MONITORING YEAR 2 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 2017 - November 2017
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PREPARED FOR:

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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 2 (MY2) assessments and site visits were completed between April and November 2017 to assess the conditions of the project. Overall, the Site has met the required stream and vegetation success criteria for MY2, and is on track to meet wetland hydrologic success criteria. All restored and enhanced streams are stable and functioning as designed.

Four automated and manual crest gages were installed on the Site to document bankfull events. Each stream and manual crest gage recorded a bankfull event. Vegetation assessment indicates that overall average stem density for the Site is 594 stems per acre, and is therefore on track to meet the MY3 requirement of 320 stems per acre. Of the nine groundwater monitoring gages installed within the wetland rehabilitation and re-establishment zones, five met the success criteria (water table with 12 inches of the ground surface for 8.5% of the growing season consecutively). GWGs 5 and 9 were

installed April 7, 2017 and the data is also being included. It is anticipated that 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.

HENRY FORK MITIGATION SITE

Monitoring Year 2 Annual Report

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APPENDICES

Section 1: PROJECT OVERVIEW

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 2 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY2 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 MY2 were conducted in April 2017. 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, UT1 and UT1A each had two bankfull events recorded during MY2. UT1B and UT2 only had one recorded bankfull event during MY2. During MY1, there was only one recorded bankfull event on UT1A; 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 in 2017 was consistently low throughout the year, but especially during the winter months, which resulted in low flow or the absence of water in streams. UT1 and UT1A were observed with water during each site visit; however, UT2 and UT1B were frequently observed dry. Refer to Appendix 5 for hydrology summary data and plots.

1.2.3 Stream Areas of Concerns

During a site walk, Wildlands and the Inter-Agency Review Team (IRT) observed an area located between stations 104+00-105+00 of UT1 Reach 1 where water flows subsurface. This area has been monitored during quarterly visits to understand the issue which is likely related to prior golf course water management efforts, and remedial maintenance efforts are scheduled for December 2017 to attempt to resolve the matter.

1.2.4 Vegetative Assessment

Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008). 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.

The MY2 vegetative survey was completed in July 2017. The 2017 vegetation monitoring resulted in an average stem density of 594 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 2.4 feet. All 15 of the 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.

1.2.5 Vegetation Areas of Concern

Invasive species including Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and multiflora rose (*Rosa multiflora*) were present along the northern edge and southern end of the Site. These areas were treated in accordance with the herbicide application rates used in cut/spray techniques during MY2 and will be monitored in future years. These species are not impacting survival rates of planted stems.

Several areas located on the lower portion of the site 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; however, the establishment of vegetation is common and typically occurs by MY2 or MY3 once the ground has been able to acclimate to the recent ground disturbance. These areas were addressed during the fall of MY2 with an additional seeding and fertilizing application, and subsequent new growth was observed during the November site visit.

The minor mowing encroachments of the easement has continued along the eastern edge of UT1 Reach 1, as shown in the CCPV (Appendix 2). The adjacent landowner has been notified that the activities are in violation of the easement.

1.2.6 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) and a rain gage were also installed on the Site. 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.

Historical growing season data is not available for Catawba County. Therefore, the growing season from Burke County, which runs from March 20th to November 11th (236 days), is being used for hydrologic success. The final performance standard (success criteria) 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, five met the success criteria for MY2. Of the gages that met, the measured hydroperiod ranged from 6% to 80% of the growing season. The relocated GWG 3 did not meet criteria during the MY2 period. The GWG 3 hydrology was below the reference gage for a majority of the year; however, the hydrology reflected improvement during the later portion of the growing season. Refer to the CCPV in Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology summary data and plots.

1.2.7 Adaptive Management Plan

Quarterly site visits will continue to address any areas of concern. If necessary, future adaptive management will be implemented to improve herbaceous cover, treatment and control of invasive plants, and remedial action to resolve stream issues.

1.3 Monitoring Year 2 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 MY2 success criteria as depicted in the CCPV. Invasive species are being treated as prescribed in the mitigation plan. Of the nine GWGs, five met the success criteria for MY2. It is anticipated that gages will meet hydrologic

success criteria in the upcoming monitoring years as precipitation normalizes. Two bankfull events were documented on UT1 and UT1A and one bankfull event was recorded on UT1B and UT2 during MY2. 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

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

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.

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.

Lee, M.T., Peet, R.K., S.D., Wentworth, T.R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Retrieved from http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-5.pdf.

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

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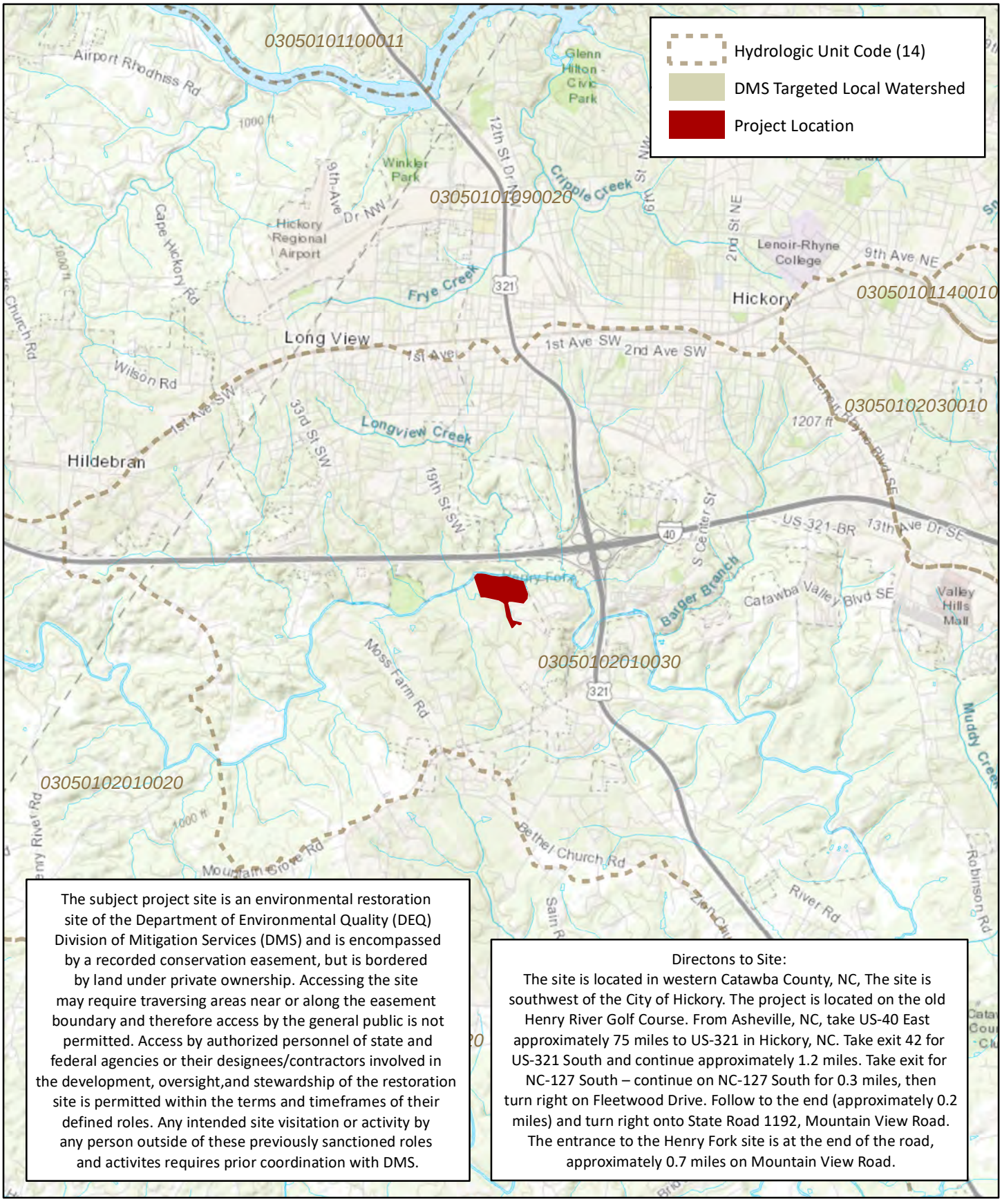
United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey. 1998. North Carolina Geology. http://www.geology.enr.state.nc.us/usgs/carolina.htm

Wildlands Engineering, Inc (2015). Henry Fork Mitigation Site Mitigation Plan. NCEEP, Raleigh, NC.

APPENDIX 1. Figures and Tables



The subject project site is an environmental restoration site of the Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight,and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

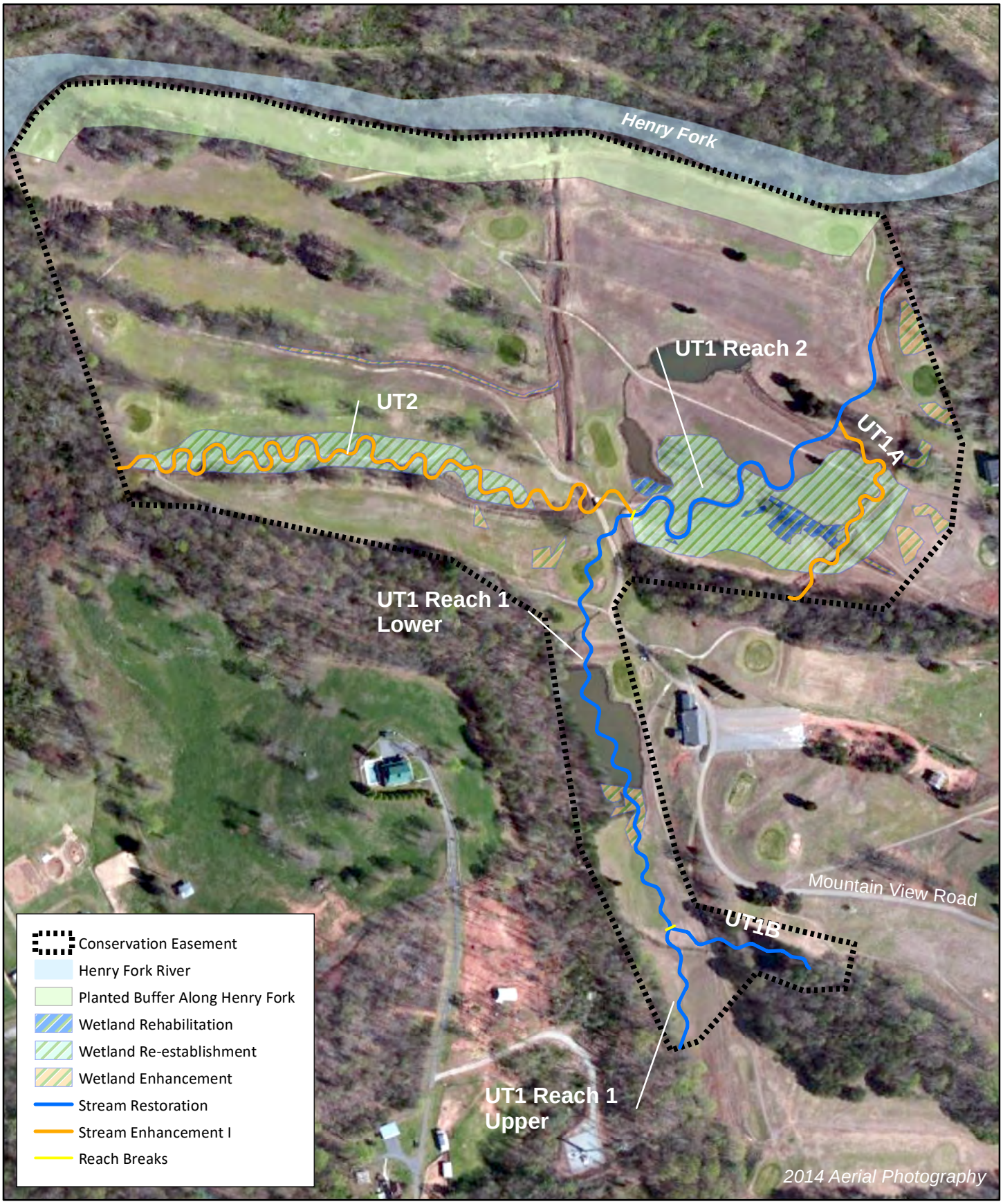
Directons to Site:
The site is located in western Catawba County, NC, The site is southwest of the City of Hickory. The project is located on the old Henry River Golf Course. From Asheville, NC, take US-40 East approximately 75 miles to US-321 in Hickory, NC. Take exit 42 for US-321 South and continue approximately 1.2 miles. Take exit for NC-127 South – continue on NC-127 South for 0.3 miles, then turn right on Fleetwood Drive. Follow to the end (approximately 0.2 miles) and turn right onto State Road 1192, Mountain View Road. The entrance to the Henry Fork site is at the end of the road, approximately 0.7 miles on Mountain View Road.

WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1 Vicinity Map
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017
Catawba County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

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Figure 2 Project Component/Asset Map
Henry fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC

Table 1. Project Components and Mitigation Credits

Henry Fork Mitigation Site
DMS Project No.96306
Monitoring Year 2 - 2017

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	4,808	N/A	3.88	0.34	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)*
STREAMS							
UT1 Reach 1 Upper	100+00 to 103+02	1,392	P1	Restoration	302	1:1	302
UT1 Reach 1 Lower	103+02 to 114+71		P1	Restoration	1,169	1:1	1,169
UT1 Reach 2	114+71 to 126+99	1,499	P1/P2	Restoration	1,228	1:1	1,228
UT1A	180+00 to 186+57	353	P1	Enhancement	657	1.5:1	438
UT1B	150+00 to 153+58	478	P1	Restoration	358	1:1	358
UT2	200+00 to 219+69	1,915	P1	Enhancement	1,969	1.5:1	1,313
WETLANDS							
Wetland 1	Floodplain near UT1 Reach 2	N/A	Planting, hydrologic improvement	Re-establishment	2.48	1:1	2.48
Wetland 2	Floodplain near UT2	N/A	Planting, hydrologic improvement	Re-establishment	1.23	1:1	1.23
Wetland A	Floodplain between UT1 Reach 2 and UT1A	0.18	Planting, hydrologic improvement	Rehabilitation	0.18	1.5:1	0.12
Wetland B	Floodplain between UT1 Reach 2 and UT1A	0.01	Planting, hydrologic improvement	Rehabilitation	0.013	1.5:1	0.01
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	0.01
Wetland H	East hillslope near UT1A	0.06	Planting	Enhancement	0.06	2:1	0.03
Wetland I	East hillslope near UT1A	0.08	Planting	Enhancement	0.08	2:1	0.04
Wetland J	East hillslope near UT1 Reach 2	0.04	Planting	Enhancement	0.04	2:1	0.02
Wetland K	East hillslope near UT1 Reach 2	0.06	Planting	Enhancement	0.06	2:1	0.03
Wetland M	East hillslope near UT1 Reach 2	0.13	Planting	Enhancement	0.13	2:1	0.07
Wetland N	Floodplain towards river from UT2	0.08	Planting	Enhancement	0.08	2:1	0.04
Wetland P	Floodplain upslope of UT2	0.02	Planting	Enhancement	0.02	2:1	0.01
Wetland Q	Floodplain upslope of UT2	0.07	Planting	Enhancement	0.07	2:1	0.03
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	0.04
Wetland S	UT1 Reach 1 Valley (Pond 1)	0.16	Planting	Enhancement	0.13	2:1	0.07

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 ceneterlines 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 2 - 2017

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[1]		March 2016	March 2016
Permanent seed mix applied to reach/segments[1]		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	May 2016
	Vegetation Survey	March 2016	
Year 1 Monitoring	Stream Survey	October 2016	December 2016
	Vegetation Survey	September 2016	
Year 1 Beaver dam removal on UT1 Reach 2		May-September 2016	
Year 1 Invasive Species treatment		June & July 2016	
Year 2 Monitoring	Stream Survey	April 2017	December 2017
	Vegetation Survey	July 2017	
Year 2 Invasive Species Treatment		August 2017	
Year 3 Monitoring	Stream Survey	2018	December 2018
	Vegetation Survey	2018	
Year 4 Monitoring	Stream Survey	2019	December 2019
	Vegetation Survey	2019	
Year 5 Monitoring	Stream Survey	2020	December 2020
	Vegetation Survey	2020	
Year 6 Monitoring	Stream Survey	2021	December 2021
	Vegetation Survey	2021	
Year 7 Monitoring	Stream Survey	2022	December 2022
	Vegetation Survey	2022	

[1]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 2 - 2017

Designer Jake McLean, PE	**Wildlands Engineering, Inc.** 167-B Haywood Rd. Asheville, NC 28806 828.774.5547
Construction Contractor	**Land Mechanics Designs, Inc.** 780 Landmark road Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanics Designs, Inc.** 780 Landmark road Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes** **Plugs**	 **Dykes and Son Nursery** **Bruton Natural Systems, Inc** **Wetland Plants, Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
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 2 - 2017

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

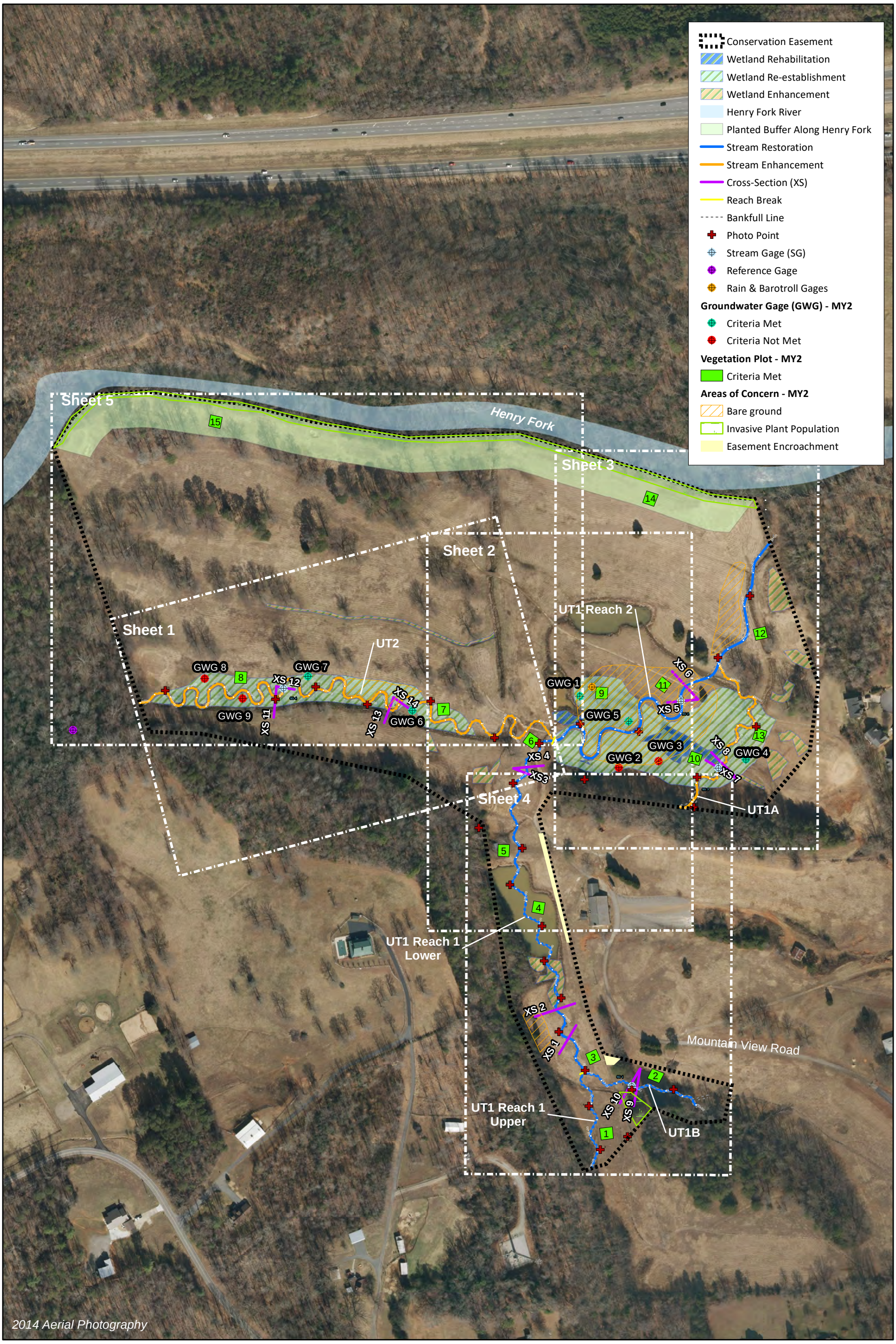
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Inner Piedmont
River Basin	Catawba
USGS Hydrologic Unit 8-digit	03050102 (Expanded Service Area for 03050103)
USGS Hydrologic Unit 14-digit	03050102010030
DWR Sub-basin	03-08-35
Project Drainage Area (acres)	178
Project Drainage Area Percentage 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 Desription (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



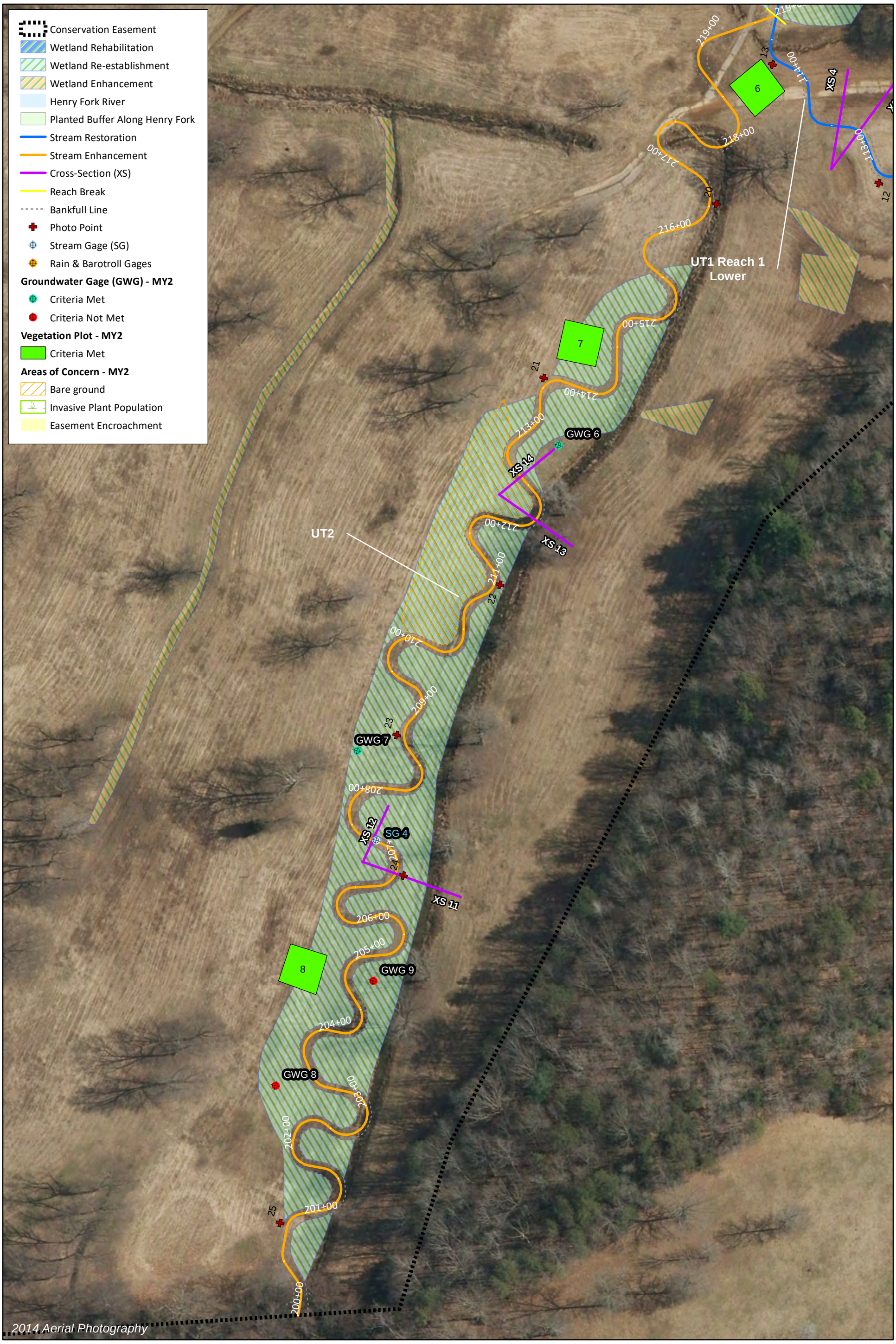
WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 3.0 Integrated Current Condition Plan View (KEY)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

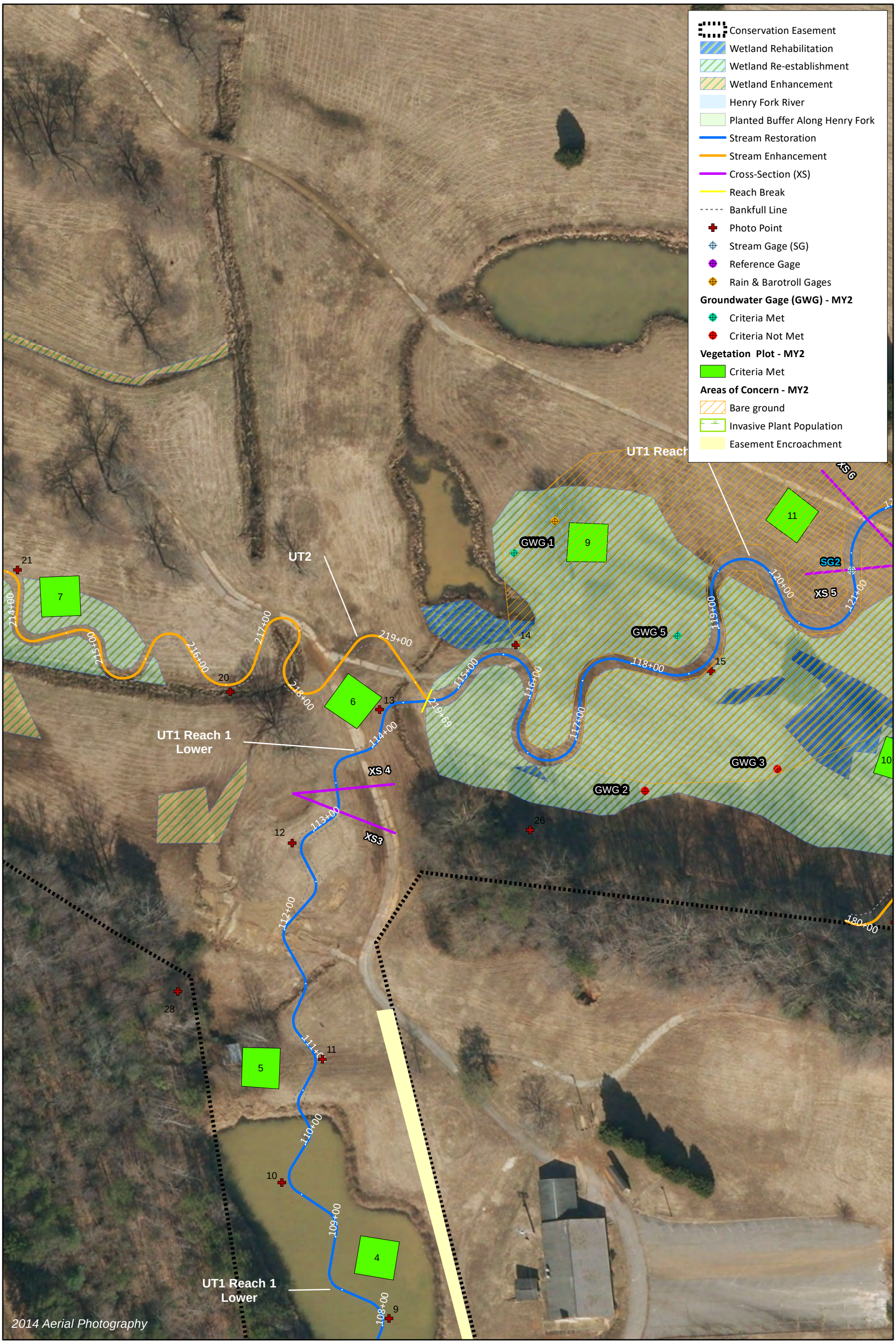
Catawba County, NC



0 75 150 Feet

Figure 3.1 Integrated Current Condition Plan View (Sheet 1)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC



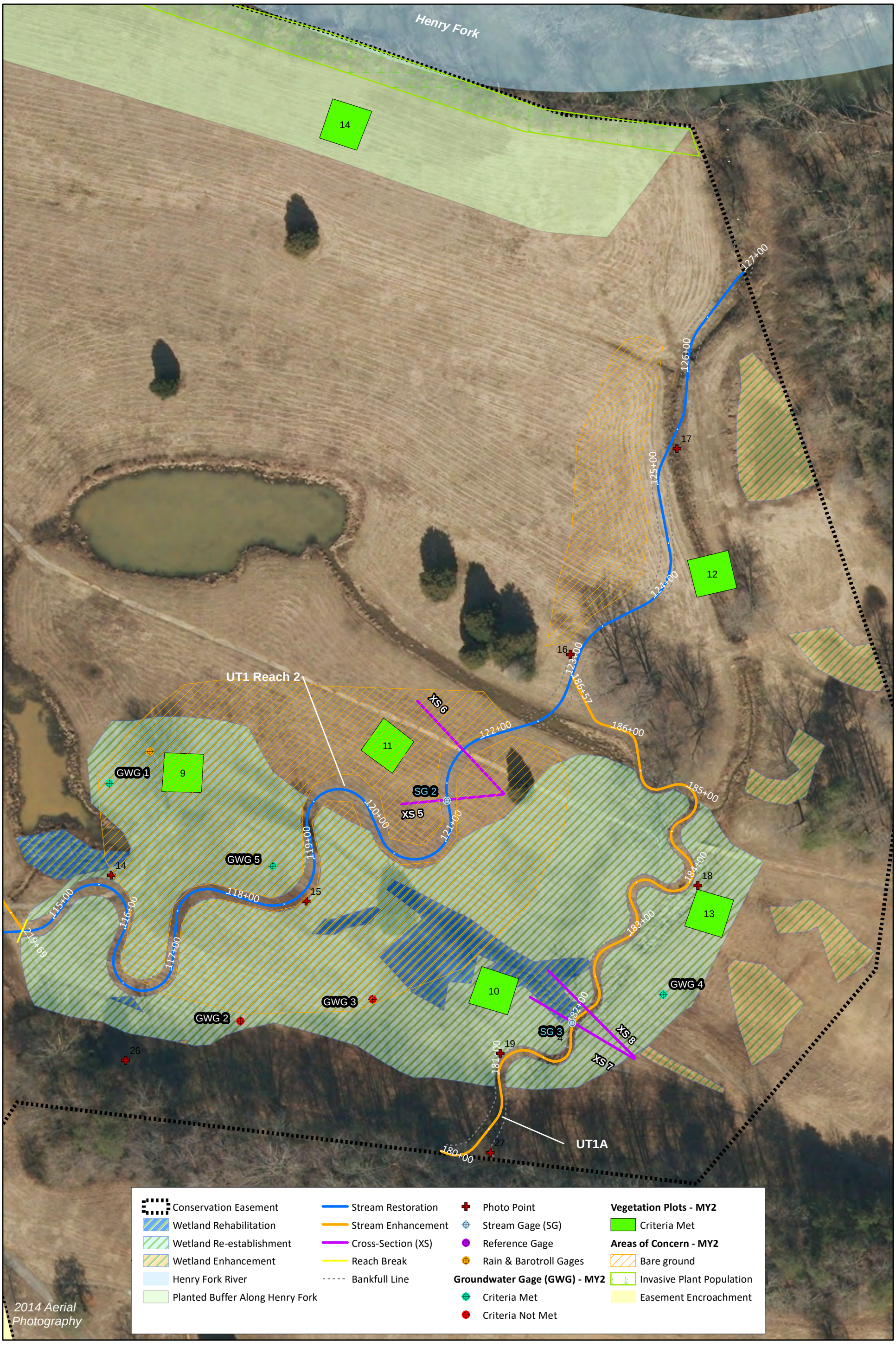
WILDLANDS ENGINEERING

0 75 150 Feet

N

Figure 3.2 Integrated Current Condition Plan View (Sheet 2)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC



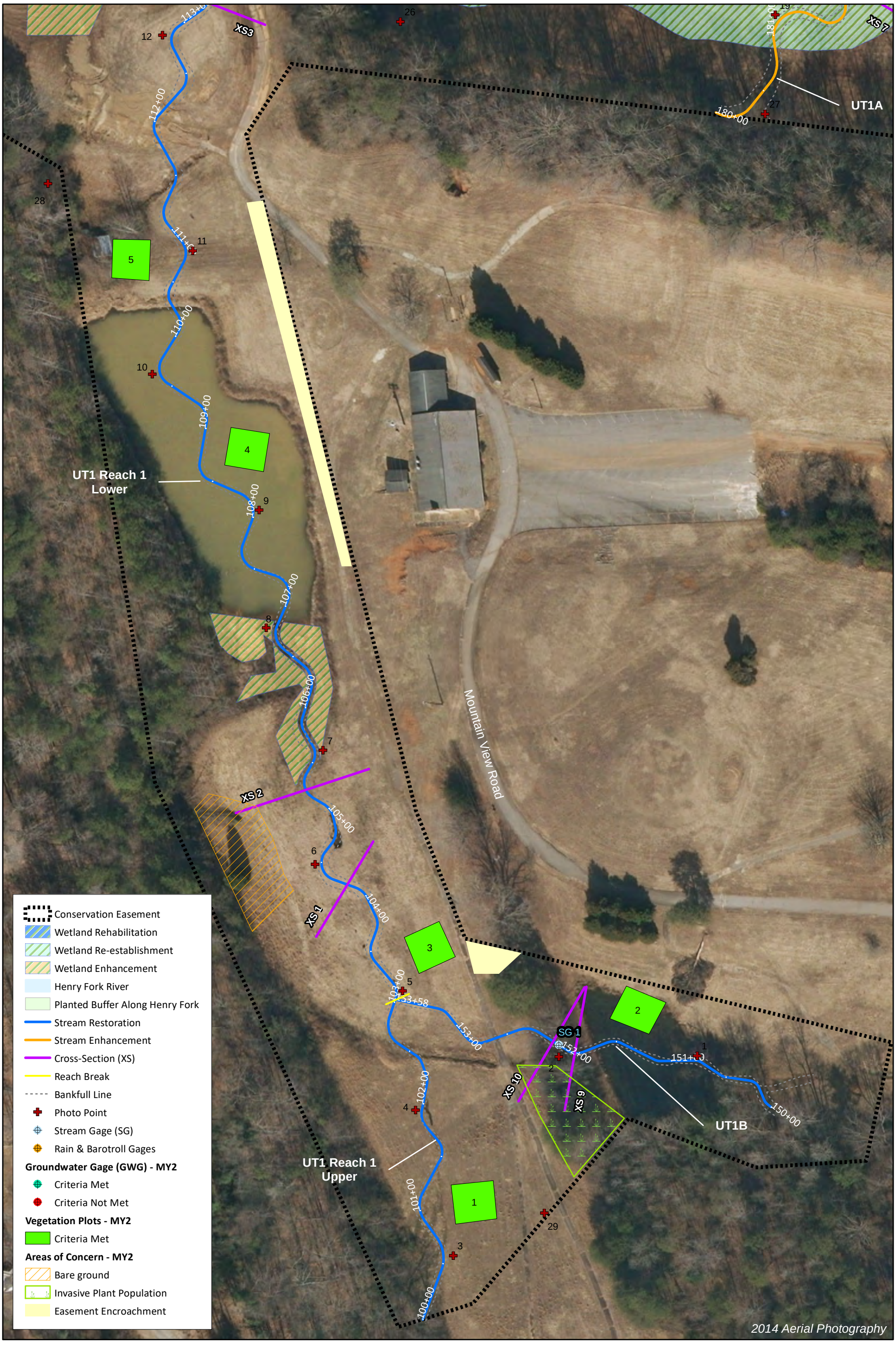
WILDLANDS ENGINEERING

0 75 150 Feet

N

Figure 3.3 Integrated Current Condition Plan View (Sheet 3)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC



WILDLANDS ENGINEERING

0 75 150 Feet

N

Figure 3.4 Integrated Current Condition Plan View (Sheet 4)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.5 Integrated Current Condition Plan View (Sheet 5)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Catawba County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

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
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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%			

[1]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 2 - 2017

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
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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%			

[1]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 2 - 2017

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
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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%			

[1]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 2 - 2017

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
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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%			

[1]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 2 - 2017

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
				Totals	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	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%			

[1]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 2 - 2017

Planted Acreage **15**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	5	2.5	17.1%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0.0	0.0%
		Total	**5**	**2.5**	**17.1%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0.0	0.0%
		Cumulative Total	**5**	**2.5**	**17.1%**

Easement Acreage **48**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	2	1.0	2.1%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	2	0.1	0.2%

Stream Photographs

	
Photo Point 1 – view upstream UT1B *(06/16/2017)*	**Photo Point 1** – view downstream UT1B *(06/16/2017)*
	
Photo Point 2 – view upstream UT1B *(06/16/2017)*	**Photo Point 2** – view downstream UT1B *(06/16/2017)*
	
Photo Point 3 – view upstream UT1 R1 Upper *(06/16/2017)*	**Photo Point 3** – view downstream UT1 R1 Upper (*06/16/2017)*

Photo Point 4 – view upstream UT1 R1 Upper *(6/16/2017)*

Photo Point 4 – view downstream UT1 R1 Upper *(6/16/2017)*

Photo Point 5 – view upstream UT1 R1 Lower *(6/16/2017)*

Photo Point 5 – view downstream UT1 R1 Lower *(6/16/2017)*

Photo Point 5 – view upstream of UT1B *(6/16/2017)*

	
Photo Point 6 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 6** – view downstream UT1 R1 Lower *(6/16/2017))*
	
Photo Point 7 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 7** – view downstream UT1 R1 Lower *(6/16/2017)*
	
Photo Point 8 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 8** – view downstream UT1 R1 Lower *(6/16/2017)*

	
Photo Point 9 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 9** – view downstream UT1 R1 Lower *(6/16/2017)*
	
Photo Point 10 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 10** –view downstream UT1 R1 Lower *(6/16/2017)*
	
Photo Point 11 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 11** –view downstream UT1 R1 Lower *(6/16/2017)*

	
Photo Point 12 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 12** –view downstream UT1 R1 Lower *(6/16/2017)*
	
Photo Point 13 – view upstream UT1 R1 Lower *(6/16/2017)*	**Photo Point 13** –view downstream UT1 R1 Lower *(6/16/2017)*
	
Photo Point 14 – view upstream UT1 R2 *(6/16/2017)*	**Photo Point 14** – view downstream UT1 R2 *(6/16/2017)*

	
Photo Point 15 – view upstream UT1 R2 *(6/16/2017)*	**Photo Point 15** – view downstream UT1 R2 *(6/16/2017)*
	
Photo Point 16 – view upstream UT1 R2 *(6/16/2017)*	**Photo Point 16** – view downstream UT1 R2 *(6/16/2017)*
	
Photo Point 17 – view upstream UT1 R2 *(6/16/2017)*	**Photo Point 17** – view downstream UT1 R2 *(6/16/2017)*

	
Photo Point 18 – view upstream UT1A *(6/16/2017)*	**Photo Point 18** – view downstream UT1A *(6/16/2017)*
	
Photo Point 19 – view upstream UT1A *(6/16/2017)*	**Photo Point 19** – view downstream UT1A *(6/16/2017)*
	
Photo Point 20 – view upstream UT2 *(6/16/2017)*	**Photo Point 20** – view downstream UT2 *(6/16/2017)*

	
Photo Point 21 – view upstream UT2 *(6/16/2017)*	**Photo Point 21** – view downstream UT2 *(6/16/2017)*
	
Photo Point 22 – view upstream UT2 *(6/16/2017)*	**Photo Point 22** – view downstream UT2 *(6/16/2017)*
	
Photo Point 23 – view upstream UT2 *(6/16/2017)*	**Photo Point 23** – view downstream UT2 *(6/16/2017)*

	
Photo Point 24 – view upstream UT2 *(6/16/2017)*	**Photo Point 24** – view downstream UT2 *(6/16/2017)*
	
Photo Point 25 – view upstream UT2 *(6/16/2017)*	**Photo Point 25** – view downstream UT2 *(6/16/2017)*
	
Photo Point 26 – view upstream UT1 R2 *(6/16/2017)*	**Photo Point 26** – view downstream UT1 R2 *(6/16/2017)*

Photo Point 26 – UT1 R2 floodplain overview *(6/16/2017)*

Photo Point 27 – view upstream UT1 R2 floodplain *(6/16/2017)*

Photo Point 27 – view downstream UT1 R2 floodplain *(6/16/2017)*

Photo Point 28 – UT1 R1 Lower floodplain overview *(6/16/2017)*

Photo Point 28 – UT2 floodplain overview *(6/16/2017)*

Photo Point 29 – UT1 R1 Upper floodplain overview *(6/16/2017)*

Vegetation Photographs

Vegetation Plot 1 - *(7/13/2017)*

Vegetation Plot 2 - *(7/13/2017)*

Vegetation Plot 3 - *(7/13/2017)*

Vegetation Plot 4 - *(7/13/2017)*

Vegetation Plot 5 - *(7/13/2017)*

Vegetation Plot 6 - *(7/12/2017)*

Vegetation Plot 7 - *(7/12/2017)*

Vegetation Plot 8 - *(7/12/2017)*

Vegetation Plot 9 - *(7/12/2017)*

Vegetation Plot 10 - *(7/13/2017)*

Vegetation Plot 11 - *(7/12/2017)*

Vegetation Plot 12 - *(7/13/2017)*

Vegetation Plot 13 - *(7/13/2017)*

Vegetation Plot 14 - *(7/12/2017)*

Vegetation Plot 15 - *(7/12/2017)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment

Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Plot	MY5 Success Criteria	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 2 - 2017

Report Prepared By	Ruby Davis
Date Prepared	8/7/2017
Database Name	cvs-eep-entrytool-v2.5.0 HENRY FORK MY2.mdb
Database Location	Q:\ActiveProjects\005-02143 Henry Fork\Monitoring\Monitoring Year 2\Vegetation Assessment
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	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.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	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.
PROJECT SUMMARY----------	
Project Code	96306
project Name	Henry Fork Mitigation Site
Description	Stream and Wetland Mitigation
Required Plots (calculated)	15
Sampled Plots	15

Table 9a. Planted and Total Stem Counts

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 2 - 2017

			Current Plot Data (MY2 2017)																	
			96306-WEI-0001			96306-WEI-0002			96306-WEI-0003			96306-WEI-0004			96306-WEI-0005			96306-WEI-0006		
Scientific Name	**Common Name**	**Species Type**	**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															4	3	3	5
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	2
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	4	4	4
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	5	3	3	18	4	4	22
Populus deltoides	Cottonwood	Tree																		2
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			
Salix nigra	Black Willow	Tree																		
Salix sericea	Silky Willow	Shrub Tree						1												
Stem count			14	14	14	16	16	17	15	15	15	16	16	17	12	12	31	16	16	39
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	4	4	5	5	5	5	4	4	4	5	5	6	5	5	6
Stems per ACRE			567	567	567	647	647	688	607	607	607	647	647	688	486	486	1255	647	647	1578

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 2 - 2017

			Current Plot Data (MY2 2017)																	
			96306-WEI-0007			96306-WEI-0008			96306-WEI-0009			96306-WEI-0010			96306-WEI-0011			96306-WEI-0012		
Scientific Name	**Common Name**	**Species Type**	**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			75				4	4	9				4	4	4			
Alnus serrulata	Tag Alder	Shrub Tree									5			1			2			
Betula nigra	River Birch	Tree	2	2	8	2	2	2	3	3	6	4	4	4	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	4	4	4	5	5	5
Juglans nigra	Black Walnut	Tree																		
Liquidambar styraciflua	Sweet Gum	Tree																		3
Liriodendron tulipifera	Tulip Poplar	Tree																		
Nyssa sylvatica	Black Gum	Tree																		
Platanus occidentalis	Sycamore	Tree	2	2	36	2	2	53	3	3	70	2	2	202	2	2	28	5	5	9
Populus deltoides	Cottonwood	Tree									16						1			
Quercus michauxii	Swamp Chestnut Oak	Tree	3	3	3	1	1	1	3	3	3	4	4	5	3	3	3			
Quercus phellos	Willow Oak	Tree	1	1	1	2	2	2	2	2	2	2	2	2				1	1	1
Salix nigra	Black Willow	Tree																		
Salix sericea	Silky Willow	Shrub Tree																		
Stem count			14	14	129	14	14	65	15	15	111	16	16	218	17	17	46	15	15	29
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	6	6	6	6	5	5	7	6	6	7	6	6	8	5	5	6
Stems per ACRE			567	567	5220	567	567	2630	607	607	4492	647	647	8822	688	688	1862	607	607	1174

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 2 - 2017

			Current Plot Data (MY2 2017)									Annual Means								
			96306-WEI-0013			96306-WEI-0014			96306-WEI-0015			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	**Common Name**	**Species Type**	**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									19			19			20			12
Acer rubrum	Red Maple	Tree				1	1	2			1	12	12	100	12	12	22	13	13	13
Alnus serrulata	Tag Alder	Shrub Tree												6			1			
Betula nigra	River Birch	Tree	1	1	2	2	2	2	2	2	2	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
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1	3	3	3	1	1	1	51	51	51	52	52	52	57	57	57
Juglans nigra	Black Walnut	Tree									1			1						
Liquidambar styraciflua	Sweet Gum	Tree									7			10			17			5
Liriodendron tulipifera	Tulip Poplar	Tree									2			2			7			2
Nyssa sylvatica	Black Gum	Tree																		2
Platanus occidentalis	Sycamore	Tree	1	1	1	5	5	5	7	7	7	44	44	460	44	44	108	57	57	57
Populus deltoides	Cottonwood	Tree												19			7			
Quercus michauxii	Swamp Chestnut Oak	Tree	1	1	1	1	1	1				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
Salix nigra	Black Willow	Tree															1			
Salix sericea	Silky Willow	Shrub Tree												1						
Stem count			13	13	14	13	13	14	14	14	44	220	220	801	222	222	350	243	243	264
size (ares)			1			1			1			15			15			15		
size (ACRES)			0.02			0.02			0.02			0.37			0.37			0.37		
Species count			6	6	6	6	6	6	4	4	9	7	7	14	7	7	14	7	7	11
Stems per ACRE			526	526	567	526	526	567	567	567	1781	594	594	2161	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 2 - 2017

Henry Fork-UT1 Reach 2, UT1A and UT2

	PRE-RESTORATION CONDITION						REFERENCE REACH DATA										DESIGN						AS-BUILT/BASELINE					
Parameter	**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[1]**	**Max[1]**	**Min[1]**	**Max[1]**	**Min[1]**	**Max[1]**	**Min[1]**	**Max[1]**	**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^2)	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		1.0		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[2]		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[2]		N/A[2]		N/A[2]		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[2]		N/A[2]		31	60	19	46	15	28	44.8		20	86	12	53	15	68	49	136	29	53	28	87
Pool Volume (ft^3)							---		---		----		----													
Pattern																										
Channel Beltwidth (ft)	N/A[2]		N/A[2]		N/A[2]		55		23		21		19		8	83	8	37	9	58	7	84	7	36	8	59
Radius of Curvature (ft)	N/A[2]		N/A[2]		N/A[2]		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[2]		N/A[2]		N/A[2]		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[2]		N/A[2]		N/A[2]		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[2]		N/A[2]		N/A[2]		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^2	0.8-1.6		0.7		0.18-0.25*[4]										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^2																										
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[3]		Modified B6c[3]		Modified F6[3]		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		1.2		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*		353		1,915		---		---		---		---		1,228		657		1,969		1,232		658		1,969	
Sinuosity	1.5[5]		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)[2]	---		---		---		---		---		---		---		0.0016	0.0018	0.0037	0.0043	0.0016	0.0019	0.0023		0.0063		0.0018	
Bankfull Slope (ft/ft)	---		---		---		---		---		---		---		0.0016	0.0018	0.0037	0.0043	0.0016	0.0019	0.0037		0.0060		0.0015	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable
[1] 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.
[2] 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.
[3]The Rosgen classification system is for natural streams and project streams have been heavily manipulated. These classifications are for illustrative purposes only.
[4]The 25-year event was the largest event modeled; it does not fill the channel
[5]Sinuosity on UT1 Reach 2 is calculated by drawing a valley length line that follows the proposed valley; the existing valley is poorly define
*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 2 - 2017

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[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Min[1]	Max[1]	Upper	Lower	Min	Max	Min	Max	Min	Max
Reference Cross Section Number	XS3,XS4		XS1,XS2		XS2	XS3	XS4		XS1	XS3	XS1	XS3	XS1	XS2	XS3	XS4	XS2		XS1	XS2								
Dimension and Substrate - Riffle																												
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[3])	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^2)	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	2.9 (5.7[3])	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	
Profile																												
Riffle Length (ft)					---		---		---		---		---		---		---		---		---		---		8.0	47.3	11.3	41.2
Riffle Slope (ft/ft)	0.041	0.21	N/A[2]		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	0.0142	0.0987	0.0259	0.0978
Pool Length (ft)					---		---		---		---		---		---		---		---		---		---		4.3	33.4	5.6	20.0
Pool Max Depth (ft)	N/A[2]		N/A[2]		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 Spacing (ft)	10.4	20.5	N/A[2]		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^3)					---		---		----		----		----		----		----		----									
Pattern																												
Channel Beltwidth (ft)	N/A[2]		N/A[2]		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[2]		N/A[2]		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[2]		N/A[2]		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[2]		N/A[2]		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[2]		N/A[2]		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
Substrate, Bed and Transport Parameters																												
Ri%/Ru%/P%/G%/S%																												
SC%/Sa%/G%/C%/B%/Be%																												
d16/d35/d50/d84/d95/d100	SC/0.18/2.80/38/62/128-180		FS/SC/SC/0.14/8.9/45/128-180		0.3/0.4/1.8/12.8/25/90		.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/-		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^2	2.3-3.1		1.3-2.4																		1.0-1.2		0.91		0.87		1.32	
Max part size (mm) mobilized at bankfull																												
Stream Power (Capacity) W/m^2																												
Additional Reach Parameters																												
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[4]		Modified B5a / E5b[4]		E5		E3b/C3b		C5		E5		E4		E5b		Slightly entrenched B4a/A4		B4a		B4a	B4a (C4b[5])	B4a[6]		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	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	
Q-NFF regression (2-yr)	---		---																									
Q-USGS extrapolation (1.2-yr)	30		24																									
Q-Mannings	8.5	11.4	8																		10	15	9		7.6	12.6	8.7	
Valley Length (ft)	---		---		---		---		---		---		---		---		---		---		---		---		1,271		338	
Channel Thalweg Length (ft)	1,392		478		---		---		---		---		---		---		---		---		1,471		358		1,497		358	
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		1.1	
Water Surface Slope (ft/ft)[7]	---		---		---		---		---		---		---		---		---		---		0.0477	0.0527	0.0500	0.0565	0.0369		0.0598	
Bankfull Slope (ft/ft)	---		---		---		---		---		---		---		---		---		---		0.0477	0.0527	0.0500	0.0565	0.0241	0.0612	0.0602	

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

[1] 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.

[2] 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.

[3] 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.

[4] The Rosgen classification system is for natural streams and project streams have been heavily manipulated. These classifications are for illustrative purposes only.

[5] 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.

[6] 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 2 - 2017

	Cross-Section 1, UT1 Reach 1 (Riffle)								Cross-Section 2, UT1 Reach 1 (Pool)								Cross-Section 3, UT1 Reach 1 (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	906.1	906.1	906.1						901.9	901.9	901.9						878.3	878.3	878.3					
Bankfull Width (ft)	7.3	6.8	7.1						8.8	9.6	10.9						7.8	7.7	9.6					
Floodprone Width (ft)	51.3	50.5	51.8						---		---						---	---	---					
Bankfull Mean Depth (ft)	0.5	0.4	0.5						1.2	1.0	0.9						1.2	1.0	0.9					
Bankfull Max Depth (ft)	0.7	0.7	0.8						2.2	1.7	1.8						2.2	1.8	1.8					
Bankfull Cross-Sectional Area (ft^2)	3.5	2.9	3.3						10.7	9.5	10.0						9.1	8.1	8.8					
Bankfull Width/Depth Ratio	15.4	15.7	15.0						---	---	---						---	---	---					
Bankfull Entrenchment Ratio	7.0	7.5	7.3						---	---	---						---	---	---					
Bankfull Bank Height Ratio	1.0	1.0	1.0						---	---	---						---	---	---					
	Cross-Section 4, UT1 Reach 1 (Riffle)								**Cross-Section 5, UT1 Reach 2 (Riffle)**								**Cross-Section 6, UT1 Reach 2 (Pool)**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	877.6	877.6	877.6						873.5	873.5	873.5						872.7	872.7	872.7					
Bankfull Width (ft)	6.9	7.4	7.6						10.5	11.1	10.9						8.8	8.8	9.2					
Floodprone Width (ft)	118.3+	118.3+	118+						96.7+	96.7+	96.7+						---	---	---					
Bankfull Mean Depth (ft)	0.4	0.4	0.4						0.9	0.9	0.9						1.0	0.8	0.7					
Bankfull Max Depth (ft)	0.8	0.7	0.7						1.5	1.5	1.5						1.8	1.4	1.3					
Bankfull Cross-Sectional Area (ft^2)	2.9	3.2	3.1						9.7	10.1	9.3						8.8	7.2	6.8					
Bankfull Width/Depth Ratio	16.2	17.1	18.7						11.4	12.1	12.7						---	---	---					
Bankfull Entrenchment Ratio	17.1+	16.0+	15.5+						9.2+	8.7+	8.9+						---	---	---					
Bankfull Bank Height Ratio	1.0	1.0	1.0						1.0	1.0	1.0						---	---	---					

Table 11b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Henry Fork Mitigation Site
DMS Project No.96306
Monitoring Year 2 - 2017

	Cross-Section 7, UT1A (Pool)								Cross-Section 8, UT1A (Riffle)								Cross-Section 9, UT1B (Pool)								Cross-Section 10, UT1B (Riffle)							
Dimension and Substrate	**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**
based on fixed bankfull elevation	874.9	874.9	874.9						875.0	875.0	875.0						922.9	922.9	922.9						922.1	922.1	922.1					
Bankfull Width (ft)	5.6	5.8	4.5						6.6	6.3	7.7						5.5	5.9	6.9						5.4	5.9	4.3					
Floodprone Width (ft)	---	---	---						31.4+	80.6+	79.1						---	---	---						37.7	55.6	54.1					
Bankfull Mean Depth (ft)	0.4	0.4	0.3						0.4	0.4	0.3						0.9	0.7	0.6						0.4	0.3	0.2					
Bankfull Max Depth (ft)	0.7	1.0	0.7						0.8	0.6	0.6						1.4	1.2	1.0						0.6	0.5	0.3					
Bankfull Cross-Sectional Area (ft^2)	2.0	2.3	1.5						2.5	2.3	2.4						5.0	4.2	4.0						2.2	2.0	1.0					
Bankfull Width/Depth Ratio	---	---	---						17.0	17.3	24.9						---	---	---						13.2	17.3	19.6					
Bankfull Entrenchment Ratio	---	---	---						4.8	12.8+	10.3+						---	---	---						6.9	9.4	12.5					
Bankfull Bank Height Ratio	---	---	---						1.0	1.0	1.0						---	---	---						1.0	1.0	1.0					
	Cross-Section 11, UT2 (Pool)								**Cross-Section 12, UT2 (Riffle)**								**Cross-Section 13, UT2 (Pool)**								**Cross-Section 14, UT2 (Riffle)**							
Dimension and Substrate	**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**
based on fixed bankfull elevation	876.0	876.0	876.0						876.0	876.0	876.0						875.1	875.1	875.1						875.2	875.2	875.2					
Bankfull Width (ft)	10.2	11.5	11.1						8.1	9.1	8.6						7.8	8.2	10.0						7.4	6.9	7.5					
Floodprone Width (ft)	---	---	---						81.3+	50.8+	50.8+						---	---	---						150+	150+	150+					
Bankfull Mean Depth (ft)	0.8	0.8	0.9						0.7	0.6	0.7						1.1	1.0	0.9						0.6	0.5	0.6					
Bankfull Max Depth (ft)	1.9	1.6	1.7						1.4	1.4	1.5						1.9	1.6	1.7						1.0	1.0	1.1					
Bankfull Cross-Sectional Area (ft^2)	8.6	9.5	9.7						5.7	5.5	6.0						8.8	8.1	9.4						4.2	3.8	4.4					
Bankfull Width/Depth Ratio	---	---	---						11.5	15.0	12.3						---	---	---						12.9	12.7	12.6					
Bankfull Entrenchment Ratio	---	---	---						10.1+	5.6+	5.9+						---	---	---						20.3+	21.8+	20.1+					
Bankfull Bank Height Ratio	---	---	---						1.10	1.10	1.10						---	---	---						1.09	1.09	1.09					

Table 12a. Monitoring - Stream Reach Data Summary
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

Henry Fork-UT1 Reach 2, UT1A and UT2

Parameter	As-Built/Baseline						MY1						MY2					
	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
Dimension and Substrate - Riffle																		
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
Floodprone Width (ft)	96.7+		31.4+		81.3	150+	96.7+		80.6+		50.8+	150+	96.7+		79.1+		50.8+	150+
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
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
Bankfull Cross Sectional Area (ft^2)	9.7		2.5		4.2	5.7	10.1		2.3		3.8	5.5	9.3		2.4		4.4	6.0
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
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+
Bank Height Ratio	1.0		1.0		1.1		1.0		1.0		1.1		1.0		1.0		1.1	
D50 (mm)	Silt/Clay																	
Profile																		
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^3)																		
Pattern																		
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												
Additional Reach Parameters																		
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%	

Table 12b. Monitoring - Stream Reach Data Summary

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 2 - 2017

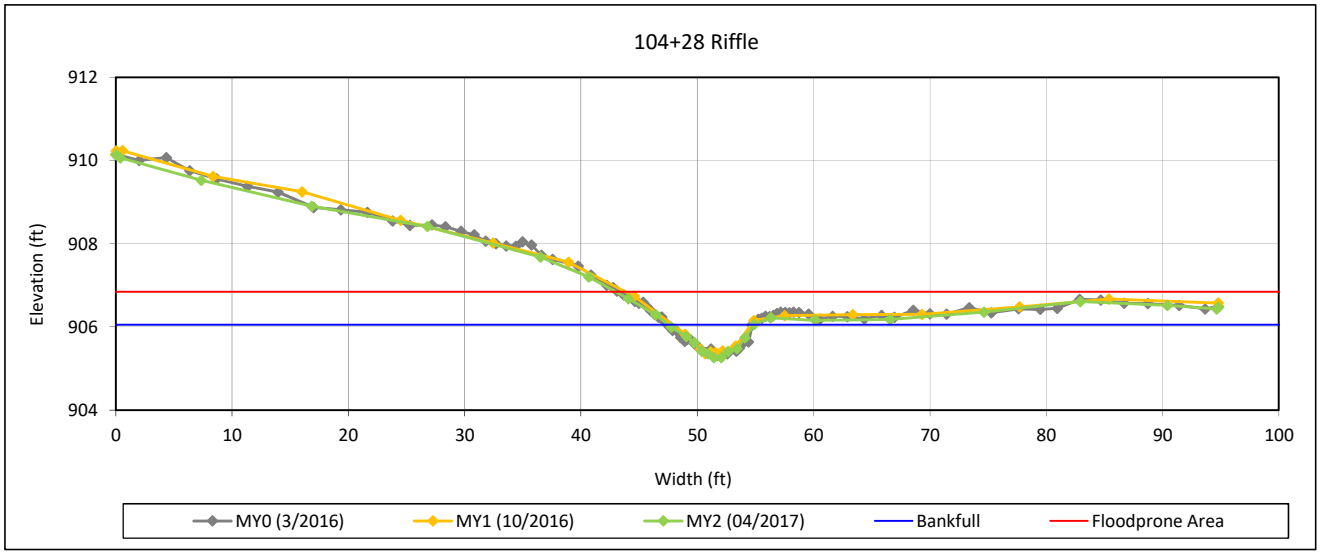
Henry Fork-UT1 Reach 1 and UT1B

Parameter	As-Built/Baseline				MY1				MY2			
	UT1 Reach 1		UT1B		UT1 Reach 1		UT1B		UT1 Reach 1		UT1B	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	6.9	7.3	5.4		6.8	7.4	5.9		7.1	7.6	4.3	
Floodprone Width (ft)	51.3	118.3+	37.7		50.5	118.3+	55.6		51.8	118.0+	54.1	
Bankfull Mean Depth	0.4	0.5	0.4		0.4	0.4	0.3		0.4	0.5	0.2	
Bankfull Max Depth	0.75		0.6		0.7		0.5		0.7	0.8	0.3	
Bankfull Cross Sectional Area (ft^2)	2.9	3.5	2.2		2.9	3.2	2.0		3.1	3.3	1.0	
Width/Depth Ratio	15.8		13.2		15.7	17.1	17.3		15.0	18.7	19.6	
Entrenchment Ratio	7.0	17.1+	6.9		7.5+	16.0+	9.4		7.3+	15.5+	12.5	
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)	17.1		11.0		33.6		40.2		20.7		69	
Profile												
Shallow Length (ft)	8.0	47.3	11.3	41.2								
Shallow Slope (ft/ft)	0.0142	0.0987	0.0259	0.0978								
Pool Length (ft)	4.3	33.4	5.6	20.0								
Pool Max Depth (ft)	0.9	2.8	0.5	2.2								
Pool Spacing (ft)	10	60	7	43								
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	10	26	4	19								
Radius of Curvature (ft)	8	31	8	32								
Rc:Bankfull Width (ft/ft)	1.2	4.5	1.5	5.9								
Meander Wave Length (ft)	56	104	48	90								
Meander Width Ratio	8	15	9	17								
Additional Reach Parameters												
Rosgen Classification	B4a		B4a									
Channel Thalweg Length (ft)	1,497		358									
Sinuosity (ft)	1.2		1.1									
Water Surface Slope (ft/ft)	0.0369		0.0598									
Bankfull Slope (ft/ft)	0.0241	0.0612	0.0602									
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%	

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 1-UT1 R1



Bankfull Dimensions	
3.3	x-section area (ft.sq.)
7.1	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
7.3	wetted perimeter (ft)
0.5	hydraulic radius (ft)
15.0	width-depth ratio
51.8	W flood prone area (ft)
7.3	entrenchment ratio
1.0	low bank height ratio

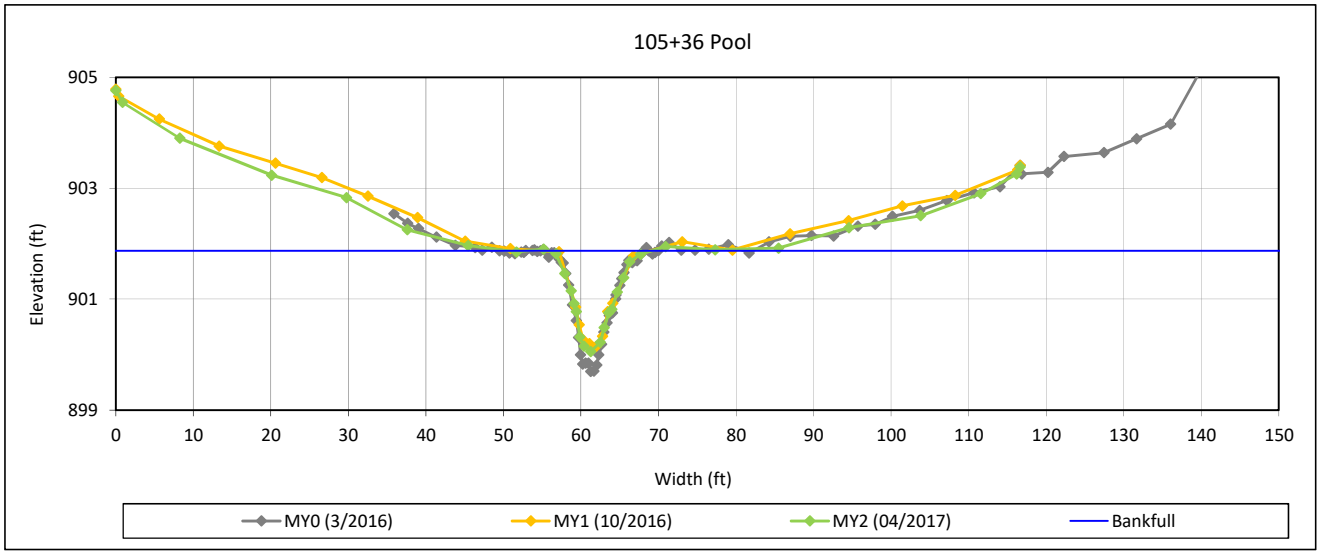
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 2-UT1 R1



Bankfull Dimensions	
10.0	x-section area (ft.sq.)
10.9	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
11.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
11.9	width-depth ratio

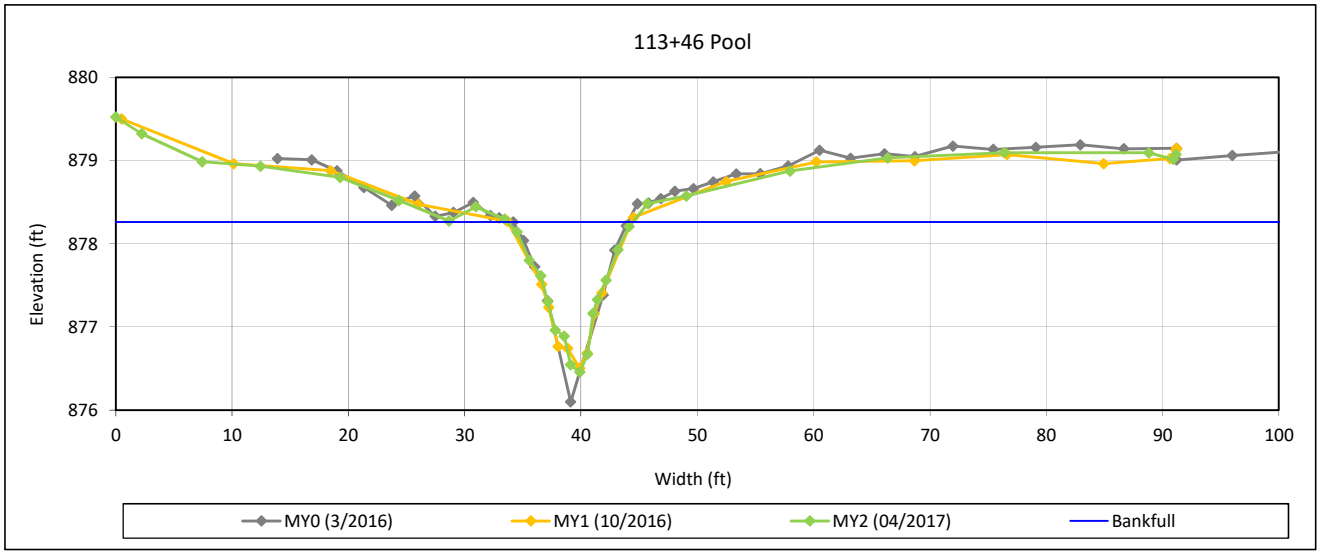
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 3-UT1 R1



Bankfull Dimensions	
8.8	x-section area (ft.sq.)
9.6	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
10.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
10.5	width-depth ratio

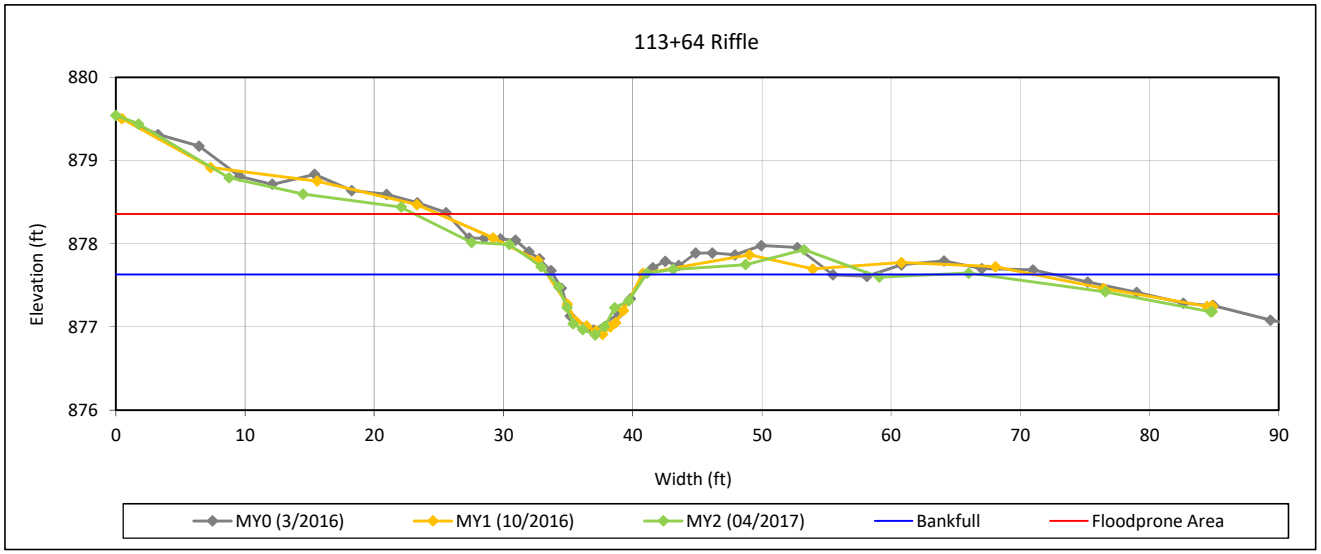
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 4-UT1 R1



Bankfull Dimensions	
3.1	x-section area (ft.sq.)
7.6	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
7.8	wetted perimeter (ft)
0.4	hydraulic radius (ft)
18.7	width-depth ratio
118.0	W flood prone area (ft)
15.5	entrenchment ratio
1.0	low bank height ratio

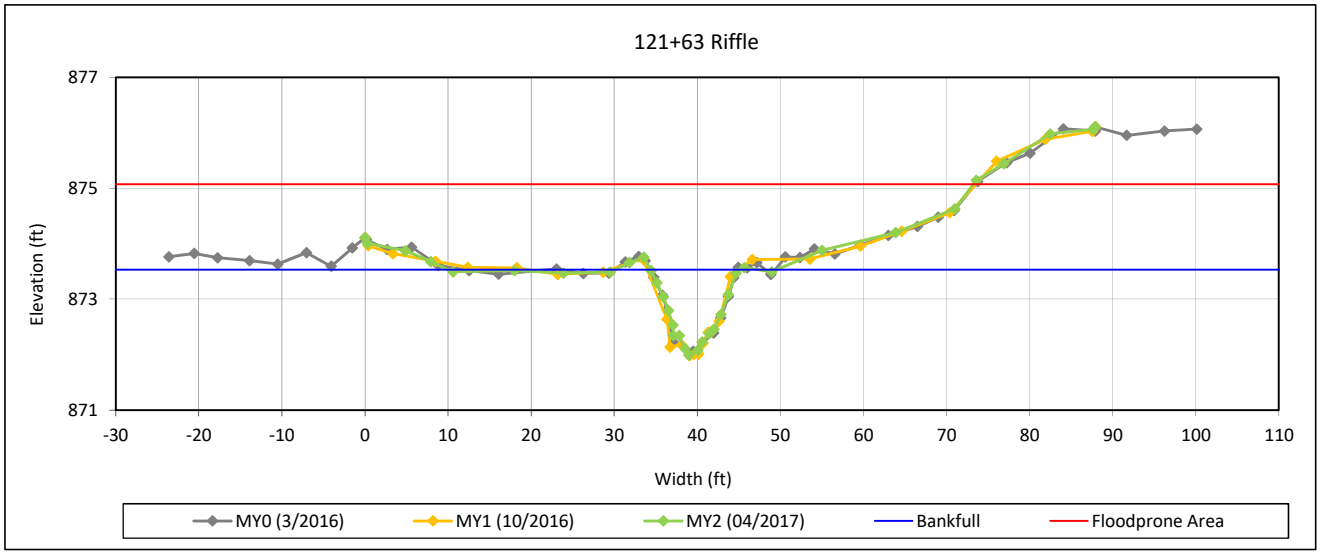
Survey Date: 4/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 5-UT1 R2



Bankfull Dimensions	
9.3	x-section area (ft.sq.)
10.9	width (ft)
0.9	mean depth (ft)
1.5	max depth (ft)
11.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.7	width-depth ratio
96.7	W flood prone area (ft)
8.9	entrenchment ratio
1.0	low bank height ratio

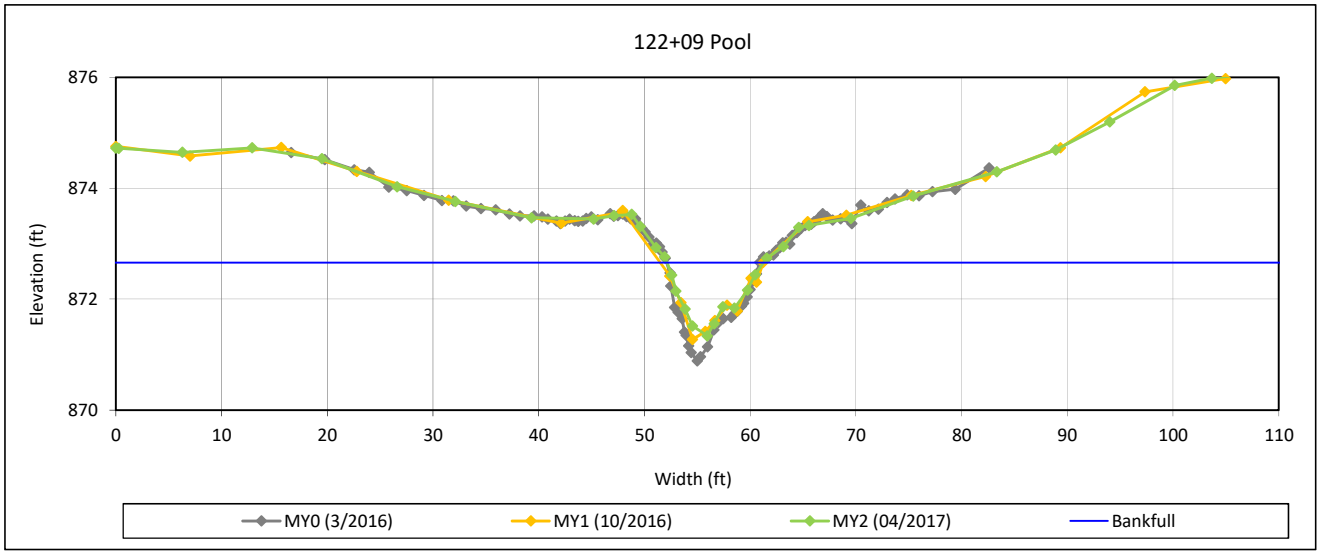
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 6-UT1 R2



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
9.2	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
9.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
12.3	width-depth ratio

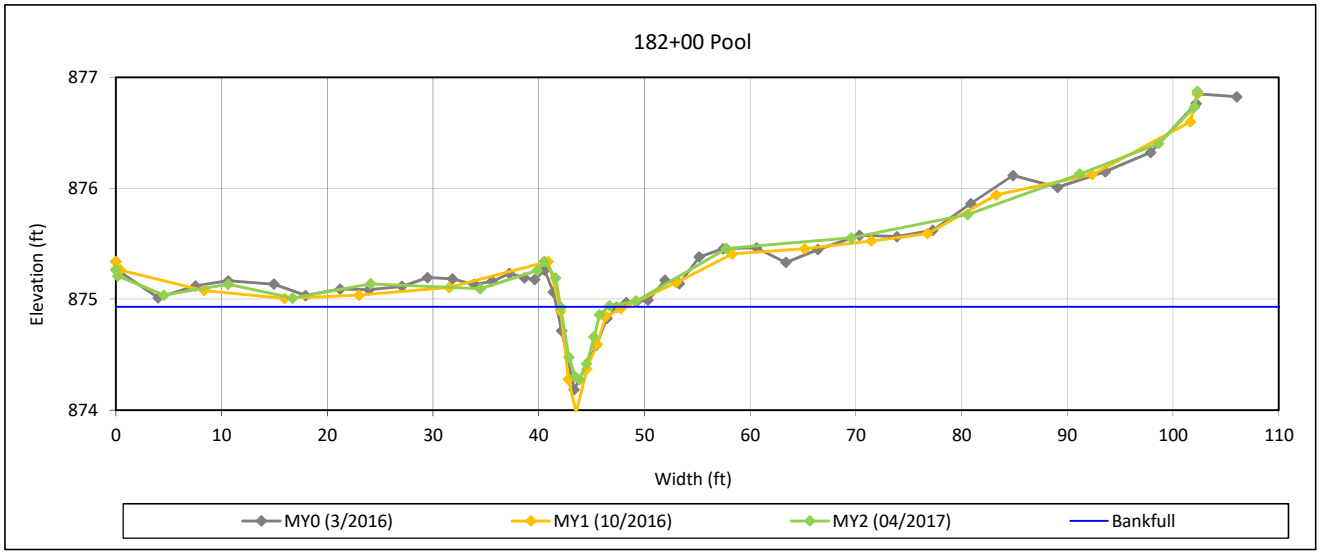
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 7-UT1A



Bankfull Dimensions	
1.5	x-section area (ft.sq.)
4.5	width (ft)
0.3	mean depth (ft)
0.7	max depth (ft)
4.7	wetted perimeter (ft)
0.3	hydraulic radius (ft)
13.1	width-depth ratio

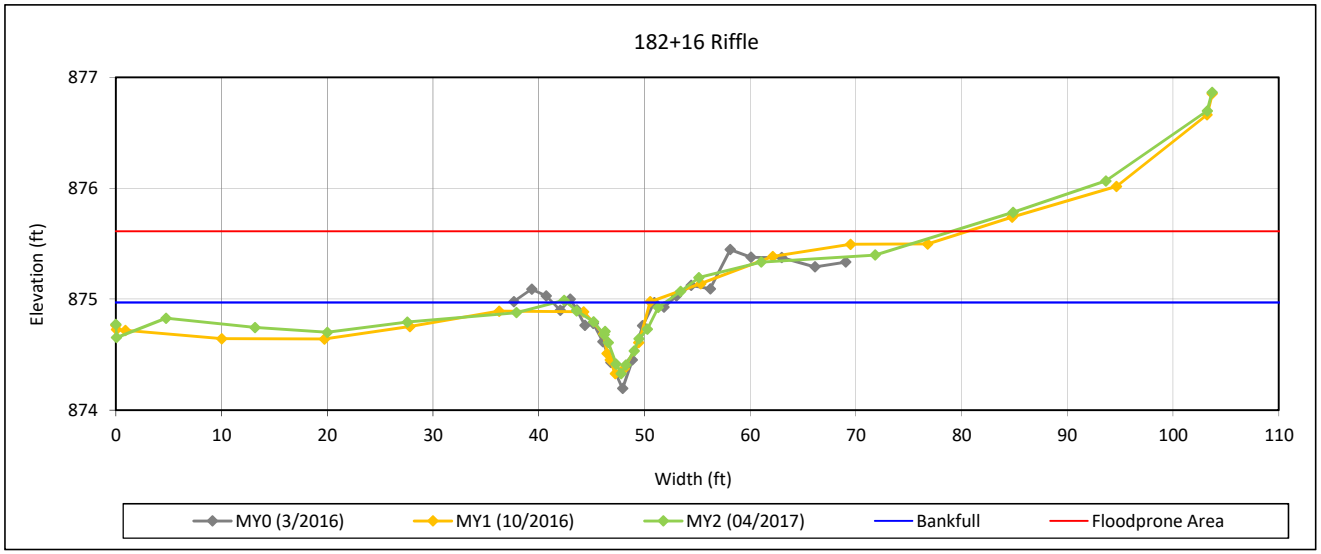
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 8-UT1A



Bankfull Dimensions	
2.4	x-section area (ft.sq.)
7.7	width (ft)
0.3	mean depth (ft)
0.6	max depth (ft)
7.8	wetted perimeter (ft)
0.3	hydraulic radius (ft)
24.9	width-depth ratio
79.1	W flood prone area (ft)
10.3	entrenchment ratio
1.0	low bank height ratio

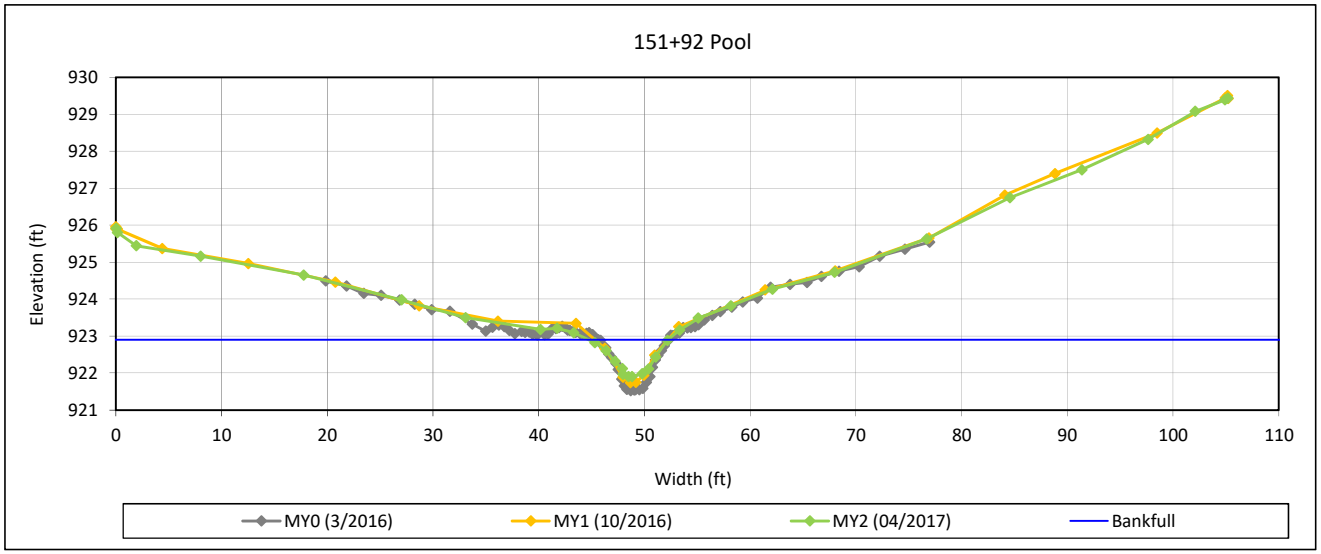
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 9-UT1B



Bankfull Dimensions	
4.0	x-section area (ft.sq.)
6.9	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
7.2	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.6	width-depth ratio

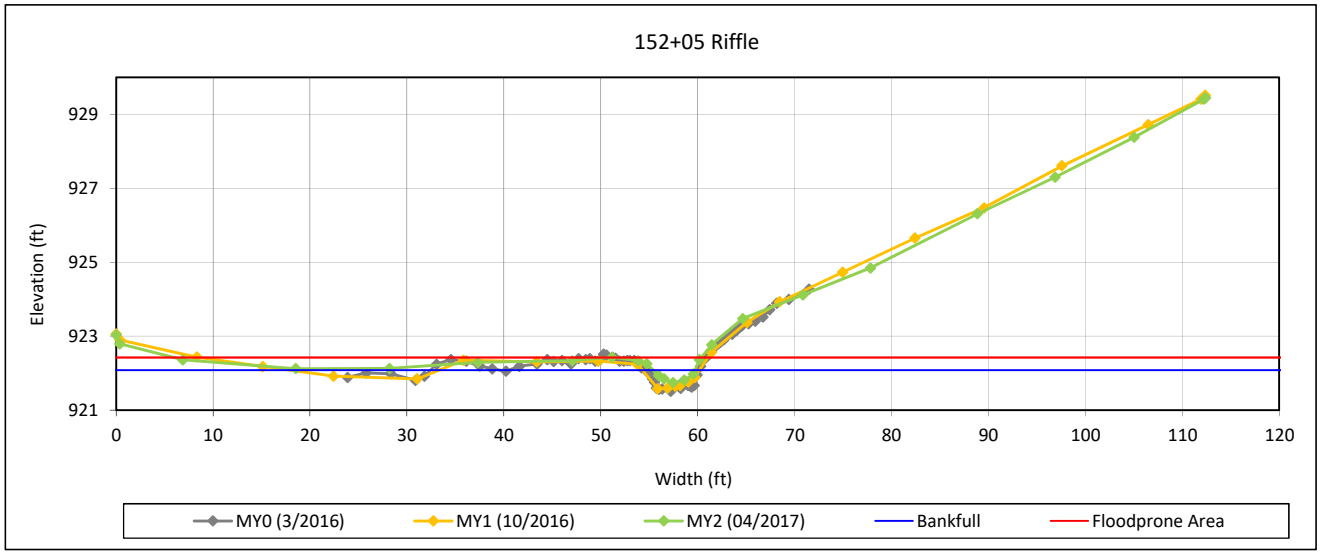
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 10-UT1B



Bankfull Dimensions	
1.0	x-section area (ft.sq.)
4.3	width (ft)
0.2	mean depth (ft)
0.3	max depth (ft)
4.4	wetted perimeter (ft)
0.2	hydraulic radius (ft)
19.6	width-depth ratio
54.1	W flood prone area (ft)
12.5	entrenchment ratio
1.0	low bank height ratio

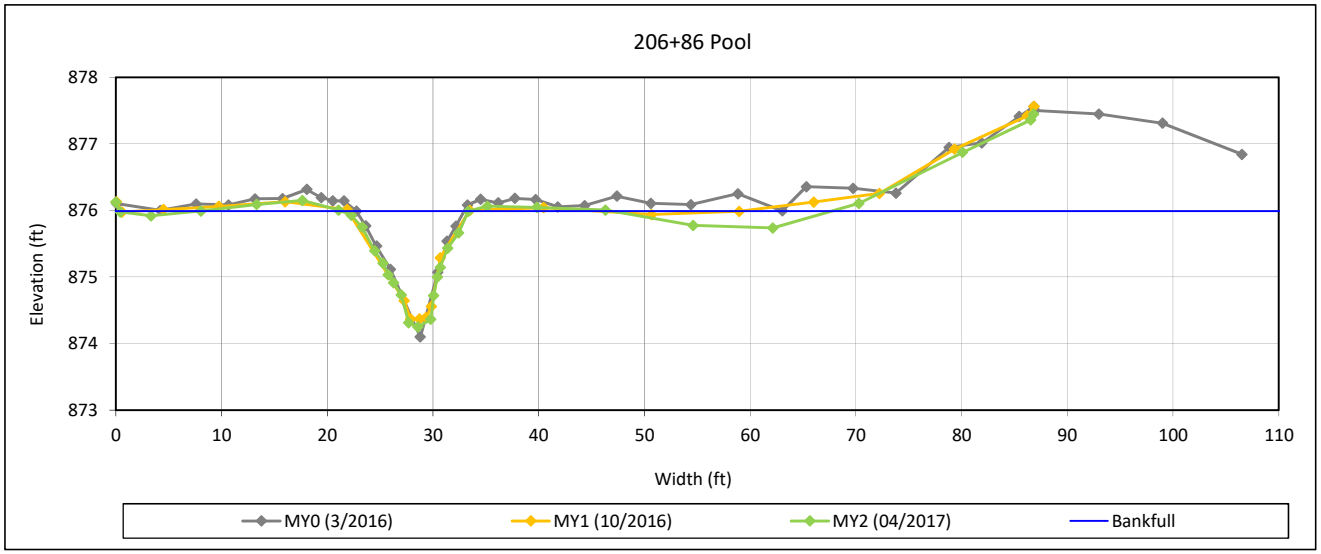
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 11-UT2



Bankfull Dimensions	
9.7	x-section area (ft.sq.)
11.1	width (ft)
0.9	mean depth (ft)
1.7	max depth (ft)
11.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.6	width-depth ratio

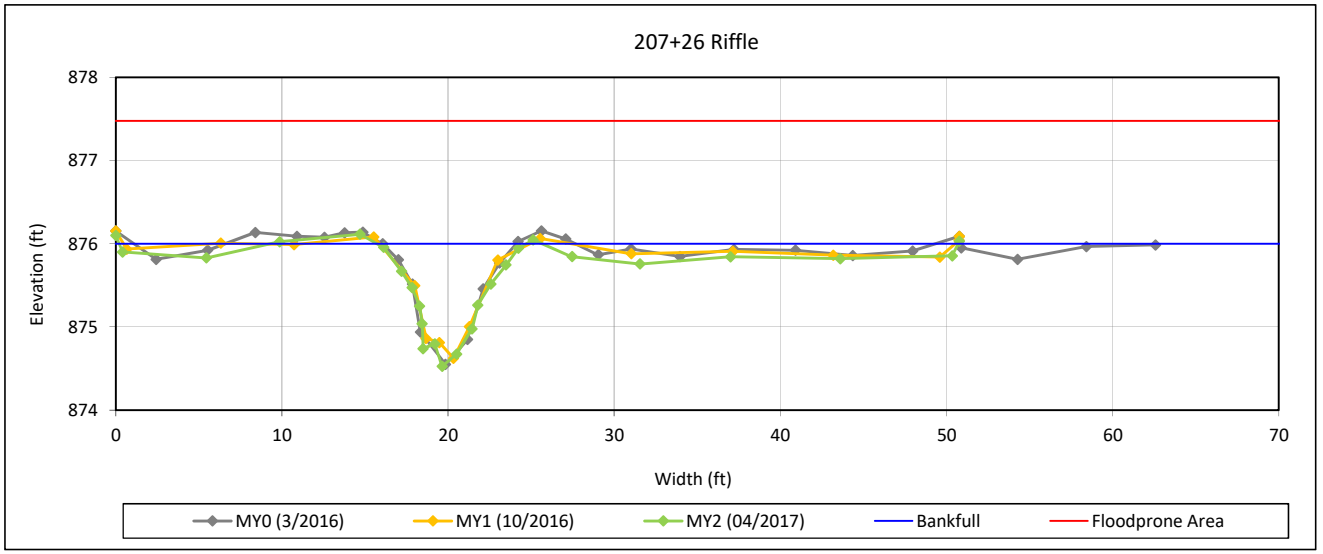
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 12-UT2



Bankfull Dimensions	
6.0	x-section area (ft.sq.)
8.6	width (ft)
0.7	mean depth (ft)
1.5	max depth (ft)
9.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
12.3	width-depth ratio
50.8	W flood prone area (ft)
5.9	entrenchment ratio
1.1	low bank height ratio

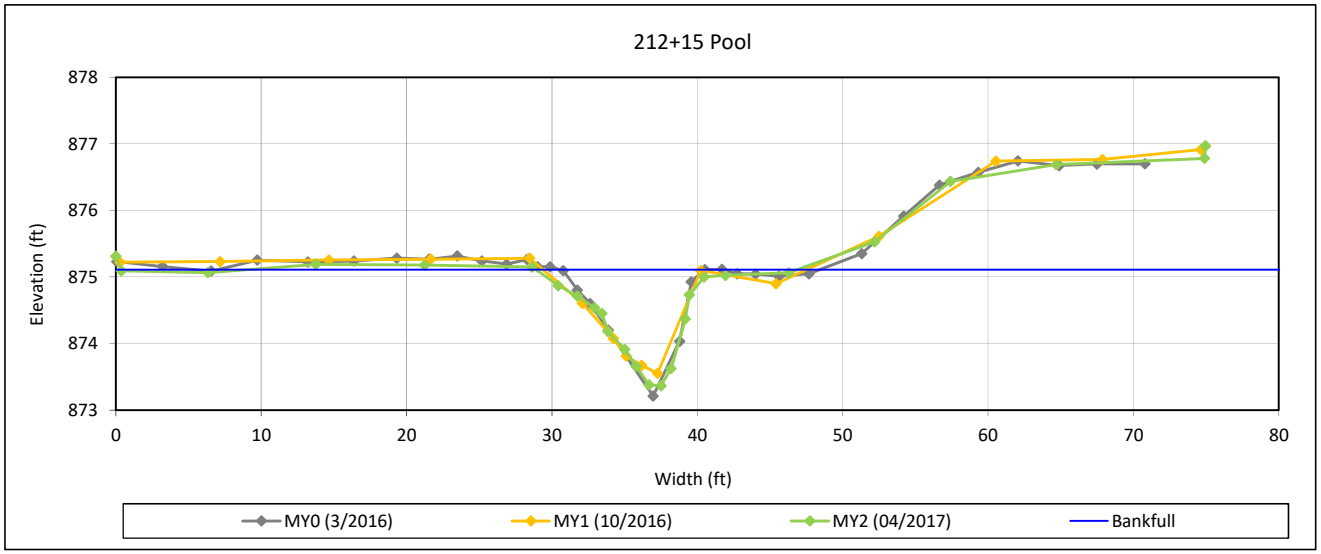
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 13-UT2



Bankfull Dimensions	
9.4	x-section area (ft.sq.)
10.0	width (ft)
0.9	mean depth (ft)
1.7	max depth (ft)
10.8	wetted perimeter (ft)
0.9	hydraulic radius (ft)
10.7	width-depth ratio

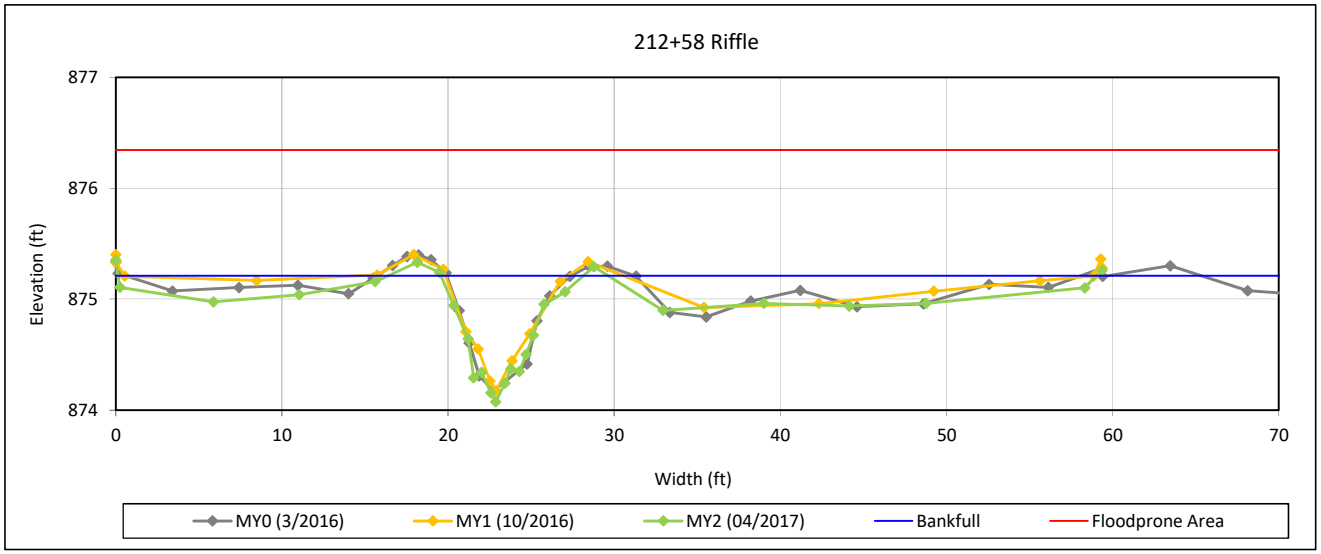
Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/07/2017)

Cross-Section Plots

Henry Fork Mitigation Site
NCDMS Project No. 96306
Monitoring Year 2 - 2017

Cross-Section 14-UT2



Bankfull Dimensions	
4.4	x-section area (ft.sq.)
7.5	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
7.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
12.6	width-depth ratio
150.0	W flood prone area (ft)
20.1	entrenchment ratio
1.1	low bank height ratio

Survey Date: 04/2017
Field Crew: Wildlands Engineering

View Downstream (04/10/2017)

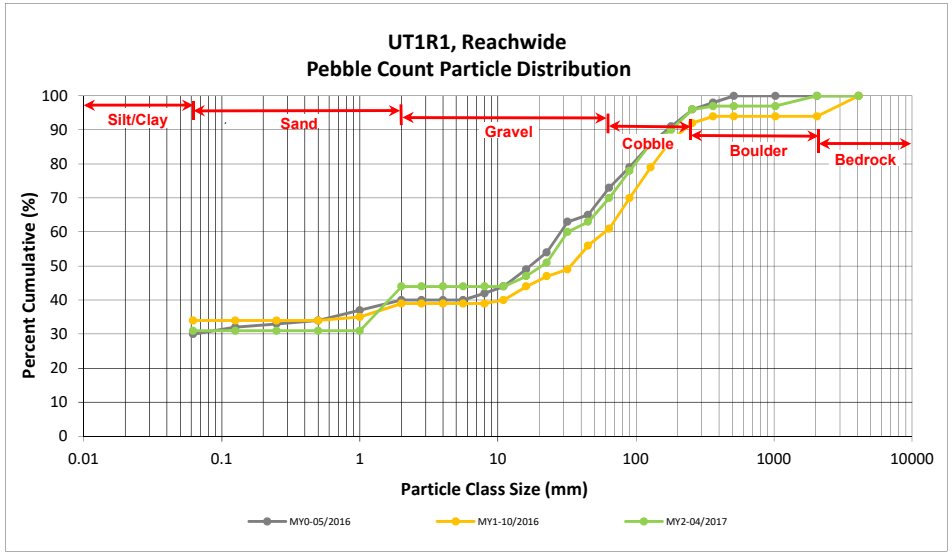
Reachwide and Cross Section Pebble Count Plots

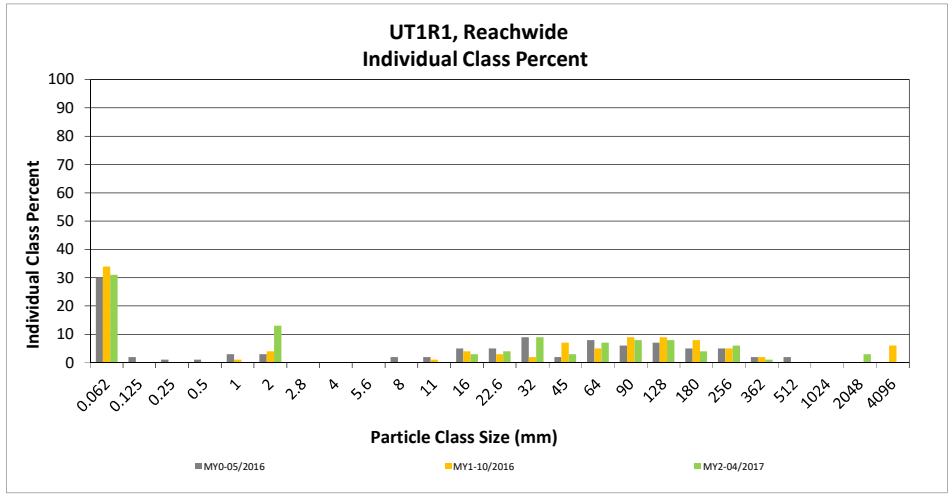
Henry Fork Stream Mitigation
DMS Project No. 96306
Monitoring Year 2 - 2017

UT1R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	27	31	31	31
SAND	Very fine	0.062	0.125					31
	Fine	0.125	0.250					31
	Medium	0.25	0.50					31
	Coarse	0.5	1.0					31
	Very Coarse	1.0	2.0	4	9	13	13	44
GRAVEL	Very Fine	2.0	2.8					44
	Very Fine	2.8	4.0					44
	Fine	4.0	5.6					44
	Fine	5.6	8.0					44
	Medium	8.0	11.0					44
	Medium	11.0	16.0	1	2	3	3	47
	Coarse	16.0	22.6	3	1	4	4	51
	Coarse	22.6	32	4	5	9	9	60
	Very Coarse	32	45	2	1	3	3	63
	Very Coarse	45	64	5	2	7	7	70
COBBLE	Small	64	90	5	3	8	8	78
	Small	90	128	8		8	8	86
	Large	128	180	4		4	4	90
	Large	180	256	6		6	6	96
BOULDER	Small	256	362	1		1	1	97
	Small	362	512					97
	Medium	512	1024					97
	Large/Very Large	1024	2048	3		3	3	100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.24
D_{50} =	20.7
D_{84} =	117.2
D_{95} =	241.4
D_{100} =	2048.0





Reachwide and Cross Section Pebble Count Plots

Henry Fork Stream Mitigation

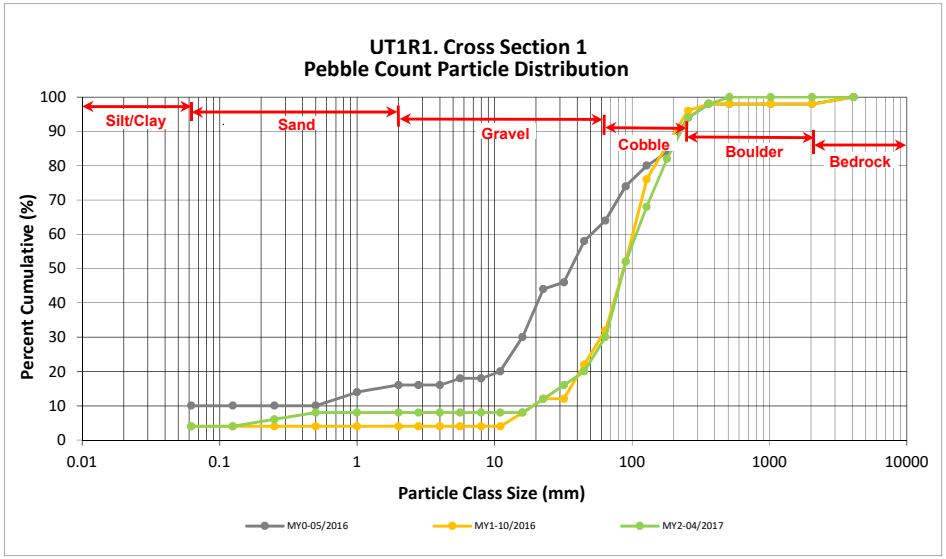
DMS Project No. 96306

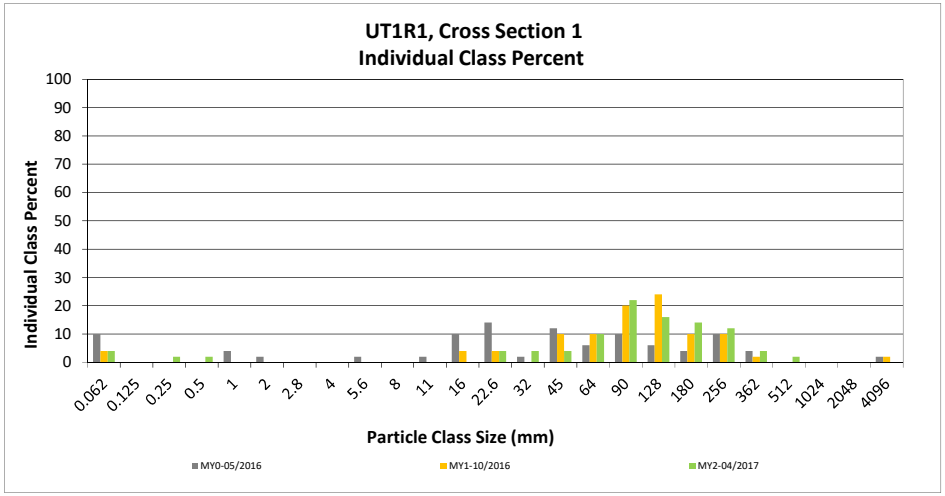
Monitoring Year 2 - 2017

UT1R1, Cross Section 1

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	1	2	6
	Medium	0.25	0.50	1	2	8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0			8
GRAVEL	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			8
	Medium	8.0	11.0			8
	Medium	11.0	16.0			8
	Coarse	16.0	22.6	2	4	12
	Coarse	22.6	32	2	4	16
	Very Coarse	32	45	2	4	20
	Very Coarse	45	64	5	10	30
COBBLE	Small	64	90	11	22	52
	Small	90	128	8	16	68
	Large	128	180	7	14	82
	Large	180	256	6	12	94
BOULDER	Small	256	362	2	4	98
	Small	362	512	1	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross Section	
Channel materials (mm)	
D_{16} =	32.00
D_{35} =	69.16
D_{50} =	87.3
D_{84} =	190.9
D_{95} =	279.2
D_{100} =	512.0





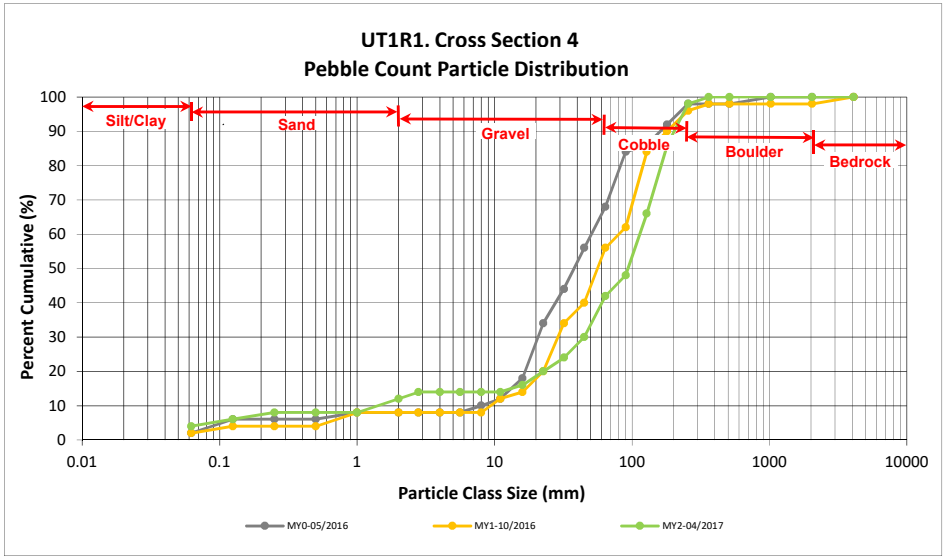
Reachwide and Cross Section Pebble Count Plots

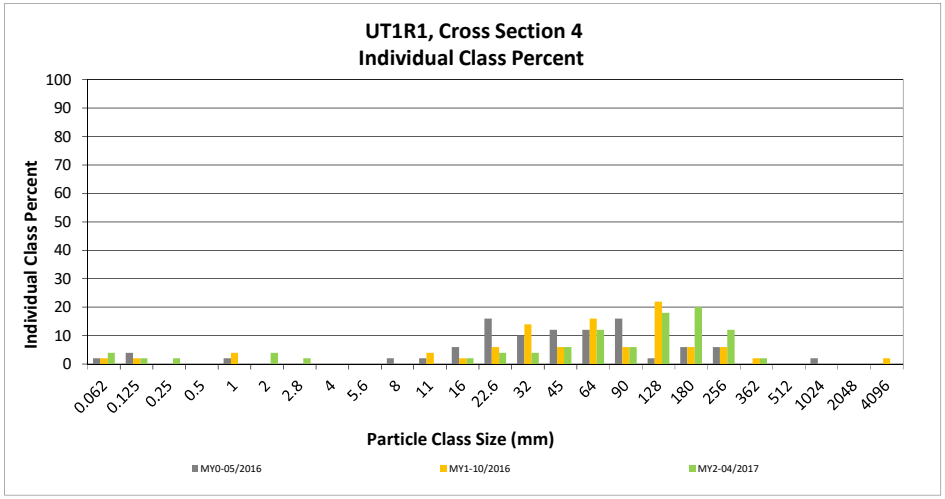
Henry Fork Stream Mitigation
DMS Project No. 96306
Monitoring Year 2 - 2017

UT1R1, Cross Section 4

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	4	4
SAND	Very fine	0.062	0.125	1	2	6
	Fine	0.125	0.250	1	2	8
	Medium	0.25	0.50			8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0	2	4	12
GRAVEL	Very Fine	2.0	2.8	1	2	14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0			14
	Medium	8.0	11.0			14
	Medium	11.0	16.0	1	2	16
	Coarse	16.0	22.6	2	4	20
	Coarse	22.6	32	2	4	24
	Very Coarse	32	45	3	6	30
	Very Coarse	45	64	6	12	42
COBBLE	Small	64	90	3	6	48
	Small	90	128	9	18	66
	Large	128	180	10	20	86
	Large	180	256	6	12	98
BOULDER	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross Section 4	
Channel materials (mm)	
D_{16} =	16.00
D_{35} =	52.11
D_{50} =	93.6
D_{84} =	174.0
D_{95} =	234.4
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Henry Fork Stream Mitigation

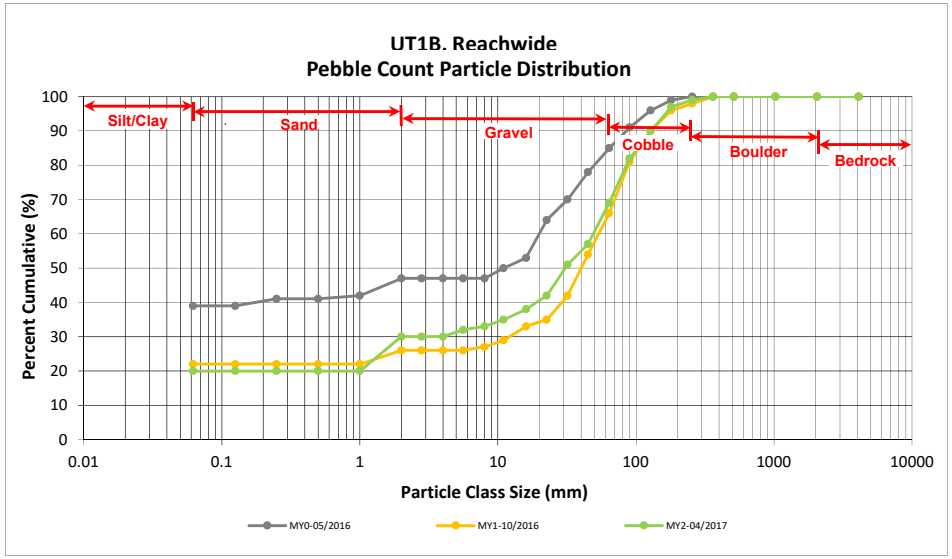
DMS Project No. 96306

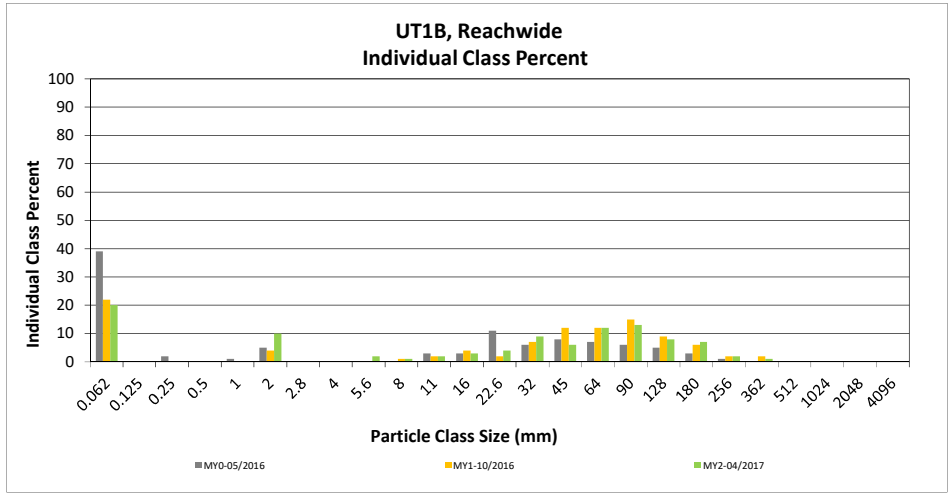
Monitoring Year 2 - 2017

UT1B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	14	20	20	20
SAND	Very fine	0.062	0.125					20
	Fine	0.125	0.250					20
	Medium	0.25	0.50					20
	Coarse	0.5	1.0					20
	Very Coarse	1.0	2.0	3	7	10	10	30
GRAVEL	Very Fine	2.0	2.8					30
	Very Fine	2.8	4.0					30
	Fine	4.0	5.6		2	2	2	32
	Fine	5.6	8.0		1	1	1	33
	Medium	8.0	11.0		2	2	2	35
	Medium	11.0	16.0	1	2	3	3	38
	Coarse	16.0	22.6	1	3	4	4	42
	Coarse	22.6	32	2	7	9	9	51
	Very Coarse	32	45	3	3	6	6	57
	Very Coarse	45	64	8	4	12	12	69
COBBLE	Small	64	90	10	3	13	13	82
	Small	90	128	7	1	8	8	90
	Large	128	180	6	1	7	7	97
	Large	180	256	2		2	2	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	11.00
D_{50} =	30.8
D_{84} =	98.3
D_{95} =	163.3
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Henry Fork Stream Mitigation

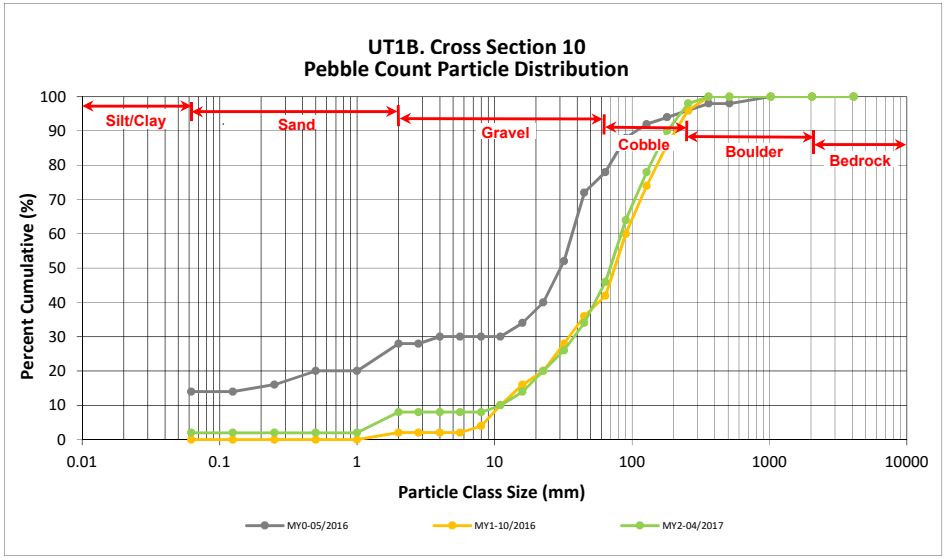
DMS Project No. 96306

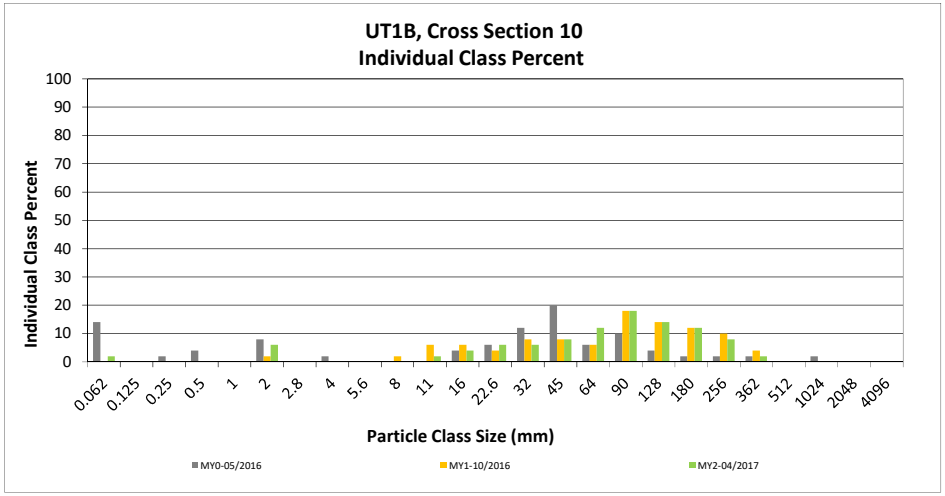
Monitoring Year 2 - 2017

UT1B, Cross Section 10

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	2	2
SAND	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
GRAVEL	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			8
	Medium	8.0	11.0	1	2	10
	Medium	11.0	16.0	2	4	14
	Coarse	16.0	22.6	3	6	20
	Coarse	22.6	32	3	6	26
	Very Coarse	32	45	4	8	34
	Very Coarse	45	64	6	12	46
COBBLE	Small	64	90	9	18	64
	Small	90	128	7	14	78
	Large	128	180	6	12	90
	Large	180	256	4	8	98
BOULDER	Small	256	362	1	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**50**	**100**	**100**

Cross Section	
Channel materials (mm)	
D_{16} =	17.95
D_{35} =	46.34
D_{50} =	69.0
D_{84} =	151.8
D_{95} =	224.3
D_{100} =	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 2 - 2017

Reach	MY of Occurrence	Date of MY2 Data Collection	Date of Occurrence	Method
UT1 Reach 2	1	N/A	N/A	Crest
	2	6/8/2017	4/24/2017	Crest & Stream
	2	11/10/2017	10/8/2017	Crest & Stream
UT1A	1	11/14/2016	U	Crest
	2	6/8/2017	4/24/2017	Crest & Stream
	2	11/10/2017	10/8/2017	Crest & Stream
UT1B	1	N/A	N/A	Crest
	2	11/10/2017	10/8/2017	Crest & Stream
UT2	1	N/A	N/A	Crest
	2	6/8/2017	4/24/2017	Crest & Stream

* N/A, no bankfull events recorded.
** U, Unknown

Table 14. Wetland Gage Attainment Summary

Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 2 - 2017

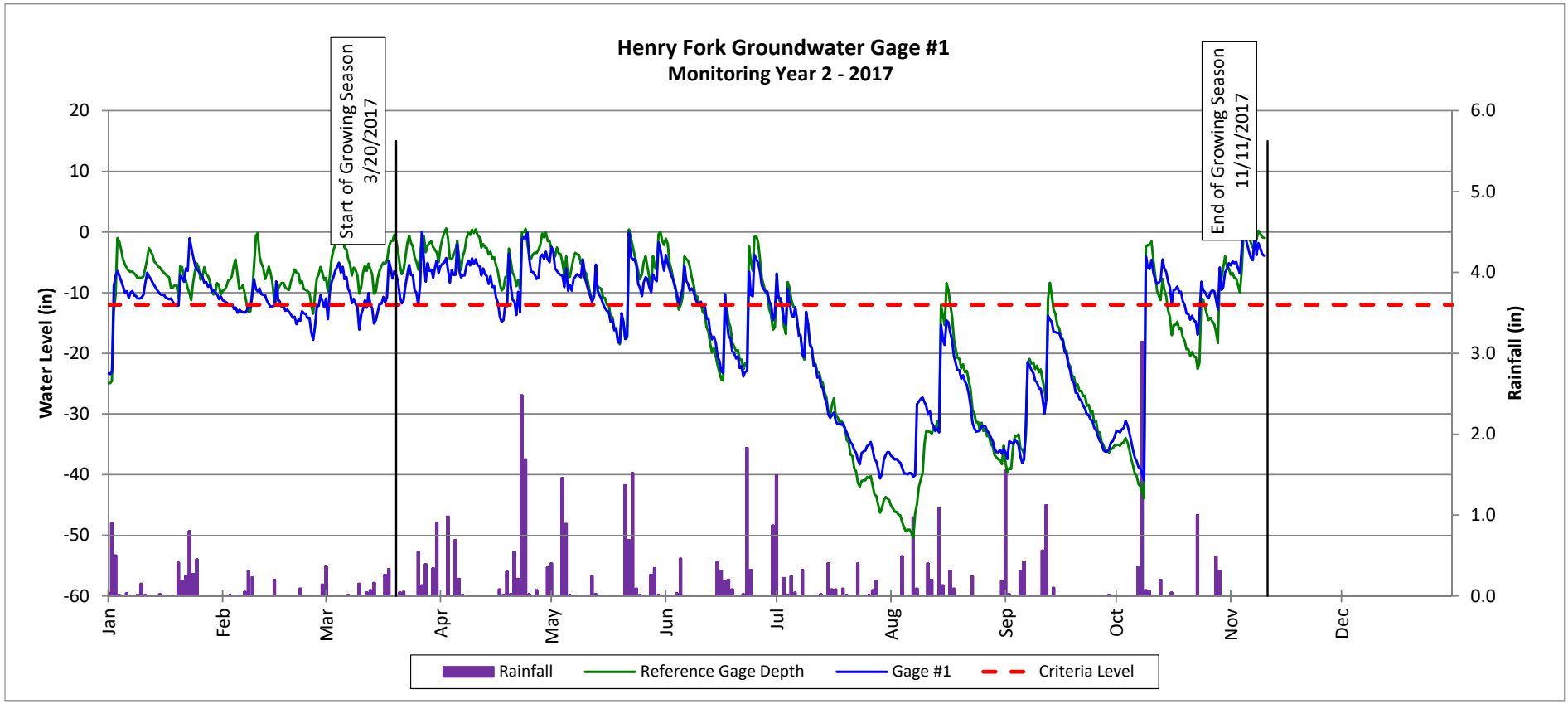
Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)	Year 7 (2022)
1	No/0 Days (0%)	Yes/23 Days (10%)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

N/A, not applicable
Growing season dates March 20 - November 11
20 consecutive days to satisfy critera
GWGs 5 and 9 installed April 7, 2017.
GWG 3 was relocated January 2017.

Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

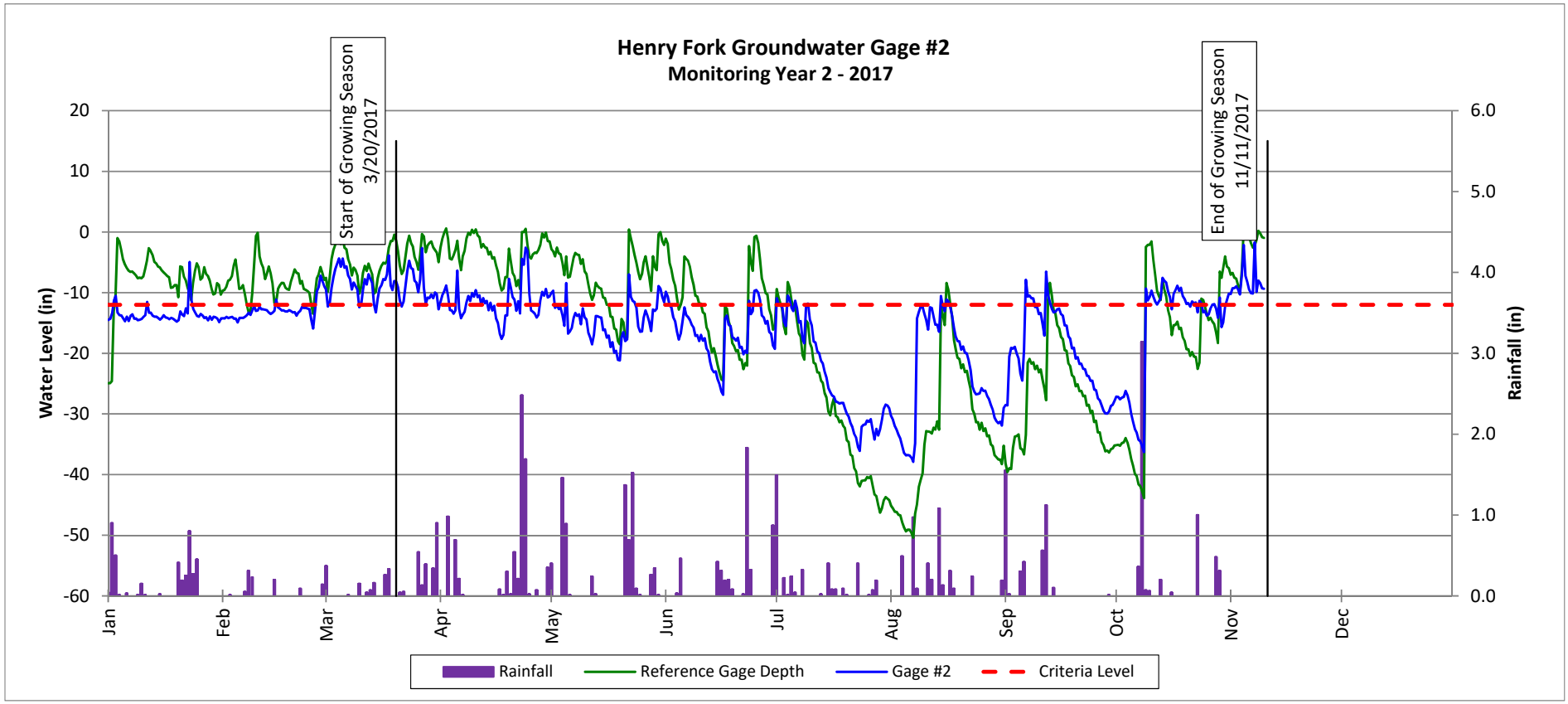
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

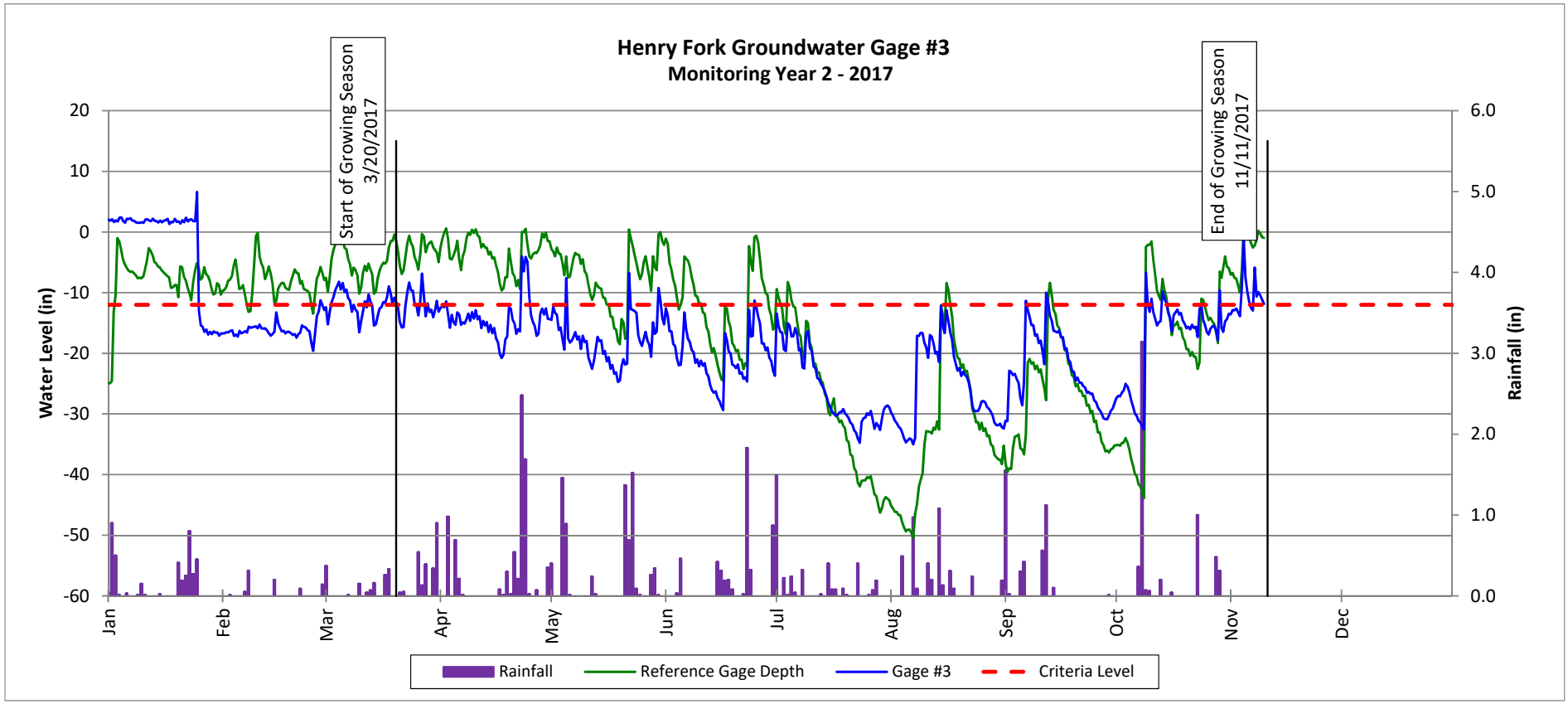
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

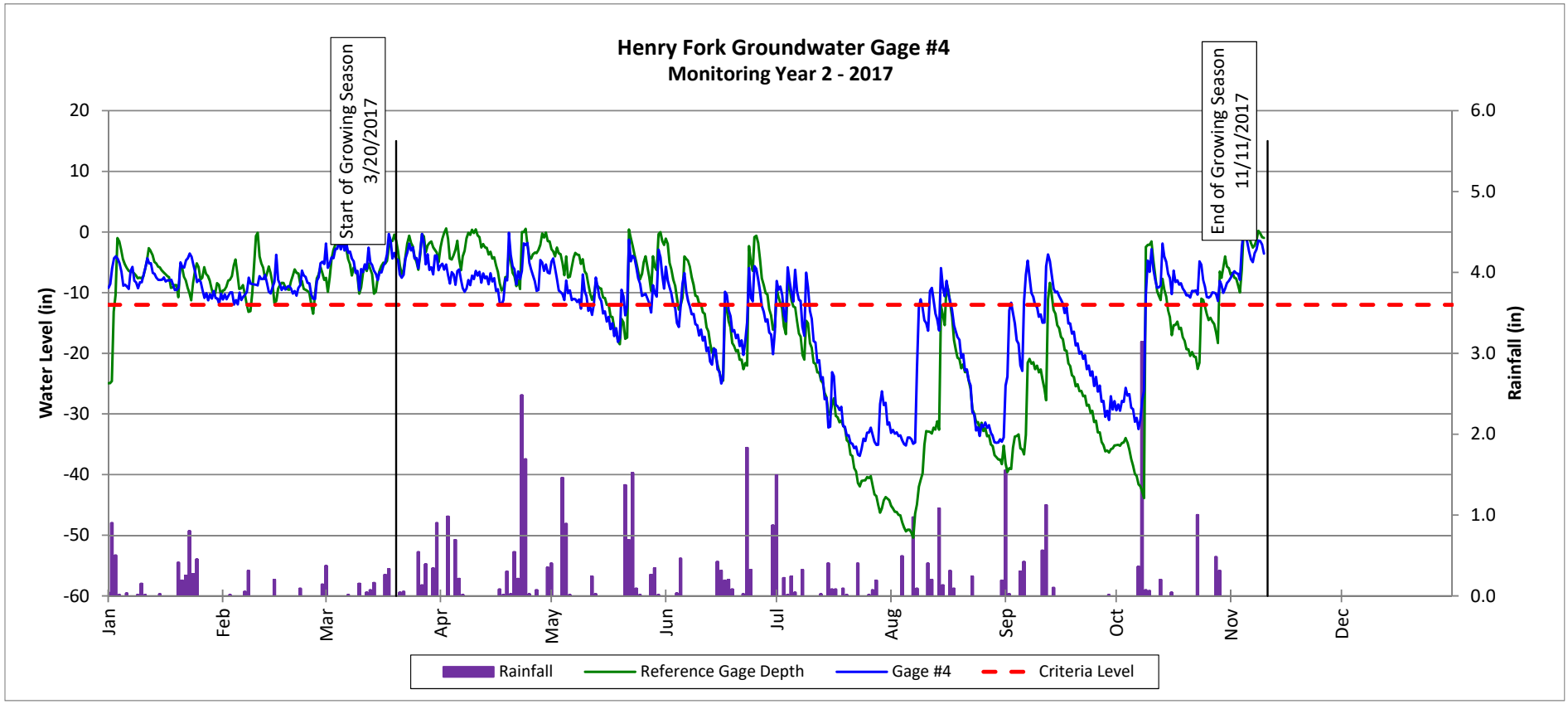
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

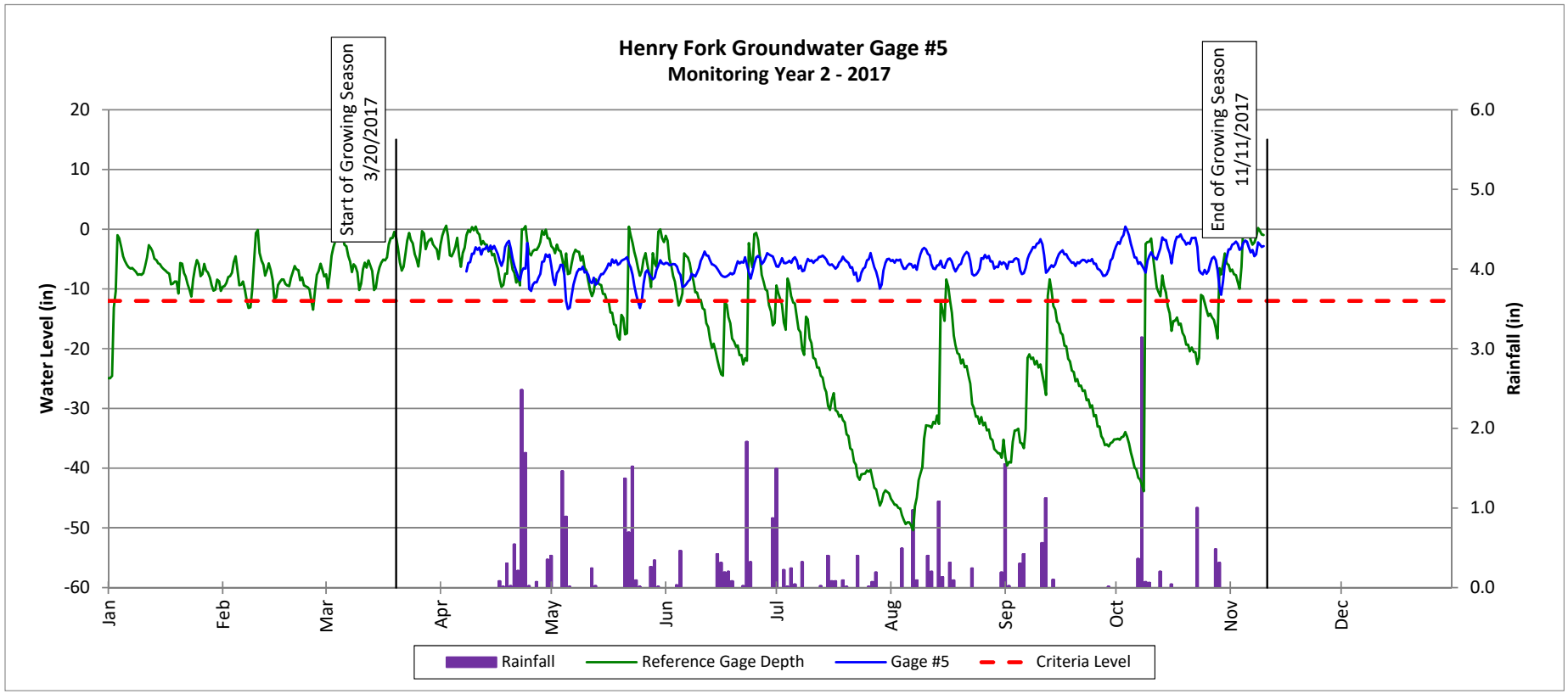
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 2 - 2017



Groundwater Gage Plots

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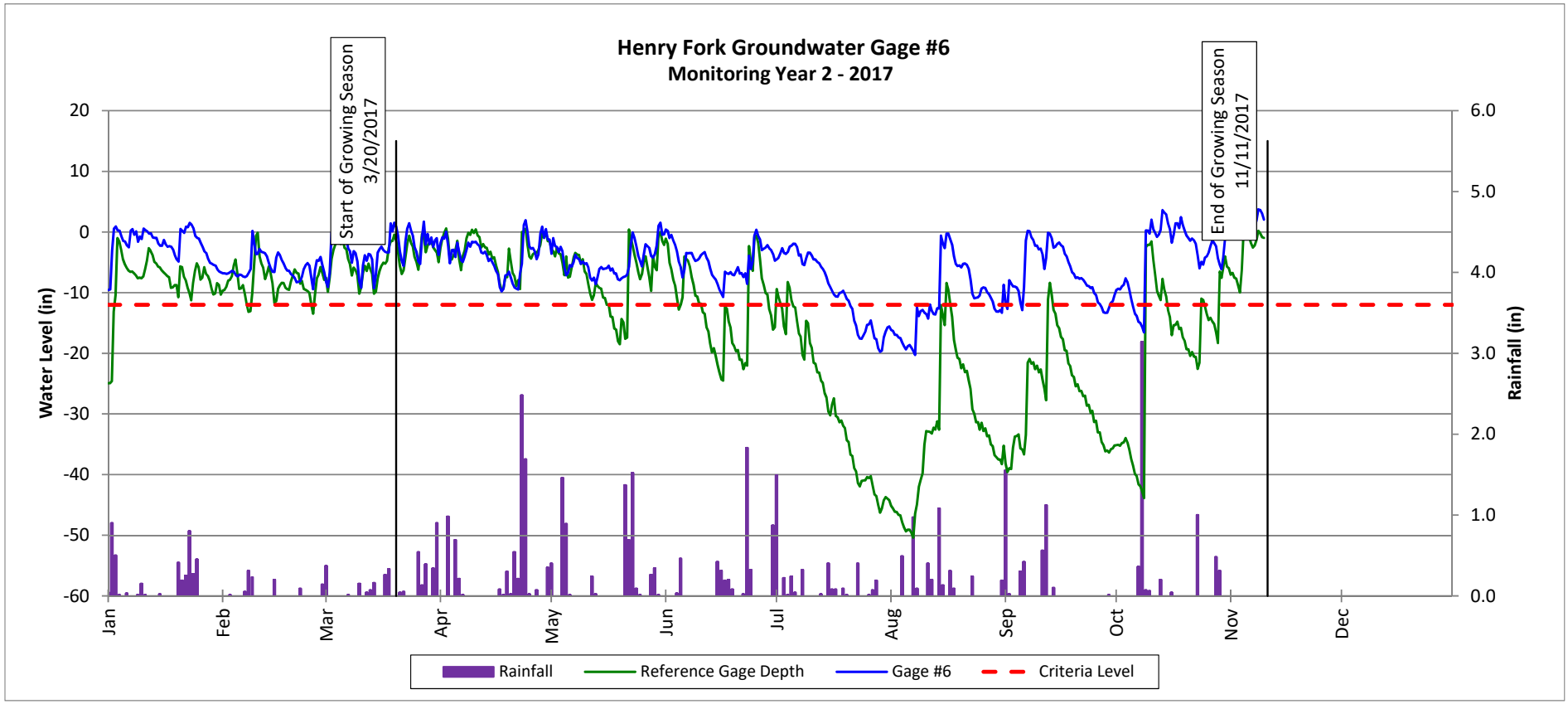
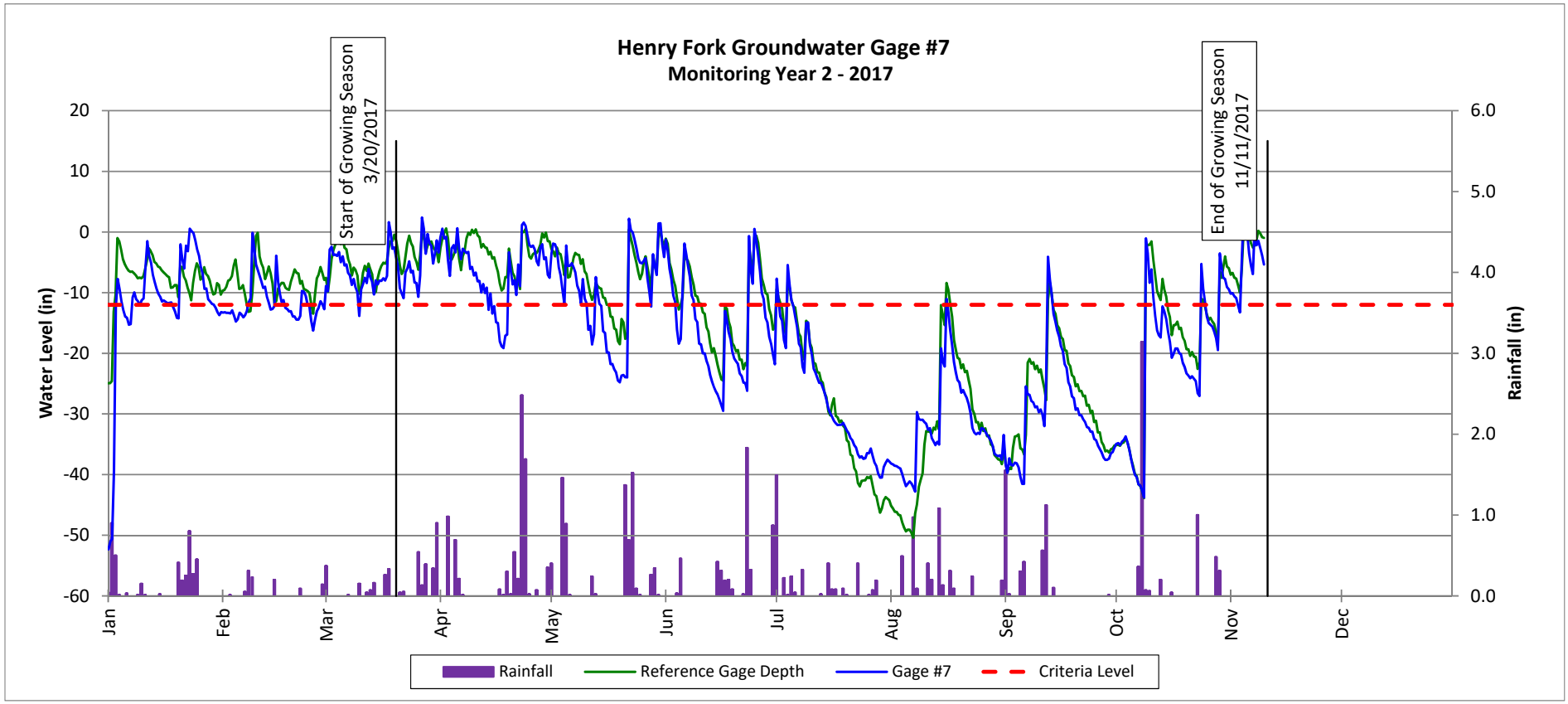
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

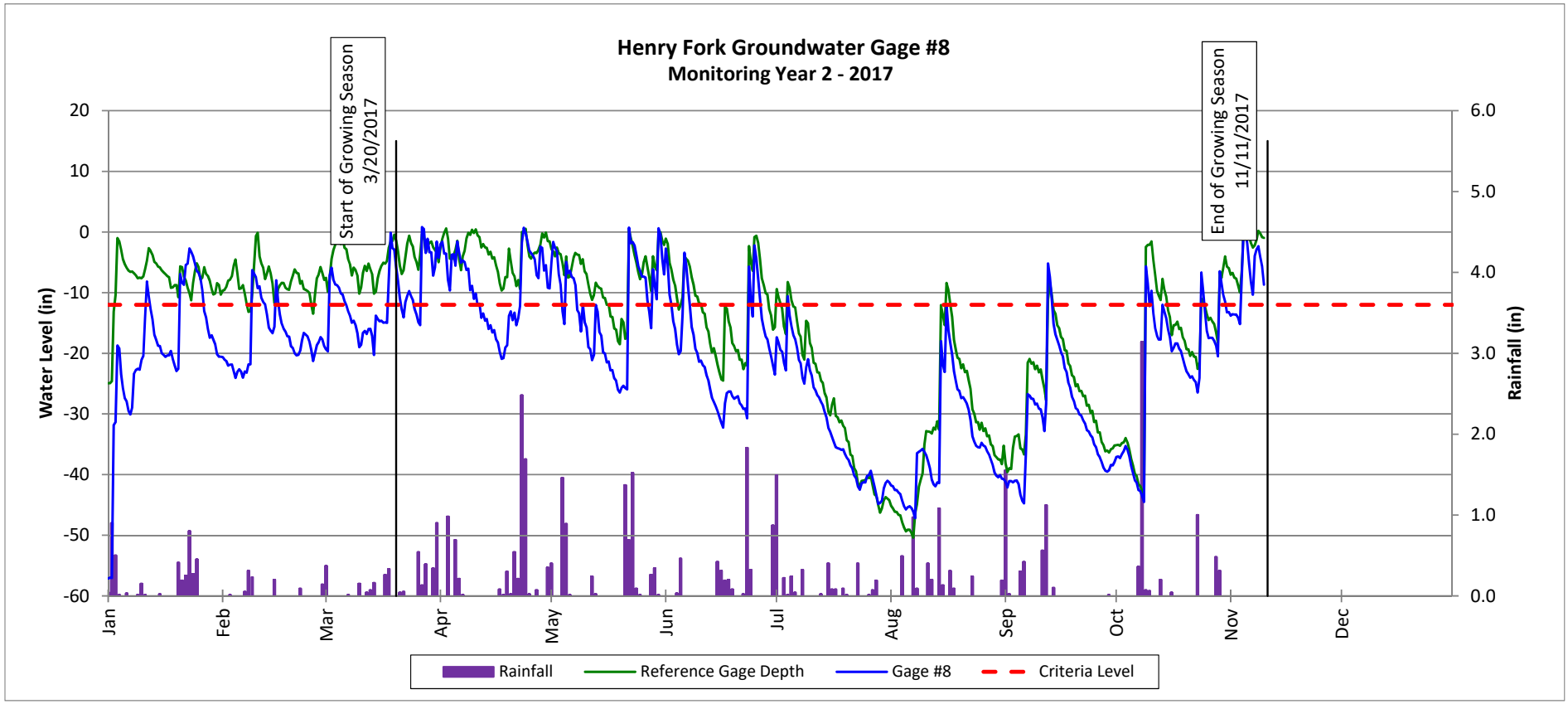
Monitoring Year 2 - 2017



Groundwater Gage Plots

Henry Fork Mitigation Site (DMS Project No. 96306)

Monitoring Year 2 - 2017



Groundwater Gage Plots

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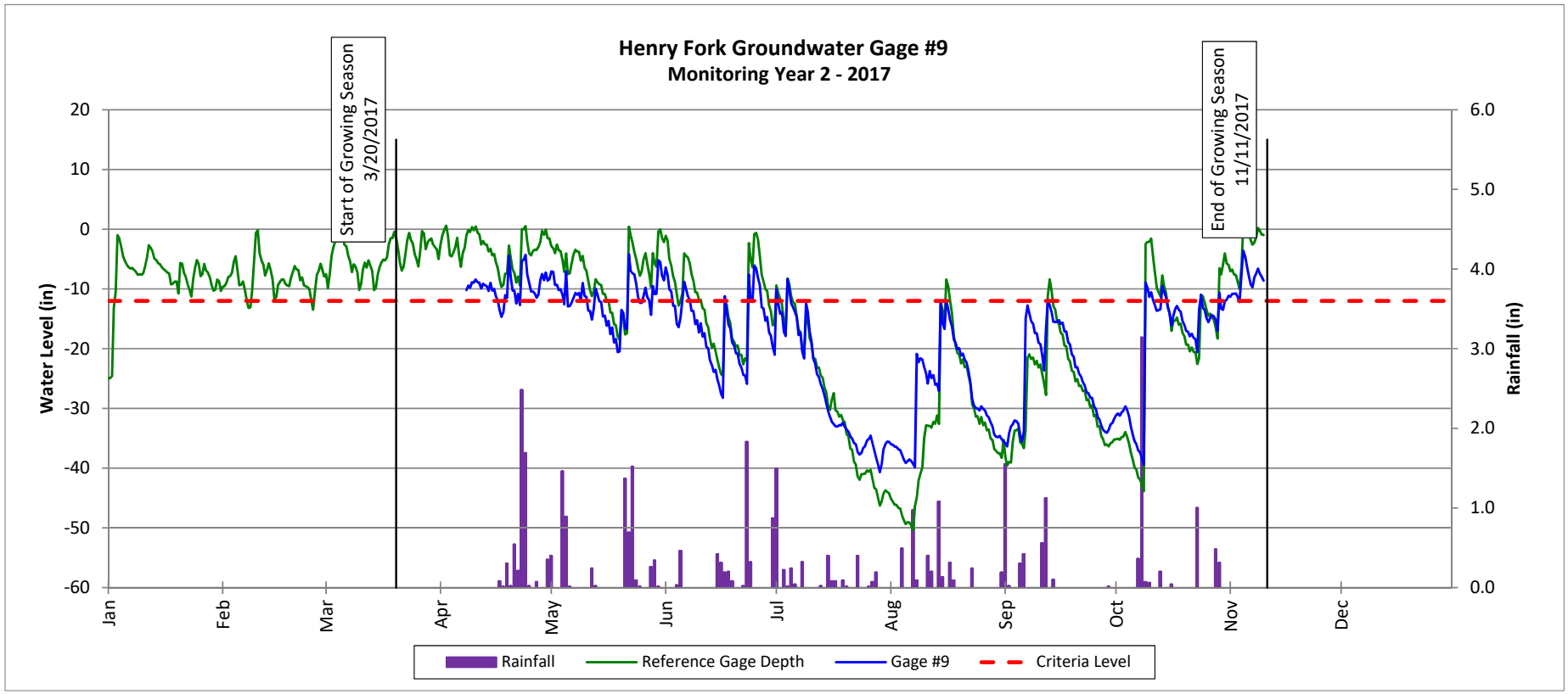
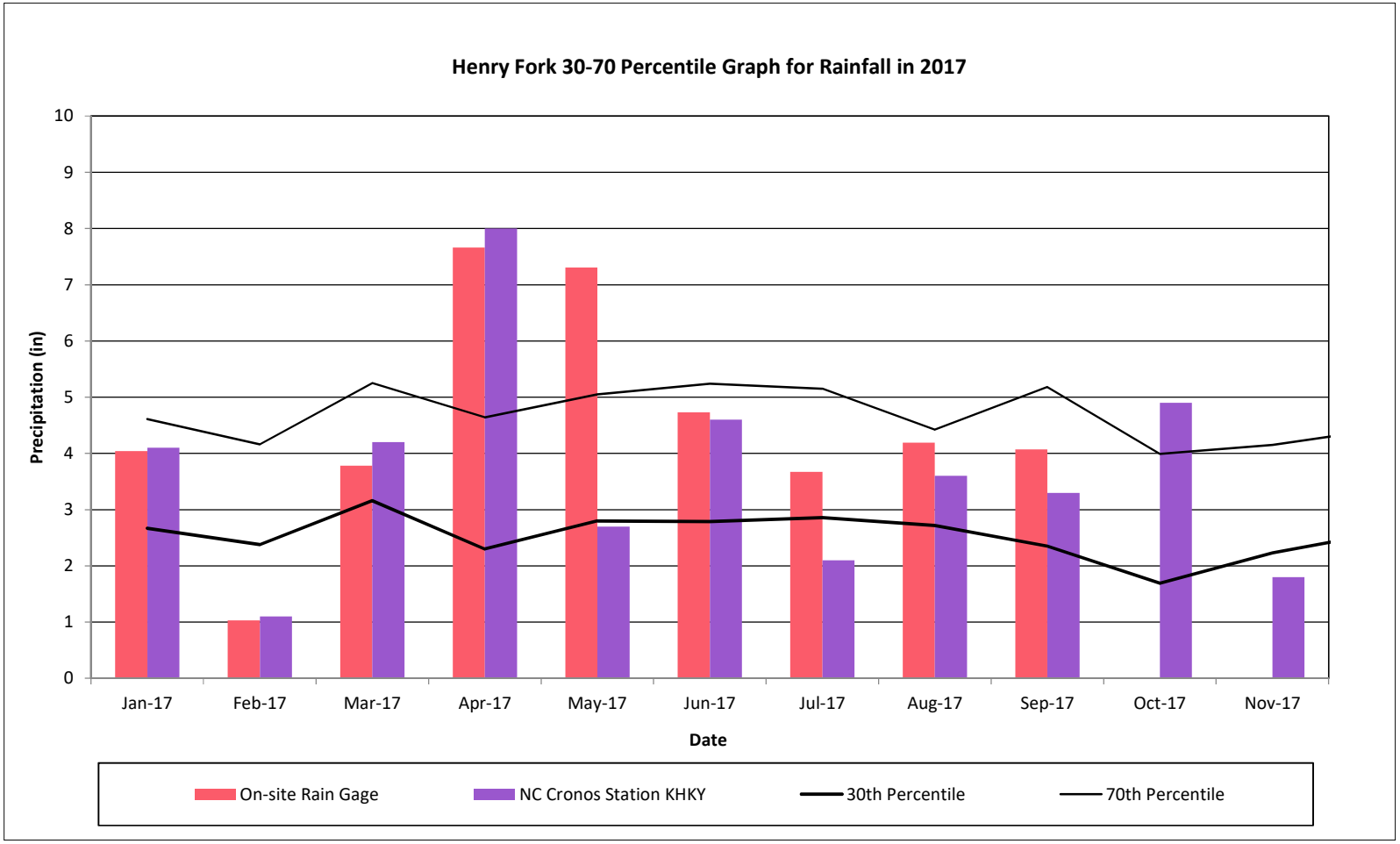


Monthly Rainfall Data

Henry Fork Mitigation Site

DMS Project No. 96306

Monitoring Year 2 - 2017



[1] 2017 rainfall collected by on-site rainfall gage and NC Cronos Station KHKY, Hickory, NC

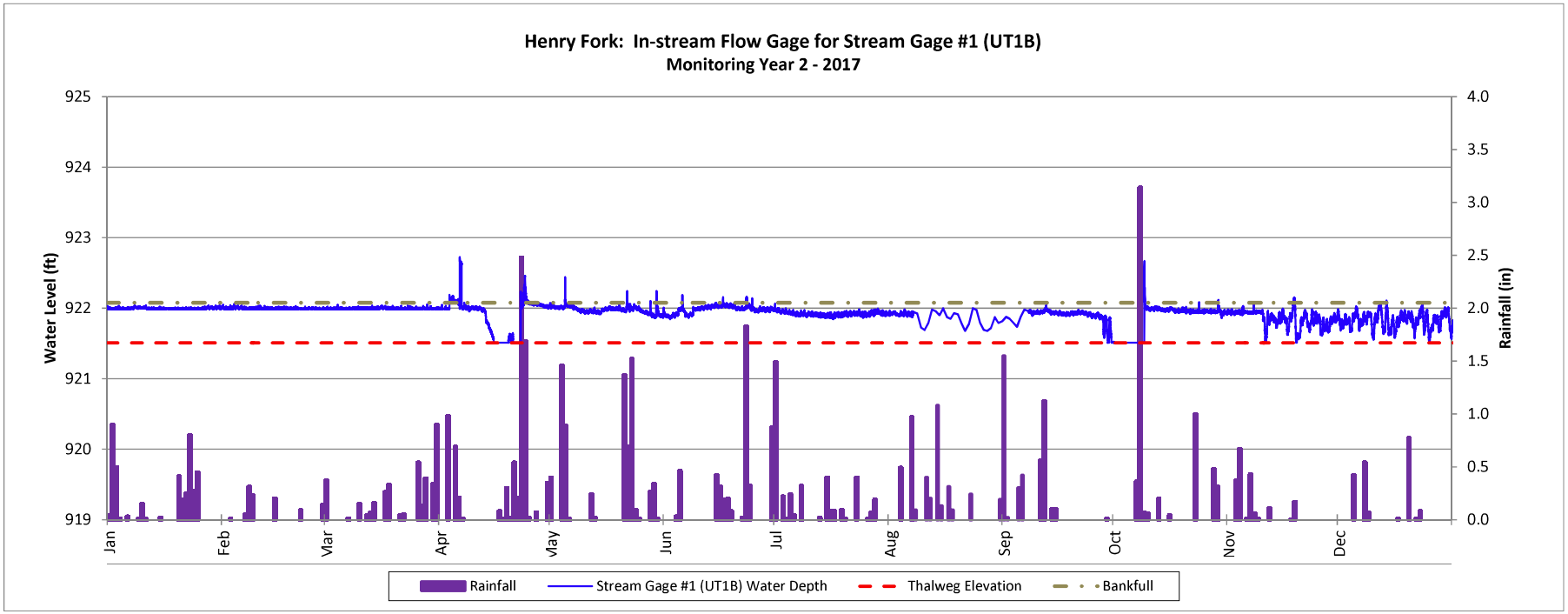
[2] 30th and 70th percentile rainfall data collected from WETS station Conover Oxford Shoal, NC

[3] On-site gage download malfunctioned during October site visit.

Recorded In-stream Flow Events

Henry Fork Mitigation Site (DMS Project No.96306)

Monitoring Year 2 - 2017



Recorded In-stream Flow Events

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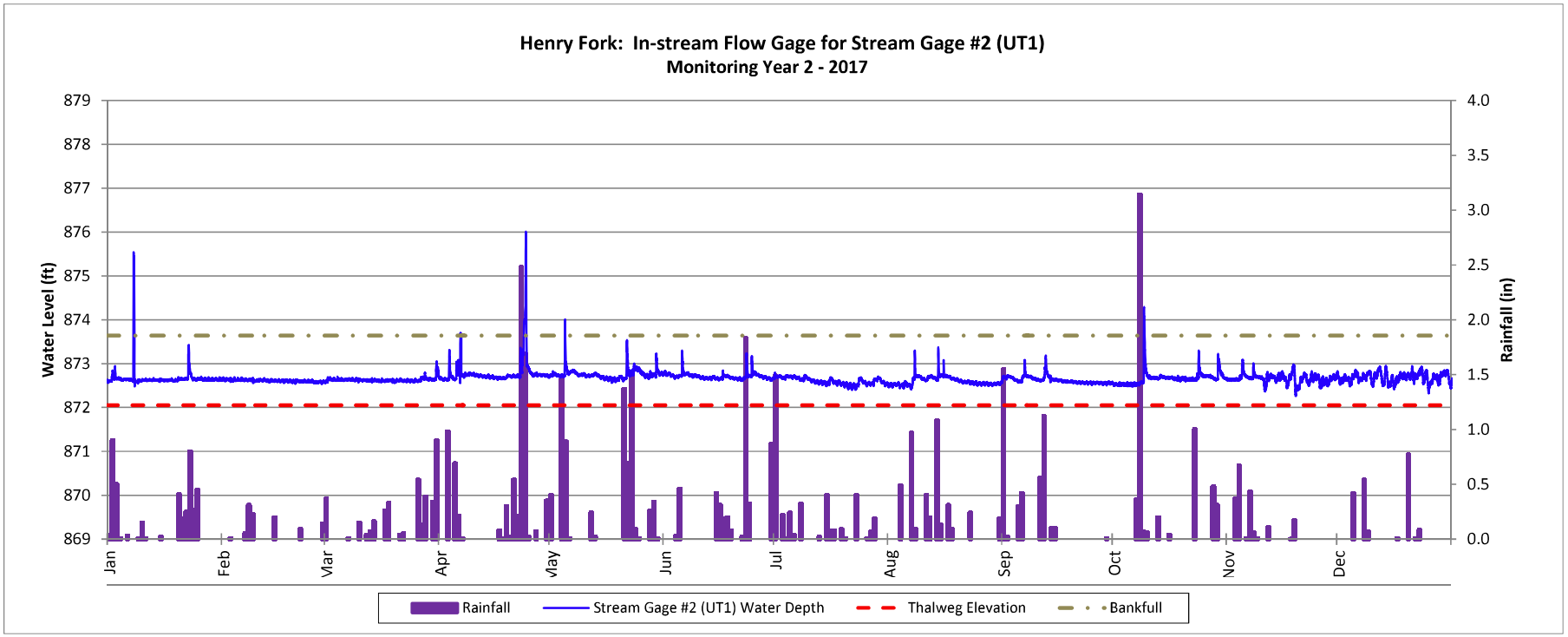
Monitoring Year 2 - 2017



Recorded In-stream Flow Events

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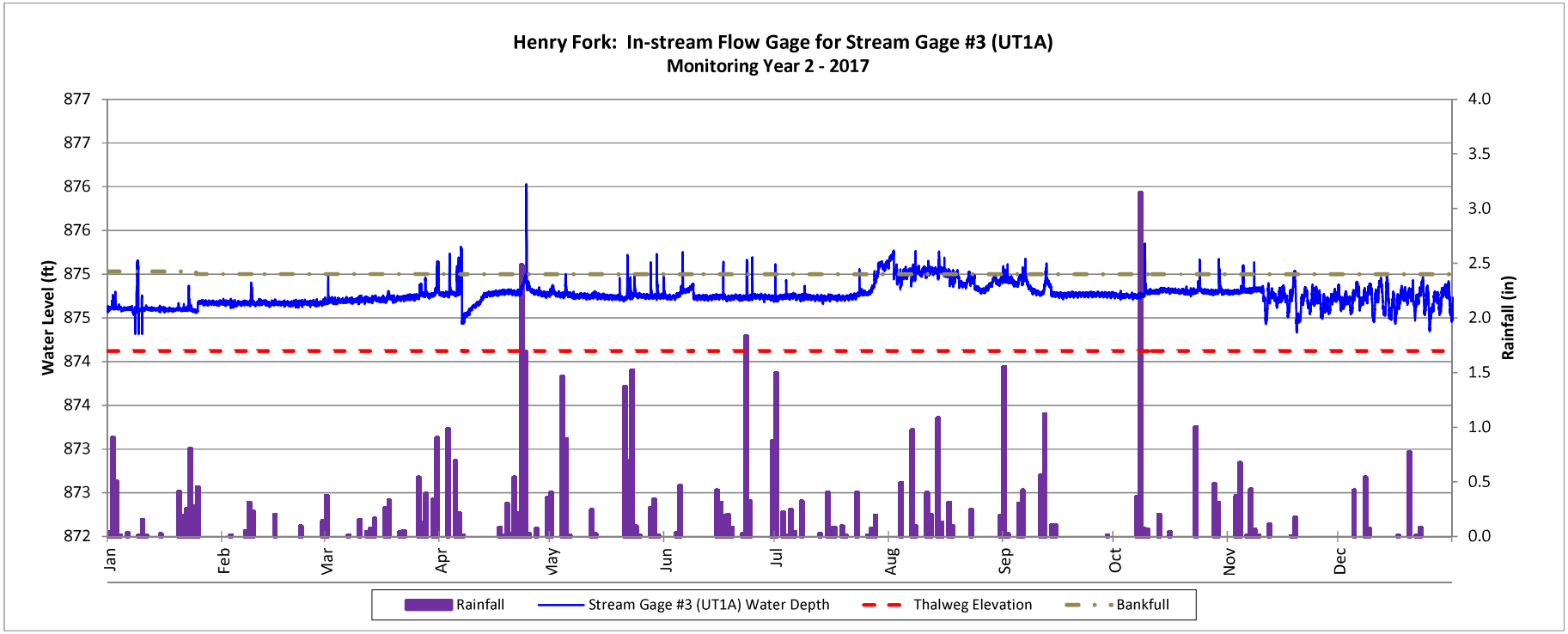

Recorded In-stream Flow Events

Henry Fork Mitigation Site (DMS Project No.96306)

Monitoring Year 2 - 2017