



# MONITORING YEAR 3 ANNUAL REPORT

Final

## HENRY FORK MITIGATION SITE

Catawba County, NC  
DEQ Contract No. 005782  
DMS Project No. 96306

Catawba River Basin  
HUC 03050103 Expanded Service Area

Data Collection Period: April 2018 - November 2018  
Submission Date: December 4, 2018

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### PREPARED FOR:



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

Mitigation Project Name Henry Fork Stream and Wetland Mitigation Project  
 DMS ID 96306  
 River Basin Catawba  
 Cataloging Unit 03050102

County Catawba  
 Date Project Instituted 2/15/2014  
 Date Prepared 5/22/2018

USACE Action ID 2014-00538  
 NCDWR Permit No 2014-0193

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)			4,807.670					4.220						
Potential Credits (As-Built Survey)			4,838.330											
Potential Credits (IRT Approved)			4,807.667					4.217						
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%		1,451.499		2016	6/24/2016	30%	1.265			30%		2016	6/24/2016
3 (Year 1 Monitoring)	10%		480.767		2017	10/20/2017	10%	0.422			10%		2017	10/20/2017
IRT Adjustment*			-9.200			10/20/2017								
4 (Year 2 Monitoring)	10%		480.767		2018	4/25/2018	10%	0.422			15%		2018	4/25/2018
5 (Year 3 Monitoring)	10%				2019		10%				20%		2019	
6 (Year 4 Monitoring)	5%				2020		10%				10%		2020	
7 (Year 5 Monitoring)	10%				2021		10%				15%		2021	
8 (Year 6 Monitoring)	5%				2022		10%				N/A		2022	
9 (Year 7 Monitoring)	10%				2023		10%				N/A		2023	
Stream Bankfull Standard	10%		480.767			4/25/2018	N/A				N/A			
Total Credits Released to Date			2,884.599					2.109						

\*NOTE: Adjustment required due to IRT concerns on how the as-built credits were calculated

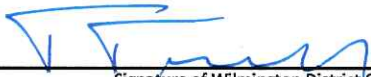
DEBITS (released credits only)

	Ratios															
	1	1.5	2.5	5	1.0214	3	2	5	1	3	2	5	1	3	2	5
	Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
IRT Approved As-Built Amounts (feet and acres)	3,057.000	2,626.000			3.960		0.680									
IRT Approved As-Built Amounts (mitigation credits)	3,057.000	1,750.667			3.877		0.340									
Percentage Released	60%	60%			50%		50%									
Released Amounts (feet / acres)	1,834.200	1,575.600			1.980		0.340									
Released Amounts (credits)	1,834.200	1,050.400			1.939		0.170									
NCDWR Permit	USACE Action ID	Project Name														
	2014-00081	NCDOT - SR 1922 - Bridge 119 - Division 13, Burke County														
2006-1849	2006-41599-390	124.000	Bromley													
2000-0162	2000-30479		Johnston Road Widening/Ballentine Road													
2000-1195	2009-03090		Wilkinson Blvd Parking Decks													
	2016-01344		NCDOT TIP B-5398													
	2005-30193	93.000	Ballantyne Country Club Golf Course													
	2009-00940		Silverlanding													
2000-1195	2009-03090		Wilkinson Blvd Parking Decks													
2004-1615	2005-30123		Midwood Phase II (Firth Court Redevelopment)													
2005-0893	2005-31884		US 521 Landfill (Foxhole)													
2000-1195	2009-03090		Wilkinson Blvd Parking Decks													
Remaining Amounts (feet / acres)	1,710.200	1,482.600			0.000		0.000									
Remaining Amounts (credits)	1,710.200	988.400			0.000		0.000									

Contingencies (if any): None



Henry Fork



Signature of Wilmington District Official Approving Credit Release

9/6/18

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

**PREPARED BY:**

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**WILDLANDS**  
ENGINEERING

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Charlotte, NC 28203

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December 4, 2018

Mr. Matthew Reid  
Western Project Manager  
Division of Mitigation Services  
5 Ravenscroft Dr., Suite 102  
Asheville, NC 28801

RE: **Response to MY3 Draft Report Comments  
Henry Fork Mitigation Project**  
DMS Project # 96306  
Contract Number 005782  
RFP Number 16-005298  
Catawba River Basin – CU# 03050103 Expanded Service Area  
Catawba County, North Carolina

Dear Mr. Reid:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 3 report for the Henry Fork Mitigation Project. The following Wildlands responses to DMS's report comments are noted in italics lettering.

**DMS comment; Please be prepared to discuss proposed remedial actions on the right floodplain of UT1 Reach 2 at the scheduled site meeting on January 16, 2019 with the IRT.**

*Wildlands response; Wildlands will be prepared to discuss the proposed remedial actions on the right floodplain of UT1 Reach 2 during the scheduled meeting on January 16, 2019 with the IRT.*

**DMS comment; 1.2.4 Wetland Assessment: A soil temperature gage was installed in October 2016. Data from this gage is not presented in the report. How is Wildlands planning to use this information? Is temperature data going to be used to better define a growing season since historical growing season data is not available for Catawba County?**

*Wildlands response; At this time, Wildlands has not adjusted the growing season dates for the Henry Fork based on soil temperature data. The soil temperature data collected is being used to verify the dates defined in the WETS table for Burke County are accurate for the Henry Fork Site. Wildlands has updated the report in Section 1.2.4 to clarify.*

**DMS comment; 1.2.4 Wetland Assessment: A reference gage is mentioned when describing trends for GWG 2, 3, and 8, but the hydrology summary data for the reference gage is not presented in the report. Consider adding the reference gage data if comparisons are discussed in the report.**

*Wildlands response; Wildlands has updated Table 14 to include the reference gage data.*



**DMS comment; Q2 update included the installation of new trees in May 2018. Please update section 1.2.5 to include this information. Please include number of trees and type (bare root, gallon, etc).**

*Wildlands response; Wildlands has updated Section 1.2.5 to include where the trees were planted, the number and types of trees.*

**DMS comment; Table 2: Please add invasive treatment dates for MY3. Invasive treatments were discussed in both the Q1 and Q2 updates provided from Wildlands.**

*Wildlands response; Table 2 has been updated to note dates of invasive plant control treatments, along with the report Section 1.2.5.*

**DMS comment; Cross-sections: Please turn off marker for all monitoring years except MY3 to make graph more legible to reviewers.**

*Wildlands response; Wildlands has updated the cross-sections to remove markers for monitoring years prior to MY3.*

**DMS comment; Groundwater Gage 5 Plot: The report indicates that Wildlands believes Gage 5 may be malfunctioning. Please add a note to graph acknowledging that the data may be inaccurate, and the gage will be replaced.**

*Wildlands response; Wildlands has updated the groundwater gage 5 plot by adding a notation that the probe may be malfunctioning along with the probability that the data may be inaccurate and will be replaced.*

**DMS comment; Stream Gage Plots: Please add number of consecutive days to each graph or add a table similar to Table 14 to present this information.**

*Wildlands response; The stream gage plots have been updated to include the number of consecutive days of flow.*

**DMS comment; As Wildlands has done in the past, please include a response to the comment letter and how/where the comments were addressed. Please insert this letter directly behind the cover page in the final deliverables. The IRT has requested that we include this letter with the final deliverables. The response letter will need to be included with all future monitoring deliverables.**

*Wildlands response; Wildlands has included this response letter as part of the final report deliverable to DMS and the IRT.*



Enclosed please find three (3) hard copies and one (1) electronic copy on CD of the Final Monitoring Report. Please contact me at 704-332-7754 x110 if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Kirsten Y. Gimbert".

Kirsten Y. Gimbert  
Environmental Scientist  
[kgimbert@wildlandseng.com](mailto:kgimbert@wildlandseng.com)



## EXECUTIVE SUMMARY

Wildlands Engineering Inc. (Wildlands) implemented a full delivery project at the Henry Fork Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore 3,057 linear feet (LF) of perennial streams and enhance 2,626 LF of intermittent streams, enhance 0.68 acres of existing wetlands, rehabilitate 0.25 acres of existing wetlands, and re-establish 3.71 acres of wetlands in Catawba County, NC. The Site is expected to generate 4,807 stream mitigation units (SMUs) and 4.22 wetland mitigation units (WMUs) (Table 1). The Site is located near the city of Hickory in Catawba County, NC, in the Catawba River Basin; eight-digit Cataloging Unit (CU) 03050102 and the 14-digit Hydrologic Unit Code (HUC) 03050102010030 (Figure 1).

The project's compensatory mitigation credits will be used in accordance with the In-Lieu Fee (ILF) Program Instrument dated July 28, 2010, the expanded service area as defined under the September 12, 2006 PACG memorandum, and/or DMS acceptance and regulatory permit conditions associated with DMS ILF requirements. Hydrologic Unit Code (HUC) 03050102010030, Lower Henry Fork, was identified as a Targeted Local Watershed (TLW) in DMS' 2007 Catawba River Basin Restoration Priority (RBRP) Plan. The project streams consist of four unnamed tributaries (UTs) to the Henry Fork River on the site of a former golf course, referred to herein as UT1, UT2, UT1A, and UT1B (Figure 2). The project also consists of several wetland restoration components, as well as buffer planting along Henry Fork. The project watershed consists of agricultural, forested, and residential land uses.

The RBRP identifies a restoration goal for all streams within HUC 03050102 of removing conditions which cause sediment impairments, including mitigating stressors from stormwater runoff. The Henry Fork watershed was also identified in the 2005 North Carolina Wildlife Resource Commission's Wildlife Action Plan as a priority area, which calls for conservation and restoration of streams and riparian zones. In addition, the 2010 DWQ Catawba River Basin Plan indicated that the section of Henry Fork that drains to the project area is impaired for high turbidity, among other stressors. The intent of this project is to help meet the goals for the watershed outlined in the RBRP and provide numerous ecological benefits within the Catawba River Basin.

The project goals established in the mitigation plan (Wildlands, 2015) were completed with careful consideration of goals and objectives that were described in the RBRP and to meet DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed. The project goals established in the mitigation plan focused on permanent protection, reestablishing natural hydrology and vegetation, reducing water quality stressors and enhancing terrestrial and aquatic habitat. The decommissioning of the existing golf course, establishment of a permanent easement, and completion of construction and planting efforts have set a new trajectory that is intended to attain these goals, and monitoring assessments are being completed as proposed to measure established success criteria.

The Site construction and as-built surveys were completed between November 2015 and March 2016. Monitoring Year (MY) 3 assessments and site visits were completed between April and November 2018 to assess the conditions of the project. Overall, the Site has met the required stream and vegetation success criteria for MY3. All restored and enhanced streams are stable and functioning as designed. Three of the four restored streams recorded a bankfull event or greater. Vegetation assessment indicates that overall average stem density for the Site is 585 stems per acre and is therefore on track to meet the MY5 requirement of 260 stems per acre. Of the nine groundwater monitoring gages installed within the wetland rehabilitation and re-establishment zones, six met the hydrologic success for MY3. It is anticipated that the hydrology within these wetland areas will continue to recharge and meet hydrologic success criteria in the upcoming monitoring years as precipitation normalizes, especially during the winter months. Easement encroachment issues have been dealt with and have ceased to be an ongoing issue. Invasive species continue to be treated and controlled.



**HENRY FORK MITIGATION SITE**  
Monitoring Year 3 Annual Report

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## Section 1: PROJECT OVERVIEW

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The Site is located near the city of Hickory in Catawba County, NC, in the Catawba River Basin; eight-digit Cataloging Unit (CU) 03050102 and the 14-digit Hydrologic Unit Code (HUC) 03050102010030 (Figure 1). Access to the Site is via Mountain View Road, approximately one mile southwest of Hickory, North Carolina. Situated in the Inner Piedmont Belt of the Piedmont Physiographic Province (USGS, 1998), the project watershed consists of agricultural, forested, and residential land uses. The drainage area for the Site is 178 acres. (0.28 square miles).

The project streams consist of four unnamed tributaries (UTs) to the Henry Fork River on the site of a former golf course, referred to herein as UT1, UT2, UT1A, and UT1B. Stream restoration reaches included UT1 (Reach 1 and 2) and UT1B, together comprising 3,057 linear feet (LF) of perennial stream channel. Stream enhancement reaches included UT1A and UT2, together totaling 2,626 LF. Stream enhancement activities for UT1A and UT2 were the same as for restoration reaches, however the tributaries are intermittent, and as such were credited as enhancement. The riparian areas of the tributaries, as well as a 100 foot-wide buffer of the Henry Fork, were planted with native vegetation to improve habitat and protect water quality. Wetland components included enhancement of 0.68 acres of existing wetlands, rehabilitation of 0.25 acres of existing wetlands and re-establishment of 3.71 acres of wetlands.

Construction activities were completed by Land Mechanic Designs, Inc. in March 2016. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in March 2016. A conservation easement has been recorded and is in place on 48.06 acres (Deed Book 03247, Page Number 0476-0488) within a tract owned by WEI-Henry Fork, LLC. The project is expected to generate 4,838 stream mitigation units (SMUs) and 4.22 wetland mitigation units (WMUs). Annual monitoring will be conducted for seven years with the close-out anticipated to commence in 2023 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project.

Directions and a map of the Site are provided in Figure 1 and project components are illustrated for the Site in Figure 2.

### 1.1 Project Goals and Objectives

This Site is intended to provide numerous ecological benefits within the Catawba River Basin. The Site will help meet the goals for the watershed outlined in the RBRP and provide numerous ecological benefits within the Catawba River Basin. While many of these benefits are limited to the Henry Fork project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, have farther-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals established were completed with careful consideration of goals and objectives that were described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project specific goals established in the mitigation plan (Wildlands, 2015) include:

- Permanently protect the project site from harmful uses; and
- Correct modifications to streams, wetlands and buffers;
- Improving and re-establishing hydrology and function of previously cleared wetlands;
- Reducing current erosion and sedimentation;
- Reduce nutrient inputs to streams and wetlands, and to downstream water bodies;





- Improve instream habitat; and
- Provide and improve terrestrial habitat, and native floodplain forest.

The project goals were addressed through the following project objectives:

- Decommissioning the existing golf course and establishing a conservation easement on the Site will eliminate direct chemical fertilizer, pesticide and herbicide inputs;
- Resizing and realigning channels to address stream dredging and ditching. Planting native woody species in riparian zones which have been maintained through mowing. By correcting these prior modifications, the channels and floodplains will provide a suite of hydrologic and biological function;
- Restoring appropriate stream dimensions and juxtaposition of streams and wetlands on the landscape. Wetlands will be enhanced through more frequent overbank flooding, and also by reducing the drawdown effect that current ditched channels have on wetland hydrology, thereby enhancing wetland connectivity to the local water table. The project will extend existing wetland zones into adjacent areas and support wetland functions;
- Removing historic overburden to uncover relic hydric soils. Roughen wetland re-establishment. Restore streams for wetland benefit. Each of these will bring local water table elevations closer to the ground surface. Create overbank flooding, and depressional storage for overland and overbank flow retention. Decrease direct runoff, and increase infiltration;
- A native vegetation community will be planted on the Site to revegetate the riparian buffers and wetlands. Conduct soil restoration through topsoil harvesting and reapplication, and leaf litter harvesting and application from adjacent forested areas. This will return functions associated with buffers and forested floodplains, as well as enhance soil productivity and bring native biological activity and seed into the disturbed areas;
- Constructing diverse and stable channel form with varied stream bedform and installing habitat features, along with removing culverts. These will allow aquatic habitat quality and connectivity enhancement; and
- Placing a portion of the right bank Henry Fork floodplain under a conservation easement, and planting all stream buffers and wetlands with native species. Creating a 100 foot-wide corridor of wooded riparian buffer along that top right bank area and re-establishing native plant communities, connectivity of habitat within Site and to adjoining natural areas along the river corridor.

## 1.2 Monitoring Year 3 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY3 to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Henry Fork Mitigation Plan (Wildlands, 2015).

### 1.2.1 Stream Assessment

Morphological surveys for the MY3 were conducted in April 2018. All streams within the site appear to be stable.

In general, riffle cross sections show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. Surveyed riffle cross sections fell within the parameters defined for channels of the appropriate Rosgen (Rosgen, 1994 & 1996) stream type. Pebble counts in UT1 Reach 1 and UT1B indicate maintenance of coarser materials in the riffle features and finer particles in the pool features. Refer to Appendix 2 for the visual stability assessment table, Current Conditions Plan View (CCPV) map, and reference photographs. Refer to Appendix 4 for the morphological data and plots.

### **1.2.2 Stream Hydrology Assessment**

At the end of the seven-year monitoring period, two or more bankfull events must have occurred in separate years within the restoration reaches. According to the stream gages, all streams, except UT1B, had at least one bankfull events recorded during MY3. During MY2 and MY3, UT1 recorded at least one bankfull event; therefore, the performance criteria has been partially met for this Site.

In addition to monitoring bankfull events, intermittent streams must be monitored to demonstrate that stream flow regimes are sufficient to establish an Ordinary High Water Mark, specifically a minimum of 30 consecutive days of flow during periods of normal rainfall. Rainfall was low throughout the winter; specifically, November and December 2017, each resulting in less than two inches of rainfall. The summer also resulted in low rainfall; therefore, caused low flow or the absence of water in streams. The stream gages indicated each stream recorded between 150-300 days of consecutive flow. Presence of baseflow was observed in UT1, UT1A, and UT1B during each site visit, however, UT2 was observed dry from June and thereafter. The game cameras located on UT1B and UT2 confirmed the same observations. Refer to Appendix 5 for hydrology summary data and plots.

### **1.2.3 Vegetative Assessment**

A total of 15 vegetation plots were established during the baseline monitoring within the project easement area. All of the plots were installed using a standard 10 meter by 10 meter plot. The final vegetative success criteria will be the survival of 210 planted stems per acre in the planted riparian and wetland corridor at the end of the required monitoring period (MY7). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of the third monitoring year (MY3) and at least 260 stems per acre at the end of the fifth monitoring year (MY5). Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. If this performance standard is met by MY5, with stem density trending towards success (i.e., no less than 260 five year old stems/acre) and there is no invasive species prevalent, monitoring of vegetation on the Site may be terminated provided written approval is provided by the United States Army Corps of Engineers in consultation with the NC Interagency Review Team (IRT).

The MY3 vegetative survey was completed in September 2018. The 2018 vegetation monitoring resulted in an average stem density of 585 stems per acre, which is greater than the interim requirement of 320 stems/acre required at MY3. There is an average of 15 stems per plot with an average stem height of 3.5 feet. All 15 vegetation plots are on track to meet the success criteria required for MY7 (Table 9, Appendix 3). Refer to Appendix 2 for vegetation plot photographs and the vegetation condition assessment table and Appendix 3 for vegetation data tables.

### **1.2.4 Wetland Assessment**

Seven groundwater hydrology gages (GWGs) were established during the baseline monitoring within the wetland rehabilitation and re-establishment zones (GWGs 1 – 4 and 6 – 8). Gages were distributed so that the data collected would provide a reasonable indication of groundwater levels throughout the wetland components on the Site. A gage was established in an adjacent reference wetland and is being utilized to compare with the hydrologic response within the restored wetland areas at the Site. A barotroll logger (to measure barometric pressure used in the calculations of groundwater levels with gage transducer data) was installed on the Site. The rainfall data is collected from an existing USGS weather station (USGS 02143040 Jacob Fork at Ramsey, NC) . All monitoring gages were downloaded on a quarterly basis and maintained on an as needed basis. Two additional gages (GWG 5 and 9) were installed within the Wetland Re-Establishment areas during 2017 (MY2) in order to further assess wetland performance. In addition, GWG 3 was relocated during 2017. During the initial GWG installation, GWG 3 was installed in a seep where hydrology was much stronger than the surrounding

area represented by GWG 3. During the MY1 monitoring period, GWG 3 documented groundwater at or just above the ground surface; therefore, GWG 3 was relocated January 2017 to an area that was more representative of the surrounding wetlands. A soil temperature gage was also installed on Site in October 2016. Wildlands is using the soil temperature probe data to confirm the dates defined in the WETS table for Burke County, NC. The WETS growing season is not available for Catawba County; however, a growing season is defined for historic weather data collected at the Hickory Regional Airport in Burke County, which is approximately 3 miles as the crow flies from the Site.

The growing season from Burke County, which runs from March 20<sup>th</sup> to November 11<sup>th</sup> (236 days), is being used for hydrologic success. The final performance standard establish for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 20 consecutive days (8.5%) of the defined 236-day growing season under typical precipitation conditions.

Of the nine GWGs, six met the success criteria for MY3. Of the gages that met, the measured cumulative hydroperiod ranged from 23% to 94% of the growing season. While the hydrology for GWG 2, 3, and 8 do not meet the consecutive inundation criteria, the trends follow the reference gage. The existing GWG 5 recorded a high water level throughout the entire year, which seems questionable; therefore, a new transducer will be substituted. Four additional groundwater gages will be installed adjacent to the areas not meeting criteria during the winter.

Refer to the CCPV in Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology summary data and plots.

### **1.2.5 Areas of Concern/Adaptive Management Plan**

Quarterly site visits will continue to be conducted to monitor and address any areas of concern. If necessary, future adaptive management will be implemented to improve herbaceous cover, treat and control invasive plants, and address hydrology issues.

During MY2, a portion of UT1 Reach 1 was found to be flowing subsurface and surface repair and plugging of this area was completed in December 2017 in order to address the issue. The repair has remained effective throughout MY3.

Wetland hydrology has been weak in the wetland rehabilitation areas upslope of UT1 Reach 2 (GWGs 2 & 3) and at the head of UT2 (GWG 8). Wildlands is planning to implement remedial actions on the right floodplain of UT1 Reach 2 in order to enhance hydrology in this area in December 2018. Remedial options for UT2 are still being considered; gage data suggests that groundwater levels around GWGs 8 & 9 may still be recharging. Additional gage installations are being evaluated here and along UT1 Reach 2 in ensure adequate representation of the hydrology in these areas.

Invasive species including Kudzu (*Pueraria lobate*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), Creeping primrose (*Ludwigia peploides*), and multiflora rose (*Rosa multiflora*) were present and continue to be treated along the northern edge and southern end of the Site, including at the top of UT2 and UT1B. The kudzu along the Henry Fork River was too small to map. Invasive treatments were completed in June and August 2018. These areas were treated in accordance with the herbicide application rates used in cut/spray techniques during MY3 and will continued to be monitored in future years. These species are not impacting survival rates of planted stems. Infestations shown on Figures 3.0 – 3.5 were treated along with lesser areas.

Several areas located on the lower portion of the site (lower UT1 floodplain) contained little to no herbaceous ground cover during monitoring visits earlier in the year. Poor soil nutrients and dry soil conditions could have been potential factors affecting herbaceous growth. These areas were addressed during the spring of MY3 with an additional seeding and fertilizing application, and subsequent new





growth was observed; however, the area between vegetation plot 9 and 11 are still reflecting sparse herbaceous cover. These areas will continue to be monitored and Wildlands will implement further remedial action if necessary. There is an approved narrow footpath through the easement for the purpose of frisbee golf that Wildlands has allowed on a conditional basis and which continued to be monitored to ensure that it does not violate easement terms or threaten stream assets.

The minor mowing encroachments along the eastern edge of UT1 Reach 1 have been resolved. Wildlands replanted these areas with 3 7-gallon Sycamore (*Platanus occidentalis*) trees and 10 1-gallon Cottonwood (*Populus deltoides*) trees. While there has been a general cessation in the encroachment issues as MY3 has progressed, the site and prior problem areas will continue to be monitored for easement enforcement.

### **1.3 Monitoring Year 3 Summary**

The streams within the Site are stable and functioning as designed. The average stem density for the Site is on track to meet the MY7 success criteria and all individual vegetation plots meet the MY3 success criteria as depicted in the CCPV. Invasive species are being treated as prescribed in the mitigation plan. Of the nine GWGs, six met the success criteria for MY3. It is anticipated that gages will meet hydrologic success criteria in the upcoming monitoring years as precipitation normalizes. Multiple bankfull events were documented on UT1. UT2 and UT1A recorded one bankfull event; however, UT1B did not record any bankfull events during MY3. Therefore, the hydrology success criteria has been partially met for this Site.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.



## Section 2: METHODOLOGY

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Geomorphic data were collected following the standards outlined in *The Stream Channel Reference Site: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994) and in the *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using either a Trimble or Topcon handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages were installed in surveyed riffle cross sections and monitored quarterly. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008).



## Section 3: REFERENCES

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- Harrelson, C.C., Rawlins, C.L., Potyondy, J.P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique*. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.
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- United States Geological Survey. 1998. North Carolina Geology. <http://www.geology.enr.state.nc.us/usgs/carolina.htm>
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## **APPENDIX 1. General Figures and Tables**

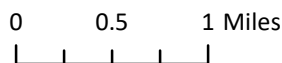
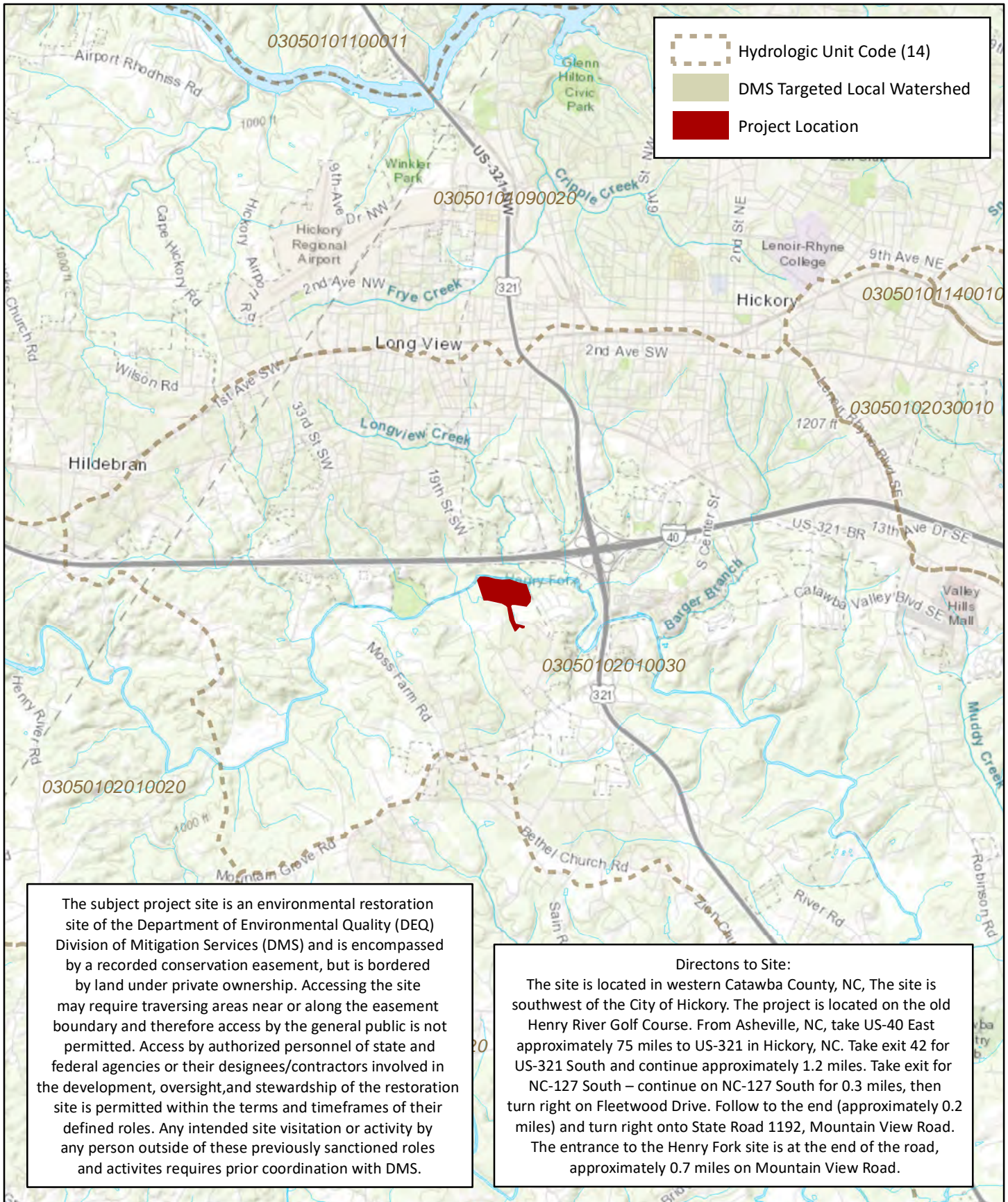
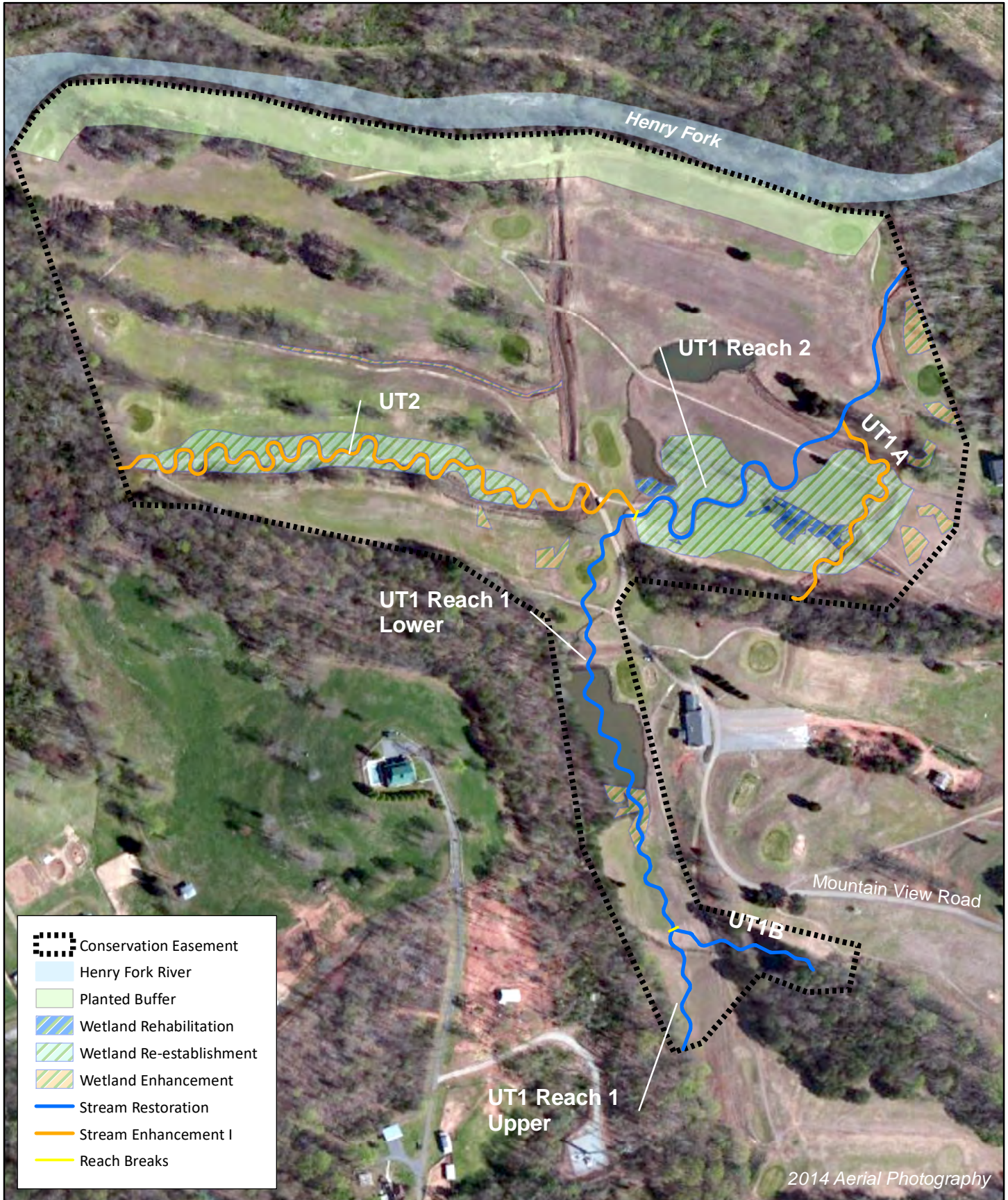


Figure 1 Vicinity Map  
 Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018  
 Catawba County, NC





0 150 300 Feet



Figure 2 Project Component/Asset Map  
 Henry fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**Table 1. Project Components and Mitigation Credits**

Henry Fork Mitigation Site  
 DMS Project No.96306  
 Monitoring Year 3 - 2018

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	4,807.667	N/A	3.880	0.341	N/A	N/A	N/A	N/A	N/A
PROJECT COMPONENTS									
Reach ID	Proposed Stationing/ Location*	Existing Footage/ Acreage	Approach	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage/Acreage*	Mitigation Ratio	Credits (SMU/WMU)*		
<b>STREAMS</b>									
UT1 Reach 1 Upper	100+00 to 103+02	1,392	P1	Restoration	302	1:1	302.000		
UT1 Reach 1 Lower	103+02 to 114+71		P1	Restoration	1,169	1:1	1,169.000		
UT1 Reach 2	114+71 to 126+99	1,499	P1/P2	Restoration	1,228	1:1	1,228.000		
UT1A	180+00 to 186+57	353	P1	Enhancement	657	1.5:1	438.000		
UT1B	150+00 to 153+58	478	P1	Restoration	358	1:1	358.000		
UT2	200+00 to 219+69	1,915	P1	Enhancement	1,969	1.5:1	1,312.667		
<b>WETLANDS</b>									
Wetland 1	Floodplain near UT1 Reach 2	N/A	Planting, hydrologic improvement	Re-establishment	2.48	1:1	2.480		
Wetland 2	Floodplain near UT2	N/A	Planting, hydrologic improvement	Re-establishment	1.23	1:1	1.230		
Wetland A	Floodplain between UT1 Reach 2 and UT1A	0.18	Planting, hydrologic improvement	Rehabilitation	0.18	1.5:1	0.120		
Wetland B	Floodplain between UT1 Reach 2 and UT1A	0.01	Planting, hydrologic improvement	Rehabilitation	0.013	1.5:1	0.009		
Wetland C	Floodplain between UT1 Reach 2 and UT1A	0.003	Planting, hydrologic improvement	Rehabilitation	0.003	1.5:1	0.002		
Wetland G	Floodplain near UT1A	0.02	Planting	Enhancement	0.02	2:1	0.009		
Wetland H	East hillslope near UT1A	0.06	Planting	Enhancement	0.06	2:1	0.028		
Wetland I	East hillslope near UT1A	0.08	Planting	Enhancement	0.08	2:1	0.039		
Wetland J	East hillslope near UT1 Reach 2	0.04	Planting	Enhancement	0.04	2:1	0.018		
Wetland K	East hillslope near UT1 Reach 2	0.06	Planting	Enhancement	0.06	2:1	0.028		
Wetland M	East hillslope near UT1 Reach 2	0.13	Planting	Enhancement	0.13	2:1	0.065		
Wetland N	Floodplain towards river from UT2	0.08	Planting	Enhancement	0.08	2:1	0.042		
Wetland P	Floodplain upslope of UT2	0.02	Planting	Enhancement	0.02	2:1	0.012		
Wetland Q	Floodplain upslope of UT2	0.07	Planting	Enhancement	0.07	2:1	0.035		
Wetland R	Floodplain in footprint of Pond 3 near head of UT1 Reach 2	0.06	Significant improvement to wetland functions	Rehabilitation	0.06	1.5:1	0.039		
Wetland S	UT1 Reach 1 Valley (Pond 1)	0.16	Planting	Enhancement	0.13	2:1	0.066		

COMPONENT SUMMATION						
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)	
Restoration	3,057	N/A	N/A	N/A	N/A	
Enhancement I	2,626	N/A	N/A	N/A	N/A	
Wetland Re-Establishment	N/A	3.71	N/A	N/A	N/A	
Wetland Rehabilitation	N/A	0.25	N/A	N/A	N/A	
Wetland Enhancement	N/A	0.68	N/A	N/A	N/A	
Preservation	N/A	N/A	N/A	N/A	N/A	

\* Stream credit calculations were originally calculated along the as-built thalweg and updated to be calculated along stream centerlines for Monitoring Year 2 after discussions with NC IRT.

**Table 2. Project Activity and Reporting History**

Henry Fork Mitigation Site  
DMS Project No.96306  
**Monitoring Year 3 - 2018**

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	August 2015	September 2015
Final Design - Construction Plans	October 2015	October 2015
Construction	November 2015 - March 2016	March 2016
Temporary S&E mix applied to entire project area <sup>1</sup>	March 2016	March 2016
Permanent seed mix applied to reach/segments <sup>1</sup>	March 2016	March 2016
Bare root and live stake plantings for reach/segments	March 2016	March 2016
Baseline Monitoring Document (Year 0)	Stream Survey	March 2016
	Vegetation Survey	March 2016
Year 1 Monitoring	Stream Survey	October 2016
	Vegetation Survey	September 2016
Year 1 Beaver dam removal on UT1 Reach 2	May-September 2016	December 2016
Year 1 Invasive Species treatment	June & July 2016	
Year 2 Monitoring	Stream Survey	April 2017
	Vegetation Survey	July 2017
Year 2 Invasive Species Treatment	August 2017	December 2017
Year 3 Monitoring	Stream Survey	April 2018
	Vegetation Survey	September 2018
Year 3 Invasive Species Treatment	June & August 2018	November 2018
Year 4 Monitoring	Stream Survey	2019
	Vegetation Survey	2019
Year 5 Monitoring	Stream Survey	2020
	Vegetation Survey	2020
Year 6 Monitoring	Stream Survey	2021
	Vegetation Survey	2021
Year 7 Monitoring	Stream Survey	2022
	Vegetation Survey	2022

<sup>1</sup>Seed and mulch is added as each section of construction is completed.

**Table 3. Project Contact Table**

Henry Fork Stream Mitigation Site  
DMS Project No.96306  
**Monitoring Year 3 - 2018**

<b>Designer</b> Jake McLean, PE	<b>Wildlands Engineering, Inc.</b> 167-B Haywood Rd. Asheville, NC 28806 828.774.5547
<b>Construction Contractor</b>	<b>Land Mechanics Designs, Inc.</b> 780 Landmark road Willow Spring, NC 27592
<b>Planting Contractor</b>	<b>Bruton Natural Systems, Inc</b> P.O. Box 1197 Fremont, NC 27830
<b>Seeding Contractor</b>	<b>Land Mechanics Designs, Inc.</b> 780 Landmark road Willow Spring, NC 27592
<b>Seed Mix Sources</b>	<b>Green Resource, LLC</b>
<b>Nursery Stock Suppliers</b> Bare Roots Live Stakes Plugs	<b>Dykes and Son Nursery</b> <b>Bruton Natural Systems, Inc</b> <b>Wetland Plants, Inc.</b>
<b>Monitoring Performers</b>	<b>Wildlands Engineering, Inc.</b>
Monitoring, POC	Kirsten Gimbert 704.332.7754, ext. 110



**Table 4. Project Information and Attributes**

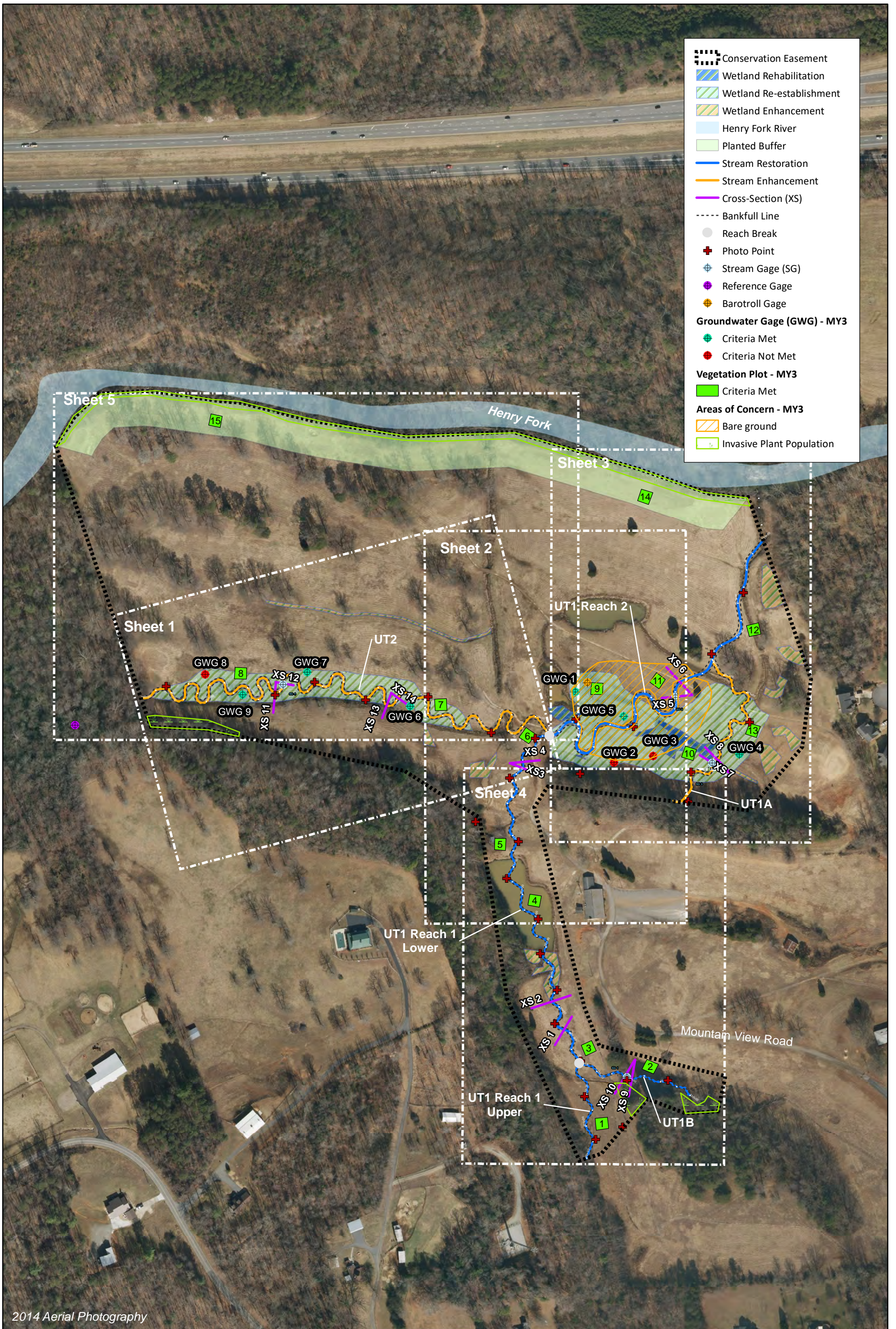
Henry Fork Mitigation Site  
 DMS Project No.96306  
 Monitoring Year 3 - 2018

PROJECT INFORMATION					
Project Name	Henry Fork Mitigation Site				
County	Catawba County				
Project Area (acres)	48.06				
Project Coordinates (latitude and longitude)	35°42'12.98"N, 81°21'53.20"W				
PROJECT WATERSHED SUMMARY INFORMATION					
Physiographic Province	Inner Piedmont				
River Basin	Catawba				
USGS Hydrologic Unit 8-digit	03050102 (Expanded Service Area for 03050103)				
USGS Hydrologic Unit 14-digit	03050102010030				
DWR Sub-basin	03-08-35				
Project Drainage Area (acres)	178				
Project Drainage Area Percentage of Impervious Area	5%				
CGIA Land Use Classification	39% - Herbaceous/Pasture, 36% - Forested, 25% - Developed, >1% - Water				
REACH SUMMARY INFORMATION					
Parameters	UT1 Reach 1	UT1 Reach 2	UT1A	UT1B	UT2
Length of Reach (linear feet) - Post-Restoration	1,497	1,232	658	358	1,969
Drainage Area (acres)	106	129	23	31	49
NCDWR Stream Identification Score	39.5	32.5	27.25	31.25	27
NCDWR Water Quality Classification	C				
Morphological Description (stream type)	P	P	I	P	I
Evolutionary Trend (Simon's Model) - Pre-Restoration	III	IV/V	IV/V	III	IV/V
Underlying Mapped Soils	Codorus loam, Dan River loam, Hatboro Loam, Poplar Forest gravelly sandy loam 2-6% slopes, and Woolwine-Fairview complex				
Drainage Class	---	---	---	---	---
Soil Hydric Status	---	---	---	---	---
Slope	0.024-0.056	0.0043-0.017	0.0095-0.016	0.015-0.077	0.0032
FEMA Classification	N/A*				
Native Vegetation Community	Piedmont Alluvial Forest				
Percent Composition Exotic Invasive Vegetation -Post-Restoration	0%				
REGULATORY CONSIDERATIONS					
Regulation	Applicable?	Resolved?	Supporting Documentation		
Waters of the United States - Section 404	Yes	PCN prepared	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885.		
Waters of the United States - Section 401	Yes	PCN prepared			
Division of Land Quality (Dam Safety)	N/A	N/A	N/A		
Endangered Species Act	Yes	Yes	Henry Fork Mitigation Plan; Wildlands determined "no effect" on Catawba County listed endangered species. June 5, 2015 email correspondence from USFWS stated "not likely to adversely affect" northern long-eared bat.		
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 3/24/2014)		
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A		
FEMA Floodplain Compliance	Yes*	No impact application was prepared for local review. No post-project activities required.	Floodplain development permit issued by Catawba County.		
Essential Fisheries Habitat	No	N/A	N/A		

\*The project site reaches do not have regulated floodplain mapping, but are located within the Henry Fork floodplain.

## **APPENDIX 2. Visual Assessment Data**





- Conservation Easement
- Wetland Rehabilitation
- Wetland Re-establishment
- Wetland Enhancement
- Henry Fork River
- Planted Buffer
- Stream Restoration
- Stream Enhancement
- Cross-Section (XS)
- Bankfull Line
- Reach Break
- Photo Point
- Stream Gage (SG)
- Reference Gage
- Barotroll Gage
- Groundwater Gage (GWG) - MY3**
- Criteria Met
- Criteria Not Met
- Vegetation Plot - MY3**
- Criteria Met
- Bare ground
- Invasive Plant Population

2014 Aerial Photography

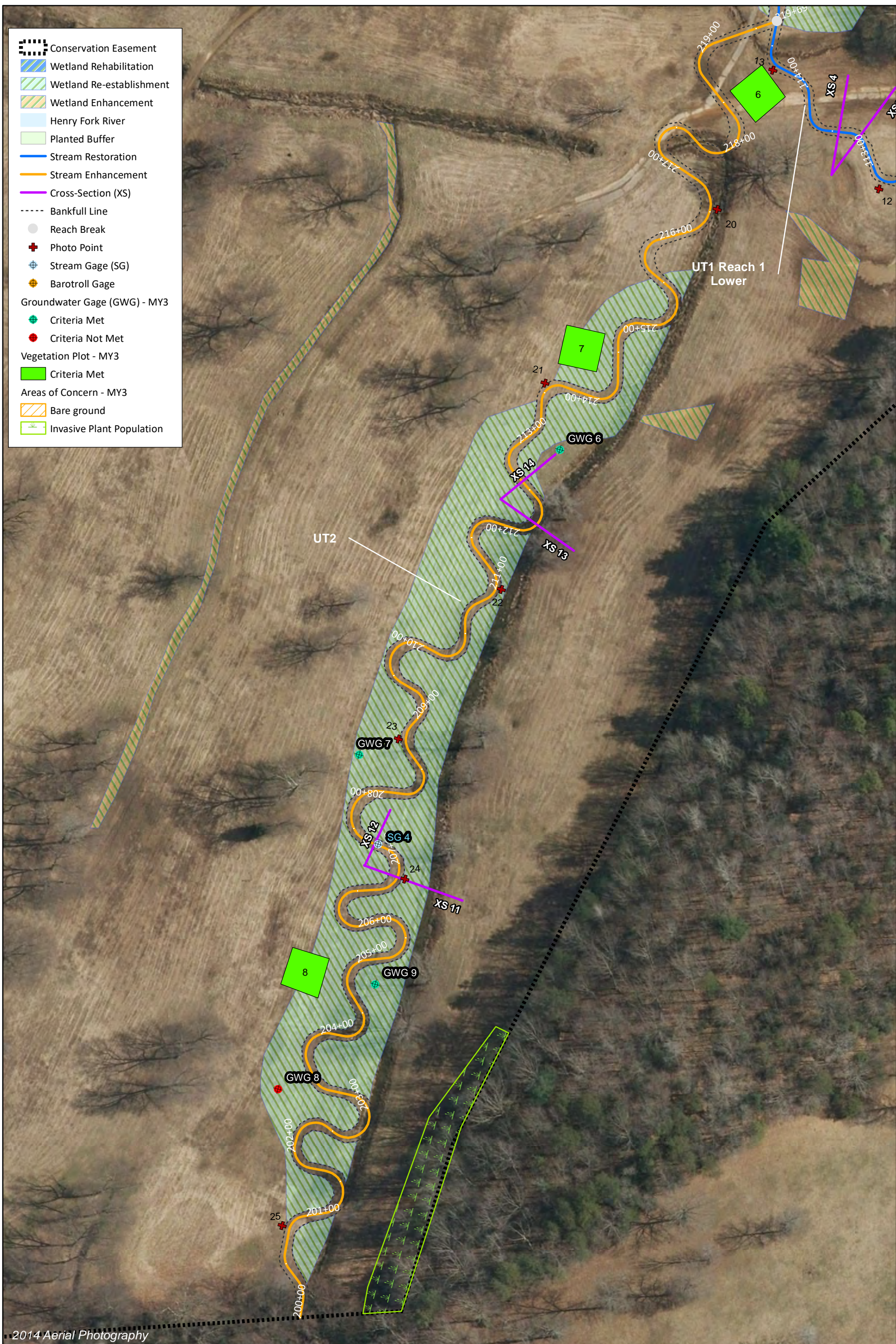


0 250 500 Feet



Figure 3.0 Integrated Current Condition Plan View (KEY)  
Henry Fork Mitigation Site  
DMS Project No. 96306  
Monitoring Year 3 - 2018





2014 Aerial Photography

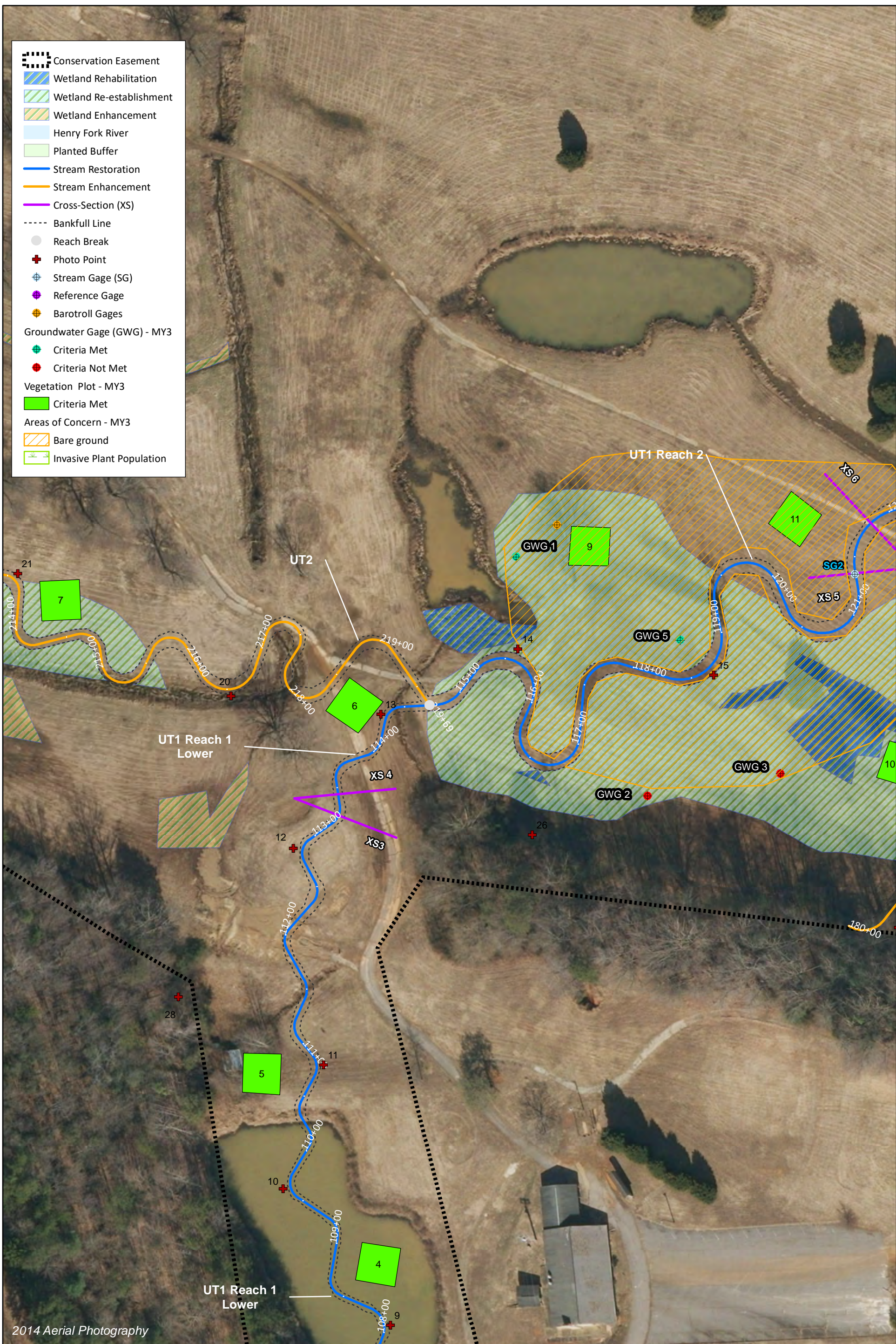


0 75 150 Feet

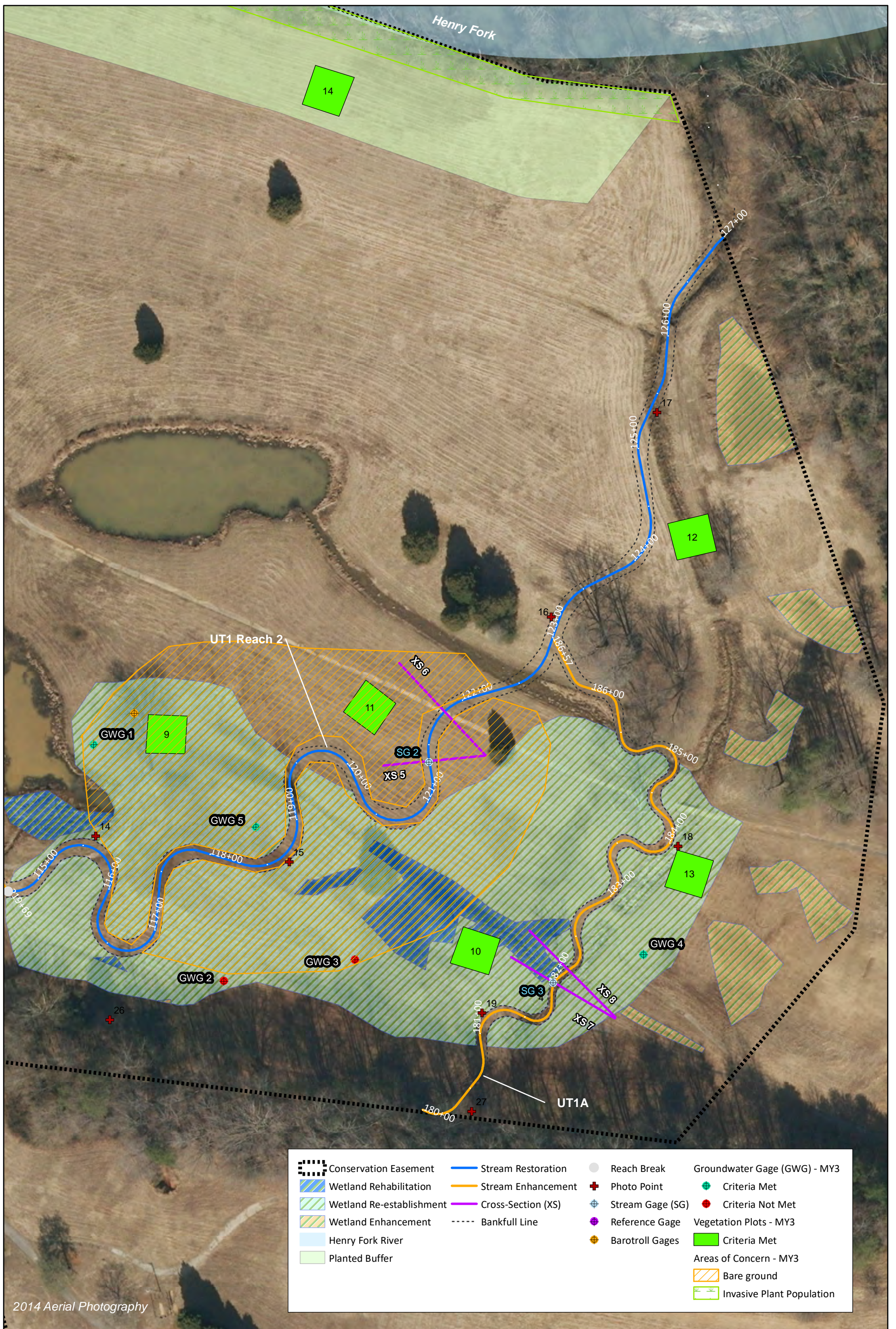


Figure 3.1 Integrated Current Condition Plan View (Sheet 1)  
 Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018









2014 Aerial Photography

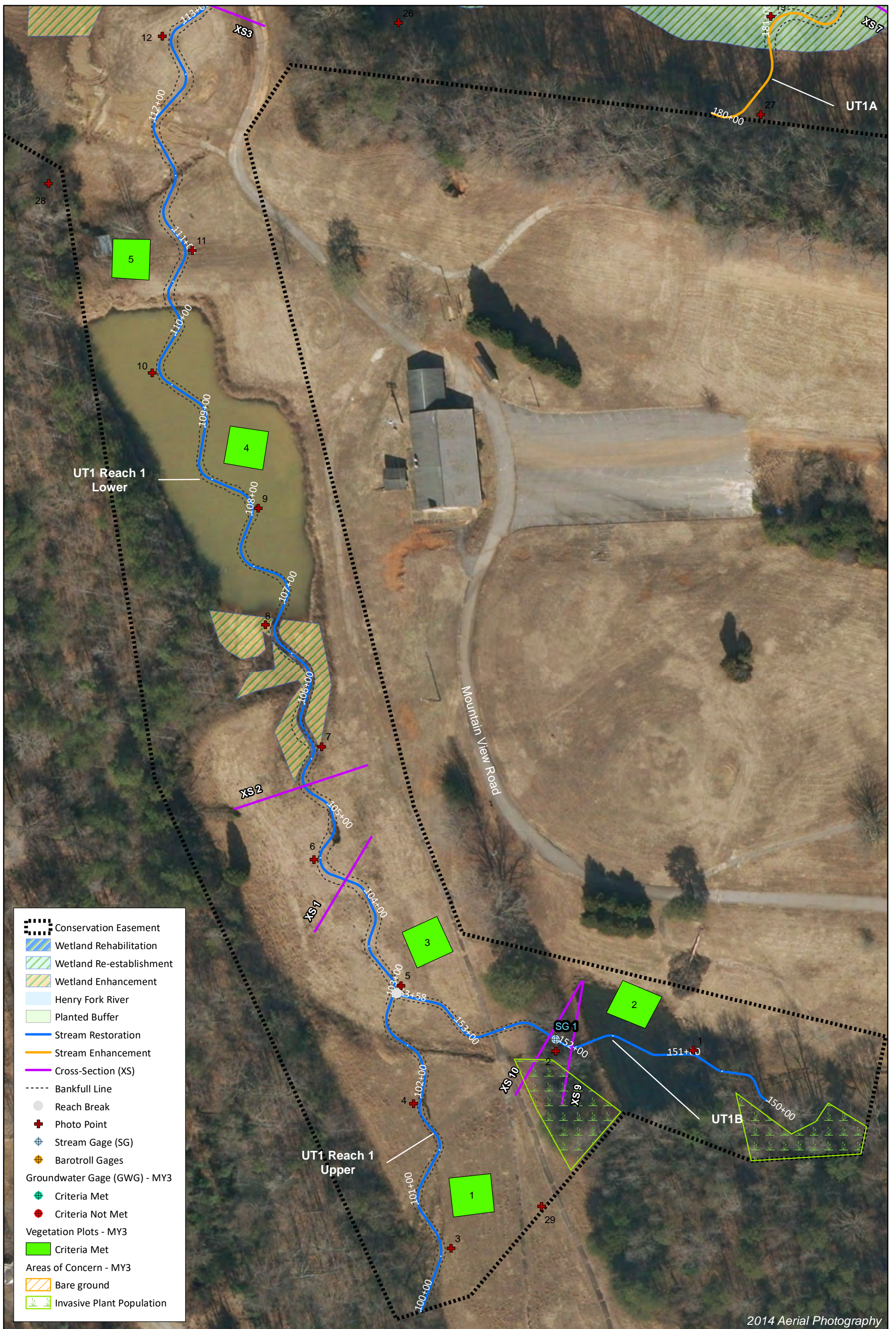


0 75 150 Feet



Figure 3.3 Integrated Current Condition Plan View (Sheet 3)  
Henry Fork Mitigation Site  
DMS Project No. 96306  
Monitoring Year 3 - 2018





- Conservation Easement
- Wetland Rehabilitation
- Wetland Re-establishment
- Wetland Enhancement
- Henry Fork River
- Planted Buffer
- Stream Restoration
- Stream Enhancement
- Cross-Section (XS)
- Bankfull Line
- Reach Break
- Photo Point
- Stream Gage (SG)
- Bartroll Gages
- Groundwater Gage (GWG) - MY3
- Criteria Met
- Criteria Not Met
- Vegetation Plots - MY3
- Criteria Met
- Areas of Concern - MY3
- Bare ground
- Invasive Plant Population

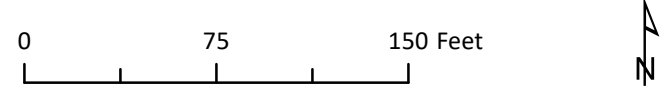


Figure 3.4 Integrated Current Condition Plan View (Sheet 4)  
 Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018







**Table 5a. Visual Stream Morphology Stability Assessment Table**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**UT1 Reach 1 (1,497 LF)**

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	39	39		100%				
	3. Meander Pool Condition	Depth Sufficient	33	33		100%				
		Length Appropriate	33	33		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	33	33		100%				
		Thalweg centering at downstream of meander bend (Glide)	33	33	100%					
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
<b>Totals</b>					0	0	100%	n/a	n/a	n/a
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	81	81			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	70	70			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	81	81			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	81	81			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	46	46			100%			

<sup>1</sup>Excludes constructed shallows since they are evaluated in section 1.

**Table 5b. Visual Stream Morphology Stability Assessment Table**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**UT1 Reach 2 (1,232 LF)**

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	14	14		100%				
	3. Meander Pool Condition	Depth Sufficient	15	15		100%				
		Length Appropriate	15	15		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	15	15		100%				
Thalweg centering at downstream of meander bend (Glide)		15	15	100%						
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
<b>Totals</b>					0	0	100%	n/a	n/a	n/a
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	12	12			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	9	9			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	12	12			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	6	6			100%			

<sup>1</sup>Excludes constructed shallows since they are evaluated in section 1.

**Table 5c. Visual Stream Morphology Stability Assessment Table**

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 3 - 2018

UT1A (658 LF)

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	14	14		100%				
	3. Meander Pool Condition	Depth Sufficient	13	13		100%				
		Length Appropriate	13	13		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	13	13		100%				
Thalweg centering at downstream of meander bend (Glide)		13	13	100%						
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
<b>Totals</b>					0	0	100%	n/a	n/a	n/a
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	6			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	6	6			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	6	6			100%			

<sup>1</sup>Excludes constructed shallows since they are evaluated in section 1.

**Table 5d. Visual Stream Morphology Stability Assessment Table**

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 3 - 2018

UT1B (358 LF)

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	11	11		100%				
	3. Meander Pool Condition	Depth Sufficient	8	8		100%				
		Length Appropriate	8	8		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	8	8		100%				
		Thalweg centering at downstream of meander bend (Glide)	8	8	100%					
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
<b>Totals</b>					0	0	100%	n/a	n/a	n/a
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	27	27			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	24	24			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	27	27			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	27	27			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	12	12			100%			

<sup>1</sup>Excludes constructed shallows since they are evaluated in section 1.



**Table 5e. Visual Stream Morphology Stability Assessment Table**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**UT2 (1,969 LF)**

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	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	35	35		100%				
	3. Meander Pool Condition	Depth Sufficient	32	32		100%				
		Length Appropriate	32	32		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	32	32		100%				
Thalweg centering at downstream of meander bend (Glide)		32	32	100%						
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	n/a	n/a	n/a
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
<b>Totals</b>					0	0	100%	n/a	n/a	n/a
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	3	3			100%			

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

**Table 6. Vegetation Condition Assessment Table**

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 3 - 2018

**Planted Acreage 15**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
<b>Bare Areas</b>	Very limited cover of both woody and herbaceous material	0.1	2	1.9	12.9%
<b>Low Stem Density Areas</b>	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0.0	0.0%
<b>Total</b>			<b>2</b>	<b>1.9</b>	<b>12.9%</b>
<b>Areas of Poor Growth Rates or Vigor</b>	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0.0	0.0%
<b>Cumulative Total</b>			<b>2</b>	<b>1.9</b>	<b>12.9%</b>

**Easement Acreage 48**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
<b>Invasive Areas of Concern</b>	Areas of points (if too small to render as polygons at map scale).	1,000	4	1.2	2.5%
<b>Easement Encroachment Areas</b>	Areas of points (if too small to render as polygons at map scale).	none	0	0	0.0%

## **Stream Photographs**





**Photo Point 1** – view upstream UT1B (9/4/2018)



**Photo Point 1** – view downstream UT1B (9/4/2018)



**Photo Point 2** – view upstream UT1B (9/4/2018)



**Photo Point 2** – view downstream UT1B (9/4/2018)



**Photo Point 3** – view upstream UT1 R1 Upper (9/4/2018)



**Photo Point 3** – view downstream UT1 R1 Upper (9/4/2018)





**Photo Point 4** – view upstream UT1 R1 Upper (9/4/2018)



**Photo Point 4** – view downstream UT1 R1 Upper (9/4/2018)



**Photo Point 5** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 5** – view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 5** – view upstream of UT1B (9/4/2018)





**Photo Point 6** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 6** – view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 7** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 7** – view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 8** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 8** – view downstream UT1 R1 Lower (9/4/2018)





**Photo Point 9** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 9** – view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 10** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 10** –view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 11** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 11** –view downstream UT1 R1 Lower (9/4/2018)





**Photo Point 12** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 12** –view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 13** – view upstream UT1 R1 Lower (9/4/2018)



**Photo Point 13** –view downstream UT1 R1 Lower (9/4/2018)



**Photo Point 14** – view upstream UT1 R2 (9/4/2018)



**Photo Point 14** – view downstream UT1 R2 (9/4/2018)





**Photo Point 15** – view upstream UT1 R2 (9/4/2018)



**Photo Point 15** – view downstream UT1 R2 (9/4/2018)



**Photo Point 16** – view upstream UT1 R2 (9/4/2018)



**Photo Point 16** – view downstream UT1 R2 (9/4/2018)



**Photo Point 17** – view upstream UT1 R2 (9/6/2018)



**Photo Point 17** – view downstream UT1 R2 (9/6/2018)





**Photo Point 18** – view upstream UT1A (9/4/2018)



**Photo Point 18** – view downstream UT1A (9/4/2018)



**Photo Point 19** – view upstream UT1A (9/4/2018)



**Photo Point 19** – view downstream UT1A (9/4/2018)



**Photo Point 20** – view upstream UT2 (9/4/2018)



**Photo Point 20** – view downstream UT2 (9/4/2018)





**Photo Point 21** – view upstream UT2 (9/4/2018)



**Photo Point 21** – view downstream UT2 (9/4/2018)



**Photo Point 22** – view upstream UT2 (9/4/2018)



**Photo Point 22** – view downstream UT2 (9/4/2018)



**Photo Point 23** – view upstream UT2 (9/4/2018)



**Photo Point 23** – view downstream UT2 (9/4/2018)





**Photo Point 24** – view upstream UT2 (9/4/2018)



**Photo Point 24** – view downstream UT2 (9/4/2018)



**Photo Point 25** – view upstream UT2 (9/4/2018)



**Photo Point 25** – view downstream UT2 (9/4/2018)



**Photo Point 26** – view upstream UT1 R2 (9/4/2018)



**Photo Point 26** – view downstream UT1 R2 (9/4/2018)





**Photo Point 26** – UT1 R2 floodplain overview (9/4/2018)



**Photo Point 27** – view upstream UT1 R2 floodplain (9/4/2018)



**Photo Point 27** – view downstream UT1 R2 floodplain (9/4/2018)



**Photo Point 28** – UT1 R1 Lower floodplain overview (9/4/2018)



**Photo Point 28** – UT2 floodplain overview (9/4/2018)





**Photo Point 29** – UT1 R1 Upper floodplain overview (9/4/2018)

## **Vegetation Photographs**





**Vegetation Plot 1 - (9/5/2018)**



**Vegetation Plot 2 - (9/5/2018)**



**Vegetation Plot 3 - (9/5/2018)**



**Vegetation Plot 4 - (9/5/2018)**



**Vegetation Plot 5 - (9/5/2018)**



**Vegetation Plot 6 - (9/5/2018)**





**Vegetation Plot 7 - (9/5/2018)**



**Vegetation Plot 8 - (9/5/2018)**



**Vegetation Plot 9 - (9/6/2018)**



**Vegetation Plot 10 - (9/6/2018)**



**Vegetation Plot 11 - (9/6/2018)**



**Vegetation Plot 12 - (9/6/2018)**





**Vegetation Plot 13 - (9/6/2018)**



**Vegetation Plot 14 - (9/5/2018)**



**Vegetation Plot 15 - (9/5/2018)**



### **APPENDIX 3. Vegetation Plot Data**



**Table 7. Vegetation Plot Criteria Attainment**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
**Monitoring Year 3 - 2018**

Plot	MY5 Success	Tract Mean
1	Y	100%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	
14	Y	
15	Y	

**Table 8. CVS Vegetation Plot Metadata**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
**Monitoring Year 3 - 2018**

<b>Report Prepared By</b>	Ruby Davis
<b>Date Prepared</b>	11/1/2018
<b>Database Name</b>	cvs-eep-entrytool-v2.5.0 HENRY FORK MY3.mdb
<b>Database Location</b>	Q:\ActiveProjects\005-02143 Henry Fork\Monitoring\Monitoring Year 3-2018\Vegetation Assessment
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Project Planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Project Total Stems</b>	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and Spp</b>	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	96306
<b>project Name</b>	Henry Fork Mitigation Site
<b>Description</b>	Stream and Wetland Mitigation
<b>Required Plots (calculated)</b>	15
<b>Sampled Plots</b>	15



**Table 9a. Planted and Total Stem Counts**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2018)																	
			96306-WEI-0001			96306-WEI-0002			96306-WEI-0003			96306-WEI-0004			96306-WEI-0005			96306-WEI-0006		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Box Elder	Tree																		
Acer rubrum	Red Maple	Tree														5	3	3	3	
Alnus serrulata	Tag Alder	Shrub Tree																		
Betula nigra	River Birch	Tree	1	1	1				4	4	4	4	4	4	4	4	4	1	1	1
Celtis laevigata	Sugarberry	Shrub Tree																		
Diospyros virginiana	American Persimmon	Tree	6	6	6	4	4	4	1	1	1	2	2	2	3	3	3			
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1	7	7	7	3	3	3	6	6	6	1	1	1	3	3	3
Juglans nigra	Black Walnut	Tree																		
Liquidambar styraciflua	Sweet Gum	Tree																		
Liriodendron tulipifera	Tulip Poplar	Tree																		
Nyssa sylvatica	Black Gum	Tree																		
Platanus occidentalis	Sycamore	Tree	1	1	1	1	1	1	2	2	2	4	4	4	3	3	21	3	3	13
Populus deltoides	Cottonwood	Tree																		
Quercus lyrata	Overcup Oak	Tree									1									
Quercus michauxii	Swamp Chestnut Oak	Tree																4	4	4
Quercus phellos	Willow Oak	Tree	5	5	5	4	4	4	5	5	5				1	1	1			
Rhus aromatica	Sumac	Shrub			2			5			1									
Salix nigra	Black Willow	Tree																		
Salix sericea	Silky Willow	Shrub Tree																		
<b>Stem count</b>			14	14	16	16	16	21	15	15	17	16	16	16	12	12	35	14	14	24
<b>size (ares)</b>			1			1			1			1			1			1		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			5	5	6	4	4	5	5	5	7	4	4	4	5	5	6	5	5	5
<b>Stems per ACRE</b>			567	567	647	647	647	850	607	607	688	647	647	647	486	486	1416	567	567	971

**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%
- Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes  
 P-all: Number of planted stems including live stakes  
 T: Total stems



**Table 9b. Planted and Total Stem Counts**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2018)																	
			96306-WEI-0007			96306-WEI-0008			96306-WEI-0009			96306-WEI-0010			96306-WEI-0011			96306-WEI-0012		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Box Elder	Tree																	1	
Acer rubrum	Red Maple	Tree							4	4	4				4	4	4			
Alnus serrulata	Tag Alder	Shrub Tree									4						1		2	
Betula nigra	River Birch	Tree	2	2	2	2	2	3	3	3	5	4	4	5	3	3	3	1	1	8
Celtis laevigata	Sugarberry	Shrub Tree																		
Diospyros virginiana	American Persimmon	Tree				1	1	1				1	1	1	1	1	1	3	3	3
Fraxinus pennsylvanica	Green Ash	Tree	6	6	6	6	6	6				3	3	3	3	3	3	5	5	5
Juglans nigra	Black Walnut	Tree																		
Liquidambar styraciflua	Sweet Gum	Tree						1												
Liriodendron tulipifera	Tulip Poplar	Tree																		
Nyssa sylvatica	Black Gum	Tree																		
Platanus occidentalis	Sycamore	Tree	2	2	5	2	2	82	3	3	103	2	2	13	2	2	2	5	5	5
Populus deltoides	Cottonwood	Tree									10									
Quercus lyrata	Overcup Oak	Tree																		
Quercus michauxii	Swamp Chestnut Oak	Tree	3	3	3	1	1	1	3	3	3	4	4	4	3	3	3			
Quercus phellos	Willow Oak	Tree	1	1	1	2	2	2	2	2	2	2	2	2				1	1	1
Rhus aromatica	Sumac	Shrub																		
Salix nigra	Black Willow	Tree																		
Salix sericea	Silky Willow	Shrub Tree																		
<b>Stem count</b>			14	14	17	14	14	96	15	15	131	16	16	28	16	16	17	15	15	25
<b>size (ares)</b>			1			1			1			1			1			1		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			5	5	5	6	6	7	5	5	7	6	6	6	6	6	7	5	5	7
<b>Stems per ACRE</b>			567	567	688	567	567	3885	607	607	5301	647	647	1133	647	647	688	607	607	1012

**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%
- Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes  
 P-all: Number of planted stems including live stakes  
 T: Total stems



**Table 9c. Planted and Total Stem Counts**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2018)									Annual Means													
			96306-WEI-0013			96306-WEI-0014			96306-WEI-0015			MY3 (9/2018)			MY2 (7/2017)			MY1 (9/2016)			MY0 (3/2016)				
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T		
Acer negundo	Box Elder	Tree								15				16			19			20			12		
Acer rubrum	Red Maple	Tree				1	1	1						12	12	17	12	12	100	12	12	22	13	13	13
Alnus serrulata	Tag Alder	Shrub Tree													7			8			1				
Betula nigra	River Birch	Tree	1	1	1	2	2	2	2	2	2	34	34	45	34	34	52	35	35	35	37	37	37		
Celtis laevigata	Sugarberry	Shrub Tree																		1					
Diospyros virginiana	American Persimmon	Tree	5	5	5	1	1	1	4	4	4	32	32	32	32	32	32	32	32	32	32	32	32		
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1	3	3	3	1	1	1	49	49	49	51	51	51	52	52	52	57	57	57		
Juglans nigra	Black Walnut	Tree									3			3			1								
Liquidambar styraciflua	Sweet Gum	Tree									30			31			10			17			5		
Liriodendron tulipifera	Tulip Poplar	Tree									30			30			2			7			2		
Nyssa sylvatica	Black Gum	Tree																					2		
Platanus occidentalis	Sycamore	Tree	1	1	2	5	5	10	7	7	7	43	43	271	44	44	460	44	44	108	57	57	57		
Populus deltoides	Cottonwood	Tree												10			19			7					
Quercus lyrata	Overcup Oak	Tree												1											
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1	1	1	1				20	20	20	20	20	21	20	20	20	20	20	20		
Quercus phellos	Willow Oak	Tree	4	4	4							27	27	27	27	27	27	27	27	27	27	27	27		
Rhus aromatica	Sumac	Shrub												8											
Salix nigra	Black Willow	Tree																		1					
Salix sericea	Silky Willow	Shrub Tree															1								
<b>Stem count</b>			13	13	14	13	13	18	14	14	92	217	217	567	220	220	803	222	222	350	243	243	264		
<b>size (ares)</b>			1			1			1			15			15			15			15				
<b>size (ACRES)</b>			0.02			0.02			0.02			0.37			0.37			0.37			0.37				
<b>Species count</b>			6	6	6	6	6	6	4	4	8	7	7	15	7	7	14	7	7	14	7	7	11		
<b>Stems per ACRE</b>			526	526	567	526	526	728	567	567	3723	585	585	1530	594	594	2166	599	599	944	656	656	712		

**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%
- Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes  
 P-all: Number of planted stems including live stakes  
 T: Total stems



## **APPENDIX 4. Morphological Summary Data and Plots**



Table 10a. Baseline Stream Data Summary

Henry Fork Mitigation Site  
DMS Project No.96306  
Monitoring Year 3 - 2018

Henry Fork-UT1 Reach 2, UT1A and UT2

Parameter	PRE-RESTORATION CONDITION						REFERENCE REACH DATA						DESIGN						AS-BUILT/BASELINE								
	UT1 Reach 2		UT1A		UT2		UT to Catawba River Reach 1		UT to Catawba River Reach 2		UT to Lyle Creek		Vile Preserve		UT1 Reach 2		UT1A		UT2		UT1 Reach 2		UT1A		UT2		
	Min	Max	Min	Max	Min	Max	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Upper	Lower	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Reference Cross Section Number	XS9		XS8		XS5,XS6		XS2	XS3	XS4		XS1	XS3	XS1	XS3													
Dimension and Substrate - Riffle																											
Bankfull Width (ft)	9.4		12.5		15.2	16.3	12.4	9.7	12.3		8.6	7.0	6.2	5.7	10.1		6.2		7.5		10.5		6.6		5.65		
Floodprone Width (ft)	17.9		23.1		18	19.8	79	52	53		48.9	45.2	200+	200+	23	46	150	200	60	110	96.7+		31.4		81.3	149.8+	
Bankfull Mean Depth	0.7		0.2		0.5	0.5	1.4	1.2	1.1		0.5	0.5	0.8	0.8	0.82		0.51		0.58		0.9		0.40		0.85		
Bankfull Max Depth	1.4		0.7		0.6	0.6	1.7	1.7	1.7		1.1	1.0	1.3	1.4	1.30		0.85		0.95		1.5		0.80		1.2		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	6.1		2.8		7.5	7.8	17.6	11.4	13.2		4.1	3.5	5.3	4.5	8.3		3.2		4.4		9.7		2.5		4.6		
Width/Depth Ratio	14.4		56.0		30.7	34.4	8.7	8.2	11.5		18.3	13.9	7.4	7.2	12.3		12.1		12.9		11.4		17.0		7.2		
Entrenchment Ratio	1.9		1.8		1.2	1.2	5.8+		5.8+		2.5+		30+		2.3	4.6	24.2	32.37	8.0	14.7	9.2+		4.8		15.9	20.3	
Bank Height Ratio	2.7		1.9		2.9	7.5			1.0						1.0						1.0		1.0		1.1		
D50 (mm)	5.3/N/A		0.28/0.34		SC/0.04		1.8		75.9		0.2		0.4		N/A		0.34		0.04		Silt/Clay						
Riffle Length (ft)							---	---	---	---	---	---	---	---	---	---	---	---	---	---	23.3	51.9	10.8	32.9	3.45	52.3	
Riffle Slope (ft/ft)	0.4	1.7	6.7		N/A <sup>2</sup>		0.0114	0.0605	0.0142	0.3451	0.0055	0.0597	0.0063		0.002	0.0080	0.005	0.0210	0.0020	0.0080	0.0000	0.0230	0.0010	0.0395	0.0000	0.0144	
Pool Length (ft)							---	---	---	---	---	---	---	---	---	---	---	---	---	---	15.4	83.1	10.2	47.5	10.28	60.9	
Pool Max Depth (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		2.5		N/A		1.3		1.4		1.3	2.5	0.8	1.5	0.0	1.8	2.2	3.5	0.9	2.6	1.6	2.6	
Pool Spacing (ft)	38.1		N/A <sup>2</sup>		N/A <sup>2</sup>		31	60	19	46	15	28	44.8		20	86	12	53	15	68	49	136	29	53	28	87	
Pool Volume (ft <sup>3</sup> )							---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Pattern																											
Channel Beltwidth (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		55		23		21		19		8	83	8	37	9	58	7	84	7	36	8	59	
Radius of Curvature (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		31	56	29	52	19	32	27	50	25	51	13	25	14	24	25	58	9	25	13	24	
Rc:Bankfull Width (ft/ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		2.8	5.1	2.4	4.2	2.2	4.6	4.4	8.8	19.2	39.2	15.3	29.4	14.7	25.3	2.4	5.5	1.4	3.8	2.3	4.2	
Meander Length (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		65	107	52	79	39	44	29	45	120	210	63	100	65	156	123	210	61	100	63	158	
Meander Width Ratio	N/A <sup>2</sup>		N/A <sup>2</sup>		N/A <sup>2</sup>		4.4	5.7	1.8	2.4	3.0	3.1	4.2	92.3	161.5	74.1	117.6	68.4	164.2	11.7	20.0	9.2	15.2	11.2	28.0		
Substrate, Bed and Transport Parameters																											
Ri%/Ru%/P%/G%/S%																											
SC%/Sa%/G%/C%/B%/Be%																											
d16/d35/d50/d84/d95/d100	SC/0.18/2.8/38/62/128-180		SC/SC/SC/SC/0.25/4.0/11.3-16		SC/SC/SC/SC/SC/8.0/45-64		0.3/0.4/1.8/12.8/25/90		5/29.8/75.9/170.8/332.0/>2048		-/0.1/0.2/0.5/4.0/8.0		0.2/0.3/0.4/0.9/2/-														
Reach Shear Stress (Competency) lb/ft <sup>2</sup>	0.8-1.6		0.7		0.18-0.25 <sup>4</sup>									0.06		0.13		0.05		0.00		0.11		0.13		0.07	0.07
Max part size (mm) mobilized at bankfull																											
Stream Power (Capacity) W/m <sup>3</sup>																											
Additional Reach Parameters																											
Drainage Area (SM)	0.2		0.036		0.077		1.60		1.60		0.25		1.09		0.24-0.28		0.04		0.08		0.24-0.28		0.04		0.08		
Watershed Impervious Cover Estimate (%)	5.3%		6.1%		2.4%		---		---		---		---		5.3%		6.1%		2.4%		5.3%		6.1%		2.4%		
Rosgen Classification	Modified B4c <sup>3</sup>		Modified B6c <sup>3</sup>		Modified F6 <sup>3</sup>		E5		E3b/C3b		C5		E5		C6		C6		C6		C6		C6		C6		
Bankfull Velocity (fps)	3.0		2.2		1.3	1.5	3.9	3.5	6.3		2	2.1	3.3	3.2	1.7	2.0	2.0	1.2	1.2	1	1	1.4	0.8	1.0			
Bankfull Discharge (cfs)	18.3		6.1		10.2		58		83		8		16		14		6		5		13		4		4.0	6.7	
Q-NFF regression (2-yr)	---		---		---		---		---		---		---		---		---		---		---		---		---		
Q-USGS extrapolation (1.2-yr)	61		19		29		---		---		---		---		---		---		---		---		---		---		
Q-Mannings	18.3		6.1		10.2		---		---		---		---		14		6		5		13		4		4.0	6.7	
Valley Length (ft)	---		---		---		---		---		---		---		---		---		---		922		415		1,174		
Channel Thalweg Length (ft)	1,499 <sup>5</sup>		353		1,915		---		---		---		---		1,228		657		1,969		1,232		658		1,969		
Sinuosity	1.5 <sup>5</sup>		1.05		1.03		1.2		1.1		1.1		1.1		1.39		1.06		1.65		1.3		1.6		1.7		
Water Surface Slope (ft/ft) <sup>1</sup>	---		---		---		---		---		---		---		0.0016	0.0018	0.0037	0.0043	0.0016	0.0019	0.0023	0.0063	0.0018	0.0018	0.0018	0.0018	
Bankfull Slope (ft/ft)	---		---		---		---		---		---		---		0.0016	0.0018	0.0037	0.0043	0.0016	0.0019	0.0037	0.0060	0.0015	0.0015	0.0015	0.0015	

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

<sup>1</sup> Min and max values may appear backwards for ratios. When this is the case, ratio values have been left in the column associated with a particular cross section.

<sup>2</sup> Due to the highly manipulated condition of the streams resulting in ditched streams with little profile diversity, no profile or pattern data was assessed on UT1A, UT2, UT1 Reach 2, and UT1B.

<sup>3</sup> The Rosgen classification system is for natural streams and project streams have been heavily manipulated. These classifications are for illustrative purposes only.

<sup>4</sup> The 25-year event was the largest event modeled; it does not fill the channel

<sup>5</sup> Sinuosity on UT1 Reach 2 is calculated by drawing a valley length line that follows the proposed valley; the existing valley is poorly defined

\*Does not include last 150' to tie-in to Henry Fork.



Table 10b. Baseline Stream Data Summary

Henry Fork Mitigation Site  
DMS Project No.96306  
Monitoring Year 3 - 2018

Henry Fork-UT1 Reach 1 and UT1B

Parameter	PRE-RESTORATION CONDITION				REFERENCE REACH DATA														DESIGN				AS-BUILT/BASELINE																													
	UT1 Reach 1		UT1B		UT to Catawba River Reach 1		UT to Catawba River Reach 2		UT to Lyle Creek		Vile Preserve		UT to South Crowders		Group Camp Tributary		UT to Gap Branch		Upstream UT1 to Henry Fork		UT1 Reach 1		UT1B		UT1 Reach 1		UT1B																									
	Min	Max	Min	Max	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Min <sup>1</sup>	Max <sup>1</sup>	Upper	Lower	Min	Max	Min	Max	Min	Max																								
Reference Cross Section Number	XS3,XS4		XS1,XS2		XS2		XS3		XS4		XS1		XS3		XS1		XS2		XS3		XS2																															
<b>Dimension and Substrate - Riffle</b>																																																				
Bankfull Width (ft)	3.2	3.3	2.7	3.1	12.4	9.7	12.3		8.6	7.0	6.2	5.7	6.1	8.4	4.4	4.2	6.2		3.2	7.7	6.0	7.0	5.5		6.9	7.3	5.4																									
Floodprone Width (ft)	6.7	11.4	17.5	19.8	79	52	53		48.9	45.2	200+	200+	25.5	31.2	8.6	10.6	20.9		6.3	13	15	20(40 <sup>1</sup> )	10	15	51.3	118.3+	13.2																									
Bankfull Mean Depth	0.6	0.7	0.6	0.7	1.4	1.2	1.1		0.5	0.5	0.8	0.8	1.1	1.0	0.8	0.8	0.6		0.6	0.5	0.40	0.49	0.4		0.4	0.5	0.4																									
Bankfull Max Depth	0.7	1.0	0.7	0.9	1.7	1.7	1.7		1.1	1.0	1.3	1.4	1.4	1.4	1.0	1.2	1.0		0.8	0.7	1.3		0.55		0.75		0.6																									
Bankfull Cross-sectional Area (ft <sup>2</sup> )	1.8	2.1	1.9	2	17.6	11.4	13.2		4.1	3.5	5.3	4.5	6.4	8.7	3.6	3.4	3.8		1.9	3.6	2.4	3.4	2.1		2.9	3.5	2.2																									
Width/Depth Ratio	5.1	5.7	3.7	5.1	8.7	8.2	11.5		18.3	13.9	7.4	7.2	5.7	8.2	5.5	5.2	10.1		5.2	16.4	12.3		14.7		15.8		37.7																									
Entrenchment Ratio	2.0	3.6	1.7	2.5	5.8+		5.8+		2.5+		30+		4.2	3.7	1.9	2.5	3.4		2.0	1.7	2.5 (5.7)		1.8	2.7	7.0	17.1+	6.9																									
Bank Height Ratio	1.0	3.1	1.7	2.2	1.0		1.0		1.0		1.0		1.6	1.0	1.0	1.0	1.0		1.0	1.3	1.0		1.0		1.0		1.0																									
D50 (mm)	16/8.3		6.9/5.3		1.8		75.9		0.2		0.4		19.7		0.3		19.0		34.0		8.3		5.3		17.1		11.0																									
<b>Profile</b>																																																				
Riffle Length (ft)	0.041		0.21		N/A <sup>2</sup>		0.0114		0.0605		0.0142		0.3451		0.0055		0.0597		0.0063		0.0202		0.0664		0.0105		0.1218		0.0110		0.1400		0.0500		0.0700		0.056		0.092		0.067		0.110		8.0		47.3		11.3		41.2	
Pool Length (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		2.5		N/A		1.3		1.4		1.3		3.0		1.8		2.8		1.5		N/A		0.6		1.5		0.7		1.3		0.9		2.8		0.5		2.2													
Pool Max Depth (ft)	10.4		20.5		N/A <sup>2</sup>		31		60		19		46		15		28		44.8		28		63		9		58		18		27		14		25		12		35		11		28		10		60		7		43	
Pool Spacing (ft)	10.4		20.5		N/A <sup>2</sup>		31		60		19		46		15		28		44.8		28		63		9		58		18		27		14		25		12		35		11		28		10		60		7		43	
Pool Volume (ft <sup>3</sup> )	10.4		20.5		N/A <sup>2</sup>		31		60		19		46		15		28		44.8		28		63		9		58		18		27		14		25		12		35		11		28		10		60		7		43	
<b>Pattern</b>																																																				
Channel Beltwidth (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		55		23		21		19		81		15.5		16.5		N/A		N/A		6		28		5		21		10		26		4		19															
Radius of Curvature (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		31		56		29		52		19		32		27		50		9		20		8.0		11.8		N/A		N/A		14		30		10		18		8		31		8		32					
Rc:Bankfull Width (ft/ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		2.8		5.1		2.4		4.2		2.2		4.6		4.4		8.8		1.5		2.4		1.9		2.7		N/A		N/A		2.3		4.3		1.8		3.3		1.2		4.5		1.5		5.9					
Meander Length (ft)	N/A <sup>2</sup>		N/A <sup>2</sup>		65		107		52		79		39		44		29		45		45		72		31		34		N/A		N/A		52		104		46		92		56		104		48		90					
Meander Width Ratio	N/A <sup>2</sup>		N/A <sup>2</sup>		4.4		5.7		1.8		2.4		3.0		3.1		4.2		9.6		13.3		3.6		3.8		N/A		N/A		9		15		8		17		8		15		9		17							
<b>Substrate, Bed and Transport Parameters</b>																																																				
Ri%/Pru%/Pp%/G%/S%																																																				
SC%/Sa%/G%/C%/B%/Be%																																																				
d16/d35/d50/d84/d95/d100	SC/0.18/2.80/38/62/128-180		FS/SC/SC/0.14/8.9/45/128-180		0.3/0.4/1.8/12.8/25/90		0.5/29.8/75.9/170.8/332.0/>2048.4		-/0.1/0.2/0.5/4.0/8.0		0.2/0.3/0.4/0.9/2/-		0.8/12.1/19.7/49.5/75.9/180.0		SC/0.1/0.3/16.0/55.6/128.0		0.4/8/19.0/102.3/256.0/>2048		2.8/16/34/64/101/128-180																																	
Reach Shear Stress (Competency) lb/ft <sup>2</sup>	2.3-3.1		1.3-2.4																																																	
Max part size (mm) mobilized at bankfull																																																				
Stream Power (Capacity) W/m <sup>2</sup>																																																				
<b>Additional Reach Parameters</b>																																																				
Drainage Area (SM)	0.17		0.048		1.60		1.60		0.25		1.09		0.22		0.10		0.04		0.05		0.07-0.17		0.048		0.07-0.17		0.048																									
Watershed Impervious Cover Estimate (%)	5.9%		7.9%																		5.9%		7.9%		5.9%		7.9%																									
Rosgen Classification	Modified Low W/D B4a / E4b <sup>2</sup>		Modified B5a / E5b <sup>4</sup>		E5		E3b/C3b		C5		E5		E4		E5b		Slightly entrenched B4a/A4		B4a		B4a		B4a <sup>5</sup>		B4a		B4a		B4a		B4a		B4a		B4a		B4a		B4a		B4a											
Bankfull Velocity (fps)	4.8		5.3		3.8		4.1		3.9		3.5		6.3		2		2.1		3.3		3.2		3.3		4.4		3.6		3.4		5.0		5.4		3.8		4.6		4.1		4.3		2.6		3.9							
Bankfull Discharge (cfs)	8.5		11.4		8		58		83		8		16		25		12		19		12		10		15		9		7.6		12.6		8.7		8.7		8.7		8.7													
Q-NFF regression (2-yr)	---		---																																																	
Q-USGS extrapolation (1.2-yr)	30		24																																																	
Q-Mannings	8.5		11.4		8																																															
Valley Length (ft)	---		---																																																	
Channel Thalweg Length (ft)	1,392		478																																																	
Sinuosity	1.0		1.1		1.2		1.1		1.1		1.1		2.2		1.6		N/A		1.1		1.11		1.16		1.30		1.2		1.2		1.2		1.2		1.2		1.1															
Water Surface Slope (ft/ft)	---		---																																																	
Bankfull Slope (ft/ft)	---		---																																																	

SC: Silt/Clay <0.062 mm diameter particles

FS: Fine Sand 0.125-0.250mm diameter particles

(---): Data was not provided

N/A: Not Applicable

<sup>1</sup> Min and max values may appear backwards for ratios. When this is the case, ratio values have been left in the column associated with a particular cross section.

<sup>2</sup> Due to the highly manipulated condition of the streams resulting in ditched streams with little profile diversity, no profile or pattern data was assessed on UT1A, UT2, UT1 Reach 2, and UT1B.

<sup>3</sup> UT1 Reach 1 (Lower) is a hybrid reach that goes through what is presently a pond and then drops rapidly down what is presently a dam embankment and drop to master stream floodplain. Through the pond, slopes and floodprone width is more typical of a C.

<sup>4</sup> The Rosgen classification system is for natural streams and project streams have been heavily manipulated. These classifications are for illustrative purposes only.

<sup>5</sup> UT1 Reach 1 (Lower) is a hybrid reach that goes through what is presently a pond and then drops rapidly down what is presently a dam embankment and drop to master stream floodplain. Through the pond, slopes and floodprone width is more typical of a C.

<sup>6</sup> UT1B is classified in existing conditions as a sand bed stream. This is thought to be reflective of manipulation (impoundment and channelization resulting in a less steep stream). The restored stream, with slopes exceeding 2% grade throughout the reach, will be a gravel dominated stream, and is classified as such.



**Table 11a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Henry Fork Mitigation Site

DMS Project No.96306

Monitoring Year 3 - 2018

Dimension and Substrate <sup>1</sup>	Cross-Section 1, UT1 Reach 1 (Riffle)								Cross-Section 2, UT1 Reach 1 (Pool)								Cross-Section 3, UT1 Reach 1 (Pool)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) <sup>1</sup>	906.1	906.1	906.1	906.1					901.9	901.9	901.9	902.0					878.3	878.3	878.3	878.2				
Low Bank Elevation	906.1	906.1	906.1	906.2					901.9	901.9	901.9	901.9					878.3	878.3	878.3	878.3				
Bankfull Width (ft)	7.3	6.8	7.1	7.2					8.8	9.6	10.9	17.2					7.8	7.7	9.6	11.4				
Floodprone Width (ft)	51.3	50.5	51.8	52.2					---	---	---	---					---	---	---	---				
Bankfull Mean Depth (ft)	0.5	0.4	0.5	0.5					1.2	1.0	0.9	0.6					1.2	1.0	0.9	0.8				
Bankfull Max Depth (ft)	0.7	0.7	0.8	1.0					2.2	1.7	1.8	1.7					2.2	1.8	1.8	2.0				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	3.5	2.9	3.3	3.5					10.7	9.5	10.0	10.7					9.1	8.1	8.8	9.1				
Bankfull Width/Depth Ratio	15.4	15.7	15.0	14.7					---	---	---	---					---	---	---	---				
Bankfull Entrenchment Ratio	7.0	7.5	7.3	7.3					---	---	---	---					---	---	---	---				
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.1					---	---	---	---					---	---	---	---				
Dimension and Substrate <sup>1</sup>	Cross-Section 4, UT1 Reach 1 (Riffle)								Cross-Section 5, UT1 Reach 2 (Riffle)								Cross-Section 6, UT1 Reach 2 (Pool)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) <sup>1</sup>	877.6	877.6	877.6	877.5					873.5	873.5	873.5	873.4					872.7	872.7	872.7	872.8				
Low Bank Elevation	877.6	877.6	877.6	877.6					873.5	873.5	873.5	873.5					872.7	872.7	872.7	873.5				
Bankfull Width (ft)	6.9	7.4	7.6	7.2					10.5	11.1	10.9	10.9					8.8	8.8	9.2	10.9				
Floodprone Width (ft)	118.3+	118.3+	118+	63.7+					96.7+	96.7+	96.7+	76+					---	---	---	---				
Bankfull Mean Depth (ft)	0.4	0.4	0.4	0.4					0.9	0.9	0.9	0.9					1.0	0.8	0.7	0.8				
Bankfull Max Depth (ft)	0.8	0.7	0.7	0.7					1.5	1.5	1.5	1.5					1.8	1.4	1.3	1.6				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	2.9	3.2	3.1	2.9					9.7	10.1	9.3	9.7					8.8	7.2	6.8	8.8				
Bankfull Width/Depth Ratio	16.2	17.1	18.7	17.9					11.4	12.1	12.7	12.2					---	---	---	---				
Bankfull Entrenchment Ratio	17.1+	16.0+	15.5+	8.9+					9.2+	8.7+	8.9+	7.0					---	---	---	---				
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.1					1.0	1.0	1.0	1.1					---	---	---	---				

<sup>1</sup>Prior to MY3, bankfull dimensions were calculated using a fixed bankfull elevation. For MY3 through MY7 bankfull elevation and channel cross-section dimensions are calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018).



**Table 11b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Henry Fork Mitigation Site  
 DMS Project No.96306  
 Monitoring Year 3 - 2018

Dimension and Substrate <sup>1</sup>	Cross-Section 7, UT1A (Pool)							Cross-Section 8, UT1A (Riffle)							Cross-Section 9, UT1B (Pool)							Cross-Section 10, UT1B (Riffle)										
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) <sup>1</sup>	874.9	874.9	874.9	874.9					875.0	875.0	875.0	874.9					922.9	922.9	922.9	923.1					922.1	922.1	922.1	922.2				
Low Bank Elevation	874.9	874.9	874.9	875.3					875.0	875.0	875.0	874.9					922.9	922.9	922.9	923.2					922.1	922.1	922.1	922.2				
Bankfull Width (ft)	5.6	5.8	4.5	7.4					6.6	6.3	7.7	7.8					5.5	5.9	6.9	7.5					5.4	5.9	4.3	6.1				
Floodprone Width (ft)	---	---	---	---					31.4+	80.6+	79.1+	89.2+					---	---	---	---					37.7	55.6	54.1	56.0				
Bankfull Mean Depth (ft)	0.4	0.4	0.3	0.3					0.4	0.4	0.3	0.3					0.9	0.7	0.6	0.7					0.4	0.3	0.2	0.4				
Bankfull Max Depth (ft)	0.7	1.0	0.7	0.8					0.8	0.6	0.6	0.8					1.4	1.2	1.0	1.3					0.6	0.5	0.3	0.6				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	2.0	2.3	1.5	2.0					2.5	2.3	2.4	2.5					5.0	4.2	4.0	5.0					2.2	2.0	1.0	2.2				
Bankfull Width/Depth Ratio	---	---	---	---					17.0	17.3	24.9	23.9					---	---	---	---					13.2	17.3	19.6	17.1				
Bankfull Entrenchment Ratio	---	---	---	---					4.8	12.8+	10.3+	11.5+					---	---	---	---					6.9	9.4	12.5	9.1				
Bankfull Bank Height Ratio	---	---	---	---					1.0	1.0	1.0	1.0					---	---	---	---					1.0	1.0	1.0	1.0				
Dimension and Substrate <sup>1</sup>	Cross-Section 11, UT2 (Pool)							Cross-Section 12, UT2 (Riffle)							Cross-Section 13, UT2 (Pool)							Cross-Section 14, UT2 (Riffle)										
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft) <sup>1</sup>	876.0	876.0	876.0	876.0					876.0	876.0	876.0	876.0					875.1	875.1	875.1	875.1					875.2	875.2	875.2	875.2				
Low Bank Elevation	876.0	876.0	876.0	876.2					876.0	876.0	876.0	876.1					875.1	875.1	875.1	875.1					875.2	875.2	875.2	875.3				
Bankfull Width (ft)	10.2	11.5	11.1	11.0					8.1	9.1	8.6	8.2					7.8	8.2	10.0	12.0					7.4	6.9	7.5	8.8				
Floodprone Width (ft)	---	---	---	---					81.3+	50.8+	50.8+	50.5+					---	---	---	---					150+	150+	150+	58.9+				
Bankfull Mean Depth (ft)	0.8	0.8	0.9	0.8					0.7	0.6	0.7	0.7					1.1	1.0	0.9	0.7					0.6	0.5	0.6	0.5				
Bankfull Max Depth (ft)	1.9	1.6	1.7	1.7					1.4	1.4	1.5	1.4					1.9	1.6	1.7	1.9					1.0	1.0	1.1	1.1				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	8.6	9.5	9.7	8.6					5.7	5.5	6.0	5.7					8.8	8.1	9.4	8.8					4.2	3.8	4.4	4.2				
Bankfull Width/Depth Ratio	---	---	---	---					11.5	15.0	12.3	11.8					---	---	---	---					12.9	12.7	12.6	18.6				
Bankfull Entrenchment Ratio	---	---	---	---					10.1+	5.6+	5.9+	6.1+					---	---	---	---					20.3+	21.8+	20.1+	6.7+				
Bankfull Bank Height Ratio	---	---	---	---					1.10	1.10	1.10	1.1					---	---	---	---					1.09	1.09	1.09	1.1				

<sup>1</sup>Prior to MY3, bankfull dimensions were calculated using a fixed bankfull elevation. For MY3 through MY7 bankfull elevation and channel cross-section dimensions are calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018).



**Table 12a. Monitoring - Stream Reach Data Summary**

Henry Fork Mitigation Site  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**Henry Fork-UT1 Reach 2, UT1A and UT2**

Parameter	As-Built/Baseline						MY1						MY2						MY3						
	UT1 Reach 2		UT1A		UT2		UT1 Reach 2		UT1A		UT2		UT1 Reach 2		UT1A		UT2		UT1 Reach 2		UT1A		UT2		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
<b>Dimension and Substrate - Riffle</b>																									
Bankfull Width (ft)	10.5		6.6		7.4	8.1	11.1		6.3		6.9	9.1	10.9		737.0		7.5	8.6	10.9		7.8		8.2	8.8	
Floodprone Width (ft)	96.7+		31.4+		81.3	150+	96.7+		80.6+		50.8+	150+	96.7+		79.1+		50.8+	150+	76+		89.2+		50.5+	58.9+	
Bankfull Mean Depth	0.9		0.4		0.6	0.7	0.9		0.4		0.5	0.6	0.9		0.3		0.6	0.7	0.9		0.3		0.5	0.7	
Bankfull Max Depth	1.5		0.8		1.0	1.4	1.5		0.6		1.0	1.4	1.5		0.6		1.1	1.5	1.5		0.8		1.1	1.4	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	9.7		2.5		4.2	5.7	10.1		2.3		3.8	5.5	9.3		2.4		4.4	6.0	9.7		2.5		4.2	5.7	
Width/Depth Ratio	11.4		17.0		11.5	12.9	12.1		17.3		12.7	15.0	12.7		24.9		12.3	12.6	12.2		23.9		11.8	18.6	
Entrenchment Ratio	9.2+		4.8		10.1	29.0+	8.7+		31.9+		5.6+	21.8+	8.9+		10.3+		5.9+	20.1+	7.0+		11.5+		6.1+	6.7+	
Bank Height Ratio	1.0		1.0		1.1		1.0		1.0		1.1		1.0		1.0		1.1		1.1		1.1		1.1		
D50 (mm)	Silt/Clay																								
<b>Profile</b>																									
Riffle Length (ft)	23.3	51.9	10.8	32.9	3.45	52.29																			
Riffle Slope (ft/ft)	0.0000	0.0230	0.0010	0.0395	0.0000	0.0144																			
Pool Length (ft)	15.4	83.1	10.2	47.5	10.28	60.9																			
Pool Max Depth (ft)	2.2	3.5	0.9	2.6	1.6	2.6																			
Pool Spacing (ft)	49	136	29	53	28	87																			
Pool Volume (ft <sup>3</sup> )																									
<b>Pattern</b>																									
Channel Beltwidth (ft)	7	84	7	36	8	59																			
Radius of Curvature (ft)	25	58	9	25	13	24																			
Rc:Bankfull Width (ft/ft)	2.4	5.5	1.4	3.8	2.3	4.2																			
Meander Wave Length (ft)	123	210	61	100	63	158																			
Meander Width Ratio	11.7	20.0	9.2	15.2	11.2	28.0																			
<b>Additional Reach Parameters</b>																									
Rosgen Classification	C6		C6		C6																				
Channel Thalweg Length (ft)	1,232		658		1,969																				
Sinuosity (ft)	1.3		1.6		1.7																				
Water Surface Slope (ft/ft)	0.0023		0.0063		0.0018																				
Bankfull Slope (ft/ft)	0.0037		0.0060		0.0015																				
Ri%/Ru%/P%/G%/S%																									
SC%/Sa%/G%/C%/B%/Be%																									
d16/d35/d50/d84/d95/d100																									
% of Reach with Eroding Banks							0%		0%		0%		0%		0%		0%		0%						

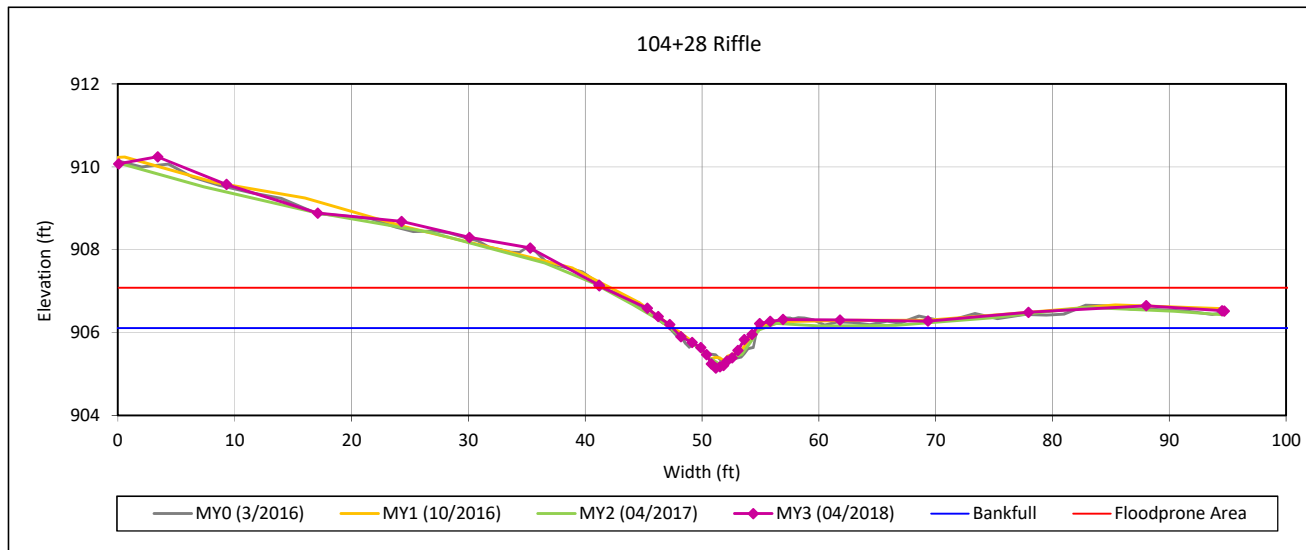




### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 1-UT1 R1



#### Bankfull Dimensions

3.5	x-section area (ft.sq.)
7.2	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
7.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
14.7	width-depth ratio
52.2	W flood prone area (ft)
7.3	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

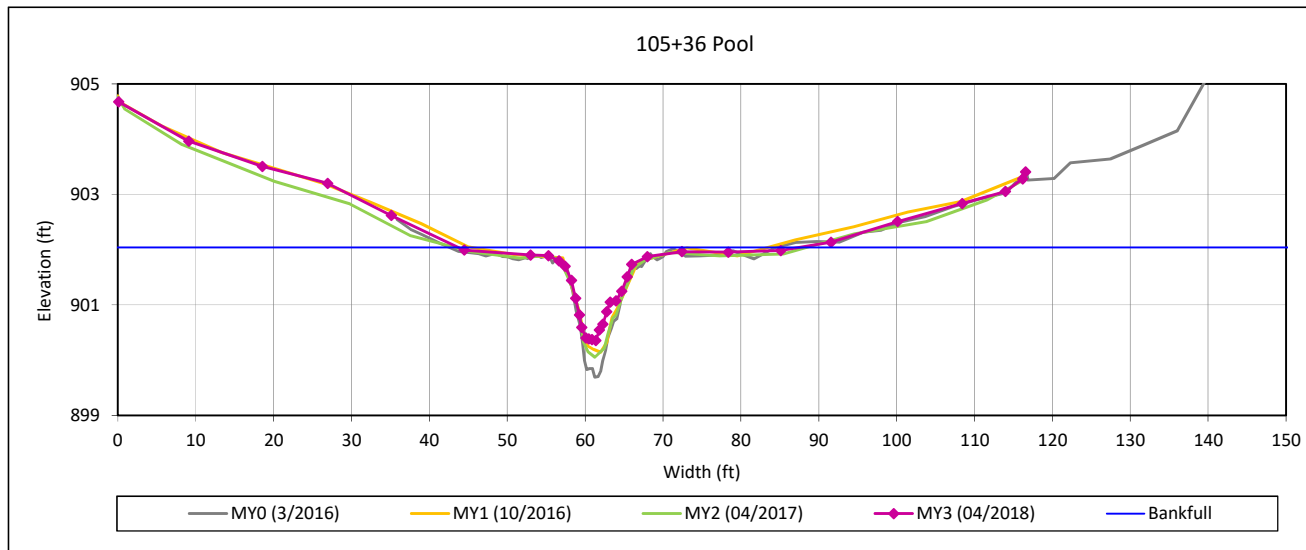


View Downstream

### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 2-UT1 R1



#### Bankfull Dimensions

10.7	x-section area (ft.sq.)
17.2	width (ft)
0.6	mean depth (ft)
1.7	max depth (ft)
17.7	wetted perimeter (ft)
0.6	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



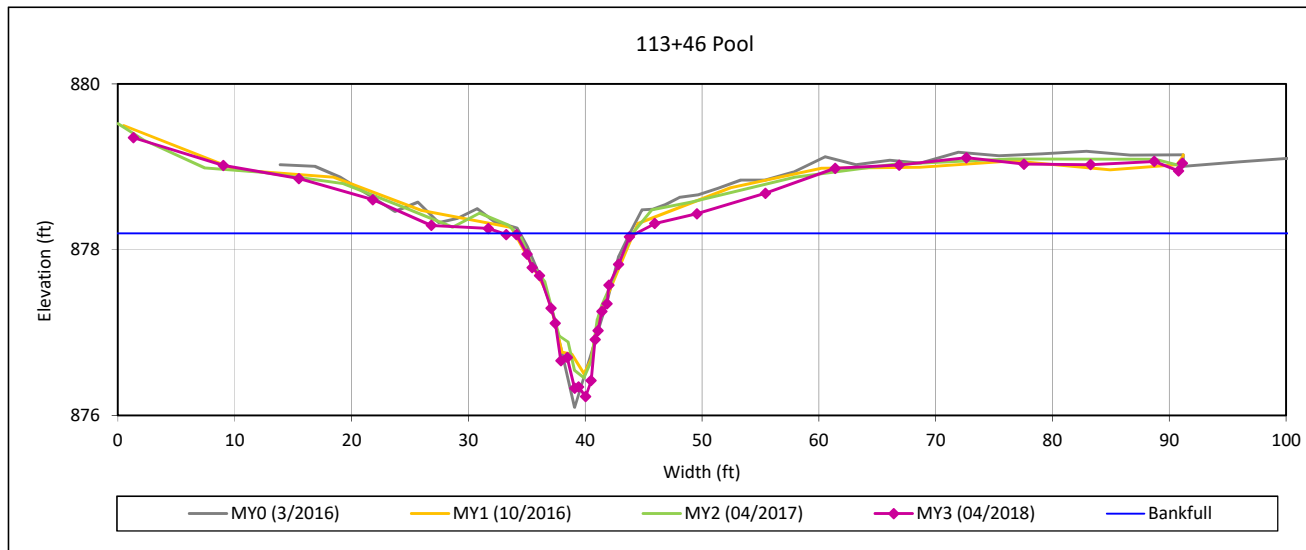
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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 3-UT1 R1



#### Bankfull Dimensions

9.1	x-section area (ft.sq.)
11.4	width (ft)
0.8	mean depth (ft)
2.0	max depth (ft)
12.5	wetted perimeter (ft)
0.7	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

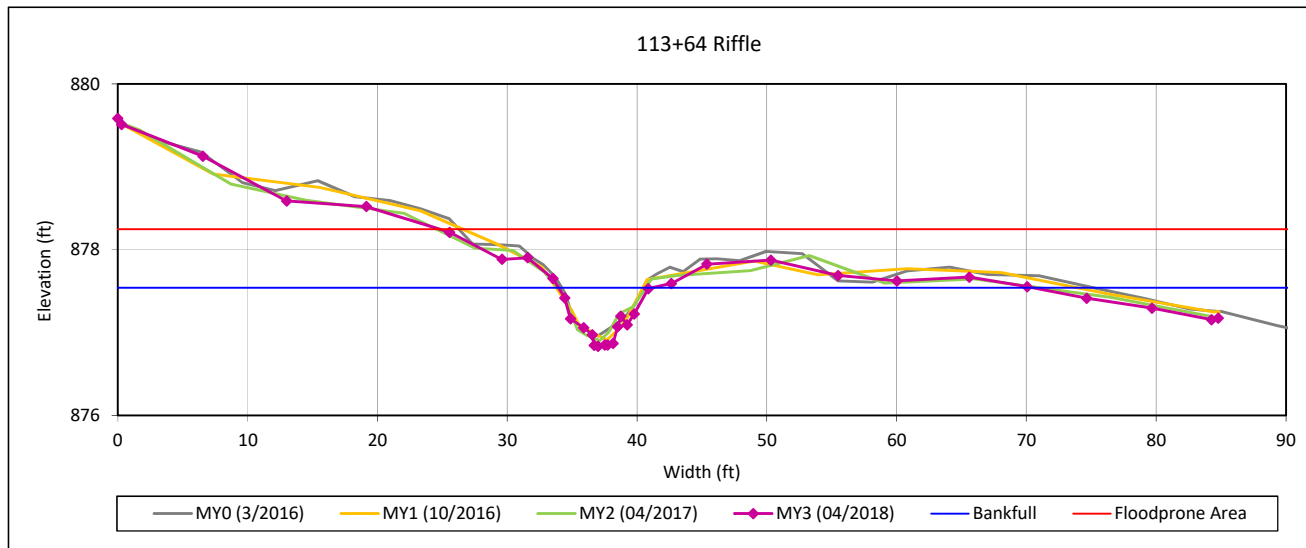


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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 4-UT1 R1



#### Bankfull Dimensions

2.9	x-section area (ft.sq.)
7.2	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
7.5	wetted perimeter (ft)
0.4	hydraulic radius (ft)
17.9	width-depth ratio
63.7	W flood prone area (ft)
8.9	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



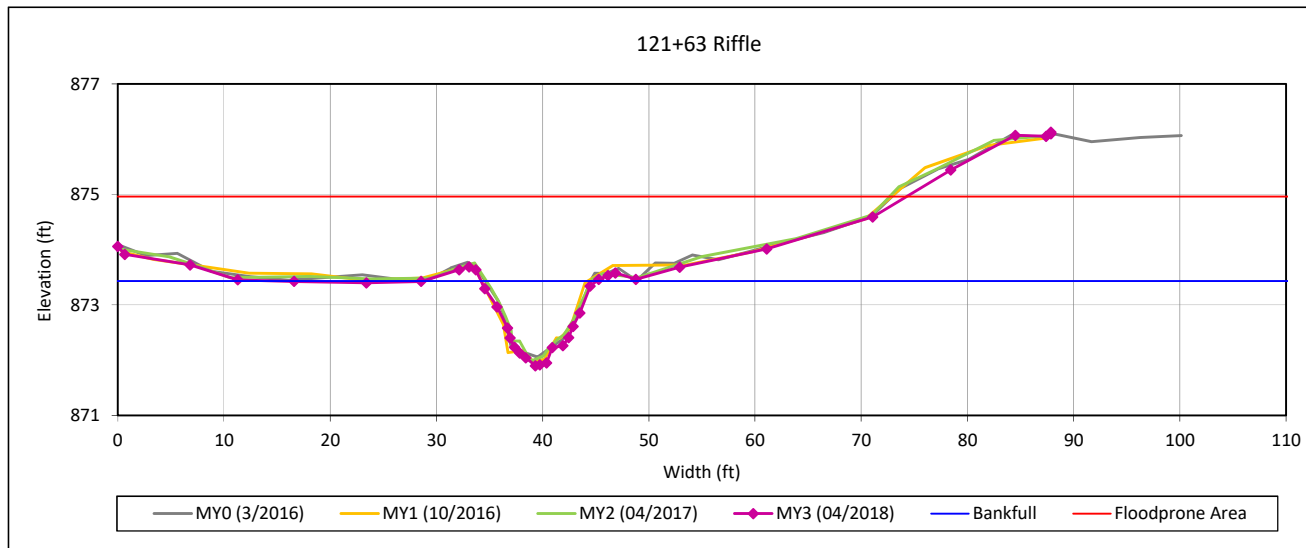
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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 5-UT1 R2



#### Bankfull Dimensions

9.7	x-section area (ft.sq.)
10.9	width (ft)
0.9	mean depth (ft)
1.5	max depth (ft)
11.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.2	width-depth ratio
76.0	W flood prone area (ft)
7.0	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

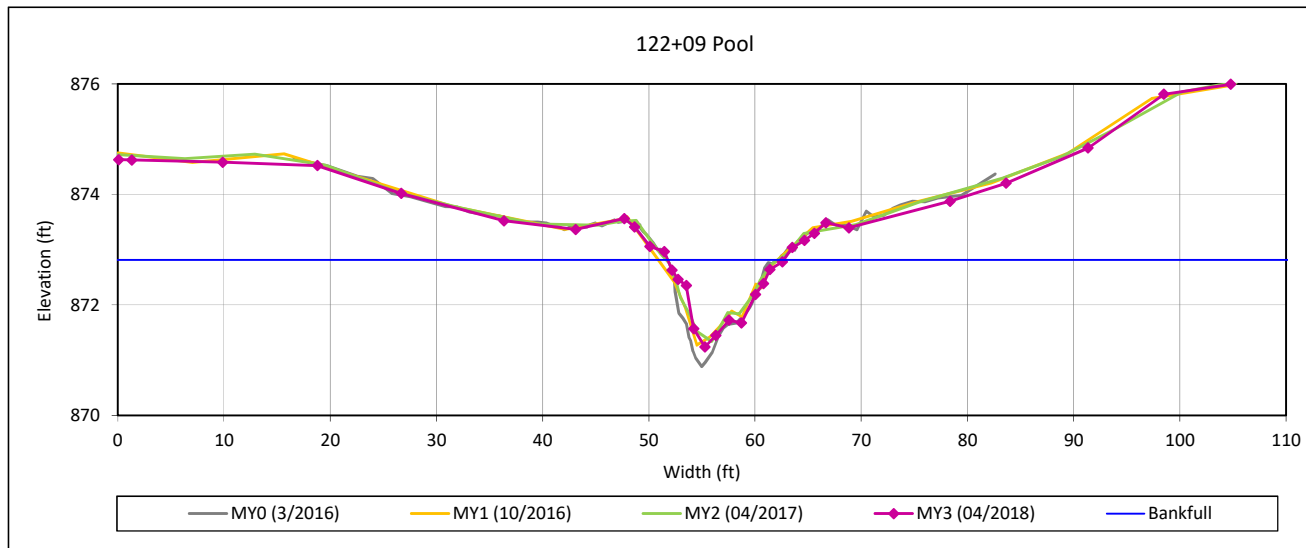


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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 6-UT1 R2



#### Bankfull Dimensions

8.8	x-section area (ft.sq.)
10.9	width (ft)
0.8	mean depth (ft)
1.6	max depth (ft)
11.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



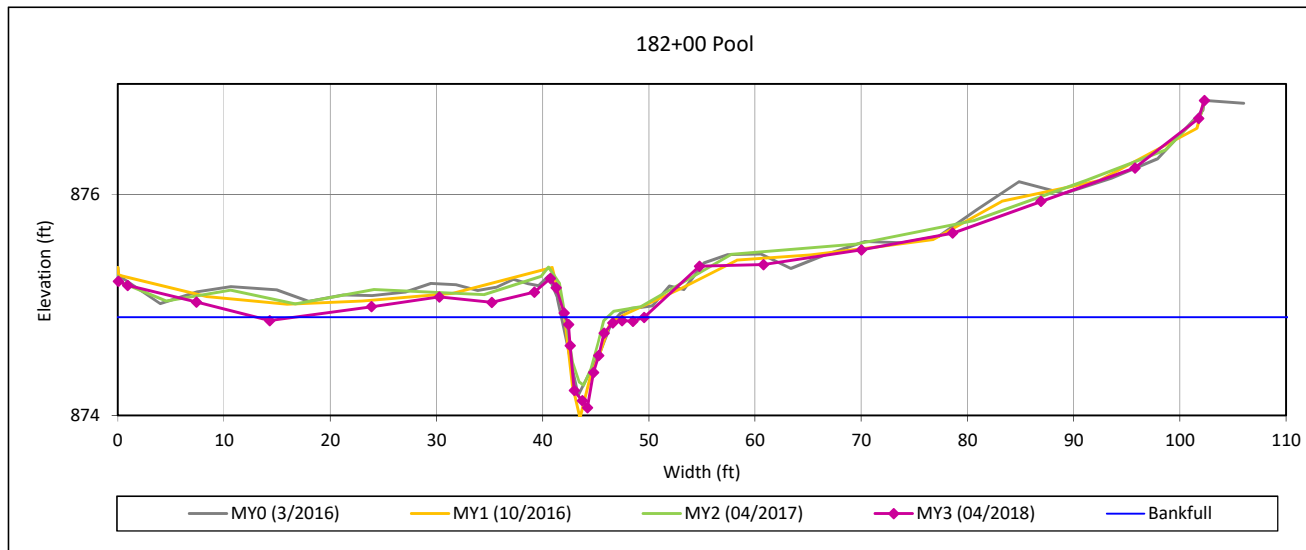
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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 7-UT1A



#### Bankfull Dimensions

2.0	x-section area (ft.sq.)
7.4	width (ft)
0.3	mean depth (ft)
0.8	max depth (ft)
7.8	wetted perimeter (ft)
0.3	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



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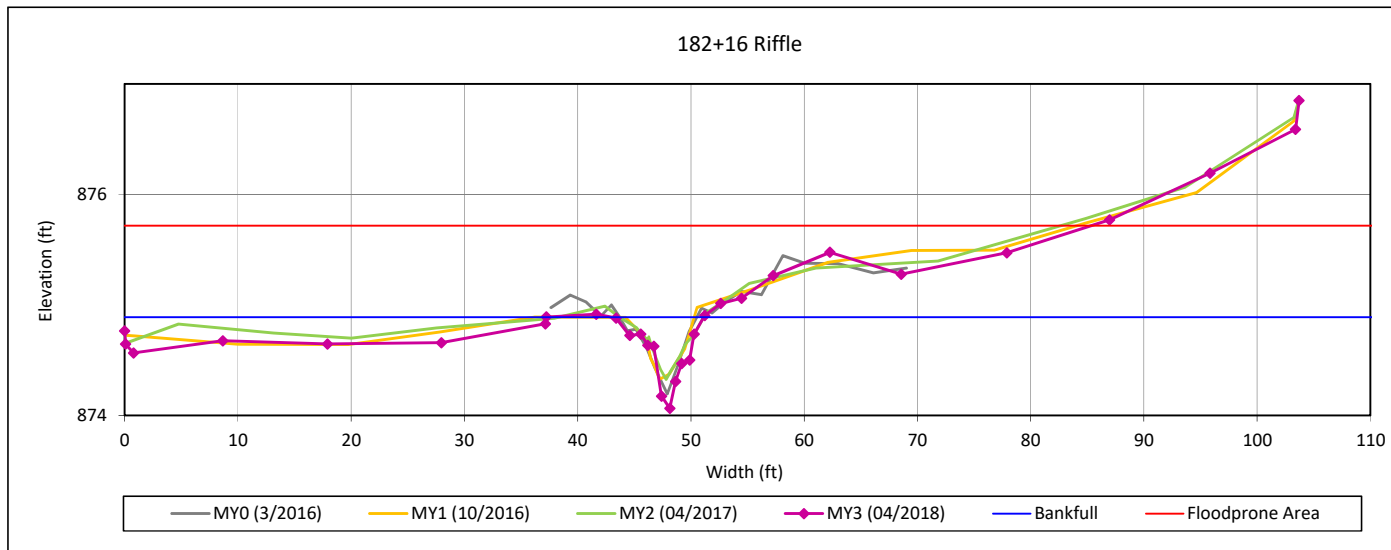
**Cross-Section Plots**

Henry Fork Mitigation Site

NCDMS Project No. 96306

Monitoring Year 3 - 2018

**Cross-Section 8-UT1A**



**Bankfull Dimensions**

2.5	x-section area (ft.sq.)
7.8	width (ft)
0.3	mean depth (ft)
0.8	max depth (ft)
8.1	wetted perimeter (ft)
0.3	hydraulic radius (ft)
23.9	width-depth ratio
89.2	W flood prone area (ft)
11.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2018

Field Crew: Wildlands Engineering



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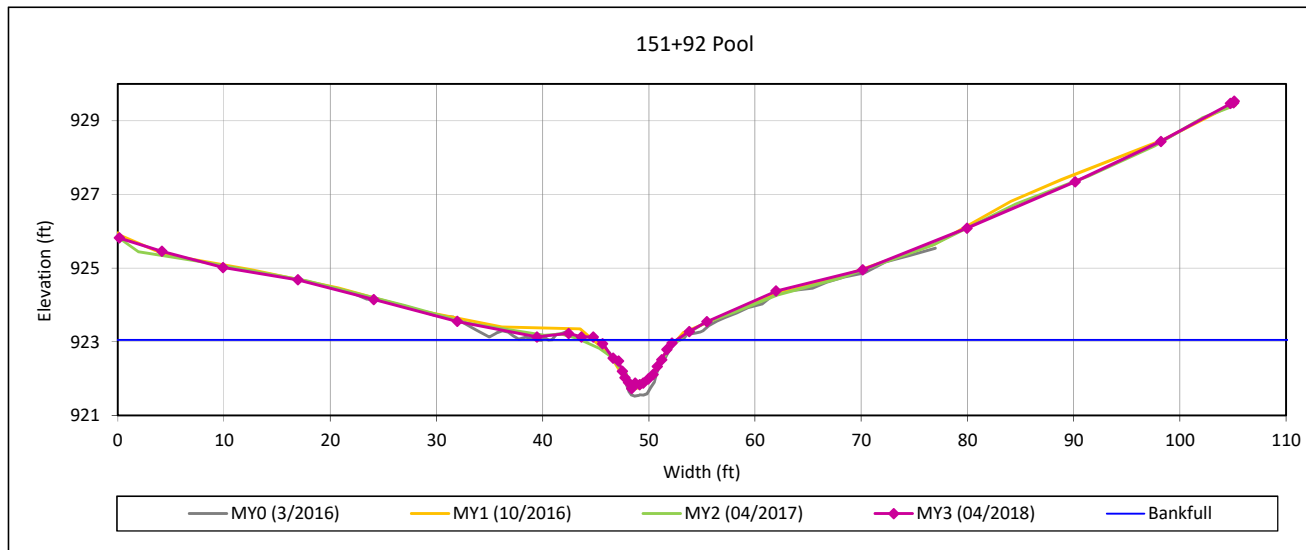
### Cross-Section Plots

Henry Fork Mitigation Site

NCDMS Project No. 96306

Monitoring Year 3 - 2018

### Cross-Section 9-UT1B



#### Bankfull Dimensions

5.0	x-section area (ft.sq.)
7.5	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
8.1	wetted perimeter (ft)
0.6	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

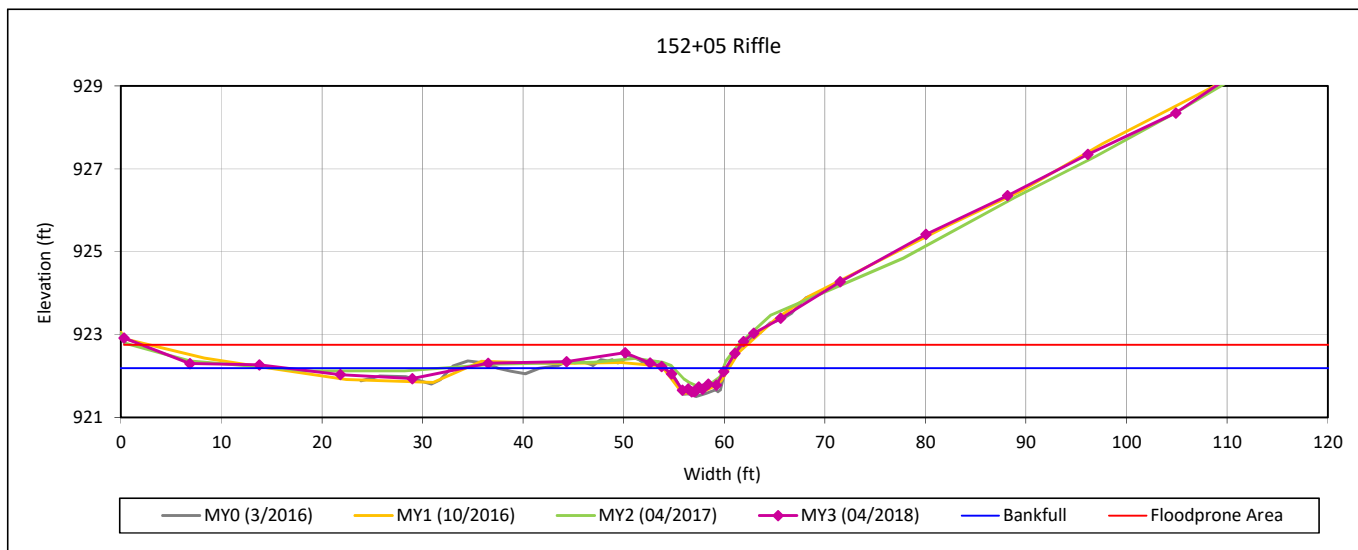


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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 10-UT1B



#### Bankfull Dimensions

2.2	x-section area (ft.sq.)
6.1	width (ft)
0.4	mean depth (ft)
0.6	max depth (ft)
6.3	wetted perimeter (ft)
0.3	hydraulic radius (ft)
17.1	width-depth ratio
56.0	W flood prone area (ft)
9.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



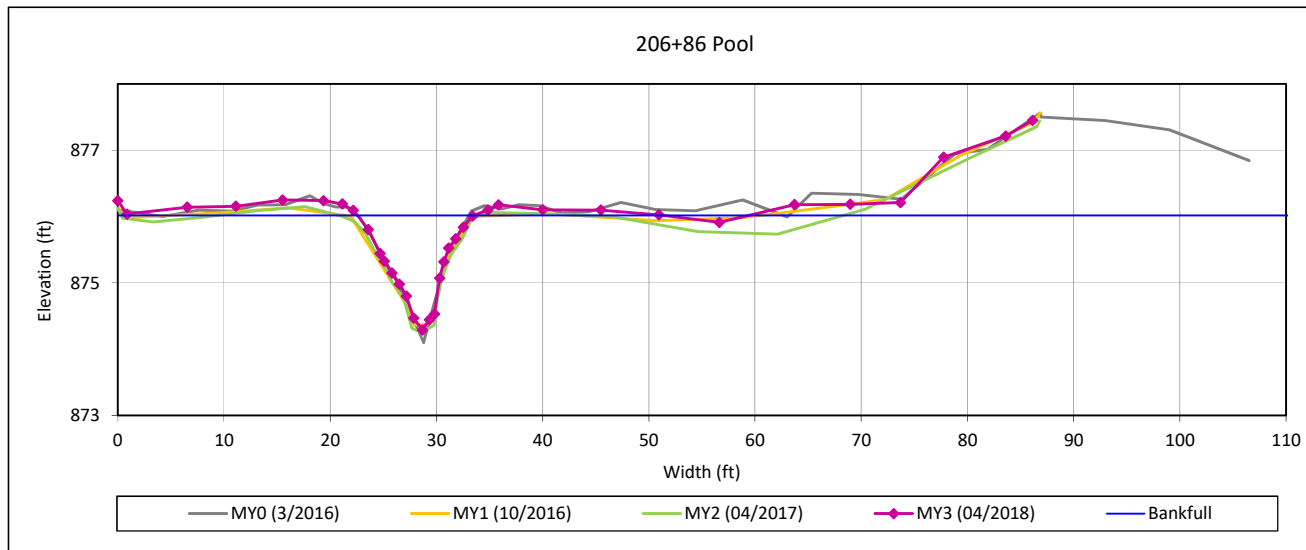
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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 11-UT2



#### Bankfull Dimensions

8.6	x-section area (ft.sq.)
11.0	width (ft)
0.8	mean depth (ft)
1.7	max depth (ft)
11.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

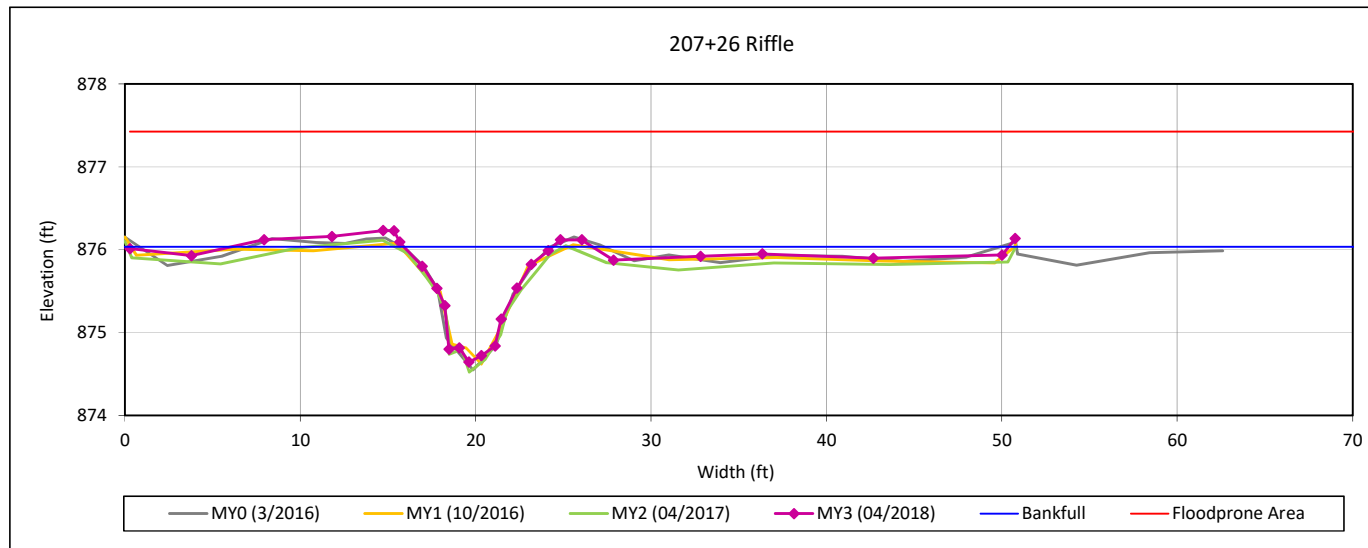


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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 12-UT2



#### Bankfull Dimensions

5.7	x-section area (ft.sq.)
8.2	width (ft)
0.7	mean depth (ft)
1.4	max depth (ft)
9.0	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.8	width-depth ratio
50.5	W flood prone area (ft)
6.1	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



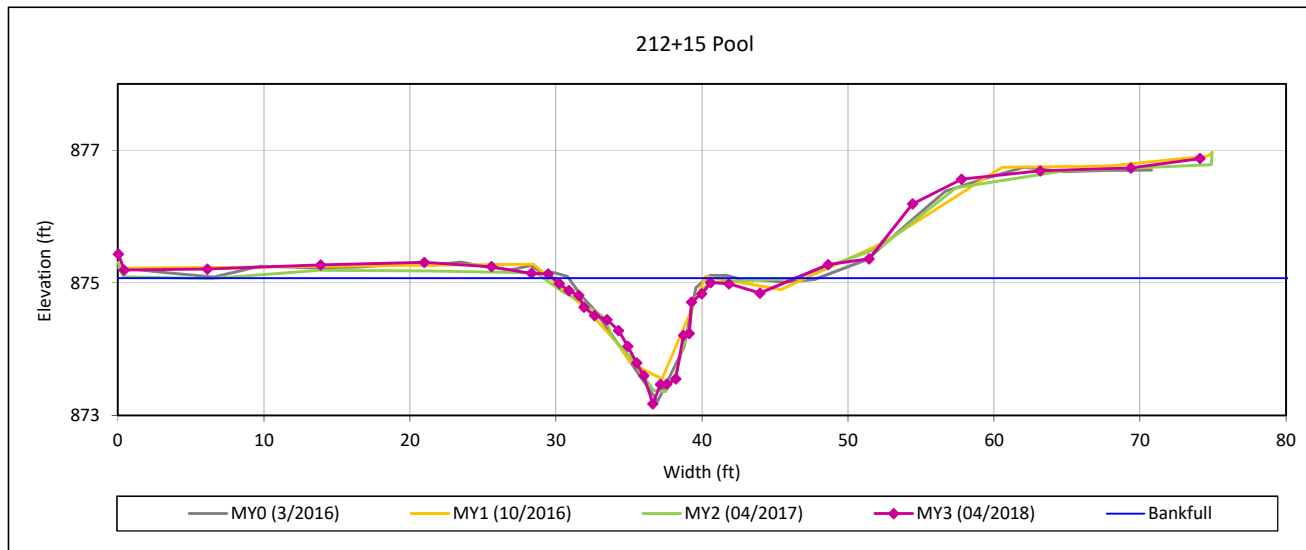
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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 13-UT2



#### Bankfull Dimensions

8.8	x-section area (ft.sq.)
12.0	width (ft)
0.7	mean depth (ft)
1.9	max depth (ft)
13.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)

Survey Date: 04/2018  
Field Crew: Wildlands Engineering

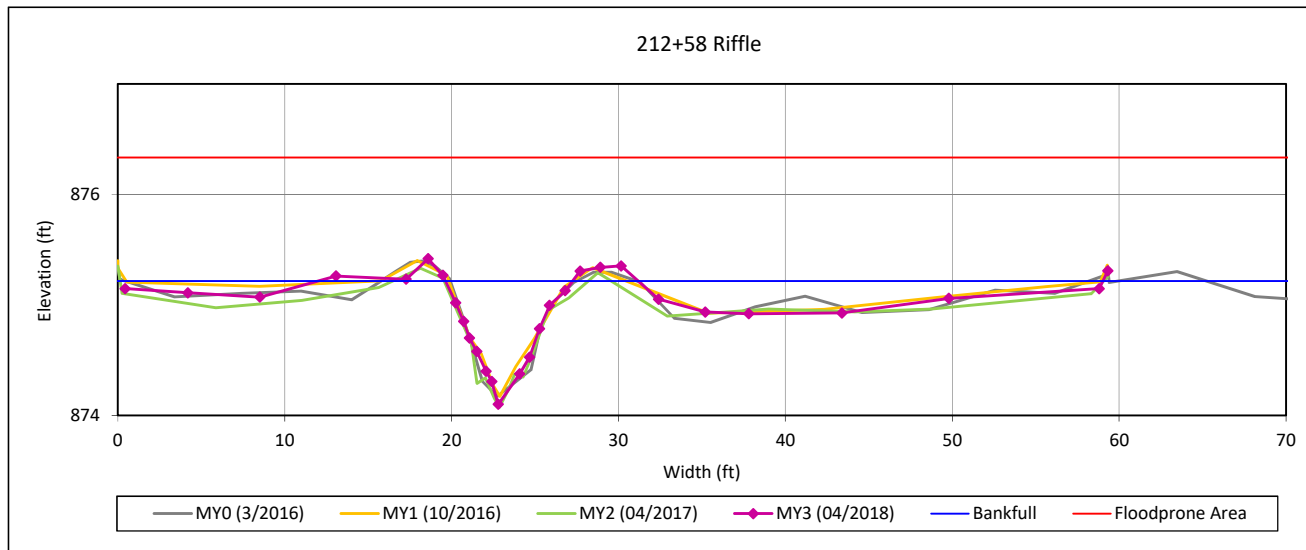


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### Cross-Section Plots

Henry Fork Mitigation Site  
NCDMS Project No. 96306  
Monitoring Year 3 - 2018

#### Cross-Section 14-UT2



#### Bankfull Dimensions

4.2	x-section area (ft.sq.)
8.8	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
9.2	wetted perimeter (ft)
0.5	hydraulic radius (ft)
18.6	width-depth ratio
58.9	W flood prone area (ft)
6.7	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2018  
Field Crew: Wildlands Engineering



View Downstream



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

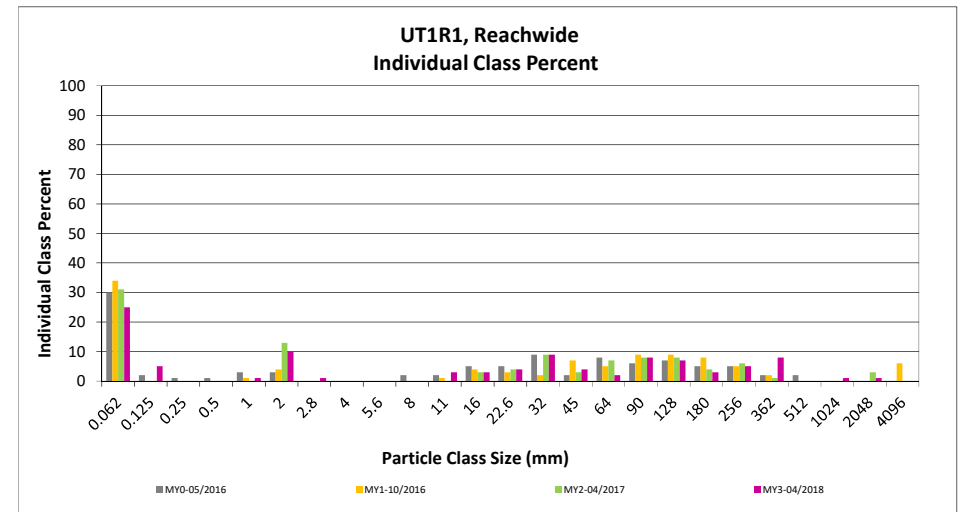
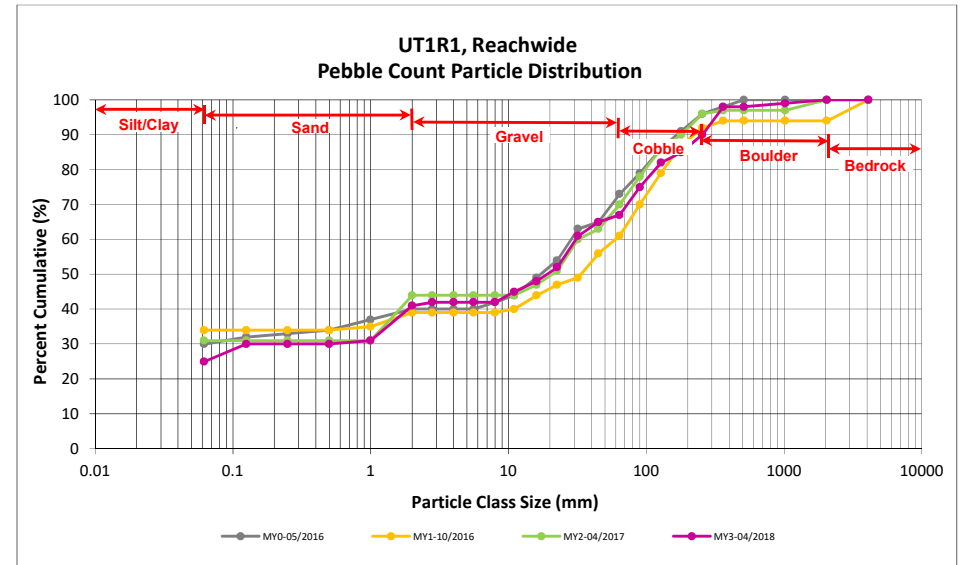
DMS Project No. 96306

Monitoring Year 3 - 2018

### UT1R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3	22	25	25	25
<b>SAND</b>	Very fine	0.062	0.125	1	4	5	5	30
	Fine	0.125	0.250					30
	Medium	0.25	0.50					30
	Coarse	0.5	1.0	1		1	1	31
	Very Coarse	1.0	2.0	3	7	10	10	41
<b>GRAVEL</b>	Very Fine	2.0	2.8		1	1	1	42
	Very Fine	2.8	4.0					42
	Fine	4.0	5.6					42
	Fine	5.6	8.0					42
	Medium	8.0	11.0	1	2	3	3	45
	Medium	11.0	16.0	1	2	3	3	48
	Coarse	16.0	22.6	2	2	4	4	52
	Coarse	22.6	32	3	6	9	9	61
	Very Coarse	32	45	3	1	4	4	65
	Very Coarse	45	64	1	1	2	2	67
<b>COBBLE</b>	Small	64	90	6	2	8	8	75
	Small	90	128	7		7	7	82
	Large	128	180	3		3	3	85
	Large	180	256	5		5	5	90
<b>BOULDER</b>	Small	256	362	8		8	8	98
	Small	362	512					98
	Medium	512	1024	1		1	1	99
	Large/Very Large	1024	2048	1		1	1	100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	1.32
D <sub>50</sub> =	19.0
D <sub>84</sub> =	160.7
D <sub>95</sub> =	317.9
D <sub>100</sub> =	2048.0



### Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

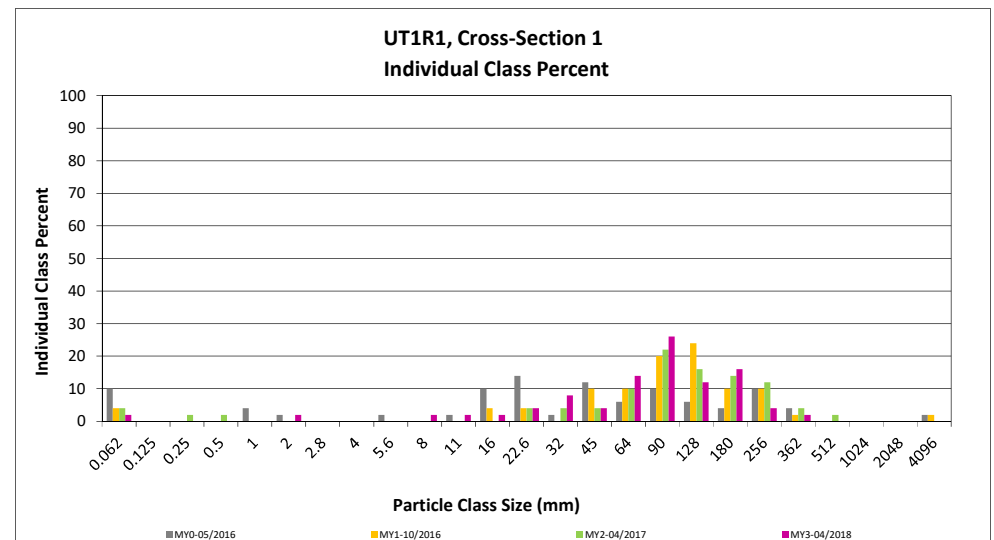
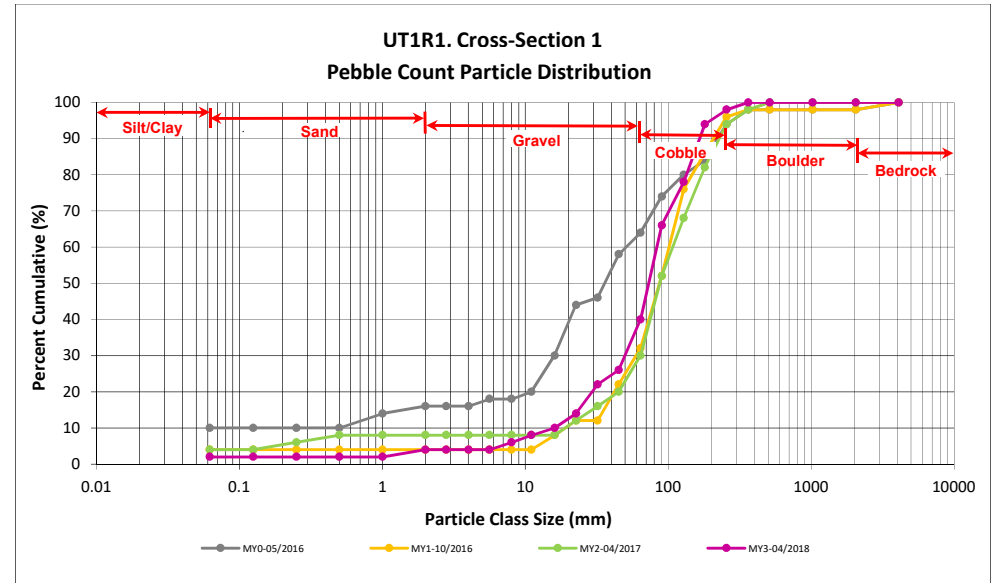
DMS Project No. 96306

Monitoring Year 3 - 2018

#### UT1R1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	2	2
<b>SAND</b>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	1	2	4
<b>GRAVEL</b>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0	1	2	6
	Medium	8.0	11.0	1	2	8
	Medium	11.0	16.0	1	2	10
	Coarse	16.0	22.6	2	4	14
	Coarse	22.6	32	4	8	22
	Very Coarse	32	45	2	4	26
Very Coarse	45	64	7	14	40	
<b>COBBLE</b>	Small	64	90	13	26	66
	Small	90	128	6	12	78
	Large	128	180	8	16	94
	Large	180	256	2	4	98
<b>BOULDER</b>	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>50</b>	<b>100</b>	<b>100</b>

Cross-Section 1	
Channel materials (mm)	
D <sub>16</sub> =	24.65
D <sub>35</sub> =	56.44
D <sub>50</sub> =	73.0
D <sub>84</sub> =	145.5
D <sub>95</sub> =	196.6
D <sub>100</sub> =	362.0





## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

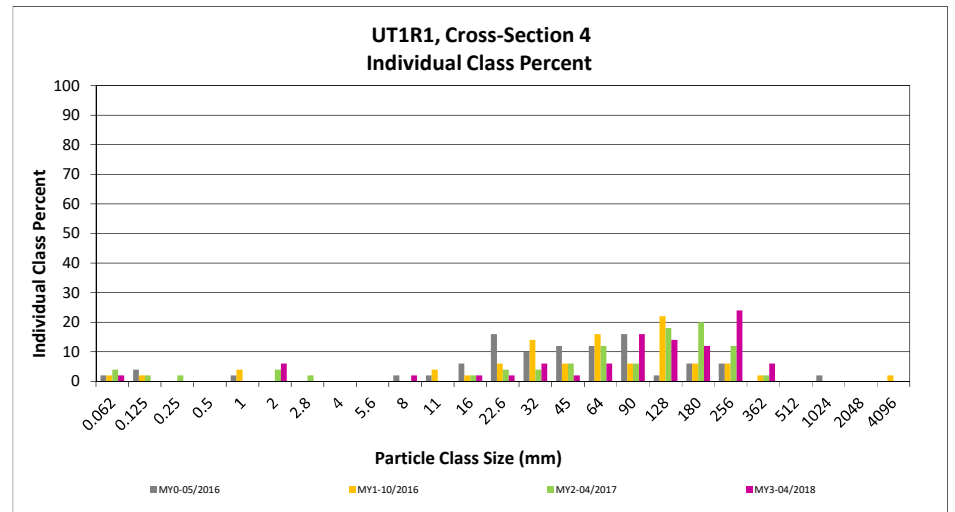
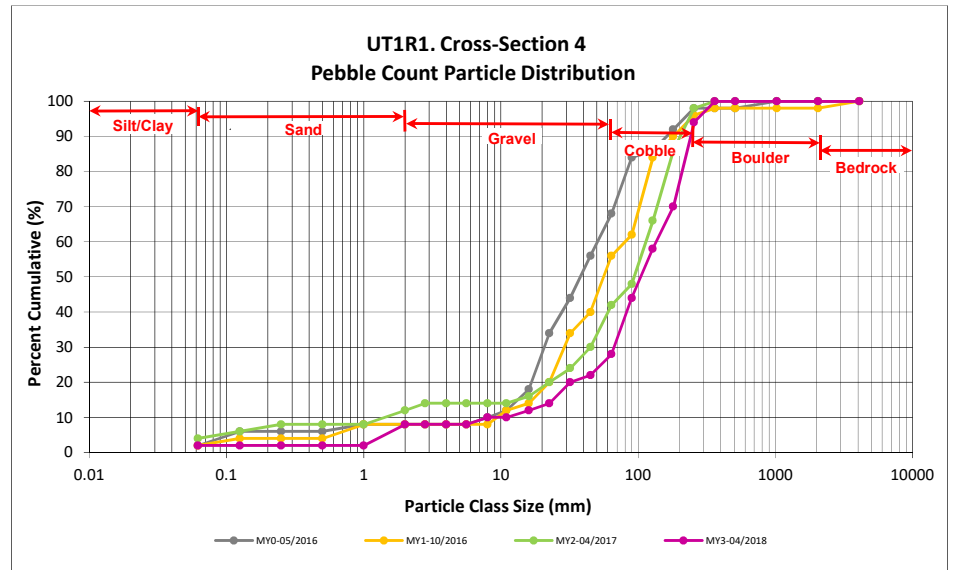
DMS Project No. 96306

Monitoring Year 3 - 2018

### UT1R1, Cross-Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	1	2	2
<b>SAND</b>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	3	6	8
<b>GRAVEL</b>	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0	1	2	10
	Medium	8.0	11.0			10
	Medium	11.0	16.0	1	2	12
	Coarse	16.0	22.6	1	2	14
	Coarse	22.6	32	3	6	20
	Very Coarse	32	45	1	2	22
	Very Coarse	45	64	3	6	28
<b>COBBLE</b>	Small	64	90	8	16	44
	Small	90	128	7	14	58
	Large	128	180	6	12	70
	Large	180	256	12	24	94
<b>BOULDER</b>	Small	256	362	3	6	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>50</b>	<b>100</b>	<b>100</b>

Cross-Section 4 Channel materials (mm)	
D <sub>16</sub> =	25.38
D <sub>35</sub> =	74.29
D <sub>50</sub> =	104.7
D <sub>84</sub> =	221.1
D <sub>95</sub> =	271.2
D <sub>100</sub> =	362.0



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

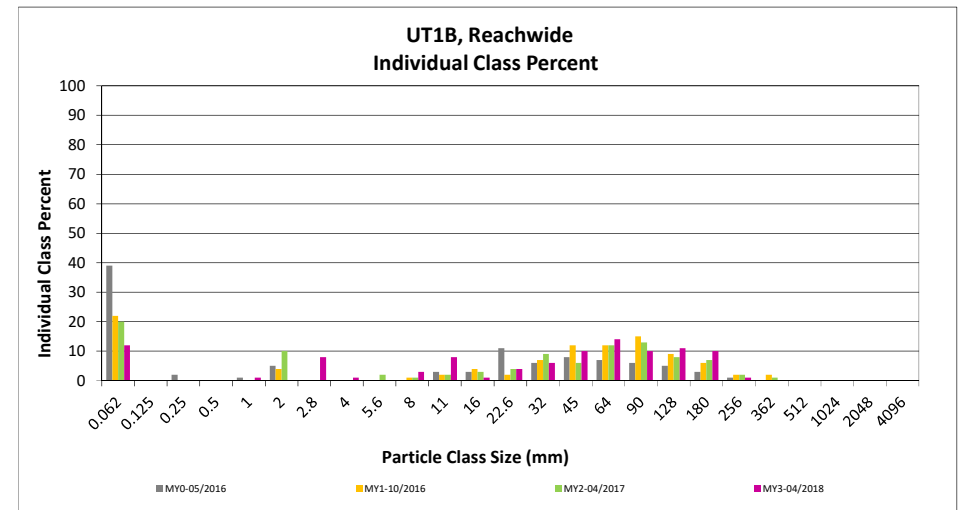
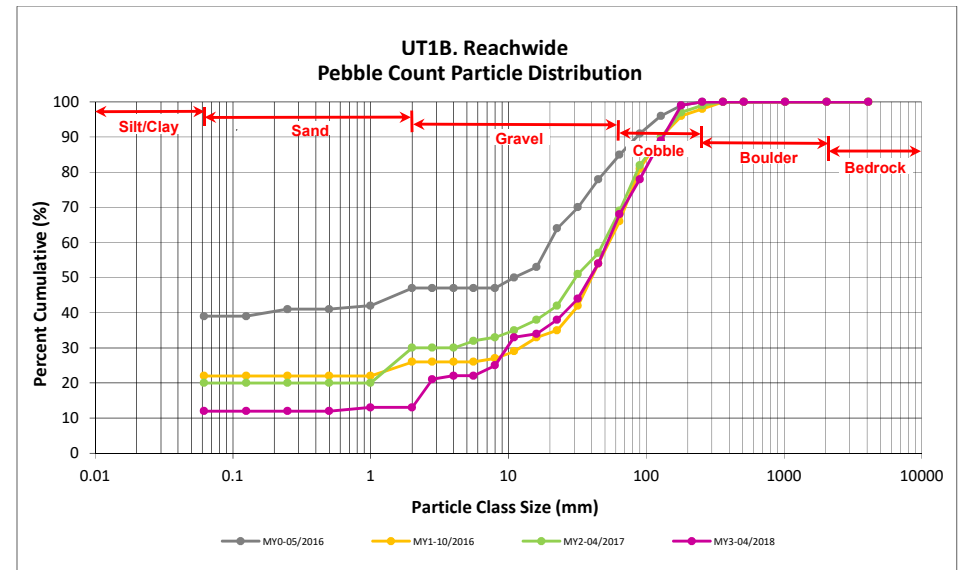
DMS Project No. 96306

Monitoring Year 3 - 2018

### UT1B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	10	12	12	12
<b>SAND</b>	Very fine	0.062	0.125					12
	Fine	0.125	0.250					12
	Medium	0.25	0.50					12
	Coarse	0.5	1.0		1	1	1	13
	Very Coarse	1.0	2.0					13
<b>GRAVEL</b>	Very Fine	2.0	2.8		8	8	8	21
	Very Fine	2.8	4.0		1	1	1	22
	Fine	4.0	5.6					22
	Fine	5.6	8.0		3	3	3	25
	Medium	8.0	11.0	2	6	8	8	33
	Medium	11.0	16.0		1	1	1	34
	Coarse	16.0	22.6	1	3	4	4	38
	Coarse	22.6	32	2	4	6	6	44
	Very Coarse	32	45	2	8	10	10	54
	Very Coarse	45	64	11	3	14	14	68
<b>COBBLE</b>	Small	64	90	9	1	10	10	78
	Small	90	128	10	1	11	11	89
	Large	128	180	10		10	10	99
	Large	180	256	1		1	1	100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	2.27
D <sub>35</sub> =	17.44
D <sub>50</sub> =	39.3
D <sub>84</sub> =	109.1
D <sub>95</sub> =	157.1
D <sub>100</sub> =	256.0





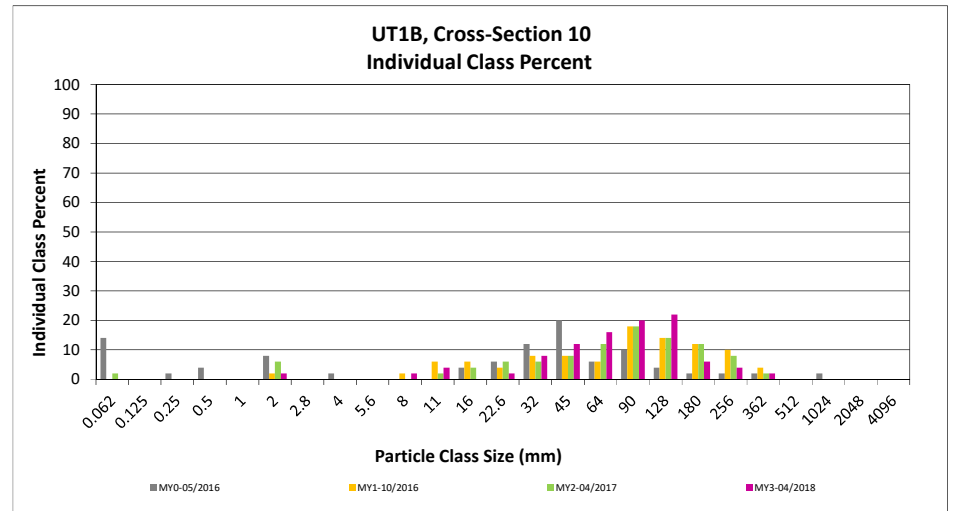
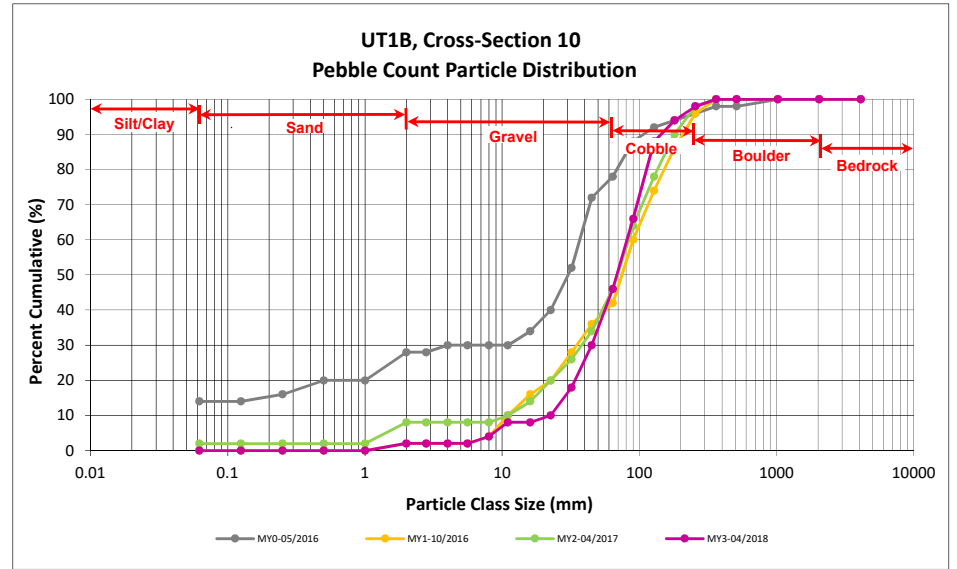
**Reachwide and Cross-Section Pebble Count Plots**

Henry Fork Stream Mitigation  
 DMS Project No. 96306  
 Monitoring Year 3 - 2018

**UT1B, Cross-Section 10**

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	1	2	2
<b>GRAVEL</b>	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0	1	2	4
	Medium	8.0	11.0	2	4	8
	Medium	11.0	16.0			8
	Coarse	16.0	22.6	1	2	10
	Coarse	22.6	32	4	8	18
	Very Coarse	32	45	6	12	30
	Very Coarse	45	64	8	16	46
<b>COBBLE</b>	Small	64	90	10	20	66
	Small	90	128	11	22	88
	Large	128	180	3	6	94
	Large	180	256	2	4	98
<b>BOULDER</b>	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>50</b>	<b>100</b>	<b>100</b>

Cross-Section Channel materials (mm)	
D <sub>16</sub> =	29.34
D <sub>35</sub> =	50.24
D <sub>50</sub> =	68.5
D <sub>84</sub> =	120.1
D <sub>95</sub> =	196.6
D <sub>100</sub> =	362.0



## **APPENDIX 5. Hydrology Summary Data and Plots**



**Table 13. Verification of Bankfull Events**

Henry Fork Mitigation Site

DMS Project No. 96306

**Monitoring Year 3 - 2018**

Reach	MY	Date of Occurrence	Method
UT1 Reach 2	MY1	N/A	Crest Gage
	MY2	4/24/2017	Crest & Stream Gage
		10/8/2017	Crest & Stream Gage
	MY3	2/7/2018	Stream Gage
		4/25/2018	
		5/29/2018	
		9/16/2018	
		10/11/2018	
	10/26/2018		
UT1A	MY1	U	Crest Gage
	MY2	4/24/2017	Crest & Stream Gage
		10/8/2017	Crest & Stream Gage
	MY3	10/11/2018	Stream Gage
UT1B	MY1	N/A	Crest Gage
	MY2	10/8/2017	Crest & Stream Gage
UT2	MY1	N/A	Crest Gage
	MY2	4/24/2017	Crest & Stream Gage
		2/7/2018	Stream Gage
	MY3	5/29/2018	

\* N/A, no bankfull events recorded.

\*\* U, Unknown

**Table 14. Wetland Gage Attainment Summary**

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 3 - 2018

Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)
Reference	No/18 Days (8%)	Yes/59 Days (25%)	Yes/79 Days (34%)				
1	No/0 Days (0%)	Yes/23 Days (10%)	Yes/48 Days (20%)				
2	Yes/ 29 Days (12.3%)	No/7 Days (3%)	No/12 Days (5%)				
3	Yes/236 Days (100%)	No/3 Days (1%)	No/5 Days (2%)				
4	No/3 Days (1.3%)	Yes/25 Days (11%)	Yes/46 Days (20%)				
5	N/A	Yes/189 Days (80%)	Yes/102 Days (43%)				
6	Yes/79 Days (33.5%)	Yes/89 Days (38%)	Yes/96 Days (41%)				
7	No/7 Days (3.0%)	Yes/21 Days (9%)	Yes/44 Days (19%)				
8	No/1 Days (0.4%)	No/14 Days (6%)	No/11 Days (5%)				
9	N/A	No/13 Days (6%)	Yes/20 Days (9%)				

N/A, not applicable

Growing season dates March 20 - November 11

Success criteria is 20 consecutive days

GWGs 5 and 9 were installed April 7, 2017.

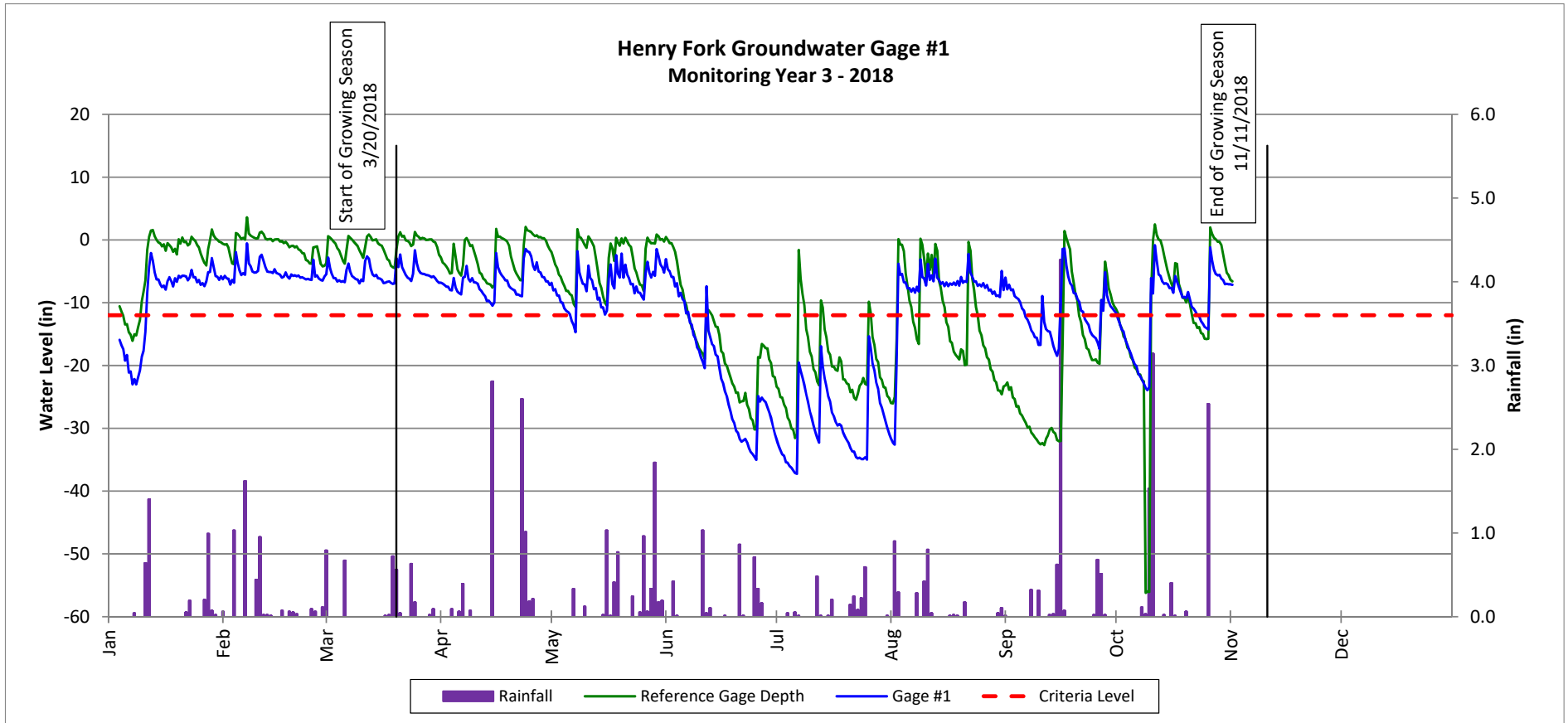
GWG 3 was relocated January 2017.



### Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

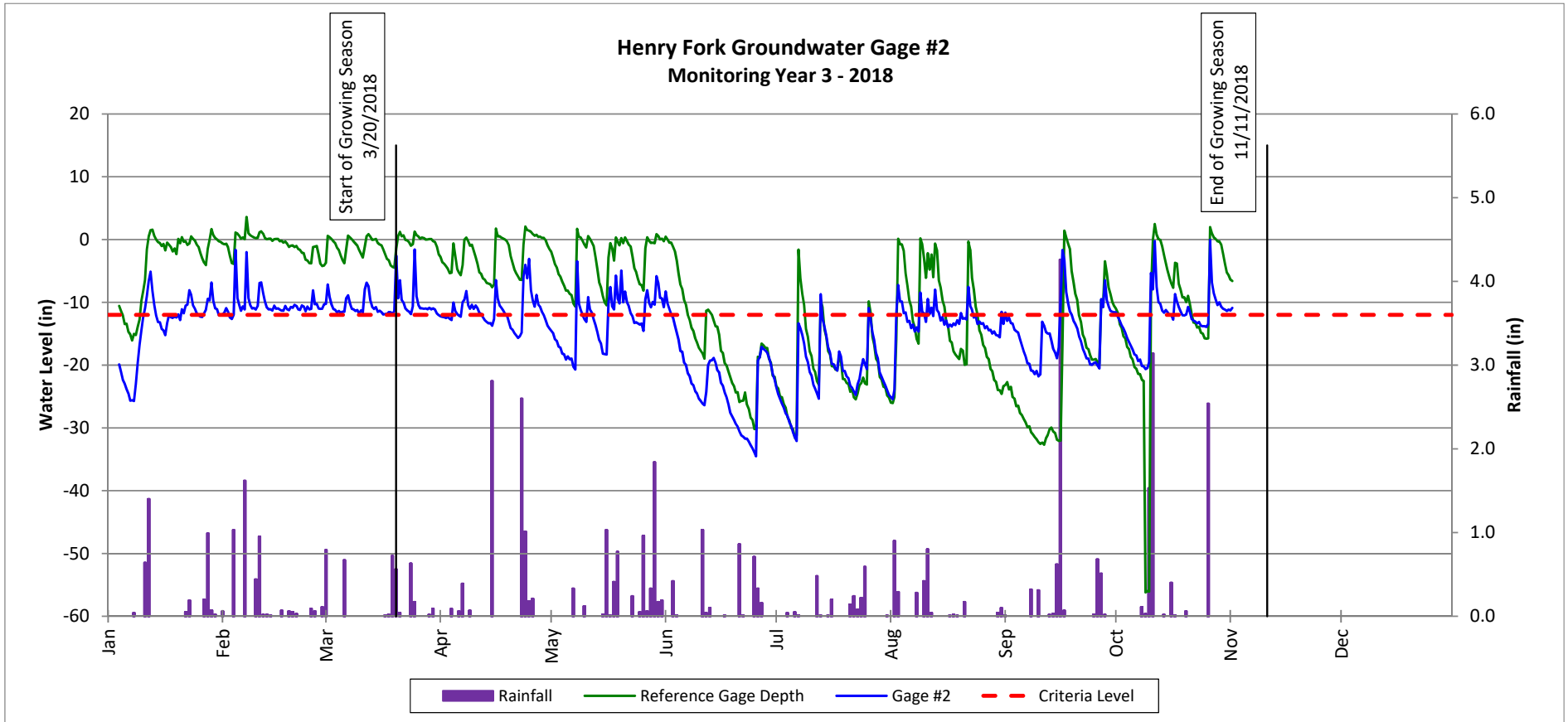
Monitoring Year 3 - 2018



## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

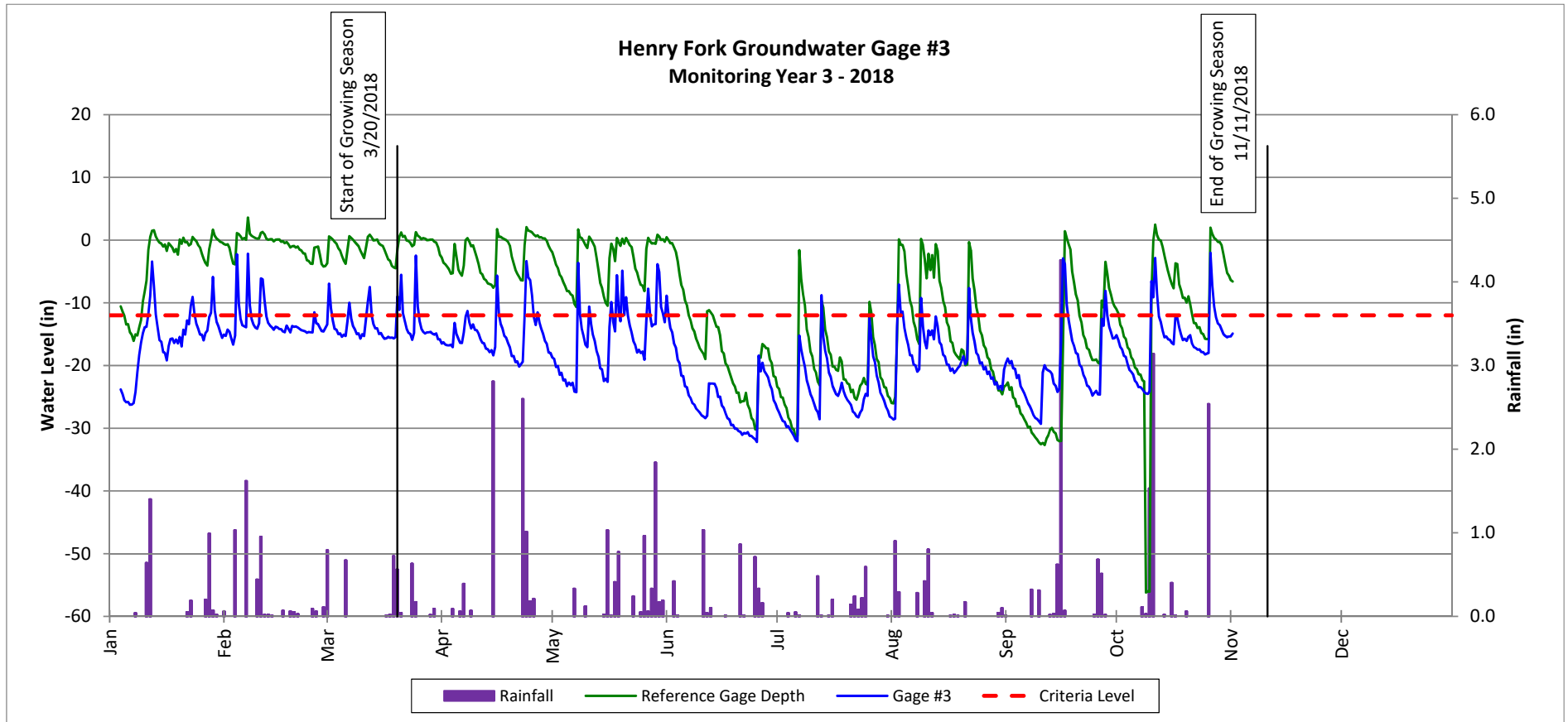




## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

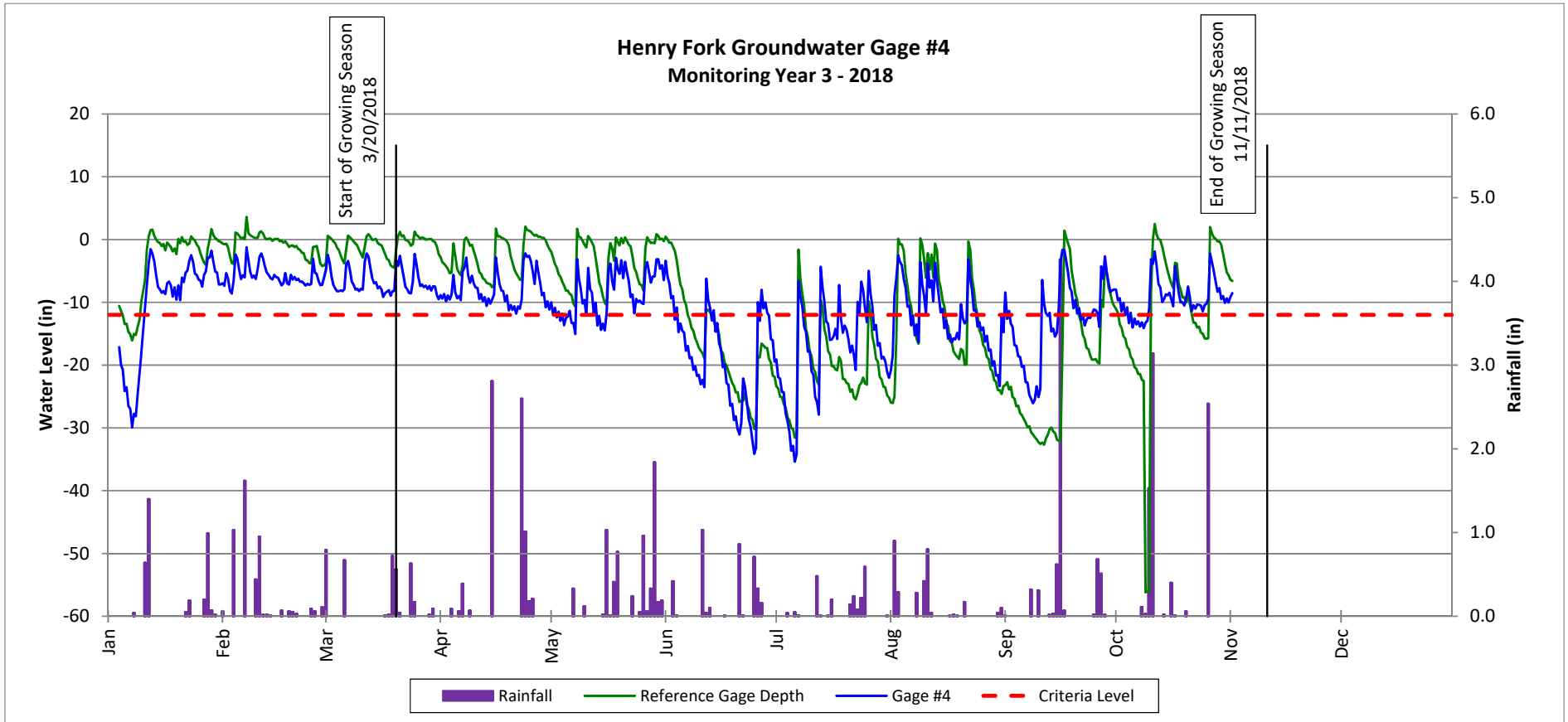
Monitoring Year 3 - 2018



## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

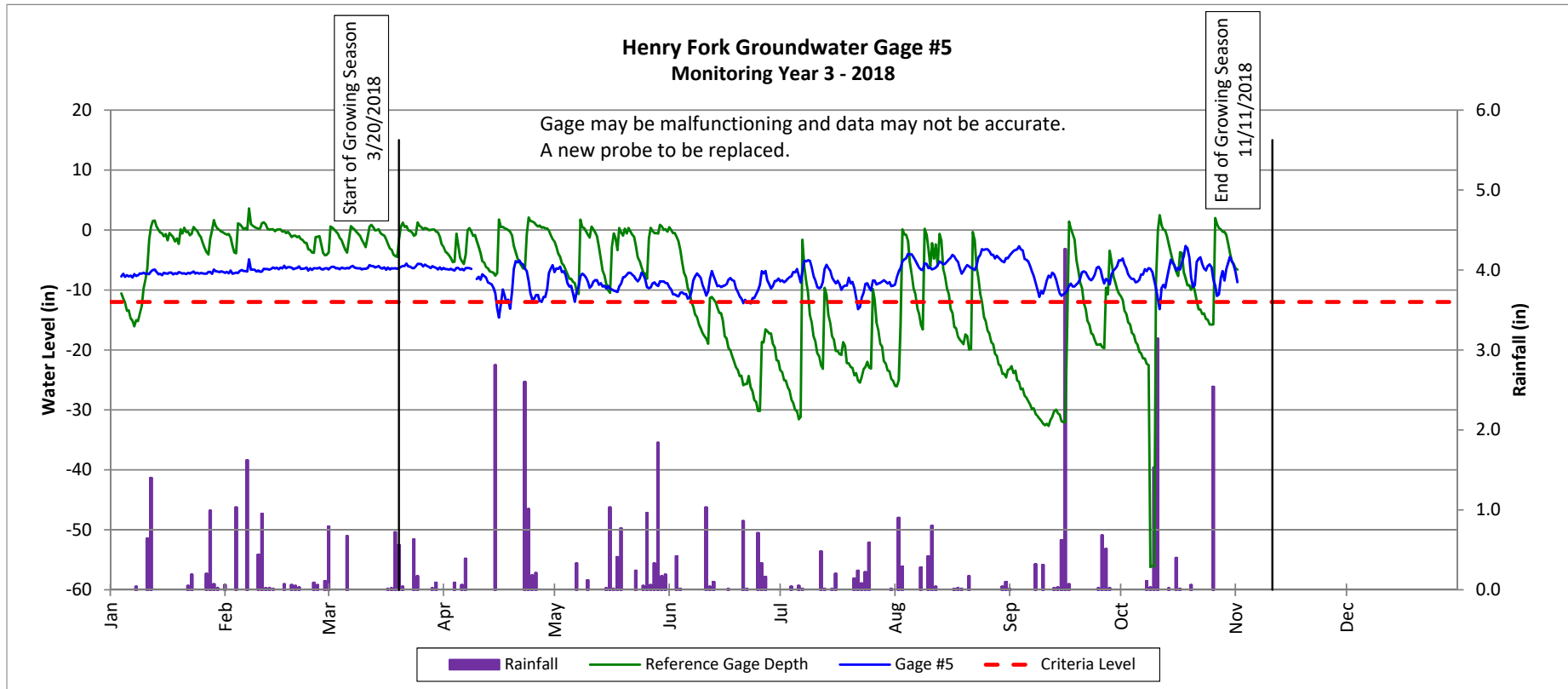




## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

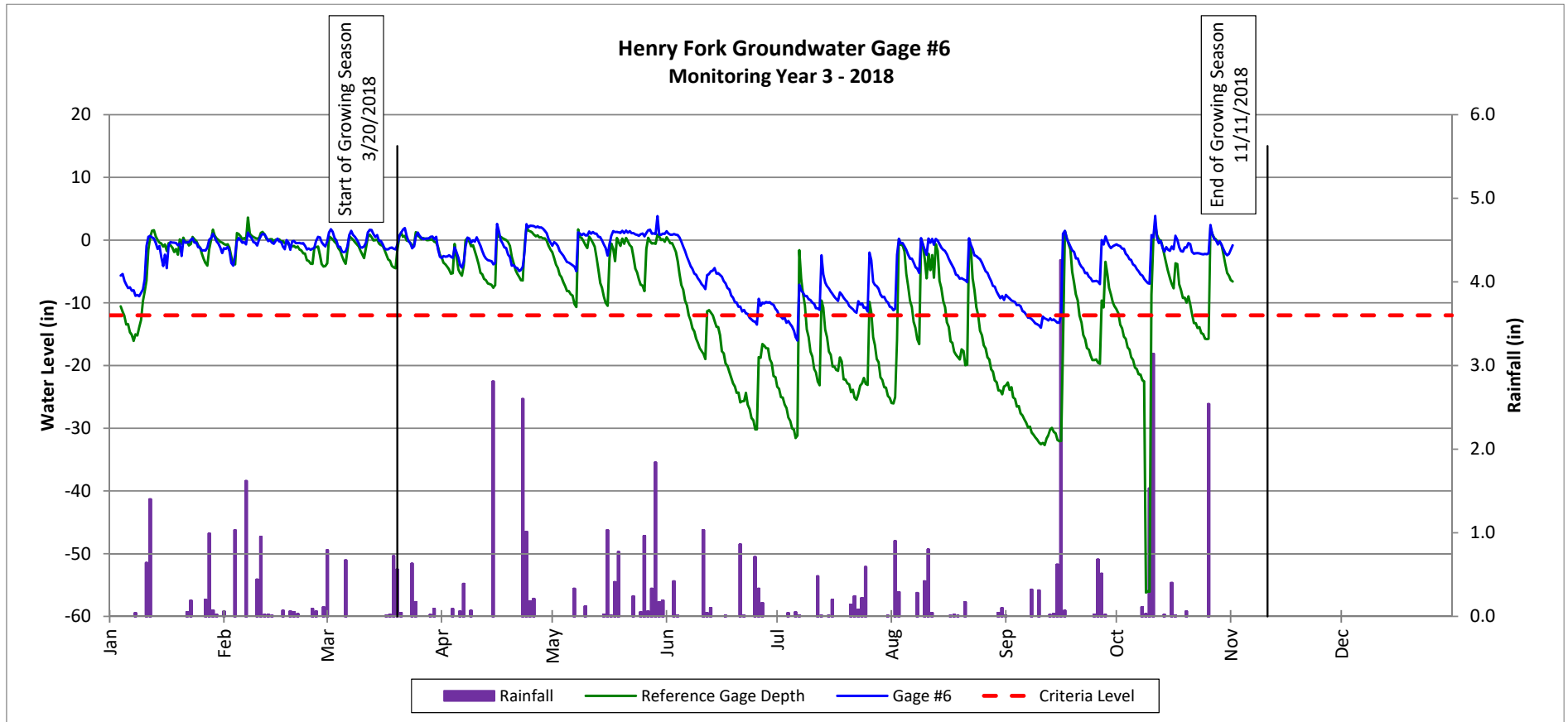
Monitoring Year 3 - 2018



## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

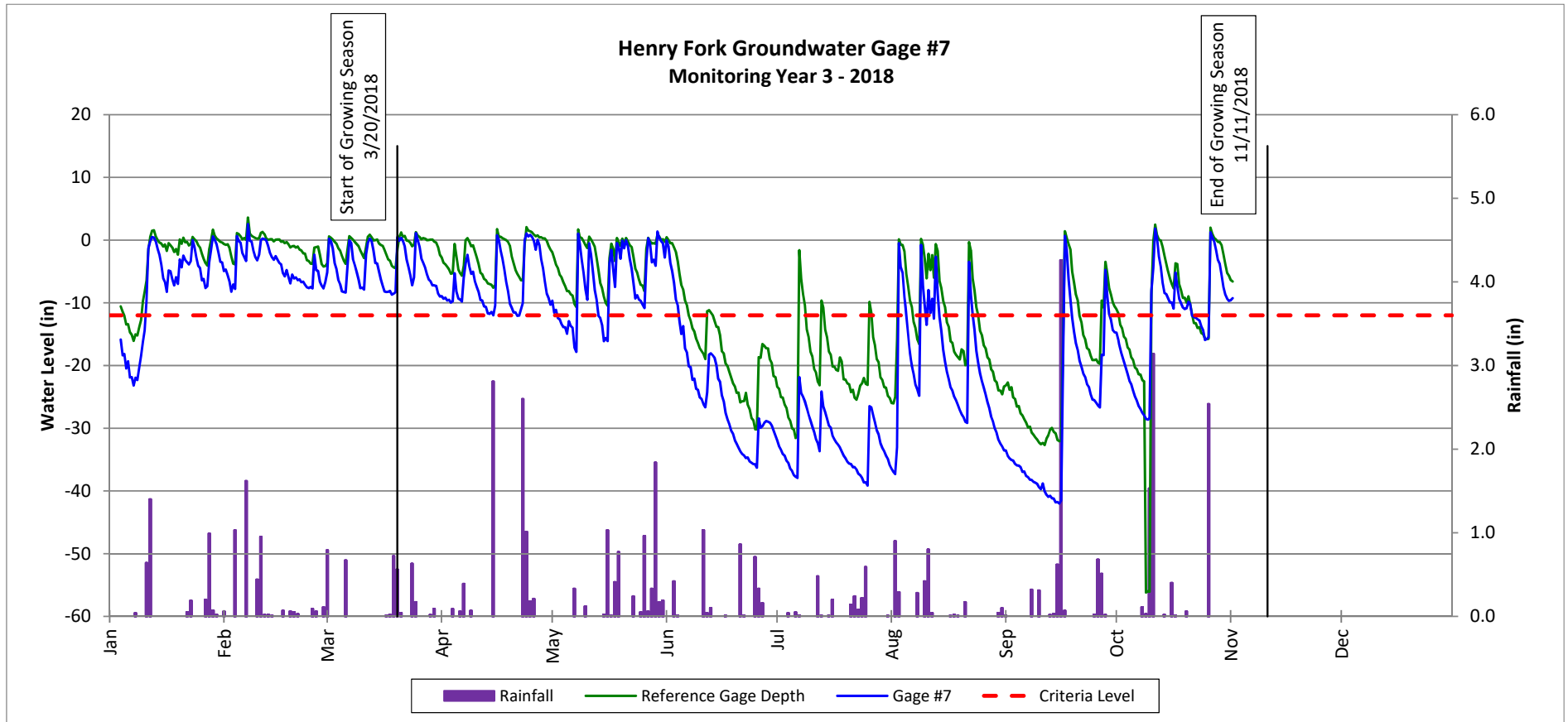




## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

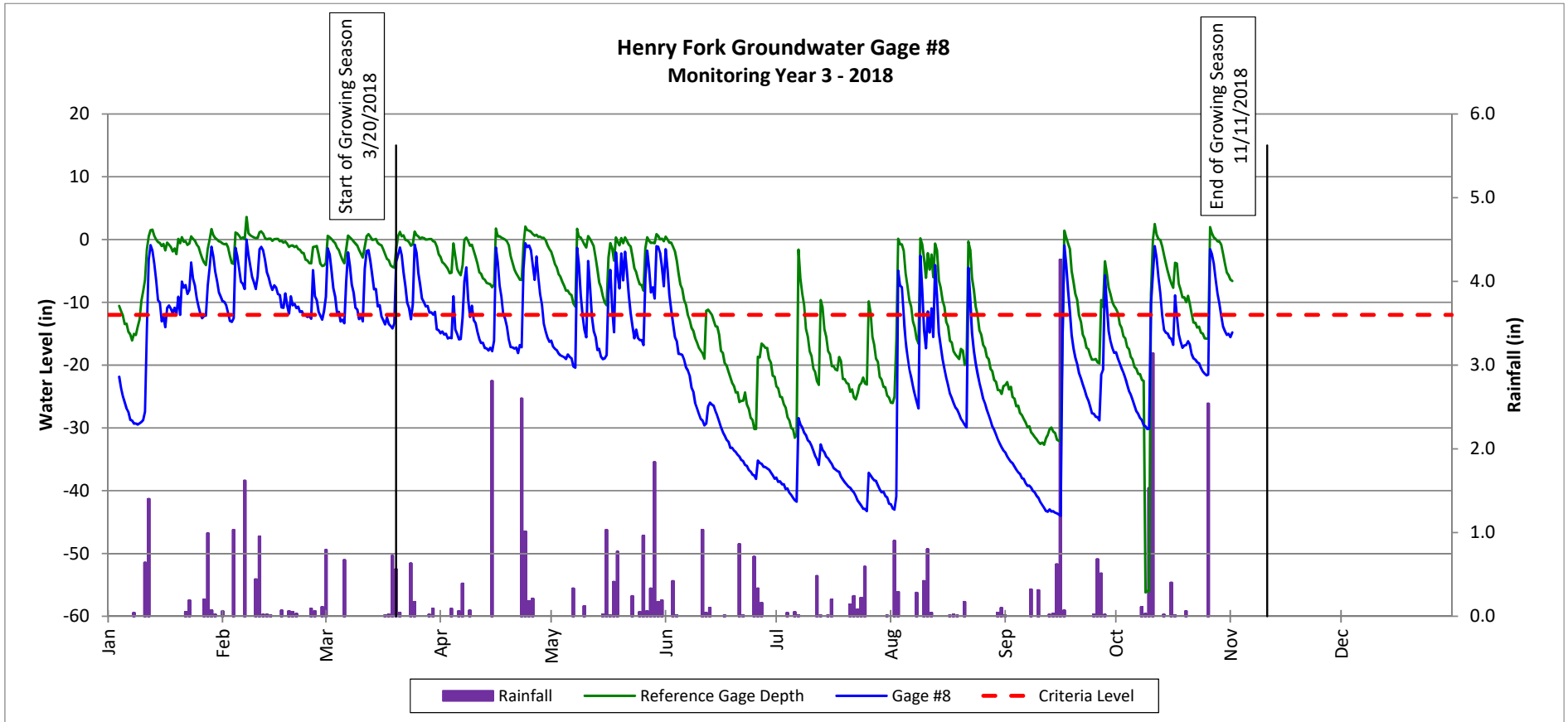
Monitoring Year 3 - 2018



## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

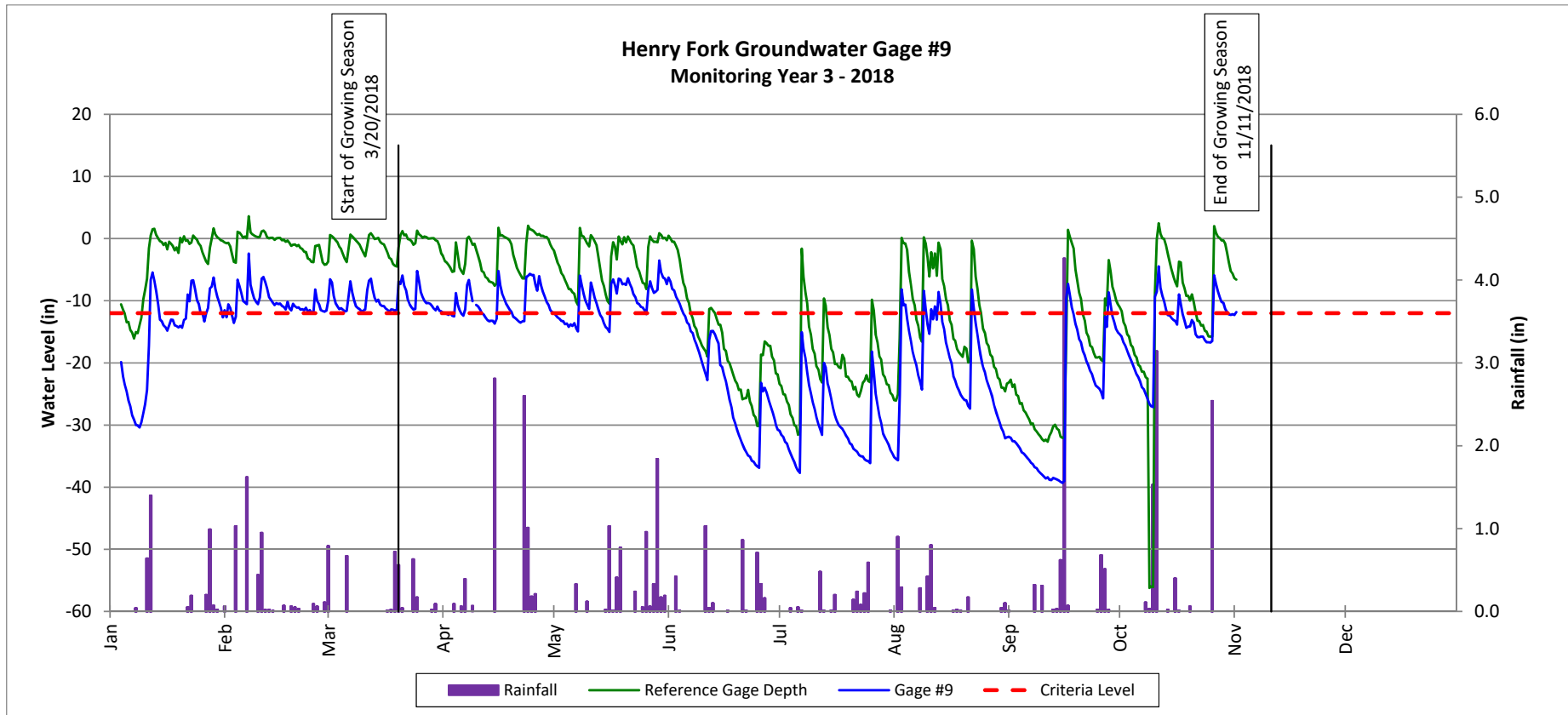




## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

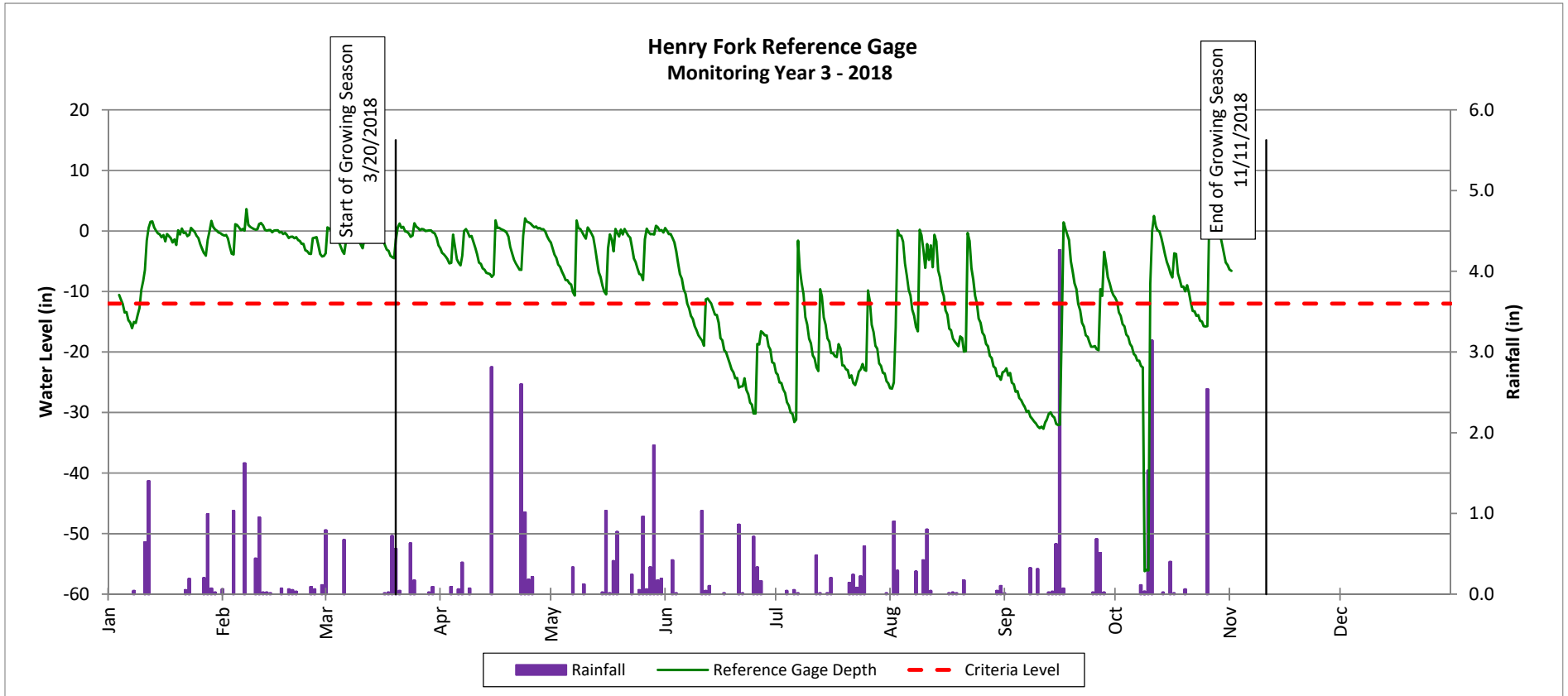


## Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

### Monitoring Year 3 - 2018

Wetland Number

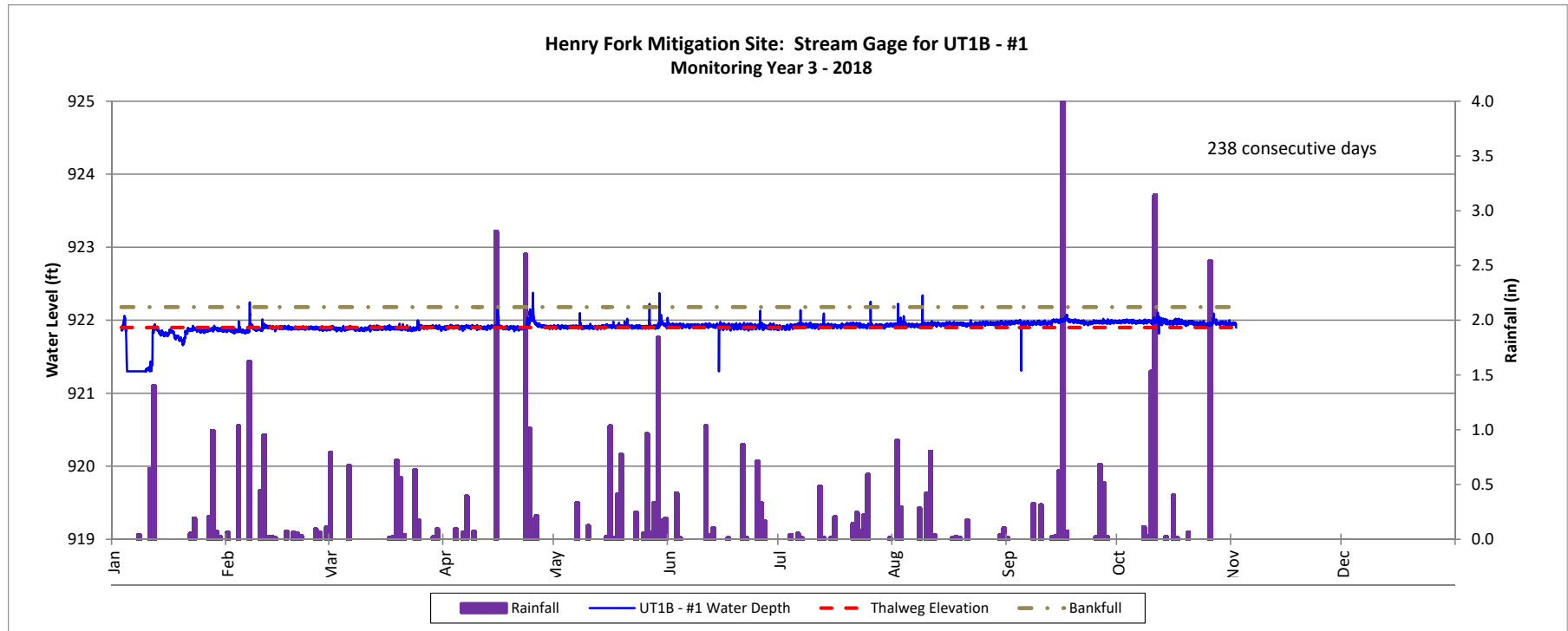




### Recorded Stream Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

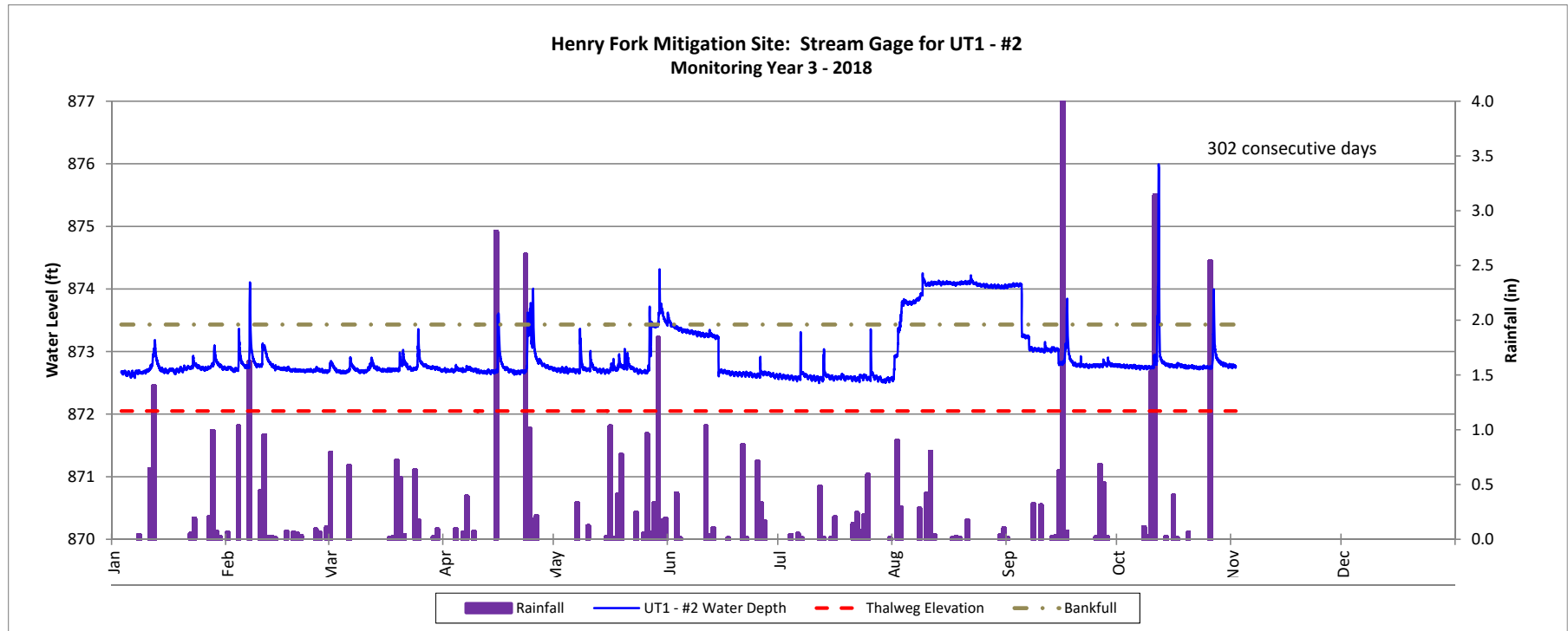
Monitoring Year 3 - 2018



### Recorded Stream Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018

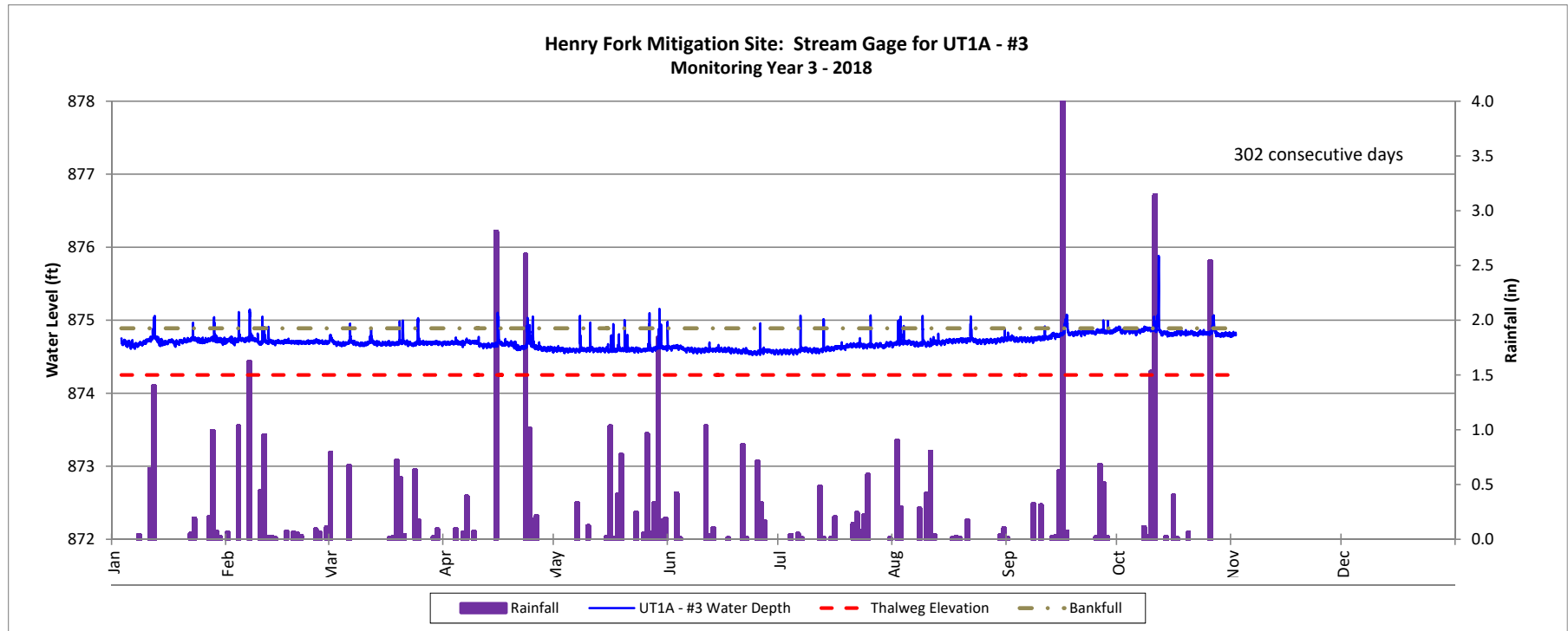




### Recorded Stream Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

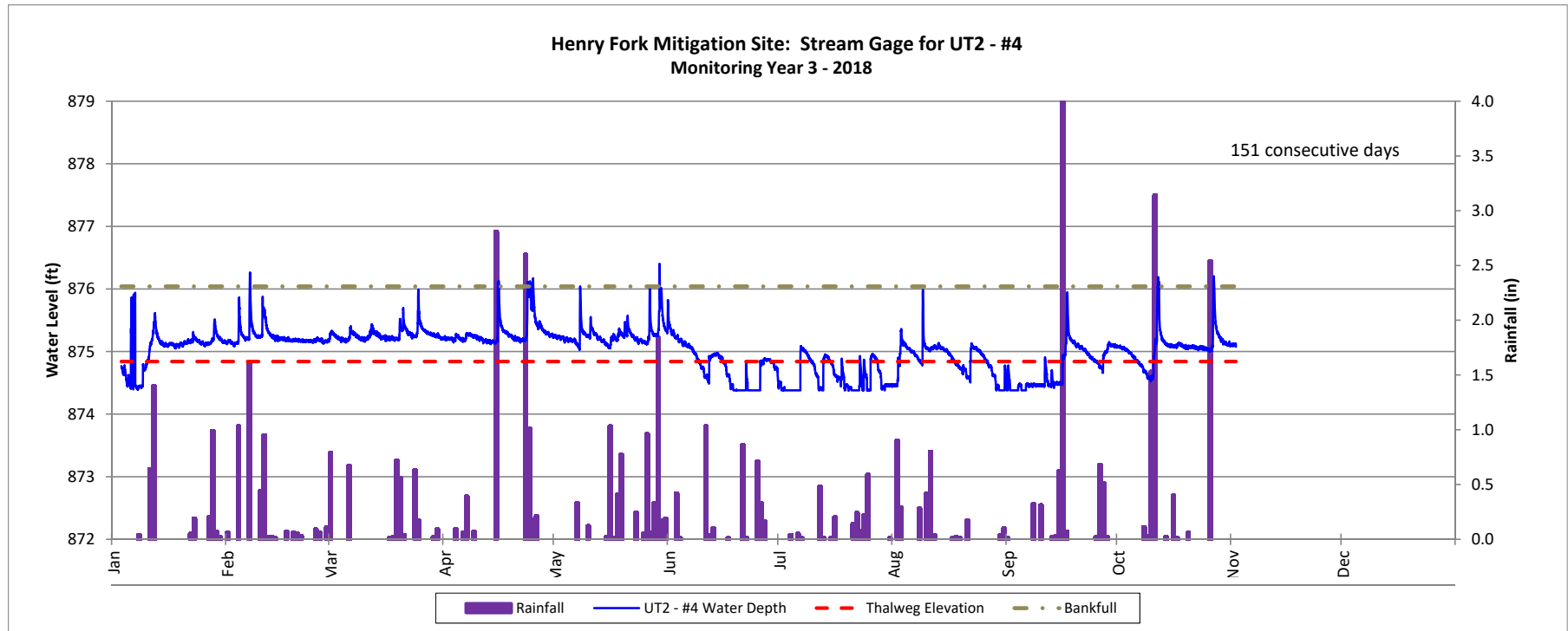
Monitoring Year 3 - 2018



### Recorded Stream Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 3 - 2018



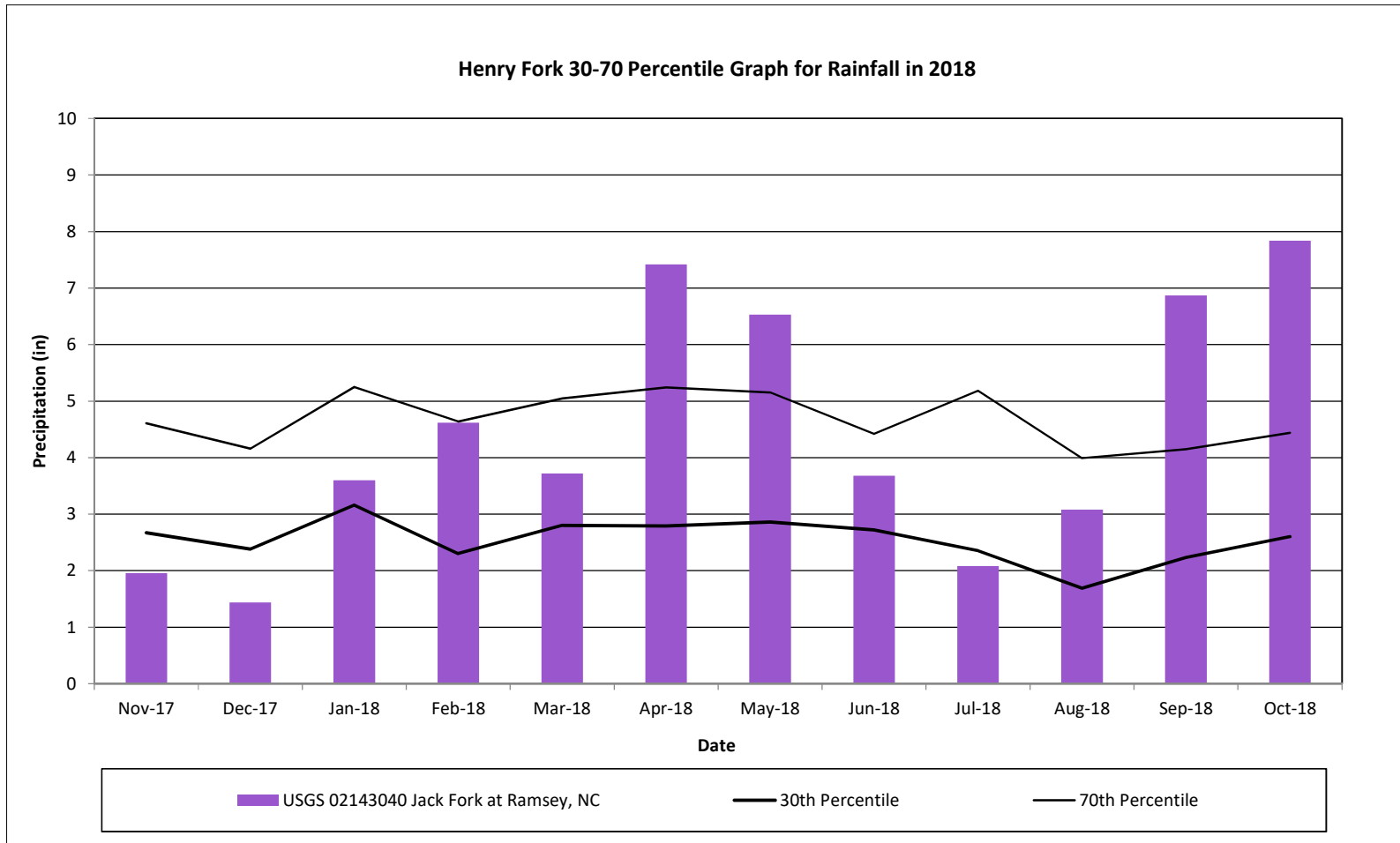


## Monthly Rainfall Data

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 3 - 2018



<sup>1</sup> 2018 rainfall collected by USGS 02143040 Jacob Fork at Ramsey, NC

<sup>2</sup> 30th and 70th percentile rainfall data collected from WETS station Conover Oxford Shoal, NC