



MONITORING YEAR 5 ANNUAL REPORT

Final

HOLMAN MILL MITIGATION SITE

Alamance County, NC
NCDEQ Contract 005795
DMS ID No. 96316
USACE Action ID Number 2015-00019
NCDWR Project Number 2014-0333

Data Collection Period: January 2020 - October 2020
Draft Submission Date: October 14, 2020
Final Submission Date: November 2, 2020

PREPARED FOR:



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

Mitigation Project Name	Holman Mill Stream Mitigation Project	USACE Action ID	2015-00019
DMS ID	96316	DWR Permit	2014-0333
River Basin	Cape Fear	Date Project Instituted	2/21/2014
Cataloging Unit	03030002	Date Prepared	4/20/2020
County	Alamance	Stream/Wet. Service Area	Cape Fear - Jordan Haw

Todd J. [Signature] 9/21/2020

Signature & Date of Official Approving Credit Release

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

Credit Release Milestone	Warm Stream Credits						
	Scheduled Releases %	Proposed Releases %	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release Year	Actual Release Date
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	1,165.000	0.000	1,165.000	2016	11/4/2016
3 - Year 1 Monitoring	10.00%	10.00%	388.333	0.000	388.333	2017	4/3/2017
4 - Year 2 Monitoring	10.00%	10.00%	388.333	0.000	388.333	2018	4/25/2018
5 - Year 3 Monitoring	10.00%	10.00%	388.333	0.000	388.333	2019	4/26/2019
6 - Year 4 Monitoring	5.00%	5.00%	194.167	0.000	194.167	2020	4/20/2020
7 - Year 5 Monitoring	10.00%					2021	
8 - Year 6 Monitoring	5.00%					2022	
9 - Year 7 Monitoring	10.00%					2023	
Stream Bankfull Standard	10.00%	10.00%	388.333	0.000	388.333	2018	4/25/2018
			Totals	0.000	2,912.499		

Total Gross Credits	3,883.333
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2,912.499
Total Percentage Released	75.00%
Remaining Unreleased Credits	970.834

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Warm Stream	Restoration	1,706.000
Warm Stream	Enhancement I	293.000
Warm Stream	Enhancement II	6,718.000

Notes

Contingencies (if any)

Mitigation Project Name **Holman Mill Stream Mitigation Project**
 DMS ID **96316**
 River Basin **Cape Fear**
 Cataloging Unit **03030002**
 County **Alamance**

USACE Action ID **2015-00019**
 DWR Permit **2014-0333**
 Date Project Instituted **2/21/2014**
 Date Prepared **4/20/2020**
 Stream/Wet. Service Area **Cape Fear - Jordan Haw**

							Stream Restoration Credits
Debits							
Beginning Balance (mitigation credits)							3,883.333
Released Credits							2,912.499
Unrealized Credits							0.000
Owning Program	Req. Id	TIP #	Project Name	USACE Permit #	DWR Permit #	DCM Permit #	
NCDOT Stream & Wetland ILF Program	REQ-005957	R-2413A, R-2413B	NC 68 Connector	2013-00557	2013-0517		511.800
NCDOT Stream & Wetland ILF Program	REQ-005957	R-2413A, R-2413B	NC 68 Connector	2013-00557	2013-0517		58.600
NCDOT Stream & Wetland ILF Program	REQ-005957	R-2413A, R-2413B	NC 68 Connector	2013-00557	2013-0517		594.598
NCDOT Stream & Wetland ILF Program	REQ-006028	U-2525B, U-2525C	Greensboro Eastern Loop	2005-21386	2013-0918		388.337
NCDOT Stream & Wetland ILF Program	REQ-006028	U-2525B, U-2525C	Greensboro Eastern Loop	2005-21386	2013-0918		341.200
NCDOT Stream & Wetland ILF Program	REQ-006028	U-2525B, U-2525C	Greensboro Eastern Loop	2005-21386	2013-0918		39.067
NCDOT Stream & Wetland ILF Program	REQ-006028	U-2525B, U-2525C	Greensboro Eastern Loop	2005-21386	2013-0918		396.400
NCDOT Stream & Wetland ILF Program	REQ-006473		SR 1007 - Bridge 42 - Division 7	2015-02641			19.530
NCDOT Stream & Wetland ILF Program	REQ-006473		SR 1007 - Bridge 42 - Division 7	2015-02641			1.670
NCDOT Stream & Wetland ILF Program	REQ-007139	I-5110	I-73 from NC 68 to Greensboro Western Loop	2011-00317			170.600
NCDOT Stream & Wetland ILF Program	REQ-007139	I-5110	I-73 from NC 68 to Greensboro Western Loop	2011-00317			196.530
Total Credits Debited							2,718.332
Remaining Available balance (Released credits)							194.167
Remaining balance (Unreleased credits)							970.834

PREPARED BY:



312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: 919.851.9986

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed a full delivery project at the Holman Mill Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore and enhance a total of 8,717 linear feet of perennial and intermittent stream in Alamance County, NC. It is anticipated that the Site will generate 3,884 Stream Mitigation Units (SMUs) through the restoration and enhancement of six unnamed tributaries (UT to Pine Hill Branch, UT1, UT1A, UT2, UT2A, and UT2B). The Site is located in the Cape Fear River Basin Hydrologic Unit Code (HUC) 03030002 (Cape Fear 02) near Snow Camp, NC (Figure 1) and is within the Cane Creek Targeted Local Watershed (TLW) (HUC 03030002050050). On-site streams flow into Cane Creek and eventually into the Haw River.

The Site is located within the Jordan Lake Water Supply Watershed, which has been designated as a Nutrient Sensitive Water. The TLW was identified in DMS's Cape Fear River Basin Restoration Priorities 2009 (RBRP) (NC EEP, 2009) report. The RBRP plan identifies agricultural operations and degraded water quality based on "fair" and "good-fair" benthic ratings as the impairments in the Cane Creek watershed. The RBRP report also identifies the successful completion of a number of stream and wetland projects within the Cane Creek watershed. The Site fully supports the Cataloging Unit wide functional objectives stated in the 2011 request for proposals to reduce and control nutrient inputs, reduce and control sediment inputs, and protect and augment Significant Natural Heritage Areas in the Cape Fear River Basin.

The mitigation project is intended to provide numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the Site; others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established with careful consideration of the goals and objectives described in the RBRP and to meet the DMS's 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) are to:

- Reduce fecal coliform, nitrogen, and phosphorous inputs by removing cattle from streams and establishing and augmenting a forested riparian corridor to intercept and process sediment and nutrients before they reach the channel during storm events;
- Reduce sediment loads by stabilizing eroding stream banks;
- Return a network of streams to a stable form that is capable of supporting biological functions;
- Install instream structures to improve bed and bank stability, create fish and macroinvertebrate habitat, and help oxygenate streamflows; and
- Protect existing high-quality streams and forested buffers.

The project is helping meet the goals for the watershed and providing numerous ecological benefits within the Cape Fear River Basin. In addition, protected parcels downstream of the Site promote cumulative project benefits within the watershed.

The Site construction and as-built surveys were completed between January and April 2016. A conservation easement is in place on 32.4 acres of the riparian corridors to protect them in perpetuity.

Monitoring Year 5 (MY5) assessments and site visits were completed between January and October 2020 to assess the condition of the Site. Overall, the Site has met the required vegetation and stream success criteria for MY5. The overall average stem density for the Site is 442 stems per acre and exceeds the MY5 requirement of 260 stems per acre. A narrow but long 0.3 acre area of easement



encroachment occurred in December 2019 but was replanted in February 2020. One low stem density area was identified which will be replanted in winter 2021. All restored and enhanced streams are stable and functioning as designed. Multiple bankfull events were recorded on all restoration reaches during MY5 and at least two bankfull events were recorded on each reach during the previous monitoring year, resulting in attainment of the MY7 stream hydrology success criteria. The localized erosion on UT2 was repaired in May 2020.



HOLMAN MILL MITIGATION SITE
Monitoring Year 5 Annual Report

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Section 1: PROJECT OVERVIEW

The Holman Mill Mitigation Site (Site) is located in southern Alamance County, southeast of Snow Camp off of Holman Mill Road (Figure 1). The Site is located within the Jordan Lake Water Supply Watershed (HUC 03030002050050) which has been designated as a Nutrient Sensitive Water. The Site is in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The project watershed consists primarily of agricultural and wooded land. The drainage area for the Site is 1,077 acres (1.68 square miles).

The project streams consist of six unnamed tributaries to Pine Hill Branch. Stream restoration reaches included UT1 (Reach 1 and 3), UT2 (Reach 3 and 4), and UT2A. Stream enhancement I (EI) and enhancement II (EII) reaches included UT1 (Reach 2 and 4), EII; UT1A, EII; UT2 (Reach 1), EII; UT2 (Reach 2), EI; UT2B, EII; and UT to Pine Hill Branch, EII. Mitigation work within the Site included restoration and enhancement of 8,717 linear feet of perennial and intermittent stream channels. The riparian areas were planted with native vegetation to improve habitat and protect water quality. The final mitigation plan was submitted and accepted by the DMS in May 2015. 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. Baseline monitoring (MY0) was conducted between January 2016 and March 2016. Annual monitoring will occur for seven years with the close-out anticipated to occur in 2023 given the success criteria are met. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for the Site.

A 32.4 acre conservation easement (Deed Book 3472, Page 968; Deed Book 3472, Page 951) has been recorded and is in place along the stream riparian corridors to protect them in perpetuity within two tracts; a tract owned by the Russell B. Hadley Revocable Trust and a tract owned by the M. Darryl Lindley Revocable Trust, respectively. The project is expected to provide 3,884 SMU's by closeout.

A project vicinity map and directions are provided in Figure 1 and project components are illustrated in Figure 2.

1.1 Project Goals and Objectives

Prior to restoration and enhancement activities, the streams and vegetative communities on the Site had been severely impacted due to direct livestock access to the streams and riparian zones. Table 4 in Appendix 1 and Tables 10a through 10c in Appendix 4 present the pre-restoration conditions in detail.

This Site is intended to provide numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the Site, others such as pollutant removal and reduced sediment loading have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established 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 goals and related objectives established in the mitigation plan (Wildlands, 2015) included:

The primary project goals are:

- Reduce fecal coliform, nitrogen, and phosphorous inputs by removing cattle from streams and establishing and augmenting a forested riparian corridor to intercept and process sediment and nutrients before they reach the channel during storm events;
- Reduce sediment loads by stabilizing eroding stream banks;
- Return a network of streams to a stable form that is capable of supporting biological functions;



- Install instream structures to improve bed and bank stability, create fish and macroinvertebrate habitat, and help oxygenate streamflows; and
- Protect existing high-quality streams and forested buffers.

Secondary project objectives are expected to include:

- Improving instream nutrient cycling by incorporating woody debris into constructed riffles and bank stabilization measures;
- Reducing thermal loadings through establishment of riparian shading;
- Reconnecting channels with floodplains to raise the local water table; and
- Create and implement a stream and riparian area restoration design that is both natural and aesthetically pleasing.

1.2 Monitoring Year 5 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY5 to assess the condition of the project. The vegetation and stream success criteria for the Site follows the approved success criteria presented in the Mitigation Plan (Wildlands, 2015).

1.2.1 Vegetative Assessment

A total of 12 standard 10-meter by 10-meter vegetation plots were established during the baseline monitoring within the project easement area. The final vegetative success criteria will be the survival of 210 planted stems per acre averaging 10 feet in height within the conservation easement at the end of MY7. The interim measure of vegetative success for the Site will be the survival of 260 planted stems per acre at the end of MY5.

The MY5 vegetative survey was completed in August 2020. The 2020 vegetation monitoring resulted in an average planted stem density of 442 planted stems per acre; exceeding the interim requirement of 260 stems per acre required at MY5 and approximately 30% less than the baseline density recorded (634 stems per acre). When including volunteer stems, the average stems per acre is 931 for MY5. This greatly exceeds the MY5 interim requirement of 260 stems per acre as well as the MY7 final success criteria of 210 stems per acre. There is an average of 11 stems per plot as compared to 15 stems per plot in MY0. Eleven of the twelve individual vegetation plots met the interim success criteria required for MY5 and are on track to meet the success criteria required for MY7 (Table 7, Appendix 3). Vegetation plot 12 had 243 stems per acre and did not meet the MY5 interim requirement. However, vegetation plot 12 is on track to meet the 210 stems per acre success criteria required for MY7. When counting volunteer trees, vegetation plot 12 had an average stem density of 647 stems per acre, which exceeds the MY5 interim requirement of 260 stems per acre. Refer to Appendix 2 for vegetation plot photographs and the vegetation condition assessment table and Appendix 3 for vegetation data tables.

1.2.2 Vegetation Areas of Concern

Encroachment occurred along the right floodplain of UT1 (Figure 3.0) for 1,100 linear feet and a total of 0.3 acres in December 2019. Horse tape and additional easement signs were installed to clearly mark the conservation easement boundary and prevent future encroachment. In February 2020 thirty supplemental trees were planted in this area which included a mixture of one-gallon and three-gallon willow oak (*Quercus phellos*), sycamore (*Platanus occidentalis*), and river birch (*Betula nigra*). Herbaceous vegetation has grown back and planted trees are healthy. This area will continue to be assessed, but no further action will be taken at this time.

An area of low stem density (Figure 3.0) was noted during MY5 for a total of 0.14 acres. Dense herbaceous vegetation has outcompeted the planted trees in the area adjacent to UT to Pine Hill



Branch. Refer to Section 1.2.6 for further information on the maintenance plan for the low stem density areas.

1.2.3 Stream Assessment

Morphological surveys for MY5 were conducted in March 2020 and all streams within the Site are stable and functioning as designed. Cross-sections at the Site show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. Bank height ratios fall within the appropriate Rosgen stream type parameters. Substrate materials in the restoration and enhancement I reaches indicated maintenance of coarser materials in the riffle reaches and finer particles in the pools. Longitudinal profile surveys are not required on the project unless visual inspection indicates reach wide vertical instability. Refer to Appendix 2 for the visual stability assessment table, Current Condition Plan View (CCPV) map, and stream photographs. Refer to Appendix 4 for the morphological data and plots.

1.2.4 Stream Areas of Concern

Localized erosion below a log sill on UT2 between stations 214+35 and 214+50 identified during MY4 was repaired in May 2020. The stream bank repair included installing sod mats and live stakes. See before and after photos of the area in Appendix 2. This area will continue to be monitored to determine the success of the repair work.

1.2.5 Hydrology Assessment

Two or more bankfull events must have occurred in separate years within the restoration reaches during the monitoring period. Multiple bankfull events were recorded on all restoration reaches during MY5 and as well as during MY1 through MY4, resulting in attainment of the stream hydrology assessment criteria. Refer to Appendix 5 for hydrologic data.

1.2.6 Maintenance Plan

The low stem density area identified in Section 1.2.2 will be replanted in early winter 2021. Prior to planting, the area along UT to Pine Hill Branch will be treated for herbaceous vegetation to provide the planted trees a competitive advantage.

1.3 Monitoring Year 5 Summary

Eleven of the 12 vegetation plots met the MY5 interim requirement of 260 planted stems per acre as noted in the CCPV. When including volunteer species all 12 vegetation plots met the MY5 interim requirement. The encroachment area noted along UT1 was replanted in winter 2020 and will continue to be monitored. The low stem density area identified at the Site will be replanted in early winter 2021. All streams within the Site are stable and functioning as designed. The localized erosion identified in MY4 on UT2 was repaired and will continue to be monitored. Multiple bankfull events in separate years have been documented on all restored stream reaches at the Site, resulting in fulfillment of the hydrologic success criteria.

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 was 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 a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages and pressure transducers were installed in surveyed riffle cross-sections and monitored throughout the year. 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.
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- United States Geological Survey. 1998. North Carolina Geology. <http://www.geology.enr.state.nc.us/usgs/carolina.htm>
- Wildlands Engineering, Inc. 2015. Holman Mill Mitigation Project Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables

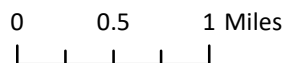
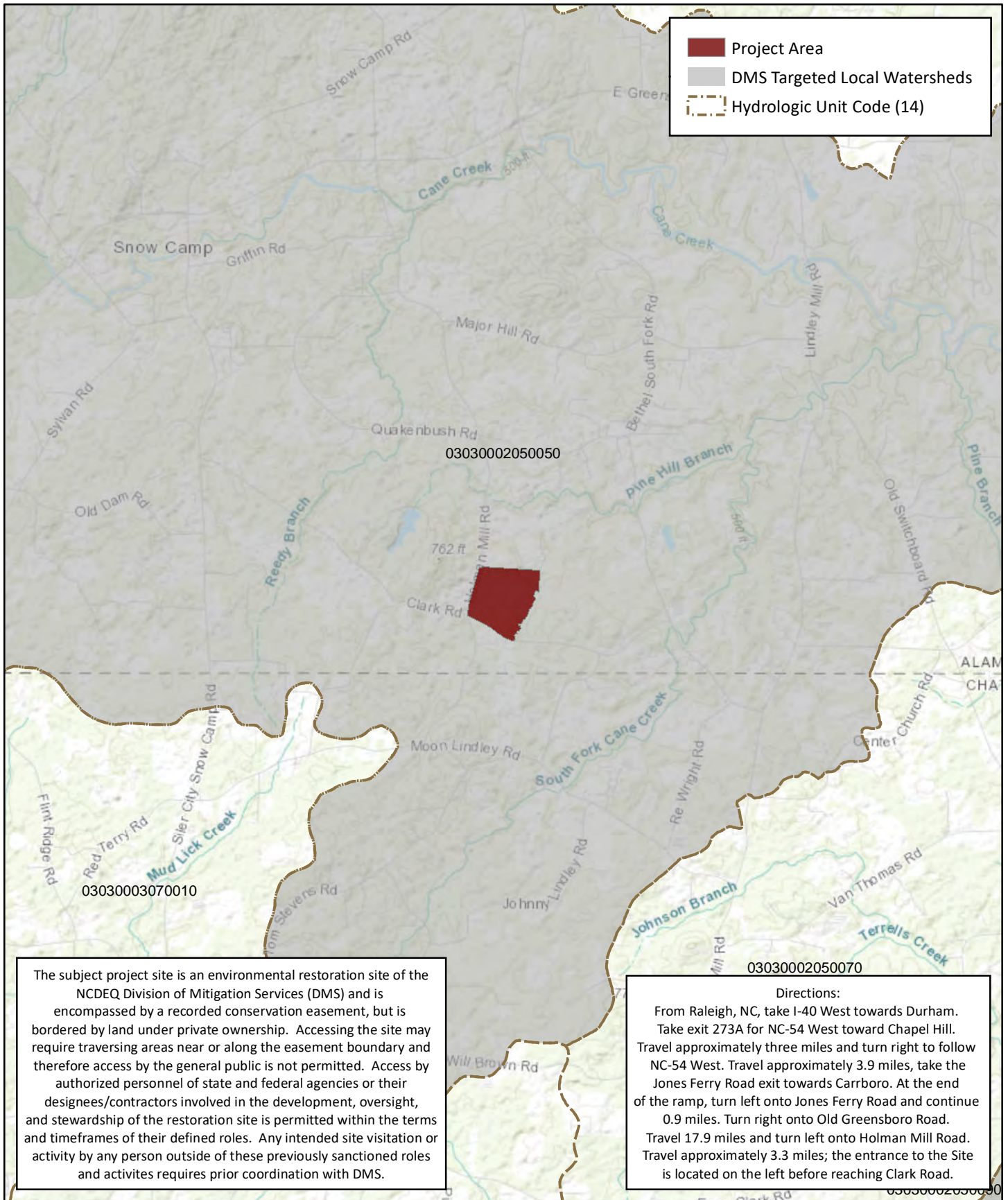


Figure 1 Project Vicinity Map
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 Alamance County, NC

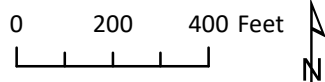
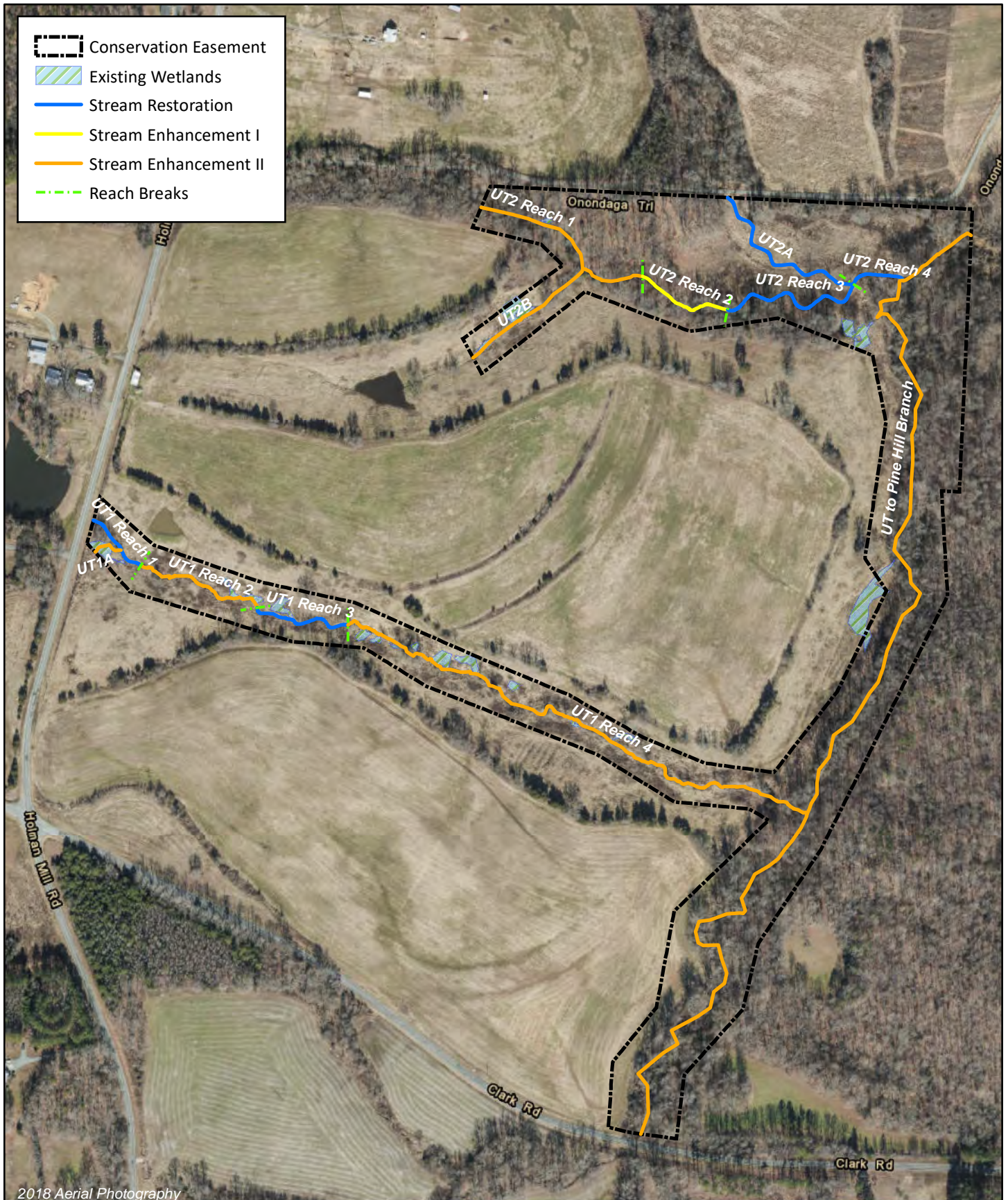


Figure 2 Project Component / Asset Map
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 Alamance County, NC

Table 1. Project Components and Mitigation Credits
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3,884	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PROJECT COMPONENTS									
Reach ID	As-Built Stationing / Location	Existing Footage / Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage / Acreage	Mitigation Ratio	Credits (SMU / WMU)		
STREAMS									
UT to Pine Hill Branch	600+00 - 635+26	3,526	EII	Restoration	3,526	5	705		
UT1 Reach 1	100+00 - 102+08	215	P1	Restoration	208	1	208		
UT1 Reach 2	102+08 - 106+31	433	EII	Restoration	423	2.5	169		
UT1 Reach 3	106+31 - 109+40	331	P1	Restoration	309	1	309		
UT1 Reach 4	109+40 - 125+98	1,687	EII	Restoration	1,658	2.5	663		
UT1A	400+00 - 400+94	84	EII	Restoration	94	2.5	38		
UT2A	300+00 - 305+40	468	P1	Restoration	540	1	540		
UT2 Reach 1	200+00 - 205+88	588	EII	Restoration	588	2.5	235		
UT2 Reach2	205+88 - 208+81	298	E1	Restoration	293	1.5	195		
UT2 Reach 3	208+81 - 213+63	396	P1	Restoration	482	1	482		
UT2 Reach 4	213+63 - 215+30	242	P1	Restoration	167	1	167		
UT2B	500+00 - 504+29	429	EII	Restoration	429	2.5	172		
COMPONENT SUMMATION									
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (acres)	Upland (acres)			
		Riverine	Non-Riverine						
Restoration	1,706	-	-	-	-	-			
Enhancement		-	-	-	-	-			
Enhancement I	293								
Enhancement II	6,718								
Creation		-	-	-					
Preservation		-	-	-					
High Quality Preservation		-	-	-					

Table 2. Project Activity and Reporting History

Holman Mill Mitigation Site
 DMS Project No. 96316
Monitoring Year 5 - 2020

Activity or Report	Date Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	April 2014 - April 2015	May 2015
Final Design - Construction Plans	May 2015 - October 2015	October 2015
Construction	January 2016 - 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
	Vegetation Survey	March 2016
Year 1 Monitoring	Stream Survey	September 2016
	Vegetation Survey	September 2016
Year 2 Monitoring	Stream Survey	March 2017
	Vegetation Survey	August 2017
Year 3 Monitoring	Stream Survey	March 2018
	Vegetation Survey	August 2018
Replanting		December 2018
Sweetgum Removal		April 2019
Tree Release		April 2019
Fence Repaired		August 2019
Easement Encroachment		December 2019
Year 4 Monitoring		December 2019
Replanting		February 2020
Stream Repair		May 2020
Year 5 Monitoring	Stream Survey	March 2020
	Vegetation Survey	August 2020
Year 6 Monitoring		December 2021
Year 7 Monitoring	Stream Survey	2022
	Vegetation Survey	2022

¹Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table

Holman Mill Mitigation Site
 DMS Project No. 96316
Monitoring Year 5 - 2020

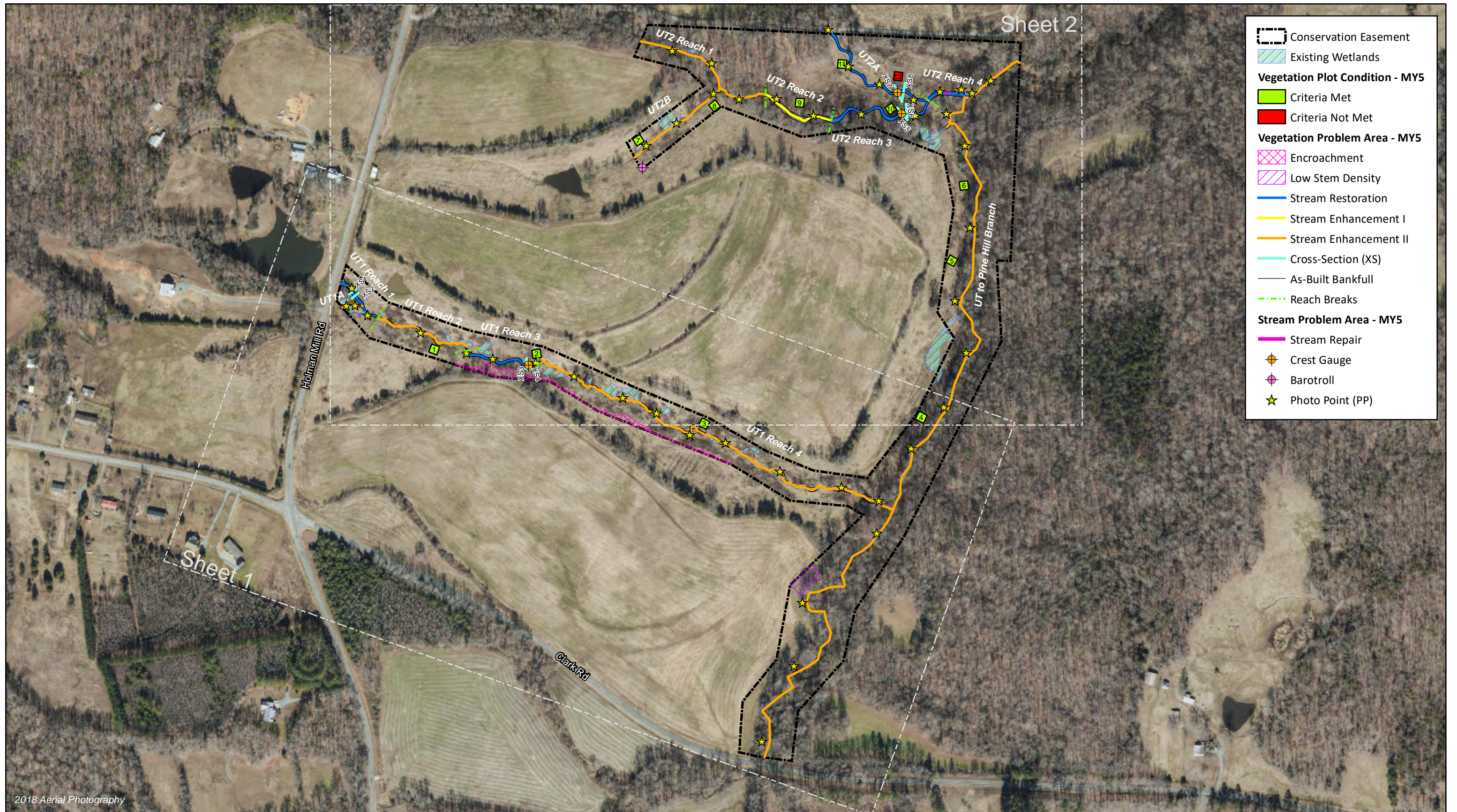
Designer Angela Allen, PE	Wildlands Engineering, Inc. 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986, ext. 106
Construction Contractor	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	Bruton Natural Systems, Inc P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	Green Resource, LLC
Nursery Stock Suppliers Bare Roots	Dykes and Son Nursery
Live Stakes	Bruton Natural Systems, Inc
Monitoring Performers Monitoring, POC	Wildlands Engineering, Inc. Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Holman Mill Mitigation Site
 DMS Project No. 96316
Monitoring Year 5 - 2020

PROJECT INFORMATION						
Project Name	Holman Mill Mitigation Site					
County	Alamance County					
Project Area (acres)	32.4 Acres					
Planted Area (acres)	14.0 Acres					
Project Coordinates (latitude and longitude)	35°51'310.12"N, 79°23'16.00"W					
PROJECT WATERSHED SUMMARY INFORMATION						
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province					
River Basin	Cape Fear River					
USGS Hydrologic Unit 8-digit	03030002					
USGS Hydrologic Unit 14-digit	03030002050050					
DWR Sub-basin	03-06-04					
Project Drainage Area (acres)	1,077					
Project Drainage Area Percentage of Impervious Area	3%					
CGIA Land Use Classification	49% Forested/Scrubland, 42% Agriculture/Managed Herbaceous, 4% Pasture, 3% Watershed Impervious Cover, 2% Residential, <1% Open Water					
REACH SUMMARY INFORMATION						
Parameters	UT to Pine Hill Branch	UT1	UT1A	UT2	UT2A	UT2B
Length of reach (linear feet) - Post-Restoration	3,526	2,598	94	1,530	540	429
Drainage area (acres)	1,077	102	20	130	47	18
NCDWR stream identification score	44.5	33.5/30.5	25.5	35	36.75	26.5
NCDWR Water Quality Classification	N/A					
Morphological Description (stream type)	P	P	I	P	P	I
Evolutionary trend (Simon's Model) - Pre- Restoration	I	II	NA	III/IV	III/IV	NA
Underlying mapped soils	Georgeville silty clay loam, Local alluvial land, Herndon silt loam, Goldston Channery silt loam					
Drainage class	---	---	---	---	---	---
Soil Hydric status	---	---	---	---	---	---
Slope	---	---	---	---	---	---
FEMA classification	AE	AE	---	AE	AE	---
Native vegetation community	Piedmont bottomland forest, Bottomland hardwood forest					
Percent composition exotic invasive vegetation - Post-Restoration	0%					
REGULATORY CONSIDERATIONS						
Regulation	Applicable?	Resolved?	Supporting Documentation			
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ			
Waters of the United States - Section 401	Yes	Yes	401 Water Quality Certification No. 3885.			
Division of Land Quality (Dam Safety)	No	N/A	N/A			
Endangered Species Act	Yes	Yes	Holman Mill Mitigation Plan (2015); Wildlands determined "no effect" on Alamance County listed endangered species.			
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 3/24/14).			
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A			
FEMA Floodplain Compliance	Yes	Yes	UT to Pine Hill Branch and portions of UT2 and UT2A are located within the floodway and flood fringe (FEMA Zone AE, FIRM panel 8786).			
Essential Fisheries Habitat	No	N/A	N/A			

APPENDIX 2. Visual Assessment Data



2018 Aerial Photography

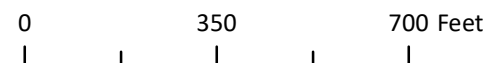


Figure 3.0 Integrated Current Condition Plan View (Key)
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 Alamance County, NC



2018 Aerial Photography

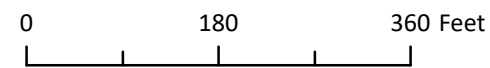


Figure 3.1 Integrated Current Condition Plan View
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020



Figure 3.2 Integrated Current Condition Plan View
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020



0 180 360 Feet



Table 5a. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT1

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)	12	12			100%			
		Thalweg centering at downstream of meander bend (Glide)	13	13			100%			
Totals					0	0	100%	n/a	n/a	n/a
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
3. Engineered Structures¹	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	10	10			100%			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 5b. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT1A

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	3	3			100%			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
Totals					0	0	100%	n/a	n/a	n/a
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
3. Engineered Structures¹	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	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%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 5c. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT2

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	10	10			100%			
		Length Appropriate	10	10			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%			
Totals										
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
Totals										
3. Engineered Structures¹	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.	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%.	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%			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 5d. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT2A

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	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	10	10			100%			
Totals					0	0	100%	n/a	n/a	n/a
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
3. Engineered Structures¹	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 5e. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT2B

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	n/a	n/a			n/a			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
Totals					0	0	100%	n/a	n/a	n/a
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
3. Engineered Structures¹	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	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%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 5f. Visual Stream Morphology Stability Assessment Table

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT to Pine Hill Branch

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	n/a	n/a			n/a			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
Totals					0	0	100%	n/a	n/a	n/a
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, caving, or collapse			0	0	100%	n/a	n/a	n/a
3. Engineered Structures¹	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	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%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

¹Excludes constructed riffles since they are evaluated in section 1.

Table 6. Vegetation Condition Assessment Table

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

Planted Acreage 14

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	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	1	0.1	1%
Total			1	0.1	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%
Cumulative Total			1	0.1	1%

Easement Acreage 32.4

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	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	1	0.3	1%

Stream Photographs



PHOTO POINT 1 UT1A – looking upstream (3/3/2020)



PHOTO POINT 1 UT1A – looking downstream (3/3/2020)



PHOTO POINT 2 UT1A – looking upstream (3/3/2020)



PHOTO POINT 2 UT1A – looking downstream (3/3/2020)



PHOTO POINT 3 UT1 – looking upstream (3/3/2020)



PHOTO POINT 3 UT1 – looking downstream (3/3/2020)



PHOTO POINT 4 UT1 – looking upstream (3/3/2020)



PHOTO POINT 4 UT1 – looking downstream (3/3/2020)



PHOTO POINT 5 UT1 – looking upstream (3/3/2020)



PHOTO POINT 5 UT1 – looking downstream (3/3/2020)



PHOTO POINT 6 UT1 – looking upstream (3/3/2020)



PHOTO POINT 6 UT1 – looking downstream (3/3/2020)



PHOTO POINT 7 UT1 – looking upstream (3/3/2020)



PHOTO POINT 7 UT1 – looking downstream (3/3/2020)



PHOTO POINT 8 UT1 – looking upstream (3/3/2020)



PHOTO POINT 8 UT1 – looking downstream (3/3/2020)



PHOTO POINT 9 UT1 – looking upstream (3/3/2020)



PHOTO POINT 9 UT1 – looking downstream (3/3/2020)



PHOTO POINT 10 UT1 – looking upstream (3/3/2020)



PHOTO POINT 10 UT1 – looking downstream (3/3/2020)



PHOTO POINT 11 UT1 – looking upstream (3/3/2020)



PHOTO POINT 11 UT1 – looking downstream (3/3/2020)



PHOTO POINT 12 UT1 – looking upstream (3/3/2020)



PHOTO POINT 12 UT1 – looking downstream (3/3/2020)



PHOTO POINT 13 UT1 – looking upstream (3/3/2020)



PHOTO POINT 13 UT1 – looking downstream (3/3/2020)



PHOTO POINT 14 UT1 – looking upstream (3/3/2020)



PHOTO POINT 14 UT1 – looking downstream (3/3/2020)



PHOTO POINT 15 UT1 – looking upstream (3/3/2020)



PHOTO POINT 15 UT1 – looking downstream (3/3/2020)



PHOTO POINT 16 UT1 – looking upstream (3/3/2020)



PHOTO POINT 16 UT1 – looking downstream (3/3/2020)



PHOTO POINT 17 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 17 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 18 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 18 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 19 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 19 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 20 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 20 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 21 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 21 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 22 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 22 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 23 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 23 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 24 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 24 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 25 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 25 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 26 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 26 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 27 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 27 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 28 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 28 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 29 UT - PHB – looking upstream (3/3/2020)



PHOTO POINT 29 UT - PHB – looking downstream (3/3/2020)



PHOTO POINT 30 UT2B – looking upstream (3/9/2020)



PHOTO POINT 30 UT2B – looking downstream (3/9/2020)



PHOTO POINT 31 UT2B – looking upstream (3/9/2020)



PHOTO POINT 31 UT2B – looking downstream (3/9/2020)



PHOTO POINT 32 UT2B – looking upstream (3/9/2020)



PHOTO POINT 32 UT2B – looking downstream (3/9/2020)



PHOTO POINT 33 UT2 – looking upstream (3/9/2020)



PHOTO POINT 33 UT2 – looking downstream (3/9/2020)



PHOTO POINT 34 UT2 – looking upstream (3/9/2020)



PHOTO POINT 34 UT2 – looking downstream (3/9/2020)



PHOTO POINT 35 UT2 – looking upstream (3/9/2020)



PHOTO POINT 35 UT2 – looking downstream (3/9/2020)



PHOTO POINT 36 UT2 – looking upstream (3/9/2020)



PHOTO POINT 36 UT2 – looking downstream (3/9/2020)



PHOTO POINT 37 UT2 – looking upstream (3/9/2020)



PHOTO POINT 37 UT2 – looking downstream (3/9/2020)



PHOTO POINT 38 UT2 – looking upstream (3/9/2020)



PHOTO POINT 38 UT2 – looking downstream (3/9/2020)



PHOTO POINT 39 UT2 – looking upstream (3/9/2020)



PHOTO POINT 39 UT2 – looking downstream (3/9/2020)



PHOTO POINT 40 UT2 – looking upstream (3/3/2020)



PHOTO POINT 40 UT2 – looking downstream (3/3/2020)



PHOTO POINT 41 UT2 – looking upstream (3/3/2020)



PHOTO POINT 41 UT2 – looking downstream (3/3/2020)



PHOTO POINT 42 UT2A – looking upstream (3/9/2020)



PHOTO POINT 42 UT2A – looking downstream (3/9/2020)



PHOTO POINT 43 UT2A – looking upstream (3/9/2020)



PHOTO POINT 43 UT2A – looking downstream (3/9/2020)



PHOTO POINT 44 UT2A – looking upstream (3/9/2020)



PHOTO POINT 44 UT2A – looking downstream (3/9/2020)



PHOTO POINT 45 UT2A – looking upstream (3/9/2020)



PHOTO POINT 45 UT2A – looking downstream (3/9/2020)

Stream Areas of Concern Photographs



Before - Localized Erosion (4/7/2020)



Before - Localized Erosion (4/7/2020)



After - Repaired Localized Erosion (5/5/2020)



After - Repaired Localized Erosion (5/5/2020)



After - Repaired Localized Erosion (9/28/2020)



After - Repaired Localized Erosion (9/28/2020)

Vegetation Photographs



Vegetation Plot 1 (08/05/2020)



Vegetation Plot 2 (08/05/2020)



Vegetation Plot 3 (08/05/2020)



Vegetation Plot 4 (08/05/2020)



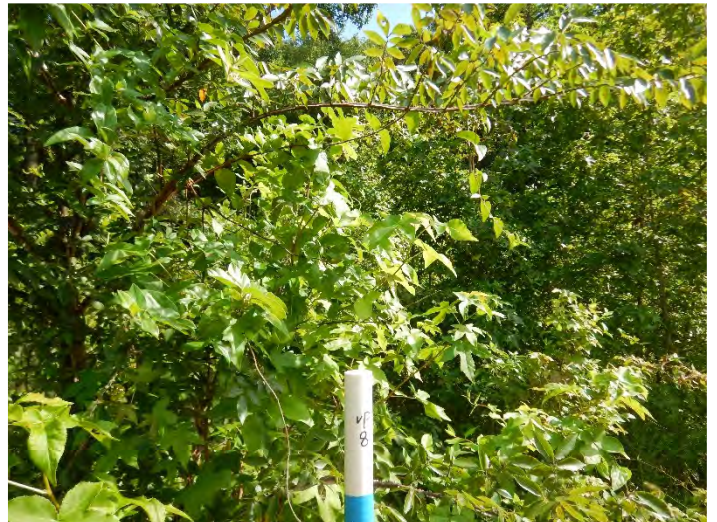
Vegetation Plot 5 (08/05/2020)



Vegetation Plot 6 (08/05/2020)



Vegetation Plot 7 (08/05/2020)



Vegetation Plot 8 (08/05/2020)



Vegetation Plot 9 (08/05/2020)



Vegetation Plot 10 (08/05/2020)



Vegetation Plot 11 (08/05/2020)



Vegetation Plot 12 (08/05/2020)

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Table

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

Plot	Success Criteria Met	Tract Mean
1	Yes	92%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	No*	

*Vegetation Plot 12 does not meet the interim success criteria for MY5 of 260 planted stems per acre. However, when including volunteers Vegetation Plot 12 does meet interim success criteria for MY5 and is on track to meet the final success criteria for MY7 of 210 planted stems per acre.

Table 8. CVS Vegetation Tables - Metadata

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

Report Prepared By	Kaitlyn Hogarth
Date Prepared	8/12/2020 12:04
Database Name	Holman Mill MYS- cvs-eep-entrytool-v2.5.0.mdb
Database Location	F:\Projects\005-02146 Holman Mill\Monitoring\Monitoring Year 5 - 2020\Vegetation Assessment
Computer Name	KAITLYN2020
File Size	49188864
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	96316
Project Name	Holman Mill
Description	Stream Restoration Project
Sampled Plots	12

Table 9. Planted and Total Stem Counts

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2020)																	
			VP 1			VP 2			VP 3			VP 4			VP 5			VP 6		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Alnus serrulata</i>	Tag Alder	Shrub Tree																	1	
<i>Betula nigra</i>	River Birch	Tree	6	6	6	4	4	4	3	3	3				2	2	2			
<i>Calycanthus floridus</i>	Sweet-shrub	Shrub																		
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree											1							
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	6	6	6	4	4	4	3	3	3	6	6	6	5	5	5	6	6	
<i>Juglans nigra</i>	Black Walnut	Tree															1		1	
<i>Juniperus virginiana</i>	Eastern Red Cedar	Tree																		
<i>Ligustrum sinense</i>	Chinese Privet	Exotic															1			
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree															13		15	
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree							4	4	4	3	3	3	3	3	3	1	1	
<i>Nyssa biflora</i>	Swamp Tupelo	Tree															1			
<i>Platanus occidentalis</i>	Sycamore	Tree													1	1	1			
<i>Quercus palustris</i>	Pin Oak	Tree				2	2	2	2	2	2	1	1	1	1	1	1	3	3	
<i>Quercus phellos</i>	Willow Oak	Tree	1	1	1	1	1	1												
<i>Rhus copallinum</i>	Winged Sumac	Shrub Tree																		
<i>Salix nigra</i>	Black Willow	Tree			1					3										
<i>Symphoricarpos orbiculatus</i>	Coralberry	Shrub																		
<i>Ulmus alata</i>	Winged Elm	Tree					3			2						4				
<i>Ulmus americana</i>	American Elm	Tree											1						7	
Stem count			13	13	14	11	11	14	12	12	17	10	10	12	12	12	31	10	10	
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			3	3	4	4	4	5	4	4	6	3	3	5	5	5	10	3	3	
Stems per ACRE			526	526	567	445	445	567	486	486	688	405	405	486	486	486	1,255	405	405	

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%
- Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 9. Planted and Total Stem Counts

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

Scientific Name	Common Name	Species Type	Current Plot Data (MYS 2020)																	
			VP 7			VP 8			VP 9			VP 10			VP 11			VP 12		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Alnus serrulata</i>	Tag Alder	Shrub Tree																		
<i>Betula nigra</i>	River Birch	Tree							1	1	1	5	5	5	4	4	4	1	1	1
<i>Calycanthus floridus</i>	Sweet-shrub	Shrub																		
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree																		
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	3	3	6	5	5	5			3						1			
<i>Juglans nigra</i>	Black Walnut	Tree															5			
<i>Juniperus virginiana</i>	Eastern Red Cedar	Tree																		
<i>Ligustrum sinense</i>	Chinese Privet	Exotic						1												1
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree			7			25												6
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree									3				1	1	1			
<i>Nyssa biflora</i>	Swamp Tupelo	Tree																		
<i>Platanus occidentalis</i>	Sycamore	Tree	2	2	2	3	3	3	8	8	8	2	2	2	2	2	2	3	3	3
<i>Quercus palustris</i>	Pin Oak	Tree	2	2	2				1	1	1	1	1	1	1	1	1	1	1	1
<i>Quercus phellos</i>	Willow Oak	Tree	5	5	5	4	4	4	2	2	2	2	2	7	3	3	3	1	1	2
<i>Rhus copallinum</i>	Winged Sumac	Shrub Tree																		
<i>Salix nigra</i>	Black Willow	Tree																		
<i>Symphoricarpos orbiculatus</i>	Coralberry	Shrub																		
<i>Ulmus alata</i>	Winged Elm	Tree			7			11						4						3
<i>Ulmus americana</i>	American Elm	Tree																		
Stem count			12	12	29	12	12	48	12	12	18	10	10	19	11	11	17	6	6	16
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	6	3	3	6	4	4	6	4	4	5	5	5	7	4	4	7
Stems per ACRE			486	486	1,174	486	486	1,942	486	486	728	405	405	769	445	445	688	243	243	647

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%
- Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 9. Planted and Total Stem Counts

Holman Mill Mitigation Project
 DMS Project No. 96316
 Monitoring Year 5 - 2020

Scientific Name	Common Name	Species Type	Annual Means														
			MYS (2020)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Alnus serrulata</i>	Tag Alder	Shrub Tree			1												
<i>Betula nigra</i>	River Birch	Tree	26	26	26	27	27	27	27	27	27	28	28	28	31	31	31
<i>Calycanthus floridus</i>	Sweet-shrub	Shrub						1									
<i>Cephalanthus occidentalis</i>	Buttonbush	Shrub Tree			1												
<i>Fraxinus pennsylvanica</i>	Green Ash	Tree	38	38	52	40	40	52	42	42	44	39	39	39	39	39	39
<i>Juglans nigra</i>	Black Walnut	Tree			7												
<i>Juniperus virginiana</i>	Eastern Red Cedar	Tree						1			1						
<i>Ligustrum sinense</i>	Chinese Privet	Exotic			3												
<i>Liquidambar styraciflua</i>	Sweet Gum	Tree			66			85			26						
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree	12	12	15	13	13	13	14	14	16	33	33	33	35	35	35
<i>Nyssa biflora</i>	Swamp Tupelo	Tree			1												
<i>Platanus occidentalis</i>	Sycamore	Tree	21	21	21	23	23	23	22	22	22	41	41	41	45	45	45
<i>Quercus palustris</i>	Pin Oak	Tree	15	15	15	15	15	15	15	15	15	18	18	18	18	18	18
<i>Quercus phellos</i>	Willow Oak	Tree	19	19	25	20	20	21	20	20	20	20	20	20	20	20	20
<i>Rhus copallinum</i>	Winged Sumac	Shrub Tree						4									
<i>Salix nigra</i>	Black Willow	Tree			4			7			3						
<i>Symphoricarpos orbiculatus</i>	Coralberry	Shrub						1									
<i>Ulmus alata</i>	Winged Elm	Tree			34			27			10						
<i>Ulmus americana</i>	American Elm	Tree			8			9									
Stem count			131	131	276	138	138	286	140	140	184	179	179	179	188	188	188
size (ares)			12			12			12			12			12		
size (ACRES)			0.30			0.30			0.30			0.30			0.30		
Species count			6	6	15	6	6	14	6	6	10	6	6	6	6	6	6
Stems per ACRE			442	442	931	465	465	965	472	472	621	604	604	604	634	634	634

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%
- Volunteers

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

Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT1

Parameter	Gage	PRE-RESTORATION	REFERENCE REACH DATA						DESIGN		AS-BUILT/BASELINE		
		UT1 - Reach 1/3	Agony Acres UT1A- Reach 1		UT to Polecat Creek		UT to Varnals Creek		UT1 - Reach 1/3		UT1 - Reach 1/3		
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Dimension and Substrate - Riffle													
Bankfull Width (ft)	N/A	5.7	9.1	10.4	5.3	10.9	9.3	10.5	7.8		7.5	7.9	
Floodprone Width (ft)		12	>36		25	65	20	64	15	65	23	24	
Bankfull Mean Depth		0.7	1.0	1.2	1.0	1.1	1.1	1.2	0.6		0.6		
Bankfull Max Depth		1.0	1.8		1.4	1.7	1.5	1.7	0.8	1.0	0.9		
Bankfull Cross-Sectional Area (ft ²)		4.3	10.7	11.3	5.4	12.4	10.3	12.3	4.3		4.3	4.6	
Width/Depth Ratio		8.1	7.3	10.1	5.2	9.6	8.1	9.3	14.1		13.1	13.6	
Entrenchment Ratio		2.0	>3.9		3.2	8.3	1.9	6.1	1.9	8.3	3.0	3.1	
Bank Height Ratio		2.2	1.0		1.0	1.1	0.9	1.0	0.9	1.1	1.0		
D50 (mm)		33.1	---		---		---		---		28.8	32.0	
Profile													
Riffle Length (ft)	N/A	---		---		---		---		12.5		31.4	
Riffle Slope (ft/ft)		N/A		0.0040	0.0470	0.0240	0.0570	0.0158	0.0661	0.0200	0.0690		
Pool Length (ft)		---		---		---		---		6.0		23.6	
Pool Max Depth (ft)		---		1.8		2.5	2.6	0.9	1.7	1.5	3.4		
Pool Spacing (ft)		N/A		34	52	8	82	2	44	20	53		
Pool Volume (ft ³)		---		---		---		---		---		---	
Pattern													
Channel Beltwidth (ft)	N/A	62	82	21	93	28	50	15	45	12	69	11	45
Radius of Curvature (ft)		56	90	14	60	19	50	8	47	10	45	9	37
Rc:Bankfull Width (ft/ft)		6.2	9.9	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.2	4.7
Meander Length (ft)		209	300	N/A		---	---	---	---	25	128	31	75
Meander Width Ratio		6.8	9.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.9	1.5	5.7
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A	---		---		---		---		---		---	
SC%/Sa%/G%/C%/B%/Be%		---		---		---		---		---		---	
d16/d35/d50/d84/d95/d100		0.18/8.66/33.11/128/2655/>2048		---		---		---		---		0.22/2.97/6.6/38.7/69.7/128	
Reach Shear Stress (Competency) lb/ft ²		1.6		---		---		---		0.9		0.7	
Max part size (mm) mobilized at bankfull		---		---		---		---		---		---	
Stream Power (Capacity) W/m ²		---		---		---		---		---		---	
Additional Reach Parameters													
Drainage Area (SM)	N/A	0.16		0.30		0.41		0.41		0.16		0.16	
Watershed Impervious Cover Estimate (%)		2%		---		---		---		2%		2%	
Rosgen Classification		B4		E4		E4		E4		C4		C4	
Bankfull Velocity (fps)		3.0	2.2	2.4	2.2	3.5	4.4	5.2	3.2	3.5	3.5	3.6	
Bankfull Discharge (cfs)		14.0		25.3		20.3		54.0		14.0		15.0	16.7
Q-NFF regression		---		---		---		---		---		---	
Q-USGS extrapolation		---		---		---		---		---		---	
Q-Mannings		---		---		---		---		---		---	
Valley Length (ft)		---		---		---		---		468		468	
Channel Thalweg Length (ft)		2,648		---		---		---		519		517	
Sinuosity		1.12		1.35		1.40		1.20		1.15	1.20	1.10	
Water Surface Slope (ft/ft) ²		---		---		---		---		---		0.0246	
Bankfull Slope (ft/ft)		0.025		0.004	0.028	0.012		0.017		0.015	0.03	0.0203	

(---): Data was not provided
 N/A: Not Applicable

Table 10b. Baseline Stream Data Summary
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT2

Parameter	Gage	PRE-RESTORATION CONDITION		REFERENCE REACH DATA						DESIGN				AS-BUILT/BASELINE					
		UT2 - Reach 3		UT2 - Reach 4		Agony Acres UT1A-Reach 1		UT to Polecat Creek		UT to Varnals Creek		UT2 - Reach 3		UT2 - Reach 4		UT2 - Reach 3		UT2 - Reach 4	
		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)	N/A	5.7	5.4	9.1	10.4	5.3	10.9	9.3	10.5	7.9		11.2		9.7		9.7			
Floodprone Width (ft)		12	26	>36		25	65	20	64	17	79	25	90	100		100			
Bankfull Mean Depth		0.7	0.8	1.0	1.2	1.0	1.1	1.1	1.2	0.6		0.8		0.5		0.5			
Bankfull Max Depth		1.0	1.5	1.8		1.4	1.7	1.5	1.7	0.8	1.0	1.1	1.5	0.8		0.8			
Bankfull Cross-Sectional Area (ft ²)		4.3	4.1	10.7	11.3	5.4	12.4	10.3	12.3	4.4		9.1		4.5		4.5			
Width/Depth Ratio		8.1	6.8	7.3	10.1	5.2	9.6	8.1	9.3	14.0		14.0		20.5		20.5			
Entrenchment Ratio		2.0	4.7	>3.9		3.2	8.3	1.9	6.1	2.2	10.0	2.2	8.0	10.4		10.4			
Bank Height Ratio		2.2	2.1	1.0		1.0	1.1	0.9	1.0	1.0	1.1	1.0	1.1	1.0		1.0			
D50 (mm)		33.1	0.7	---		---		---		---		---		11.4		11.4			
Profile																			
Riffle Length (ft)	N/A	---	---	---		---		---		---		---		14.7	45.8	23.7	31.4		
Riffle Slope (ft/ft)		---	---	---		0.0040	0.0470	0.024	0.057	0.0138	0.0598	0.0062	0.0264	0.0135	0.0288	0.0395*	0.0592*		
Pool Length (ft)		---	---	---		---		---		---		---		20.4		59.8			
Pool Max Depth (ft)		---	2.3	2.5		1.8		2.5	2.6	0.9	1.7	1.3	2.5	1.5	2.7	1.9	3.1		
Pool Spacing (ft)		---	---	N/A		34	52	8	82	4	44	3	63	56	87	33	61		
Pool Volume (ft ³)		---	---	---		---		---		---		---		---		---			
Pattern																			
Channel Beltwidth (ft)	N/A	62	82	16	50	21	93	28	50	15	45	13	70	18	100	31	52	20	
Radius of Curvature (ft)		56	90	10	47	14	60	19	50	8	47	10	46	15	65	18	42	45	
Rc:Bankfull Width (ft/ft)		6.2	9.9	1.2	5.6	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.3	5.8	1.9	4.3	4.6	
Meander Length (ft)		209	300	42	192	N/A		---	---	---	---	25	130	36	184	56	92	130	
Meander Width Ratio		6.8	9.0	1.9	6.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.9	1.6	8.9	3.2	5.4	2.1	
Substrate, Bed and Transport Parameters																			
R _p /R _u /P%/G%/S%	N/A	---	---	---		---		---		---		---		---		---			
SC%/Sa%/G%/C%/B%/Be%		---	---	---		---		---		---		---		---		---			
d16/d35/d50/d84/d95/d100		0.18/8.66/33.11/128/2655/>2048		SC/0.43/0.69/17.84/32.14/64		---		---		---		---		SC/2.18/5.6/34.0/56.9/362.0		SC/2.18/5.6/34.0/56.9/362.0			
Reach Shear Stress (Competency) lb/ft ²		1.77	1.10	---		---		---		0.38	0.59	0.38		0.44					
Max part size (mm) mobilized at bankfull		---	---	---		---		---		---		---		---					
Stream Power (Capacity) W/m ²		---	---	---		---		---		---		---		---					
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.13	0.21	0.30		0.41		0.41		0.13	0.21	0.13		0.21					
Watershed Impervious Cover Estimate (%)		2%	2%	---		---		---		2%	2%	2%		2%					
Rosgen Classification		B4	E5	E4		E4		E4		C4	C4	C4		C4					
Bankfull Velocity (fps)		3.0	2.9	2.2	2.4	2.2	3.5	4.4	5.2	2.9	2.5	2.6		N/A					
Bankfull Discharge (cfs)		13.0	22.0	25.3		20.3		54.0		13.0	22.0	11.7		N/A					
Q-NFF regression		---	---	---		---		---		---		---		---					
Q-USGS extrapolation		---	---	---		---		---		---		---		---					
Q-Mannings		---	---	---		---		---		---		---		---					
Valley Length (ft)		---	---	---		---		---		386	152	---		---					
Channel Thalweg Length (ft)		396	242	---		---		---		479	210	482		167					
Sinuosity		1.12	1.17	1.35		1.40		1.20		1.15	1.25	1.13	1.20	---					
Water Surface Slope (ft/ft) ²		---	---	---		---		---		---		---		0.0119					
Bankfull Slope (ft/ft)		0.0300	0.013	0.0040	0.028	0.012		0.0170		0.014		0.02		0.0120					

*: Alignment change during construction created steeper riffles
 (---): Data was not provided
 N/A: Not Applicable

Table 10c. Baseline Stream Data Summary

Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020

UT2A

Parameter	Gage	PRE-RESTORATION	REFERENCE REACH DATA						DESIGN		AS-BUILT/BASELINE		
		UT2A	Agony Acres UT1A-Reach 1		UT to Polecat Creek		UT to Varnals Creek		UT2A		UT2A		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Dimension and Substrate - Riffle													
Bankfull Width (ft)	N/A	5.1	9.1	10.4	5.3	10.9	9.3	10.5	6.4		6.6		
Floodprone Width (ft)		11.5	>36		25	65	20	64	14	80	100		
Bankfull Mean Depth		0.4	1.0	1.2	1.0	1.1	1.1	1.2	0.5		0.5		
Bankfull Max Depth		0.9	1.8		1.4	1.7	1.5	1.7	0.7	0.9	0.7		
Bankfull Cross-Sectional Area (ft ²)		2.1	10.7	11.3	5.4	12.4	10.3	12.3	3.3		3.2		
Width/Depth Ratio		12	7.3	10.1	5.2	9.6	8.1	9.3	13.0		13.5		
Entrenchment Ratio		2.3	>3.9		3.2	8.3	1.9	6.1	2.2	12.5	15.1		
Bank Height Ratio		3.4	1.0		1.0	1.1	0.9	1.0	0.9	1.1	1.0		
D50 (mm)		3.2	---		---		---		---		18.3		
Profile													
Riffle Length (ft)	N/A	---	---	---	---	---	---	---	---	17.9	38.2		
Riffle Slope (ft/ft)		---	N/A		0.0040	0.0470	0.0240	0.0570	0.018	0.08	0.0007	0.0520	
Pool Length (ft)		---	---	---	---	---	---	---	---	---	16.3	33.0	
Pool Max Depth (ft)		2.4	2.5		1.8		2.5	2.6	0.8	1.6	1.5	3.3	
Pool Spacing (ft)		---	N/A		34	52	8	82	2	36	29	62	
Pool Volume (ft ³)		---	---	---	---	---	---	---	---	---	---	---	
Pattern													
Channel Beltwidth (ft)	N/A	15	30	21	93	28	50	15	45	10	57	25	40
Radius of Curvature (ft)		5.8	33	14	60	19	50	8	47	8	37	11	31
Rc:Bankfull Width (ft/ft)		1.1	6.5	1.5	5.8	2.0	5.3	0.6	3.2	1.3	5.8	1.7	4.7
Meander Length (ft)		27	69	N/A		---	---	---	---	20	105	41	61
Meander Width Ratio		2.9	9.0	2.3	8.9	3.0	5.3	1.0	3.0	1.6	8.6	3.8	6.1
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A	---	---	---	---	---	---	---	---	---	---	---	
SC%/Sa%/G%/C%/B%/Be%		---	---	---	---	---	---	---	---	---	---	---	
d16/d35/d50/d84/d95/d100		0.18/8.66/33.11/128/2655/>2048	---	---	---	---	---	---	---	---	3.15/11.86/18.3/43.5/101.2/362	---	
Reach Shear Stress (Competency) lb/ft ²		1.85	---	---	---	---	---	---	0.52	---	0.45	---	
Max part size (mm) mobilized at bankfull		---	---	---	---	---	---	---	---	---	---	---	
Stream Power (Capacity) W/m ²		---	---	---	---	---	---	---	---	---	---	---	
Additional Reach Parameters													
Drainage Area (SM)	N/A	0.08	0.30		0.41		0.41		0.08		0.08		
Watershed Impervious Cover Estimate (%)		2%	---		---		---		2%		2%		
Rosgen Classification		C4b	E4		E4		E4		C4		C4		
Bankfull Velocity (fps)		2.5	2.2	2.4	2.2	3.5	4.4	5.2	3.1		2.9		
Bankfull Discharge (cfs)		9.0	25.3		20.3		54.0		9.0		8.6		
Q-NFF regression		---	---	---	---	---	---	---	---	---	---	---	
Q-USGS extrapolation		---	---	---	---	---	---	---	---	---	---	---	
Q-Mannings		---	---	---	---	---	---	---	---	---	---	---	
Valley Length (ft)		---	---	---	---	---	---	---	480		480		
Channel Thalweg Length (ft)		468	---	---	---	---	---	---	540		540		
Sinuosity		1.15	1.35		1.40		1.20		1.15	1.25	1.13		
Water Surface Slope (ft/ft) ²		---	---	---	---	---	---	---	---	---	0.0129		
Bankfull Slope (ft/ft)		0.023	0.0040	0.028	0.012		0.0170		0.007	0.018	0.0143		

(---): Data was not provided
 N/A: Not Applicable

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

Holman Mill Mitigation Site

DMS Project No. 96316

Monitoring Year 5 - 2020

Dimension and Substrate	UT1 Reach 1												UT1 Reach 3											
	Cross-Section 1 (Riffle)						Cross-Section 2 (Pool)						Cross-Section 3 (Pool)					Cross-Section 4 (Riffle) ³						
	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft)	570.5	570.5	570.5	570.7	570.7		569.8	569.8	569.8	569.9	569.7		554.1	554.1	554.1	554.2	554.2		554.3	554.3	554.3	554.6	554.5	
Low Bank Elevation (ft)	570.5	570.5	570.5	570.7	570.7		569.8	569.8	569.8	569.8	569.7		554.1	554.1	554.1	554.1	554.2		554.3	554.3	554.3	554.4	554.5	
Bankfull Width (ft)	7.9	7.7	7.2	8.3	8.8		8.4	7.3	7.1	8.2	6.8		9.6	8.9	8.5	9.2	6.4		10.7	9.9	9.4	9.8	11.3	
Floodprone Width (ft)	23.6	21.6	21.6	22.0	22.0		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		23.4	17.0	17.0	17.0	17.0	
Bankfull Mean Depth (ft)	0.6	0.5	0.5	0.6	0.6		0.9	0.9	0.8	0.9	0.7		0.9	0.9	0.9	0.9	1.1		0.7	0.7	0.6	0.8	0.6	
Bankfull Max Depth (ft)	0.9	0.8	0.8	1.1	1.3		1.6	1.5	1.4	1.5	1.1		1.8	1.9	1.7	1.7	1.9		1.3	1.2	1.1	1.4	1.3	
Bankfull Cross-Sectional Area (ft ²)	4.6	3.8	3.6	4.6	5.2		7.4	6.5	5.8	7.4	4.5		8.2	8.1	7.9	8.2	7.3		8.0	6.4	6.1	8.0	7.2	
Bankfull Width/Depth Ratio	13.6	15.8	14.4	15.1	15.0		9.5	8.3	8.7	9.1	10.2		11.3	9.8	9.2	10.3	5.6		14.3	15.2	14.6	12.0	17.8	
Entrenchment Ratio ¹	3.0	2.8	3.0	3.0	2.5		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		2.2	1.7	1.8	1.7	1.5	
Bankfull Bank Height Ratio ²	1.0	1.0	1.0	1.0	1.1		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		1.0	1.0	1.0	<1.0	<1.0	
Dimension and Substrate	UT2 Reach 3												UT2A											
	Cross-Section 5 (Riffle)						Cross-Section 6 (Pool)						Cross-Section 7 (Riffle)					Cross-Section 8 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft)	520.1	520.1	520.1	520.1	520.1		519.5	519.5	519.5	519.5	519.5		520.5	520.5	520.5	520.6	520.5		520.2	520.2	520.2	520.3	520.2	
Low Bank Elevation (ft)	520.1	520.1	520.1	520.1	520.1		519.5	519.5	519.5	519.5	519.5		520.5	520.5	520.5	520.6	520.5		520.2	520.2	520.2	520.1	520.2	
Bankfull Width (ft)	9.7	9.8	9.2	9.8	7.1		9.9	10.7	10.6	10.0	9.0		6.6	7.5	7.4	8.3	6.9		9.7	8.6	9.8	9.5	9.1	
Floodprone Width (ft)	100.0	100.0	100.0	100.0	100.0		N/A	N/A	N/A	N/A	N/A		100.0	100.0	100.0	100.0	100.0		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.5	0.4	0.4	0.5	0.5		0.9	0.8	0.8	0.9	1.1		0.5	0.4	0.4	0.4	0.4		0.9	0.8	0.9	1.0	0.6	
Bankfull Max Depth (ft)	0.8	0.9	0.9	0.9	1.0		1.6	1.7	1.6	1.7	1.9		0.7	0.7	0.7	0.9	0.8		1.5	1.6	1.6	1.7	0.9	
Bankfull Cross-Sectional Area (ft ²)	4.5	4.4	3.9	4.5	3.6		8.9	9.0	8.4	8.9	9.6		3.2	2.7	2.7	3.2	2.5		9.1	8.6	9.1	9.1	5.5	
Bankfull Width/Depth Ratio	20.5	21.9	21.7	21.2	14.2		11.0	12.7	13.4	11.2	8.5		13.5	20.7	20.6	21.6	18.8		10.4	12.3	10.5	9.9	14.8	
Entrenchment Ratio ¹	10.4	10.2	10.8	10.2	14.1		N/A	N/A	N/A	N/A	N/A		15.1	13.3	13.4	12.0	14.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio ²	1.0	1.0	1.0	1.0	<1.0		N/A	N/A	N/A	N/A	N/A		1.0	1.0	1.0	<1.0	<1.0		N/A	N/A	N/A	N/A	N/A	

¹Entrenchment Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

²Bank Height Ratio is calculated using the method specified in the Industry Technical Workgroup Memorandum

³Cross-Section 4 Bankfull Elevation was changed at MY3. Base and MY1-2 was updated based off of new Bankfull Elevation

Table 12a. Monitoring Data - Stream Reach Data Summary

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

UT1 Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY5		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	7.9		7.7		7.2		8.3		8.8			
Floodprone Width (ft)	24		22		22		22		22			
Bankfull Mean Depth	0.6		0.5		0.5		0.6		0.6			
Bankfull Max Depth	0.9		0.8		0.8		1.1		1.3			
Bankfull Cross Sectional Area (ft ²)	4.6		3.8		3.6		4.6		5.2			
Width/Depth Ratio	13.6		15.8		14.4		15.1		15.0			
Entrenchment Ratio	3.0		2.8		3		3.0		2.5			
Bank Height Ratio	1.0		1.0		1.0		1.0		1.1			
D50 (mm)	32.0		43.7		7.1		6.2		28.0			
Profile												
Riffle Length (ft)	12.5	31.4										
Riffle Slope (ft/ft)	0.0200	0.0690										
Pool Length (ft)	6.0	23.6										
Pool Max Depth (ft)	1.5	3.4										
Pool Spacing (ft)	20	53										
Pool Volume (ft ³)												
Pattern												
Channel Beltwidth (ft)	11	45										
Radius of Curvature (ft)	9	37										
Rc:Bankfull Width (ft/ft)	1.1	4.7										
Meander Wave Length (ft)	31	75										
Meander Width Ratio	1.4	5.7										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	208											
Sinuosity (ft)	1.1											
Water Surface Slope (ft/ft)	0.0246											
Bankfull Slope (ft/ft)	0.0203											
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	0.22/2.97/6.6/38.7/ 69.7/128		SC/1.19/9.1/57.4/ 107.3/256		SC/SC/4.9/61.0/ 163.2/362		SC/SC/2.1/42.9/137.0/ 256		SC/0.67/1.6/39.3/113.8 /256			
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(--): Data was not provided

Table 12b. Monitoring Data - Stream Reach Data Summary

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

UT1 Reach 3

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY5		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	10.7		9.9		9.4		9.8		11.3			
Floodprone Width (ft)	23		17		17		17		17			
Bankfull Mean Depth	0.7		0.7		0.6		0.8		0.6			
Bankfull Max Depth	1.3		1.2		1.1		1.4		1.3			
Bankfull Cross Sectional Area (ft ²)	8.0		6.4		6.1		8.0		7.2			
Width/Depth Ratio	14.3		15.2		14.6		12.0		17.8			
Entrenchment Ratio	2.2		1.7		1.8		1.7		1.5			
Bank Height Ratio	1.0		1.0		1.0		<1.0		<1.0			
D50 (mm)	28.8		22.6		23.6		10.0		23.5			
Profile												
Riffle Length (ft)	12.5	31.4										
Riffle Slope (ft/ft)	0.0200	0.0690										
Pool Length (ft)	6.0	23.6										
Pool Max Depth (ft)	1.5	3.4										
Pool Spacing (ft)	20	53										
Pool Volume (ft ³)												
Pattern												
Channel Beltwidth (ft)	11	45										
Radius of Curvature (ft)	9	37										
Rc:Bankfull Width (ft/ft)	0.8	3.5										
Meander Wave Length (ft)	31	75										
Meander Width Ratio	1.0	4.2										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	309											
Sinuosity (ft)	1.1											
Water Surface Slope (ft/ft)	0.0246											
Bankfull Slope (ft/ft)	0.0203											
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	0.22/2.97/6.6/38.7/ 69.7/128		SC/1.19/9.1/57.4/ 107.3/256		0.75/13.14/23.6/63.4/ 138.2/256		SC/SC/2.1/42.9/137.0/ 256		SC/0.67/1.6/39.3/113.8 /256			
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

¹ Cross-Section 4 Bankfull Elevation was changed at MY3. As-Built/Baseline and MY1-2 was updated based off of new Bankfull Elevation.

Table 12c. Monitoring Data - Stream Reach Data Summary

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

UT2 Reaches 3, 4

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY5		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	9.7		9.8		9.2		9.8		7.1			
Floodprone Width (ft)	100		100		100		100		100			
Bankfull Mean Depth	0.5		0.4		0.4		0.5		0.5			
Bankfull Max Depth	0.8		0.9		0.9		0.9		1.0			
Bankfull Cross Sectional Area (ft ²)	4.5		4.4		3.9		4.5		3.6			
Width/Depth Ratio	20.5		21.9		21.7		21.2		14.2			
Entrenchment Ratio	10.4		10.2		10.8		10.2		14.1			
Bank Height Ratio	1.0		1.0		1.0		1.0		<1.0			
D50 (mm)	11.4		35.0		41.3		16.0		38.5			
Profile												
Riffle Length (ft)	15	46										
Riffle Slope (ft/ft)	0.0135	0.0592										
Pool Length (ft)	11	60										
Pool Max Depth (ft)	1.5	3.1										
Pool Spacing (ft)	33	61										
Pool Volume (ft ³)												
Pattern												
Channel Beltwidth (ft)	20	52										
Radius of Curvature (ft)	18	45										
Rc:Bankfull Width (ft/ft)	1.9	4.6										
Meander Wave Length (ft)	56	130										
Meander Width Ratio	2.1	3.2										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	649											
Sinuosity (ft)	1.15											
Water Surface Slope (ft/ft)	0.0119	0.0237										
Bankfull Slope (ft/ft)	0.0120	0.0176										
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/2.18/5.6/ 34.0/56.9/362.0		1.0/9.17/24.5/53.7/ 77.8/128		19.15/31.72/41.3/84.3/ 123.1/256		SC/2.50/11.0/53.7/98.3/1 80.3		SC/0.66/3.7/50 /128 /256			
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(--): Data was not provided

Table 12d. Monitoring Data - Stream Reach Data Summary

Holman Mill Mitigation Project

DMS Project No. 96316

Monitoring Year 5 - 2020

UT2A

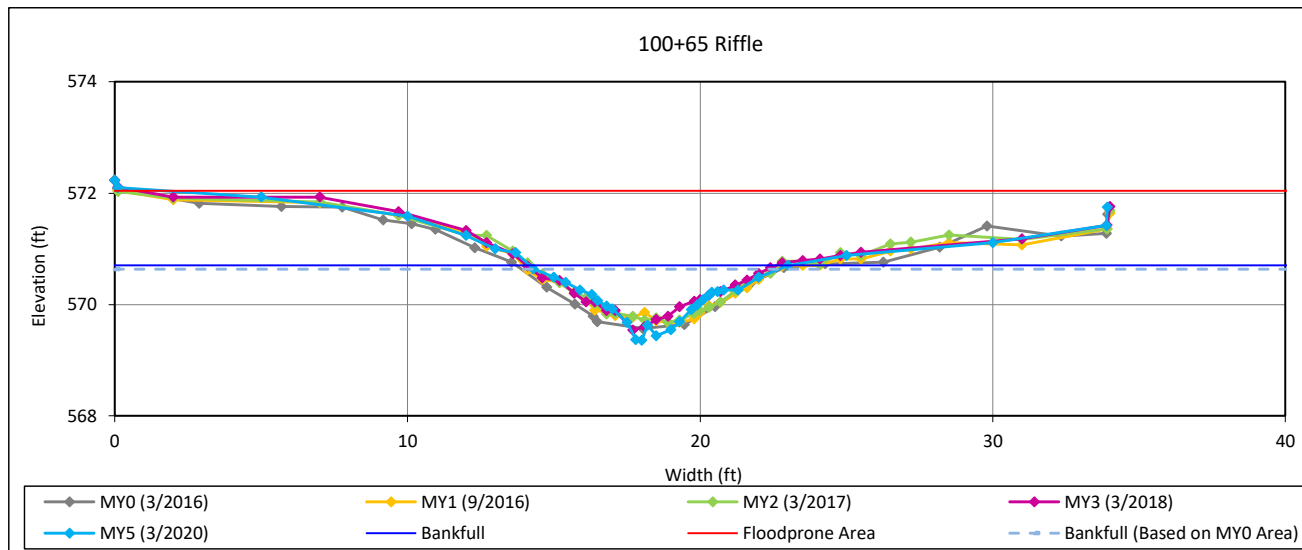
Parameter	As-Built/Baseline		MY1		MY2		MY3		MY5		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	6.6		7.5		7.4		8.3		6.9			
Floodprone Width (ft)	100		100		100		100		100			
Bankfull Mean Depth	0.5		0.4		0.4		0.4		0.4			
Bankfull Max Depth	0.7		0.7		0.7		0.9		0.8			
Bankfull Cross Sectional Area (ft ²)	3.2		2.7		2.7		3.2		2.5			
Width/Depth Ratio	13.5		20.7		20.6		21.6		18.8			
Entrenchment Ratio	15.1		13.3		13.4		12.0		14.6			
Bank Height Ratio	1.0		1.0		1.0		<1.0		<1.0			
D50 (mm)	18.3		29.7		7.1		11.2		12.3			
Profile												
Riffle Length (ft)	17.9	38.2										
Riffle Slope (ft/ft)	0.0007	0.0520										
Pool Length (ft)	16.3	33.0										
Pool Max Depth (ft)	1.5	3.3										
Pool Spacing (ft)	29	62										
Pool Volume (ft ³)												
Pattern												
Channel Beltwidth (ft)	25	40										
Radius of Curvature (ft)	11	31										
Rc:Bankfull Width (ft/ft)	1.7	4.7										
Meander Wave Length (ft)	41	61										
Meander Width Ratio	3.8	6.1										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	540											
Sinuosity (ft)	1.10											
Water Surface Slope (ft/ft)	0.0129											
Bankfull Slope (ft/ft)	0.0143											
Ri%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	3.15/11.86/18.3/43.5/ 101.2/362		.21/6.69/20.1/53.1/ 75.9/128		SC/0.87/1.9/32.0/ 75.9/128		SC/SC/11/45.0/86.6/ 2048.0		0.21/1.78/6.9/47/119.3 /180			
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(--): Data was not provided

Cross-Section Plots

Holman Mill Mitigation Site
(DMS Project No. 96316)
Monitoring Year 5 - 2020

Cross-Section 1-UT1



Bankfull Dimensions

5.2	x-section area (ft.sq.)
8.8	width (ft)
0.6	mean depth (ft)
1.3	max depth (ft)
9.5	wetted perimeter (ft)
0.5	hydraulic radius (ft)
15.0	width-depth ratio
22.0	W flood prone area (ft)
2.5	entrenchment ratio
1.1	low bank height ratio

Survey Date: 3/2020
Field Crew: Wildlands Engineering

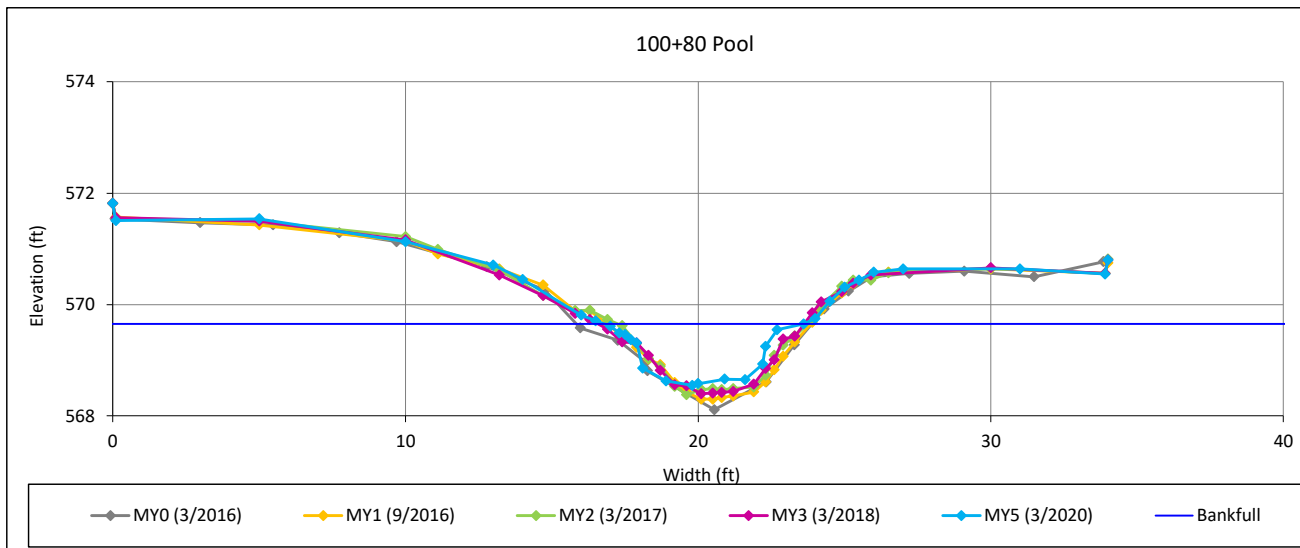


View Downstream

Cross-Section Plots

Holman Mill Mitigation Site
(DMS Project No. 96316)
Monitoring Year 5 - 2020

Cross-Section 2-UT1



Bankfull Dimensions

4.5	x-section area (ft.sq.)
6.8	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
7.6	wetted perimeter (ft)
0.6	hydraulic radius (ft)
10.2	width-depth ratio

Survey Date: 3/2020
Field Crew: Wildlands Engineering



View Downstream

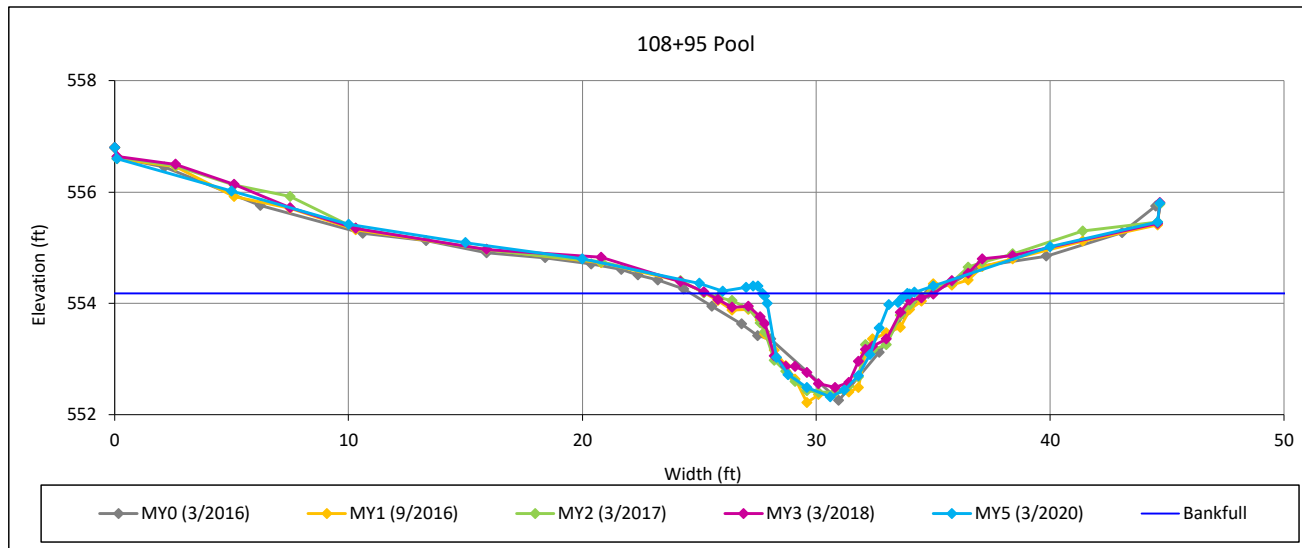
Cross-Section Plots

Holman Mill Mitigation Site

(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 3-UT1



Bankfull Dimensions

7.3	x-section area (ft.sq.)
6.4	width (ft)
1.1	mean depth (ft)
1.9	max depth (ft)
7.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
5.6	width-depth ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering



View Downstream

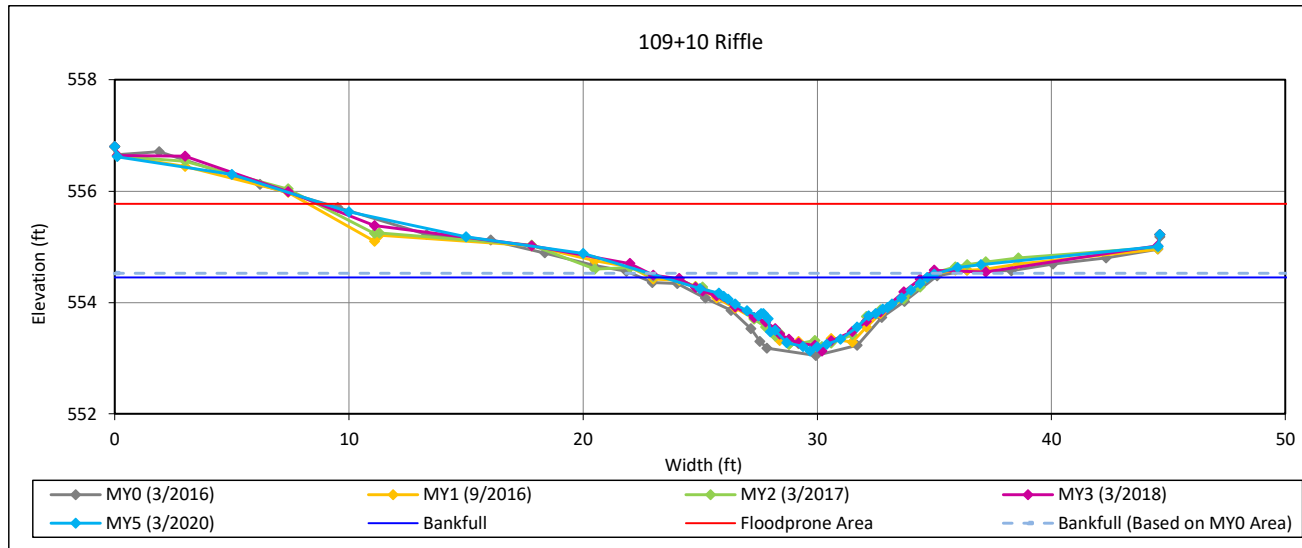
Cross-Section Plots

Holman Mill Mitigation Site

(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 4-UT1



Bankfull Dimensions

7.2	x-section area (ft.sq.)
11.3	width (ft)
0.6	mean depth (ft)
1.3	max depth (ft)
11.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
17.8	width-depth ratio
17.0	W flood prone area (ft)
1.5	entrenchment ratio
< 1.0	low bank height ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering



View Downstream

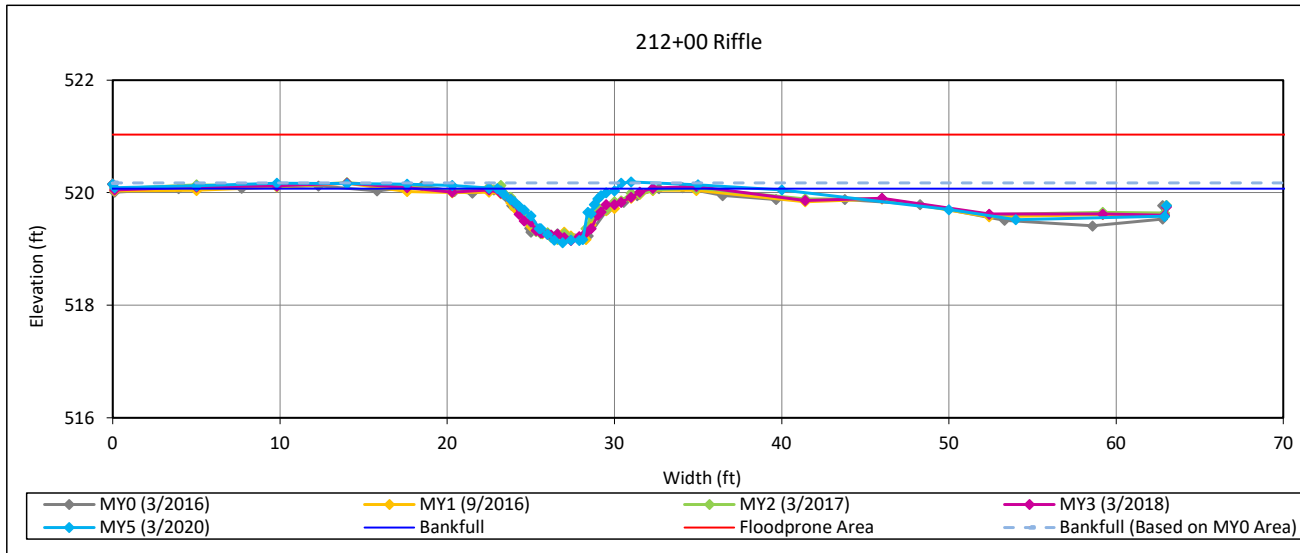
Cross-Section Plots

Holman Mill Mitigation Site

(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 5-UT2



Bankfull Dimensions

3.6	x-section area (ft.sq.)
7.1	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
7.6	wetted perimeter (ft)
0.5	hydraulic radius (ft)
14.2	width-depth ratio
100.0	W flood prone area (ft)
14.1	entrenchment ratio
< 1.0	low bank height ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering



View Downstream

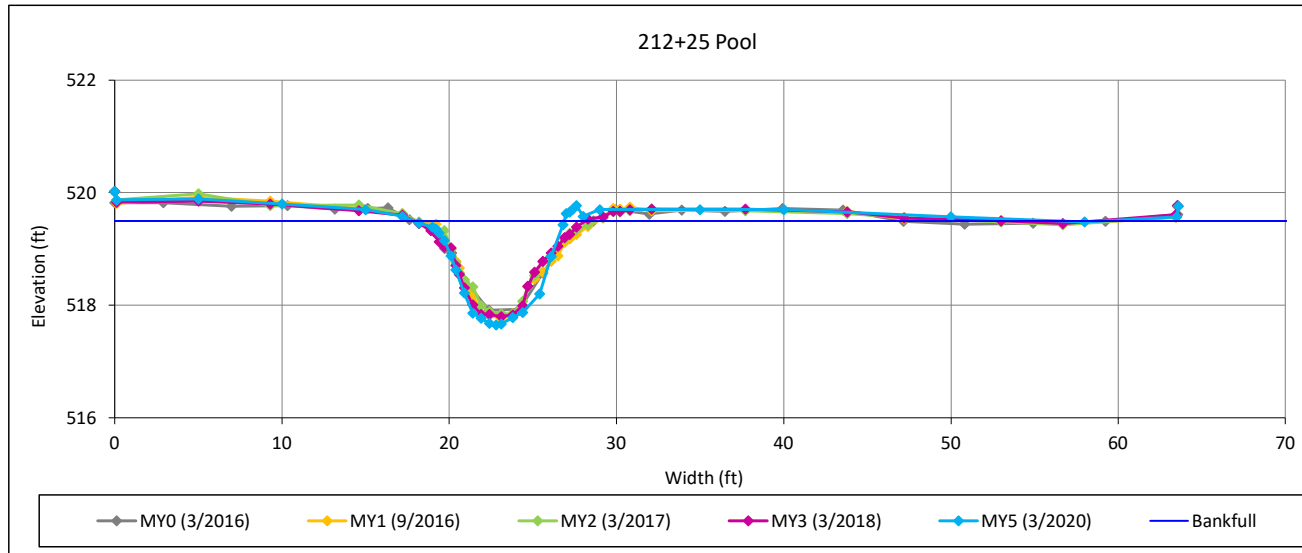
Cross-Section Plots

Holman Mill Mitigation Site

(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 6-UT2



Bankfull Dimensions

9.6	x-section area (ft.sq.)
9.0	width (ft)
1.1	mean depth (ft)
1.9	max depth (ft)
10.1	wetted perimeter (ft)
0.9	hydraulic radius (ft)
8.5	width-depth ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering



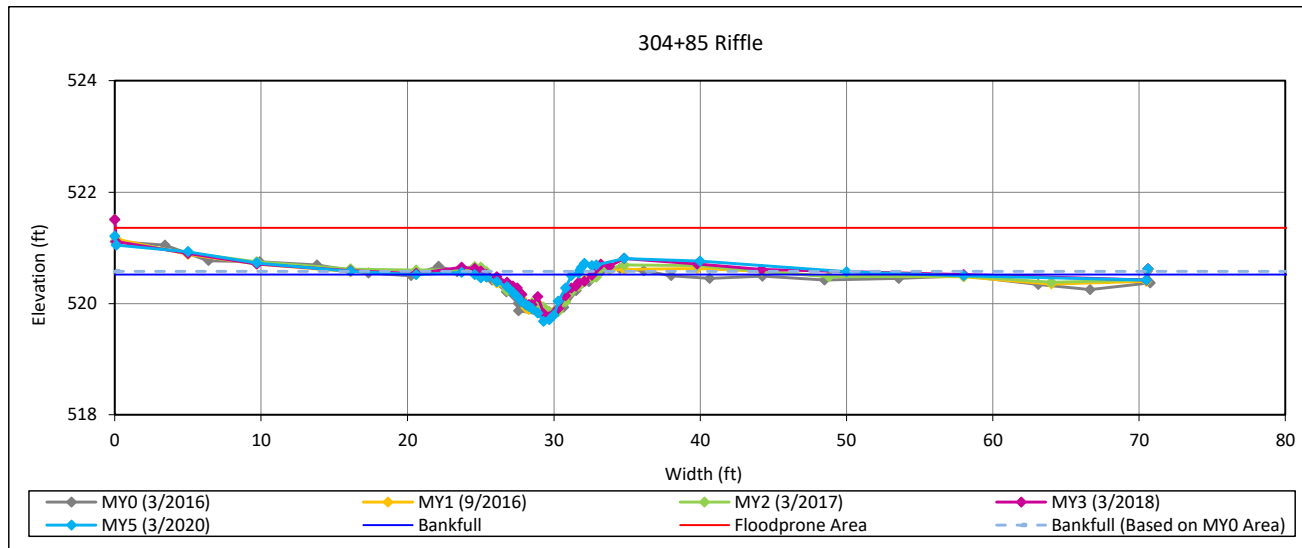
View Downstream

Cross-Section Plots

Holman Mill Mitigation Site
(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 7-UT2A



Bankfull Dimensions

2.5	x-section area (ft.sq.)
6.9	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
7.2	wetted perimeter (ft)
0.3	hydraulic radius (ft)
18.8	width-depth ratio
100.0	W flood prone area (ft)
14.6	entrenchment ratio
< 1.0	low bank height ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering



View Downstream

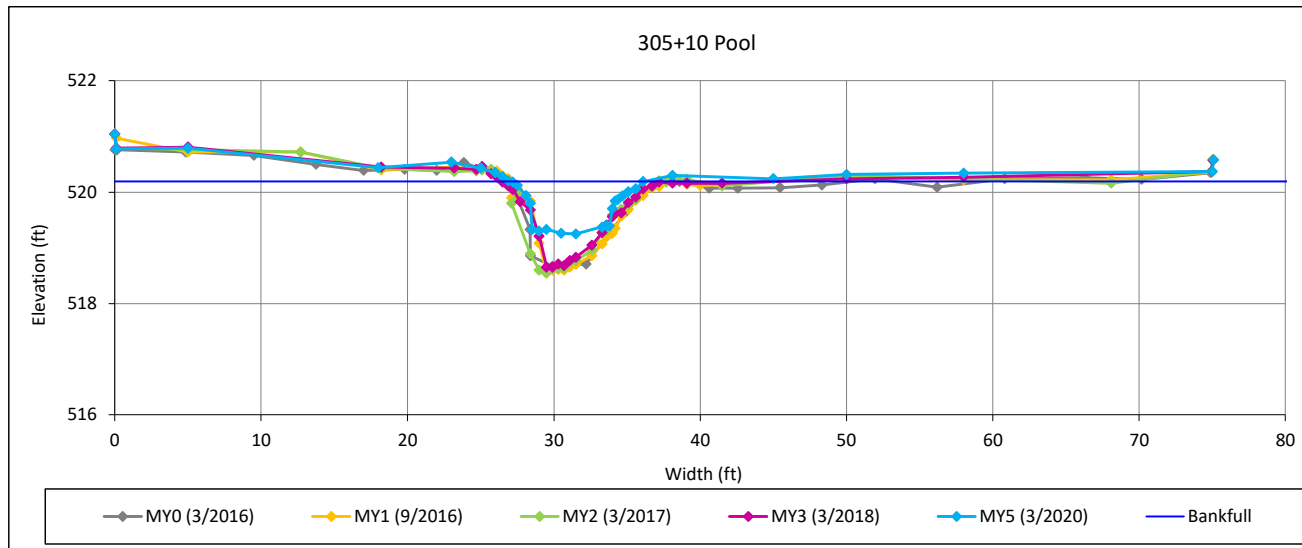
Cross-Section Plots

Holman Mill Mitigation Site

(DMS Project No. 96316)

Monitoring Year 5 - 2020

Cross-Section 8-UT2A



Bankfull Dimensions

5.5	x-section area (ft.sq.)
9.1	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
10.4	wetted perimeter (ft)
0.5	hydraulic radius (ft)
14.8	width-depth ratio

Survey Date: 3/2020

Field Crew: Wildlands Engineering

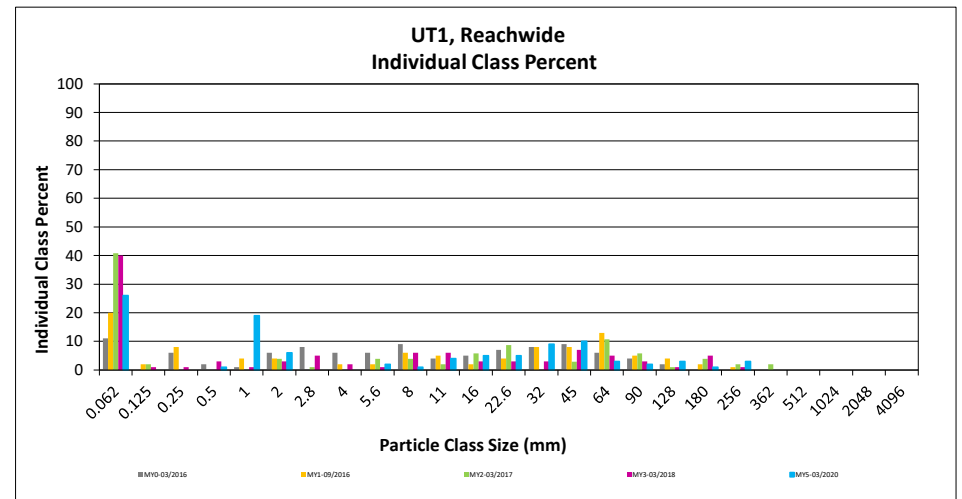
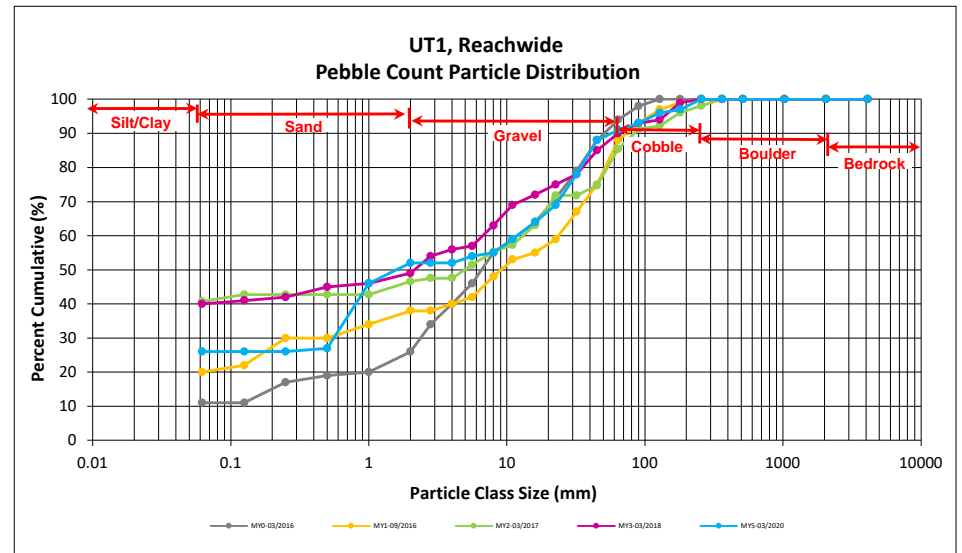


View Downstream

Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	4	22	26	26	26
<i>SAND</i>	Very fine	0.062	0.125					26
	Fine	0.125	0.250					26
	Medium	0.25	0.50	1		1	1	27
	Coarse	0.5	1.0	5	14	19	19	46
	Very Coarse	1.0	2.0		6	6	6	52
<i>GRAVEL</i>	Very Fine	2.0	2.8					52
	Very Fine	2.8	4.0					52
	Fine	4.0	5.6	2		2	2	54
	Fine	5.6	8.0	1		1	1	55
	Medium	8.0	11.0	3	1	4	4	59
	Medium	11.0	16.0	5		5	5	64
	Coarse	16.0	22.6	4	1	5	5	69
	Coarse	22.6	32	7	2	9	9	78
	Very Coarse	32	45	10		10	10	88
Very Coarse	45	64		3	3	3	91	
<i>COBBLE</i>	Small	64	90	1	1	2	2	93
	Small	90	128	3		3	3	96
	Large	128	180	1		1	1	97
	Large	180	256	3		3	3	100
<i>BOULDER</i>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				50	50	100	100	100

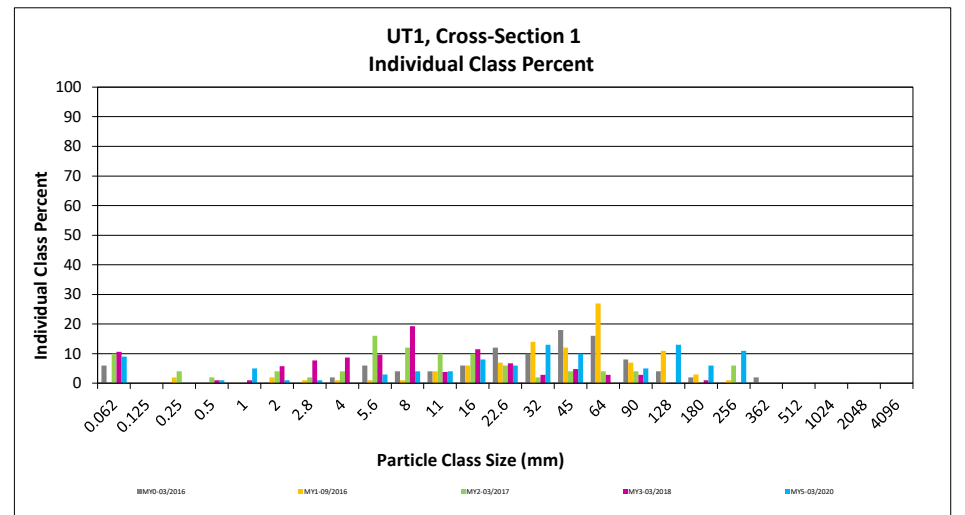
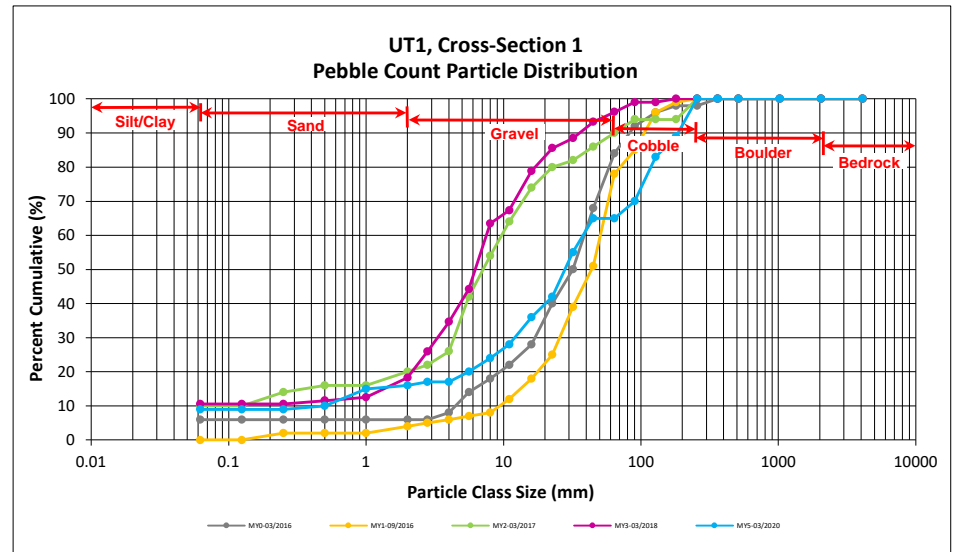
Reachwide Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.67
D ₅₀ =	1.6
D ₈₄ =	39.3
D ₉₅ =	113.8
D ₁₀₀ =	256.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	9	9	9
<i>SAND</i>	Very fine	0.062	0.125			9
	Fine	0.125	0.250			9
	Medium	0.25	0.50	1	1	10
	Coarse	0.5	1.0	5	5	15
	Very Coarse	1.0	2.0	1	1	16
<i>GRAVEL</i>	Very Fine	2.0	2.8	1	1	17
	Very Fine	2.8	4.0			17
	Fine	4.0	5.6	3	3	20
	Fine	5.6	8.0	4	4	24
	Medium	8.0	11.0	4	4	28
	Medium	11.0	16.0	8	8	36
	Coarse	16.0	22.6	6	6	42
	Coarse	22.6	32	13	13	55
	Very Coarse	32	45	10	10	65
	Very Coarse	45	64			65
<i>COBBLE</i>	Small	64	90	5	5	70
	Small	90	128	13	13	83
	Large	128	180	6	6	89
	Large	180	256	11	11	100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

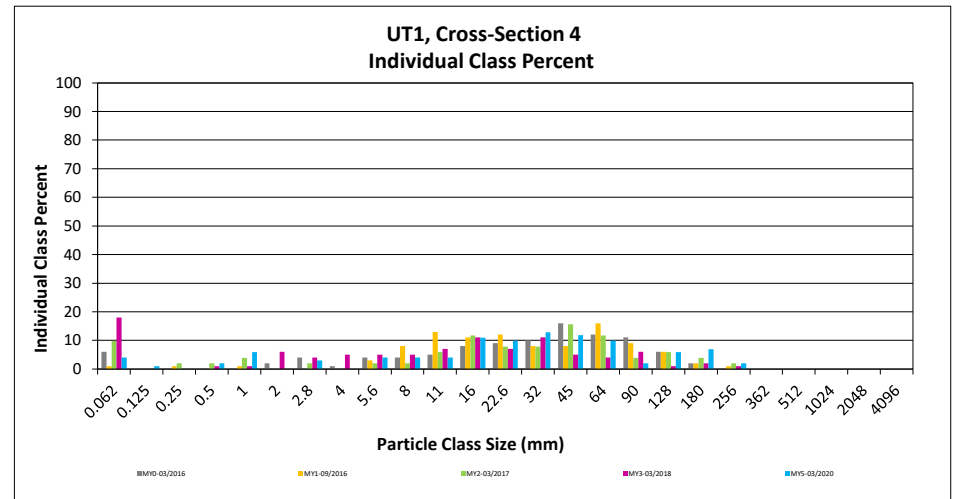
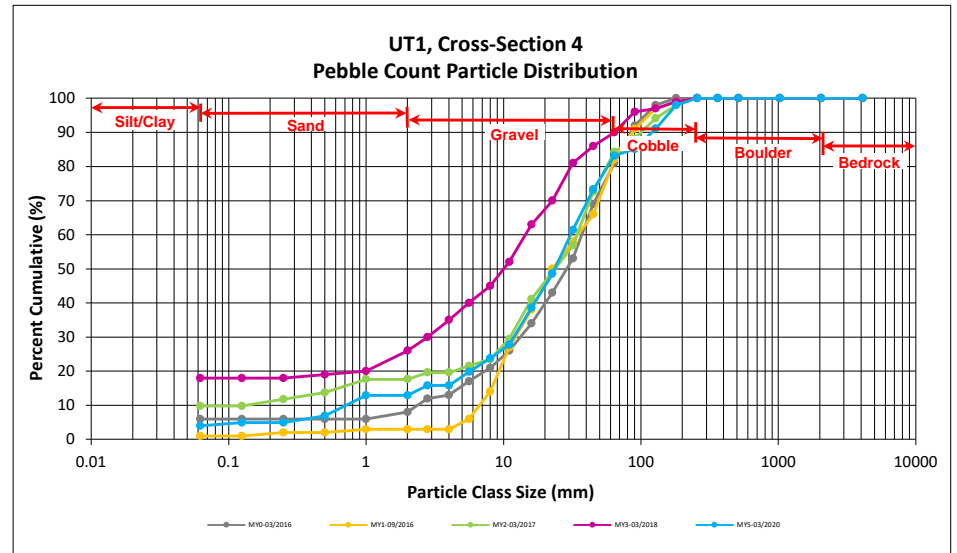
Cross-Section 1 Channel materials (mm)	
D ₁₆ =	2.00
D ₃₅ =	15.27
D ₅₀ =	28.0
D ₈₄ =	135.5
D ₉₅ =	218.1
D ₁₀₀ =	256.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT1, Cross-Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125	1	1	5
	Fine	0.125	0.250			5
	Medium	0.25	0.50	2	2	7
	Coarse	0.5	1.0	6	6	13
	Very Coarse	1.0	2.0			13
GRAVEL	Very Fine	2.0	2.8	3	3	16
	Very Fine	2.8	4.0			16
	Fine	4.0	5.6	4	4	20
	Fine	5.6	8.0	4	4	24
	Medium	8.0	11.0	4	4	28
	Medium	11.0	16.0	11	11	39
	Coarse	16.0	22.6	10	10	49
	Coarse	22.6	32	13	13	61
	Very Coarse	32	45	12	12	73
	Very Coarse	45	64	10	10	83
COBBLE	Small	64	90	2	2	85
	Small	90	128	6	6	91
	Large	128	180	7	7	98
	Large	180	256	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				101	100	100

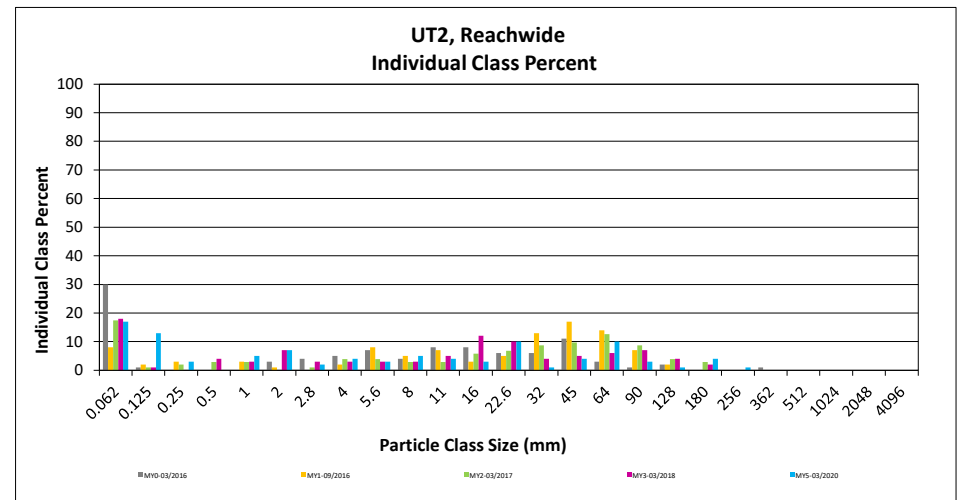
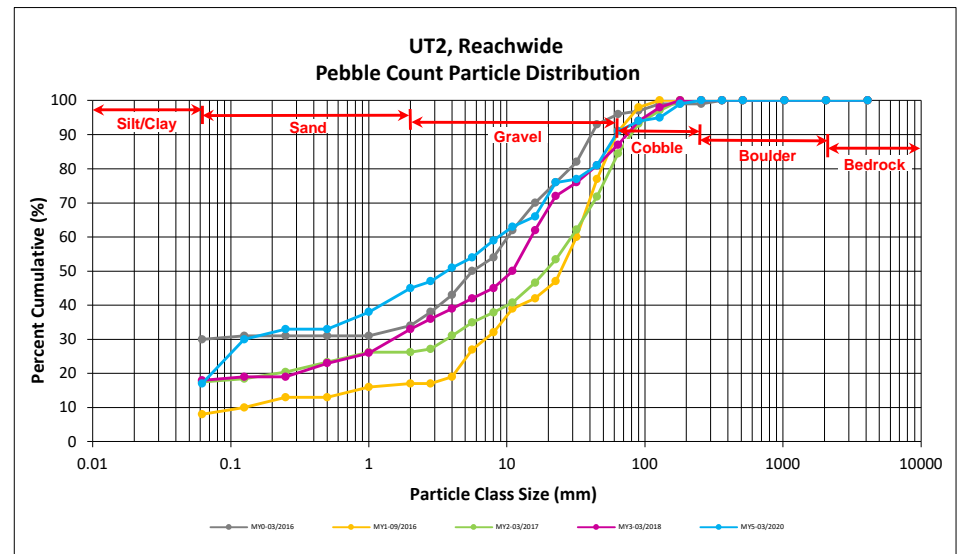
Cross-Section 4 Channel materials (mm)	
D ₁₆ =	4.05
D ₃₅ =	14.13
D ₅₀ =	23.5
D ₈₄ =	73.9
D ₉₅ =	155.2
D ₁₀₀ =	256.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062		17	17	17	17
<i>SAND</i>	Very fine	0.062	0.125		13	13	13	30
	Fine	0.125	0.250		3	3	3	33
	Medium	0.25	0.50					33
	Coarse	0.5	1.0	2	3	5	5	38
	Very Coarse	1.0	2.0	2	5	7	7	45
<i>GRAVEL</i>	Very Fine	2.0	2.8	2		2	2	47
	Very Fine	2.8	4.0	2	2	4	4	51
	Fine	4.0	5.6	1	2	3	3	54
	Fine	5.6	8.0	3	2	5	5	59
	Medium	8.0	11.0	3	1	4	4	63
	Medium	11.0	16.0	2	1	3	3	66
	Coarse	16.0	22.6	10		10	10	76
	Coarse	22.6	32	1		1	1	77
	Very Coarse	32	45	4		4	4	81
	Very Coarse	45	64	10		10	10	91
<i>COBBLE</i>	Small	64	90	3		3	3	94
	Small	90	128	1		1	1	95
	Large	128	180	3	1	4	4	99
	Large	180	256	1		1	1	100
<i>BOULDER</i>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				50	50	100	100	100

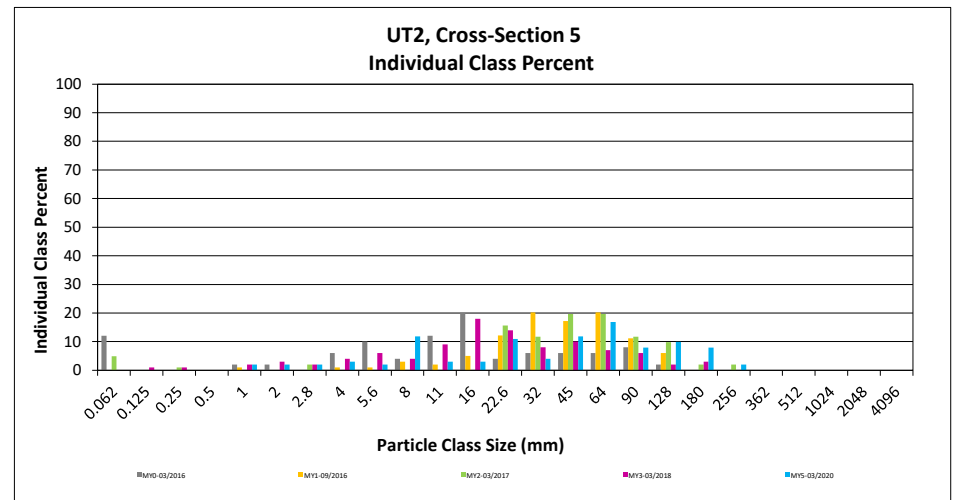
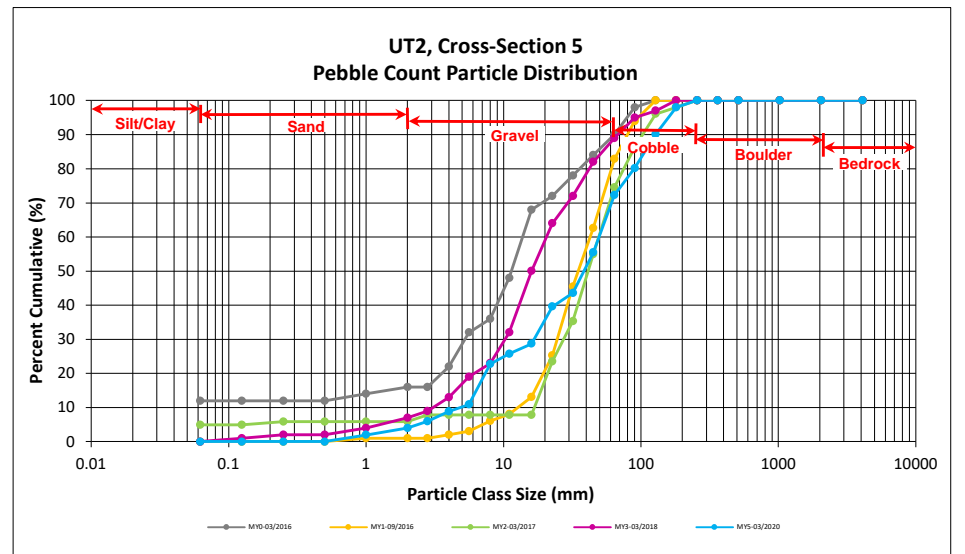
Reachwide Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.66
D ₅₀ =	3.7
D ₈₄ =	50.0
D ₉₅ =	128.0
D ₁₀₀ =	256.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT2, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	2	2	2
	Very Coarse	1.0	2.0	2	2	4
GRAVEL	Very Fine	2.0	2.8	2	2	6
	Very Fine	2.8	4.0	3	3	9
	Fine	4.0	5.6	2	2	11
	Fine	5.6	8.0	12	12	23
	Medium	8.0	11.0	3	3	26
	Medium	11.0	16.0	3	3	29
	Coarse	16.0	22.6	11	11	40
	Coarse	22.6	32	4	4	44
	Very Coarse	32	45	12	12	55
	Very Coarse	45	64	17	17	72
COBBLE	Small	64	90	8	8	80
	Small	90	128	10	10	90
	Large	128	180	8	8	98
	Large	180	256	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		101		100

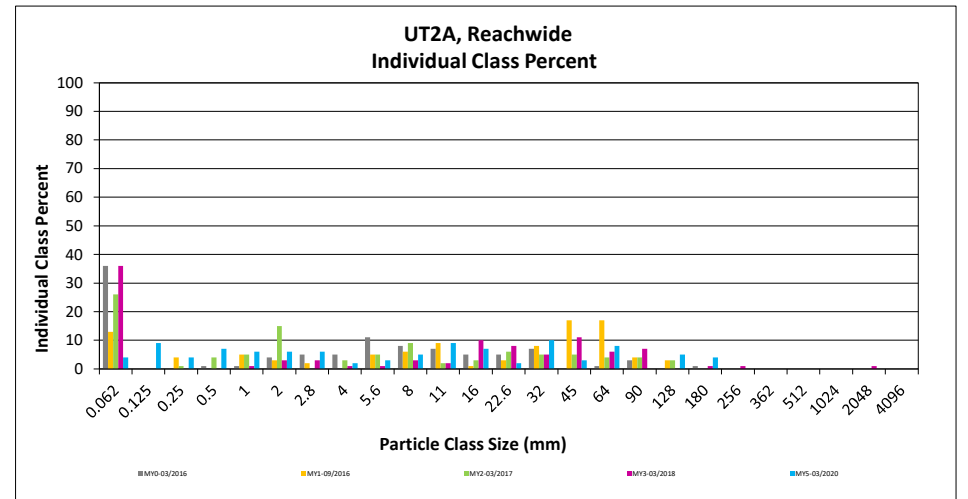
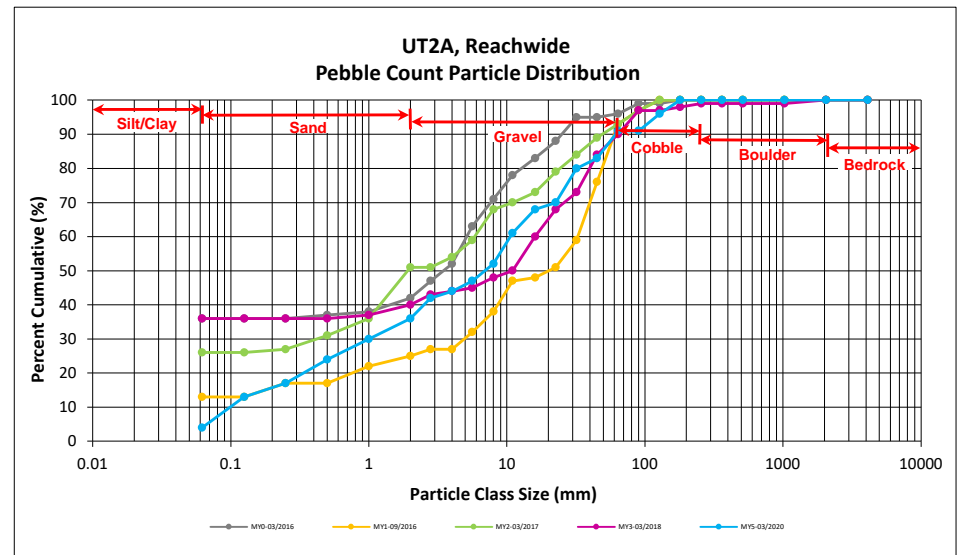
Cross-Section 5	
Channel materials (mm)	
D ₁₆ =	6.53
D ₃₅ =	19.53
D ₅₀ =	38.5
D ₈₄ =	103.0
D ₉₅ =	158.1
D ₁₀₀ =	256.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT2A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062		4	4	4	4
<i>SAND</i>	Very fine	0.062	0.125	2	7	9	9	13
	Fine	0.125	0.250		4	4	4	17
	Medium	0.25	0.50		7	7	7	24
	Coarse	0.5	1.0	2	4	6	6	30
	Very Coarse	1.0	2.0	3	3	6	6	36
<i>GRAVEL</i>	Very Fine	2.0	2.8	3	3	6	6	42
	Very Fine	2.8	4.0	2		2	2	44
	Fine	4.0	5.6		3	3	3	47
	Fine	5.6	8.0	3	2	5	5	52
	Medium	8.0	11.0	6	3	9	9	61
	Medium	11.0	16.0	4	3	7	7	68
	Coarse	16.0	22.6		2	2	2	70
	Coarse	22.6	32	7	3	10	10	80
	Very Coarse	32	45	3		3	3	83
	Very Coarse	45	64	7	1	8	8	91
<i>COBBLE</i>	Small	64	90					91
	Small	90	128	4	1	5	5	96
	Large	128	180	4		4	4	100
	Large	180	256					100
<i>BOULDER</i>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				50	50	100	100	100

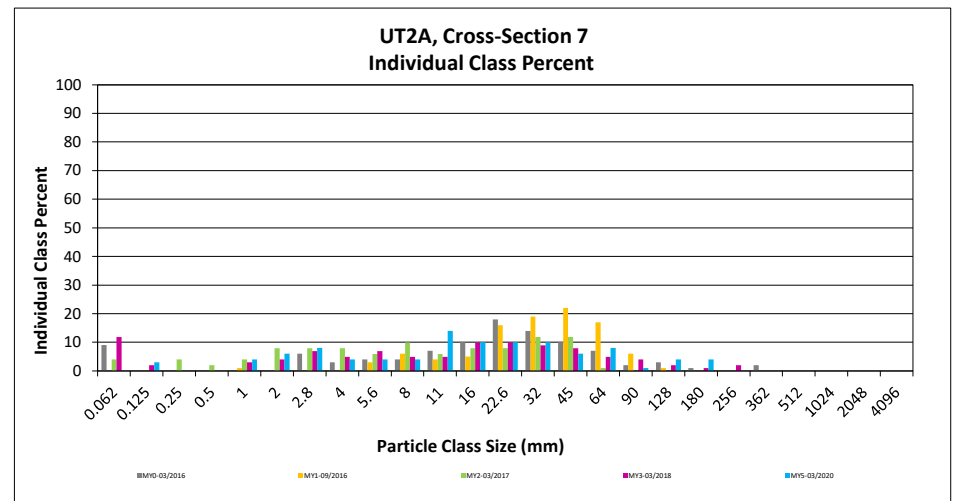
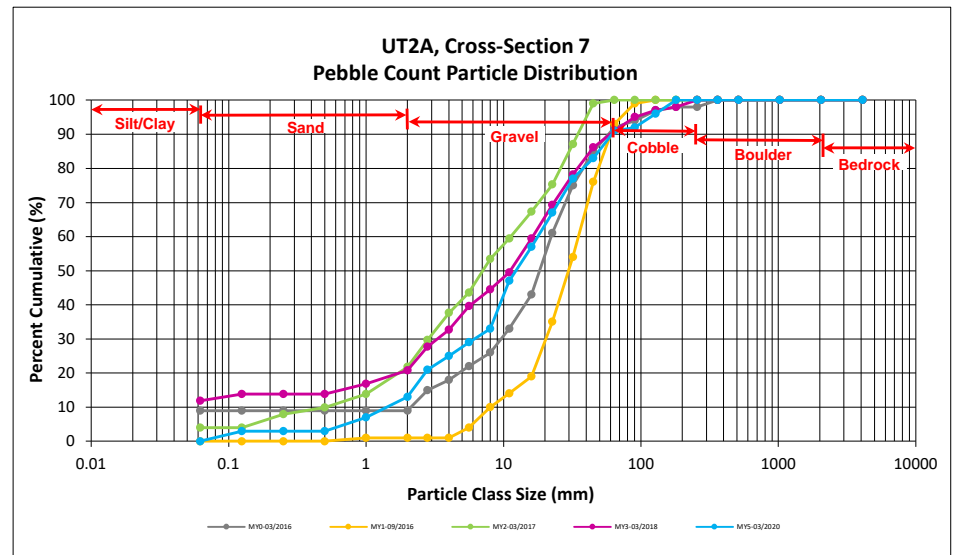
Reachwide	
Channel materials (mm)	
D ₁₆ =	0.21
D ₃₅ =	1.78
D ₅₀ =	6.9
D ₈₄ =	47.0
D ₉₅ =	119.3
D ₁₀₀ =	180.0



Reachwide and Cross-Section Pebble Count Plots
 Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020
 UT2A, Cross-Section 7

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	3	3	3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0	4	4	7
	Very Coarse	1.0	2.0	6	6	13
GRAVEL	Very Fine	2.0	2.8	8	8	21
	Very Fine	2.8	4.0	4	4	25
	Fine	4.0	5.6	4	4	29
	Fine	5.6	8.0	4	4	33
	Medium	8.0	11.0	14	14	47
	Medium	11.0	16.0	10	10	57
	Coarse	16.0	22.6	10	10	67
	Coarse	22.6	32	10	10	77
	Very Coarse	32	45	6	6	83
	Very Coarse	45	64	8	8	91
COBBLE	Small	64	90	1	1	92
	Small	90	128	4	4	96
	Large	128	180	4	4	100
	Large	180	256			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		100	100	100

Cross-Section 7	
Channel materials (mm)	
D ₁₆ =	2.27
D ₃₅ =	8.37
D ₅₀ =	12.3
D ₈₄ =	47.0
D ₉₅ =	117.2
D ₁₀₀ =	180.0



APPENDIX 5. Hydrology Summary Data

Table 13. Verification of Bankfull Events

Holman Mill Mitigation Site

DMS Project No. 96316

Monitoring Year 5 - 2020

Reach	MY1		MY2		MY3		MY4		MY5		Method
	Date of Data Collection	Date of Occurrence	Date of Data Collection	Date of Occurrence	Date of Data Collection	Date of Occurrence	Date of Data Collection	Date of Occurrence	Date of Data Collection	Date of Occurrence	
UT1	9/6/2016	7/31/2016	10/17/2017	4/24/2017	10/19/2018	8/8/2018	9/26/2019	3/21/2019	2/11/2020	2/6/2020	Crest Gage/ Pressure Transducer
	10/11/2016	10/8/2016		6/20/2017		9/17/2018*		4/13/2019		8/6/2020	
UT2	9/6/2016	7/31/2016	10/17/2017	4/24/2017	10/19/2018	8/8/2018	9/26/2019	3/21/2019	2/11/2020	2/6/2020	
	10/11/2016	10/8/2016		6/20/2017		9/17/2018*		4/13/2019		8/6/2020	
UT2A	9/6/2016	7/31/2016	10/17/2017	4/24/2017	10/19/2018	8/8/2018	9/26/2019	3/21/2019	2/11/2020	2/6/2020	
	10/11/2016	10/8/2016		6/20/2017		9/17/2018*		4/13/2019		8/6/2020	

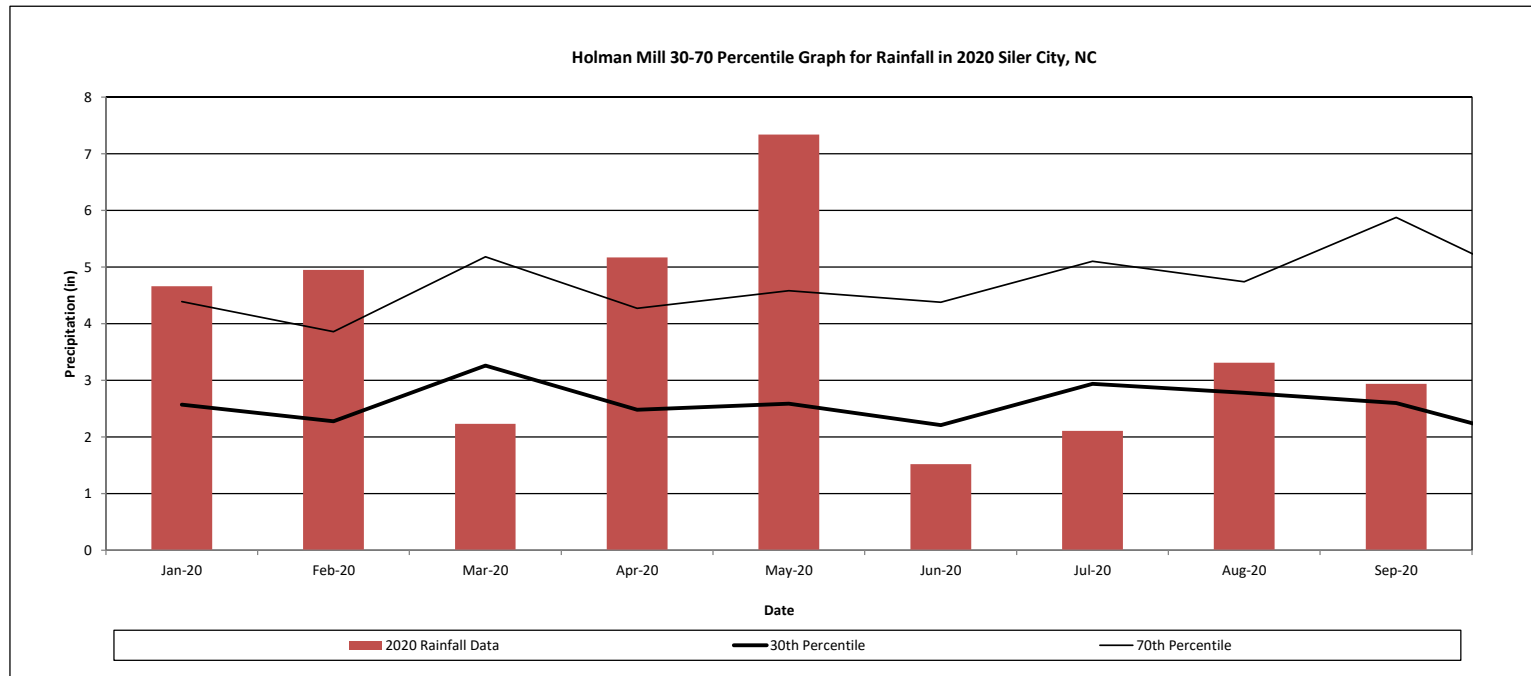
*Hurricane Florence

Monthly Rainfall Data

Holman Mill Mitigation Site

DMS Project No. 96316

Monitoring Year 5 - 2020

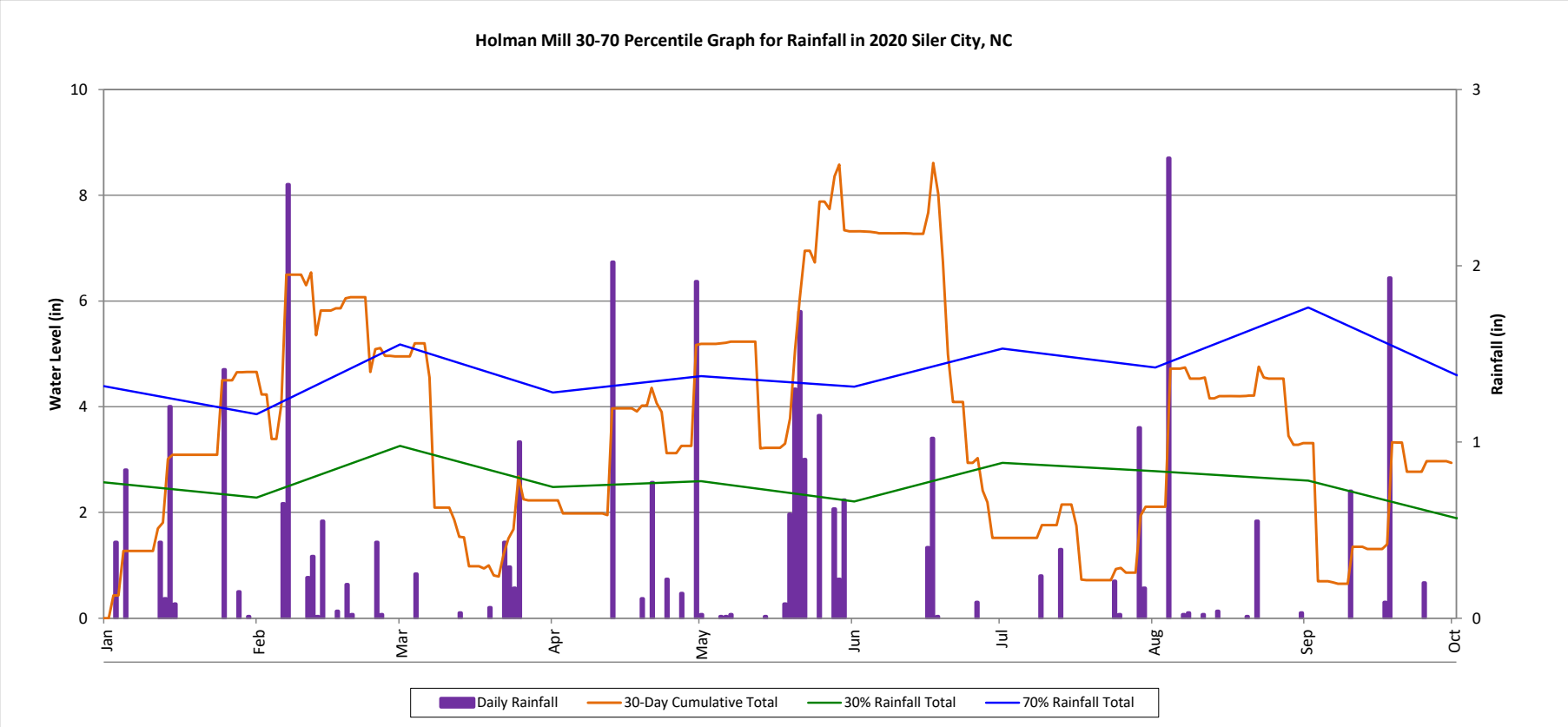


¹ 2020 monthly rainfall from USDA Station SILER CITY (317924)

² 30th and 70th percentile rainfall data collected from weather station Siler City 2 N, NC7924 (USDA, 2020).

30-Day Cumulative Total Rainfall Data

Holman Mill Mitigation Site
 DMS Project No. 96316
 Monitoring Year 5 - 2020



¹ 2020 monthly rainfall from USDA Station SILER CITY (317924)

² 30th and 70th percentile rainfall data collected from weather station Siler City 2 S, NC7924 (USDA, 2020).