# MONITORING YEAR 4 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: February 2019 - November 2019
Final Submission Date: December 23, 2019

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**PREPARED FOR:**

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

| | | | | | |
|---|---|---|---|---|---|
| **Mitigation Project Name** | **Henry Fork Stream and Wetland Mitigation Project** | **County** | **Catawba** | **USACE Action ID** | **2014-00538** |
| **DMS ID** | **96306** | **Date Project Instituted** | **2/15/2014** | **NCDWR Permit No** | **2014-0193** |
| **River Basin** | **Catawba** | **Date Prepared** | **7/19/2019** | | |
| **Cataloging Unit** | **03050102** | | | | |

| Credit Release Milestone | Stream Credits | | | | | | Wetland Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Scheduled Releases (Stream) | Warm | Cool | Cold | Anticipated Release Year (Stream) | Actual Release Date (Stream) | Scheduled Releases (Forested) | Riparian Riverine | Riparian Non-riverine | Non-riparian | Scheduled Releases (Coastal) | Coastal | Anticipated Release Year (Wetland) | Actual Release Date (Wetland) |
| **Potential Credits (Mitigation Plan)** | | | **4,807.670** | | | | | **4.217** | | | | | | |
| **Potential Credits (As-Built Survey)** | | | **4,838.330** | | | | | | | | | | | |
| **Potential Credits (IRT Approved)** | | | **4,807.667** | | | | | **4.217** | | | | | | |
| **1 (Site Establishment)** | **N/A** | | | | N/A | N/A | **N/A** | | | | **N/A** | | N/A | N/A |
| **2 (Year 0 / As-Built)** | **30%** | | 1,451.499 | | 2016 | 6/24/2016 | **30%** | 1.265 | | | **30%** | | 2016 | 6/24/2016 |
| **3 (Year 1 Monitoring)** | **10%** | | 480.767 | | 2017 | 10/20/2017 | **10%** | 0.422 | | | **10%** | | 2017 | 10/20/2017 |
| **IRT Adjustment*** | | | -9.200 | | | 10/20/2017 | | | | | | | | |
| **4 (Year 2 Monitoring)** | **10%** | | 480.767 | | 2018 | 4/25/2018 | **10%** | 0.422 | | | **15%** | | 2018 | 4/25/2018 |
| **5 (Year 3 Monitoring)** | **10%** | | 480.767 | | 2019 | 4/26/2019 | **15%** | 0.633 | | | **20%** | | 2019 | 4/26/2019 |
| **6 (Year 4 Monitoring)** | **5%** | | | | 2020 | | **5%** | | | | **10%** | | 2020 | |
| **7 (Year 5 Monitoring)** | **10%** | | | | 2021 | | **15%** | | | | **15%** | | 2021 | |
| **8 (Year 6 Monitoring)** | **5%** | | | | 2022 | | **5%** | | | | **N/A** | | 2022 | |
| **9 (Year 7 Monitoring)** | **10%** | | | | 2023 | | **10%** | | | | **N/A** | | 2023 | |
| **Stream Bankfull Standard** | **10%** | | 480.767 | | | 4/25/2018 | **N/A** | | | | **N/A** | | | |
| **Total Credits Released to Date** | | | **3,365.366** | | | | | **2.741** | | | | | | |

**NOTES:**
10/20/2017: Adjustment required due to IRT concerns on how the as-built credits were calculated

**CONTINGENCIES:**

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

27 Sept 2019

**Date**

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

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met

| | | | | | | |
|---|---|---|---|---|---|---|
| **Mitigation Project Name** | **Henry Fork Stream and Wetland Mitigation Project** | **County** | **Catawba** | **USACE Action ID** | **2014-00538** |
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| **River Basin** | **Catawba** | **Date Prepared** | **7/19/2019** | | |
| **Cataloging Unit** | **03050102** | | | | |

**DEBITS (released credits only)**

| | | | Ratios | 1 | 1.5 | 2.5 | 5 | **1.0214** | 3 | 2 | 5 | 1 | 3 | 2 | 5 | 1 | 3 | 2 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Stream Restoration | Stream Enhancment I | Stream Enhancement II | Stream Preservation | Riparian Restoration | Riparian Creation | Riparian Enhancement | Riparian Preservation | Nonriparian Restoration | Nonriparian Creation | Nonriparian Enhancement | Nonriparian Preservation | Coastal Marsh Restoration | Coastal Marsh Creation | Coastal Marsh Enhancement | Coastal Marsh Preservation |
| **IRT Approved As-Built Amounts (feet and acres)** | | | | **3,057.000** | **2,626.000** | | | **3.960** | | **0.680** | | | | | | | | | |
| **IRT Approved As-Built Amounts (mitigation credits)** | | | | **3,057.000** | **1,750.667** | | | **3.877** | | **0.340** | | | | | | | | | |
| **Percentage Released** | | | | **70%** | **70%** | | | **65%** | | **65%** | | | | | | | | | |
| **Released Amounts (feet / acres)** | | | | **2,139.900** | **1,838.200** | | | **2.574** | | **0.442** | | | | | | | | | |
| **Released Amounts (credits)** | | | | **2,139.900** | **1,225.467** | | | **2.520** | | **0.221** | | | | | | | | | |
| NCDWR Permit | USACE Action ID | Project Name | | | | | | | | | | | | | | | | | |
| | 2014-00081 | NCDOT - SR 1922 - Bridge 119 - Division 13, Burke County | | 124.000 | | | | | | | | | | | | | | | |
| 2006-1849 | 2006-41599-390 | Bromley | | | | | | 0.040 | | | | | | | | | | | |
| 2000-0162 | 2000-30479 | Johnston Road Widening/Ballentine Road | | | | | | 0.112 | | 0.200 | | | | | | | | | |
| 2000-1195 | 2009-03090 | Wilkinson Blvd Parking Decks | | | | | | 1.036 | | | | | | | | | | | |
| | 2016-01344 | NCDOT TIP B-5398 | | | 93.000 | | | | | | | | | | | | | | |
| | 2005-30193 | Ballantyne Country Club Golf Course | | | | | | 0.029 | | | | | | | | | | | |
| | 2009-00940 | Sliverlanding | | | | | | | | 0.072 | | | | | | | | | |
| 2000-1195 | 2009-03090 | Wilkinson Blvd Parking Decks | | | | | | 0.352 | | | | | | | | | | | |
| 2004-1615 | 2005-30123 | Midwood Phase II (Firth Court Redevelopment) | | | | | | 0.352 | | | | | | | | | | | |
| 2000-1195 | 2009-03090 | Wilkinson Blvd Parking Decks | | | | | | | | 0.068 | | | | | | | | | |
| 2006-1849 | 2006-41599-390 | Bromley | | | | | | | | 0.026 | | | | | | | | | |
| 2000-1195 | 2009-03090 | Wilkinson Blvd Parking Decks | | | | | | 0.032 | | | | | | | | | | | |
| 2005-0893 | 2005-31884 | US 521 Landfill (Foxhole) | | | | | | 0.621 | | | | | | | | | | | |
| | 2009-00940 | Silverlanding | | | | | | | | 0.076 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| **Remaining Amounts (feet / acres)** | | | | **2,015.900** | **1,745.200** | | | **0.000** | | **0.000** | | | | | | | | | |
| **Remaining Amounts (credits)** | | | | **2,015.900** | **1,163.467** | | | **0.000** | | **0.000** | | | | | | | | | |

**PREPARED BY:**

WILDLANDS
ENGINEERING

1430 South Mint Street, Suite 104
Charlotte, NC 28203

Phone: 704.332.7754
Fax: 704.332.3306

December 23, 2019

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

RE: **Response to MY4 Draft Report Comments**
**Henry Fork Mitigation Project**
DMS Project # 96306
Contract Number 005782
RFP Number 16-005298
Catawba River Basin – CU# 03050103 Expanded Service Area
Catawba County, North Carolina

Dear Mr. Reid:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 4 report for the Henry Fork Mitigation Project. The following Wildlands responses to DMS's report comments are noted in italics lettering.

**DMS comment; Please add callout on CCPV for location of bank repair on UT1.**

*Wildlands response; A callout has been added to CCPV Figure 3.2 to note the location of the bank repair on UT1.*

**DMS comment; On Page 1-4, the report mentions minor bank repairs are planned on UT1 Reach 2 near 102+75. This stationing does not correspond to UT1 Reach 2 according to the CCPV. Please update accordingly.**

*Wildlands response; The stationing has been corrected in the report text.*

**DMS comment; Page 1-5 describes a narrow footpath through the easement near vegetation plot 5 for the purpose of the frisbee golf course. During the on-site meeting held January 16, 2019 with Wildlands, IRT and DMS, the IRT expressed concern with the trail and indicated it would need to discontinue by the time of closeout. Wildlands indicated they would communicate this to the adjacent land owner. Meeting minutes are attached.**

*Wildlands response; Text has been added to this paragraph to be consistent with the January 16, 2019 meeting minutes.*

**DMS comment; For clarity, consider adding the consecutive day number for each gage on the groundwater gage plots instead of using the currently shown 20 day bar. The gage 8 plot shows 19 days which corresponds to the consecutive days for that gage. All the other gages use the 20 day bar.**

**The 20 day bar adds some confusion to the plots without a description of what it corresponds too (8.5% of the growing season).**

*Wildlands response; For clarity, the number of consecutive days is now shown instead of the 20 day bar on all groundwater gage plots.*

**Digital Files Review**

**DMS comment; Wetland 1, 2, B, G, N, and R features in the DMS geodatabase do not match what is reported in the monitoring report asset table. Please provide DMS with features for these wetlands that accurately characterize the creditable assets.**

*Wildlands response; A new shapefile called "ALL_Wetlands" has been added to the electronic support files that correctly matches the creditable assets.*

**DMS comment; DMS cannot open the "Henry Fork In-Stream Flow Gage with..." file. Please confirm that the file cannot be opened, and if it cannot, provide a new file.**

*Wildlands response; Yes, Wildlands is able to open the file that was provided to DMS in the electronic support files. Please let us know if there continues to be an issue with opening the file.*

Enclosed please find two (2) hard copies and one (1) electronic copy on CD of the Final Monitoring Report. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Andrea S. Eckardt

Andrea S. Eckardt,
Ecological Assessment Team Leader
aeckardt@wildlandseng.com

## EXECUTIVE SUMMARY

Wildlands Engineering Inc. (Wildlands) implemented a full delivery project at the Henry Fork Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore 3,057 linear feet (LF) of perennial streams and enhance 2,626 LF of intermittent streams, enhance 0.68 acres of existing wetlands, rehabilitate 0.25 acres of existing wetlands, and re-establish 3.71 acres of wetlands in Catawba County, NC. The Site is expected to generate 4,807.667 stream mitigation units (SMUs) and 4.221 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 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 established project goals 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 Site construction and as-built surveys were completed between November 2015 and March 2016. Monitoring Year (MY) 4 assessments and site visits were completed between February and November 2019. Per Inter-agency Review Team (IRT) guidelines, detailed monitoring and analysis of vegetation and channel cross-sectional dimensions were omitted during MY4. Visual observations, substrate data, hydrology data, and management practices are included in this report. To preserve the clarity and continuity of reporting structure, this report maintains section and appendix numbering from previous monitoring reports. Omitted sections are denoted in the table of contents.

Overall, the Site has met the required stream and vegetation success criteria for MY4. All restored and enhanced streams are stable and functioning as designed. All project streams recorded at least one bankfull event or greater in MY4; therefore, the bankfull performance standard has been met for the Site. Vegetation appears to be performing adequately to attain the MY5 density requirement of 260 stems per acre. Fourteen of the fifteen groundwater monitoring gages installed on the Site met or exceeded the hydrologic success criteria for MY4. The MY4 visual assessment revealed a few areas of concern including pockets of invasive plant species, areas of low stem vigor, isolated areas of bank scour, and beaver activity which will continue to be monitored and adaptive management will be performed as needed.

**HENRY FORK MITIGATION SITE**

Monitoring Year 4 Annual Report

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## APPENDICES



*Content not required for Monitoring Year 4 Report

# Section 1: PROJECT OVERVIEW

The Site is located near the city of Hickory in Catawba County, NC, in the Catawba River Basin; eight-digit CU 03050102 and the 14-digit 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 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 4,807.667 SMUs and 4.221 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 4 Data Assessment

Annual monitoring was conducted during MY4 (February to November 2019) 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

MY4 is a reduced monitoring year that does not require morphological surveys; therefore no cross-sectional survey was performed this year. In general, MY4 pebble counts in UT1 and UT1B indicate maintenance of coarser material in the riffle features and finer particles in the pool features. Refer to Appendix 2 for the visual stability assessment tables, Current Conditions Plan View (CCPV) Figures 3.0-3.2, and reference photographs and Appendix 4 for pebble count 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. During MY4, all stream reaches recorded at least one bankfull event. Multiple bankfull events had been recorded in previous monitoring years on all reaches; therefore, the performance criteria has been met for the 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. The stream gages indicated each stream recorded between 150-300 days of consecutive flow. Presence of baseflow was observed in UT1, UT1A, and UT1B during each site visit. UT2 was observed with baseflow during all site visits except for the period with lower than normal amounts of rainfall from September to October. These observations confirm data recorded by the stream gages. Refer to Appendix 5 for hydrology summary data and plots.

### 1.2.3 Vegetative Assessment

MY4 is a reduced monitoring year that does not require detailed vegetation inventory and analysis; therefore no vegetation plot monitoring was performed this year. Visual assessment in MY4 indicate that planted stems are surviving, and the Site should be on track to meet the MY5 density requirement of 260 stems per acre.

### 1.2.4 Wetland Assessment

In total, there are fifteen GWGs currently on the Site. 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). 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. During the initial GWG installation, GWG 3 was installed in a seep where hydrology was much stronger than the surrounded area; therefore, GWG 3 was relocated in January 2017 (MY2) to an area that was more representative of the surrounding wetlands. The transducer for GWG 5 was replaced at the beginning of MY4 due to abnormal data in MY3 and to ensure accurate water level data is being reported. In February and March 2019 (MY4), six additional GWG were added to the Site. Three gages (GWG 10 – 12) were installed to better define the wetland re-establishment area within the right floodplain of UT1 Reach 2. The remaining three gages (GWG 13 – 15) were installed in locations adjacent to wetland enhancement areas to provide groundwater data to support the potential expansion of these wetland areas.

Following construction, gages were distributed so that the data collected would provide a reasonable indication of groundwater levels throughout the wetland components on the Site. Additional gages have been added to further refine this data. A gage was established in an adjacent reference wetland and is being utilized to compare with the hydrologic response within the restored wetland areas at the Site. A barotroll logger (to measure barometric pressure used in the calculations of groundwater levels with gage transducer data) was installed on the Site. The rainfall data is collected from an existing NC CRONOS station (Hickory 4.8 SW, NC). All monitoring gages were downloaded on a quarterly basis and maintained on an as needed basis. A soil temperature gage was also installed on Site in October 2016. Wildlands is using the soil temperature probe data to confirm the dates defined in the WETS table for Burke County, NC. The WETS growing season is not available for Catawba County; however, a growing season is defined for historic weather data collected at the Hickory Regional Airport in Burke County, which is approximately 3 miles as the crow flies from the Site. The growing season from Burke County, which runs from March 20$^{th}$ to November 11$^{th}$ (236 days), is being used for hydrologic success. The final performance standard established 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 growing season under typical precipitation conditions.

Of the fifteen GWGs, fourteen met the success criteria for MY4. Of the gages that met, the percentage consecutive days of the growing season ranged from 15% to 100% of the growing season. While GWG 8 was the only gage that did not meet criteria, the measured maximum consecutive days was short by

only one day. GWGs 5, 10, and 13 achieved the success criteria for 100% of the growing season with plots showing similar hydroperiods indicating comparable groundwater hydrology in those areas. The remainder of the GWGs follow the hydroperiod of the reference gage.

Refer to the CCPV Figures 3.0-3.2 in Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology summary data and plots.

### 1.2.5 Areas of Concern and Adaptive Management Plan

Vegetation

In MY4, minor areas of invasive plant populations are found within the conservation easement. These species include: Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), Creeping primrose (*Ludwigia* peploides), and Asian spiderwort (*Murdannia keisak*). Areas of dense sweet gum (*Liquidambar styraciflua*) monocultures were also identified and treated within the planted areas in the Site. Wildlands contracted with a provider for invasive species/sweet gum treatment that occurred in November 2019.

Visual assessments in MY4 continued to reveal areas with low stem vigor/height and poorer herbaceous cover on the lower portion of the Site (UT2 and UT1 Reach 2 floodplains). Though the herbaceous cover in these areas remains less established in comparison to the rest of the Site, it has improved over time from previous monitoring years. The floodplains of UT2 and UT1 Reach 2 were addressed in the fall of MY4 with an additional seeding and amendment application. These areas will continue to be monitored and Wildlands will implement further remedial action such as supplemental planting if necessary.

Streams

Following a large storm event in June 2019, isolated areas of bank scour were noted along UT1. In August 2019, minor repairs were performed on UT1 Reach 1 on the pool near station 106+00 consisting of regrading the outside meander bend and replanting the banks with established vegetation transplanted from the floodplain. Additional minor bank repairs, in part related to beaver activity, are planned for an area of bank scour on UT1 Reach 2 near station 124+75 and to be completed in the winter of 2019/2020.

Continuing in MY4, low flow (water present, but low velocity) in UT1A and UT2 was observed with some vegetation within the channel. A defined baseflow channel is still present and as woody vegetation becomes more established and shades out in-stream vegetation, the baseflow channel is expected to become less vegetated. In November 2019, additional live-stakes were planted to supplement the woody vegetation along the banks where needed on UT1A and UT2 in order to improve stream shading.

During MY2, a portion of UT1 Reach 1 was found to be flowing subsurface and surface repair and plugging of this area was completed in December 2017 in order to address the issue. The repair has remained effective throughout MY4.

Several beaver dams have been removed in MY4 throughout the lower portion of UT1 Reach 2. The beaver activity has been limited to the lower portion of the project and off site before the tributary reaches Henry Fork. Beaver activity will continue to be monitored and managed throughout closeout.

Wetlands

In previous monitoring years, wetland hydrology had been weak in the wetland rehabilitation areas upslope of UT1 Reach 2 (GWGs 2 – 3) and at the head of UT2 (GWG 8). As discussed in section 1.2.4, all GWGs except for GWG 8 met or exceeded the success criteria indicating that groundwater levels have continued to recharge in MY4, bolstered by strong winter rainfall totals, as well as above average growing season rainfall. Three of the additional gages (GWGs 10 – 12) were installed at the beginning of MY4 ensure adequate representation of the hydrology in the wetland re-establishment area upslope of

UT1 Reach 2. The three remaining gages (GWGs 13 – 15) added in MY4 were installed adjacent to wetland enhancement areas to provide hydrology data to support the potential expansion of these areas to offset any loss of wetland re-establishment areas where GWGs are not meeting success criteria.

Conservation Easement

There is an approved narrow footpath through the easement near vegetation plot 5 for the purpose of frisbee golf that Wildlands has allowed on a conditional basis and to discontinue by the time of closeout. This has continued to be monitored to ensure that it does not violate easement terms or threaten stream assets.

The minor mowing encroachments that were observed in MY1 and MY2 have been resolved. While there has been a stop to the encroachment issues, the Site boundary and prior problem areas will continue to be monitored for easement enforcement.

Quarterly site visits will continue to be conducted to monitor and address any areas of concern. If necessary, future adaptive management will be implemented to improve herbaceous cover, treat and control invasive plants, and address hydrology issues. Please refer to Appendix 2 for CCPV Figures 3.0-3.2.

## 1.3 Monitoring Year 4 Summary

Overall, the Site has met the required stream and vegetation success criteria for MY4. All restored and enhanced streams are stable and functioning as designed. All project streams recorded at least one bankfull event or greater in MY4; therefore, the bankfull performance standard has been met for the Site. Vegetation appears to be performing adequately to attain the MY5 density requirement of 260 stems per acre. Fourteen of the fifteen groundwater monitoring gages installed on the Site met or exceeded the hydrologic success criteria for MY4. The MY4 visual assessment revealed a few areas of concern including pockets of invasive plant species, areas of low stem vigor, isolated areas of bank scour, and beaver activity which will continue to be monitored and adaptive management will be performed as needed.

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.

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North Carolina Division of Mitigation Services (DMS), 2007. Catawba River Basin Restoration Priorities. http://www.nceep.net/services/restplans/RBRPCatawba2007.pdf

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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

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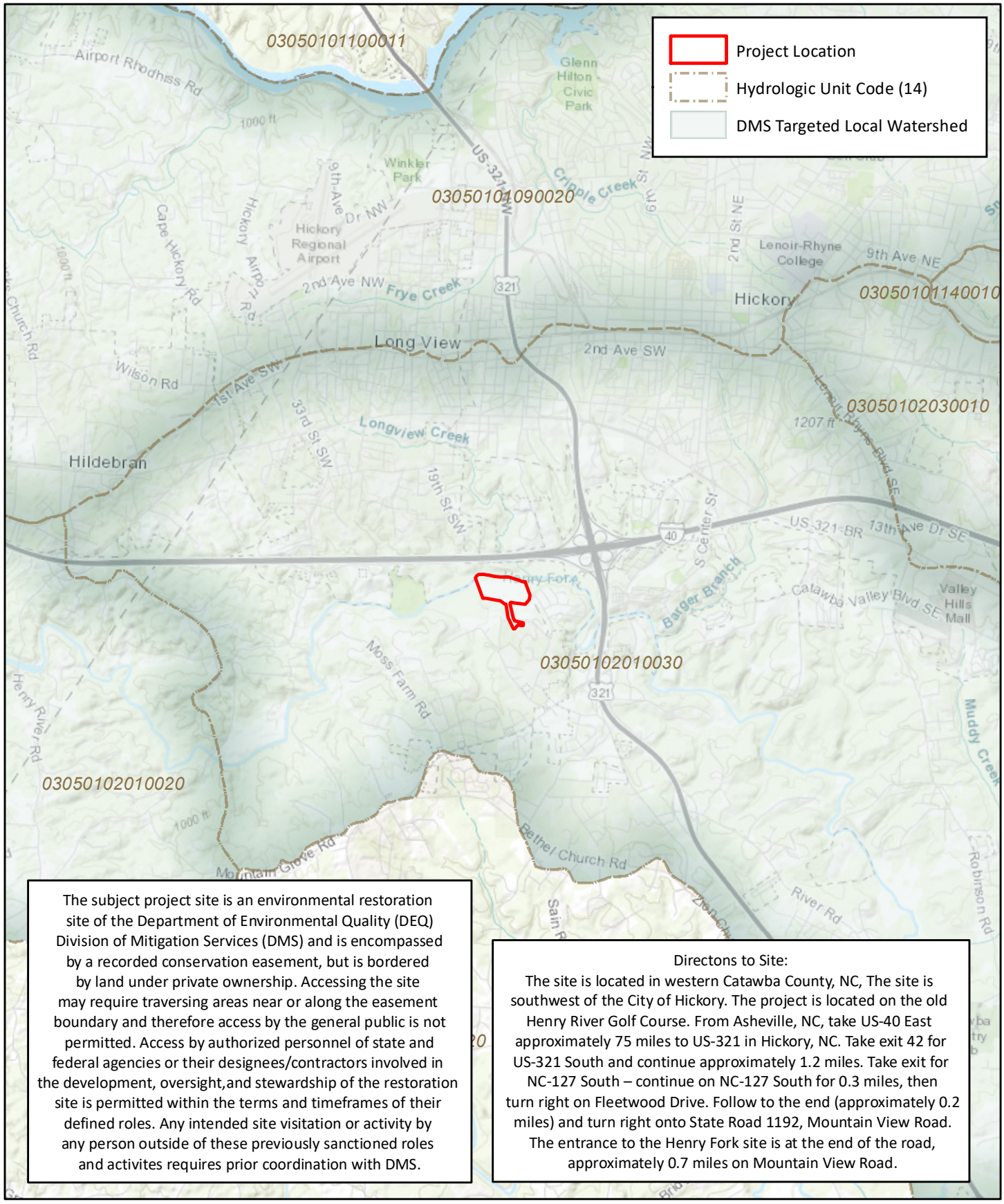
# APPENDIX 1. General Figures and Tables




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.

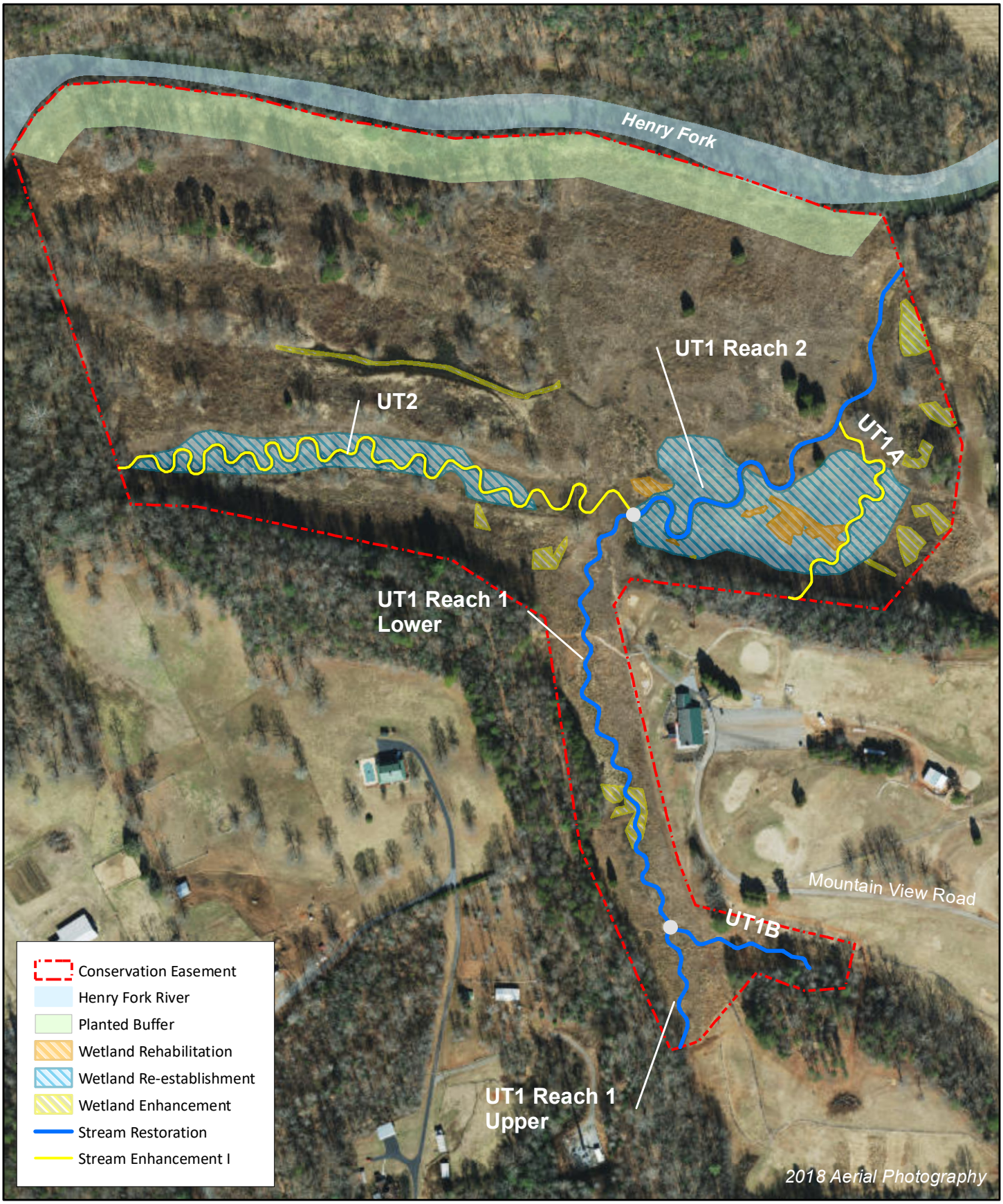
Directons to Site:
The site is located in western Catawba County, NC, The site is southwest of the City of Hickory. The project is located on the old Henry River Golf Course. From Asheville, NC, take US-40 East approximately 75 miles to US-321 in Hickory, NC. Take exit 42 for US-321 South and continue 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 4 - 2019
*Catawba County, NC*




WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 2 Project Component/Asset Map
Henry fork Mitigation Site
DMS Project No. 96306
Monitoring Year 4 - 2019

*Catawba County, NC*

## Table 1. Project Components and Mitigation Credits

Henry Fork Mitigation Site
DMS Project No.96306
**Monitoring Year 4 - 2019**

| MITIGATION CREDITS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Stream | | Riparian Wetland | | Non-Riparian Wetland | | Buffer | Nitrogen Nutrient Offset | Phosphorous Nutrient Offset |
| Type | R | RE | R | RE | R | RE | | | |
| Totals | 4,807.667 | N/A | 3.880 | 0.341 | N/A | N/A | N/A | N/A | N/A |

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

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

* Stream credit calculations were originally calculated along the as-built thalweg and updated to be calculated along stream 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 4 - 2019**

| 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 | April 2018 | November 2018 |
| | Vegetation Survey | September 2018 | |
| Year 3 Invasive Species Treatment | | June & August 2018 | |
| Year 4 Monitoring | Stream Survey | N/A | November 2019 |
| | Vegetation Survey | N/A | |
| Year 4 Beaver dam removal on UT1 Reach 2 | | March 2019 - November 2019 | |
| Year 4 Bank Repair on UT1 Reach 1 | | August 2019 | |
| Year 4 Invasive Species Treatment | | October 2019 | |
| Year 5 Monitoring | Stream Survey | 2020 | December 2020 |
| | Vegetation Survey | 2020 | |
| Year 6 Monitoring | Stream Survey | N/A | December 2021 |
| | Vegetation Survey | N/A | |
| Year 7 Monitoring | Stream Survey | 2022 | December 2022 |
| | Vegetation Survey | 2022 | |

[1]Seed and mulch is added as each section of construction is completed.
N/A - Not applicable

## Table 3. Project Contact Table

Henry Fork Stream Mitigation Site
DMS Project No.96306
**Monitoring Year 4 - 2019**

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

## Table 4. Project Information and Attributes

Henry Fork Mitigation Site
DMS Project No.96306
**Monitoring Year 4 - 2019**

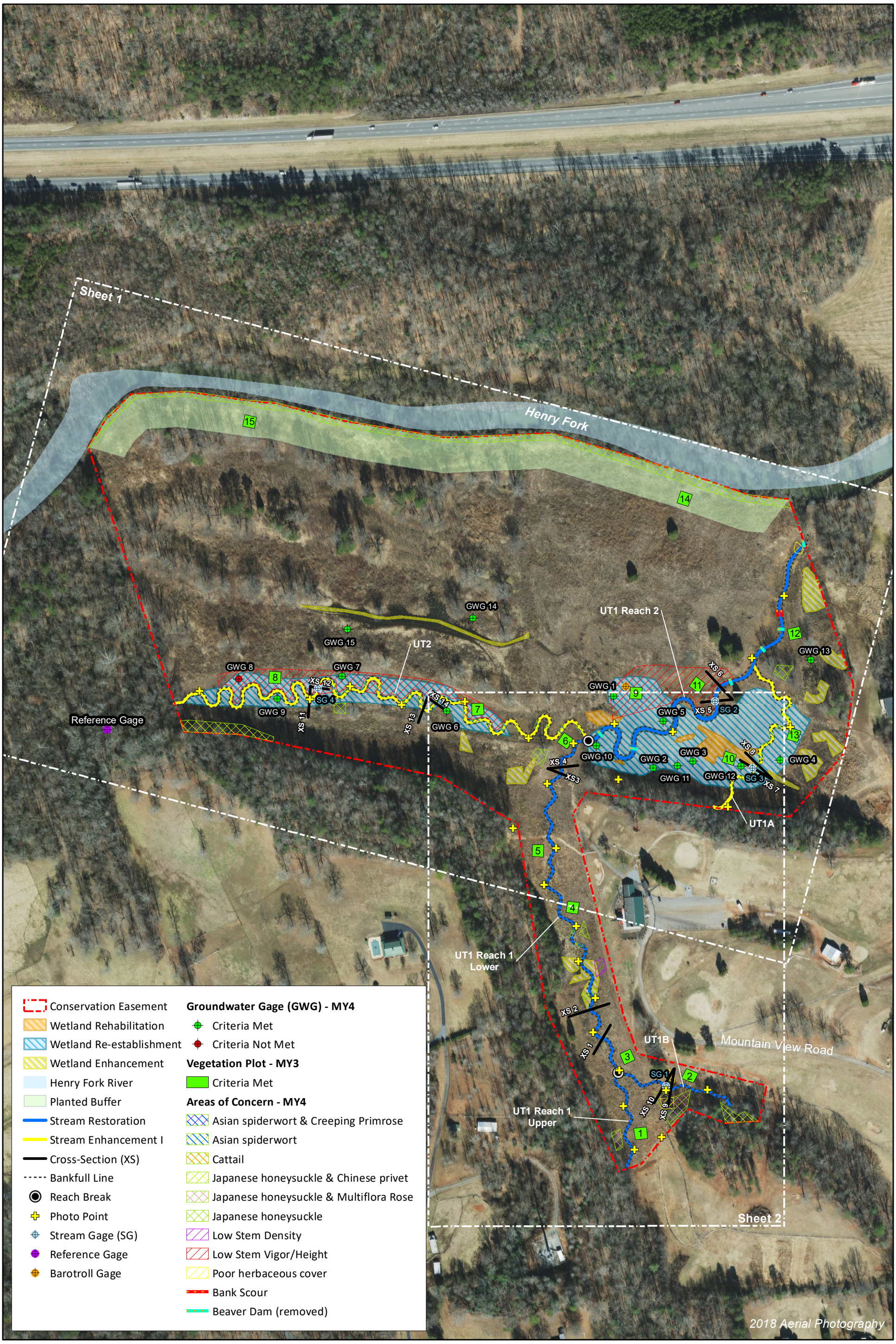
| PROJECT INFORMATION | |
|---|---|
| Project Name | Henry Fork Mitigation Site |
| County | Catawba County |
| Project Area (acres) | 48.06 |
| Project Coordinates (latitude and longitude) | 35°42'12.98"N, 81°21'53.20"W |
| **PROJECT WATERSHED SUMMARY INFORMATION** | |
| Physiographic Province | Inner 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



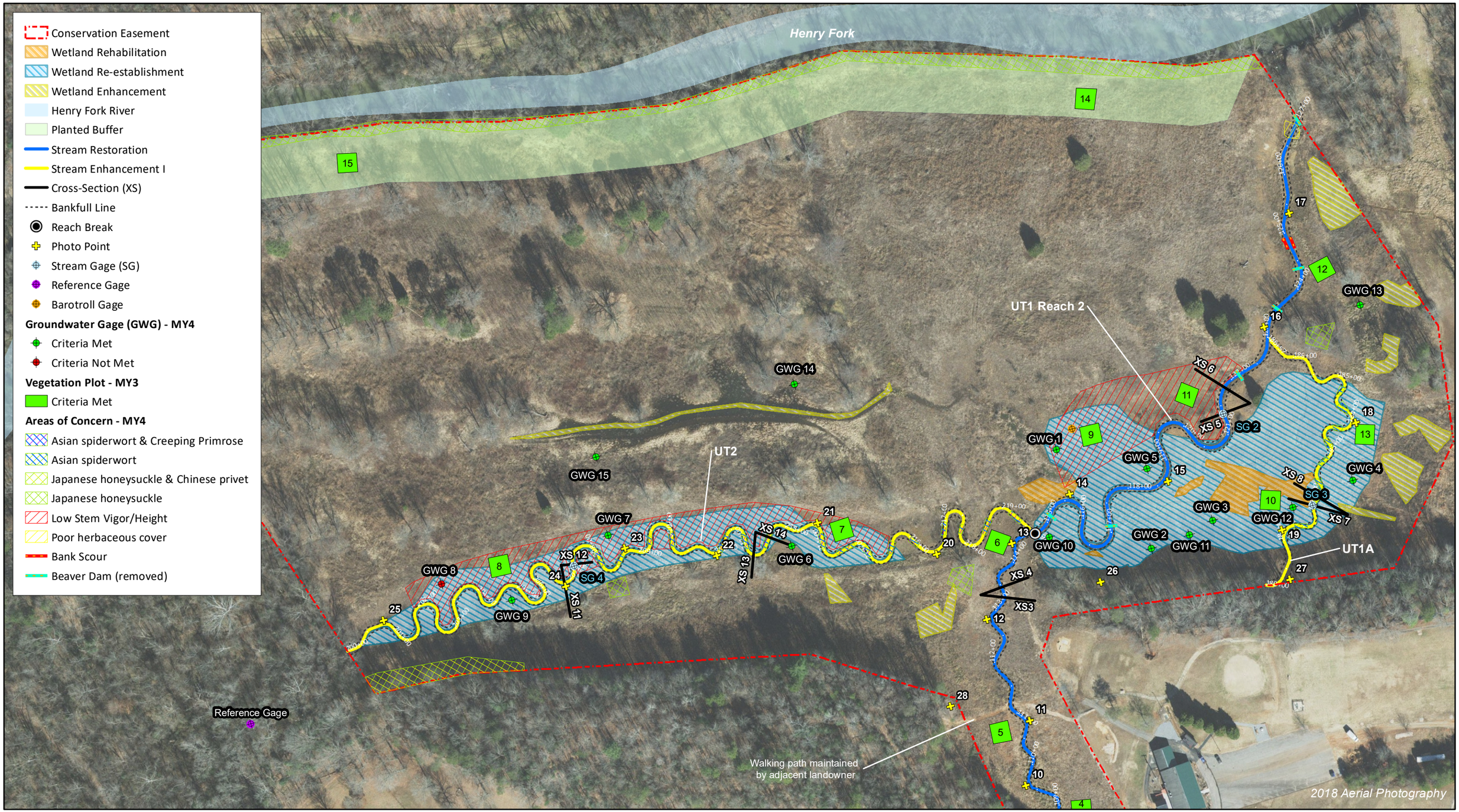

WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 3.0 Integrated Current Condition Plan View (KEY)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 4 - 2019

*Catawba County, NC*

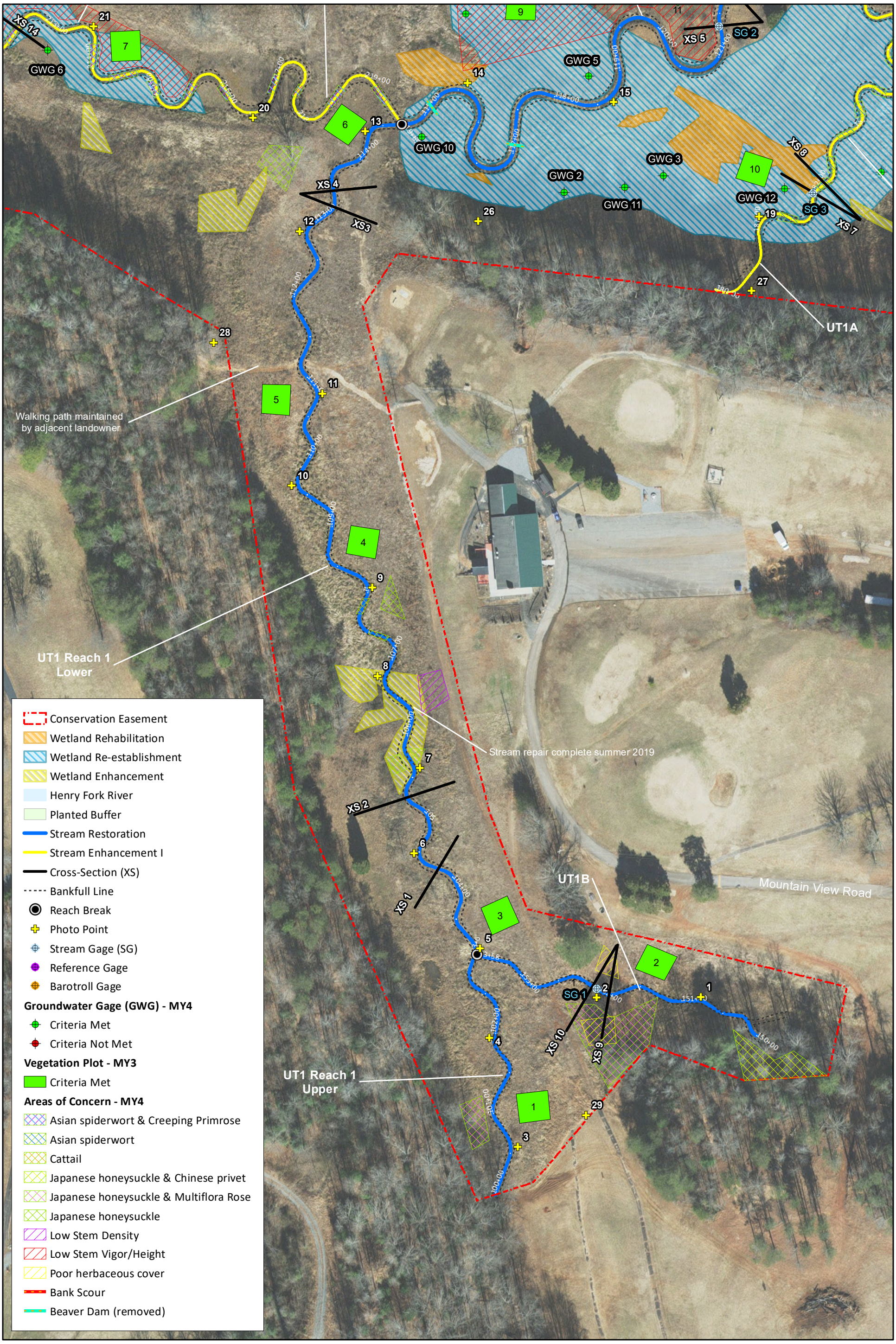



WILDLANDS ENGINEERING

0 150 300 Feet

Figure 3.1 Integrated Current Condition Plan View (Sheet 1)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 4 - 2019

*Catawba County, NC*




WILDLANDS ENGINEERING

Figure 3.2 Integrated Current Condition Plan View (Sheet 2)
Henry Fork Mitigation Site
DMS Project No. 96306
Monitoring Year 4 - 2019

*Catawba County, NC*

**Table 5a. Visual Stream Morphology Stability Assessment Table**
Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**

**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 4 - 2019**

**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 | 13 | 14 | | | 93% | | | |
| | 3. Meander Pool Condition | Depth Sufficient | 14 | 15 | | | 93% | | | |
| | | Length Appropriate | 14 | 15 | | | 93% | | | |
| | 4. Thalweg Position | Thalweg centering at upstream of meander bend (Run) | 14 | 15 | | | 93% | | | |
| | | Thalweg centering at downstream of meander bend (Glide) | 14 | 15 | | | 93% | | | |
| | | | | | | | | | | |
| 2. Bank | 1. Scoured/Eroded | Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion. | | | 2 | 40 | 98% | 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 | 2 | 40 | 98% | n/a | n/a | n/a |
| 3. Engineered Structures[1] | 1. Overall Integrity | Structures physically intact with no dislodged boulders or logs. | 11 | 12 | | | 92% | | | |
| | 2. Grade Control | Grade control structures exhibiting maintenance of grade across the sill. | 8 | 9 | | | 89% | | | |
| | 2a. Piping | Structures lacking any substantial flow underneath sills or arms. | 8 | 9 | | | 89% | | | |
| | 3. Bank Protection | Bank erosion within the structures extent of influence does not exceed 15%. | 11 | 12 | | | 92% | | | |
| | 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 4 - 2019**

**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 4 - 2019**

**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 4 - 2019**

**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. | N/A | N/A | | | N/A | | | |
| | 2a. Piping | Structures lacking any substantial flow underneath sills or arms. | N/A | N/A | | | N/A | | | |
| | 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 4 - 2019**

**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 | 3 | 0.05 | 0.3% |
| **Low Stem Density Areas** | Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria. | 0.1 | 1 | 0.03 | 0.2% |
| | | **Total** | **4** | **0.1** | **0.5%** |
| **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 | 4 | 1.6 | 10.8% |
| | | **Cumulative Total** | **8** | **1.6** | **11.3%** |

**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 | 45 | 3.1 | 6.5% |
| | | | | | |
| **Easement Encroachment Areas** | Areas of points (if too small to render as polygons at map scale). | none | 0 | 0 | 0.0% |

**Stream Photographs**

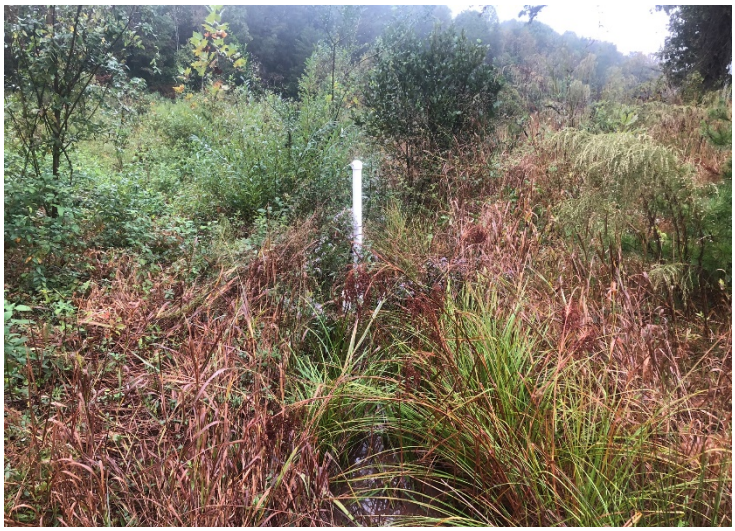
| | |
|---|---|
|  |  |
| **Photo Point 1** – view upstream UT1B *(10/16/2019)* | **Photo Point 1** – view downstream UT1B *(10/16/2019)* |
|  |  |
| **Photo Point 2** – view upstream UT1B *(10/16/2019)* | **Photo Point 2** – view downstream UT1B *(10/16/2019)* |
|  |  |
| **Photo Point 3** – view upstream UT1 R1 Upper *(10/16/2019)* | **Photo Point 3** – view downstream UT1 R1 Upper (*10/16/2019)* |

**Photo Point 4** – view upstream UT1 R1 Upper *(10/16/2019)*

**Photo Point 4** – view downstream UT1 R1 Upper *(10/16/2019)*

**Photo Point 5** – view upstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 5** – view downstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 5** – view upstream of UT1B *(10/16/2019)*

| | |
|---|---|
|  |  |
| **Photo Point 6** – view upstream UT1 R1 Lower *(10/16/2019)* | **Photo Point 6** – view downstream UT1 R1 Lower *(10/16/2019)* |
|  |  |
| **Photo Point 7** – view upstream UT1 R1 Lower *(10/16/2019)* | **Photo Point 7** – view downstream UT1 R1 Lower *(10/16/2019)* |
|  |  |
| **Photo Point 8** – view upstream UT1 R1 Lower *(10/16/2019)* | **Photo Point 8** – view downstream UT1 R1 Lower *(10/16/2019)* |

**Photo Point 9** – view upstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 9** – view downstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 10** – view upstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 10** –view downstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 11** – view upstream UT1 R1 Lower *(10/16/2019)*

**Photo Point 11** –view downstream UT1 R1 Lower *(10/16/2019)*

| | |
|---|---|
|  |  |
| **Photo Point 12** – view upstream UT1 R1 Lower *(10/16/2019)* | **Photo Point 12** –view downstream UT1 R1 Lower *(10/16/2019)* |
|  |  |
| **Photo Point 13** – view upstream UT1 R1 Lower *(10/16/2019)* | **Photo Point 13** –view downstream UT1 R1 Lower *(10/16/2019)* |
|  |  |
| **Photo Point 14** – view upstream UT1 R2 *(9/5/2019)* | **Photo Point 14** – view downstream UT1 R2 *(9/5/2019)* |

| | |
|---|---|
|  |  |
| **Photo Point 15** – view upstream UT1 R2 *(9/5/2019)* | **Photo Point 15** – view downstream UT1 R2 *(9/5/2019)* |
|  |  |
| **Photo Point 16** – view upstream UT1 R2 *(9/5/2019)* | **Photo Point 16** – view downstream UT1 R2 *(9/5/2019)* |
|  |  |
| **Photo Point 17** – view upstream UT1 R2 *(9/5/2019)* | **Photo Point 17** – view downstream UT1 R2 *(9/5/2019)* |

| | |
|---|---|
|  |  |
| **Photo Point 18** – view upstream UT1A *(9/5/2019)* | **Photo Point 18** – view downstream UT1A *(9/5/2019)* |
|  |  |
| **Photo Point 19** – view upstream UT1A *(9/5/2019)* | **Photo Point 19** – view downstream UT1A *(9/5/2019)* |
|  |  |
| **Photo Point 20** – view upstream UT2 *(9/5/2019)* | **Photo Point 20** – view downstream UT2 *(9/5/2019)* |

| | |
|---|---|
|  |  |
| **Photo Point 21** – view upstream UT2 *(9/5/2019)* | **Photo Point 21** – view downstream UT2 *(9/5/2019)* |
|  |  |
| **Photo Point 22** – view upstream UT2 *(9/5/2019)* | **Photo Point 22** – view downstream UT2 *(9/5/2019)* |
|  |  |
| **Photo Point 23** – view upstream UT2 *(9/5/2019)* | **Photo Point 23** – view downstream UT2 *(9/5/2019)* |

| | |
|---|---|
|  |  |
| **Photo Point 24** – view upstream UT2 *(9/5/2019)* | **Photo Point 24** – view downstream UT2 *(9/5/2019)* |
|  |  |
| **Photo Point 25** – view upstream UT2 *(9/5/2019)* | **Photo Point 25** – view downstream UT2 *(9/5/2019)* |
|  |  |
| **Photo Point 26** – view upstream UT1 R2 *(9/6/2019)* | **Photo Point 26** – view downstream UT1 R2 *(9/6/2019)* |

**Photo Point 26** – UT1 R2 floodplain overview *(9/5/2019)*

**Photo Point 27** – view upstream UT1 R2 floodplain *(9/5/2019)*

**Photo Point 27** – view downstream UT1 R2 floodplain *(9/5/2019)*

**Photo Point 28** – UT1 R1 Lower floodplain overview *(10/16/2019)*

**Photo Point 28** – UT2 floodplain overview *(10/16/2019)*

**Photo Point 29** – UT1 R1 Upper floodplain overview *(10/16/2019)*

**APPENDIX 3. Vegetation Plot Data**

Vegetation assessment and analysis not required in Monitoring Year 4

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

Cross-sectional morphological surveys and analysis not required in Monitoring Year 4

## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

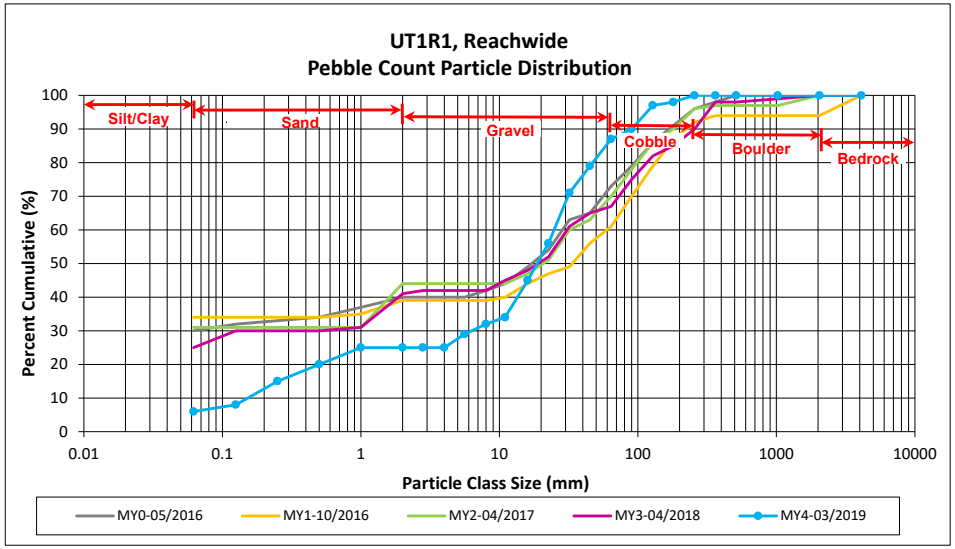
DMS Project No. 96306

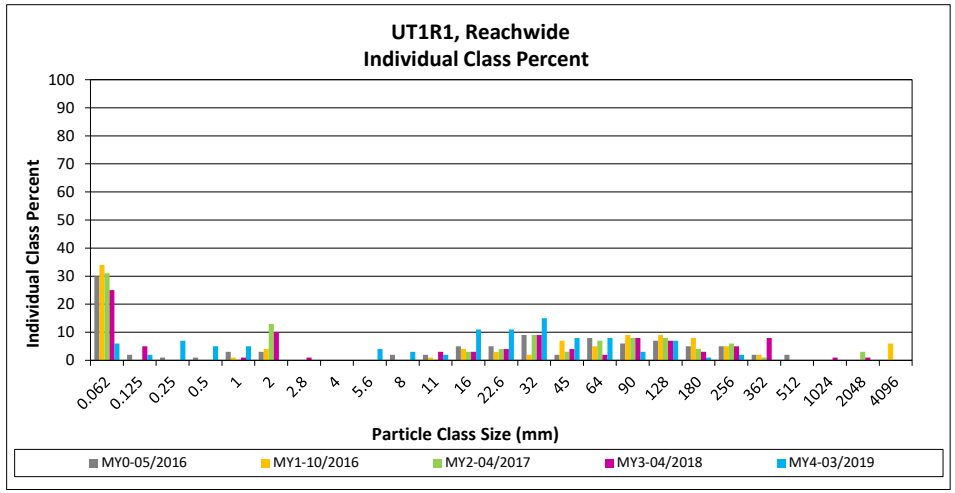
**Monitoring Year 4 - 2019**

### 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 | | 6 | 6 | 6 | 6 |
| *SAND* | Very fine | 0.062 | 0.125 | | 2 | 2 | 2 | 8 |
| | Fine | 0.125 | 0.250 | 2 | 5 | 7 | 7 | 15 |
| | Medium | 0.25 | 0.50 | | 5 | 5 | 5 | 20 |
| | Coarse | 0.5 | 1.0 | 1 | 4 | 5 | 5 | 25 |
| | Very Coarse | 1.0 | 2.0 | | | | | 25 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 25 |
| | Very Fine | 2.8 | 4.0 | | | | | 25 |
| | Fine | 4.0 | 5.6 | 2 | 2 | 4 | 4 | 29 |
| | Fine | 5.6 | 8.0 | | 3 | 3 | 3 | 32 |
| | Medium | 8.0 | 11.0 | 1 | 1 | 2 | 2 | 34 |
| | Medium | 11.0 | 16.0 | 6 | 5 | 11 | 11 | 45 |
| | Coarse | 16.0 | 22.6 | 3 | 8 | 11 | 11 | 56 |
| | Coarse | 22.6 | 32 | 8 | 7 | 15 | 15 | 71 |
| | Very Coarse | 32 | 45 | 8 | | 8 | 8 | 79 |
| | Very Coarse | 45 | 64 | 8 | | 8 | 8 | 87 |
| *COBBLE* | Small | 64 | 90 | 2 | 1 | 3 | 3 | 90 |
| | Small | 90 | 128 | 6 | 1 | 7 | 7 | 97 |
| | Large | 128 | 180 | 1 | | 1 | 1 | 98 |
| | Large | 180 | 256 | 2 | | 2 | 2 | 100 |
| *BOULDER* | Small | 256 | 362 | | | | | 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) | |
| $D_{16}$ = | 0.3 |
| $D_{35}$ = | 11.4 |
| $D_{50}$ = | 18.7 |
| $D_{84}$ = | 56.1 |
| $D_{95}$ = | 115.7 |
| $D_{100}$ = | 256.0 |



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

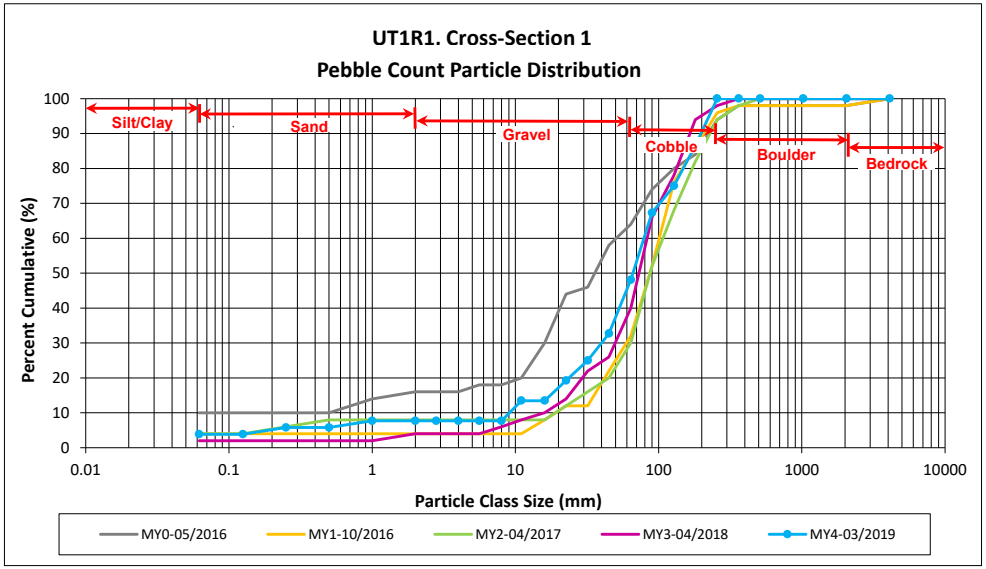
DMS Project No. 96306

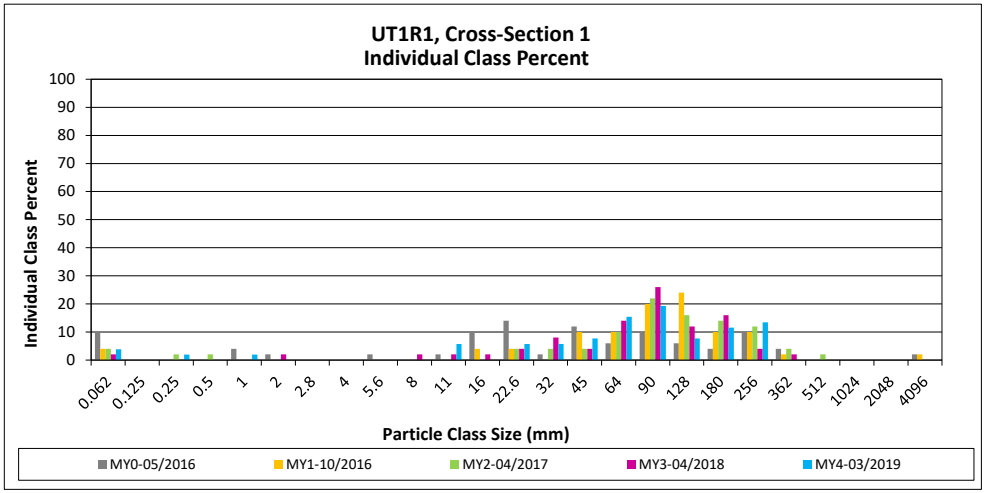
**Monitoring Year 4 - 2019**

### 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 | 4 | 4 | 4 |
| SAND | Very fine | 0.062 | 0.125 | | | 4 |
| | Fine | 0.125 | 0.250 | 2 | 2 | 6 |
| | Medium | 0.25 | 0.50 | | | 6 |
| | Coarse | 0.5 | 1.0 | 2 | 2 | 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 | 6 | 6 | 13 |
| | Medium | 11.0 | 16.0 | | | 13 |
| | Coarse | 16.0 | 22.6 | 6 | 6 | 19 |
| | Coarse | 22.6 | 32 | 6 | 6 | 25 |
| | Very Coarse | 32 | 45 | 8 | 8 | 33 |
| | Very Coarse | 45 | 64 | 16 | 15 | 48 |
| COBBLE | Small | 64 | 90 | 20 | 19 | 67 |
| | Small | 90 | 128 | 8 | 8 | 75 |
| | Large | 128 | 180 | 12 | 12 | 87 |
| | Large | 180 | 256 | 14 | 13 | 100 |
| BOULDER | Small | 256 | 362 | | | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **104** | **100** | **100** |

| Cross-Section 1 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 18.6 |
| $D_{35}$ = | 47.4 |
| $D_{50}$ = | 66.2 |
| $D_{84}$ = | 167.0 |
| $D_{95}$ = | 224.6 |
| $D_{100}$ = | 256.0 |



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

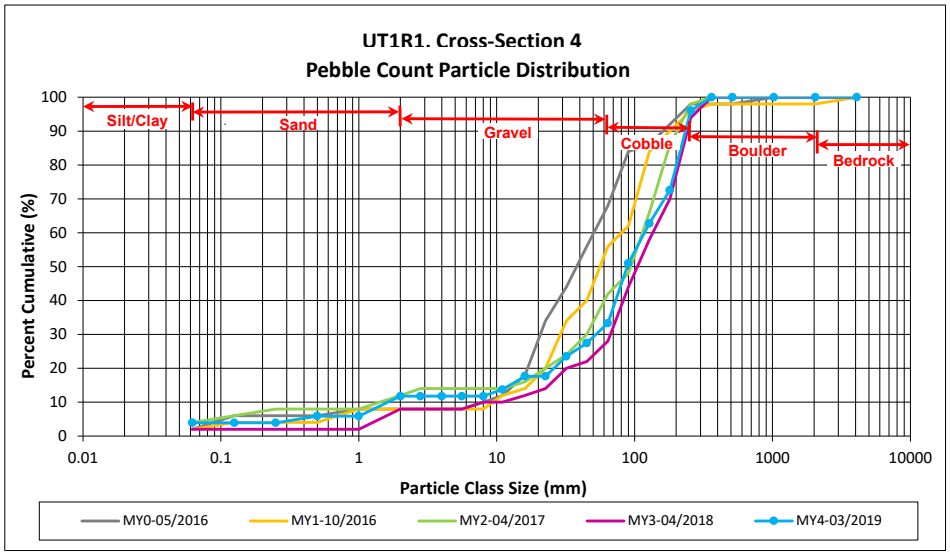
DMS Project No. 96306

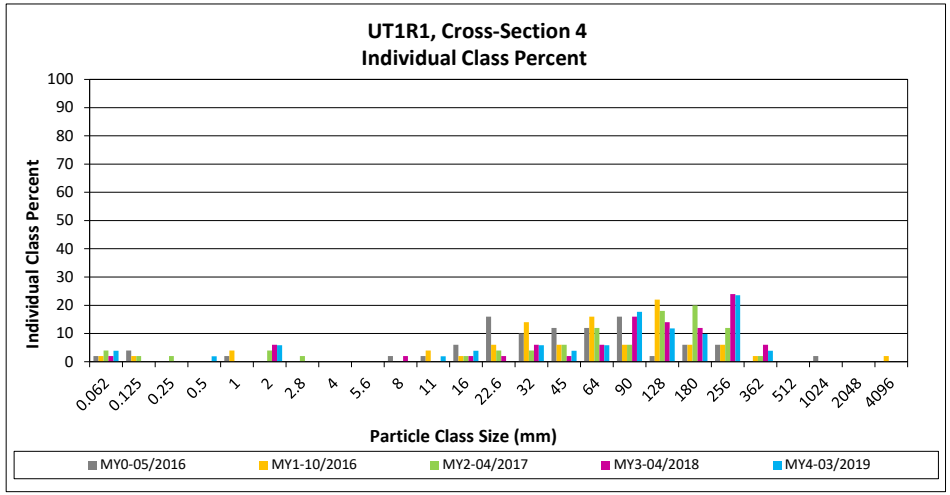
**Monitoring Year 4 - 2019**

### 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 | | | 4 |
| | Fine | 0.125 | 0.250 | | | 4 |
| | Medium | 0.25 | 0.50 | 1 | 2 | 6 |
| | Coarse | 0.5 | 1.0 | | | 6 |
| | Very Coarse | 1.0 | 2.0 | 3 | 6 | 12 |
| GRAVEL | Very Fine | 2.0 | 2.8 | | | 12 |
| | Very Fine | 2.8 | 4.0 | | | 12 |
| | Fine | 4.0 | 5.6 | | | 12 |
| | Fine | 5.6 | 8.0 | | | 12 |
| | Medium | 8.0 | 11.0 | 1 | 2 | 14 |
| | Medium | 11.0 | 16.0 | 2 | 4 | 18 |
| | Coarse | 16.0 | 22.6 | | | 18 |
| | Coarse | 22.6 | 32 | 3 | 6 | 24 |
| | Very Coarse | 32 | 45 | 2 | 4 | 27 |
| | Very Coarse | 45 | 64 | 3 | 6 | 33 |
| COBBLE | Small | 64 | 90 | 9 | 18 | 51 |
| | Small | 90 | 128 | 6 | 12 | 63 |
| | Large | 128 | 180 | 5 | 10 | 73 |
| | Large | 180 | 256 | 12 | 24 | 96 |
| BOULDER | Small | 256 | 362 | 2 | 4 | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **51** | **100** | **100** |

| Cross-Section 4 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 13.7 |
| $D_{35}$ = | 66.1 |
| $D_{50}$ = | 88.3 |
| $D_{84}$ = | 213.7 |
| $D_{95}$ = | 251.9 |
| $D_{100}$ = | 362.0 |



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

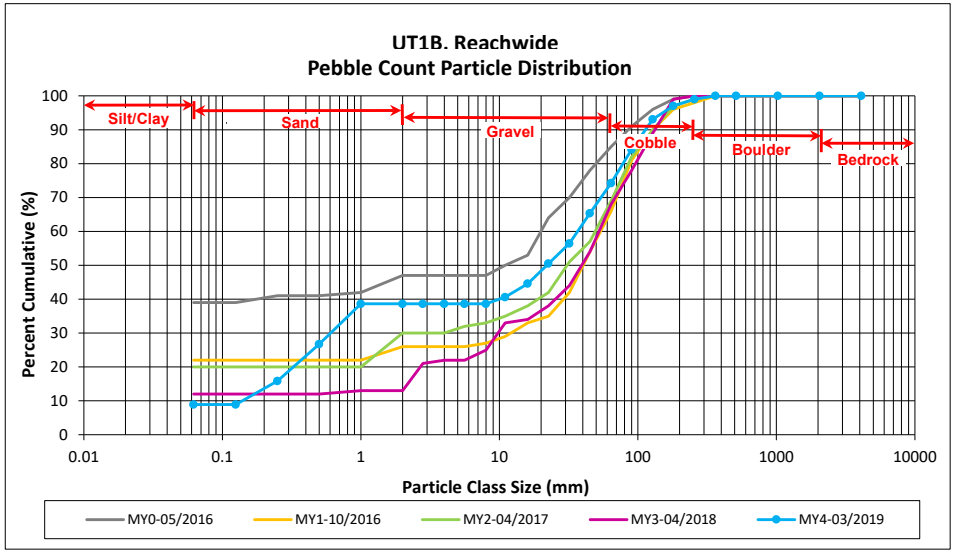
DMS Project No. 96306

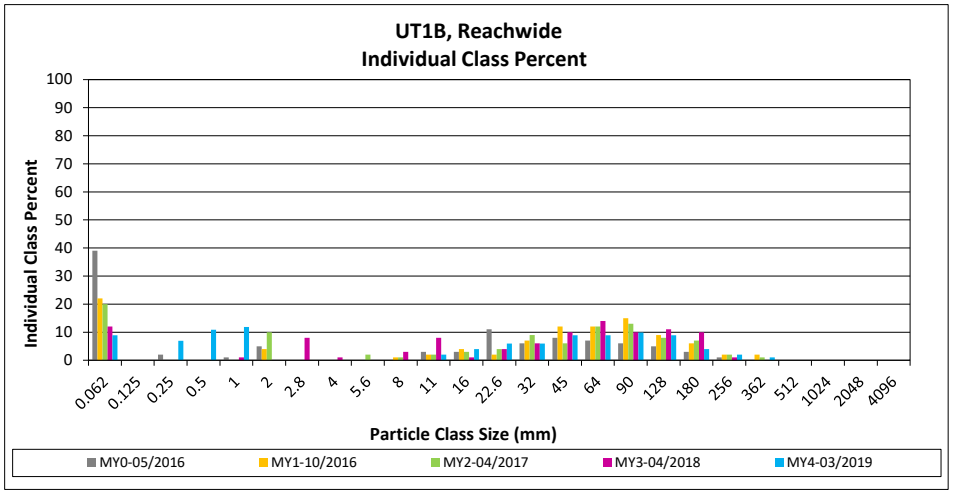
**Monitoring Year 4 - 2019**

### 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 | 2 | 7 | 9 | 9 | 9 |
| *SAND* | Very fine | 0.062 | 0.125 | | | | | 9 |
| | Fine | 0.125 | 0.250 | 4 | 3 | 7 | 7 | 16 |
| | Medium | 0.25 | 0.50 | 1 | 10 | 11 | 11 | 27 |
| | Coarse | 0.5 | 1.0 | 3 | 9 | 12 | 12 | 39 |
| | Very Coarse | 1.0 | 2.0 | | | | | 39 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 39 |
| | Very Fine | 2.8 | 4.0 | | | | | 39 |
| | Fine | 4.0 | 5.6 | | | | | 39 |
| | Fine | 5.6 | 8.0 | | | | | 39 |
| | Medium | 8.0 | 11.0 | 2 | | 2 | 2 | 41 |
| | Medium | 11.0 | 16.0 | 3 | 1 | 4 | 4 | 45 |
| | Coarse | 16.0 | 22.6 | 4 | 2 | 6 | 6 | 50 |
| | Coarse | 22.6 | 32 | 3 | 3 | 6 | 6 | 56 |
| | Very Coarse | 32 | 45 | 8 | 1 | 9 | 9 | 65 |
| | Very Coarse | 45 | 64 | 4 | 5 | 9 | 9 | 74 |
| *COBBLE* | Small | 64 | 90 | 5 | 5 | 10 | 10 | 84 |
| | Small | 90 | 128 | 7 | 2 | 9 | 9 | 93 |
| | Large | 128 | 180 | 2 | 2 | 4 | 4 | 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** | **51** | **101** | **100** | **100** |

| Reachwide | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 0.3 |
| $D_{35}$ = | 0.8 |
| $D_{50}$ = | 22.0 |
| $D_{84}$ = | 89.5 |
| $D_{95}$ = | 151.1 |
| $D_{100}$ = | 362.0 |



## Reachwide and Cross-Section Pebble Count Plots

Henry Fork Stream Mitigation

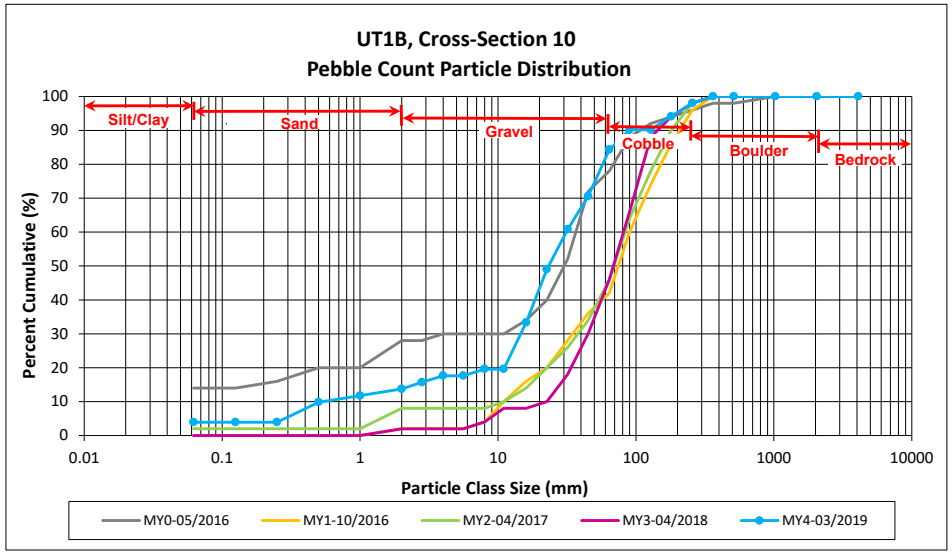
DMS Project No. 96306

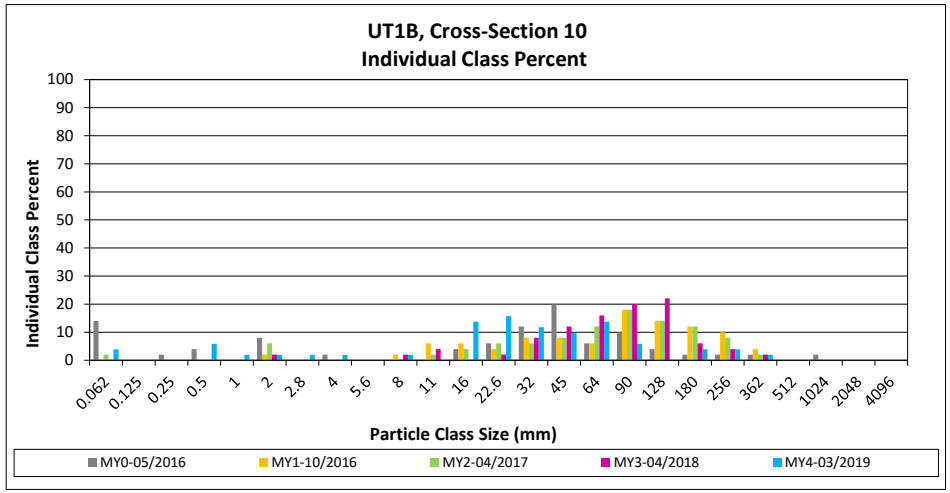
**Monitoring Year 4 - 2019**

### 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 | 2 | 4 | 4 |
| SAND | Very fine | 0.062 | 0.125 | | | 4 |
| | Fine | 0.125 | 0.250 | | | 4 |
| | Medium | 0.25 | 0.50 | 3 | 6 | 10 |
| | Coarse | 0.5 | 1.0 | 1 | 2 | 12 |
| | Very Coarse | 1.0 | 2.0 | 1 | 2 | 14 |
| GRAVEL | Very Fine | 2.0 | 2.8 | 1 | 2 | 16 |
| | Very Fine | 2.8 | 4.0 | 1 | 2 | 18 |
| | Fine | 4.0 | 5.6 | | | 18 |
| | Fine | 5.6 | 8.0 | 1 | 2 | 20 |
| | Medium | 8.0 | 11.0 | | | 20 |
| | Medium | 11.0 | 16.0 | 7 | 14 | 33 |
| | Coarse | 16.0 | 22.6 | 8 | 16 | 49 |
| | Coarse | 22.6 | 32 | 6 | 12 | 61 |
| | Very Coarse | 32 | 45 | 5 | 10 | 71 |
| | Very Coarse | 45 | 64 | 7 | 14 | 84 |
| COBBLE | Small | 64 | 90 | 3 | 6 | 90 |
| | Small | 90 | 128 | | | 90 |
| | Large | 128 | 180 | 2 | 4 | 94 |
| | Large | 180 | 256 | 2 | 4 | 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** | **51** | **100** | **100** |

| Cross-Section | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 3.0 |
| $D_{35}$ = | 16.6 |
| $D_{50}$ = | 23.3 |
| $D_{84}$ = | 63.5 |
| $D_{95}$ = | 194.8 |
| $D_{100}$ = | 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 4 - 2019**

| Reach | MY | Date of Occurrence | Method |
|---|---|---|---|
| UT1 Reach 2 | MY1 | N/A | Crest Gage |
| | MY2 | 4/24/2017 | Crest & Stream Gage |
| | | 10/8/2017 | Crest & Stream Gage |
| | MY3 | 2/7/2018 | Stream Gage |
| | | 4/25/2018 | |
| | | 5/29/2018 | |
| | | 9/16/2018 | |
| | | 10/11/2018 | |
| | | 10/26/2018 | |
| | MY4 | 6/9/2019 | |
| | | 10/31/2019 | |
| UT1A | MY1 | U | Crest Gage |
| | MY2 | 4/24/2017 | Crest & Stream Gage |
| | | 10/8/2017 | Crest & Stream Gage |
| | MY3 | 10/11/2018 | Stream Gage |
| | MY4 | 6/9/2019 | Stream Gage |
| | | 10/31/2019 | Stream Gage |
| UT1B | MY1 | N/A | Crest Gage |
| | MY2 | 10/8/2017 | Crest & Stream Gage |
| | MY4 | 6/9/2019 | Stream Gage |
| | | 8/24/2019 | |
| | | 10/31/2019 | |
| UT2 | MY1 | N/A | Crest Gage |
| | MY2 | 4/24/2017 | Crest & Stream Gage |
| | MY3 | 2/7/2018 | Stream Gage |
| | | 5/29/2018 | |
| | MY4 | 6/9/2019 | |
| | | 10/31/2019 | |

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

**Table 14. Wetland Gage Attainment Summary**

Henry Fork Mitigation Site

DMS Project No. 96306

**Monitoring Year 4 - 2019**

| Summary of Groundwater Gage Results for Monitoring Years 1 through 7 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gage | Success Criteria Achieved[2]/Max Consecutive Days During Growing Season[1] (Percentage) | | | | | | |
| | Year 1 (2016) | Year 2 (2017) | Year 3 (2018) | Year 4 (2019) | Year 5 (2020) | Year 6 (2021) | Year 7 (2022) |
| Reference | No/18 Days (8%) | Yes/59 Days (25%) | Yes/79 Days (34%) | Yes/61 Days (26%) | | | |
| GWG 1 | No/0 Days (0%) | Yes/23 Days (10%) | Yes/48 Days (20%) | Yes/42 Days (18%) | | | |
| GWG 2 | Yes/ 29 Days (12.3%) | No/7 Days (3%) | No/12 Days (5%) | Yes/39 Days (17%) | | | |
| GWG 3 [4] | Yes/236 Days (100%) | No/3 Days (1%) | No/5 Days (2%) | Yes/35 Days (15%) | | | |
| GWG 4 | No/3 Days (1.3%) | Yes/25 Days (11%) | Yes/46 Days (20%) | Yes/68 Days (29%) | | | |
| GWG 5 [3] | N/A | Yes/189 Days (80%) | Yes/102 Days (43%) | Yes/236 Days (100%) | | | |
| GWG 6 | Yes/79 Days (33.5%) | Yes/89 Days (38%) | Yes/96 Days (41%) | Yes/76 Days (32%) | | | |
| GWG 7 | No/7 Days (3.0%) | Yes/21 Days (9%) | Yes/44 Days (19%) | Yes/44 Days (19%) | | | |
| GWG 8 | No/1 Days (0.4%) | No/14 Days (6%) | No/11 Days (5%) | No/19 Days (8%) | | | |
| GWG 9 [3] | N/A | No/13 Days (6%) | Yes/20 Days (9%) | Yes/68 Days (29%) | | | |
| GWG 10 [5] | N/A | N/A | N/A | Yes/236 Days (100%) | | | |
| GWG 11 [5] | N/A | N/A | N/A | Yes/61 Days (26%) | | | |
| GWG 12 [5] | N/A | N/A | N/A | Yes/36 Days (15%) | | | |
| GWG 13 [5] | N/A | N/A | N/A | Yes/236 Days (100%) | | | |
| GWG 14 [6] | N/A | N/A | N/A | Yes/67 Days (28%) | | | |
| GWG 15 [6] | N/A | N/A | N/A | Yes/45 Days (19%) | | | |

N/A, not applicable

[1]Growing season dates March 20 - November 11

[2]Success criteria is 20 consecutive days

[3]GWGs 5 and 9 were installed on April 7, 2017.

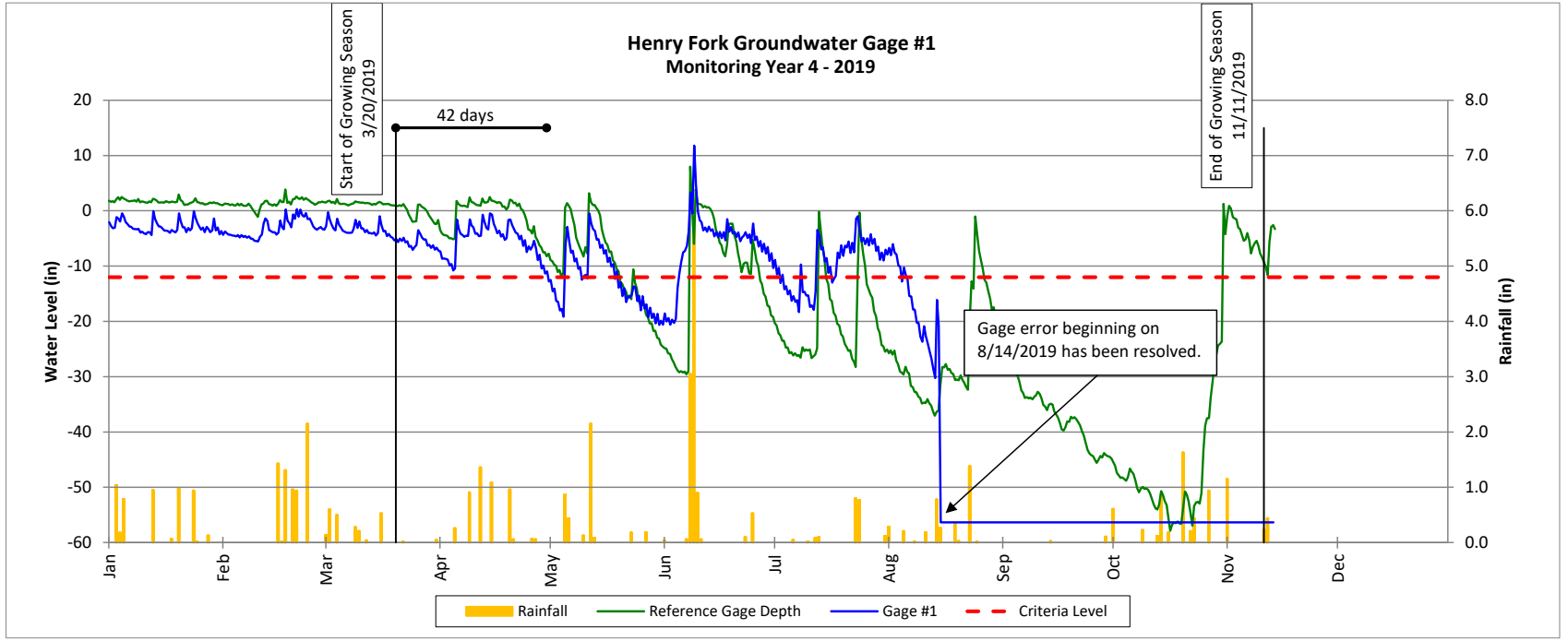
[4]GWG 3 was relocated in January 2017.

[5]GWGs 10 -13 were installed on February 20, 2019.

[6]GWGs 14-15 were installed on March 7, 2019.

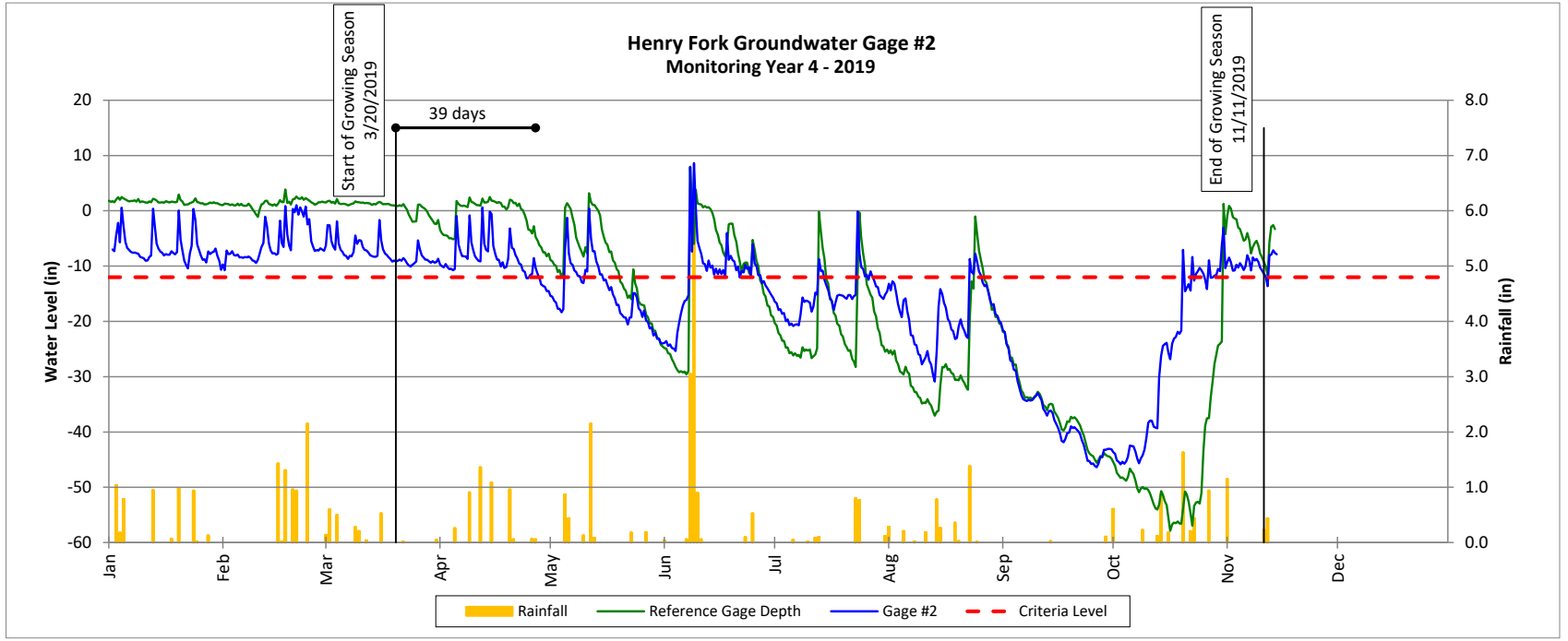
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



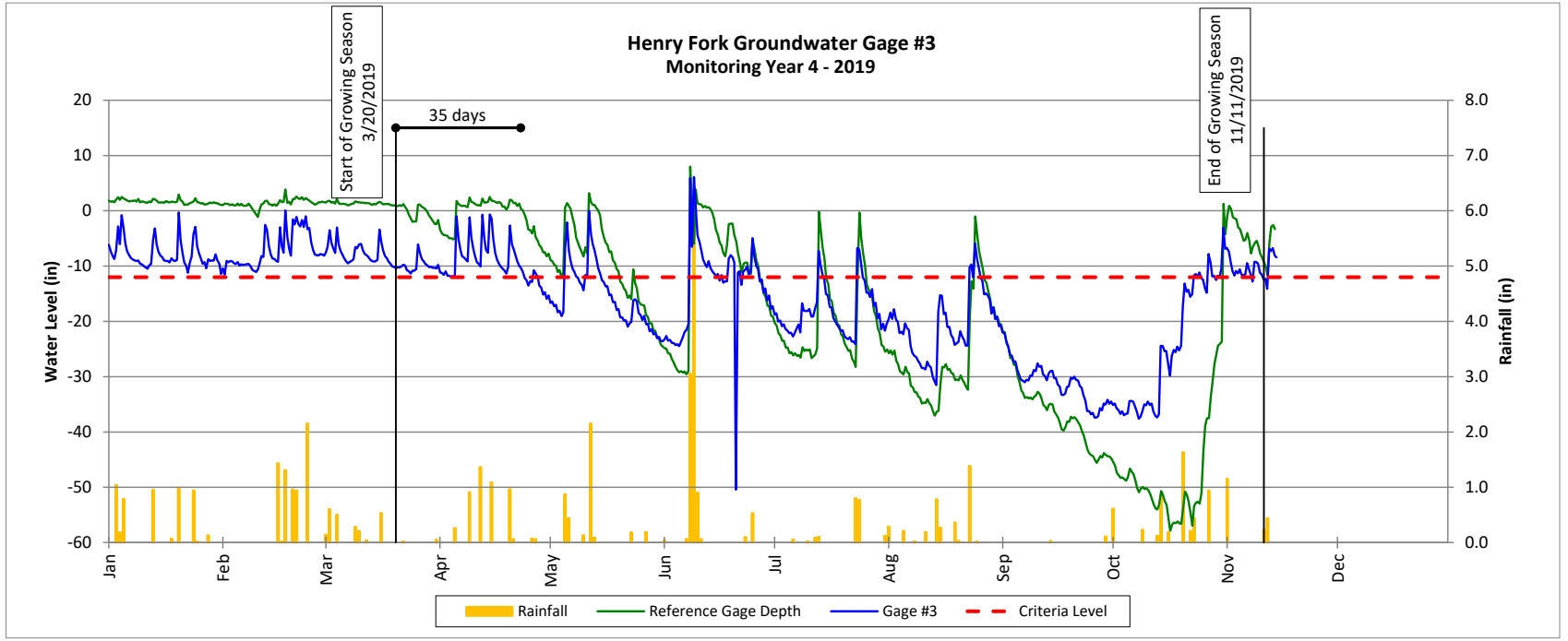
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



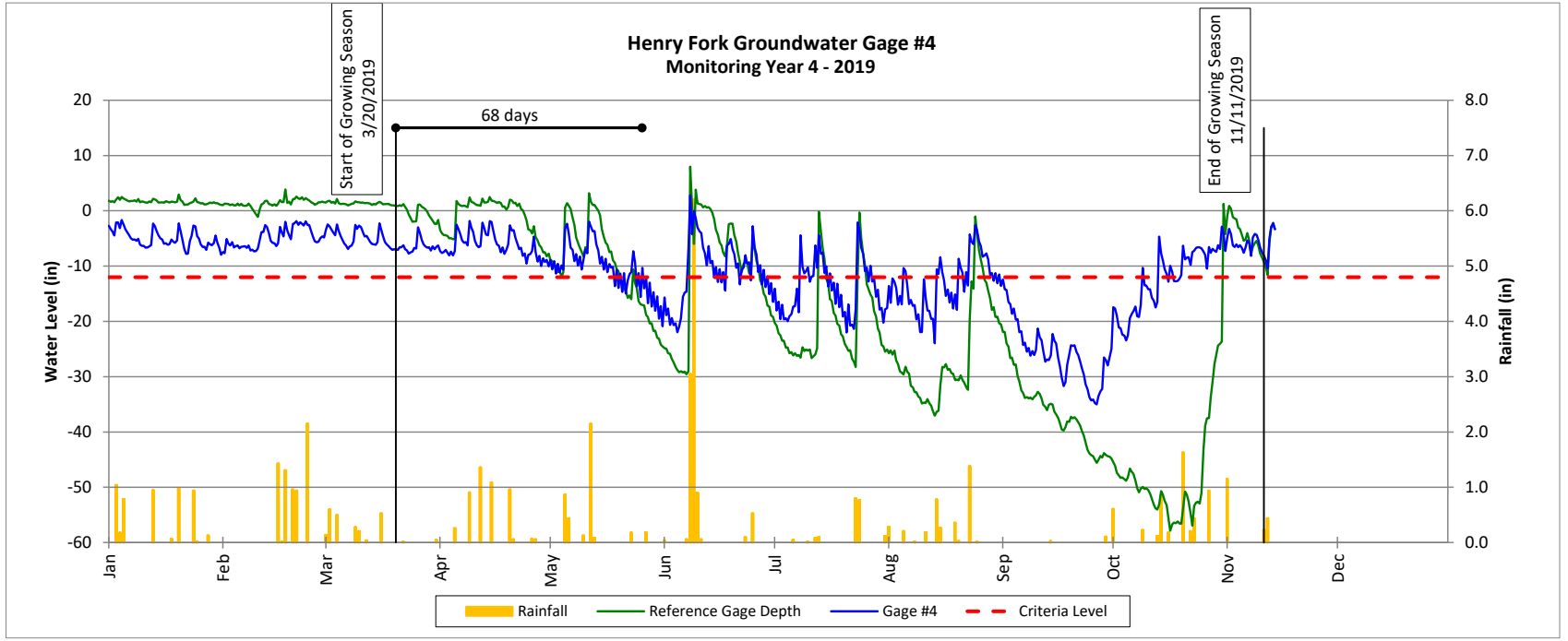
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



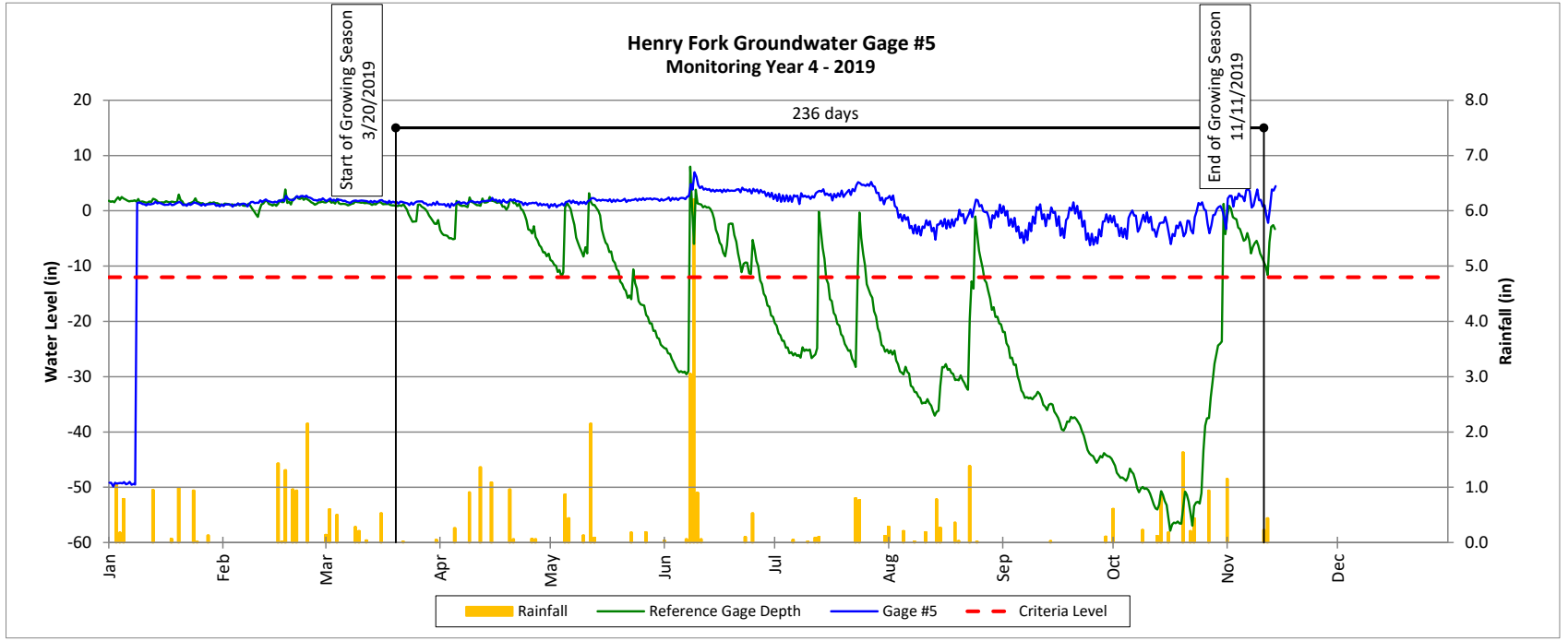
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



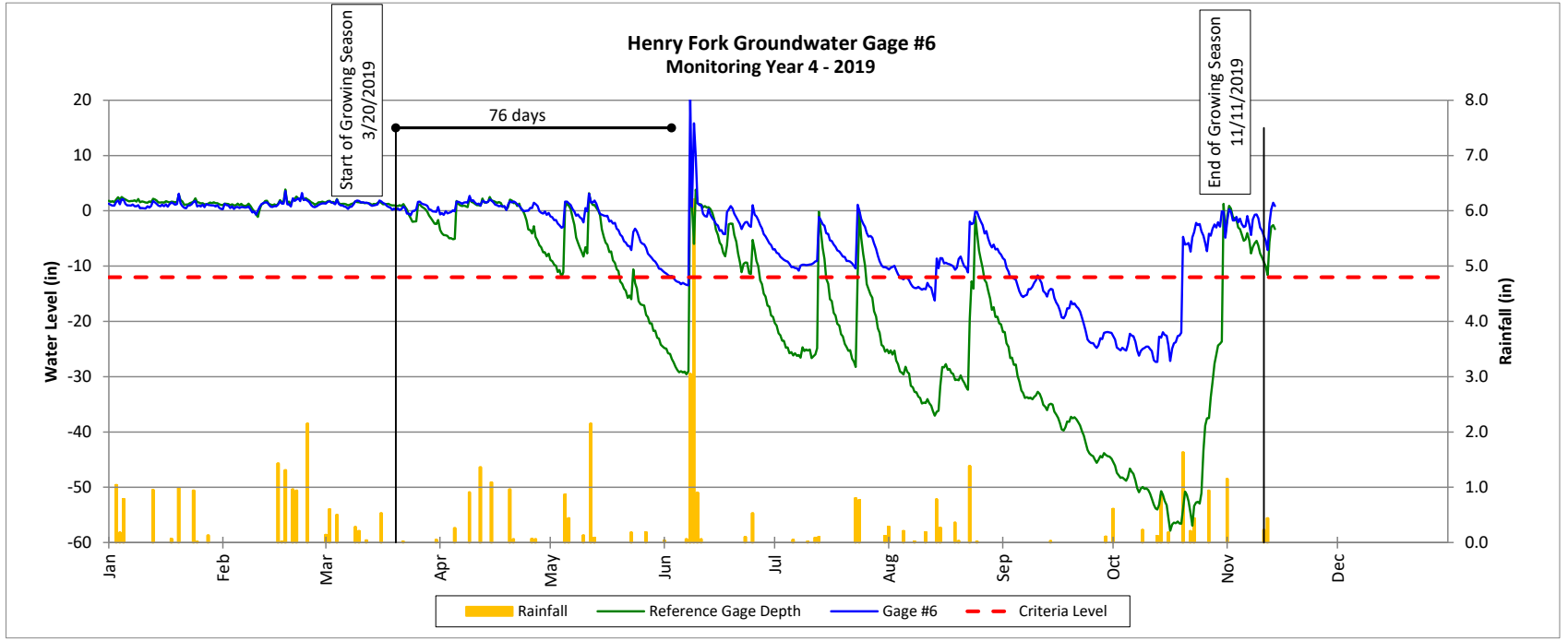
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



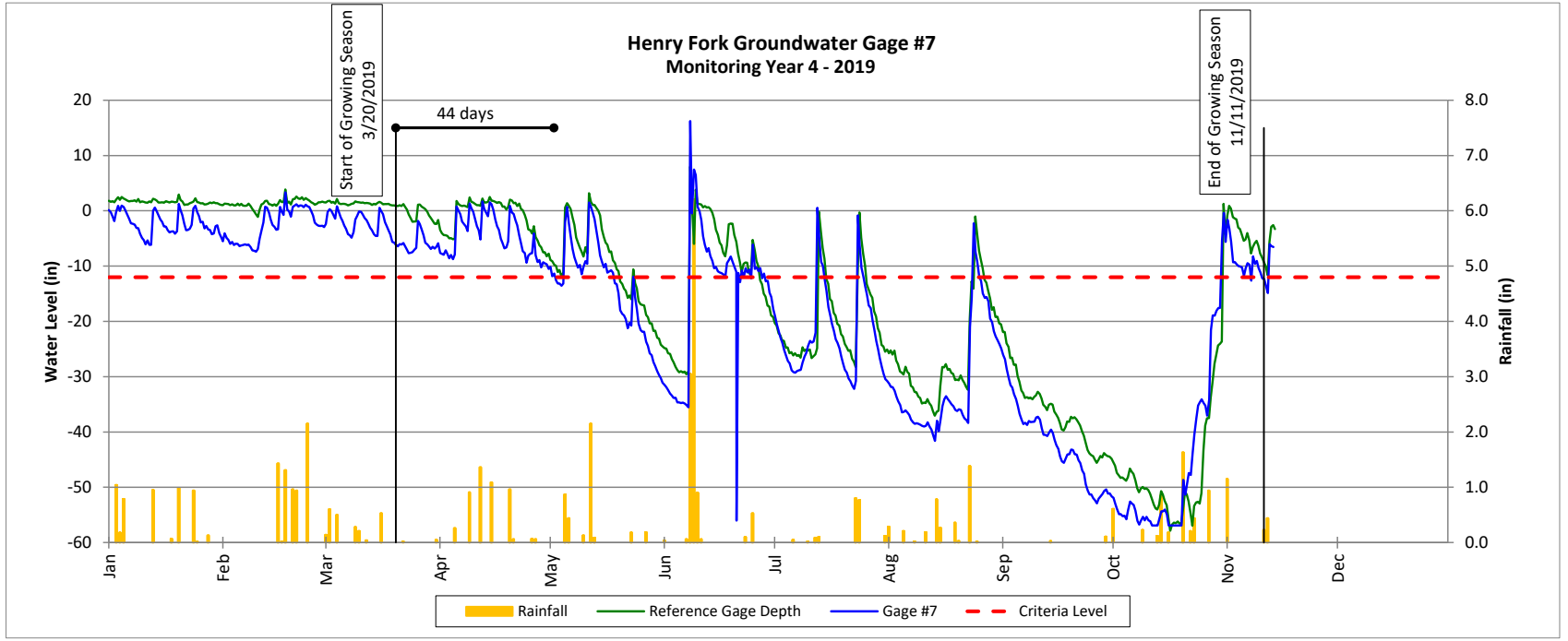
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



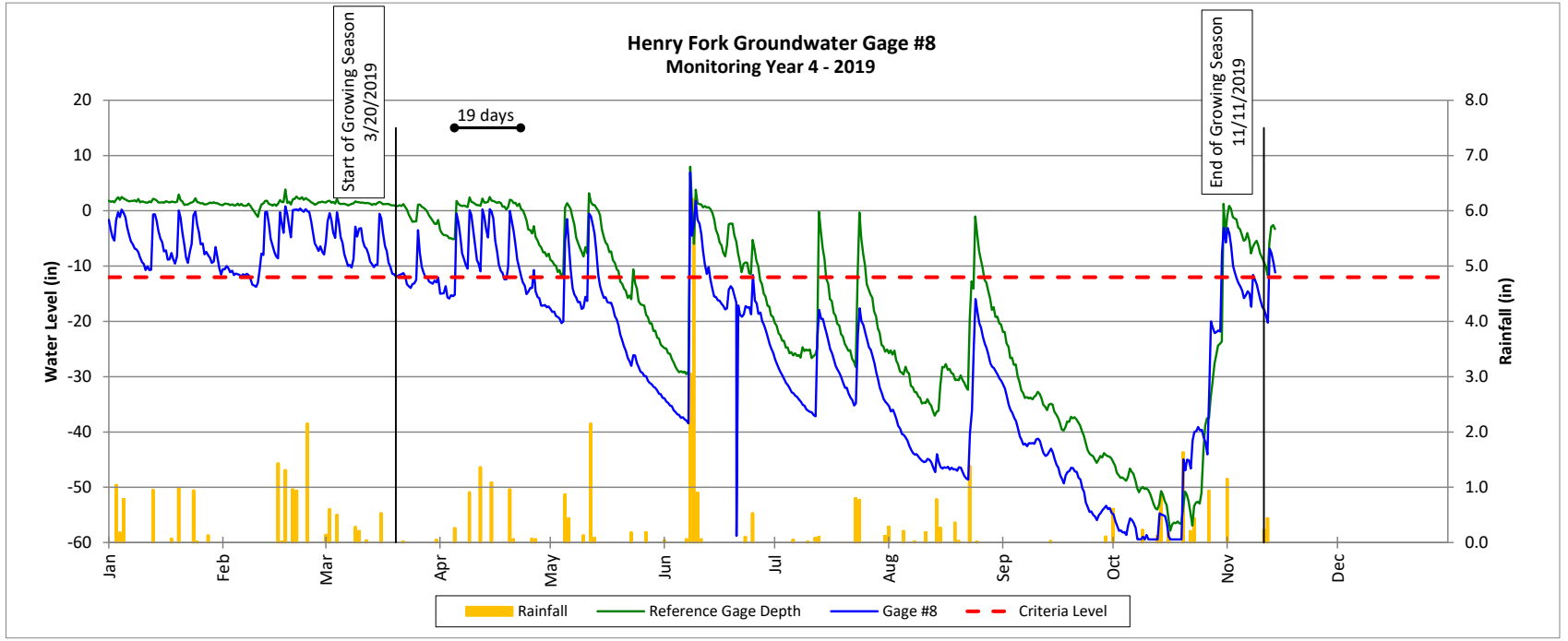
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



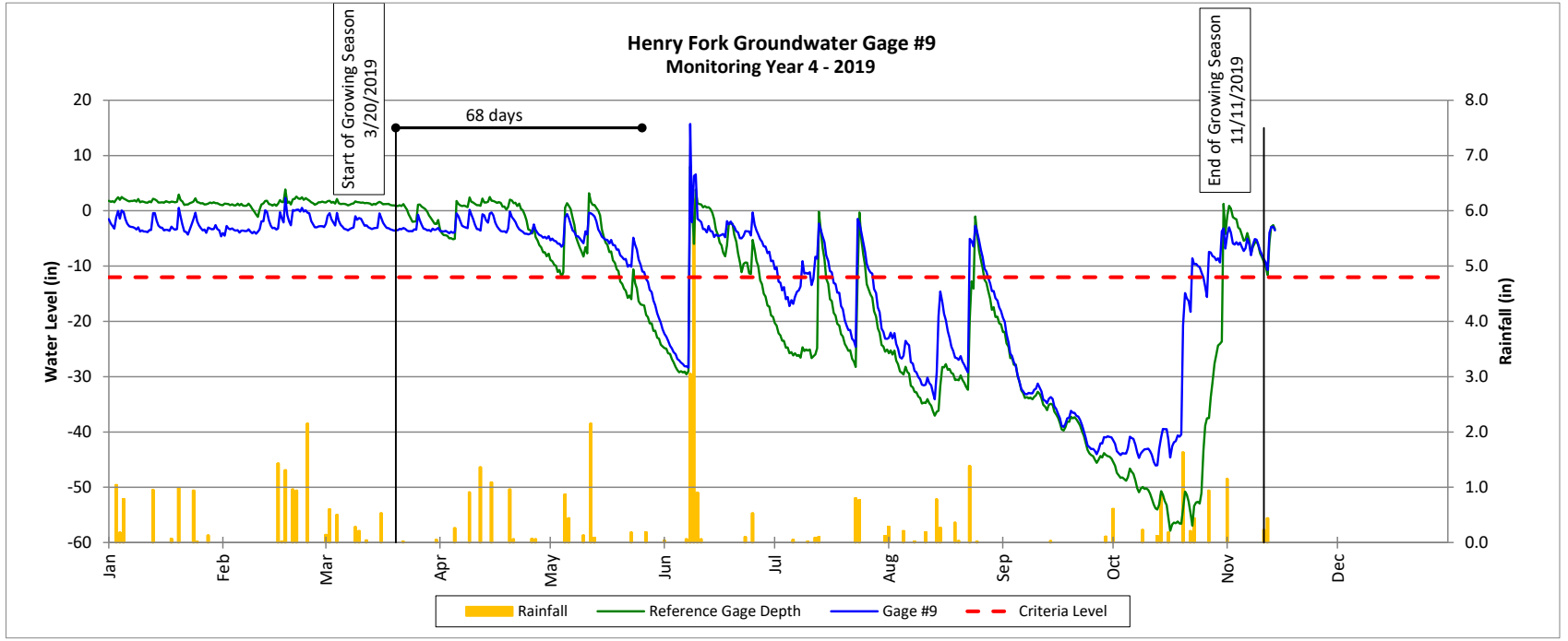
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



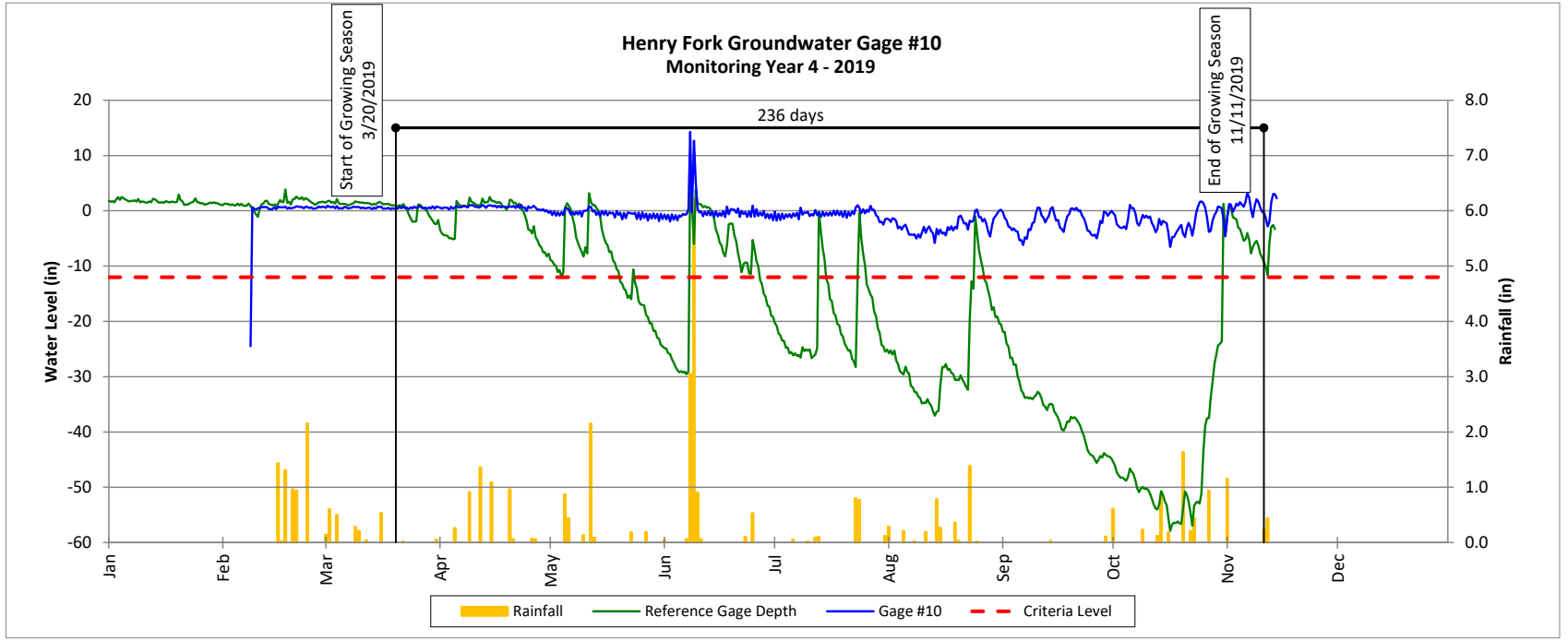
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



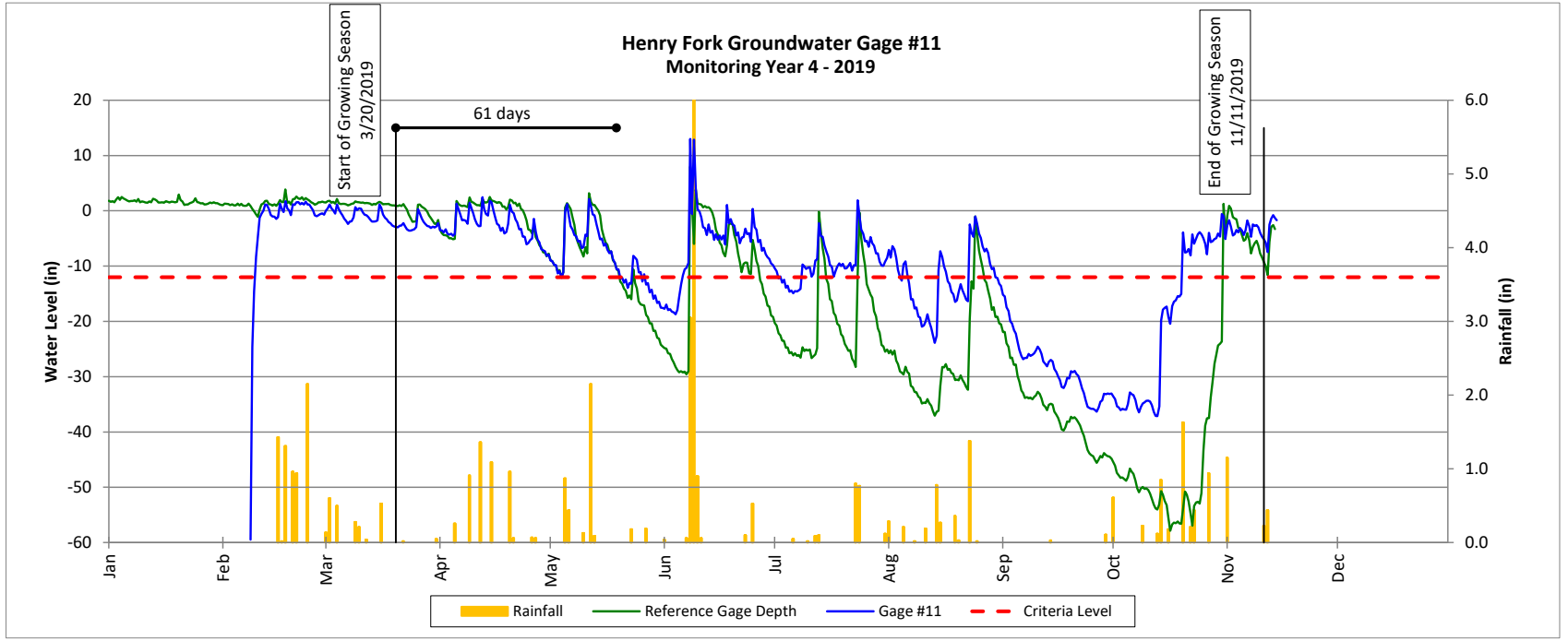
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



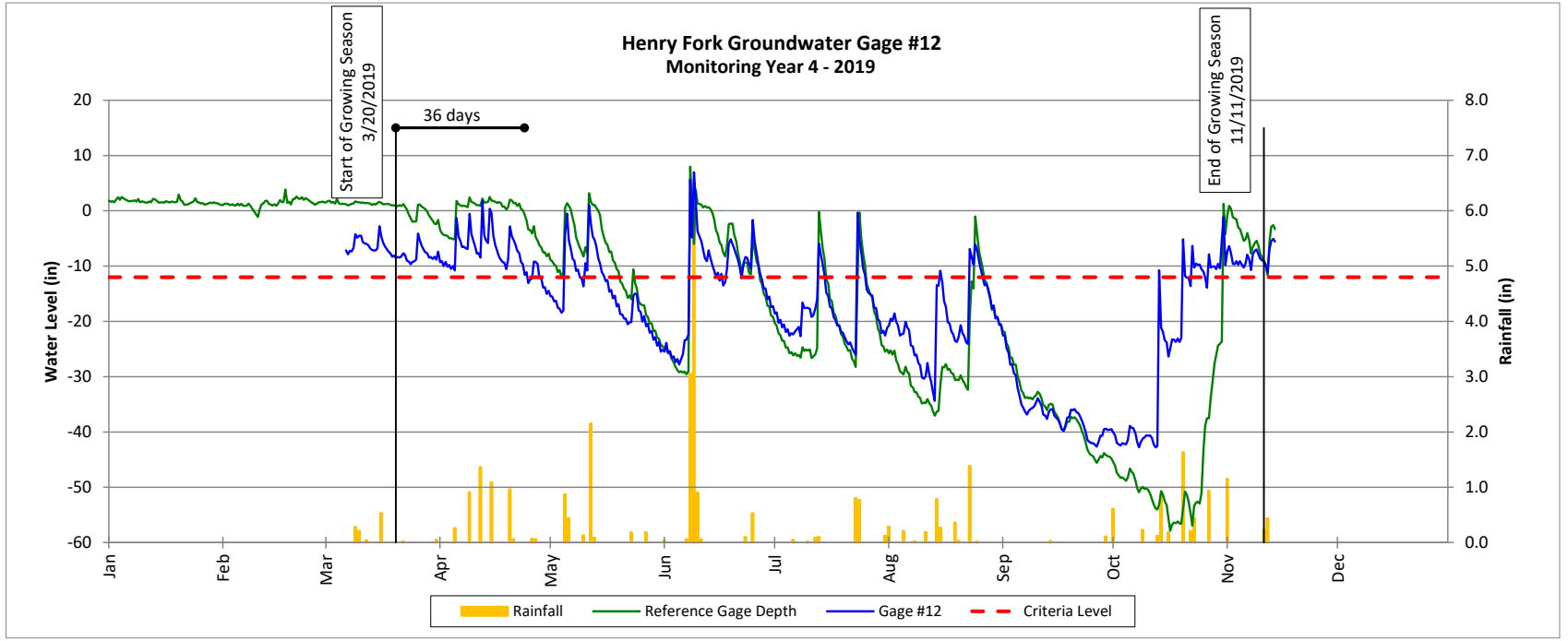
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



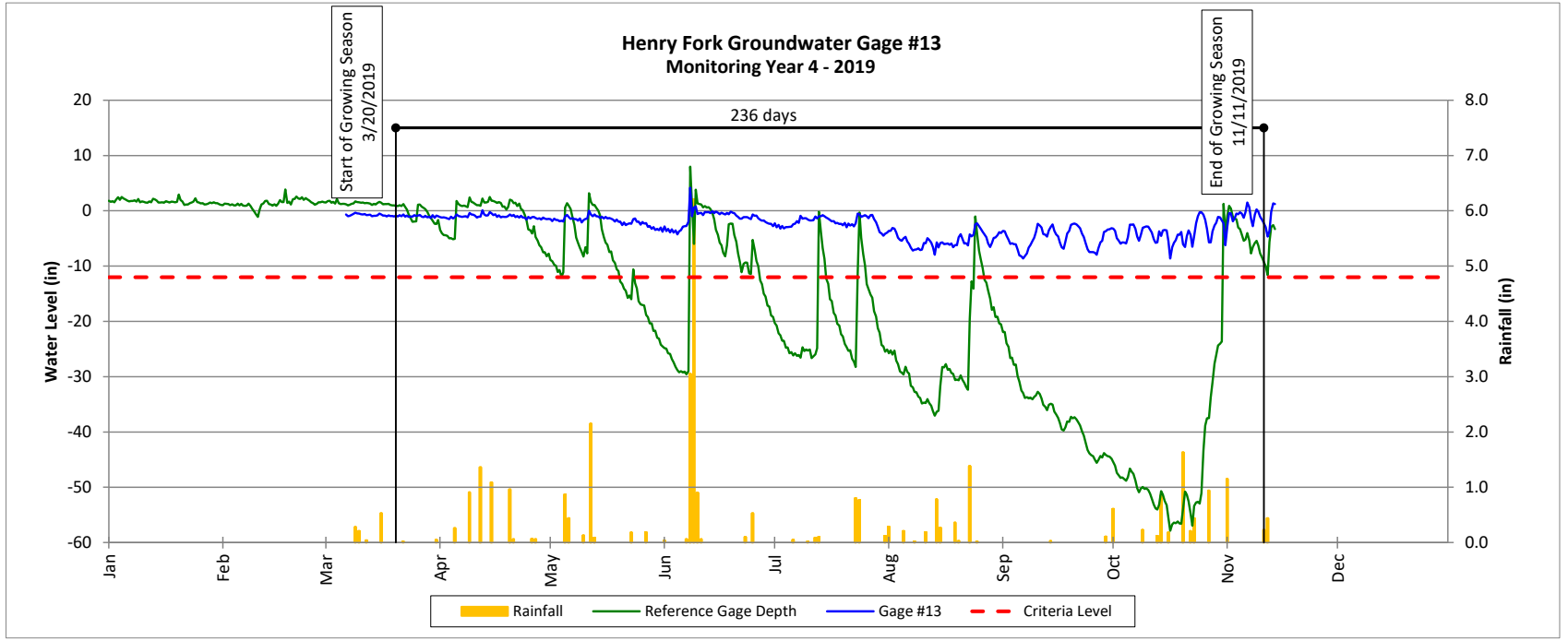
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



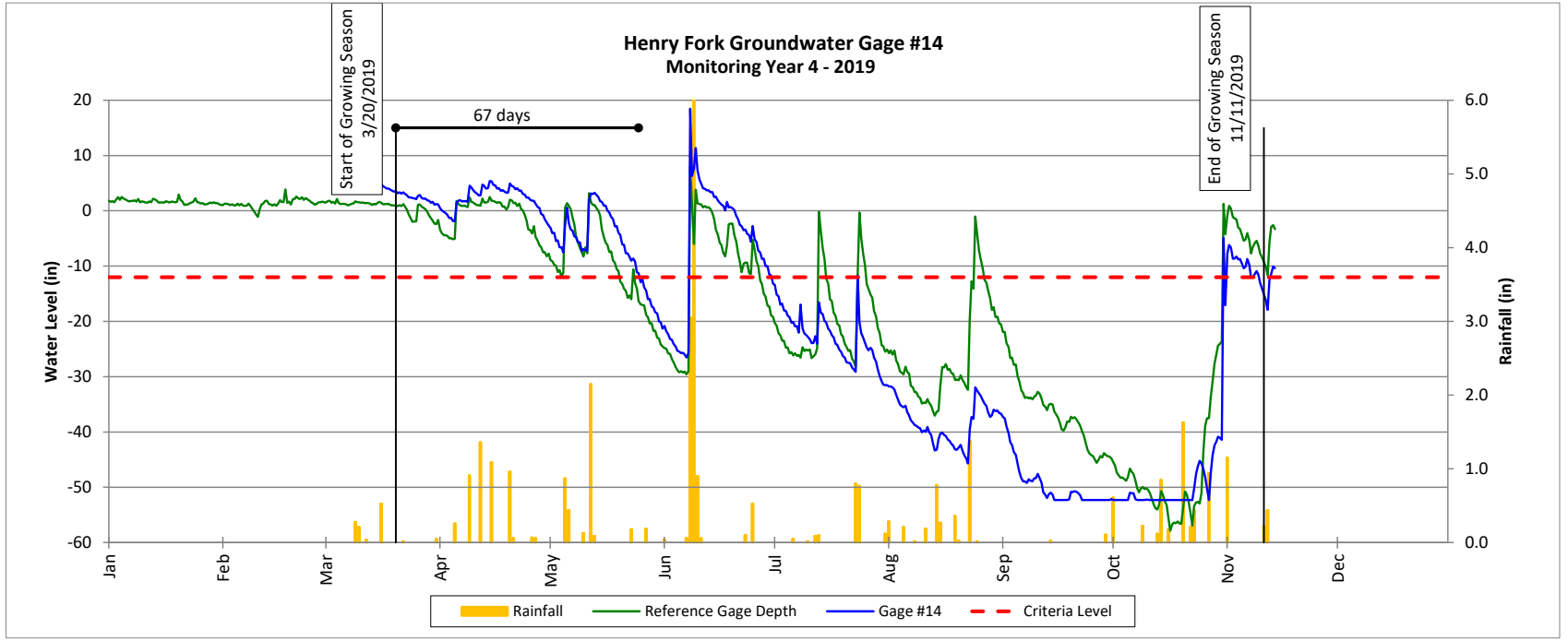
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



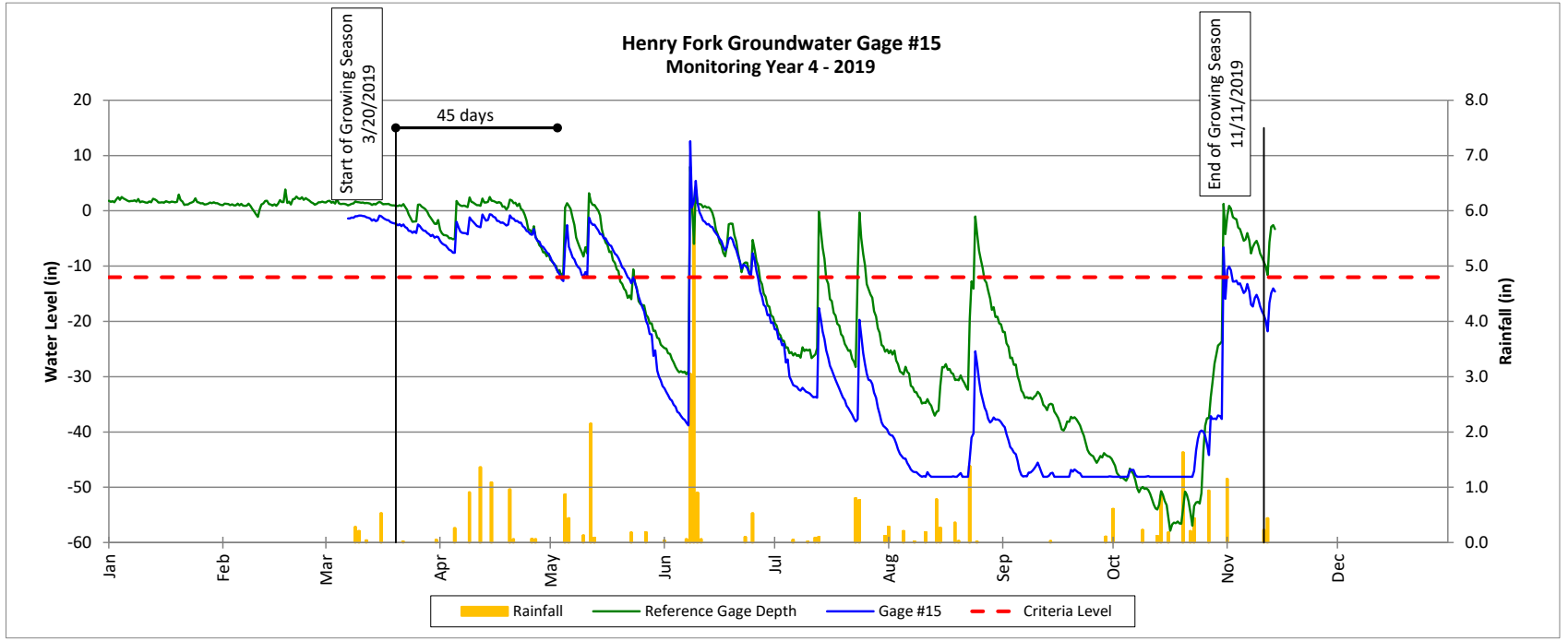
## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



## Groundwater Gage Plots

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**

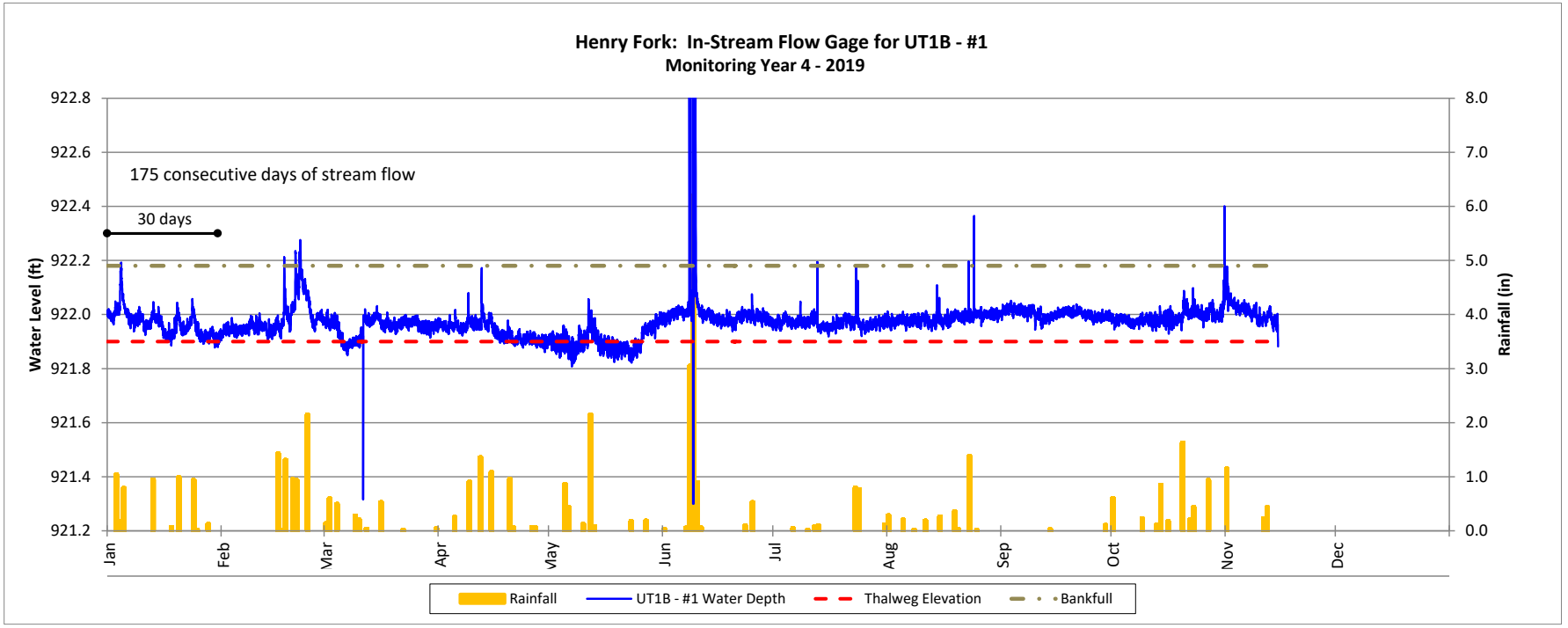


## Recorded In-stream Flow Events

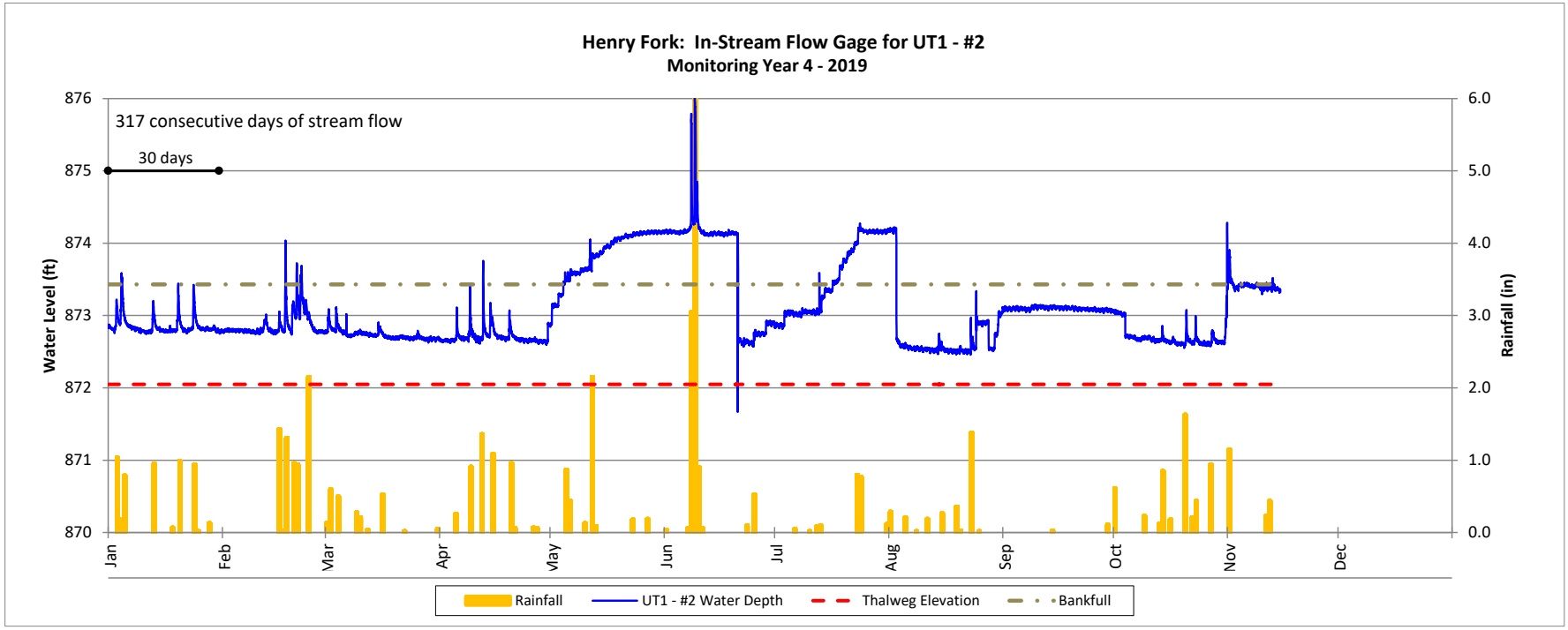
Henry Fork Mitigation Site

DMS Project No. 96306

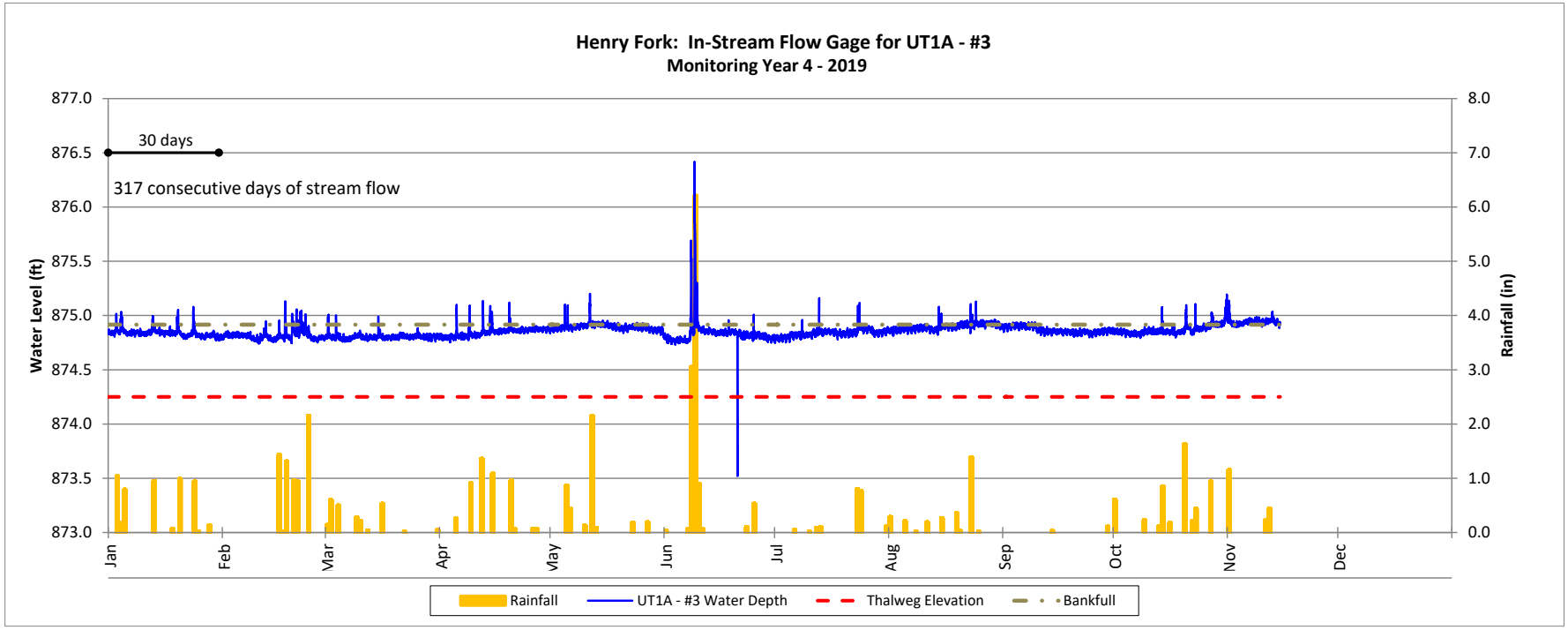
**Monitoring Year 4 - 2019**



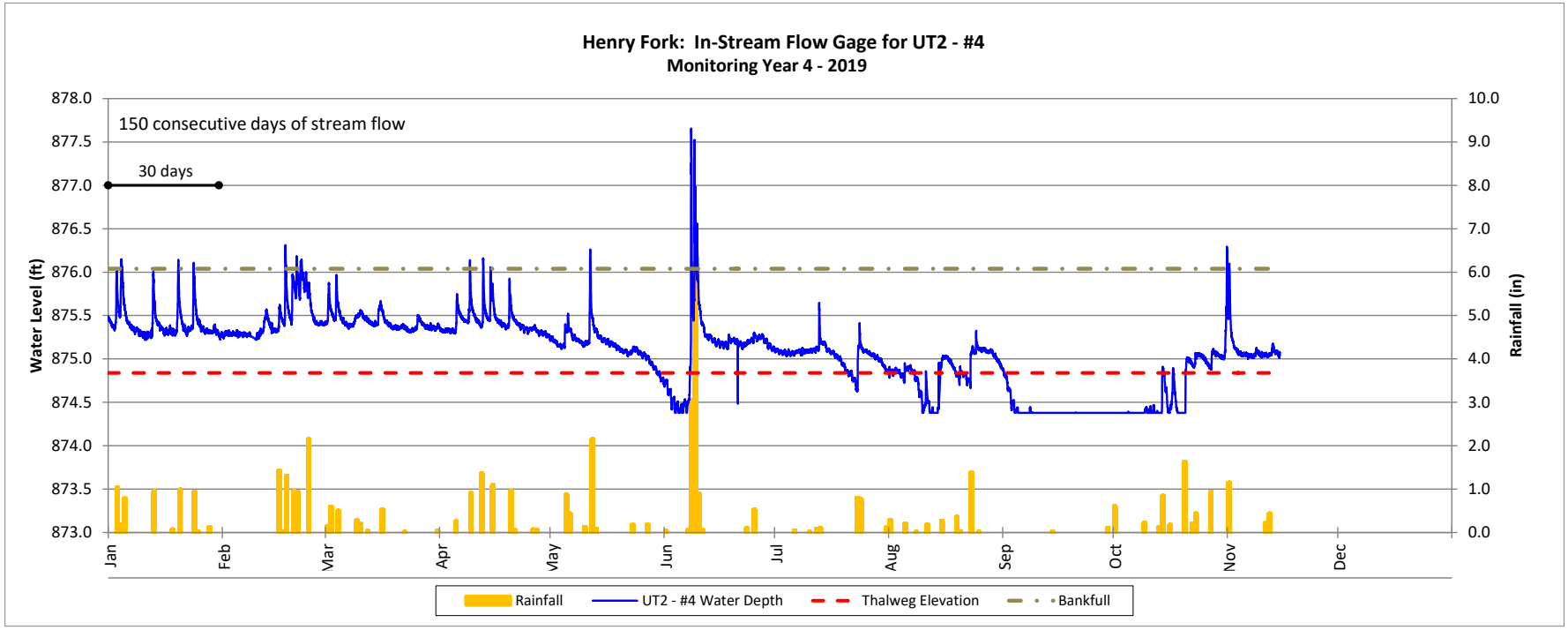
**Recorded In-stream Flow Events**
Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



**Recorded In-stream Flow Events**
Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**

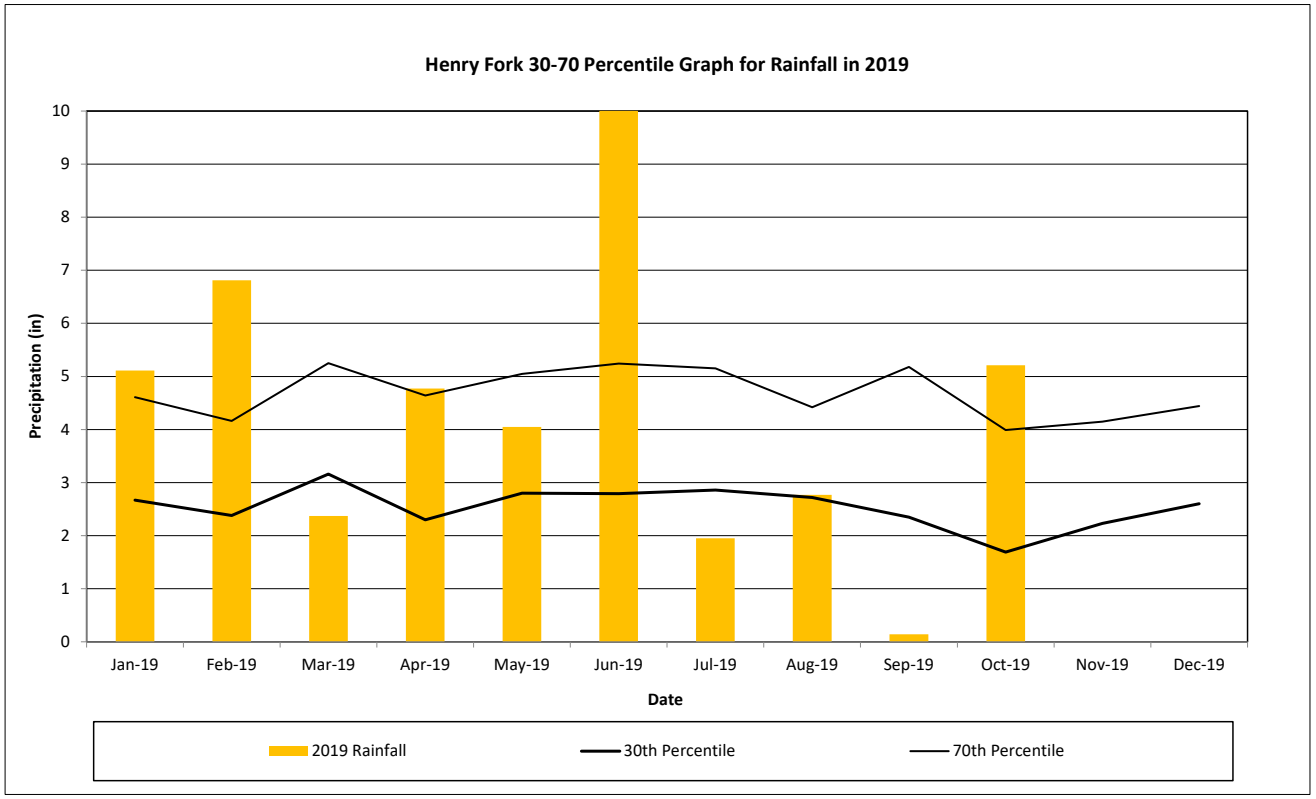


**Recorded In-stream Flow Events**
Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**



## Monthly Rainfall Data

Henry Fork Mitigation Site
DMS Project No. 96306
**Monitoring Year 4 - 2019**




[1] 2019 rainfall collected by NC CRONOS Station Hickory 4.8 SW, NC

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