MY6 (2026)**	**MY7 (2027)**
UT1 - SCTSG1	167	308	365	298	-	-	-
UT1 - *SCTSG2	167	308	145	298	-	-	-
UT3 Reach 1 - SCTSG3	167	290	365	256	-	-	-
UT3 Reach 2 - *SCTSG4	167	308	91	299	-	-	-
UT2 - SCTSG5	167	217	179	205	-	-	-

***Note:** SCTSG5 suffered gauge malfunctions from 7/25/2023 - 10/25/2023 in MY4. Corrupted data was not included in stream gauge plots.
SCTSG3 suffered gauge malfunctions from 9/14/2023-10/25/2023 in MY4. Corrupted data was not included in stream gauge plots.
Stream gauge data was last downloaded on 10/26/2023. Therefore we cannot show 365 days of continuous flow.

Appendix E: Project Timeline and Contact Information

Table 12. Project Activity and Reporting History

Table 13. Project Contacts Table

Table 12. Project Activity and Reporting History
Stewarts Creek Tributaries Stream Restoration Project (NCDMS Project No. 100023)

Elapsed Time Since grading complete: **3 yrs 6 months**
Elapsed Time Since planting complete: **3 yrs 8 months**
Number of reporting Years: **4**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	NA	May-17
404 permit date	NA	Jul-19
Final Mitigation Plan	2017 to 2019	May-19
Final Design – Construction Plans	2017 to 2019	Sep-19
Site Earthwork	NA	May-20
As-Built Survey Performed	May - June 2020	Jun-20
Bare root plantings	NA	Mar-20
As-built monitoring report (Year 0 Monitoring – baseline)	Jun-20	Oct-20
Year 1 Monitoring	2020	Nov-20
Year 1 Monitoring Moores Fork Repairs	NA	Aug-20
Year 2 Monitoring	2021	Dec-21
Year 2 Monitoring Supplemental Planting	NA	Apr-21
Adaptive Management Plan (AMP)	Nov 2020 - April 2022	Jun-22
AMP Site Earthwork	NA	Jan-22
Year 3 Monitoring	2022 - 2023	Feb-23
Year 4 Monitoring - Supplemental Planting	April 2023	Apr-23
Year 4 Monitoring	Dec-23	Dec-23
Year 5 Monitoring	2024	--
Year 6 Monitoring	2025	--
Year 7 Monitoring	2026	--

Table 13. Project Contacts Table
Stewarts Creek Tributaries Stream Restoration Project (NCDMS Project No. 100023)

Designer Primary project design POC	Ecosystem Planning and Restoration, PLLC 1150 SE Maynard Road, Suite 140 Cary, NC 27511 Kevin Tweedy, PE (919) 388-0787
Construction Contractor Original Construction contractor POC	Resource Environmental Solutions, LLC (Formally Carolina Environmental Contracting, Inc.) 150 Pine Ridge Rd, Mt Airy, NC 27030 Wayne Taylor
Construction Contractor AMP Construction contractor POC	Yadkin Valley Construction, Inc. 2961 Old 60 Hwy Ronda, NC 28670 Brad Benton
Survey Contractor Original Survey contractor POC	Turner Land Surveying, PLLC PO Box 148, Swannanoa, NC 28778 Lissa Turner (919) 827-0745
Planting Contractor Original Planting contractor POC	Bruton Natural Systems, Inc. Charlie Bruton
Planting Contractor AMP Planting contractor POC	Foggy Mountain Nursery 797 Helton Creek Road Lansing, NC 28643
Seeding Contractor Original Contractor point of contact	Resource Environmental Solutions, LLC (Formally Carolina Environmental Contracting, Inc.) 150 Pine Ridge Rd, Mt Airy, NC 27030 Wayne Taylor
Seeding Contractor AMP Contractor point of contact	Yadkin Valley Construction, Inc. 2961 Old 60 Hwy Ronda, NC 28670 Brad Benton
Seed Mix Sources Original	Green Resources
Seed Mix Sources AMP	Green Resources
Nursery Stock Suppliers Original	Dykes & Son Nursery (931) 668-8833
Nursery Stock Suppliers AMP	Foggy Mountain Nursery 797 Helton Creek Road Lansing, NC 28643
Monitoring Performers	Ecosystem Planning and Restoration, PLLC
Stream Monitoring POC	Erin Bennett, EPR (919) 388-0787
Vegetation Monitoring POC	Tom Barrett, EPR (919) 388-0787