Monitoring Year 1 Report

FINAL

Meadow Brook Stream Restoration Project

Yadkin County, North Carolina

Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101

Data Collection Period:	**Submission Date:**
September 2020 -October 2020	December 2020

NCDEQ Contract No. 7184
DMS ID No. 100024
RFP No. 16-006993
USACE Action ID No. SAW-2017-01509
NCDWR ID: 2018-0919

Prepared For:

NC Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

Prepared By:

Ecosystem Planning and Restoration
1150 SE Maynard Road, Suite 140
Cary, NC 27511

Mitigation Project Name	Meadow Brook Site		County	Yadkin	USACE Action ID	2017-01509
DMS ID	100024		Date Project Instituted	5/22/2017	NCDWR Permit No	2018-0919
River Basin	YADKIN		Date Prepared	3/6/2020		
Cataloging Unit	03040101					

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)		3,409.333												
Potential Credits (As-Built Survey)		3,409.333												
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	1,022.800			2020	3/6/2020	30%				30%		N/A	N/A
3 (Year 1 Monitoring)	10%				2021		10%				10%		N/A	N/A
4 (Year 2 Monitoring)	10%				2022		10%				15%		N/A	N/A
5 (Year 3 Monitoring)	10%				2023		15%				20%		N/A	N/A
6 (Year 4 Monitoring)	5%				2024		5%				10%		N/A	N/A
7 (Year 5 Monitoring)	10%				2025		15%				15%		N/A	N/A
8 (Year 6 Monitoring)	5%				2026		5%				N/A		N/A	N/A
9 (Year 7 Monitoring)	10%				2027		10%				N/A		N/A	N/A
Stream Bankfull Standard	10%						N/A				N/A			
Total Credits Released to Date		1,022.800												

NOTES:

CONTINGENCIES:

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Date: 2020.04.10 10:17:34 -04'00'

Signature of Wilmington District Official Approving Credit Release | **Date**

1 - For NCDMS, no credits are released during the first milestone
2 - For NCDMS projects, the second credit release milestone occurs when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:
1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Receipt of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required
3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met

DEBITS (released credits only)

Ratios	1	1.5	2.5	10.0	1.0	1	3	2	5	1	3	2	5	1	3	2	5

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Mr. Harry Tsomides
NCDEQ – Division of Mitigation Services
5 Ravencroft Dr., Suite 102
Asheville, NC 28801

December 18, 2020

RE: Response to Draft Task 6 – Year 1 Monitoring Report for the Meadow Brook Site
Yadkin River Basin – CU# 03040101 – Yadkin County, North Carolina
NCDMS Project # 100024, Contract # 007184

Dear Mr. Tsomides,

Ecosystem Planning and Restoration (EPR) has reviewed the comments on the Draft MY1 Monitoring Report provided December 16, 2020. The comments have been addressed as described below and the Final MY1 Report and electronic deliverables have been revised in response to this review.

- *Table 1 (Assets) – Please include significant digits in all numbers per the current guidance.*
  - **The significant digits in Table 1 have been updated to reflect the current guidance.**

- *Table 6 (Vegetation) – Please edit as discussed previously to reflect the post-mitigation plan species*
  - **Tables 6 and 7 have been updated to reflect the post-mitigation plan species as discussed previously. The plot totals have been updated in the report text and Table 2.**

- *Visual assessment of aggradation, while no longer in DMS's standard visual assessment tables, should be mapped where excessive wetland vegetation and/or aggradation may be a concern. During DMS site walk earlier this year, signs of dense wetland vegetation / Juncus spp. establishment were observed (for example in/along the stream for sections of the Ut, mostly upper half), however this was not described in the report. It was indicated that cross sections 1-4 on MB-upper are aggrading slightly.*
  - **EPR noted the dense vegetation in September when cross-sections 1-6 were surveyed on 9 /10/2020 and this is reflected in the photos and plots for these cross-sections in Appendix B. Most of the vegetation that was in the channel was tearthumb (Persicaria sagittata) that was growing from the stream banks and laying in the channel. When the remaining cross sections were surveyed on 10/27/2020**

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this plant material had been flushed through the system in several high flow events and was no longer in the channel. This is shown in the photos for cross sections 7-13. The stream channels will be monitored during MY2 for any excessive vegetation growth in the stream channel itself.

- *It is indicated that site-wide supplemental planting will occur in 2021; can EPR clarify the month this is planned? Since EPR has indicated that thick wetland vegetation has smothered the original plantings, it is assumed that more wet-tolerant bare root species are planned. Which species (and percentages if available) will EPR plant?*
    - **EPR has not scheduled the supplementary planting yet but has contacted the original planting contractor about performing the work in early 2021 (before March). In the areas where thick herbaceous vegetation is an issue, taller tree stock will be used, if available, to ensure that the trees can survive. Only wet-tolerant trees that were originally included in the approved mitigation plan will be used in particularly wet areas.**

- *It is indicated that the Meadow Brook stream gage met the criteria "with ease" and that the graphs are in an Appendix. Please note (in the text) what the duration was. Similarly, please indicate the performance numbers (% growing season) for the two wetland gages.*
    - **This information has been added to the report in 2.0 Monitoring Data Assessment. This summary data can also be found in the wetland and flow gauge plots in Appendix D.**

- *EPR notes 11- 14 bankfull events for the main stem and UT. While it was a wetter than normal year, can EPR offer an explanation of why such an unusual number of apparent bankfull events occurred in 2020? It was good to see that bankfull elevations will be confirmed in the field due to so many recorded bankfull events. Thank you for being proactive about that. Will this be done in 2021?*
    - **The numerous bankfull events recorded in Meadow Brook and the UT are likely influenced by these streams' proximity to riparian wetland areas and strong ground water interaction. Additionally, other restored streams in this region experienced similar conditions during 2020. These reaches are performing as intended and the number of bankfull events is not concerning. Still, stream gauge and bankfull elevations will be re-surveyed and verified or updated as necessary during 2021.**

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- *Table 2, Table 4, etc – If possible, please format the table so the pages face the same way when the report is read.*
    - **The orientation of these pages has been changed so that the tables face the same way when read.**

- *As usual EPR's mapping format and content look coherent and accurate, thank you for the quality GIS production. Only comment is that vegetation plots not meeting criteria should be "red" on the CCPV Maps.*
    - **Vegetation plots that did not meet the criteria have been changed to red on the CCPV maps.**

- *Cross section graphs 7 – 13 are indicated as "Baseline". Please correct the titles.*
    - **The cross-section graph titles have been corrected.**

- *Thank you for EPR's wetland reporting, and providing wetland data despite the project being stream-only for credit. This will help determine the no net loss of wetland function as you note.*
    - **Noted. EPR will continue to monitor wetland hydrology through MY2.**

- *Digital Support Files - This is just a reminder to re-run the cross section data through the cross section tool, because of the updates discussed with Russell on 12/3.*
    - **The cross section data was re-run through the DMS cross section tool on 12/17/2020 and the cross section plots and Table 9 have been updated accordingly.**

If you have any questions regarding the Draft MY1 Monitoring Report, please contact me at 919-388-0787 or via email at cjones@eprusa.net.

Sincerely,

Cidney Jones, PE & CFM

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 PROJECT SUMMARY

Ecosystem Planning and Restoration, PLLC (EPR) implemented the Meadow Brook Stream Restoration Project (Project; Site) for the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS) to provide 3,409 stream mitigation credits (SMCs) in the Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101. The Project restored and enhanced 3,437 linear feet (LF) of two perennial unnamed tributaries (UT) to South Deep Creek within a 11.2-acre conservation easement. Mitigation assets are listed in Table 1.

The Site is located in DMS Targeted Local Watershed 03040101130020. Project location is shown in Figure 1. The Site was historically utilized for agricultural and cattle practices. As such, streams and existing wetlands in the Project area were adversely impacted by direct cattle access, farming activities, and stream channelization. The Site is situated on once active pastureland in a WS-III Watershed that is 57% agricultural land, 33% forest, 6% developed open space, and 3% herbaceous land. Prior to construction activities, both Project streams were incised, straightened, and suffered from significant cattle damage. The adjacent wetlands were similarly trampled, heavily grazed, routinely mowed, and drained by multiple ditches and the channelization of the Project streams. Pre-construction, or pre-existing, Site conditions are provided in Table 3 and the Baseline Stream Data Summary Tables in Appendix C. Photos and a more detailed description of Site conditions before restoration are available in the Mitigation Plan (Final version submitted September 2018).

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 Basinwide Water Quality Plan (NCDWQ, 2008). These goals and objectives are presented in Table 2.

Site construction was completed in June 2019, and the as-built survey was completed in August 2019. Planting and baseline vegetation data collection was completed in January 2020. 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 or the As-built Baseline Monitoring Report.

Table 1. Project Mitigation Quantities and Credits

Project Component (reach ID, etc.)	Original Mitigation Plan (ft/ac)	As-built (ft/ac)	Original Mitigation Thermal Regime Category	Original Restoration Level	Priority Level	Original Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
Meadow Brook Reach 1	1304	1917	Warm	R	I	1.00000	1,917.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Meadow Brook Reach 2	327	353	Warm	R	II	1.00000	353.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Meadow Brook Reach 3	289	273	Warm	R	II	1.00000	273.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Meadow Brook Reach 4	283	218	Warm	EI	-	1.50000	218.000	Habitat Structures, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
UT to Meadow Brook	396	676	Warm	R	I	1.00000	676.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Wetland A	2.930	2.630	RR	N/A		0.00000	2.630	Planted, excluded livestock, plugged ditches, and encompasses section of Priority Level II Restoration reach.
Wetland B	2.230	2.000	RR	N/A		0.00000	2.000	Planted, excluded livestock, plugged ditches, and encompasses section of Priority Level II Restoration reach.
Wetland C	0.820	0.740	RR	N/A		0.00000	0.740	Planted, excluded livestock, plugged ditches, and encompasses section of Priority Level II Restoration reach.
Wetland D	0.100	0.090	RR	N/A		0.00000	0.090	Planted, excluded livestock, and encompasses section of Priority Level II Restoration reach.

*Note: Wetlands are not currently part of the Project assets and are not generating mitigation credits

Table 1. Project Mitigation Quantities and Credits (continued)

Length and Area Summations by Mitigation Category							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Rip Wetland**	**Coastal Marsh**
	Warm	Cool	Cold	Riverine	Non-Riverine		
Restoration	3219.000						
Re-establishment							
Enhancement							
Enhancement I	145.333						
Enhancement II							
Rehabilitation				5.460			
Preservation							
Creation							
Totals	3364.333			5.460			

Total Base SMCs	3364.333
Credit Loss in Required Buffer	-142.550
Credit Gain for Additional Buffer	187.600
Net Change in Credit from Buffers	45.000
Total Adjusted SMCs*	3409.333

*Credit adjustment for Non-standard Buffer Width calculation using Wilmington District Stream Buffer Credit Calculator (Updated 1/19/2019)

Table 2. Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reduce sediment inputs and stream turbidity	▪ Stabilize eroding stream banks. ▪ Install fencing to exclude livestock from project streams. ▪ Reconnect streams to the floodplain at lower flows. ▪ Restore woody riparian buffer vegetation.	▪ The exclusion of livestock has removed a direct source of nutrients, coliform, and sediment from the system, as well as a major contributor to channel instability. ▪ Restored riparian buffers will provide woody debris and detritus for aquatic organisms, reduced water temperatures and increased dissolved oxygen concentrations, as well as shade and diverse aquatic and terrestrial habitats that are appropriate for the ecoregion and setting.	▪ Recordation and protection of a conservation easement meeting NCDMS 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 4 and 210 native stems/acre in Year 7. ▪ Trees must average 7 feet in height at Year 5, and 10 feet in height at Year 7. ▪ Any single species can only account for 50% of the required stems per monitoring plot. ▪ 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.	<u>Permanent Vegetation Plots</u> 6 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.	At the end of Monitoring Year 1, the 6 permanent riparian vegetation plots had an average stem density of 397 native stems/acre and have met the success criteria of 320 native stems/acre in Year 3.
Reduce nutrient inputs	▪ Decrease drainage of riparian wetlands. ▪ Install wetland treatment cell. ▪ Reconnect streams to the floodplain at lower flows. ▪ Restore woody riparian buffer vegetation. ▪ Stabilize eroding stream banks.				
Reduce Fecal Coliform Inputs	▪ Install fencing to exclude livestock from project streams. ▪ Restore woody riparian buffer vegetation. ▪ Reconnect streams to the floodplain at lower flows. ▪ Install a wetland treatment cell.			<u>Annual Random Vegetation Plots</u> 6 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.	The 6 randomly selected vegetation plots had an average stem density of 223 native stems/acre, which does not meet the success criteria for MY1.
Restore / Enhance Degraded Riparian Buffers	▪ Restore woody riparian buffer vegetation. ▪ Protect min. 50-foot riparian buffers with a permanent conservation easement. ▪ Decrease drainage of riparian wetlands. ▪ Reconnect streams to the floodplain at lower flows. ▪ Install fencing to exclude livestock from conservation easement.				
Implement Agricultural BMPs in Agricultural Watersheds	▪ Restore woody riparian buffer vegetation. ▪ Protect min. 50-foot riparian buffers with a permanent conservation easement. ▪ Install fencing to exclude livestock from project streams. ▪ Install alternative watering system for livestock. ▪ Install a wetland treatment cell.				

Table 2. Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Protect High Resource Value Waters (including HQW, ORW, and WS classifications)	▪ Restore bed form diversity to improve habitat for native species. ▪ Restore woody riparian buffer vegetation. ▪ Protect min. 50-foot riparian buffers with a permanent conservation easement. ▪ Reconnect streams to the floodplain at lower flows. ▪ Install a wetland treatment cell.	▪ Wetland hydrology and in-channel hydraulics have been improved by restoring project channels to their historic valley, raising the streambeds, and connecting them to adjacent wetlands at lower flows. ▪ The addition of in-stream structures helps to ensure channel stability and will provide greater bedform diversity, enhancing aquatic habitat for native species.	▪ 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. ▪ 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 project streams was conducted during As-built monitoring. No signs of instability or degradation were noted during MY1 monitoring so a new profile was not surveyed.
				<u>Cross Sections</u> Cross sections are surveyed during Years 1,2,3,5, and 7. 13 total cross sections, 10 on Meadow Brook (5 riffle/5 pool), 3 on UT to Meadow Brook (2 riffle/1 pool).	The Year 1 monitoring cross-section survey indicates that the project streams are geomorphically stable and restored channel dimensions have aggraded slightly during Monitoring Year 1.
				<u>Visual Assessment</u> Conducted yearly on all restored stream channels.	Stream photo points and visual assessment indicate that all restored are in good condition and performing as intended. No significant stream problem areas were observed.
				<u>Additional Cross Sections</u> Only surveyed if instability is documented during monitoring.	No instability was documented during MY1 monitoring, so no additional cross sections were surveyed.
				<u>Stream Hydrology Monitoring</u> 2 pressure transducers (1 on Meadow Brook and UT to Meadow Brook each) 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 MY1 indicate that all three project streams met the established success criteria of 30 days or more of consecutive flow throughout the year. In addition, 17 bankfull events were recorded for Meadow Brook, and 13 bankfull events were recorded for UT to Meadow Brook.

Table 3. Project Attributes Table

Project Background Information				
Project Name		Meadow Brook Stream Restoration Project		
County		Yadkin		
Project Area (acres)		11.2		
Project Coordinates (latitude and longitude)		36.14139 / 80.81889		
Planted Acreage (Acres of Woody Stems Planted)		11.2		
Project Watershed Summary Information				
Physiographic Province		Northern Inner Piedmont		
River Basin		Yadkin Pee-Dee		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101130020	
DWR Sub-basin		03-07-02		
Project Drainage Area (Acres and Sq. Mi.)		1088 acres / 1.7 Sq. Mi.		
Project Drainage Area Percentage of Impervious Area		<1%		
CGIA Land Use Classification		Pasture (57%) and Deciduous Forest (26%)		

Reach Summary Information					
Parameters	**Meadow Brook**				**UT to Meadow Brook**
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	
Length of reach (linear feet)	1304	327	289	283	396
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Confined	Confined	Unconfined
Drainage area (Acres and Square Miles)	.93 sq mi / 595 ac	1.51 sq mi / 966 ac	1.73 sq mi. / 1107 ac	1.73 sq mi / 1107 ac	.56 sq mi / 358 ac
Perennial, Intermittent, Ephemeral	Perennial				
NCDWR Water Quality Classification	WS-III				
Stream Classification (existing)	Incised E4	E4	E4	E4	E4
Stream Classification (proposed)	C4	C4	B4c	B4c	C4
Evolutionary trend (Simon)	IV				
FEMA classification	AE				

Wetland Summary Information				
Parameters	**Wetland A**	**Wetland B**	**Wetland C**	**Wetland D**
Size of Wetland (acres)	2.93	2.23	0.82	0.10
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine
Mapped Soil Series	Dan River Sandy Loam	Dan River Sandy Loam	Dan River Sandy Loam / Clifford sandy clay loam	Dan River Sandy Loam
Drainage Class	Well-drained	Well-drained	Well-drained	Well-drained
Soil Hydric Status	Non-Hydric*	Non-Hydric*	Non-Hydric*	Non-Hydric*
Source of Hydrology	Groundwater, precipitation, runoff, overbank flooding	Groundwater, precipitation, runoff, overbank flooding	Groundwater, precipitation, runoff, overbank flooding	Groundwater, precipitation, runoff, overbank flooding
Restoration or enhancement method (hydrologic, vegetative etc.)	Vegetative*	Vegetative*		Vegetative*

Table 3. Project Attributes Table

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	USACE NWP 27 - ID# SAW-2017-01509
Water of the United States - Section 401	Yes	Yes	DWR 401 WQC No. 4134 -- ID # 2180919
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	General Permit NCG010000 - ID # YADKI-2019-004
Endangered Species Act	Yes	Yes	Categorical Exclusion Document; Appendix 7 in Mitigation Plan
Historic Preservation Act	Yes	Yes	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Yadkin County Floodplain Development Permit – ID # 2018-1
Essential Fisheries Habitat	No	N/A	N/A

*Wetlands are not being restored or enhanced for mitigation credit, but functional uplift is expected and there will be no net loss of wetland functions

+Jurisdictional wetlands were identified on soils mapped as non-hydric

2.0 MONITORING DATA ASSESSMENT

Monitoring Year 1 (MY1) data was collected in September and October 2020. Current Site conditions and monitoring data are described in the following sections to evaluate whether the Project is meeting the success criteria established in the Mitigation Plan. The monitoring plan for the Site will follow this guidance as the *NCDEQ DMS Annual Monitoring Report Format, Data, and Content Requirements* (October 2020).

2.1 Stream Monitoring

Stream monitoring involved field data collection to assess the hydrologic, hydraulic, and geomorphic functions of Meadow Brook and the UT. 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 Figure 2 Current Condition Plan View (CCPV).

2.1.1 Stream Dimension

Permanent cross sections were installed across the Site to monitor stream stability through dimension change. Thirteen (13) permanent cross sections were installed across the Site; 10 on Meadow Brook and 3 on UT to Meadow Brook. Seven (7) cross sections were installed in riffles and six (6) were installed in pools. Each cross-section was monumented using a length of rebar and PVC pipe 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 (consistent with the Baseline As-Built Report), Bank Height Ratio (BHR), Low Top of Bank (LTOB) elevation, Thalweg Elevation, LTOB Max Depth, LTOB Cross Sectional Area, and Entrenchment Ratio (ER). BHR measurements were made by holding the bankfull area recorded in the Baseline As-built report constant and adjusting the bankfull elevation. All other geomorphic measurements were made by maintaining a constant benchmark

bankfull elevation as recorded in the Baseline As-built report. Reference photos were taken of both streambanks every year to provide a visual assessment of any changes that may occur.

The Year 1 monitoring cross-section survey indicates that the Project streams are geomorphically stable. Due to heavy herbaceous vegetation along the floodplain and streambanks, some cross sections appear to be aggrading slightly, but there is no concern of wide-spread channel instability. Notes on specific cross-sections and actions to be taken in the next monitoring year are listed below.

- Cross sections 1, 2, 3, and 4 show signs of aggradation primarily due to herbaceous vegetation laying in the stream channel. This vegetation did not appear to be rooted in the channel for the most part. Recent large flood events have cleared much of this out and EPR expects these cross sections to improve as streambank vegetation matures.
- Cross section 8 (riffle) has downcut about 0.5 feet, but is still meeting the success criteria. This cross section, and Reach 2 overall, will be observed for possible further degradation in the next monitoring year.
- Cross section 13 (pool) has filled about 1 foot. A high sediment load on the UT is expected in this monitoring year since the Greenbrier Project construction was occurring upstream of this reach. This cross section will also be monitored to determine whether adaptive management is needed to provide pool habitat within the UT.

All restored streams meet the success criteria as established in the Mitigation Plan and shown in Table 2. The cross-section plots, photos, and data summary (Table 9) are included in Appendix C.

2.1.2 Stream Profile

A full longitudinal profile was surveyed for the entire length of the restored streams in August 2019 to document as-built conditions (EPR, 2020). This survey was tied to a permanent benchmark and includes thalweg, 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 and data are provided in the Baseline Stream Data Summary tables in Appendix C. As noted in the baseline report, there were some pools that are filled with sediment that are expected to flush throughout the monitoring period.

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.

2.1.3 Channel Stability

Channel stability is assessed on a yearly basis using photographs to visually document the condition of the restored Project streams. Visual assessments of channel stability and in-stream structure condition were made throughout Monitoring Year 1, primarily after storm events. Visual assessments of banks stability and in-stream structures for each reach are provided in Appendix A. Sixteen (16) photo points were established during baseline monitoring at which photographs are taken from the same location in the same direction each year. The location of the photo points are shown in the CCPV (Figure 2) and the photographs taken on October 27, 2020 are provided in Appendix A.

Stream photo points and visual assessment indicate that all restored channels and in-stream structures are in good condition and performing as intended. No significant stream problem areas were observed.

No channel manipulation, including vegetation or sediment removal, has been performed in this monitoring year.

2.1.4 Stream Hydrology

Two (2) pressure transducers were installed, 1 each in Meadow Brook and the UT to Meadow Brook, to document stream flow and the occurrence of bankfull events within the monitoring period. The locations of these gauges are shown in the CCPV (Figure 2). Both gauges were installed in 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. Each year, these elevations are compared with the gauge readings to determine whether the stream is flowing and if a bankfull event has occurred. This Project utilizes a tipping bucket rain gauge installed 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 1 and rainfall data is presented in the flow gauge plots in Appendix D.

Flow gauge data from MY1 indicate that both Project streams met the established success criteria of 30 days or more of consecutive flow throughout the year. Despite missing data from 1/22/2020 to 4/7/2020 due to a malfunctioning barometric pressure gauge, the stream hydrology still met the performance criteria. According to the gauge for Meadow Brook (MB STR), the stream had consistent flow throughout the year (at least 101 consecutive days) and the gauge documented 11 separate bankfull events. MB STR indicated a long period (from 4/7-7/19) of no flowing water in the channel, which is highly unlikely given the size of the watershed and the recorded precipitation. The gauge and controlling riffle elevation will be re-surveyed and verified or updated in MY2. Gauge MB UT1 STR, located in the UT to Meadow Brook, documented consistent flow throughout the year (at least 205 consecutive days) and 14 separate bankfull events. Bankfull events were further documented by photographs of other flood indicators, which are also provided in Appendix D. The date and timing of these bankfull events typically correlated with significant rainfall events recorded by the tipping bucket rain gauge. The numerous bankfull events recorded in Meadow Brook and the UT are likely influenced by these streams' proximity to riparian wetland areas and strong ground water interaction. Additionally, other restored streams in this region experienced similar conditions during 2020. These reaches are performing as intended and the number of bankfull events is not concerning. Still, stream gauge and bankfull elevations will be re-surveyed and verified or updated as necessary during MY2.

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 Section 1.

2.2.1 Vegetation Monitoring Data

Six (6) permanent vegetation monitoring plots were established 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 tagged and identified to facilitate repeat monitoring each year. In addition to the 6 permanent plots, 6 randomly placed

vegetation plots are established each year and the location of these plots is recorded using a GPS. All vegetation plots for MY1 are shown in the CCPV (Figure 2). Table 5 in Appendix A summarizes the results of a visual review of the conservation easement, mapping bare areas, areas of low stem density, invasive species, or easement encroachments.

Year 1 vegetation monitoring occurred in October 2020, before leaf drop, and more than 180 days after planting. Annual vegetation data is compiled and summarized using the DMS Vegetation Data Entry Tool in Appendix B. Planted stem counts for each plot ranged from 1 tree per plot (40 trees per acre) in Random VP-7, to 21 trees per plot (850 trees per acre) in VP-2. The average density of planted stems from all 12 vegetation plots (permanent and random) was 8 trees per plot (310 trees per acre). As indicated by the low planted stem count numbers found in many vegetation plots, much of the planted areas are not meeting the performance criteria. This is likely due to the thick herbaceous wetland vegetation that has established throughout the Site which has smothered many of the bare-root trees that were originally planted. Nearly the entire Site will undergo supplemental planting in 2021 with larger bare-root trees that can survive in the thick herbaceous vegetation.

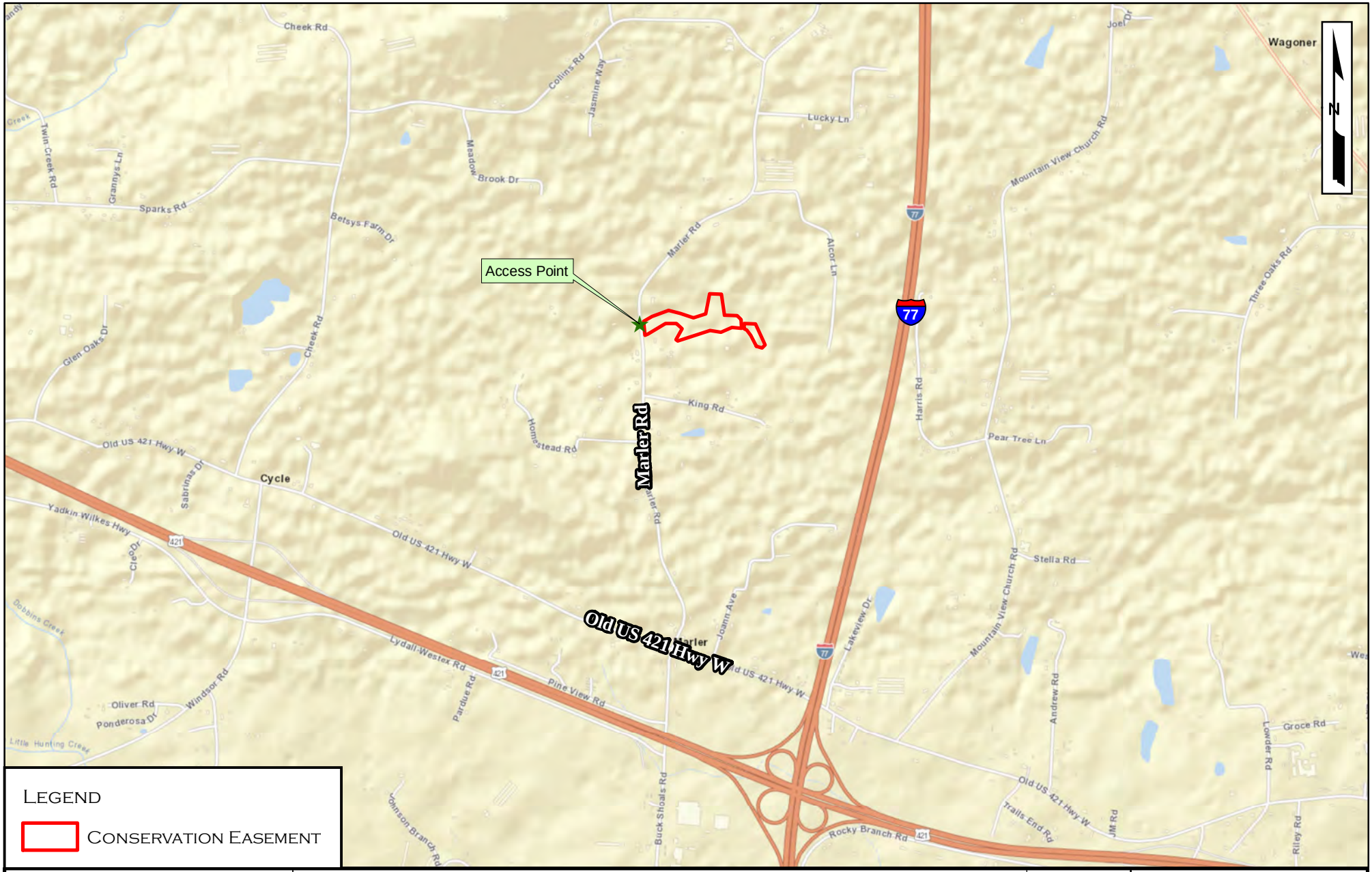
Riparian herbaceous vegetation that was established after construction appears to be flourishing throughout the Site. Additionally, no invasive species vegetation were noted within the conservation easement.

2.3 Wetland Hydrology

While no wetland mitigation credit was proposed as a part of this Project, efforts were taken to ensure that there was no net loss of existing riparian wetland function after construction. A preliminary jurisdictional wetland determination (PJD) and NCWAM assessment was completed prior to completion of construction to document the extent and functionality of the existing wetlands at the Site. The same assessments will be made after the monitoring period ends to document that there was no net loss of wetland functionality over the life of the Project.

In addition, hydrophytic vegetation that is present within vegetation plots that are located in planting Zone 2 (Riparian Wetlands) has been documented, and this documentation records of the extent and species diversity of this vegetation are being kept. VP-1, VP-2, RVP-5, and RVP-6 are split between riparian planting and upland planting, but the rest of the permanent and random vegetation plots are within the riparian wetland planting zone (Zone 2). VP-6 is located within the wetland treatment cell and planted with hydrophytic herbaceous and woody vegetation. The plot and surrounding wetland areas will be replanted in the next growing season with more developed and larger trees due to high woody vegetation mortality, apparently caused by excessive herbaceous vegetation growth.

Finally, as required by the 401/404 Permit, two groundwater gauges were installed in the existing wetlands at the Site. These data are provided in Appendix D, but are not associated with success criteria for mitigation. The locations of the 2 wetland groundwater gauges are shown in the CCPV (Figure 2). The wetland gauges were downloaded regularly throughout Monitoring Year 1 and the wetland gauge data indicates that these are still have adequate wetland hydrology. MB GW1 recorded 102 consecutive days of groundwater within 1 foot of the ground surface during the growing season, or 49.3%. MB GW2 recorded 205 consecutive days of success, or 99% of the growing season. Wetland gauge and rainfall data are presented in the plots in Appendix D.



LEGEND

Conservation Easement

0 1,000 2,000 Feet

MEADOW BROOK STREAM MITIGATION PROJECT

PROJECT LOCATION MAP

MY1 - 2020

NC Mitigation Services

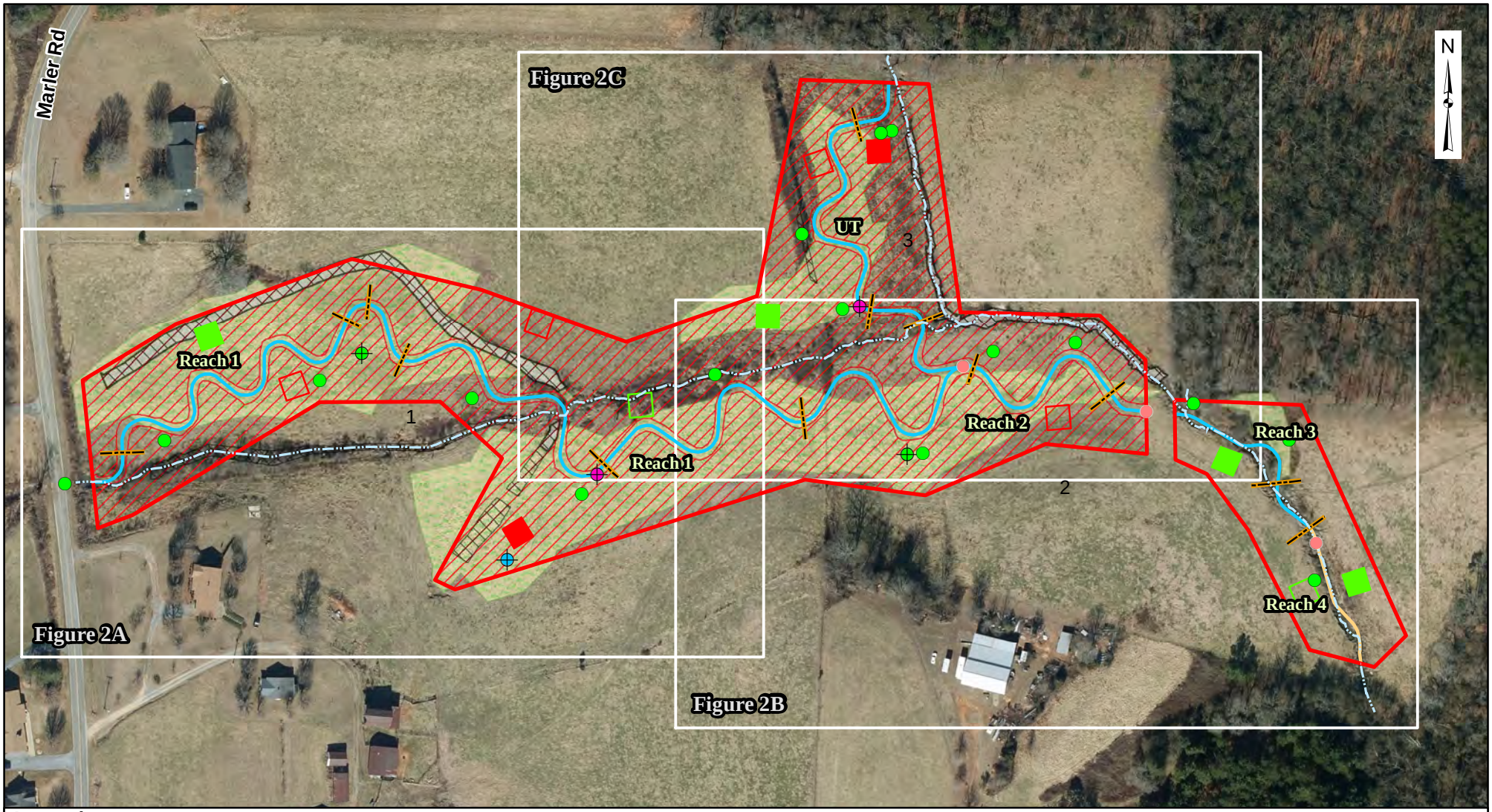
EPR Ecosystem Planning & Restoration

FIGURE 1

DMS PROJECT #100024

YADKIN COUNTY, NC

DEC 2020



Legend

- Photo Points
- Pre-Existing Streams
- Existing Wetlands
- Conservation Easement
- Rain Gauge
- Stream Gauge
- Wetland Gauge
- Reach Breaks
- Stream Restoration
- Stream Enhancement
- Fixed Veg Plot - Unsuccessful
- Fixed Veg Plot - Successful
- Random Veg Plot - Unsuccessful
- Random Veg Plot - Successful
- Cross Sections
- Unfilled Ditches
- Filled Ditches
- Vegetation Problem Area

NC OneMap Orthoimagery (2018)

0 200 Feet

1 inch = 200 feet

MEADOW BROOK STREAM MITIGATION PROJECT

Current Condition Plan View: Overview
MY1: 2020

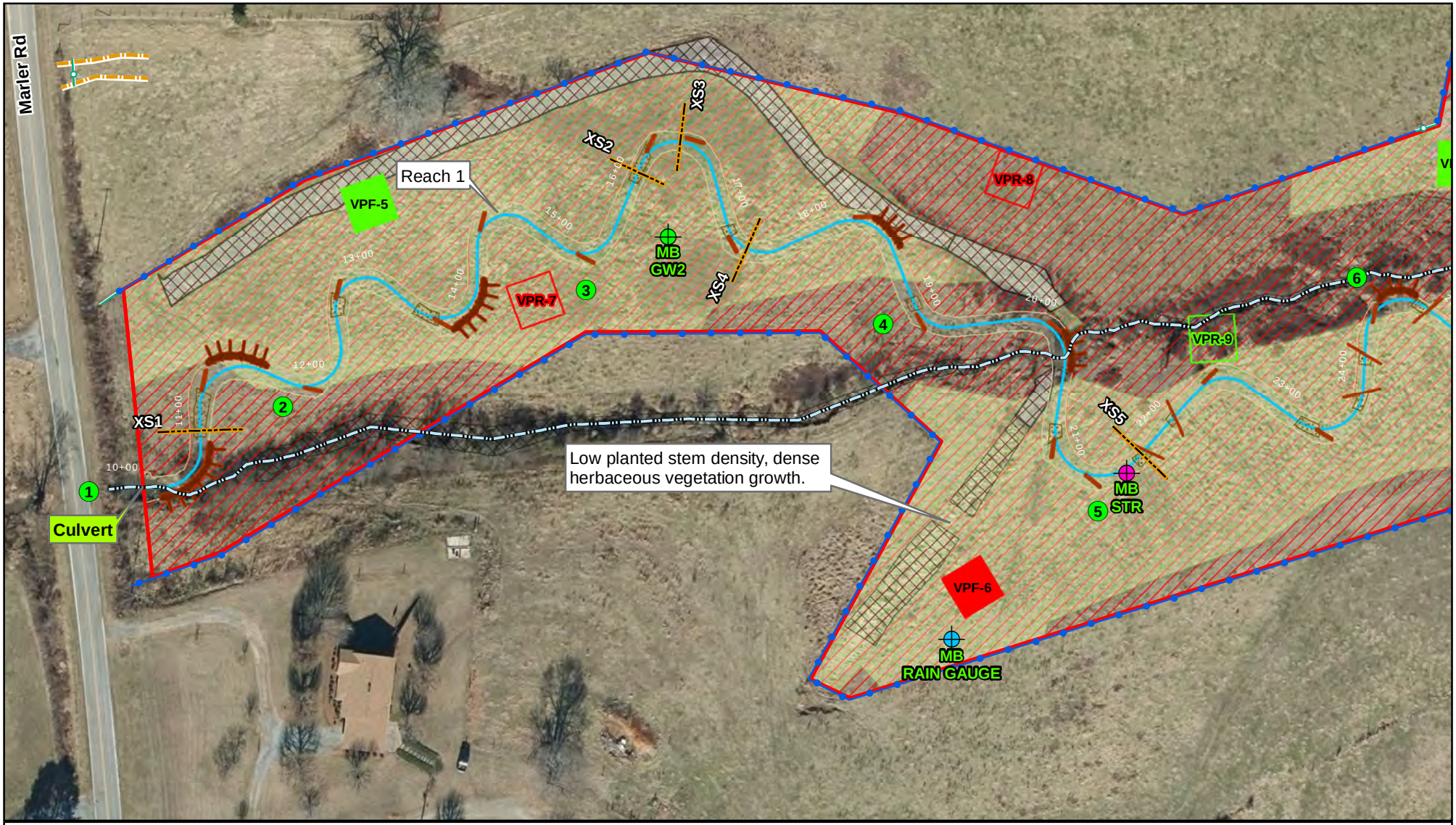
DMS Project ID# 100024
DEC 2020

FIGURE 2

Yadkin County, NC

Mitigation Services Environmental Quality

Ecosystem Planning & Restoration



Legend

- Top of Bank (ASB)
- Stream Centerline
- Pre-Existing Streams
- Structures
- Existing Wetlands
- Conservation Easement
- Cross Sections
- Photo Points
- Fixed Veg Plot - Unsuccessful
- Fixed Veg Plot - Successful
- Random Veg Plot - Unsuccessful
- Random Veg Plot - Successful
- Rain Gauge
- Stream Gauge
- Wetland Gauge
- Farm Path
- Fencing
- Fence Gates
- Vegetation Problem Area
- Unfilled Ditches
- Filled Ditches

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

MEADOW BROOK STREAM MITIGATION PROJECT

Current Condition Plan View: Asset Map

MY1: 2020

DMS Project ID# 100024

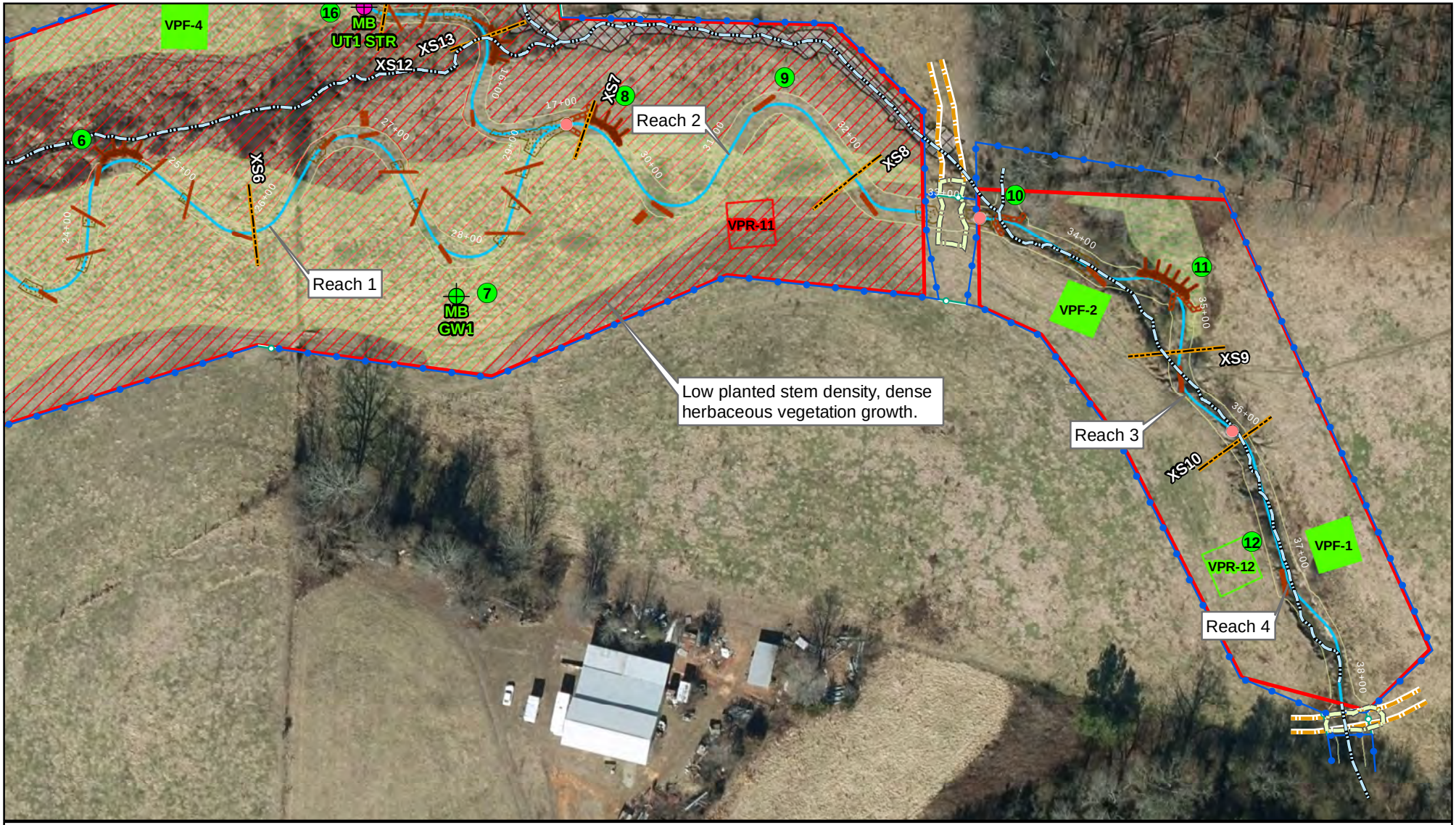
DEC 2020

FIGURE 2A

Yadkin County, NC

Mitigation Services

Ecosystem Planning & Restoration



Legend

- Top of Bank (ASB)
- Stream Centerline
- Pre-Existing Streams
- Structures
- Existing Wetlands
- Conservation Easement
- Cross Sections
- Photo Points
- Fixed Veg Plot - Successful
- Random Veg Plot - Unsuccessful
- Random Veg Plot - Successful
- Stream Gauge
- Wetland Gauge
- Reach Breaks
- Stream Crossing
- Farm Path
- Fencing
- Fence Gates
- Vegetation Problem Area
- Unfilled Ditches
- Filled Ditches

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

MEADOW BROOK STREAM MITIGATION PROJECT

Current Condition Plan View: Asset Map

MY1: 2020

DMS Project ID# 100024

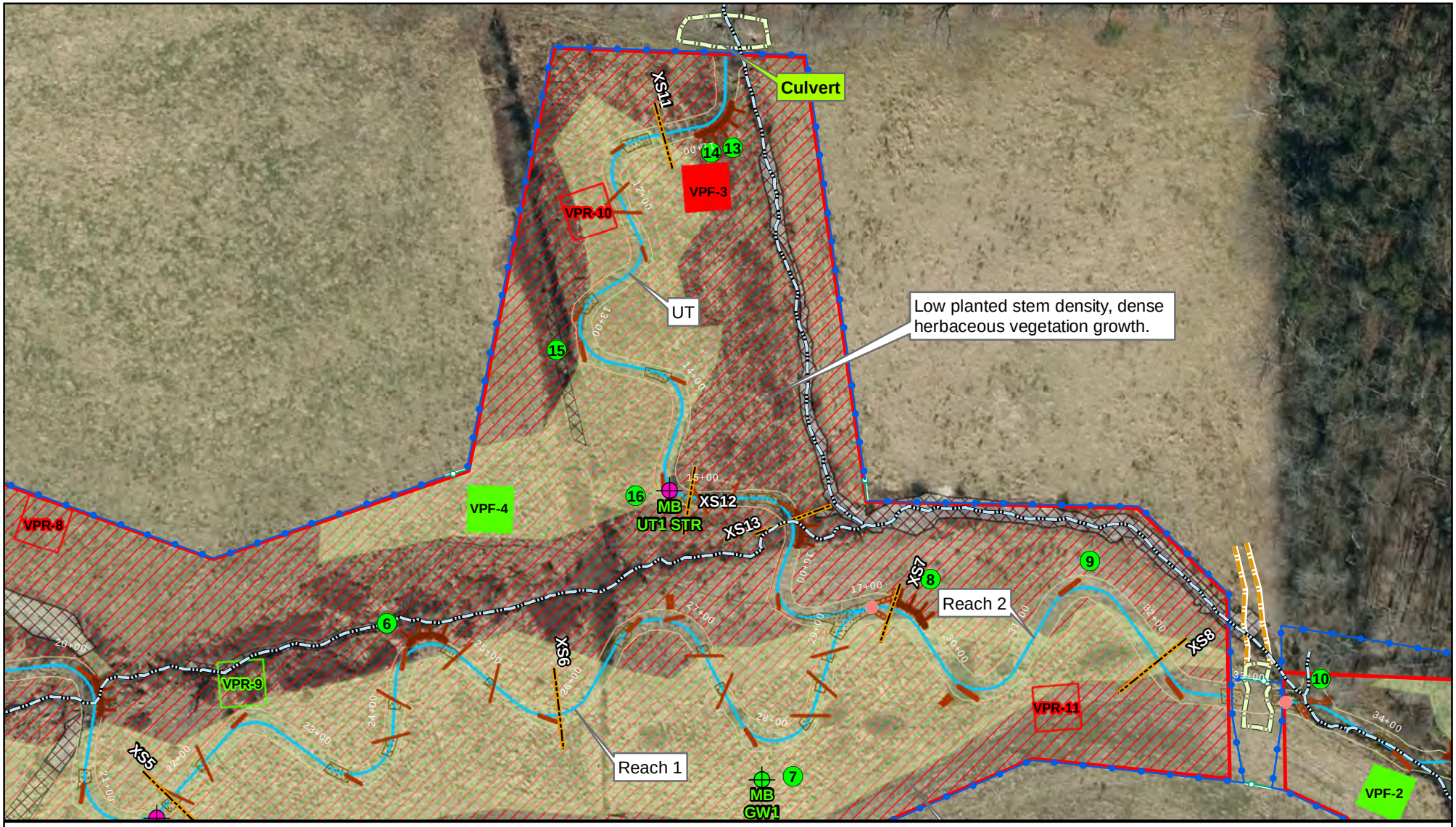
DEC 2020

FIGURE 2B

Yadkin County, NC

Mitigation Services Environmental Quality

Ecosystem Planning & Restoration



Legend

- Top of Bank (ASB)
- Stream Centerline
- Pre-Existing Streams
- Structures
- Existing Wetlands
- Conservation Easement
- Cross Sections
- Photo Points
- Fixed Veg Plot - Unsuccessful
- Fixed Veg Plot - Successful
- Random Veg Plot - Unsuccessful
- Random Veg Plot - Successful
- Stream Gauge
- Wetland Gauge
- Reach Breaks
- Stream Crossing
- Farm Path
- Fencing
- Fence Gates
- Vegetation Problem Area
- Unfilled Ditches
- Filled Ditches

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

MEADOW BROOK STREAM MITIGATION PROJECT

Current Condition Plan View: Asset Map

MY1: 2020

DMS Project ID# 100024

DEC 2020

FIGURE 2C

Yadkin County, NC

Mitigation Services

Ecosystem Planning & Restoration

3.0 REFERENCES

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Appendix A

Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Vegetation Photos

Photo Points

Table 4a. Visual Stream Morphology Stability Assessment Table
Meadow Brook Stream Restoration Project (DMS No.100024)

Reach ID	**Meadow Brook Reach 1**
Assessed Stream Length (ft)	**1936**
Assessed Bank Length (ft)	**3872**

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.	16	16		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)	45	45		100%

Table 4b. Visual Stream Morphology Stability Assessment Table
Meadow Brook Stream Restoration Project (DMS No.100024)

Reach ID	**Meadow Brook Reach 2**
Assessed Stream Length (ft)	**393**
Assessed Bank Length (ft)	**786**

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.	1	1		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)	7	7		100%

Table 4c. Visual Stream Morphology Stability Assessment Table
Meadow Brook Stream Restoration Project (DMS No.100024)

Reach ID Meadow Brook Reach 3 (273 ft) Meadow Brook Reach 4 (218 ft)
Assessed Stream Length (ft) 491
Assessed Bank Length (ft) 982

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.	5	5		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)	7	7		100%

Table 4d. Visual Stream Morphology Stability Assessment Table
Meadow Brook Stream Restoration Project (DMS No.100024)

Reach ID	**UT to Meadow Brook**
Assessed Stream Length (ft)	**703**
Assessed Bank Length (ft)	**1406**

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.	8	8		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)	17	17		100%

Table 5. Vegetation Condition Assessment Table
Meadow Brook Restoration Project (DMS No.100024)

Planted Acreage **11.2**

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	8.80	78.6%
		Total	8.80	78.6%
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	8.80	78.6%

Easement Acreage **11.2**

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	No Encroachments Noted	

Meadow Brook Stream Restoration Project
Monitoring Year 1 – Vegetation Plot Photo Log

Veg Plot 1 Fixed – SE Corner (10/27/2020)

Veg Plot 2 Fixed – SW Corner (10/27/2020)

Veg Plot 3 Fixed – SE Corner (10/27/2020)

Veg Plot 4 Fixed – NW Corner (10/27/2020)

Veg Plot 5 Fixed – NW Corner (10/27/2020)

Veg Plot 6 Fixed – N Corner (10/27/2020)

Random Veg Plot 7 R– SW Corner (10/27/2020)

Random Veg Plot 8 R – SW Corner (10/27/2020)

Random Veg Plot 9 R – SE Corner (10/27/2020)

Random Veg Plot 10 R – SE Corner (10/27/2020)

Random Veg Plot 11 R – NE Corner (10/27/2020)

Random Veg Plot 12 R – NE Corner (10/27/2020)

Meadow Brook Stream Restoration Project
MY1 - Photo Log

Photo Point 1 – Reach 1, Sta. 0+00
Facing Downstream (10/27/2020)

Photo Point 2 – Reach 1, Sta. 11+90
Facing Downstream (10/27/2020)

Photo Point 3 – Reach 1, Sta. 15+35
Facing Downstream (10/27/2020)

Photo Point 4 – Reach 1, Sta. 19+10
Facing Downstream (10/27/2020)

Photo Point 5 – Reach 1, Sta. 21+50
Facing Downstream (10/27/2020)

Photo Point 6 – Reach 1, Sta. 24+50
Facing Downstream (10/27/2020)

Meadow Brook Stream Restoration Project
MY1 - Photo Log

Photo Point 7 – Reach 1, Sta. 28+20
Facing Downstream (10/27/2020)

Photo Point 8 – Reach 2, Sta. 29+70
Facing Upstream (10/27/2020)

Photo Point 9 – Reach 2, Sta. 31+60
Facing Downstream (10/27/2020)

Photo Point 10 – Reach 3, Sta. 33+55
Facing Upstream (10/27/2020)

Photo Point 11 – Reach 3, Sta. 34+80
Facing Downstream (10/27/2020)

Photo Point 12 – Reach 4, Sta. 36+90
Facing Downstream (10/27/2020)

Meadow Brook Stream Restoration Project
MY1 - Photo Log

Photo Point 13 – UT, Sta. 10+90
Facing Upstream (10/27/2020)

Photo Point 14 – UT, Sta. 10+90
Facing Downstream (10/27/2020)

Photo Point 15 – UT, Sta. 13+20
Facing Downstream (10/27/2020)

Photo Point 16 – UT, Sta. 14+90
Facing Downstream (10/27/2020)

Appendix B

Vegetation Plot Data

Table 6. Vegetation Plot Data

Table 7. Vegetation Performance Standards Summary Table

Table 6. Vegetation Plot Data
Meadow Brook Stream Restoration Project (NCDMS Project No. 100024)

Planted Acreage	11.2
Date of Initial Plant	2020-01-20
Date(s) of Supplemental Plant(s)	#N/A
Date(s) Mowing	#N/A
Date of Current Survey	2020-10-27
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 R	Veg Plot 8 R	Veg Plot 9 R	Veg Plot 10 R	Veg Plot 11 R	Veg Plot 12 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW			2	2	2	2			3	3				2	1	1		1
	Celtis laevigata	sugarberry	Tree	FACW	1	1					1	1										
	Cercis canadensis	eastern redbud	Tree	FACU			3	3													1	
	Cornus amomum	silky dogwood	Shrub	FACW			4	4			1	1	4	4					1			4
	Diospyros virginiana	common persimmon	Tree	FAC			2	2	1	1	2	2	2	2	1	1			2		1	1
	Fraxinus pennsylvanica	green ash	Tree	FACW	2	2	3	3			2	2						1	1	2		2
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1	3	3														2
	Platanus occidentalis	American sycamore	Tree	FACW			3	3					1	1			1	1			2	
	Quercus alba	white oak	Tree	FACU							1	1										
	Quercus nigra	water oak	Tree	FAC														1	1			
	Quercus phellos	willow oak	Tree	FAC															2			
	Quercus rubra	northern red oak	Tree	FACU	2	2	1	1			1	1	1	1								
	Salix nigra	black willow	Tree	OBL	2	2			1	1	1	1	1	1	2	2						1
	Sambucus canadensis	American black elderberry	Tree						1	1												
	Ulmus americana	American elm	Tree	FACW									1	1				1				
Sum	Performance Standard				8	8	21	21	5	5	9	9	13	13	3	3	1	6	8	3	4	11
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*					*2*	*2*												
	Alnus serrulata	*tag alder*	*Tree*	*OBL*			*1*	*1*														
Sum	Proposed Standard				8	8	21	21	5	5	9	9	13	13	3	3	1	6	8	3	4	11
Mitigation Plan Performance Standard	Current Year Stem Count					8		21		5		9		13		3	1	6	8	3	4	11
	Stems/Acre					324		850		202		364		526		121	40	243	324	121	162	445
	Species Count					5		8		4		7		7		2	1	5	6	2	3	6
	Dominant Species Composition (%)					25		18		29		22		31		67	100	33	25	67	50	36
	Average Plot Height					3		1		1		2		3		6	2	2	3	3	3	2
	% Invasives					0		0		0		0		0		0	0	0	0	0	0	0

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.

Does not Meet Interim Performance Criteria	Meets interim Performance Criteria

Table 7. Vegetation Performance Standards Summary Table
Meadow Brook Stream Restoration Project (NCDMS Project No. 100024)

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	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												
Monitoring Year 2												
Monitoring Year 1	324		5	0	850		9	0	202		5	0
Monitoring Year 0	809		6	0	1174		10	0	728		6	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	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												
Monitoring Year 2												
Monitoring Year 1	364		7	0	526		7	0	121		2	0
Monitoring Year 0	647		7	0	728		8	0	688		3	0
	Veg Plot 7 R				Veg Plot 8 R				Veg Plot 9 R			
	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												
Monitoring Year 2												
Monitoring Year 1	40		1	0	243		5	0	324		6	0
Monitoring Year 0												
	Veg Plot 10 R				Veg Plot 11 R				Veg Plot 12 R			
	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												
Monitoring Year 2												
Monitoring Year 1	121		2	0	162		3	0	445		6	0
Monitoring Year 0												

*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.

Meets interim Performance Criteria	Does not Meet Interim Performance Criteria

Appendix C

Stream Geomorphology Data

Cross-Sections With Annual Overlays

Table 8. Baseline Stream Data Summary

Table 9. Cross-Section Morphology Monitoring Summary

Cross Section Plot - MY1

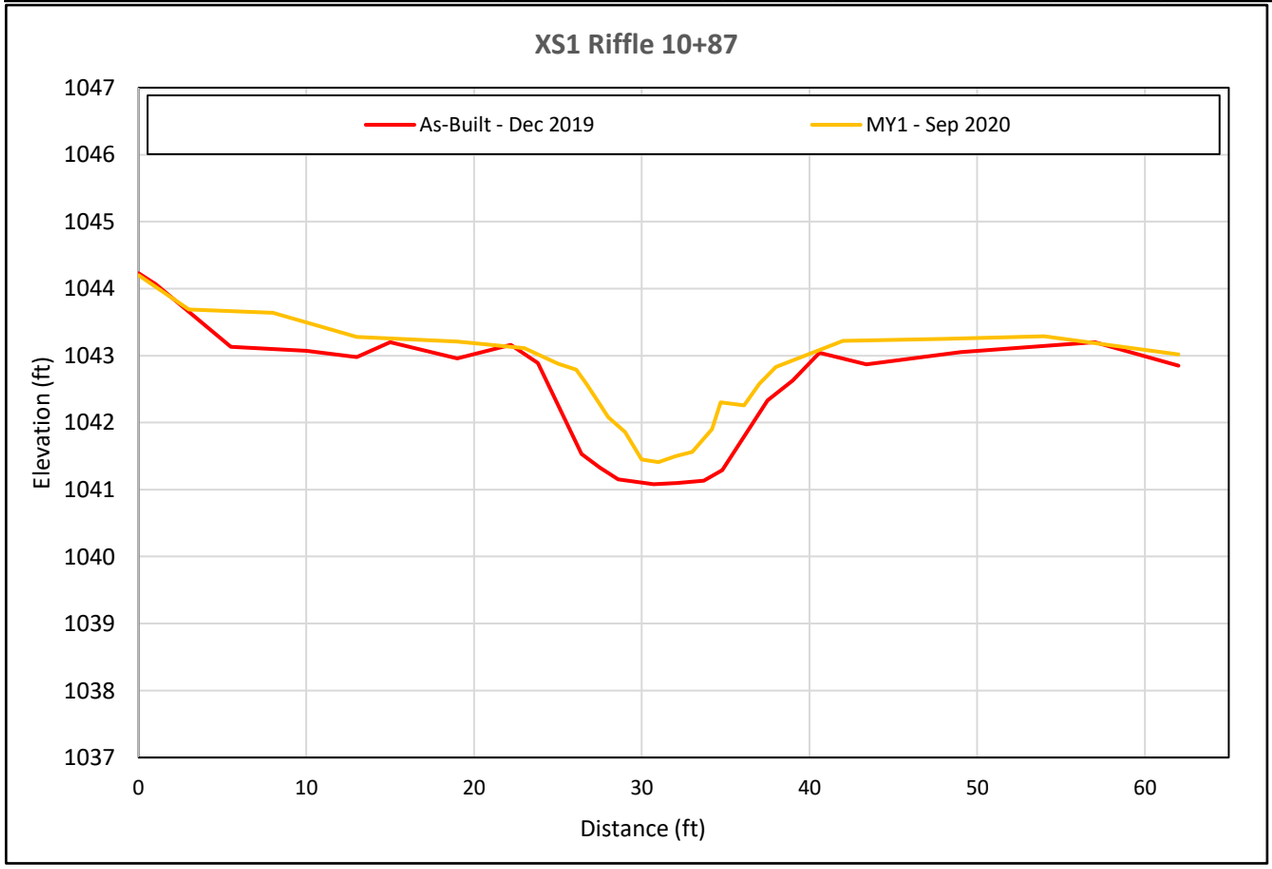
XS1 - Reach 1

Station 10+87 - Riffle

XS2 looking upstream

XS2 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1042.89	1043.43					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.84					
Thalweg Elevation	1041.08	1041.41					
LTOB Elevation	1042.89	1043.11					
LTOB Max Depth	1.81	1.70					
LTOB Cross Sectional Area	19.79	14.06					
Entrenchment Ratio	>3.5	>4.52					



Cross Section Plot - MY1

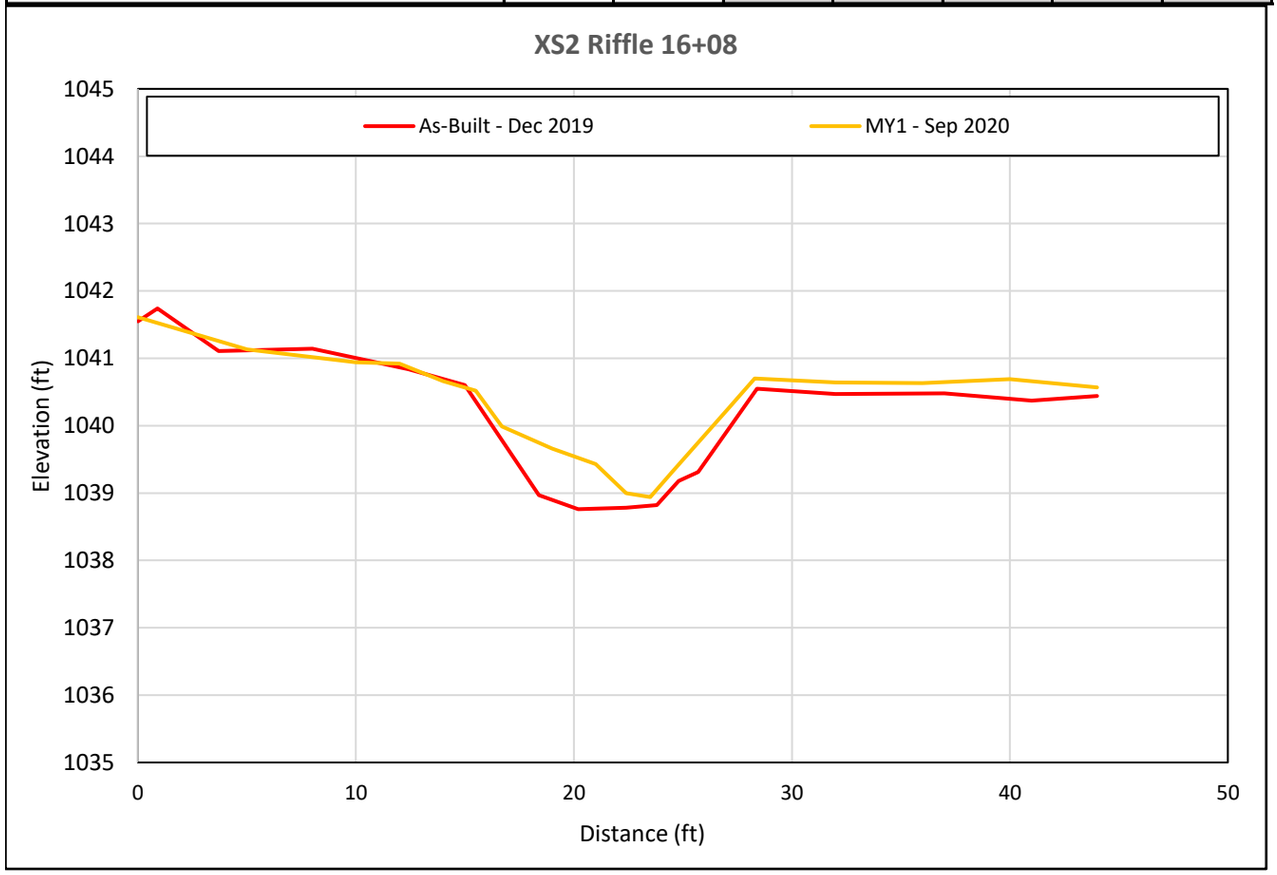
XS2 - Reach 1

Station 16+08- Riffle

XS2 looking upstream

XS2 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1040.55	1040.98					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.78					
Thalweg Elevation	1038.76	1038.94					
LTOB Elevation	1040.55	1040.52					
LTOB Max Depth	1.79	1.58					
LTOB Cross Sectional Area	16.40	10.80					
Entrenchment Ratio	>3.31	>3.46					



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - MY1

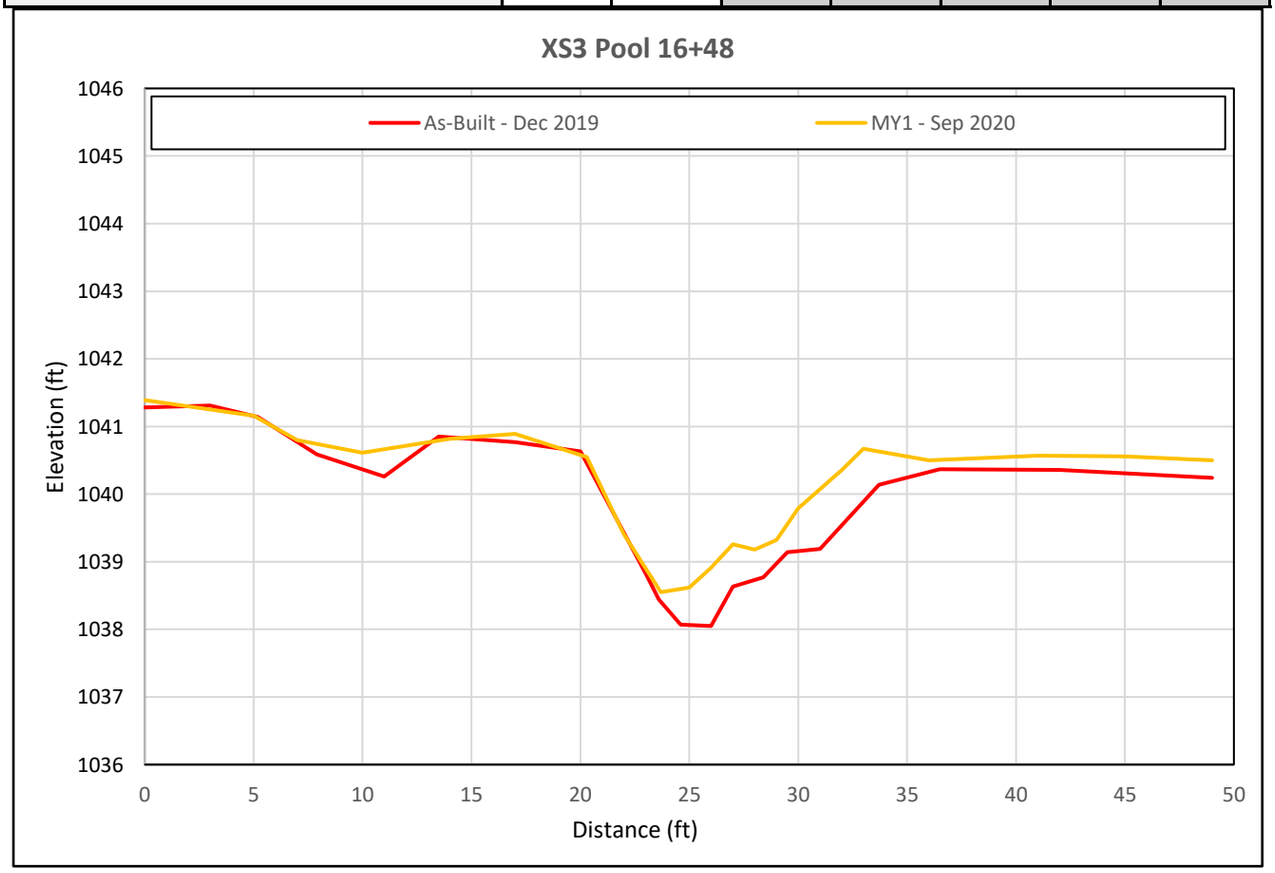
XS3 - Reach 1

Station 16+48- Pool

XS3 looking upstream

XS3 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1040.37	1040.90					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.85					
Thalweg Elevation	1038.05	1038.55					
LTOB Elevation	1040.37	1040.55					
LTOB Max Depth	2.32	2.00					
LTOB Cross Sectional Area	18.32	14.08					
Entrenchment Ratio	-	-					



Cross Section Plot - MY1

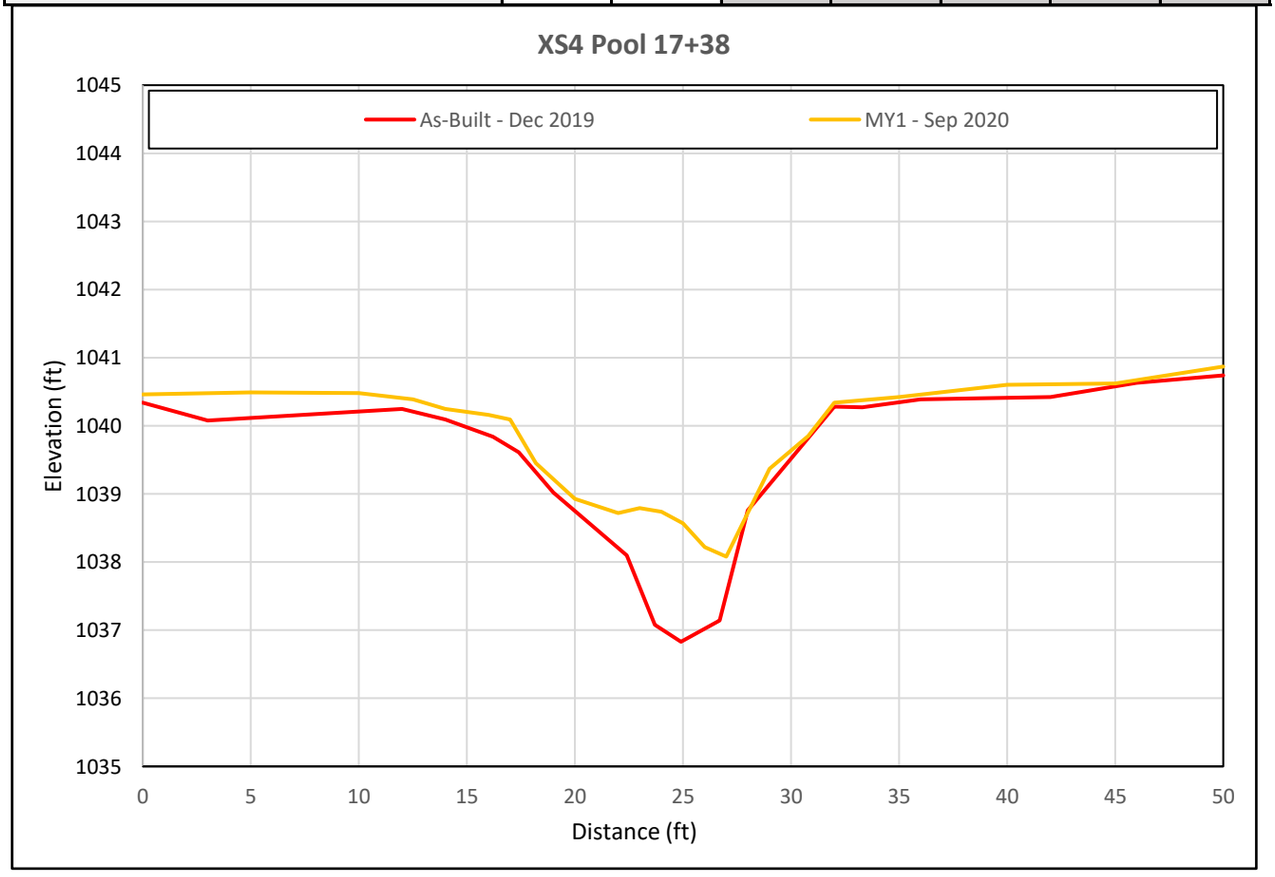
XS4 - Reach 1

Station 17+38- Pool

XS4 looking upstream

XS4 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1040.25	1040.78					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.80					
Thalweg Elevation	1036.83	1038.08					
LTOB Elevation	1040.25	1040.25					
LTOB Max Depth	3.42	2.17					
LTOB Cross Sectional Area	27.86	18.48					
Entrenchment Ratio	-	-					



Cross Section Plot - MY1

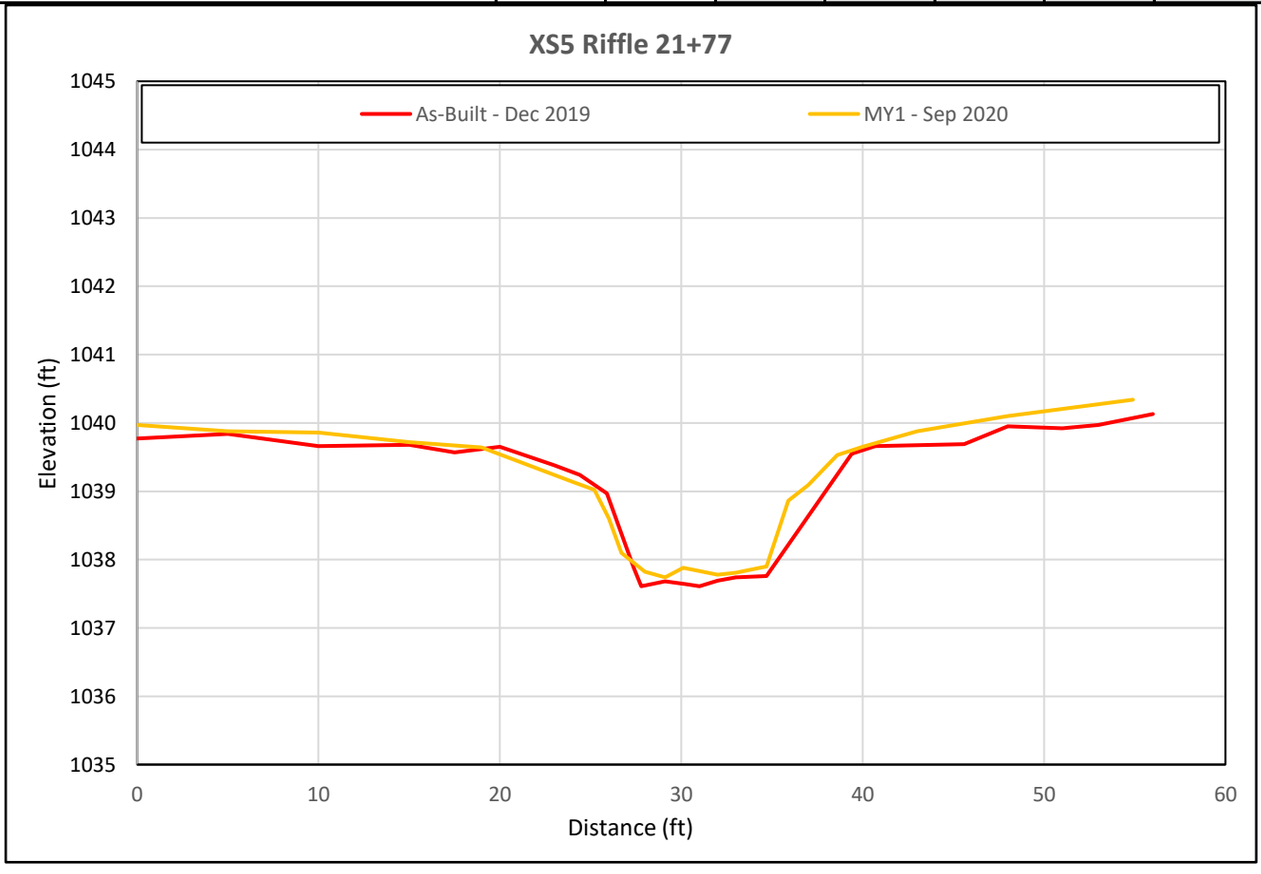
XS5 - Reach 1

Station 21+77 - Riffle

XS5 looking upstream

XS5 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1039.55	1039.65					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.94					
Thalweg Elevation	1037.61	1037.74					
LTOB Elevation	1039.55	1039.53					
LTOB Max Depth	1.94	1.79					
LTOB Cross Sectional Area	20.68	18.54					
Entrenchment Ratio	>3.06	>2.90					



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - MY1

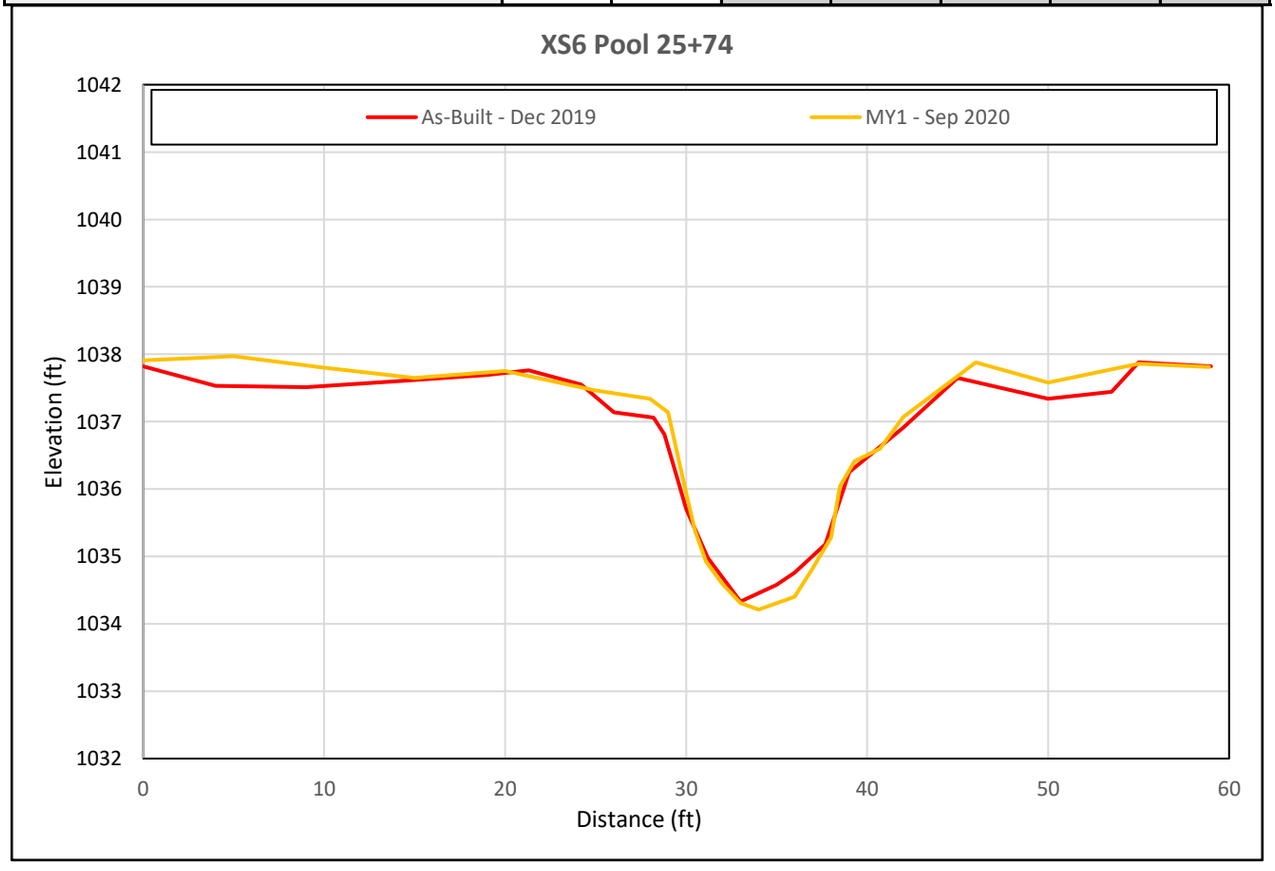
XS6 - Reach 1

Station 25+74 - Pool

XS6 looking upstream

XS6 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1037.06	1037.03					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.11					
Thalweg Elevation	1034.33	1034.21					
LTOB Elevation	1037.06	1037.34					
LTOB Max Depth	2.73	3.13					
LTOB Cross Sectional Area	21.82	26.18					
Entrenchment Ratio	-	-					



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - MY1

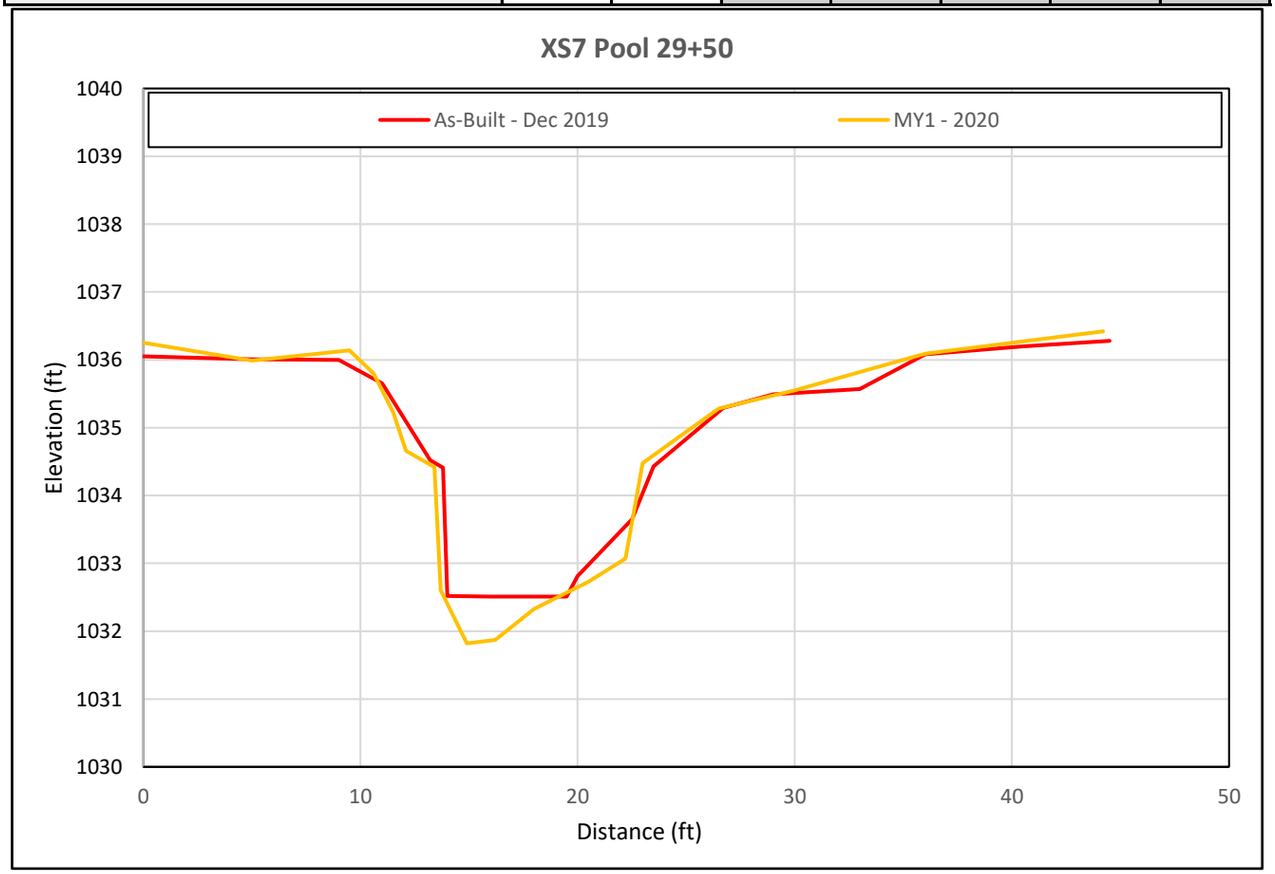
XS7 - Reach 2

Station 29+50 - Pool

XS7 looking upstream

XS7 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1035.65	1035.48					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.09					
Thalweg Elevation	1032.51	1031.82					
LTOB Elevation	1035.65	1035.80					
LTOB Max Depth	3.14	3.98					
LTOB Cross Sectional Area	32.43	38.84					
Entrenchment Ratio	-	-					



Cross Section Plot - MY1

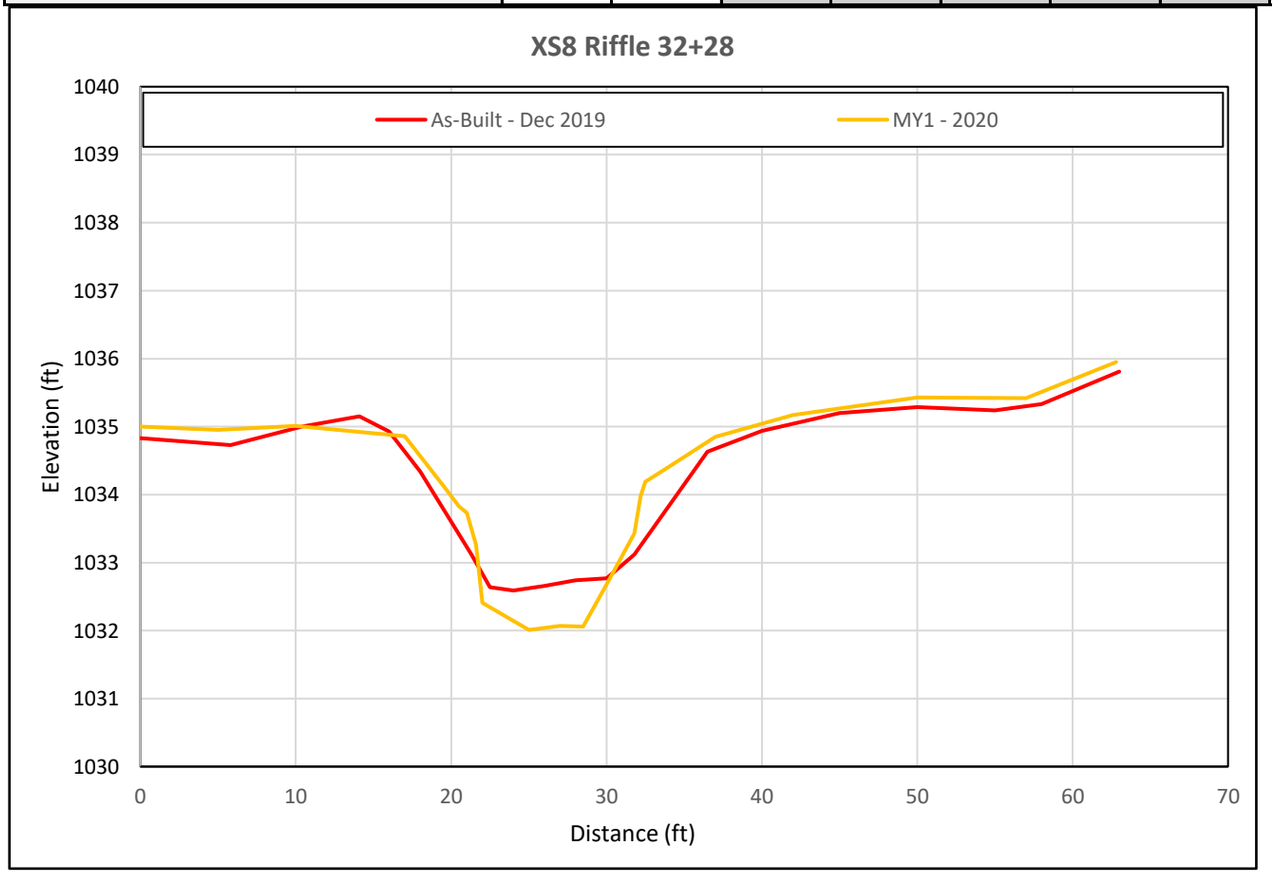
XS8 - Reach 2

Station 32+28 - Riffle

XS8 looking upstream

XS8 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1034.63	1034.62					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.09					
Thalweg Elevation	1032.59	1032.01					
LTOB Elevation	1034.63	1034.85					
LTOB Max Depth	2.04	2.84					
LTOB Cross Sectional Area	26.44	30.76					
Entrenchment Ratio	>3.23	>3.55					



Cross Section Plot - MY1

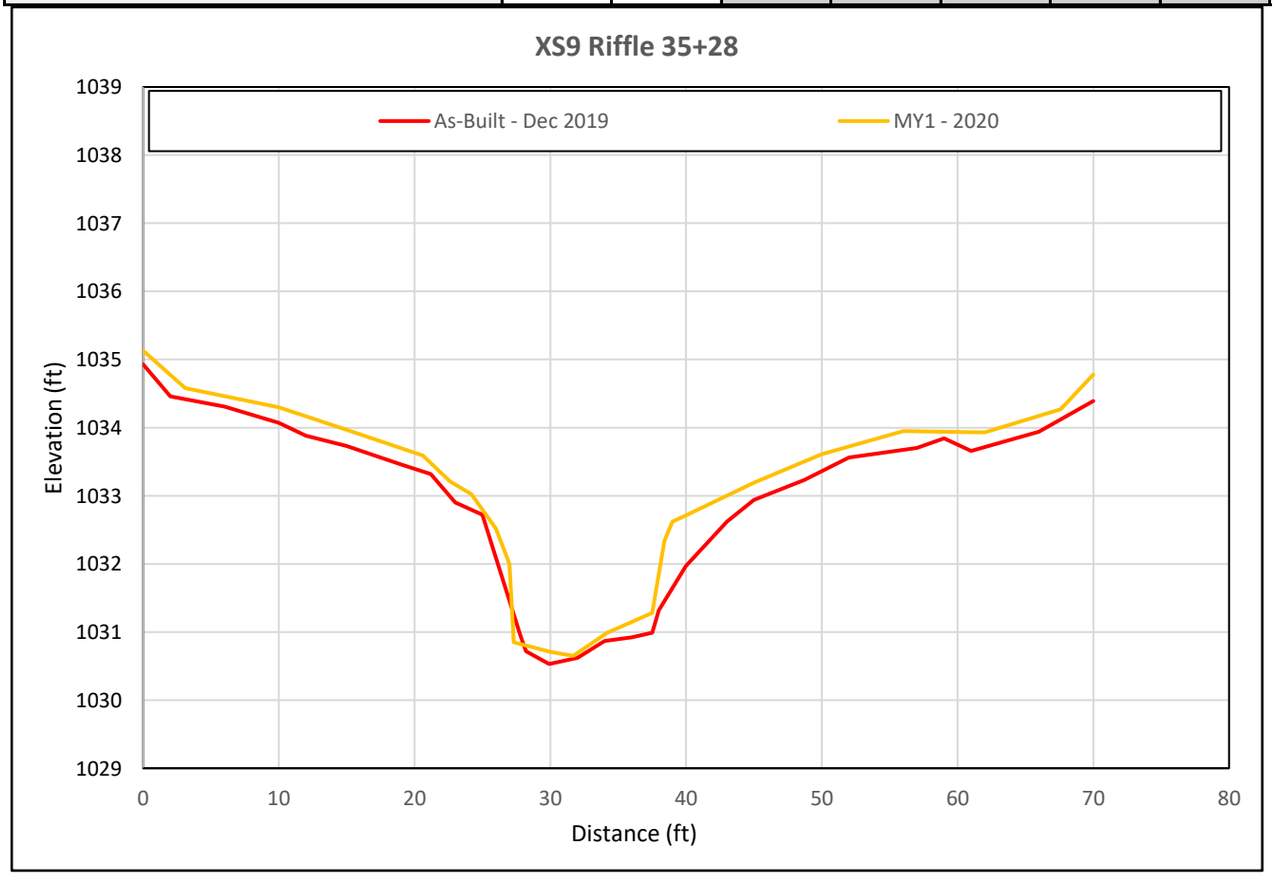
XS9 - Reach 3

Station 35+28 - Riffle

XS9 looking upstream

XS9 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1032.62	1032.98					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.85					
Thalweg Elevation	1030.53	1030.65					
LTOB Elevation	1032.62	1032.62					
LTOB Max Depth	2.09	1.97					
LTOB Cross Sectional Area	23.96	19.22					
Entrenchment Ratio	>3.87	>4.94					



Cross Section Plot - MY1

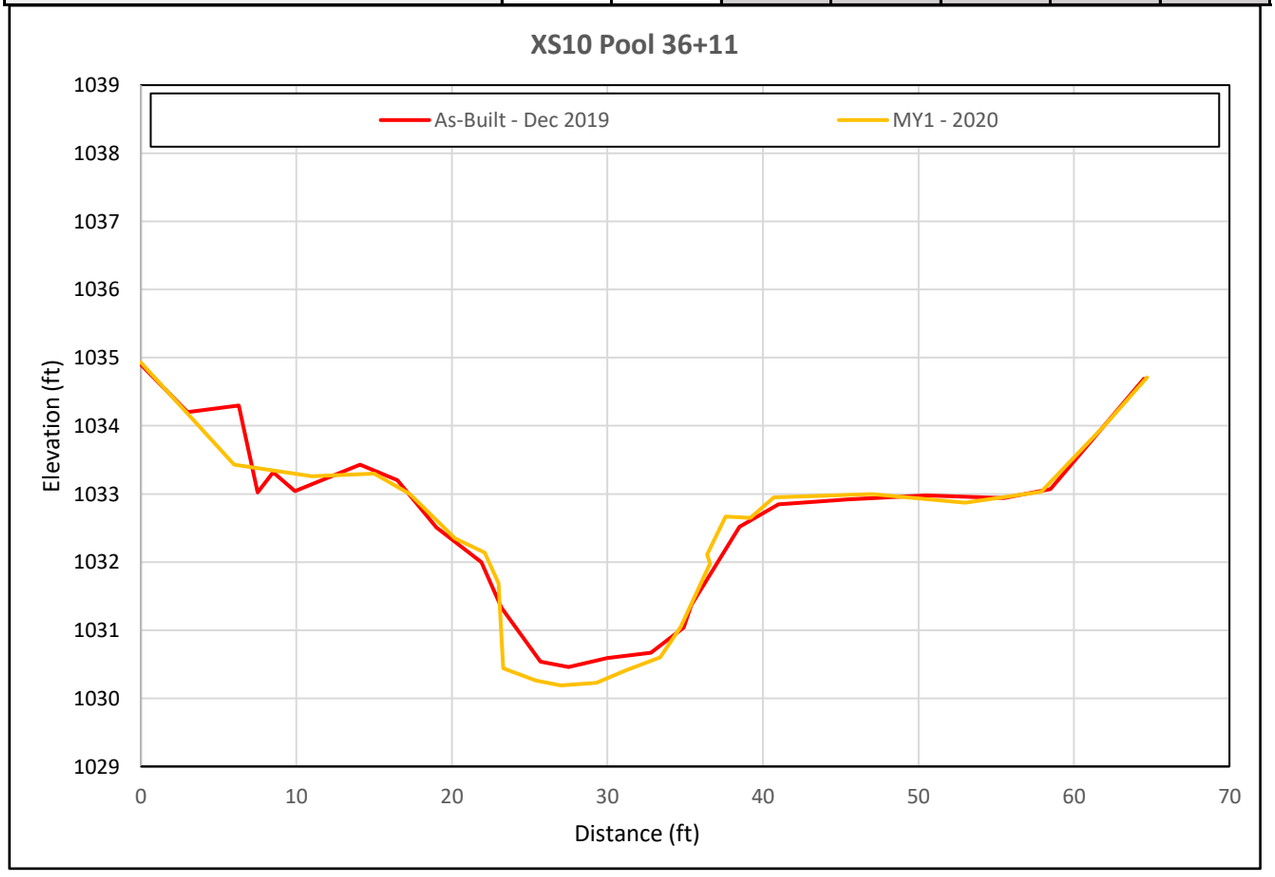
XS10 - Reach 3

Station 36+11- Pool

XS10 looking upstream

XS10 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1032.85	1032.77					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.07					
Thalweg Elevation	1030.46	1030.19					
LTOB Elevation	1032.85	1032.95					
LTOB Max Depth	2.39	2.76					
LTOB Cross Sectional Area	32.75	36.72					
Entrenchment Ratio	-	-					



Cross Section Plot - MY1

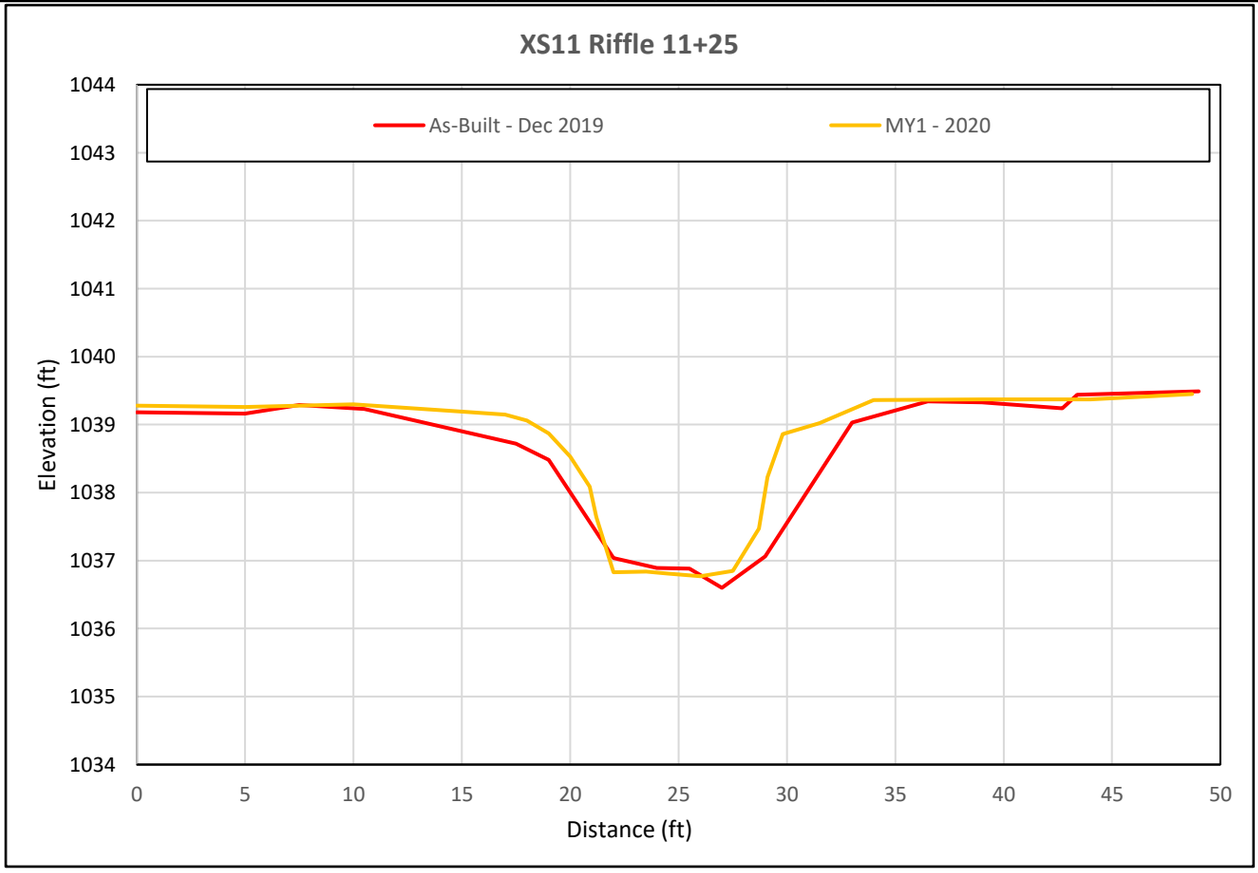
XS11 - UT

Station 11+25 - Riffle

XS11 looking upstream

XS11 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1038.48	1038.87					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.99					
Thalweg Elevation	1036.60	1036.84					
LTOB Elevation	1038.48	1038.86					
LTOB Max Depth	1.88	2.02					
LTOB Cross Sectional Area	15.54	15.40					
Entrenchment Ratio	>3.8	>5.23					



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - MY1

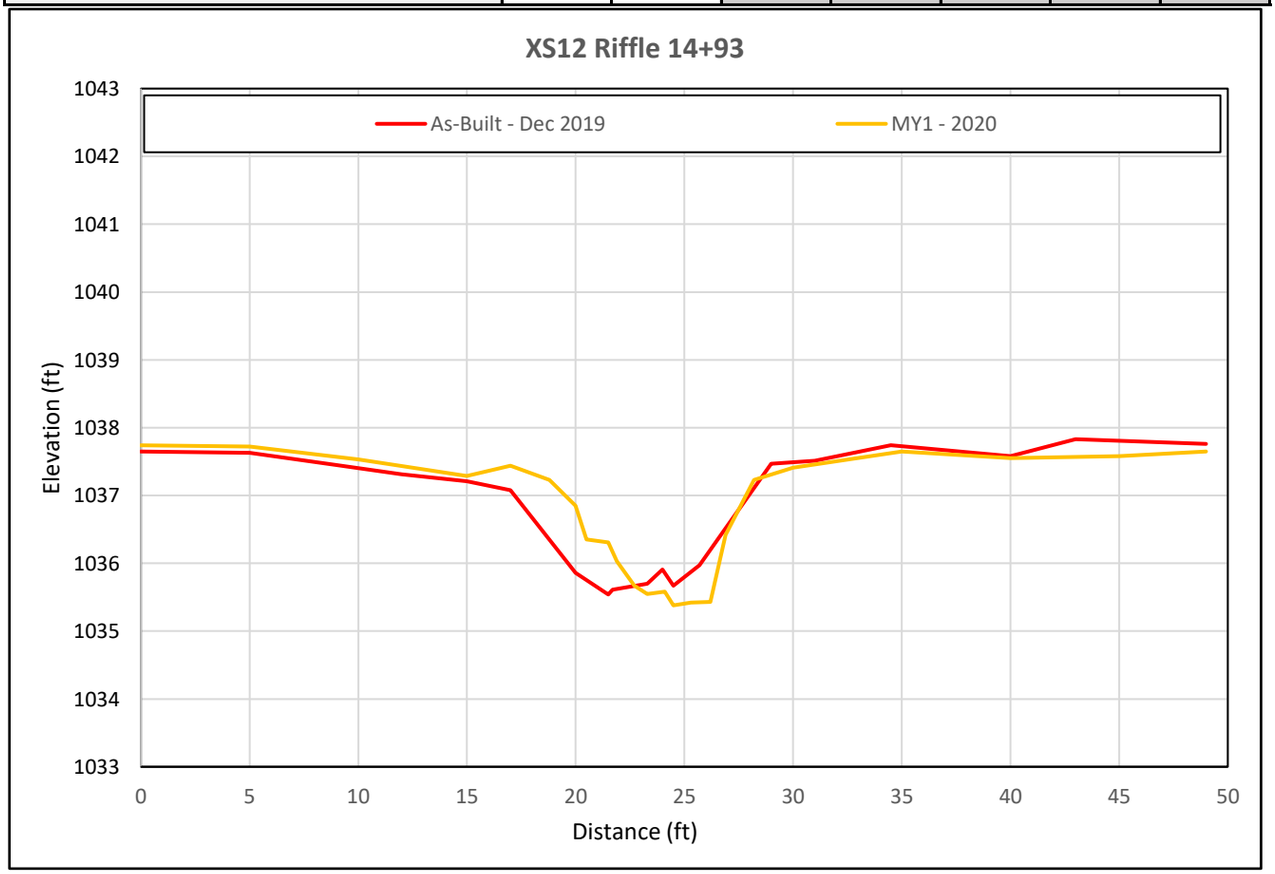
XS12 - UT

Station 14+93 - Riffle

XS12 looking upstream

XS12 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1037.08	1037.49					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.86					
Thalweg Elevation	1035.54	1035.67					
LTOB Elevation	1037.08	1037.23					
LTOB Max Depth	1.54	1.56					
LTOB Cross Sectional Area	10.89	8.47					
Entrenchment Ratio	>4.4	>5.64					



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - MY1

XS13 - UT

Station 15+72 - Pool

XS13 looking upstream

XS13 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1036.46	1037.27					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.94					
Thalweg Elevation	1033.32	1034.52					
LTOB Elevation	1036.46	1037.09					
LTOB Max Depth	3.14	2.57					
LTOB Cross Sectional Area	19.55	17.77					
Entrenchment Ratio	-	-					

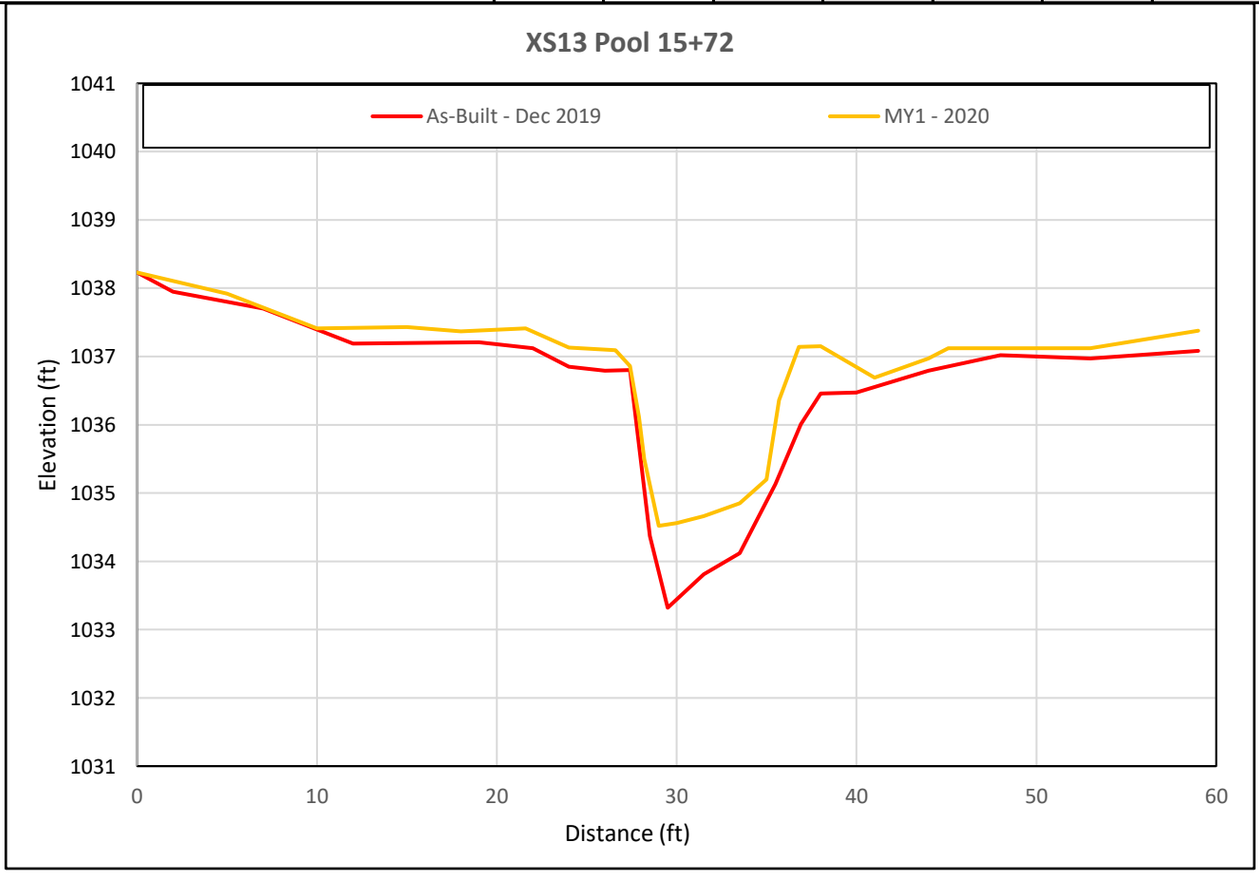


Table 8a. Baseline Stream Data Summary
Meadow Brook Stream Restoration Project (DMS No. 100024) - Meadow Brook Reach 1 (1936 feet)

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)	7	25	11.5	7.2	12.5	11.6	19.6	5.4	4	13.8	15.4	-	16.9	-	N/A	13.8	14.5	15.7	13.3	16.0	16.4	18.3	2.1	3
Floodprone Width (ft)				56.0	192.8	209.0	297.0	102.6	4	30.8	291.0	-	552	-	N/A	180.0	215.0	250.0	>44	>54	>56	>62	-	3
Bankfull Mean Depth (ft)	0.9	2.3	1.5	0.8	1.5	1.4	2.2	0.6	4	0.8	1.3	-	1.7	-	N/A	1.1	1.3	1.6	1.1	1.2	1.2	1.2	0.0	3
[1]Bankfull Max Depth (ft)				2.0	2.3	2.2	2.8	0.4	4	1.1	1.8	-	2.4	-	N/A	1.3	1.8	2.2	1.8	1.8	1.8	1.9	0.1	3
Bankfull Cross Sectional Area (ft^2)	9	40	15.1	15.1	15.7	15.4	16.9	0.9	4	11.0	19.9	-	28.7	-	N/A	15.2	19.0	25.1	16.4	18.9	19.5	20.7	1.8	3
Width/Depth Ratio				3.3	11.4	8.4	25.4	9.8	4	10.0	12.5	-	15	-	N/A	10.0	11.0	13.0	10.8	13.6	13.8	16.2	2.2	3
Entrenchment Ratio				5.7	17.5	15.7	33.0	12.5	4	2.2	3.1	-	40.0	-	N/A	12.2	22.6	33.0	>3.1	>3.1	>3.1	>3.1	-	3
[1]Bank Height Ratio				1.0	1.2	1.2	1.5	0.2	5	1.0	1.1	-	1.1	-	N/A	1.0	1.0	1.0	1	1	1	1	-	3
Profile																								
Riffle Length (ft)				11.0	48.7	20.0	216.0	74.2	7	Total riffle length 60-70% of reach length						31.0	52.0	72.0	32.2	55.7	60.1	72.0	14.2	12
Riffle Slope (ft/ft)				0.003	0.00757	0.004	0.022	0.0067	7	0.002	0.0045	-	0.007	-	-	0.0034	0.0045	0.006	0.003	0.004	0.004	0.006	0.001	12
Pool Length (ft)				9.0	43.9	39.0	98.0	36.8	8	Total pool length 30-40% of reach length						20.0	26.3	38.0	20.4	27.9	26.6	36.7	5.1	17
Pool Max depth (ft)				2.1	2.5	2.5	2.8	0.2	8	1.6	3.8	-	5.0	-	-	2.1	3.2	4.7	0.7	1.5	1.3	3.1	0.7	19
Pool Spacing (ft)				30.0	88.0	73.0	177.0	55.0	8	61.4	84.4	-	140	-	-	40.5	86.0	120.0	50.0	95.0	99.6	119.4	20.9	16
Pattern																								
Channel Beltwidth (ft)				11.0	27.1	24.0	44.0	12.1	10	53.7	88.3	-	122.8	-	-	54.8	75.5	106.8	55.0	76.3	69.1	106.6	15.0	18
Radius of Curvature (ft)				12.0	62.2	31.0	150.0	49.7	11	30.7	42.2	-	53.7	-	-	30.4	36.3	41.4	30.4	32.6	31.5	40.8	2.7	18
Rc:Bankfull width (ft/ft)				1.1	5.7	2.8	13.6	4.5	11	2.0	2.8	-	3.5	-	-	2.1	2.5	2.8	1.9	2.0	2.0	2.5	0.2	18
Meander Wavelength (ft)				65.0	176.4	120.0	450.0	143.9	7	107.5	145.8	-	184.2	-	-	103	138.1	189	108.0	135.0	136.4	166.0	18.0	17
Meander Width Ratio				1.0	2.5	2.2	4.0	1.1	10	3.5	5.8	-	8.0	-	-	3.7	5.1	7.2	3.4	4.7	4.3	6.6	0.8	17
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				1												0.3			0.22					
Max part size (mm) mobilized at bankfull				243												68			50					
Stream Power (transport capacity) W/m^2				4.6												10			14.5					
Additional Reach Parameters																								
Rosgen Classification				E4						C4						C4			C4					
Bankfull Velocity (fps)	0.8	25.6	5.6	4.8												3.8			3.9					
Bankfull Discharge (cfs)	30	230	84.5	73												73			73					
Valley length (ft)				1249						-						1358*			1358					
Channel Thalweg length (ft)				1304						-						1936			1965					
Sinuosity (ft)				1.0						1.2 to 1.6						1.4			1.4					
Water Surface Slope (Channel) (ft/ft)				0.00498						-						0.0034			0.0035					
BF slope (ft/ft)				0.00498						-						0.0034			0.0035					
[3]Bankfull Floodplain Area (acres)				5.5						-						6.7			5.5					
[4]% of Reach with Eroding Banks				61%						-														
Channel Stability or Habitat Metric				37%						-														
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

* Note that the valley length has increased in the proposed alignment.

Table 8b. Baseline Stream Data Summary
Meadow Brook Stream Restoration Project (DMS No. 100024) - Meadow Brook Reach 2 (393 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)	8.5	30	14.2	14.5	14.5	14.5	14.5	-	1	15.2	16.9	-	18.6	-	-	16.1	16.6	18.4	19.5	19.5	19.5	19.5	-	1
Floodprone Width (ft)				48.0	48.0	48.0	48.0	-	1	37.2	323.0	-	608	-	-	180.0	197.5	215.0	>63	>63	>63	>63	-	1
Bankfull Mean Depth (ft)	1.1	3	1.7	1.7	1.7	1.7	1.7	-	1	1	1.5	-	1.9	-	-	1.2	1.4	1.8	1.4	1.4	1.4	1.4	-	1
[1]Bankfull Max Depth (ft)				2.5	2.5	2.5	2.5	-	1	1.2	1.9	-	2.6	-	-	1.5	1.9	2.6	2.0	2.0	2.0	2.0	-	1
Bankfull Cross Sectional Area (ft^2)	13	53	21.6	24.0	24.0	24.0	24.0	-	1	15.2	25.3	-	35.3	-	-	19.3	23.0	33.1	26.4	26.4	26.4	26.4	-	1
Width/Depth Ratio				8.7	8.7	8.7	8.7	-	1	10.0	12.5	-	15	-	-	10.0	12.0	13.0	14.3	14.3	14.3	14.3	-	1
Entrenchment Ratio				3.3	3.3	3.3	3.3	-	1	2.2	3.1	-	40.0	-	-	11.1	12.2	13.2	>3.2	>3.2	>3.2	>3.2	-	1
[1]Bank Height Ratio				1.0	1.0	1.0	1.0	-	1	1.0	1.1	-	1.1	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	1
Profile																								
Riffle Length (ft)				20.0	55.0	55.0	90.0	-	2	Total riffle length 60-70% of reach length						37.0	49.0	53.0	66.6	77.8	80.6	86.3	8.3	3
Riffle Slope (ft/ft)				0.002	0.031	0.031	0.06	-	2	0.002	0.0045	-	0.007	-	-	0.0038	0.0045	0.006	0.001	0.003	0.002	0.005	0.001	3
Pool Length (ft)				72.0	134.0	134.0	196.0	-	2	Total pool length 30-40% of reach length						32.0	34.0	39.0	16.8	24.7	23.7	34.5	6.5	4
Pool Max depth (ft)				3.1	3.4	3.4	3.7	-	2	2	4.3	-	6.7	-	-	2.8	3.2	4.9	1.0	1.8	1.7	2.9	0.7	4
Pool Spacing (ft)				135.0	213.0	213.0	290.0	-	2	67.6	93.0	-	118.3	-	-	95.0	108.0	111.0	89.8	115.9	112.1	149.5	21.9	4
Pattern																								
Channel Beltwidth (ft)				25.0	25.0	25.0	25.0	-	1	59.2	97.2	-	135.2	-	-	49.3	84.8	92.3	81.2	87.7	89.9	92.1	4.7	3
Radius of Curvature (ft)				25.0	25.0	25.0	25.0	-	1	33.8	46.5	-	59.2	-	-	37.1	38.1	42.1	37.3	38.5	38.7	39.2	0.7	4
Rc:Bankfull width (ft/ft)				2.3	2.3	2.3	2.3	-	1	2.0	2.8	-	3.5	-	-	2.3	2.3	2.6	1.9	2.0	2.0	2.0	0.0	4
Meander Wavelength (ft)				295.0	295.0	295.0	295.0	-	1	118.3	160.6	-	202.8	-	-	144.0	154.0	187.0	149.2	154.3	155.5	156.8	3.0	4
Meander Width Ratio				2.3	2.3	2.3	2.3	-	1	3.5	5.8	-	8.0	-	-	3.0	5.2	5.7	4.2	4.5	4.6	4.7	0.2	3
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.7												0.3			0.3					
Max part size (mm) mobilized at bankfull				186												81			60					
Stream Power (transport capacity) W/m^2				43												15			18					
Additional Reach Parameters																								
Rosgen Classification				E4						C4						C4			C4					
Bankfull Velocity (fps)	3.3	6.6	5.6	4.4												2.8			3.8					
Bankfull Discharge (cfs)	43	350	120.0	100												100			100					
Valley length (ft)				322						-						322			322					
Channel Thalweg length (ft)				350						-						393			390					
Sinuosity (ft)				1.1						1.2 to 1.6						1.2			1.2					
Water Surface Slope (Channel) (ft/ft)				0.00685						-						0.0038			0.0039					
BF slope (ft/ft)				0.00685						-						0.0038			0.0039					
[3]Bankfull Floodplain Area (acres)				0.4						-						1.5			0.9					
[4]% of Reach with Eroding Banks				33%						-														
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 8c. Baseline Stream Data Summary
Meadow Brook Stream Restoration Project (DMS No. 100024) - Meadow Brook Reach 3 (273 feet) and Meadow Brook Reach 4 (218 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)	8.8	32	14.9	21	21	21	21	-	1	17.7	19.7	-	21.6	-	-	17.7	17.7	18.4	17.8	17.8	17.8	17.8	-	1
Floodprone Width (ft)				38	38	38	38	-	1	27.5	736.0	-	708	-	-	35.0	52.5	70.0	>70	>70	>70	>70	-	1
Bankfull Mean Depth (ft)	1.1	3	1.8	1.4	1.4	1.4	1.4	-	1	1.0	1.4	-	1.8	-	-	1.4	1.5	1.5	1.3	1.3	1.3	1.3	-	1
[1]Bankfull Max Depth (ft)				2.9	2.9	2.9	2.9	-	1	1.1	1.7	-	2.3	-	-	1.5	1.9	2.0	2.1	2.1	2.1	2.1	-	1
Bankfull Cross Sectional Area (ft^2)	15	62	23.6	30	30	30	30	-	1	17.7	28.3	-	38.88	-	-	24.8	26.0	27.6	24.0	24.0	24.0	24.0	-	1
Width/Depth Ratio				15	15	15	15	-	1	12.0	15.0	-	18	-	-	12.0	12.0	13.0	13.3	13.3	13.3	13.3	-	1
Entrenchment Ratio				2	2	2	2	-	1	1.4	1.8	-	40	-	-	1.9	2.9	3.9	>3.9	>3.9	>3.9	>3.9	-	1
[1]Bank Height Ratio				1.0	1.0	1.0	1.0	-	1	1.0	1.1	-	1.1	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	1
Profile																								
Riffle Length (ft)				7	12	12	18	-	2	Total riffle length 60-70% of reach length						16.0	23.5	30.0	38.2	73.5	62.2	131.4	36.9	4
Riffle Slope (ft/ft)				0.080	0.068	0.068	0.056	-	2	0.002	0.007	-	0.015	-	-	0.007	0.008	0.01	0.002	0.006	0.007	0.010	0.003	4
Pool Length (ft)				50	142	152	225	88	3	Total pool length 30-40% of reach length						21.0	27.5	64.0	17.7	36.2	34.0	59.3	13.4	5
Pool Max depth (ft)				2.7	3.1	3.1	3.4	0.4	3	2.0	4.2	-	6.3	-	-	3.0	2.7	5.3	1.2	1.4	1.4	1.9	0.2	5
Pool Spacing (ft)				60	152	152	243	-	2	29.5	63.9	-	98.3	-	-	22.0	61.0	104.0	29.9	94.0	103.4	168.9	47.2	5
Pattern																								
Channel Beltwidth (ft)				28	35	35	41	-	2	-	-	-	-	-	-	27.1	35.6	50.1	-	-	-	-	-	-
Radius of Curvature (ft)				25	50	50	74	-	2	-	-	-	-	-	-	38.0	43.0	49.0	39.2	40.8	40.8	42.4	1.6	2
Rc:Bankfull width (ft/ft)				2.3	4.5	4.5	6.7	-	2	-	-	-	-	-	-	2.1	2.4	2.7	2.2	2.3	2.3	2.4	0.1	2
Meander Wavelength (ft)				295	295	295	295	-	1	-	-	-	-	-	-	92.0	130.0	172.0	-	-	-	-	-	-
Meander Width Ratio				2.5	3.1	3.1	3.7	-	2	-	-	-	-	-	-	1.5	2.0	2.8	-	-	-	-	-	-
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.6												0.6			0.53					
Max part size (mm) mobilized at bankfull				158												148			98					
Stream Power (transport capacity) W/m^2				58												41			43					
Additional Reach Parameters																								
Rosgen Classification				E4						B4c						Bc4			Bc4					
Bankfull Velocity (fps)	3.3	6.5	5.6	3.9												3.8			4.8					
Bankfull Discharge (cfs)	50	400	131.0	116												99			116					
Valley length (ft)				508						-									508					
Channel Thalweg length (ft)				523						-						533			532					
Sinuosity (ft)				1.03						1.1 to 1.2						1.05			1.05					
Water Surface Slope (Channel) (ft/ft)				0.00369						-						0.0066			0.007					
BF slope (ft/ft)				0.00369						-						0.0066			0.007					
[3]Bankfull Floodplain Area (acres)				0.4						-						0.6			0.4					
[4]% of Reach with Eroding Banks				18%						-														
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 8d. Baseline Stream Data Summary
Meadow Brook Stream Restoration Project (DMS No. 100024) - UT to Meadow Brook (703 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)	6	21	9.3	8	8	8	8	-	1	11.8	13.2	-	14.5	-	-	11.8	12.4	13.4	11.1	12.0	12.0	12.9	0.9	3
Floodprone Width (ft)				195	195	195	195	-	1	28.9	250.0	-	472	-	-	188	188	188	>49	>49	>49	>49	-	3
Bankfull Mean Depth (ft)	0.8	2.1	1.2	1.5	1.5	1.5	1.5	-	1	0.8	1.2	-	1.5	-	-	0.9	1.1	1.4	1.0	1.1	1.1	1.2	0.1	3
[1]Bankfull Max Depth (ft)				2.2	2.2	2.2	2.2	-	1	0.9	1.5	-	2	-	-	1.1	1.6	1.9	1.5	1.7	1.7	1.9	0.2	3
Bankfull Cross Sectional Area (ft^2)	7	30	10.3	11	11	11	11	-	1	9.4	15.6	-	21.8	-	-	11	14	19	10.9	13.2	13.2	15.5	2.3	3
Width/Depth Ratio				5	5	5	5	-	1	10	12.5	-	15	-	-	10	11	13	10.6	11.0	11.0	11.4	0.4	3
Entrenchment Ratio				26	26	26	26	-	1	2.2	3.1	-	40	-	-	15	15.0	15.0	>3.8	>4.1	>4.1	>4.4	-	3
[1]Bank Height Ratio				1.2	1.2	1.2	1.2	-	1	1	1.1	-	1.1	-	-	1	1	1	1	1	1	1	0.0	3
Profile																								
Riffle Length (ft)				8	85	118	129	67	3	Total riffle length 60-70% of reach length						27	37	53.6	33.5	43.4	44.4	51.2	7.6	4
Riffle Slope (ft/ft)				0.0066	0.02153	0.008	0.050	0.025	3	0.002	0.0045	-	0.007	-	-	0.005	0.006	0.008	0.001	0.008	0.010	0.013	0.005	5
Pool Length (ft)				29	39	31	56	15	3	Total pool length 30-40% of reach length						17	23	52	21.9	29.1	26.0	39.5	6.8	5
Pool Max depth (ft)				3.1	3.3	3.1	3.6	0.3	3	1.6	3.4	-	5.3	-	-	2.2	2.6	3.85	0.9	1.3	1.4	1.8	0.4	5
Pool Spacing (ft)				65	160	160	254	-	2	52.6	72.3	-	92.05	-	-	10	56	92	49.8	70.6	68.9	95.0	16.6	4
Pattern																								
Channel Beltwidth (ft)				16	16	16	16	0	3	46.0	75.6	-	105.2	-	-	44.7	61.7	68.7	45.4	56.8	56.7	67.8	7.7	6
Radius of Curvature (ft)				81	81	81	81	-	1	26.3	36.2	-	46.0	-	-	28.3	29.8	34.3	26.4	30.0	29.7	33.9	2.8	7
Rc:Bankfull width (ft/ft)				7.4	7.4	7.4	7.4	-	1	2.0	2.8	-	3.5	-	-	2.2	2.4	2.7	2.2	2.5	2.5	2.8	0.2	7
Meander Wavelength (ft)				-	-	-	-	-	-	92.1	124.9	-	157.8	-	-	97.0	119.0	128.0	113.9	117.9	116.0	126.0	4.1	6
Meander Width Ratio				1.5	1.5	1.5	1.5	0.0	3	3.5	5.8	-	8.0	-	-	3.5	4.9	5.4	3.8	4.7	4.7	5.6	0.6	6
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				1.8												0.3			0.3					
Max part size (mm) mobilized at bankfull				459												81			60					
Stream Power (transport capacity) W/m^2				97												11			29					
Additional Reach Parameters																								
Rosgen Classification				E4						C4						C4			C4					
Bankfull Velocity (fps)	2.9	6.7	5.7	6.8												2.7			5.8					
Bankfull Discharge (cfs)	20	200	59.0	77												37			77					
Valley length (ft)				381						-						514*			524					
Channel Thalweg length (ft)				396						-						703			694					
Sinuosity (ft)				1.04						1.2 to 1.6						1.37			1.32					
Water Surface Slope (Channel) (ft/ft)				0.00828						-						0.0047			0.005					
BF slope (ft/ft)				0.00828						-						0.0047			0.005					
[3]Bankfull Floodplain Area (acres)				1.7						-						2.2			1.5					
[4]% of Reach with Eroding Banks				80%						-														
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

* Note that the valley length has increased in the proposed alignment.

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Meadow Brook Stream Restoration Project (DMS No. 100024)

	Main Stem - Reach 1 (1,936 feet)																									
	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1042.89	1043.43						1040.55	1040.98						1040.37	1040.90						1040.25	1040.78					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.84						1.00	0.78						1.00	0.85						1.00	0.80					
Thalweg Elevation	1041.08	1041.41						1038.76	1038.94						1038.05	1038.55						1036.83	1038.08					
LTOB[2] Elevation	1042.89	1043.11						1040.55	1040.52						1040.37	1040.55						1040.25	1040.25					
LTOB[2] Max Depth (ft)	1.81	1.70						1.79	1.58						2.32	2.00						3.42	2.17					
LTOB[2] Cross Sectional Area (ft^2)	19.79	14.06						16.40	10.80						18.32	14.08						27.86	18.48					
Entrenchment Ratio	>3.5	>4.52						>3.31	>3.46						-	-						-	-					

	Main Stem - Reach 1 (1,936 feet)														Main Stem - Reach 2 (393 feet)													
	Cross Section 5 (Riffle)							Cross Section 6 (Pool)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+								MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1039.55	1039.65						1037.06	1037.03						1035.65	1035.48						1034.63	1034.62					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.94						1.00	1.11						1.00	1.09						1.00	1.09					
Thalweg Elevation	1037.61	1037.74						1034.33	1034.21						1032.51	1031.82						1032.59	1032.01					
LTOB[2] Elevation	1039.55	1039.53						1037.06	1037.34						1035.65	1035.80						1034.63	1034.85					
LTOB[2] Max Depth (ft)	1.94	1.79						2.73	3.13						3.14	3.98						2.04	2.84					
LTOB[2] Cross Sectional Area (ft^2)	20.68	18.54						21.82	26.18						32.43	38.84						26.44	30.76					
Entrenchment Ratio	>3.06	>2.90						-	-						-	-						>3.23	>3.55					

	Main Stem - Reach 3 (273 feet)														UT (703 feet)													
	Cross Section 9 (Riffle)							Cross Section 10 (Pool)							Cross Section 11 (Riffle)							Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1032.62	1032.98						1032.85	1032.77						1038.48	1038.87						1037.08	1037.49					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.85						1.00	1.07						1.00	0.99						1.00	0.86					
Thalweg Elevation	1030.53	1030.65						1030.46	1030.19						1036.60	1036.84						1035.54	1035.67					
LTOB[2] Elevation	1032.62	1032.62						1032.85	1032.95						1038.48	1038.86						1037.08	1037.23					
LTOB[2] Max Depth (ft)	2.09	1.97						2.39	2.76						1.88	2.02						1.54	1.56					
LTOB[2] Cross Sectional Area (ft^2)	23.96	19.22						32.75	36.72						15.54	15.40						10.89	8.47					
Entrenchment Ratio	>3.87	>4.94						-	-						>3.8	>5.23						>4.4	>5.64					

	UT (703 feet)																											
	Cross Section 13 (Pool)																											
	MY0	MY1	MY2	MY3	MY5	MY7	MY+																					
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1036.46	1037.27																										
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.94																										
Thalweg Elevation	1033.32	1034.52																										
LTOB[2] Elevation	1036.46	1037.09																										
LTOB[2] Max Depth (ft)	3.14	2.57																										
LTOB[2] Cross Sectional Area (ft^2)	19.55	17.77																										
Entrenchment Ratio	-	-																										

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.

Appendix D

Hydrologic Data

Table 10. Verification of Bankfull Events

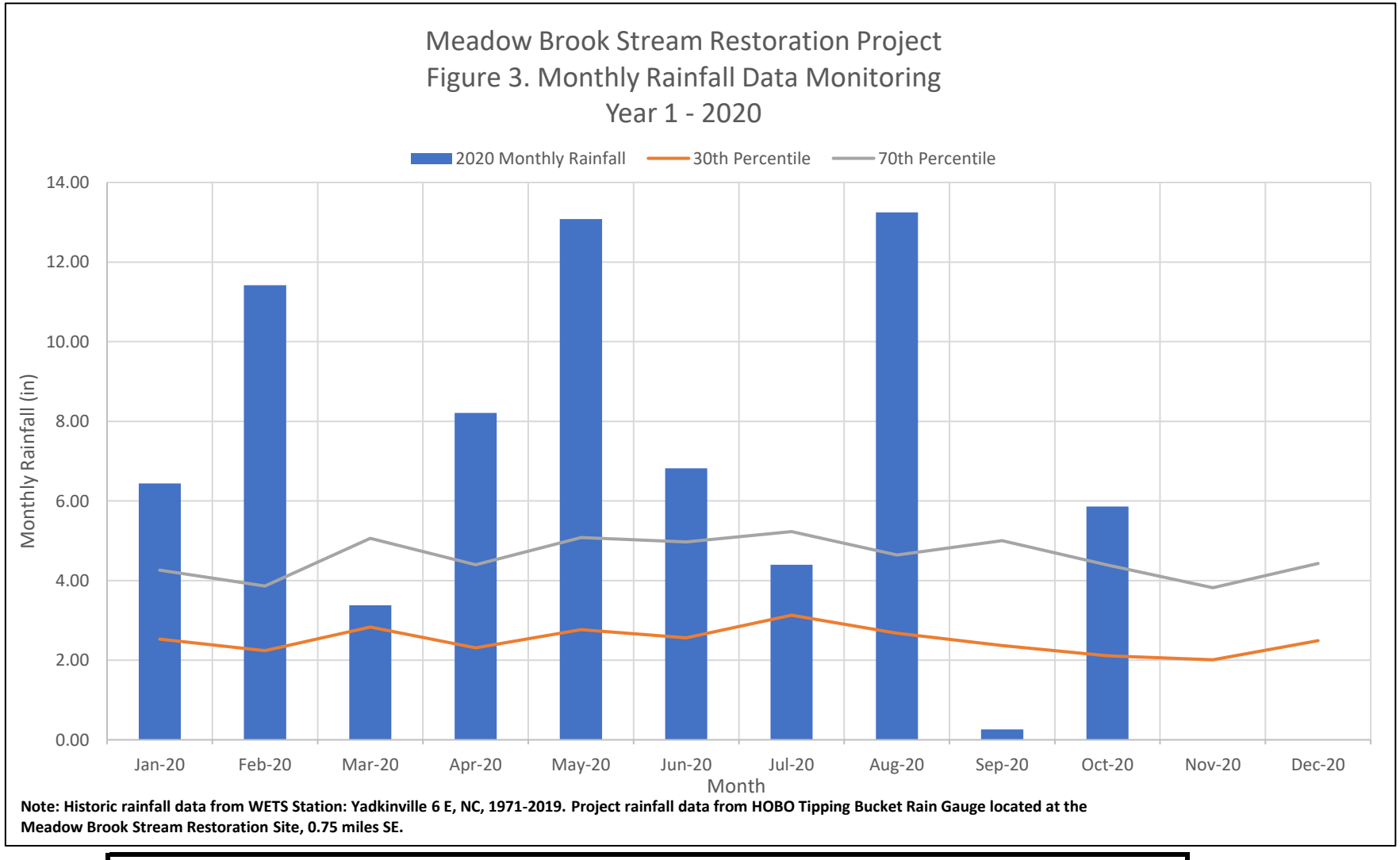
Figure 3. Monthly Rainfall Summary Data

Precipitation and Water Level Hydrographs

Bankfull Evidence Photos

Table 10. Bankfull Event Verification
Meadow Brook Stream Restoration Project (DMS No. 100024)

Overbank Events							
Gage ID	**MY1 (2020)**	**MY2 (2021)**	**MY3 (2022)**	**MY4 (2023)**	**MY5 (2025)**	**MY6 (2026)**	**MY7 (2027)**
Meadow Brook - MB2 STR	11 separate events: 4/13/2020 5/21/2020 5/24/2020 5/27/2020 5/29/2020 8/6/2020 8/15/2020 8/21/2020 9/29/2020 10/11/2020 10/25/2020	-	-	-	-	-	-
UT1 - MB1 STR UT1	14 separate events: 1/12/2020 4/13/2020 4/30/2020 5/27/2020 5/28/2020 7/24/2020 8/5/2020 8/15/2020 8/17/2020 8/21/2020 9/17/2020 9/29/2020 10/11/2020 10/25/2020	-	-	-	-	-	-

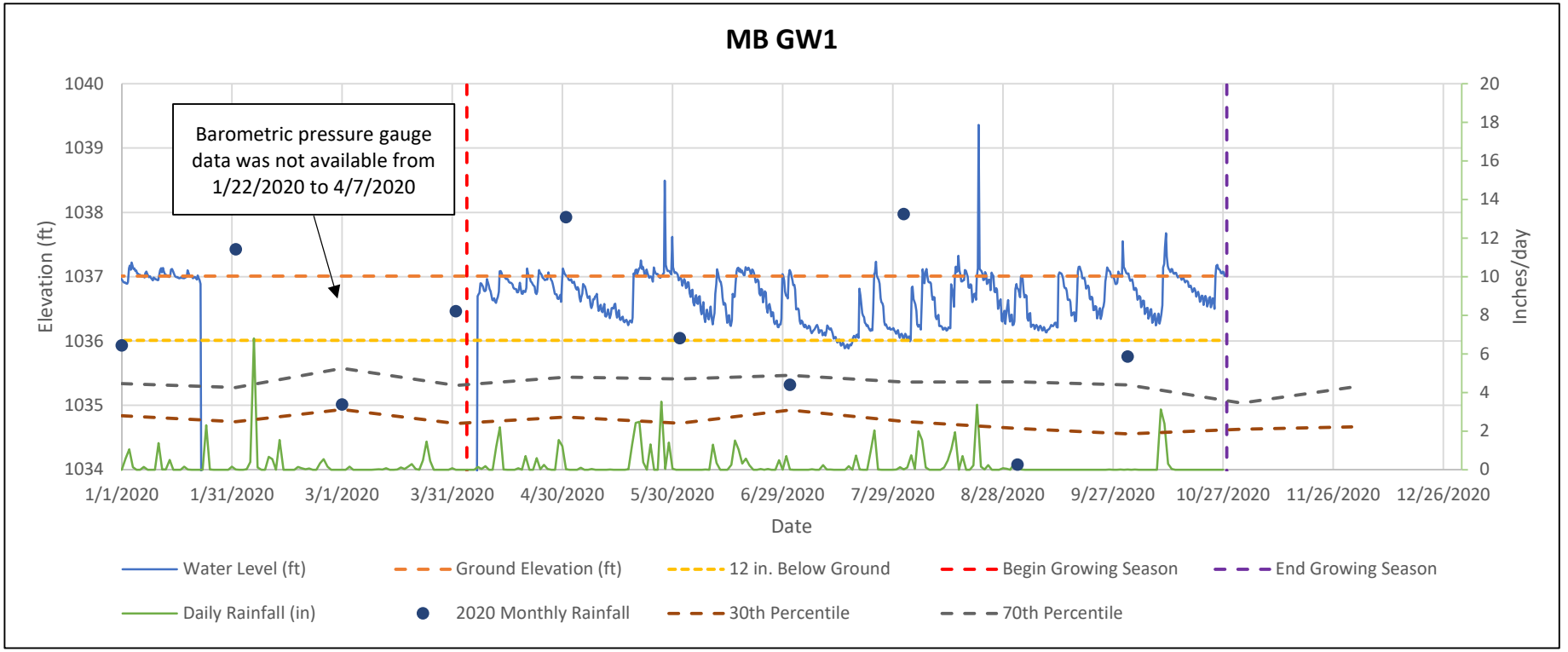


Note: Historic rainfall data from WETS Station: Yadkinville 6 E, NC, 1971-2019. Project rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site, 0.75 miles SE.

Rainfall Summary							
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Annual Precip Total	73.12	-	-	-	-	-	-
WETS 30th Percentile	41.65	-	-	-	-	-	-
WETS 70th Percentile	49.68	-	-	-	-	-	-
Normal	Y	-	-	-	-	-	-

*Note: 2020 rainfall data does not include data from November or December because the gauge was last downloaded in October during MY1 monitoring.

Meadow Brook Stream Restoration Project
Year 1 (2020) Groundwater Data

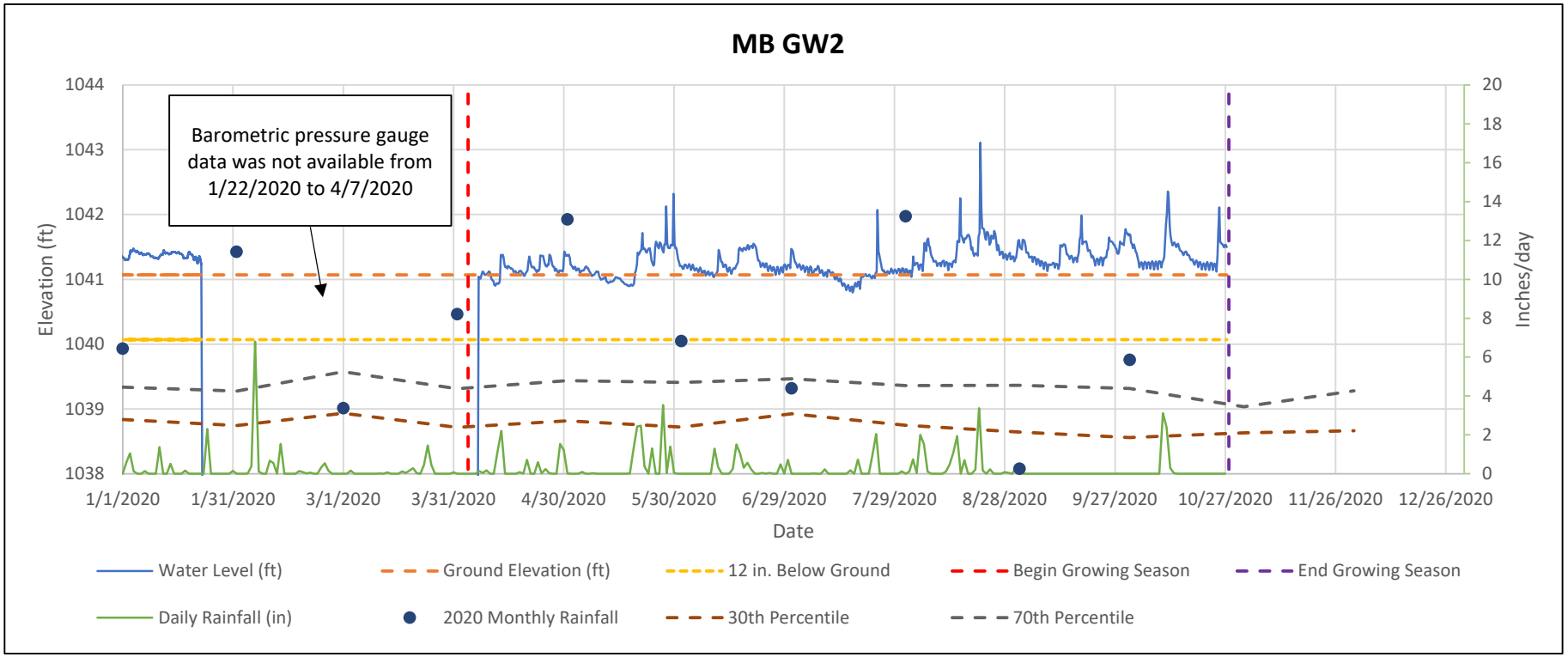


Site Info (Year 1)	
Site	Meadow Brook Stream Restoration Project
Begin Date	7/16/2019
End Date	10/28/2020
Total Days of Well Data	470

*Percentile lines in reference to WETS historic monthly rainfall data

Growing Season Information (Year 1 - 2020)		
Site		Meadow Brook Stream Restoration Project
Gauge ID		MB GW1
Serial #		20234983
Growing Season Start Date		4/4/2020
Growing Season End Date		10/28/2020
Total Growing Season Days		207
NRCS Soil Series		Dan River and Codorus
5.0%	Growing Season (Days)	10
12.5%	Growing Season (Days)	26
Most Consecutive Successful Days Within Growing Season		102
Percent of Growing Season with Consecutive Successful Days		49.3%
Average Water Level Elevation During Growing Season (ft)		1036.63
Total Cumulative Successful Days Within Growing Season		202

Meadow Brook Stream Restoration Site
Year 1 (2020) Groundwater Data

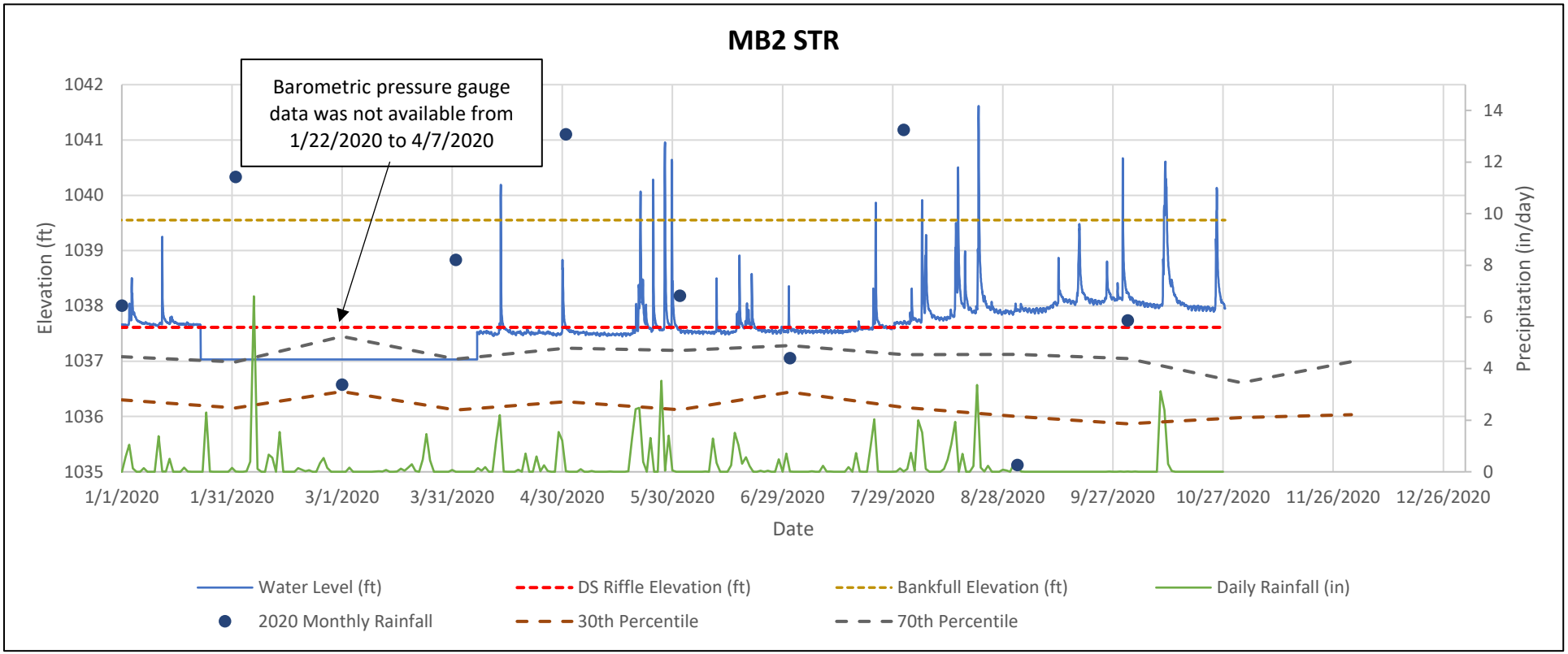


Site Info (Year 1)	
Site	Meadow Brook Stream Restoration Site
Begin Date	7/23/2019
End Date	10/28/2020
Total Days of Well Data	497

*Percentile lines in reference to WETS historic monthly rainfall data

Growing Season Information (Year 1 - 2020)		
Site		Meadow Brook Stream Restoration Site
Gauge ID		MB GW2
Serial #		20234986
Growing Season Start Date		4/4/2020
Growing Season End Date		10/28/2020
Total Growing Season Days		207
NRCS Soil Series		Dan River and Codorus
5.0%	Growing Season (Days)	10
12.5%	Growing Season (Days)	26
Most Consecutive Successful Days Within Growing Season		205
Percent of Growing Season with Consecutive Successful Days		99.0%
Average Water Level Elevation During Growing Season (ft)		1041.23
Total Cumulative Successful Days Within Growing Season		205

Meadow Brook Stream Restoration Project
Year 1 (2020) Streamflow Data



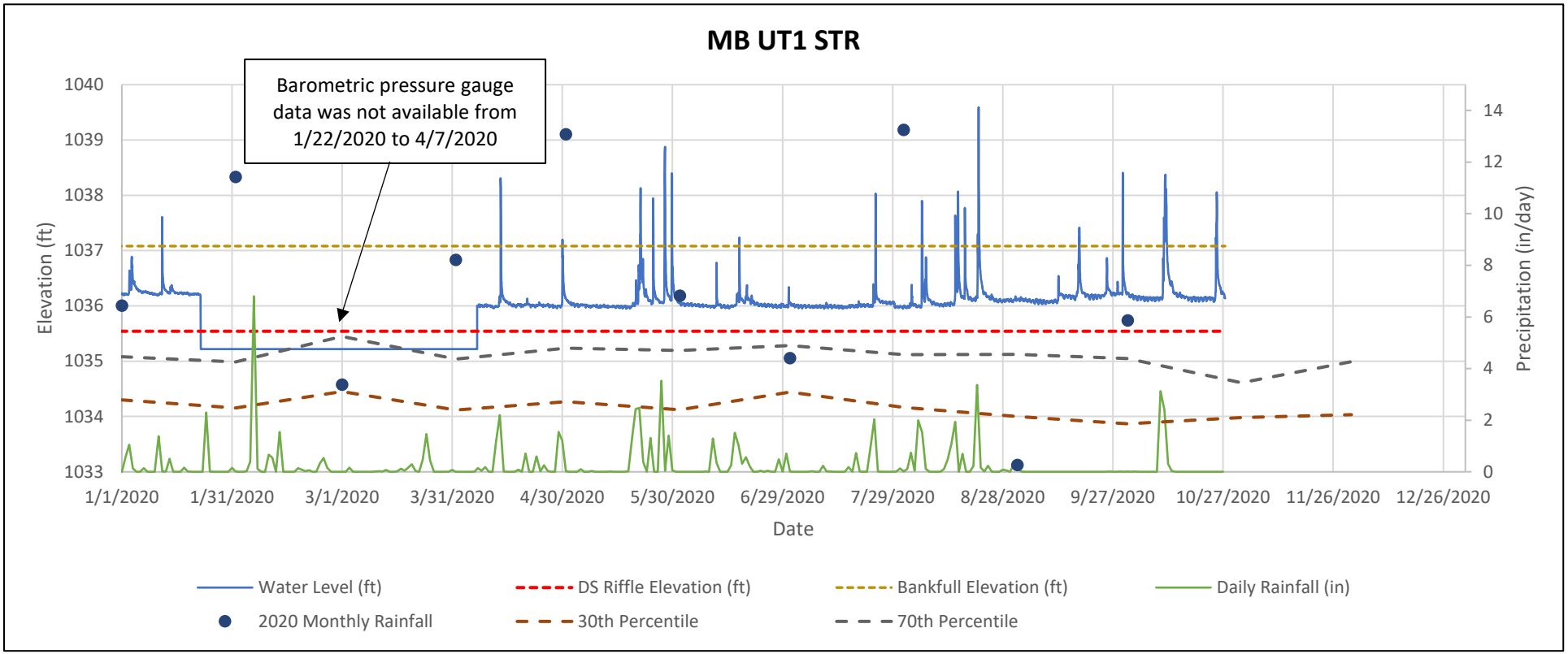
Site Info	
Stream	Meadow Brook Stream Restoration Project
Reach	Meadow Brook Reach 1
Date Installed	7/16/2019
Serial Number	20234985
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site

-Percentile lines in reference to WETS historic monthly rainfall data

Year 1 (2020) Streamflow Data	
Gauge ID	MB2 STR
Start Date	1/1/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1037.03
Controlling Grade Elevation (ft)	1037.61
Bankfull Elevation (ft)	1039.55
Most Consecutive Days of Flow	101
Total Days of Flow	153
Max High Water Level Above Bankfull (ft)	2.07
Bankfull Events	11
Meets Success Criteria	Yes

Meadow Brook Stream Restoration Project
Year 1 (2020) Streamflow Data



Site Info	
Stream	Meadow Brook Stream Restoration Project
Reach	UT
Date Installed	7/16/2019
Serial Number	20234990
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site.

-Percentile lines in reference to WETS historic monthly rainfall data

Year 1 (2020) Streamflow Data	
Gauge ID	MB UT1 STR
Start Date	1/1/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1035.22
Controlling Grade Elevation (ft)	1035.54
Bankfull Elevation (ft)	1037.08
Most Consecutive Days of Flow	205
Total Days of Flow	227
Max High Water Level Above Bankfull (ft)	2.51
Bankfull Events	14
Meets Success Criteria	Yes

Meadow Brook Stream Restoration Project
MY1 – Bankfull Evidence Photos

Photo 1 – Meadow Brook Bankfull Wrack Line (10/27/2020)

Photo 2 – Meadow Brook sediment deposition on floodplain (4/20/2020)

Photo 3 – UT to Meadow Brook Bankfull Wrack Line (10/27/2020)

Photo 4 – UT to Meadow Brook sediment deposition on floodplain, washed vegetation Bankfull Wrack Line (4/20/2020)

Appendix E

Project Timeline and Contact Information

Table 11. Project Activity and Reporting History

Table 12. Project Contacts Table

Table 11. Project Activity and Reporting History
Meadow Brook Stream Restoration Project - DMS ID 100024

Elapsed time since grading complete: **1 yrs 5 months**
Elapsed time since planting complete: **0 yrs 11 months**
Number of reporting years[1]: **1**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	-	Aug-17
404 permit date	-	Oct-18
Final Mitigation Plan	2017 to 2018	Sep-18
Final Design – Construction Plans	-	Dec-18
Site Earthwork	Jan to June 2019	Jun-19
As-Built Survey Performed	Aug-19	Aug-19
Bare root plantings	-	Jan-20
As-built Baseline Monitoring Report (Monitoring Year 0)	2019	Feb-20
Year 1 Monitoring	2020	Dec-20
Year 2 Monitoring	2021	Dec-21
Year 3 Monitoring	2022	Dec-22
Year 4 Monitoring	2023	Dec-23
Year 5 Monitoring	2024	Dec-24
Year 6 Monitoring	2025	Dec-25
Year 7 Monitoring	2026	Dec-26

1 = The number of reports or data points produced excluding the baseline

Table 12. Project Contacts Table
Meadow Brook Stream Restoration Project - DMS ID 100024

Designer	Ecosystem Planning and Restoration, PLLC 1150 SE Maynard Rd. Ste 140 Cary, NC 27511
Primary project design POC	Kevin Tweedy, PE (919) 388-0787
Construction Contractor	Yadkin Valley Construction, Inc 2961 Old 60 Hwy Ronda, NC 28670
Construction contractor POC	Brad Benton
Survey Contractor	Turner Land Surveying, PLLC PO Box 148, Swannanoa, NC 28778
Survey contractor POC	Lissa Turner (919) 827-0745
Planting Contractor	Foggy Mountain Nursery 797 Helton Creek Road Lansing, NC 28643
Planting contractor POC	Glenn Sullivan
Seeding Contractor	Yadkin Valley Construction, Inc
Contractor point of contact	
Seed Mix Sources	Green Resource (Sourced through Swan Creek Farm Supply) 5204 Highgreen Court Colfax, NC 27235
Nursery Stock Suppliers	Foggy Mountain Nursery
Monitoring Performers	Ecosystem Planning and Restoration, PLLC
Stream Monitoring POC	Russell Myers, EPR (828) 348-8580
Vegetation Monitoring POC	Russell Myers, EPR (828) 348-8580