

Monitoring Report

Final

Harrell Stream and Wetland Mitigation Site

Monitoring Year 1-2020

NCDMS Project No. 100005

NCDMS Contract No. 007006

DWR# 20161077

USACE Action ID: SAW-2016-02202

Jackson County, North Carolina

Data Collected: April 2020, Sept 2020 and Dec 2020

Date Submitted: February 2021



Submitted to:

NCDEQ-Division of Mitigation Services
1652 Mail Service Center Raleigh N C 27699-1652

Mitigation Project Name Harrell Stream and Wetland Site
DMS ID 100005
River Basin LITTLE TENNESSEE
Cataloging Unit 06010203

County Jackson
Date Project Instituted 10/6/2016
Date Prepared 2/13/2020

USACE Action ID 2016-02202
NCDWR Permit No 2016-1077

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)				1,854.000				3.530						
Potential Credits (As-Built Survey)				1,854.000				3.530						
1 (Site Establishment)	N/A				N/A	N/A	N/A						N/A	N/A
2 (Year 0 / As-Built)	30%			556.200	2020	2/10/2020	30%	1.059					2020	2/10/2020
3 (Year 1 Monitoring)	10%				2021		10%						2021	
4 (Year 2 Monitoring)	10%				2022		10%						2022	
5 (Year 3 Monitoring)	10%				2023		15%						2023	
6 (Year 4 Monitoring)	5%				2024		5%						2024	
7 (Year 5 Monitoring)	10%				2025		15%						2025	
8 (Year 6 Monitoring)	5%				2026		5%						2026	
9 (Year 7 Monitoring)	10%				2027		10%						2027	
Stream Bankfull Standard	10%						N/A						N/A	
Total Credits Released to Date				556.200				1.059						

NOTES:

CONTINGENCIES:

March 11, 2020

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 automatically 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 projects 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

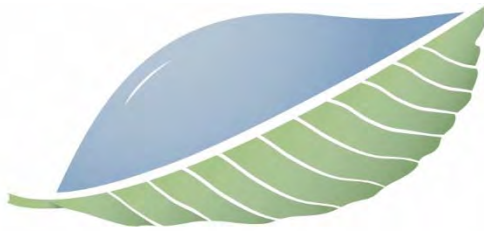
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Prepared for:



37 Haywood Street, Suite 100
Asheville, NC 28801

Prepared by:



EQUINOX

balance through proper planning

37 Haywood Street, Suite 100
Asheville, NC 28801

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January 29, 2021

Paul Wiesner
Western Regional Supervisor
DENR Division of Mitigation Services
5 Ravenscroft Dr., #102
Asheville, NC 28801

Subject: MY1 Monitoring Report (Task 6)
Harrell Stream & Wetland Site, Jackson County
Little Tennessee River Basin – CU 06010203 – Jackson County
DMS Project ID No. 100005
DEQ Contract #007006

Dear Mr. Wiesner,

Equinox/EWS has reviewed and addressed the comments for the draft MY1 Monitoring Report for the Harrell Stream & Wetland Site. This deliverable documents stream and wetland restoration, enhancement and preservation assets totaling 1,854 Stream Mitigation Units (SMU) and 3,530 riparian Wetland Mitigation Units (WMU). Comments provided by NCDMS on January 21, 2021 are listed below with red text indicating how each was addressed in the final iteration of the report:

General: Please include the IRT's 3/11/20 MY0 approval email (attached) in the MY1 Appendices for reference. Please also reference the approval email in the report text. **Approval email included in Appendices and report text updated in section 1.1 accordingly.**

Harrell Performance Standards Table (page 3): Please correct the typo/ “?” in the table. The corrected standard in the table should be, “Entrenchment Ratios should be ≥ 2.2 for C/E channels and ≥ 1.4 for B Channels.” **Typo corrected; table updated accordingly.**

Section 1.5 Project Performance: Please provide an additional report Section summarizing and discussing the project's MY1 wetland performance and groundwater gauge data provided in the report Appendices. Any groundwater gauge malfunctions or issues should also be discussed in this section. Groundwater gauges 2, 5, and 7 did not meet the established 12% wetland hydrology success criteria in MY1. Based on the precipitation data provided, the site had an abnormally wet year; however, the project is only in MY1 of 7. Does EW Solutions believe that the site hydrology on the northern portion of the reestablishment area will improve over the monitoring term? Please consider, discuss and update the report text accordingly.

EWS understands the concerns regarding long term monitoring and the outcome for Wetland gauges 2, 5, and 7 hydroperiod success criteria. Upon revisiting the groundwater data to address comments, it was discovered a formula error had resulted in initially underreporting the success criteria for MW2. While currently meeting wetland criteria, MW2 remains at a marginal level. Our intent is to reconvene with project designers to determine what if any additional actions may be needed. We will confer with DMS after our discussion with the designers.

Section 1.5.1 Vegetation: Is any supplemental planting of more wet tolerant species proposed in the vicinity of VP4 during MY2 (2021)? Please briefly discuss and update the report text accordingly. **Supplemental planting is proposed for that area. Report and text updated accordingly.**

Section 1.5.1 Vegetation: Although it is reported as low density, invasive areas of concern are currently reported on 11.86% of the project easement in MY1. Please continue to treat invasive species on a regular basis through the monitoring term to reduce invasive coverage as much as possible on the project site. In the report text, please note that invasive species treatment will be conducted on the site in MY2 and subsequent monitoring years. **Language included in reference to plans for continued invasive treatment.**

Table 4: Please add a row to the Project Information portion of the table to note that the project stream's thermal regime is "Cold". **Table updated accordingly.**

Section 1.5.2 – Stream Geomorphology (Reach 1D): Based on the Reach 1D photos provided and cross section 5, does EW Solutions have any concerns about this reach maintaining bed and bank stream features through the monitoring term? Please note that the IRT has historically required that mitigation project streams maintain jurisdictional bed and bank features for stream mitigation credit. DMS understands that EW Solutions has worked with NCDOT to keep the downstream culvert clear. These efforts should also be reported in the text. Please consider, discuss and update the report text accordingly. **EWS understands the concerns related to Reach 1D. Our primary concern is clogging of the DOT Culvert which has been monitored by both NCDOT and Equinox staff. MY1 data suggests stability within Reach 1D.**

CCPV Maps: Please provide the permanent photo point locations on the CCPV maps and legend. These features should also be provided in the revised digital support files. **Added to the CCPV and Digital Support Files.**

Permanent Photo Stations: A majority of the permanent photo station photos were taken in early April 2020. In future monitoring years, DMS recommends taking photos later in the applicable monitoring year so the report better represents conditions later in the growing season. **Photo stations were initially established in April 2020 as an internal effort to mark vegetative establishment. In future monitoring years, photo points will be captured concurrently with vegetation plot monitoring.**

Groundwater Gauge Graphs: In the graphs, please also identify the start and end points of the total number of consecutive growing season days reported in each graph. Please also identify any gauge malfunctions or issues on each graph. Any gauge malfunctions or issues should also be discussed in the report text as requested above. **The start and end points of the total number of consecutive growing season days and total growing season days measured have been identified in each groundwater gauge graph. Gauge malfunctions and issues are identified on graphs and in report text.**

Digital Support File Comments:

- In the revised support files, please submit a set of features that characterize the IRT approved mitigation plan asset features. **A line feature class characterizing the IRT approved mitigation plan stream assets is included in the support file. Wetland polygon feature classes representative of the IRT approved mitigation plan assets are also included.**
- Please submit photo point features attributed with their unique ID's. **Updated and added to the digital support files.**
- Please review the cross-section data. It looks like for several cross sections the entries for low top of bank did not change from MY0 and MY1, but there is no specific point in the MY1 figure representing the low top of bank (e.g. XS2 vs. XS5). Also note that the "Omit Bkf" boxes were not checked for XS5,



resulting in an inaccurate BHR. Please review, update and revise the support files, report text and figures accordingly. **Cross-section data reviewed and updated. Appropriate supporting files and report text edited to reflect changes to the geomorphologic calculations.**

The Equinox project manager for this project is Mr. Danvey Walsh. His contact is as follows:

Environmental Scientist
Equinox
37 Haywood Street
Asheville, NC 28801
Office: 828-253-6856 ext. 201
Fax: 828-253-8256

Sincerely,

Danvey Walsh

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Table of Contents

1.0	Project Summary.....	1
1.1.	Project Setting and Background.....	1
1.2.	Project Goals and Objectives	1
1.3.	Project Performance Standards	2
1.4.	Mitigation Components.....	4
1.5.	Project Performance	4
1.6.	Vicinity Map	6
2.0	References.....	7
	Appendix A Background Tables	9
	Appendix B Visual Assessment Data.....	15
	Appendix C Vegetation Plot Data	35
	Appendix D Stream Measurement and Geomorphology Data.....	39
	Appendix E Hydrologic Data	57
	Appendix F MY0 Notice of Initial Credit Release.....	67

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1.0 PROJECT SUMMARY

1.1. Project Setting and Background

The Harrell Stream and Wetland Mitigation Site (Harrell Mitigation Site) is located in the Little Tennessee River (CU 06010203). The Harrell Mitigation Site also lies within the lower portion of the Eastern Little Tennessee River Basin (HUC 06010203010060) watershed which is identified as a Targeted Local Watershed (TLW) according to the 2008 Little Tennessee River Basin Restoration Priorities (RBRP) Plan. Project work at the Harrell Site was completed in early September 2019, and included construction, monitoring feature installation, and boundary marking; bare root and live stake installation occurred in mid-January 2020. The Notice of Initial Credit Release was received from the US Army Corps of Engineers on March 11, 2020, (Appendix F). Through the project work, a total of 1,756 linear feet were restored, 640 linear feet were preserved, 0.22 acre of wetland were rehabilitated, and 3.31 acres of wetland were re-established. The Harrell Mitigation Site generated a total of 1,854 SMU's and 3.53 WMU's. Refer to Table 1 for the project components and mitigation credit information and Figure 2 for the Project Asset Map.

Historic land use at the Harrell Mitigation Site consisted of silvicultural logging and agricultural use for at least 40 years, according to historic aerial photos. Historic agricultural practices, relocation of the channel, and berm construction along the right descending bank of Harrell Creek had functionally removed the stream's connectivity with the floodplain and adjacent wetlands, resulting in highly degraded wetland function. Two poorly functioning culverts have also degraded the ecological connectivity of the stream at the headwaters of the Harrell Mitigation Site. The lack of deep-rooted vegetation and unstable channel characteristics have contributed to the degradation of the streambanks on both sides of the project. Ecological function has been restored to the existing streams, wetlands and riparian corridor by returning the existing stream and wetlands to a stable condition. The relocation of Harrell Creek to the historic floodplain and removal of the berm has restored proper floodplain connectivity and improved wetland hydrology. The restoration of the upper reach addressed a perched culvert, removed a second pipe crossing, and corrected erosion issues from an existing logging road through the installation of stormwater control devices. At the downstream end of Harrell Creek, the profile of the channel was raised and proper channel dimensions were restored. Additional measures that promoted functional uplift included stabilizing and revegetating stream banks and adjacent disturbed areas, restoring floodplain connectivity and wetland hydrology, reestablishing wooded riparian areas. These measures contribute to reduced downstream sediment and nutrient loads, as well as improving aquatic and terrestrial habitat.

This project is protected by an 8.45 acre conservation easement and is located approximately 2.8 miles southeast of Cullowhee, NC in Jackson County at 35.300553° N, -83.133689° W. The Harrell Mitigation Site is bounded by agricultural land and mountainous woodlands.

1.2. Project Goals and Objectives

The project goals address stressors identified in the TLW and priority sub-watershed, as outlined in the Final Mitigation Plan, and include:

- Provide a network of streams with natural, stable forms that support proper stream functions;
- Improve groundwater hydrology to support recovery of native riparian vegetation;
- Reduce sediment inputs from eroding stream banks to reduce fine sediment loads and percentage of fines in the bed-material load;
- Restore proper sediment transport to support channel stability and bedform diversity;
- Improve substrate quality to facilitate hyporheic flow and support aquatic communities;

- Improve quantity, quality, and diversity of habitats to support healthy aquatic communities;
- Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus) to restore a balance to proper nutrient cycles;
- Improve riparian vegetation community to provide temperature regulation of the stream, provide a future source of organic inputs, and aid in long-term channel bank stability;
- Restore areas of former riparian wetlands so that the hydrology and soils will support wetland vegetative communities and wildlife;
- Improve landscape connectivity that allows space for biotic and abiotic processes and provides a source and sink for natural populations; and,
- Prevent the site from future impacts of development and agricultural issues.

The following objectives are proposed for accomplishing the above listed goals as outlined in the Final Mitigation Plan:

- Construct stream channels that will maintain proper dimension, pattern, and profile;
- Construct streams with proper bankfull to floodplain relationship;
- Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering;
- Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time;
- Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes;
- Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions;
- Construct in-stream habitat features from native material to provide diversity of habitat;
- Provide a buffer from agricultural activities and row crops;
- Plant native climax tree species and understory species in the riparian zone;
- Reconstruct stream channels that are properly connected to the riparian wetlands;
- Re-grade topography to eliminate ditches and drainage features;
- Plant native wetland tree and shrub species; and,
- Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed and ensure aquatic organism passage by correcting perched culverts or removing other barriers within the easement.

1.3. Project Performance Standards

The stream restoration performance standards for the project will follow accepted and approved criteria based on the Final Mitigation Plan for the Harrell Mitigation Site (2019). Performance standards conform with the performance criteria provided in The Harrell Site Mitigation Plan which references the DMS Stream and Wetland Mitigation Plan Template and Guidance (October 2015), the Annual Monitoring Template (April 2015), and the Closeout Report Template (v2.1 March 2015). Performance criteria will be evaluated throughout the seven-year monitoring period.

Harrell Mitigation Site Performance Standards		
Objective	Performance Standard	Monitoring Approach
Construct stream channels that will maintain proper dimension, pattern and profile	<ul style="list-style-type: none"> · Riffle section W/D ratios should remain within the range of the appropriate stream type. · BHR should not exceed 1.2. BHR should not change more than 10% in any given monitoring interval. Changes that do occur should indicate a trend toward stability. · Entrenchment Ratios should be ≥ 2.2 for C/E channels and ≥ 1.4 for B Channels. · Document continuous surface flow in tributaries for at least 30 consecutive days in each year 	<p>Survey of select cross sections and visual assessment.</p> <p>Continuous stage recorders</p>
Construct streams with proper bankfull to floodplain relationship	Four bankfull events or greater, in separate years, will be documented during the monitoring period	Crest gauges, continuous stage recorders, and debris lines.
Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering	Channel banks should generally remain stable. Where bank migration does occur, it should not exceed 20% of the bankfull width.	Visual assessment and bank pin monitoring as necessary.
Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time.	Profile adjustments should not indicate significant aggradation or degradation. BHR requirements as stated above.	Resurvey of longitudinal profile if visual assessment indicates potential instability.
Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes	Profile should maintain a diversity of depths expressed in riffle/pool forms.	Visual assessment
Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions	Substrate material should progress towards or maintain coarser material in riffles and runs with finer material present in pools and glides.	Pebble count measurements at surveyed cross sections
Construct in-stream habitat features from native material to provide a diversity of habitats	In-stream habitat structures should remain intact and functional.	Visual assessment
Provide a buffer from agricultural activities and row crops	Record conservation easement prior to implementation.	None
Plant native climax tree species and understory species in the riparian zone	Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7.	Vegetation plots

Objective	Performance Standard	Monitoring Approach
Reconstruct stream channels that are properly connected to the riparian wetlands	Groundwater elevation within 12 inches of the ground surface for 12% of the growing season.	Groundwater monitoring gauges
Re-grade topography to eliminate ditches and drainage features	Groundwater elevation within 12 inches of the ground surface for 12% of the growing season.	Groundwater monitoring gauges
Plant native wetland tree and shrub species	Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7.	Vegetation plots
Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed.	Record conservation easement prior to implementation.	None

1.4. Mitigation Components

The Harrell Mitigation Site generated 1,854 SMUs and 3.53 WMUs. Refer to Figure 2 for the project component/ asset map for a visual description of the project assets and Table 1 for project components and mitigation credit information for the Harrell Site. These credits are based on the IRT approved Harrell Mitigation Plan.

1.5. Project Performance

Monitoring data was collected from April 1st, 2020 to September 28th, 2020. Monitoring activities included visual assessment of Harrell Creek, the conservation easement, collection of images at eight permanent photo stations, inventory of five permanent vegetation monitoring plots, surveying of six cross-sections, conducting three pebble counts, maintenance of 9 groundwater monitoring wells, and 1 continuous stage recorder.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information can be found in the Baseline Monitoring Report and in the Mitigation Plan documents available on the NCDMS website (<http://portal.NCDEQ.org/web/eep>). All raw data supporting the tables and figures in the appendices is available from DMS upon request.

1.5.1. Vegetation

Visual assessment of vegetation outside of the monitoring plots (Appendix B – Table 6) indicates that both the herbaceous vegetation and planted stems were becoming established throughout much of the project. In the wetter portions of the site, Harrell Reach 1D and the area of Vegetation Plot #4, planted stems have been slower to establish due to inundation coupled with competition with herbaceous vegetation. Supplemental planting of more wet tolerant species has been proposed for these areas.

Monitoring of the permanent vegetation plots (n = 5) was completed in September 2020. Summary tables and photographs associated with MY1 vegetation monitoring are located in Appendix B and Appendix C. A total of 9 species of planted stems were documented within the plots. Planted stem densities among the five plots ranged from 202 to 768 planted stems per acre with an annual mean of 660 planted stems per acre across all plots. Plot number 4 fell under the MY3 interim count of 320 stems per

acre. This plot was located within one of the wetter sections of the easement where herbaceous vegetation growth has been the most vigorous. Supplemental planting of more wet-tolerant species within the vicinity of Plot number 4 is planned for January/February 2021, and will consist of 1-2 year old bare root plants, planted on 6-foot centers, with species to include silky dogwood (*Cornus amomum*), tag alder (*Alnus serrulata*), and black willow (*Salix nigra*). Supplemental planted stems will be flagged. Stem densities and survival will continue to be monitored in future years.

Invasive species have been documented throughout the site, with overall low abundance. These areas were treated on June 6, 2020 and June 16, 2020. The primary species documented at the Harrell Site include Chinese Privet (*Ligustrum sinensis*), Multiflora Rose (*Rosa multiflora*), and Japanese Honeysuckle (*Lonicera japonica*) along the fringes. Treatment of these invasive species populations will continue in MY2 and subsequent monitoring years. Details on invasive species density and area can be found in Table 6 and the CCPV.

1.5.2. Stream Geomorphology

Visual assessment of the stream channel was performed to document signs of instability, such as beaver activity, eroding banks, structural instability, or excessive sedimentation. No areas of immediate concern were identified during MY1. Monitoring of the NCDOT culvert at the bottom of the project area will be ongoing and has been conducted by both NCDOT and Equinox Staff.

Geomorphic data for MY1 was collected during September 2020. Summary tables and cross-section data plots related to stream morphology are located in Appendix D. Cross-sectional dimensions remained stable between baseline conditions and the MY1 monitoring efforts. Some shifts in depth and bankfull width were noted within the cross-sections. Additionally, debris mobilized during numerous overbank events has been depicted within two of the six cross-sections, (XS2 and XS5, Appendix D). In cross section #2 a log had shifted during a storm event and was captured within the MY1 data. Movement of debris has caused a similar change in the dimension noted at cross-section #5 (Appendix D, Table 9a & b). None of the above observations were indicative of channel instability. Stream dimension will be monitored in future years for changes in dimension.

Substrate monitoring was performed during MY1. Pebble count D_{50} fell into the silt-clay range for Harrell Creek Reach 1C, cross-section 2 and medium gravel for cross-section 4. This indicates increased coarseness in Cross-section 4 and a decrease in particle size in Cross-section 2. Harrell Creek Reach 1D showed increasing substrate particle distribution with D_{50} falling into the medium gravel category. (Appendix D, Pebble Count Graphics and Tables). The channel substrate will be monitored in future years for shifts in particle size distribution.

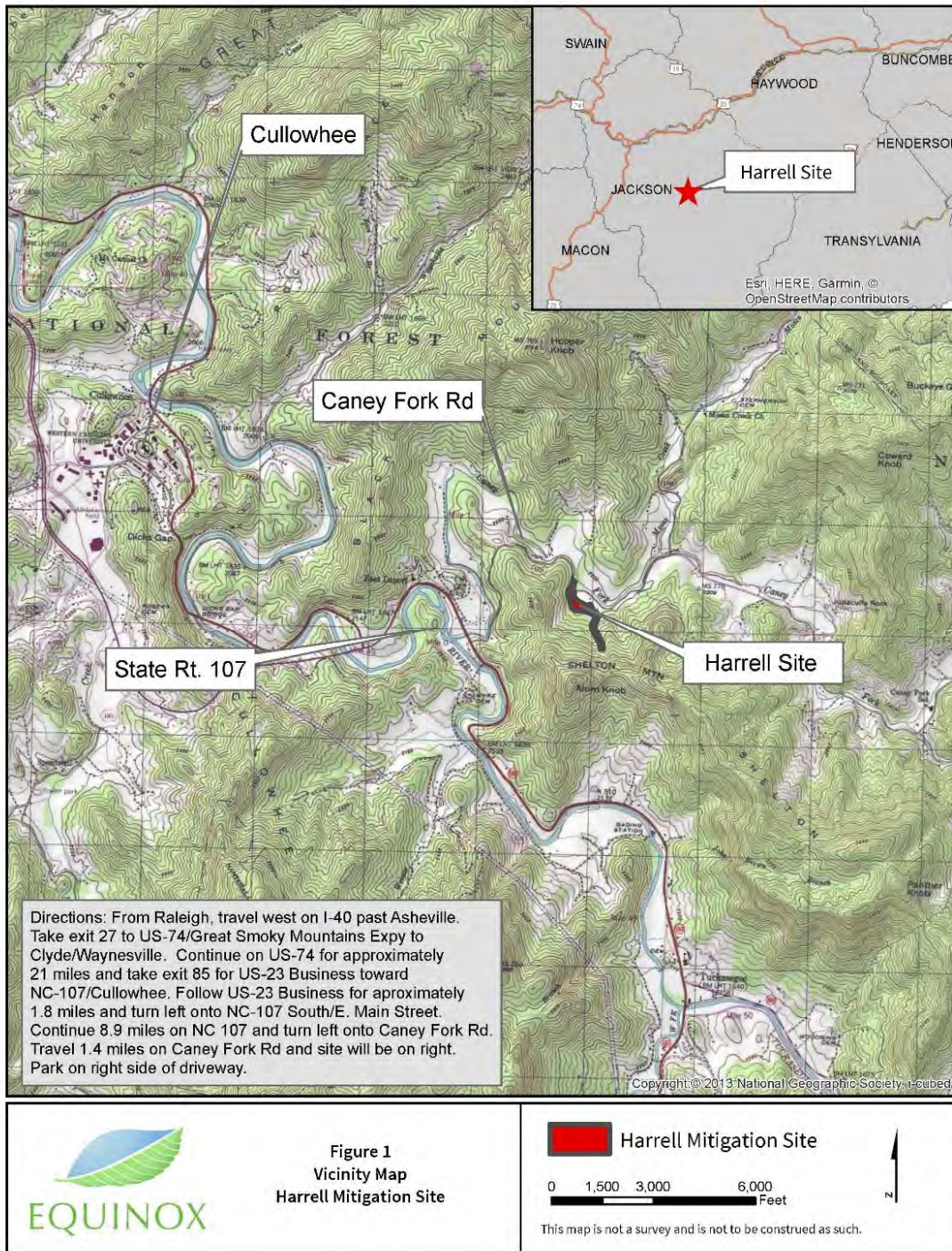
1.5.3. Stream Hydrology

Since project completion in early 2020, 13 bankfull events have been documented at the Harrell Mitigation Site. The suspected dates and associated precipitation records can be found in Table 10, Appendix E.

Two groundwater wells, #5 and 7, failed to meet the success criteria during MY1. Monitoring well 2 was meeting at a marginal level. Additional gages will be installed in the MY2 monitoring period to identify the wetland boundary and track both current and future wetland development along the northeastern wetland re-establishment zone. Monitoring well data shows some inconsistencies regarding total days deployed and number of days data was recorded. Groundwater gages #4 and 5 required replacement in April of 2020 due to unexpected gage failures. Gages #4 and 6 were frozen in place

during the December 2020 download but had already met minimum wetland success criteria of 12% during the previous data download. Groundwater gage #5, 7, 8, and 9 data was lost for 10 days (September 10-20, 2020), due to an error encountered during the barometric compensation processing. This data was subsequently recovered during post processing. Groundwater gage graphics can be found in Appendix E.

1.6. Vicinity Map



2.0 REFERENCES

DMS Stream and Wetland Mitigation Annual Monitoring Template (June 2017)

Harrelson, Cheryl C., Rawlins, C. L., Potyondy, John, P., (1994) Stream Channel Reference Sites: An illustrated guide to field technique.

Kee Mapping and Survey. 2019. As-Built Survey of Harrell Creek Restoration Project. Prepared for EW Solutions.

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (<http://cvs.bio.unc.edu/methods.htm>).

Stantec Consulting, Inc. 2019. Final Mitigation Plan – Harrell Mitigation Site. . Prepared for North Carolina Department of Environmental Quality, Division of Mitigation Services. DMS Project No. 100005.

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Appendix A

Background Tables

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Table 1. Project Mitigation Assets and Components Harrell Mitigation Site									
Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)		As-Built Centerline Footage or Acreage^	Comments
Reach 1A	654	640	Cold	P	NA	10.0		640	
Reach 1B	286	273	Cold	R	PI	1.0		273	Less 38' for crossing and outlet protection. Less than 30' buffer for 41 LF
Reach 1C	1,265	1,268	Cold	R	PI	1.0		1,189	0.026 ac impact to Wetland B
Reach 1D	223	249	Cold	R	P1	1.0		294	Less 13' for ROW Less than 30' buffer for 32 LF 0.008 ac impact to Wetland A
Wetland A	1.59	1.58	RNR	Re (Pres)		0.0		1.58	Existing wetland will be protected 0.008 ac impact to Wetland A for stream construction
Wetland A	1.59	0.26	RNR	R(Re-est)		1.0		0.26	Area of the existing channel within the wetland was filled and replanted
Wetland B	0.24	0.22	RNR	R (Rehab)		1.0		0.22	0.026 ac impact to Wetland B for stream construction
Wetland C	-	3.05	RNR	R (Re-Est)		1.0		3.05	

^ Based on centerline calculations from the as-built survey, accounts for breaks in conservation easement and utility right-of-ways.

Project Credits

Restoration Level	Stream			Riparian Wetland		Non-Rip	Coastal
	Warm	Cool	Cold	Riverine	Non-Riv	Wetland	Marsh
Restoration	-	-	1790	-	-	-	-
Re-establishment				-	3.31	-	-
Rehabilitation				-	0.22	-	-
Enhancement				-	-	-	-
Enhancement I	-	-	-				
Enhancement II	-	-	-				
Creation				-	-	-	-
Preservation	-	-	64	-	-	-	-
Total Credits	-	-	1,854	-	3.53	-	-

* Project credits reflect the sum of credits outlined in the IRT approved mitigation plan. Mitigation plan credits account for breaks in conservation easements and are based on centerline design stream stationing and taken from the IRT approved mitigation plan. Mitigation plan credits are the same as the IRT approved mitigation plan.

* Wetland A will be protected but is not generating wetland credit due to the 100% Restoration credit requirement in RFP 16-008611

Table 2. Project Activity and Reporting History Harrell Mitigation Site		
Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	Dec - 2018	Jan - 2019
Mitigation Plan Addendum	-	-
Final Design - Construction Plans	-	June - 2019
Construction	-	Aug - 2019
Temporary S&E Mix Applied	-	Aug - 2019
Permanent Seed Mix Applied	-	Aug - 2019
Bare Root and Live Stake Plantings	-	Jan - 2020
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	Jan - 2020	Feb - 2020
Stream Assessment	Jan - 2020	
Vegetation Assessment	Jan - 2020	
Year 1 Monitoring	-	Dec-2020
Stream Assessment	Sept - 2020	
Vegetation Assessment	Sept - 2020	
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contacts Harrell Mitigation Site	
Prime Contractor	EW Solutions 37 Haywood Street, Suite 100 Asheville, NC 28801 David Tuch (828) 253-6856
Designer	Stantec Consulting, Inc 56 College Street, Suite 201 Asheville, North Carolina 28801 Grant Ginn (828) 449-1930
Construction Contractor	Penland Contracting, Inc 300 NP&L Loop Franklin, NC 28734 Lewis Penland (828) 421-1753
Seeding Contractor	Penland Contracting, Inc 300 NP&L Loop Franklin, NC 28734 Lewis Penland (828) 421-1753
Planting Contractor	Equinox 37 Haywood St. Asheville, North Carolina 28801 Owen Carson (828) 253-6856
As-built Surveys	Kee Mapping 88 Central Ave. Asheville, NC 28801 Brad Kee (828) 575-9021
Seeding Mix Source	Hancock Farm & Seed 18724 Hancock Farm Rd Dade City, Fl 333523 (352) 567-6971
Bare Roots/Live Stakes	Mellow Marsh Farms 1312 Woody Store Road Siler City, NC 27344 (919) 742-1200
Monitoring Performers (MY1)-2020	Equinox 37 Haywood St. Asheville, North Carolina 28801 Owen Carson (828) 253-6856 ext. 204 Danvey Walsh (828) 253-6856 ext.201

Table 4. Project Baseline Information and Attributes

Project Information				
Project Name	Harrell Stream and Wetland Mitigation Site			
County	Jackson			
Project Area (acres)	8.45			
Project Coordinates (latitude and longitude)	35.300533° N, -83.133689° W			
Project Thermal Regime	Cold			
Project Watershed Summary Information				
Physiographic Province	Blue Ridge Mountains			
River Basin	Little Tennessee			
USGS Hydrologic Unit 8-digit	6010203	USGS Hydrologic Unit 14-digit	06010203010060	
DWR Sub-basin	04-04-02			
Project Drainage Area (acres)	102.0			
Project Drainage Area Percentage of Impervious Area	< 1%			
CGIA Land Use Classification	Agricultural			
Reach Summary Information				
Parameters	Reach 1A	Reach 1B	Reach 1C	Reach 1D
Length of Reach (linear feet)	640	273	1,268	249
Valley Confinement (Rosgen)	II	II	VII	VII
Drainage area (miles ²)	0.05	0.07	0.16	0.17
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	A & B	G	E & F	E
Stream Classification (proposed)	A	B4	E4	E4
FEMA classification	-	-	-	-
Wetland Summary Information				
Parameters	Wetland A	Wetland B	Wetland C	
Size of Wetland (acres)	1.58	0.22	3.05	
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian	Riparian	Riparian	
Mapped Soil Series	NkA	NkA	NkA	
Drainage class	poorly	poorly	poorly	
Soil Hydric Status	Hydric	Hydric	Hydric	
Source of Hydrology	Groundwater	Groundwater	Groundwater	
Hydrologic Impairment	Agriculture/ Ditching	Agriculture/ Ditching	Agriculture/ Ditching	
Native vegetation community	Swamp-Forest Bog	Swamp-Forest Bog	Swamp-Forest Bog	
Percent composition of exotic invasive vegetation	15%	15%	1%	
Regulatory Considerations				
Regulation	Applicable?	Resolved?	Supporting Documentation	
Waters of the United States – Section 404	Yes	Yes	404 Permit #SAW-2016-02202	
Waters of the United States – Section 401	Yes	Yes	401 Permit #20161077	
Endangered Species Act	Yes	Yes	FFHWA Categorical Exclusion (CE)/ERTR	
Historic Preservation Act	No	N/A	FFHWA Categorical Exclusion (CE)/ERTR	
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	Yes	Yes	FEMA Floodplain Requirements Checklist (Jan-2019) Jackson County, NC Floodplain Development Permit #2019-F187	
Essential Fisheries Habitat	No	N/A	N/A	

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Appendix B
Visual Assessment Data

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Assets Map
 Harrell Mitigation Site
 Jackson County, NC
 December 2020






--- Conservation Easement
 --- Boundary

Streams

-  Preservation
-  Restoration
-  Reach Breaks

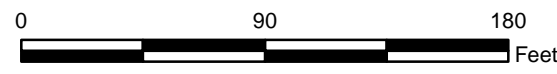
Wetlands

-  Preservation (No Credit)
-  Reestablishment
-  Rehabilitation





MY1 CCPV
Harrell Mitigation Site
Jackson County, NC
December 2020



Monitoring Features

- Continuous Stage Recorder
- Groundwater Gauge
- Cross-section
- Vegetation Plot
- Conservation Easement Boundary
- Photopoints
- Rain Gauge
- Invasive Vegetation Present

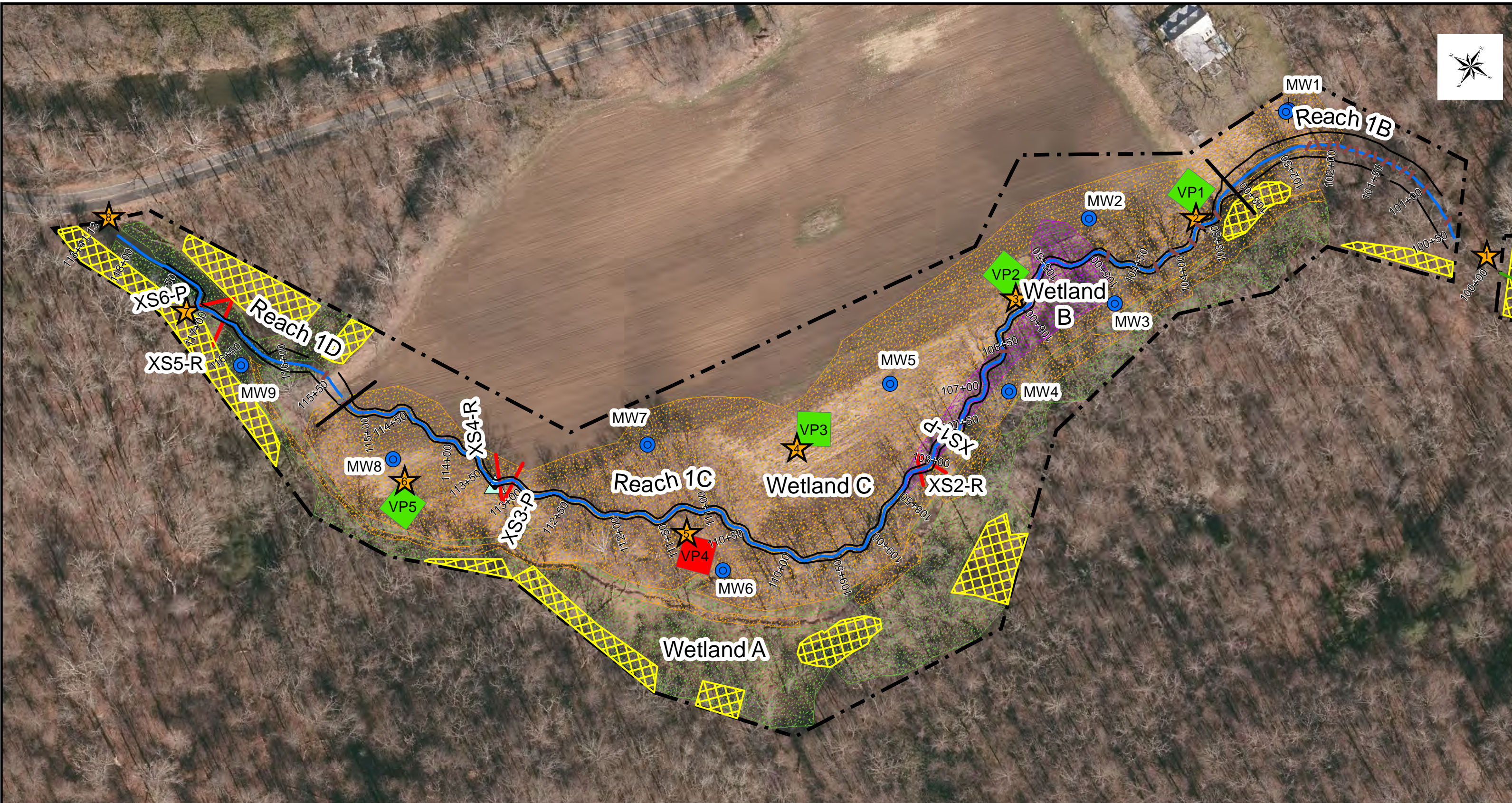
Streams

- Preservation
- Restoration
- Reach Breaks
- Log Sills
- Rock Sills
- TOB

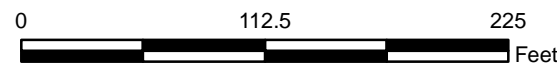
Wetlands

- Preservation (No Credit)
- Reestablishment
- Rehabilitation





MY1 CCPV
 Harrell Mitigation Site
 Jackson County, NC
 December 2020



Monitoring Features

- Continuous Stage Recorder
- Groundwater Gauge
- Cross-section
- Vegetation Plot
- Conservation Easement Boundary
- Photopoints
- Rain Gauge
- Invasive Vegetation Present

Streams

- Preservation
- Restoration
- Reach Breaks
- Log Sills
- Rock Sills
- TOB

Wetlands

- Preservation (No Credit)
- Reestablishment
- Rehabilitation



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Table 5 Visual Stream Morphology Stability Assessment										
Harrell Mitigation Site - Harrell Reach 1B - Restoration P1										
Assessed Length 286 feet										
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
Totals					0	0	100%	N/A	N/A	N/A
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	30	30			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	30	30			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	30	30			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	30	30			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio \geq 1.6. Rootwads/logs providing some cover at base-flow.	30	30			100%			

N/A - Item does not apply.

Table 5 cont'd. Visual Stream Morphology Stability Assessment										
Harrell Mitigation Site - Harrell Reach 1C - Restoration P1										
Assessed Length 1268 feet										
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
Totals					0	0	100%	N/A	N/A	N/A
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	14	14			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	14	14			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	14	14			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	14	14			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio \geq 1.6. Rootwads/logs providing some cover at base-flow.	14	14			100%			

N/A - Item does not apply.

**Table 5 cont'd. Visual Stream Morphology Stability Assessment
Harrell Mitigation Site - Harrell Reach 1D - Restoration P1**

Assessed Length 223 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
Totals					0	0	100%	N/A	N/A	N/A
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.					100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>NOT</u> exceed 15%.	7	7			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio \geq 1.6. Rootwads/logs providing some cover at base-flow.	7	7			100%			

N/A - Item does not apply.

**Table 6. Vegetation Condition Assessment
Harrell Mitigation Site**

Planted Acreage: 4.46

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	n/a	0	0	0.00%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres		0	0	0.00%
Total				0	0	0.00%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	n/a	0	0	0.00%
Cumulative Total				0	0	0.00%
Easement Acreage: 8.43						
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale). High Density	1000 SF		0	0	0.00%
	Areas or points (if too small to render as polygons at map scale). Low Density	1000 SF		11	1	11.86%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	n/a	0	0	0.00%

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Vegetation Plot Photos



Vegetation Monitoring Plot 1



Vegetation Monitoring Plot 2



Vegetation Monitoring Plot 3



Vegetation Monitoring Plot 4



Vegetation Monitoring Plot 5

Permanent Photo Stations



Photo point #1, facing upstream at Reach 1A.



Photo point #2, facing upstream towards, Reach 1B.



Photo point #2, facing downstream, Reach 1C and Wetland B.



Photo point #3, facing upstream, Reach 1C and Wetland B



Photo point #3, facing downstream, Reach 1C and Wetland 1C.



Photo point #4, facing upstream, Reach 1C and Wetland C.



Photo point #4, facing downstream, Reach 1C and Wetland C.



Photo point #5, facing upstream, Reach 1C and Wetland C.



Photo point #5, facing downstream, Reach 1C and Wetland C.



Photo point #6, facing upstream, Reach 1C and Wetland C.



Photo point #6, facing downstream. Reach 1C and Wetland C.



Photo point #7, facing upstream, Reach 1D.



Photo point #7, facing downstream, Reach 1D.



Photo point #8, facing upstream, Reach 1D.

Appendix C

Vegetation Plot Data

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**Table 7. Current Plot Data (MY1) 2020
Harrell Mitigation Site**

Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2020)															Annual Means					
			100005-01-0001			100005-01-0002			100005-01-0003			100005-01-0004			100005-01-0005			MY1 (2020)			MY0 (2020)		
			PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T
<i>Alnus serrulata</i>	hazel alder	Shrub	4	4	7	2	2	2	1	1	1				7	7	7	14	14	17	19	19	19
<i>Asimina triloba</i>	pawpaw	Tree																			3	3	3
<i>Betula nigra</i>	river birch	Tree										1	1	1	4	4	4	5	5	5	10	10	10
<i>Cephalanthus occidentalis</i>	common buttonbush	Shrub							2	2	2	2	2	2	1	1	1	5	5	5	8	8	8
<i>Cornus amomum</i>	silky dogwood	Shrub	2	2	2	3	3	3	4	4	4	2	2	2	2	2	2	13	13	13	13	13	13
<i>Fraxinus pennsylvanica</i>	green ash	Tree	2	2	2	3	3	3	3	3	3				1	1	1	9	9	9	10	10	10
<i>Ilex verticillata</i>	common winterberry	Shrub	1	1	1	1	1	1							3	3	3	5	5	5	9	9	9
<i>Lindera benzoin</i>	northern spicebush	Shrub	1	1	1	1	1	1										2	2	2	8	8	8
<i>Salix nigra</i>	black willow	Tree	1	1	3	3	3	20			5				1	1	1	5	5	29	6	6	6
Stem count			11	11	16	13	13	30	10	10	15	5	5	5	19	19	19	58	58	85	86	86	86
size (ares)			1			1			1			1			1			5			5		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.12			0.12		
Species count			6	6	6	6	6	6	4	4	5	3	3	3	7	7	7	8	8	8	9	9	9
Stems per ACRE			445.2	445.2	647.5	526.1	526.1	1214	404.7	404.7	607	202.3	202.3	202.3	768.9	768.9	768.9	469.4	469.4	688	696.1	696.1	696.1

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

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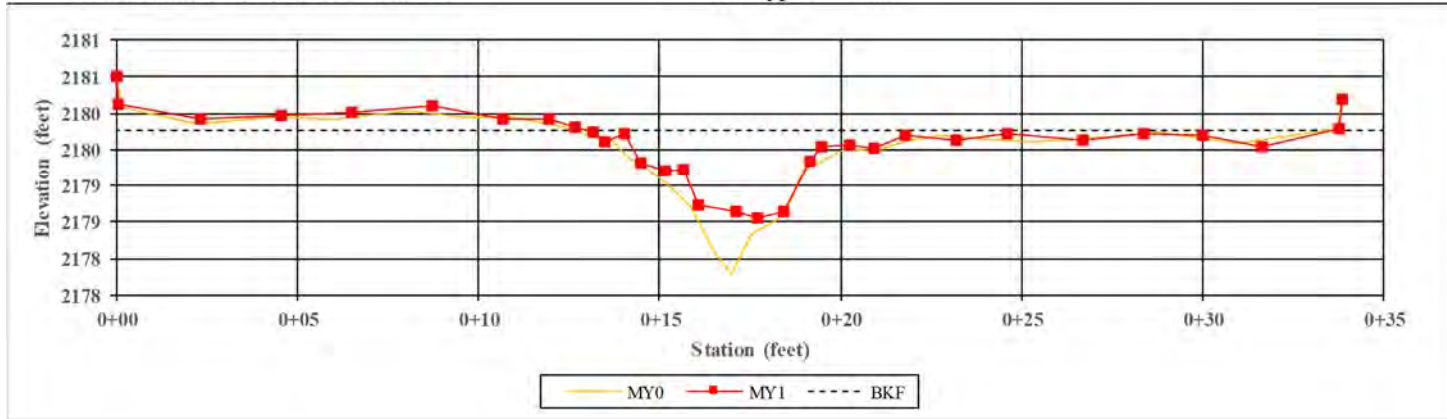
Appendix D
Stream Measurement and Geomorphology Data

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Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 1
XS Type: Pool

Station: 107+75



CHANNEL DIMENSIONS SUMMARY		MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)		9.6	20.4	-	-	-	-	-	-
Floodprone Width (ft)		50.0	50.0	-	-	-	-	-	-
Bankfull Mean Depth (ft)		0.6	0.3	-	-	-	-	-	-
Bankfull Max Depth (ft)		1.9	1.2	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)		6.0	6.0	-	-	-	-	-	-
Width/Depth Ratio		15.2	69.1	-	-	-	-	-	-
Entrenchment Ratio		5.2	2.5	-	-	-	-	-	-
Bank Height Ratio		1.0	0.9	-	-	-	-	-	-



Left Descending Bank

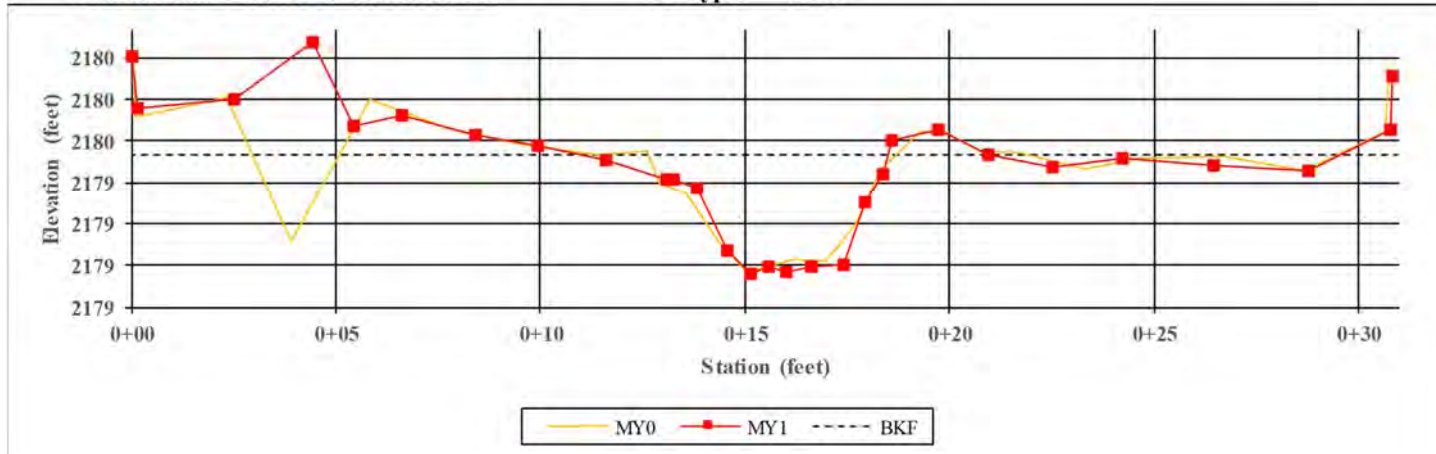


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 2
XS Type: Riffle

Station: 107+88



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.2	6.8	-	-	-	-	-	-
Floodprone Width (ft)	50.0	50.0	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.6	0.5	-	-	-	-	-	-
Bankfull Max Depth (ft)	0.9	0.9	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	3.4	3.4	-	-	-	-	-	-
Width/Depth Ratio	11.2	13.7	-	-	-	-	-	-
Entrenchment Ratio	8.1	7.4	-	-	-	-	-	-
Bank Height Ratio	1.1	1.2	-	-	-	-	-	-



Left Descending Bank

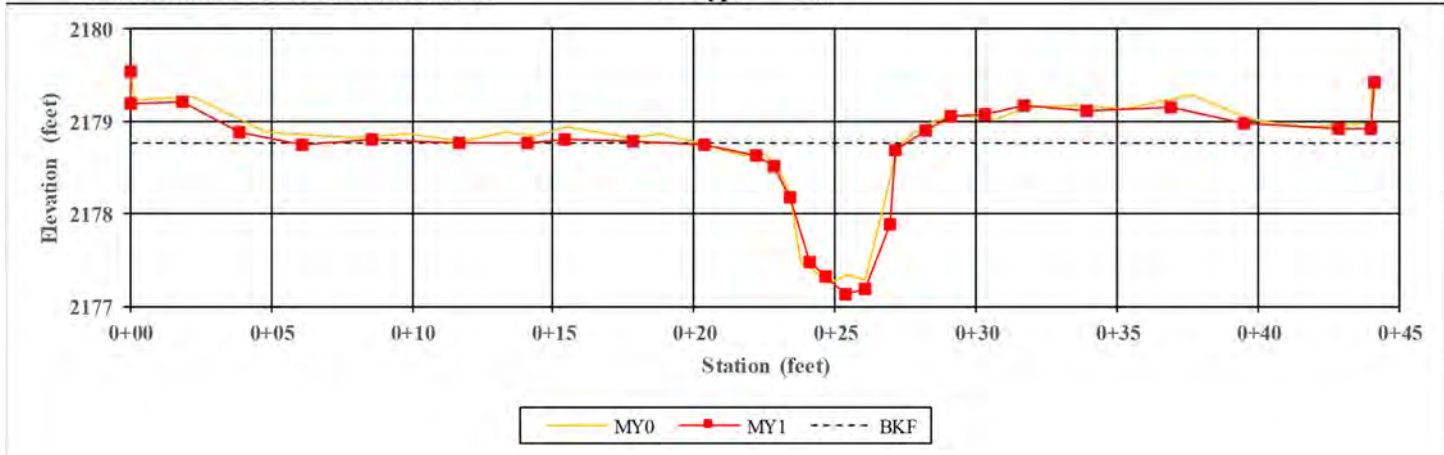


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 3
XS Type: Pool

Station: 112+76



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	5.2	6.8	-	-	-	-	-	-
Floodprone Width (ft)	50.0	50.0	-	-	-	-	-	-
Bankfull Mean Depth (ft)	1.0	0.8	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.6	1.6	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	5.3	5.3	-	-	-	-	-	-
Width/Depth Ratio	5.1	8.8	-	-	-	-	-	-
Entrenchment Ratio	9.6	7.4	-	-	-	-	-	-
Bank Height Ratio	1.1	1.0	-	-	-	-	-	-



Left Descending Bank

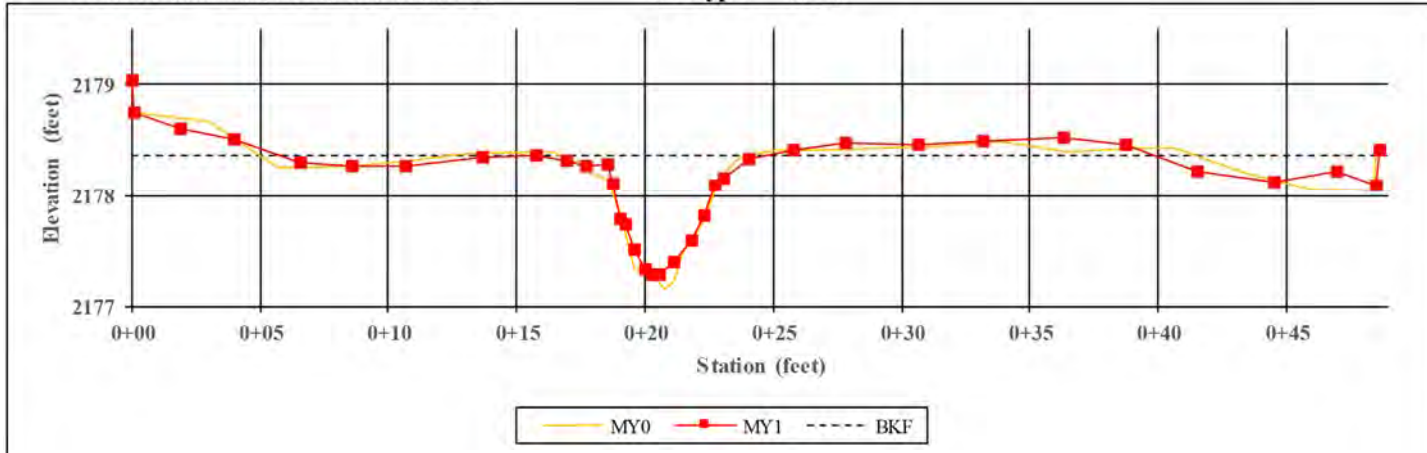


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 4
XS Type: Riffle

Station: 112+90



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.8	7.1	-	-	-	-	-	-
Floodprone Width (ft)	50.0	50.0	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.5	0.5	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.2	1.1	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	3.6	3.6	-	-	-	-	-	-
Width/Depth Ratio	12.6	14.2	-	-	-	-	-	-
Entrenchment Ratio	14.8	7.0	-	-	-	-	-	-
Bank Height Ratio	1.0	1.0	-	-	-	-	-	-



Left Descending Bank

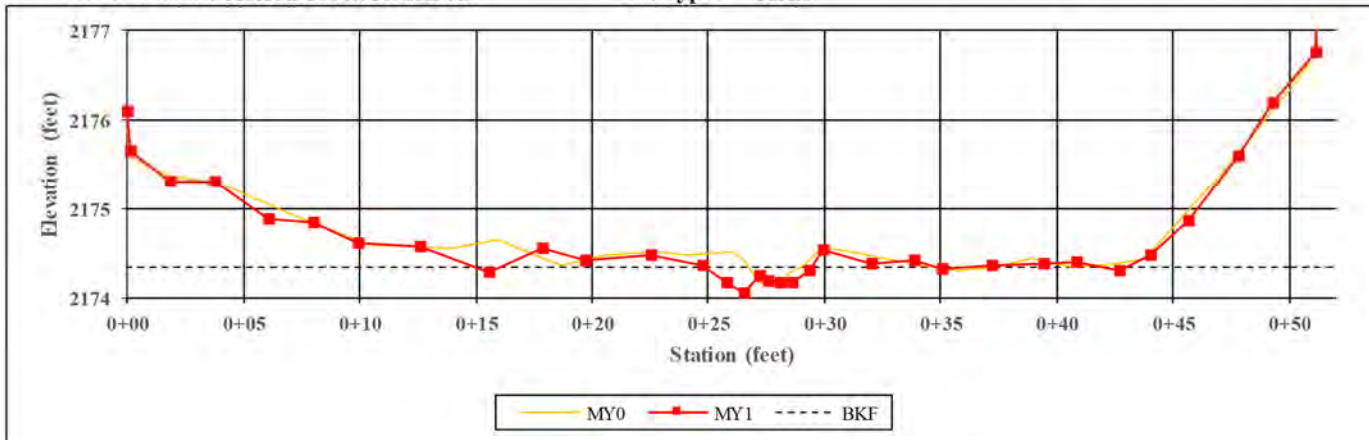


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1D

XS Number: 5
XS Type: Riffle

Station: 116+36



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	2.5	4.4	-	-	-	-	-	-
Floodprone Width (ft)	33.4	33.4	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.3	0.2	-	-	-	-	-	-
Bankfull Max Depth (ft)	0.4	0.3	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	0.7	0.7	-	-	-	-	-	-
Width/Depth Ratio	8.6	29.6	-	-	-	-	-	-
Entrenchment Ratio	13.2	7.5	-	-	-	-	-	-
Bank Height Ratio	1.0	1.1	-	-	-	-	-	-



Left Descending Bank

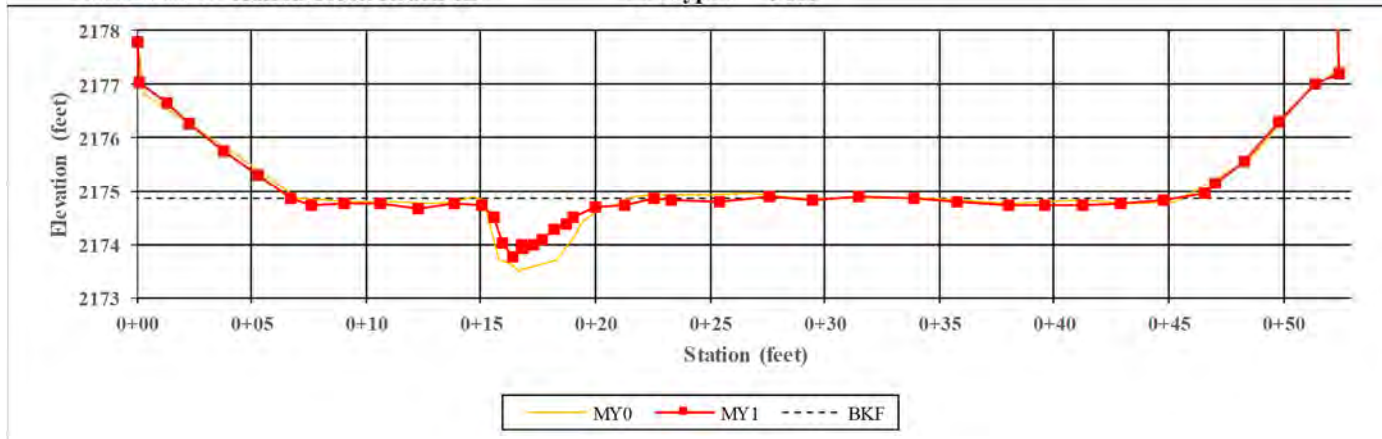


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1D

XS Number: 6
XS Type: Pool

Station: 116+65



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.1	20.0	-	-	-	-	-	-
Floodprone Width (ft)	38.3	38.3	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.7	0.2	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.3	1.1	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	4.5	4.5	-	-	-	-	-	-
Width/Depth Ratio	8.3	89.9	-	-	-	-	-	-
Entrenchment Ratio	6.3	1.9	-	-	-	-	-	-
Bank Height Ratio	1.0	0.9	-	-	-	-	-	-

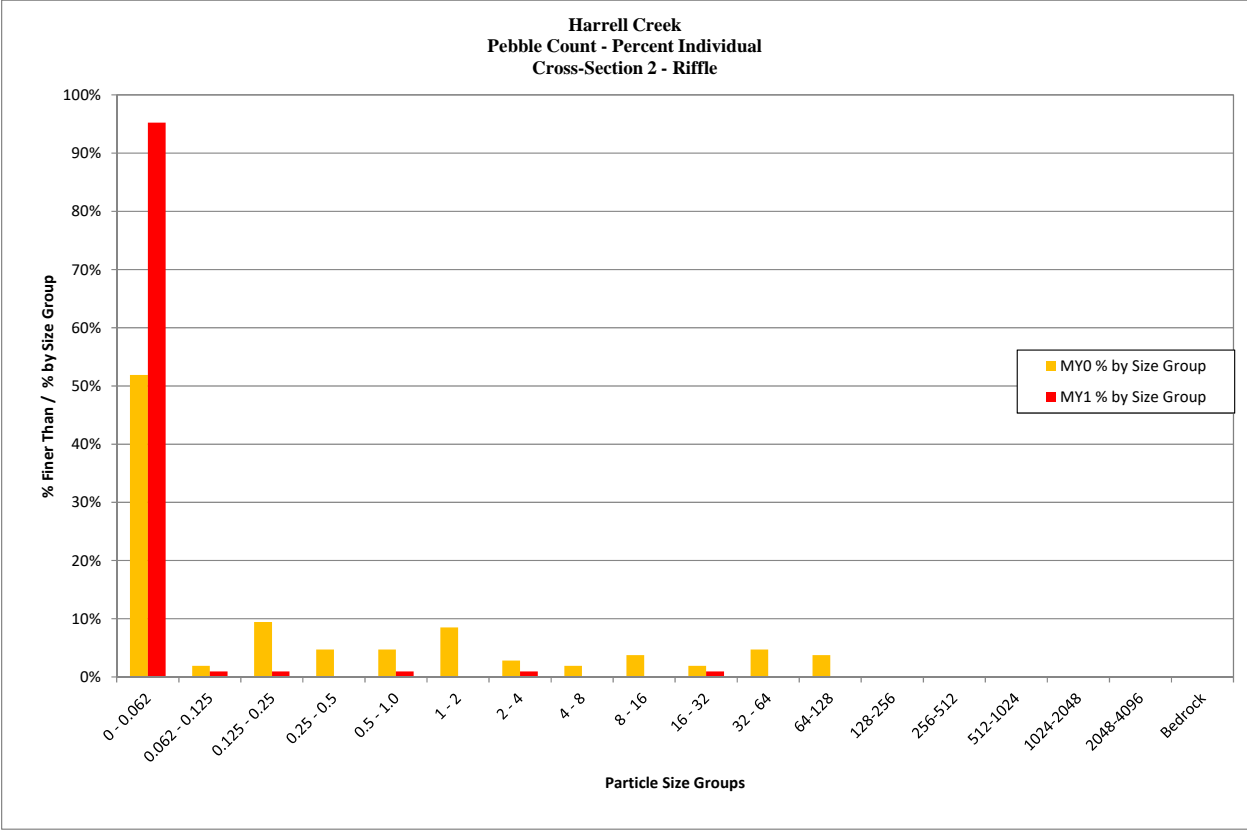
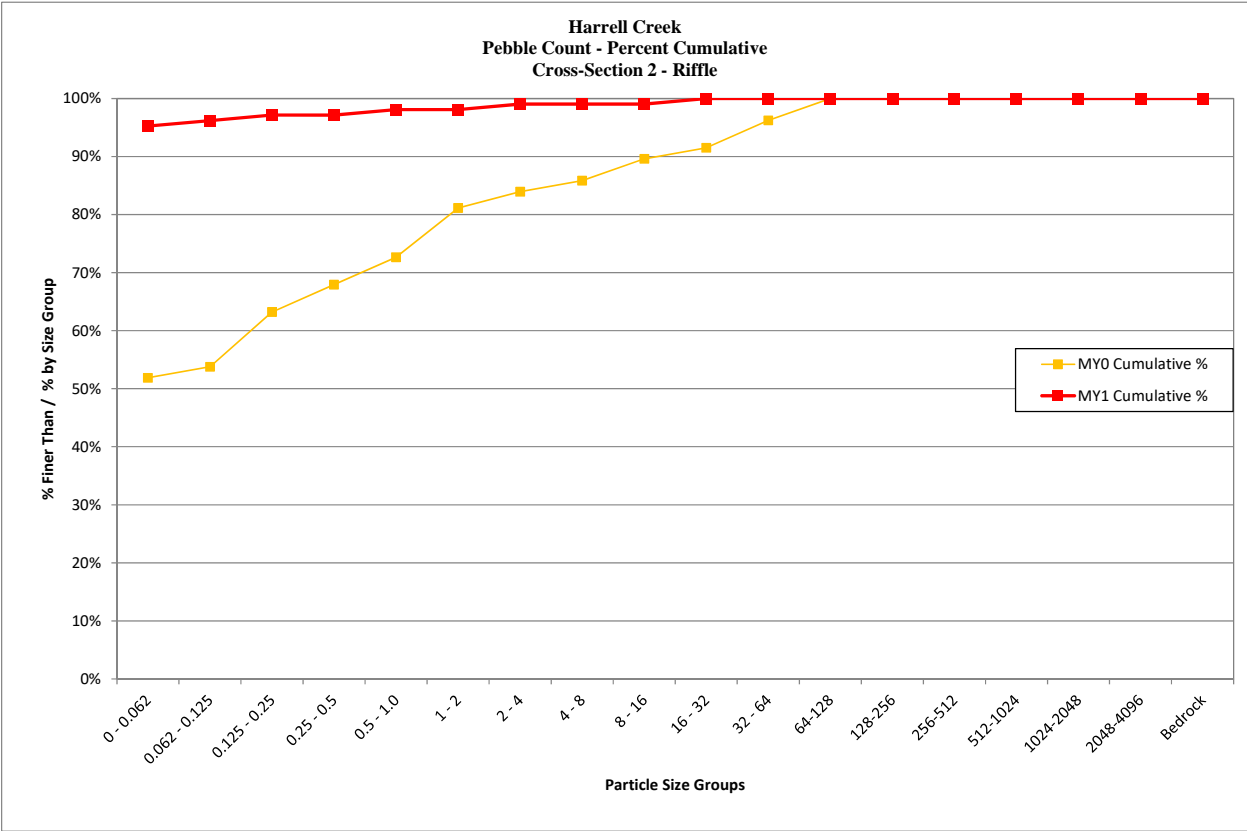


Left Descending Bank



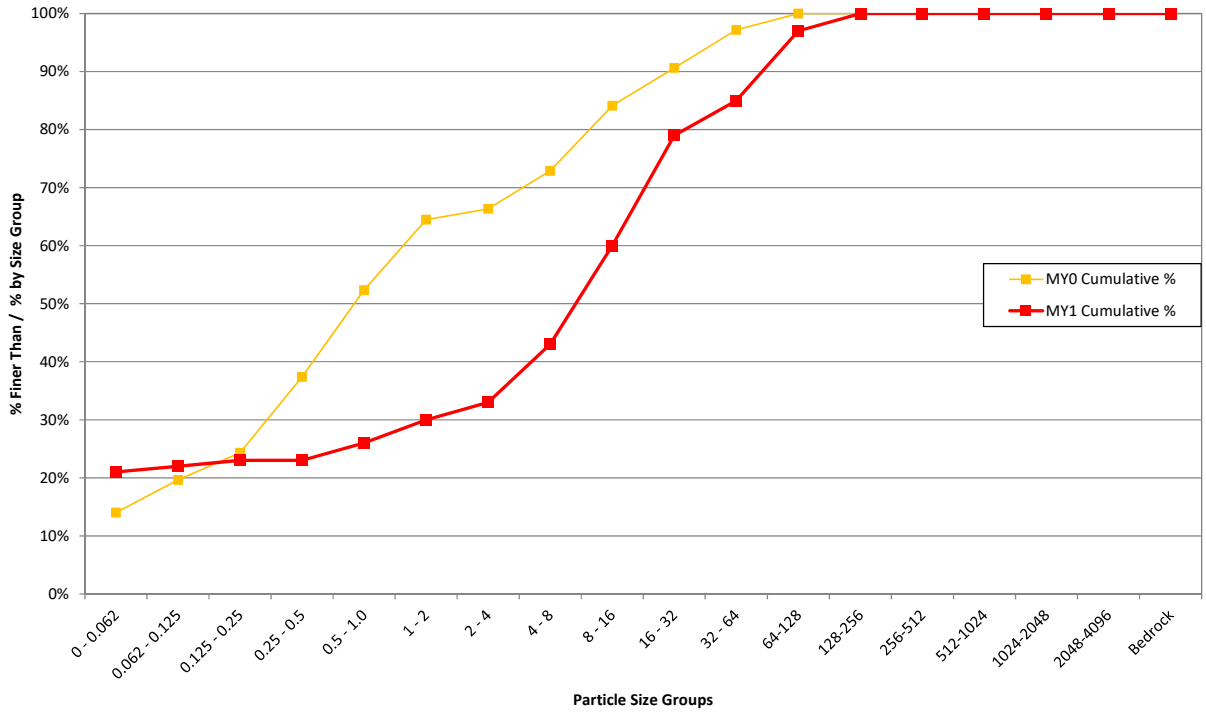
Right Descending Bank

Harrell			
Cross Section 2 - Riffle			
Monitoring Year - 2020; MY1			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	100	95.2%	95%
0.062 - 0.125	1	1.0%	96%
0.125 - 0.25	1	1.0%	97%
0.25 - 0.5	0	0.0%	97%
0.5 - 1.0	1	1.0%	98%
1 - 2	0	0.0%	98%
2 - 4	1	1.0%	99%
4 - 8	0	0.0%	99%
8 - 16	0	0.0%	99%
16 - 32	1	1.0%	100%
32 - 64	0	0.0%	100%
64-128	0	0.0%	100%
128-256	0	0.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	105	100%	100%
Summary Data			
D50		0.062	
D84		0.062	
D95		0.062	

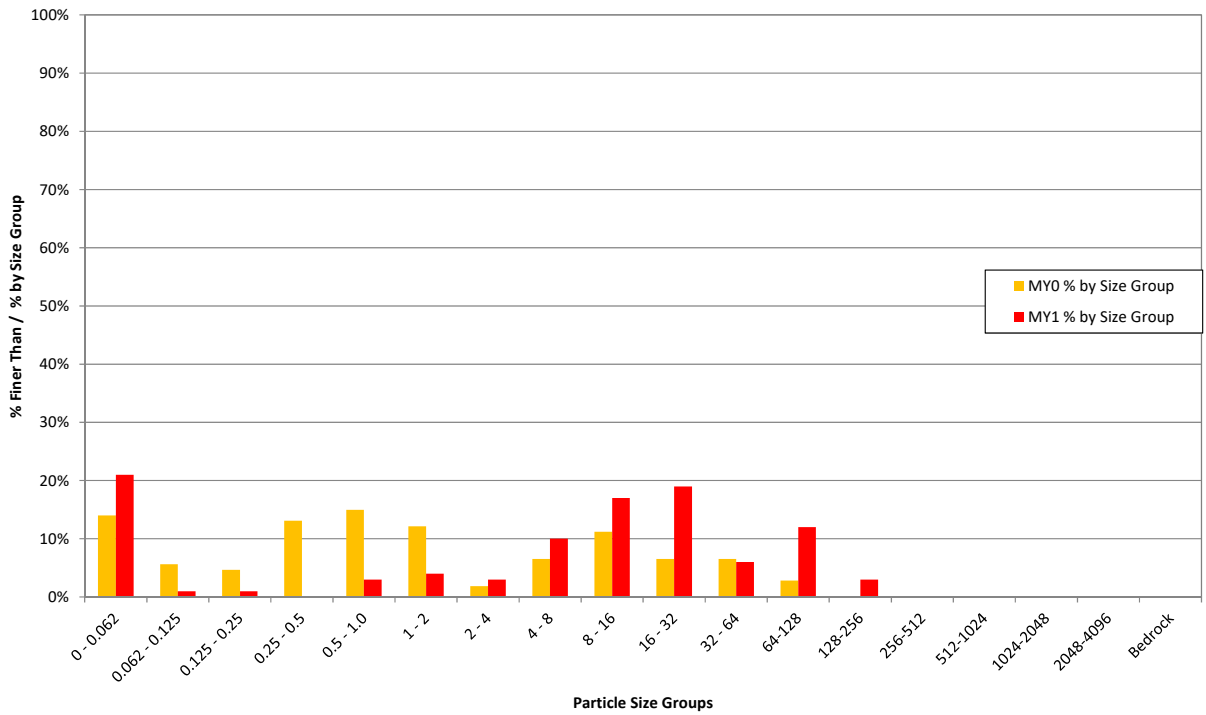


Harrell			
Cross Section 4 - Riffle			
Monitoring Year - 2020; MY1			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	21	21.0%	21%
0.062 - 0.125	1	1.0%	22%
0.125 - 0.25	1	1.0%	23%
0.25 - 0.5	0	0.0%	23%
0.5 - 1.0	3	3.0%	26%
1 - 2	4	4.0%	30%
2 - 4	3	3.0%	33%
4 - 8	10	10.0%	43%
8 - 16	17	17.0%	60%
16 - 32	19	19.0%	79%
32 - 64	6	6.0%	85%
64-128	12	12.0%	97%
128-256	3	3.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	100	100%	100%
Summary Data			
D50		11	
D84		45	
D95		120	

Harrell Creek
Pebble Count - Percent Cumulative
Cross-Section 4 - Riffle

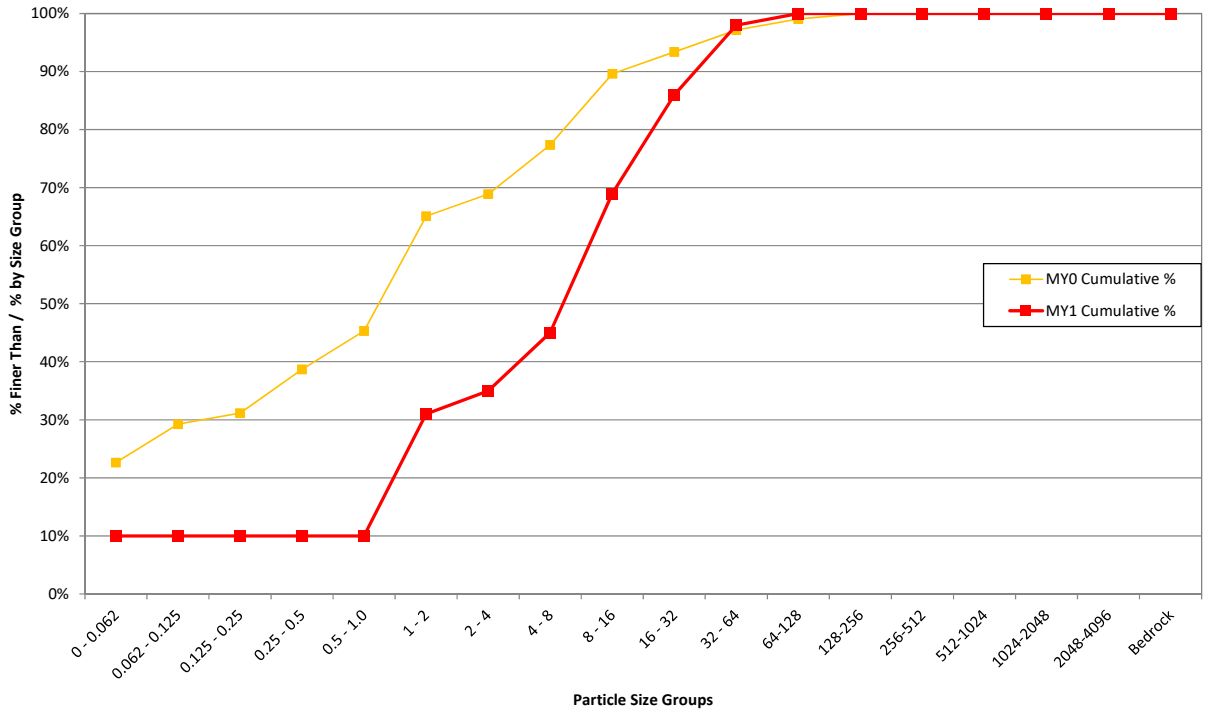


Harrell Creek
Pebble Count - Percent Individual
Cross-Section 4 - Riffle



Harrell			
Cross Section 5 - Riffle			
Monitoring Year - 2020; MY1			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	10	10.0%	10%
0.062 - 0.125	0	0.0%	10%
0.125 - 0.25	0	0.0%	10%
0.25 - 0.5	0	0.0%	10%
0.5 - 1.0	0	0.0%	10%
1 - 2	21	21.0%	31%
2 - 4	4	4.0%	35%
4 - 8	10	10.0%	45%
8 - 16	24	24.0%	69%
16 - 32	17	17.0%	86%
32 - 64	12	12.0%	98%
64-128	2	2.0%	100%
128-256	0	0.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	100	100%	100%
Summary Data			
D50		9.2	
D84		29	
D95		49	

Harrell Creek
Pebble Count - Percent Cumulative
Cross-Section 5 - Riffle



Harrell Creek
Pebble Count - Percent Individual
Cross-Section 5 - Riffle

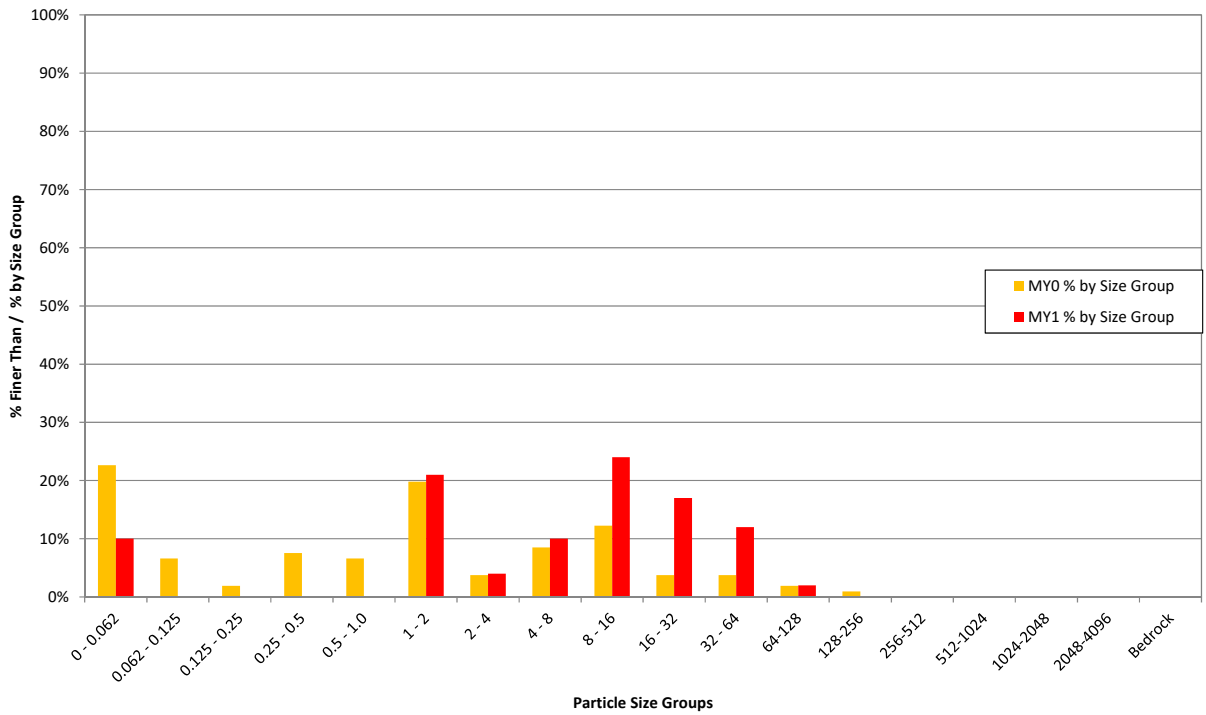


Table 8. Baseline Stream Data Summary
Harrell Mitigation Site - Harrell Creek Reach 1D (294 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N
Dimension & Substrate - Riffle																								
Bankfull Width (ft)	-	-	-	2.9	-	-	2.9	-	1	6.3	8.5	-	10.7	-	-	-	4.2	-	2.5	-	-	2.5	0.0	1
Floodprone Width (ft)	-	-	-	35.0	-	-	35.0	-	1	25.0	32.2	-	40	-	-	>50	-	-	33.4	-	-	33.4	0.0	1
Bankfull Mean Depth (ft)	-	-	-	0.7	-	-	0.7	-	1	-	-	-	-	-	-	1.6	-	-	0.3	-	-	0.3	0.0	1
Bankfull Max Depth (ft)	-	-	-	1.0	-	-	1.0	-	1	1.2	1.4	-	1.6	-	-	2.3	-	-	0.4	-	-	0.4	0.0	1
Bankfull Cross Sectional Area (ft ²)	-	-	-	2.4	-	-	2.4	-	1	8.8	8.8	-	10	-	-	2.8	-	-	0.7	-	-	0.7	0.0	1
Width/Depth Ratio	-	-	-	3.5	-	-	3.5	-	1	5.2	8.4	-	10.5	-	-	6.1	-	-	8.6	-	-	8.6	0.0	1
Entrenchment Ratio	-	-	-	12.1	-	-	12.1	-	1	2.5	3.5	-	3.8	-	-	8.4	-	-	13.2	-	-	13.2	0.0	1
Bank Height Ratio	-	-	-	1.0	-	-	1.0	-	1	0.8	1.0	-	1.1	-	-	1.0	-	-	1.0	-	-	1.0	0.0	1
d50 (mm)	-	-	-	-	-	-	-	-	-	-	13.0	-	-	-	-	-	-	-	1.2	-	-	1.2	0	1
Profile																								
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	4.0	6.6	-	10.0	-	-	4.0	6.6	-	10.0	-	-	27.0	7.2	35
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	0.9	2.2	-	4.0	-	-	0.9	2.2	-	4.0	-	-	0.97	0.03	35
Pool Length (ft)	-	-	-	-	-	-	-	-	-	3.0	15.2	-	23.0	-	-	3.0	15.2	-	23.0	-	-	48.5	23.3	2
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	0.2	2
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	0.8	1.6	-	2.5	-	-	0.8	1.6	-	2.5	-	-	72.0	n/a	1
Pattern																								
Channel Belt Width (ft)	-	-	-	-	-	-	-	-	-	20.0	33.0	-	53.0	-	-	-	-	-	53.0	-	-	15.4	1.1	3
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	7.5	11.2	-	15.0	-	-	18.0	-	-	15.0	-	-	22.0	0.2	2
Rc: Bankfull Width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.8	0.1	2
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	25.0	41.0	-	56.0	-	-	-	-	-	56.0	-	-	102.9	19.7	5
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.1	-	-	-	-	-	6.2	0.4	2
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max Part Size (mm) Mobilized at Bankfull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (Transport Capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																								
Drainage Area (mi ²)	-	-	-	-	-	-	0.17	-	-	-	-	-	0.25	-	-	0.17	-	-	-	-	-	0.17	-	-
Rosgen Classification	-	-	-	-	-	-	E	-	-	-	-	-	E;F	-	-	E4	-	-	-	-	-	E4	-	-
Bankfull Velocity (fps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bankfull Discharge (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	275	-	-
Channel Thalweg Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	294	-	-
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	-	1.63	-	-	1.06	-	-	-	-	-	1.07	-	-
Water Surface Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	0.005	-	-
Bankfull Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	0.006	-	-
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% of Reach with Eroding Banks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

^ Channel Centerline (ft): Based on stream centerline stationing from design stream stationing; accounts for breaks in conservation easement and utility right-of-ways.

- Information unavailable.

Non-Applicable.

Table 9a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Harrell Mitigation Site

	Cross Section 1 (Pool) Harrell Creek Reach 1C								Cross Section 2 (Riffle) Harrell Creek Reach 1C								Cross Section 3 (Pool) Harrell Creek Reach 1C							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Record Elevation (datum) Used	2179.70	2179.76							2179.63	2179.60							2178.36	2178.26						
Low Bank Height Elevation (datum) Used	2179.70	2179.69							2179.76	2179.78							2178.55	2178.29						
Bankfull Width (ft)	9.6	20.4							6.2	6.8							5.2	6.8						
Floodprone Width (ft)	50.0	50.0							50.0	50.0							50.0	50.0						
Bankfull Mean Depth (ft)	0.6	0.3							0.6	0.5							1.0	0.8						
Bankfull Max Depth (ft)	1.9	1.2							0.9	0.9							1.6	1.6						
Bankfull Cross Sectional Area (ft ²)	6.0	6.0							3.4	3.4							5.3	5.3						
Bankfull Width/Depth Ratio	15.2	69.1							11.2	13.7							5.1	8.8						
Bankfull Entrenchment Ratio	5.2	2.5							8.1	7.4							9.6	7.4						
Bankfull Bank Height Ratio	1.0	0.9							1.1	1.2							1.1	1.0						
Low Top of Bank Depth (ft)	1.9	1.1							1.0	1.0							1.8	1.6						
	Cross Section 4 (Riffle) Harrell Creek Reach 1C								Cross Section 5 (Riffle) Harrell Creek Reach 1D								Cross Section 6 (Pool) Harrell Creek Reach 1D							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Record Elevation (datum) Used	2178.33	2178.37							2174.52	2174.34							2174.31	2174.37						
Low Bank Height Elevation (datum) Used	2178.33	2178.37							2174.52	2174.36							2174.31	2174.27						
Bankfull Width (ft)	6.8	7.1							2.5	4.4							6.1	20.0						
Floodprone Width (ft)	50.0	50.0							33.4	33.4							38.3	38.3						
Bankfull Mean Depth (ft)	0.5	0.5							0.3	0.2							0.7	0.2						
Bankfull Max Depth (ft)	1.2	1.1							0.4	0.3							1.3	1.1						
Bankfull Cross Sectional Area (ft ²)	3.6	3.6							0.7	0.7							4.5	4.5						
Bankfull Width/Depth Ratio	12.6	14.2							8.6	29.6							8.3	89.9						
Bankfull Entrenchment Ratio	14.8	7.0							13.2	7.5							6.3	1.9						
Bankfull Bank Height Ratio	1.0	1.0							1.0	1.1							1.0	0.9						
Low Top of Bank Depth (ft)	1.2	1.1							0.4	0.3							1.3	1.0						

- Information Unavailable

N/A - Information does not apply.

Appendix E

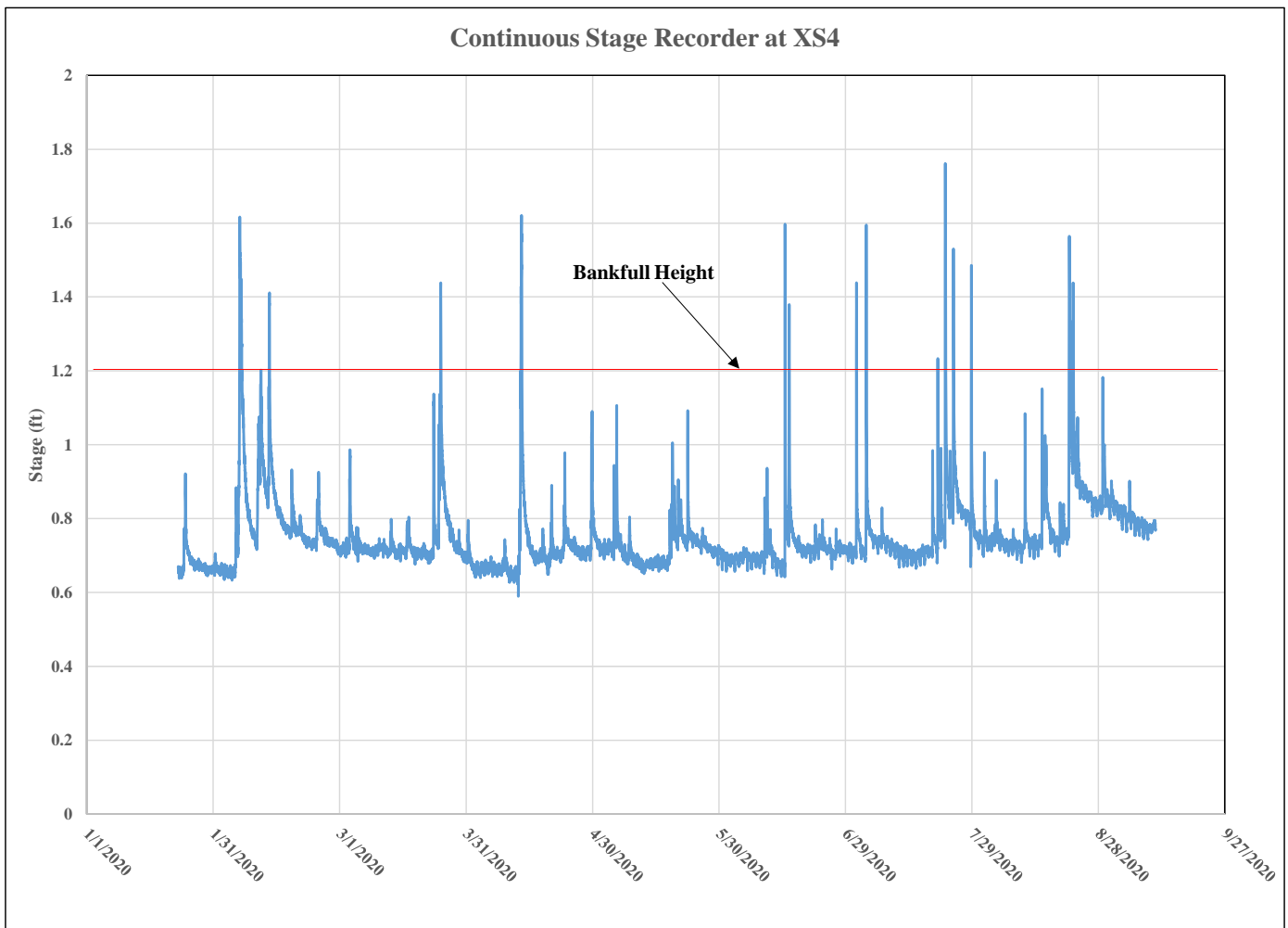
Hydrologic Data

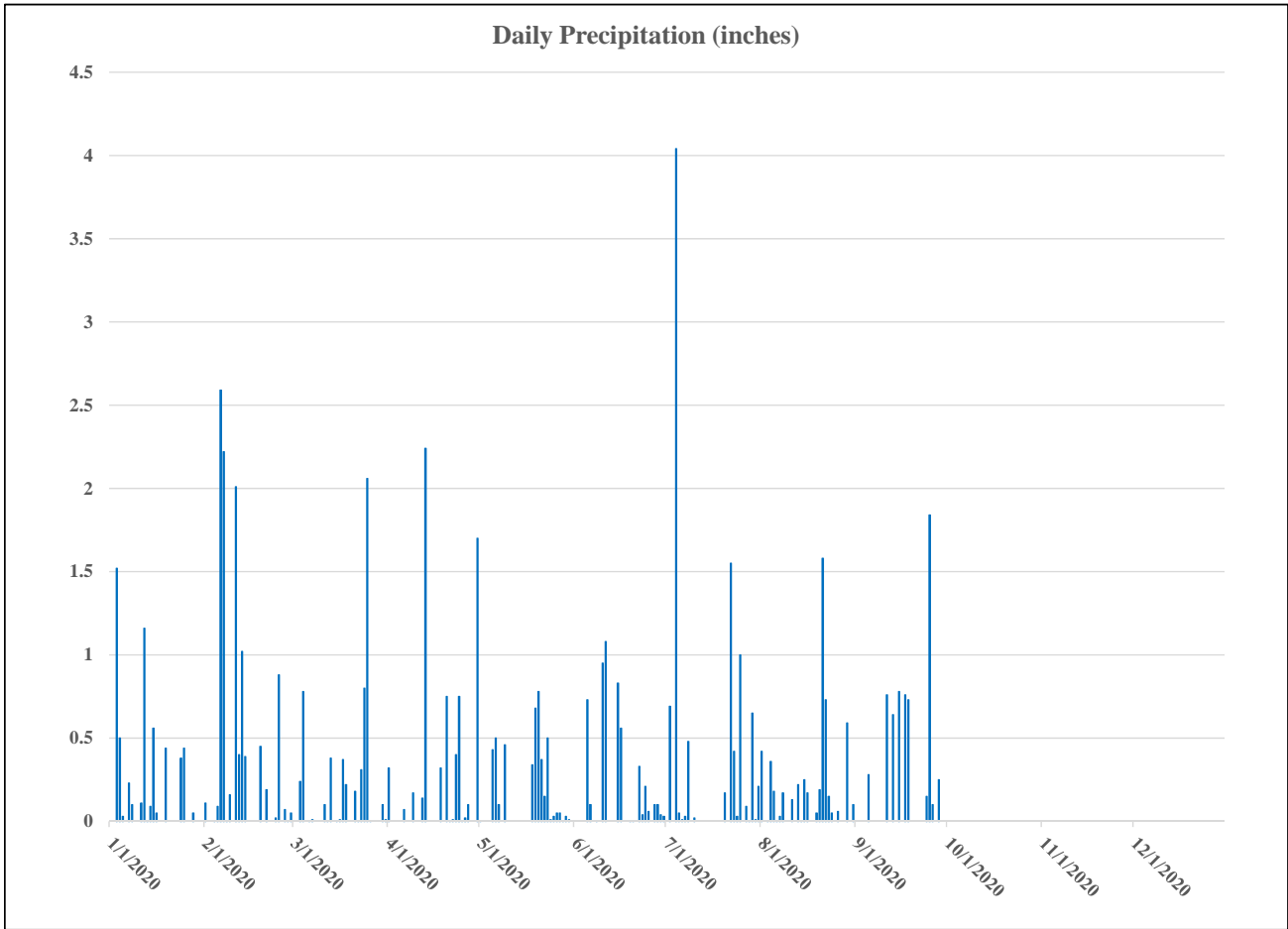
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**Table 10. Verification of Bankfull Events
Harrell Creek Mitigation Project**

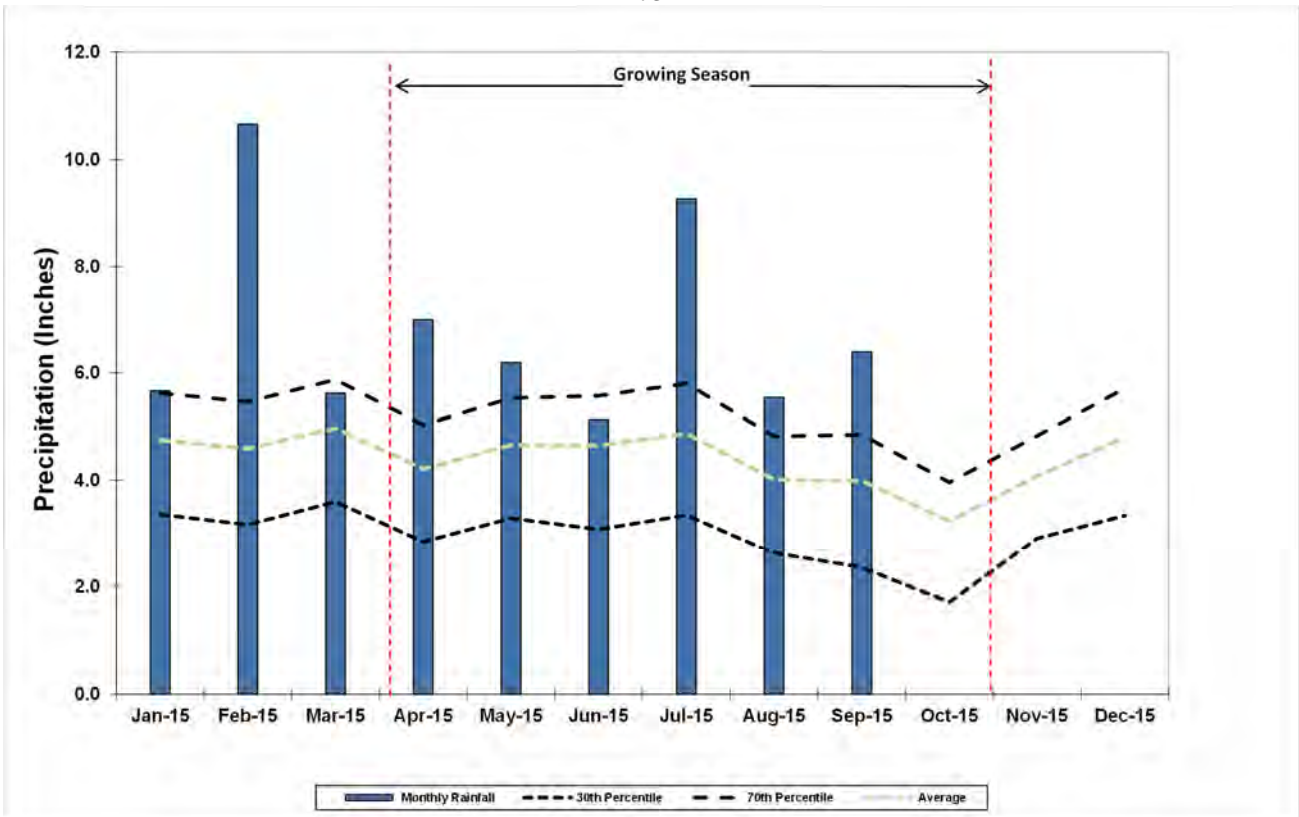
Reach 1				
Date of Data Collection	Date of Occurrence	Method	Feet Above Bankfull Elevation	Photo # (if available)
4/1/2020	2/6/2020	Crest Gauge	0.43	n/a
4/1/2020	2/11/2020	Crest Gauge	>0.01	n/a
4/1/2020	2/13/2020	Crest Gauge	0.2	n/a
4/1/2020	3/25/2020	Crest Gauge	0.23	n/a
9/10/2020	4/13/2020	Crest Gauge	0.42	n/a
9/10/2020	6/14 - 6/15/2020	Crest Gauge	0.39	n/a
9/10/2020	7/1 & 7/3/2020	Crest Gauge	0.38	n/a
9/10/2020	7/20, 7/22, and 7/24/2020	*Crest Gauge	Unknown	n/a
9/10/2020	7/28/2020	Crest Gauge	0.27	n/a
9/10/2020	8/21-8/22/2020	Wrack Lines	0.35	n/a

* Crest Gauge recorded abnormally high bankfull event relative to rainfall. True event elevation undetermined.

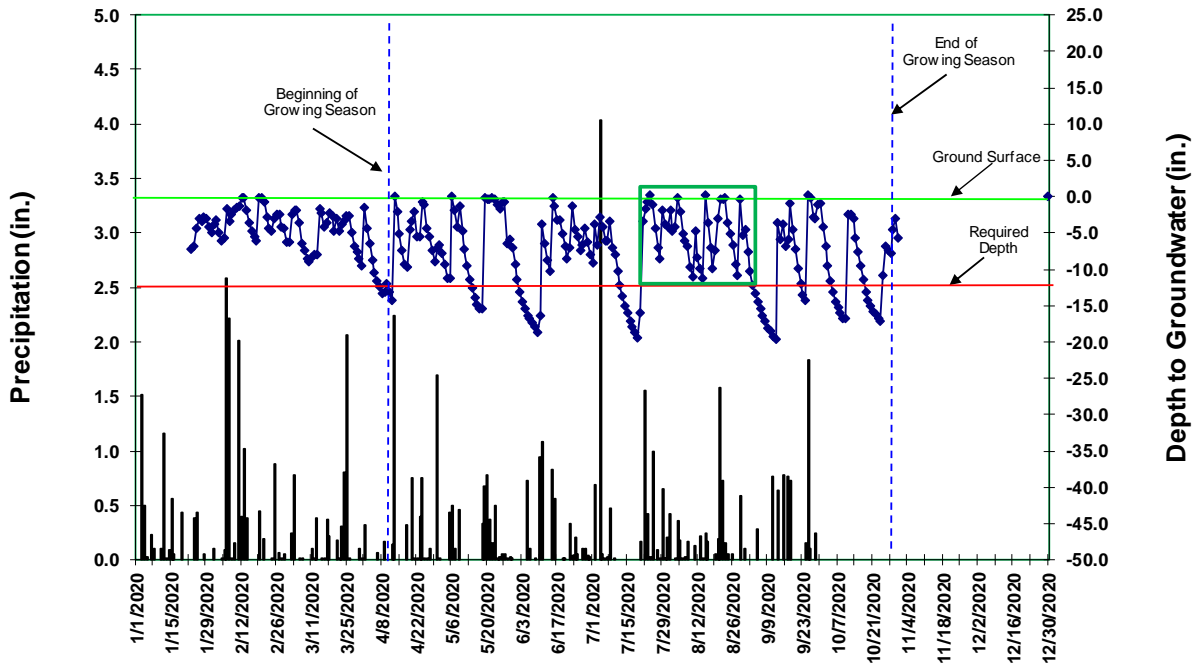




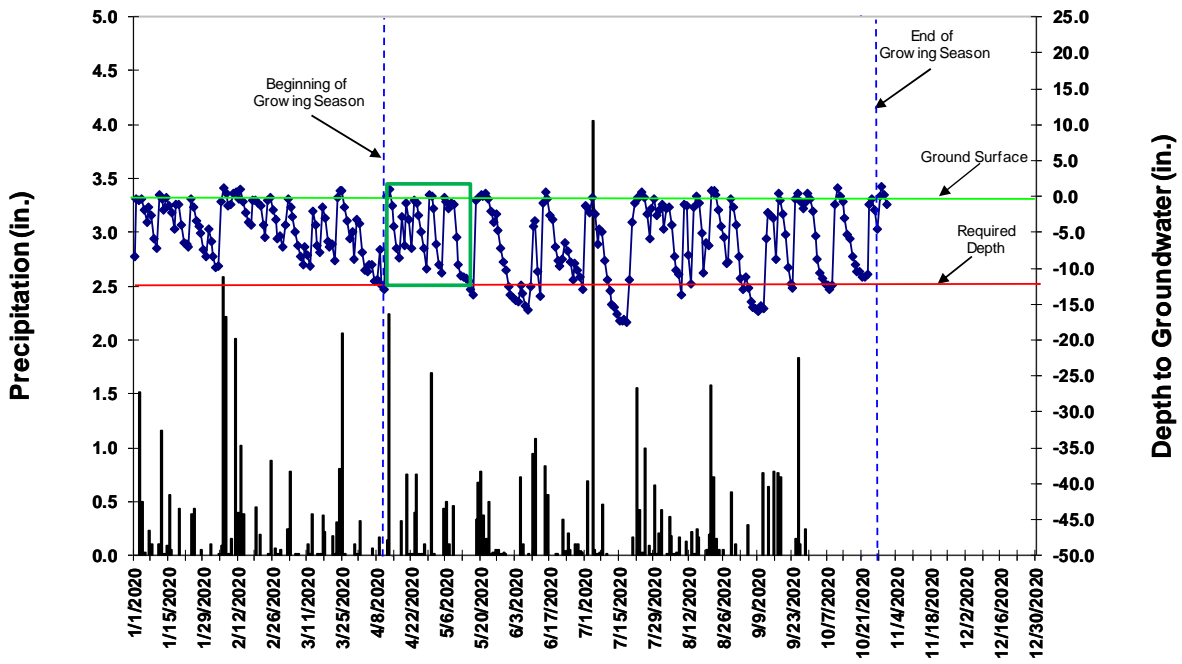
75



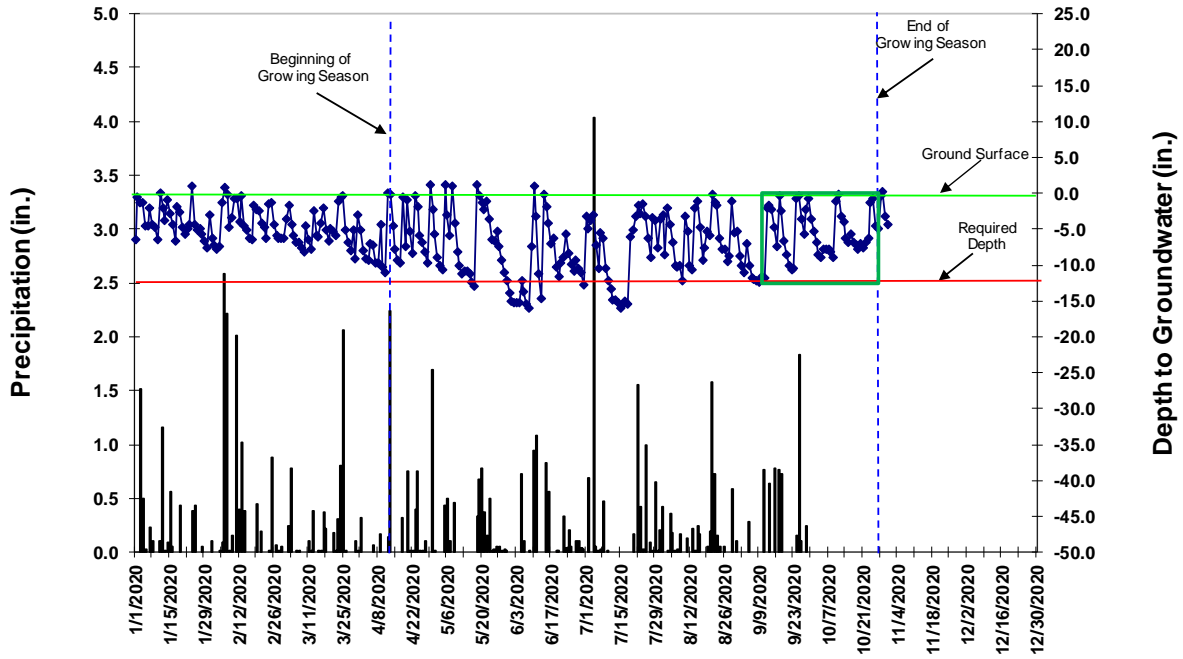
Gauge ID: **MW1** Reported Growing Season Days: 201
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **44** 07/21-09/02
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **22%**



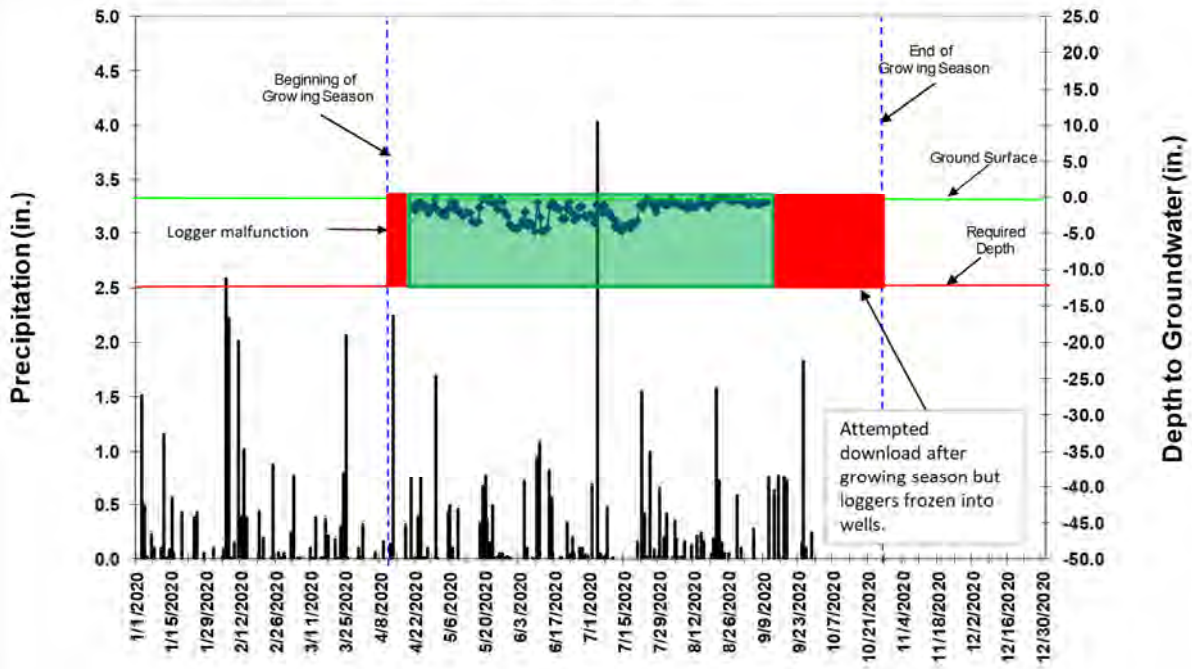
Gauge ID: **MW2** Reported Growing Season Days: 201
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **34** 04/12-05/15
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **17%**



Gauge ID: **MW3** Reported Growing Season Days: 201
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **49** 09/10-10/28
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **24%**

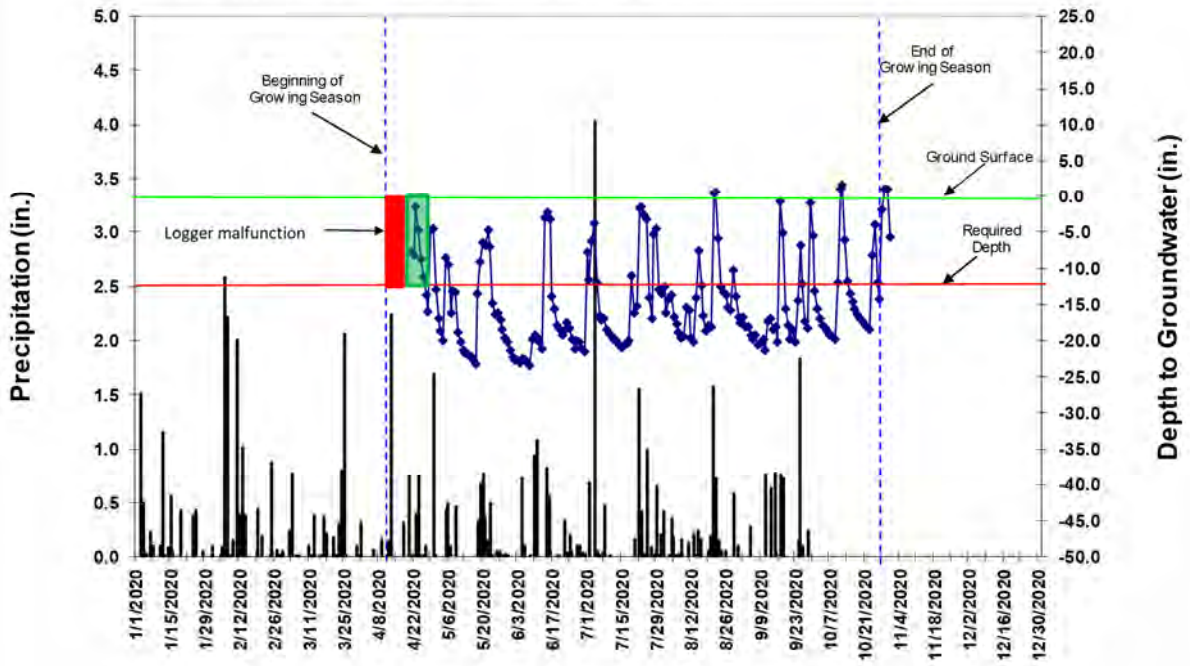


Gauge ID: **MW4** Reported Growing Season Days: 142
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **142** 04/21-09/09
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **71%**



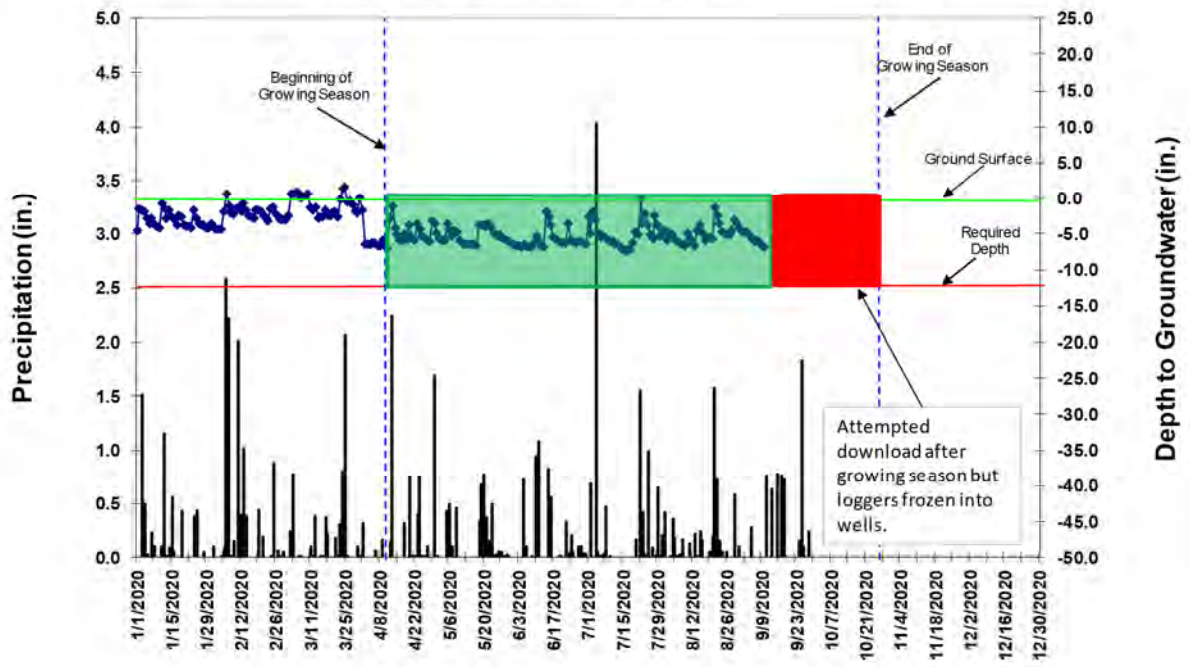
Gauge ID: **MW5** Reported Growing Season Days: 191
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **6**
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **3%**

Dates: **04/21-04/26**

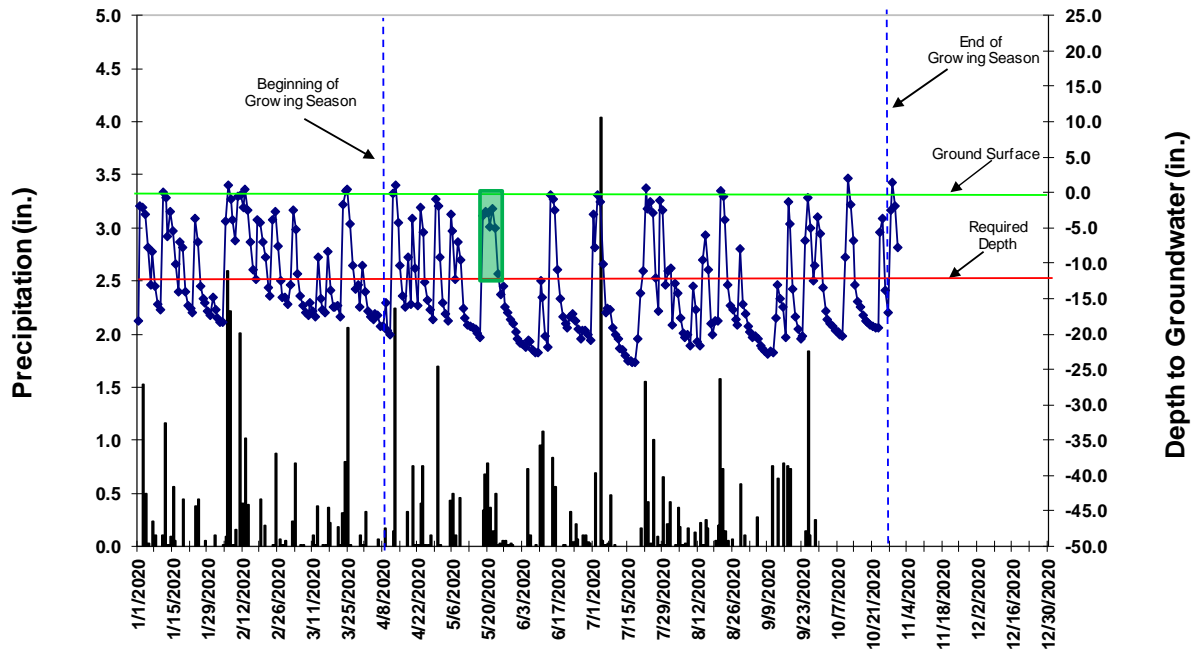


Gauge ID: **MW6** Reported Growing Season Days: 153
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **153**
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **76%**

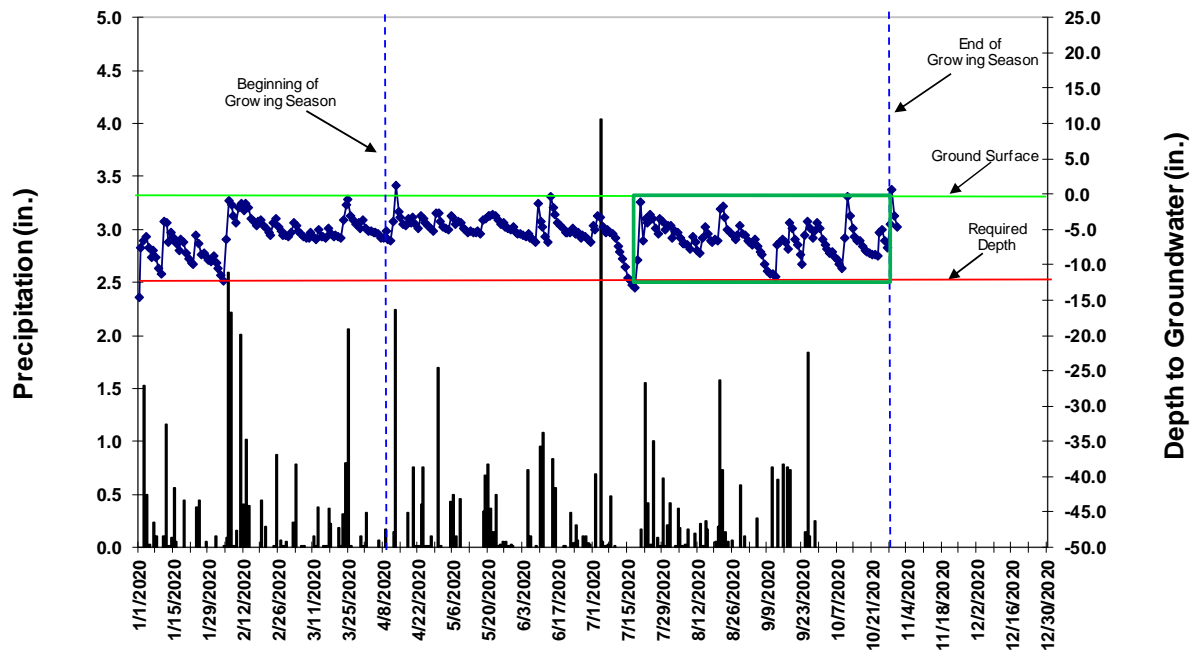
Dates: **04/09-09/09**



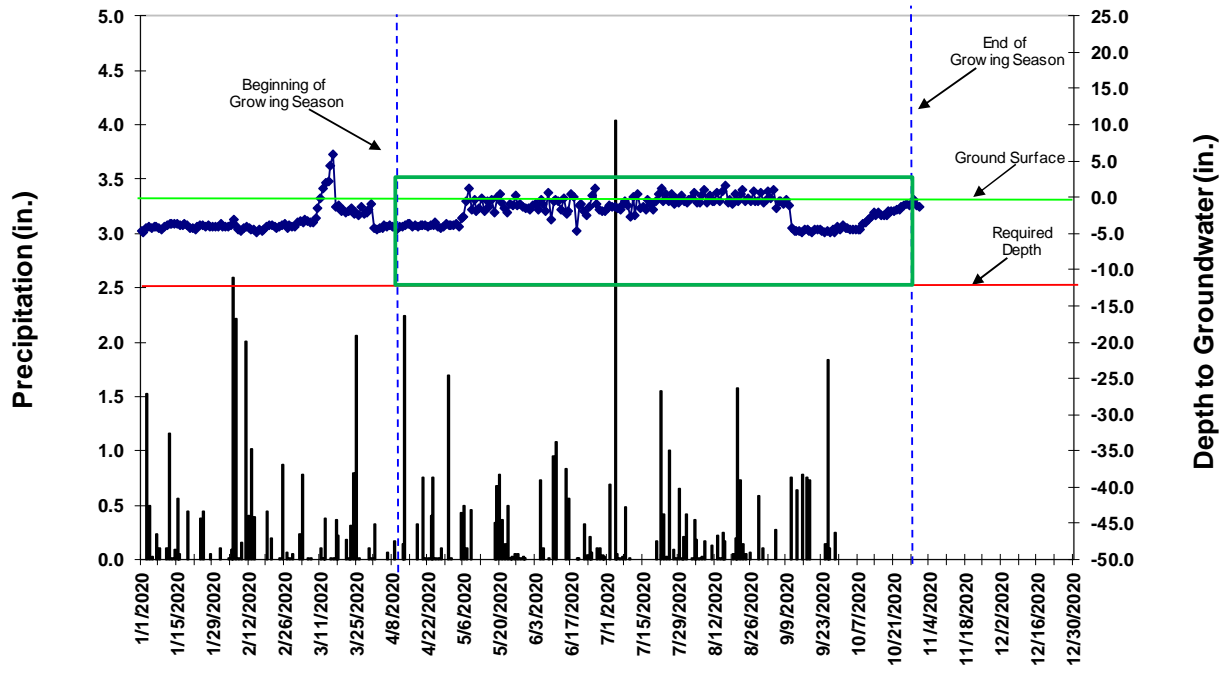
Gauge ID: **MW7** Reported Growing Season Days: 201
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **7** **05/18-05/23**
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **3%**



Gauge ID: **MW8** Reported Growing Season Days: 201
 Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **102** **07/19-10/28**
 Percentage of Growing Season Water Table within 12 inches of Soil Surface: **51%**



Gauge ID: **MW9** Reported Growing Season Days: 201
Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **201** **04/09/10/28**
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **100%**



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Appendix F
MY0 Notice of Initial Credit Release

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From: [Browning, Kimberly D CIV USARMY CESAW \(USA\)](#)
To: [Baumgartner, Tim](#); [Wiesner, Paul](#); [David Tuch](#)
Cc: [Tugwell, Todd J CIV USARMY CESAW \(US\)](#); [McLendon, C S CIV USARMY CESAW \(USA\)](#); [Crumbley, Tyler A CIV USARMY CESAW \(USA\)](#); [Gledhill-earley, Renee](#); [Bowers, Todd](#); [Haupt, Mac](#); [Wilson, Travis W](#); [byron_hamstead@fws.gov](#); [Leslie, Andrea J](#); [Davis, Erin B](#); [Jones, M Scott \(Scott\) CIV USARMY CESAW \(USA\)](#); [Brown, David W CIV USARMY CESAW \(US\)](#); [Steve Kichefski](#); [Kim Browning](#)
Subject: [External] Notice of Initial Credit Release/ Harrell Stream and Wetland Site / Jackson County /SAW-2016-02202
Date: Wednesday, March 11, 2020 2:45:28 PM
Attachments: [Harrell_100005_LT_03_STR_RW_Initial_Release_signed.pdf](#)

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov

Good afternoon,

The 15-Day Record Drawing review for the Harrell Stream and Wetland Mitigation Site (SAW-2016-02202) ended March 7, 2020. Per Section 332.8(o)(9) of the 2008 Mitigation Rule, this review followed the streamlined review process. All comments received from the NCIRT are incorporated within this email. There were no objections to issuing the initial credit release. Please find attached the current signed ledger.

Please note: The IRT would like to schedule a site visit later this year, likely in Fall. Additional IRT comments may follow after reviewing the Record Drawing and MY-0 Report. I noted that the As-Built length and Mitigation Plan lengths are different, but the SMUs remained the same.

Harrell Stream and Wetland Site
DMS Project # 100005
RFP# 16-006811 – Issued 2/15/16
Institution Date: 10/6/16 – Full Delivery
Little Tennessee River Basin
Cataloging Unit 06010203
Jackson County, North Carolina

Mitigation Plan Project Credits:

1,854 SMUs (Warm)
3.53 WMUs (Riparian)

As-Built-MYO Project Credits:

1,854 SMUs (Warm)
3.53 WMUs (Riparian)

Mitigation Plan Lengths/ Acreages:

2,430 ft.
5.11 acres

As-Built-MYO Lengths/ Acreages:

2,396 ft.
5.11 acres

Thanks

Kim

Kim Browning

Mitigation Project Manager, Regulatory Division | U.S. Army Corps of Engineers
3331 Heritage Trade Dr, Ste. 105 | Wake Forest, NC 27587 | 919.554.4884 x60

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