



# **Final Thomas Creek Restoration Project Year 4 Monitoring Report**

Wake County, North Carolina

DMS Project ID Number – 96074, DEQ Contract No. 5549

Permits: SAW-2013-02009, DWR# 14-1328

Cape Fear River Basin: 03030004-020010

Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1084





January 17, 2020

Jeremiah Dow, Project Manager  
NCDEQ, Division of Mitigation Services  
1652 Mail Service Center  
Raleigh, NC 27699-1652

**Subject:** Response to DMS Comments for DRAFT Monitoring Year 4 Report  
Thomas Creek Restoration Project, Wake County  
DMS Project # 96074, DEQ Contract #5549, RFP# 16-005020

Mr. Dow:

Please find enclosed our responses to the NC Division of Mitigation Services (DMS) review comments dated December 17, 2019 in reference to the Thomas Creek Restoration Project –DRAFT Monitoring Year 4 Report. We have revised the Draft document in response to the referenced review comments. Each comment and its corresponding response is outlined below.

1. Digital files/drawings:

- a. Please provide excel sheet including the raw streamflow gage and precipitation data. In this file, please make note of the gauge type used. Please also label any probe or benchmark elevations, the raw and corrected readings of the water elevations, and any offsets applied. DMS needs to be able to clearly identify these key elevations before incorporating these into the DMS database for independent calculation/verification.

**Response: Baker will provide all of the raw data as described above (with additional labeling and notations as requested) in the revised digital submission files.**

2. Section 2.2 Vegetation Assessment:

- a. The second paragraph states that “No Vegetation Problem Areas (VPAs) were identified in Year 4.” Please restate this sentence to state that no additional VPAs were identified in Year 4.

**Response: Baker has revised the report as requested.**

3. Appendix B, Table 6:

- a. Please update the table to reflect continuing low vigor areas identified in MY3.

**Response: Baker has revised Table 6 as requested and added a notation explaining that by DMS request this previously reported VPA is not shown on the CCPV as a VPA so as not to create confusion between any potential new, current year VPAs for MY4 with those reported in previous monitoring years. It is, however, shown on the CCPV as an area of maintenance having received soil amendments.**

4. Appendix E, Figure 8:

- a. As discussed during the site visit, please update Figure 8 for Flow Gauge TMCK FL2 to call out the point where flow potentially fell below the established surface water depth threshold.

**Response: Baker revised the FL2 flow gauge graph. Upon closer review, the arrow drawn to show when the start of the longest consecutive flow event began was drawn to the incorrect date.**

**However, the consecutive flow length was *calculated* from the correct date and thus the 94-day value shown in both the graph notation and in Table 13 are correct. We apologize for the confusion.**

5. As required by contract, specifically RFP#16-005020 Addendum No. 1, Baker must submit an updated Monitoring Phase Performance Bond (MPPB) for Monitoring Year 5 (Task 11) to Jeff Jurek for his approval before DMS approves this deliverable and the associated payment.

**Response: Baker will have an approved monitoring bond in place before submitting an invoice for payment for this monitoring year task.**

As requested, Baker has provided one (1) hardcopy and one (1) pdf copy of the FINAL report, along with all the updated digital files (to be sent by secure ftp link). Please do not hesitate to contact me should you have any questions regarding our response submittal.

Sincerely,



Scott King, LSS, PWS  
Project Manager

Enclosures

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\* Note: The figures and tables marked above with an asterisk are not included as part of this Year 4 Monitoring Report, but were left listed in the Table of Contents to explain the otherwise out-of-sequence figure/table numbering and appendix designations. For clarity, Michael Baker wishes to preserve the continuity of the labeling for these features between monitoring years to avoid confusion (e.g. to allow Appendix C to always contain vegetation data, and Table 12 to always be the bankfull event table, etc. in each monitoring report). These figures and tables had been included in past reports and will be included again as part of the Year 5 monitoring report for 2020.

## 1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 4,721 linear feet of perennial and intermittent stream and enhanced 3,948 linear feet of intermittent stream as documented in the As-built Baseline Report. Baker also planted approximately 14.4 acres of native riparian vegetation within the 22.7 acre recorded conservation easement areas along all or portions of the restored and enhanced reaches (Reaches R1, R2, R3, R4, R5, R6, R7, T1, and T2). The Thomas Creek Restoration Project (Site) is located in Wake County, North Carolina (Figure 1), approximately 1.5 miles southwest of the Community of New Hill (Figure 1). The Site is located within the NC Division of Mitigation Services' (NCDMS) Targeted Local Watershed (TLW) 03030004-020010 (the Harris Lake Hydrologic Unit) of the Cape Fear River Basin and is located in what was formerly known as the NC Division of Water Resources (NCDWR) subbasin 03-06-07. The project involved the restoration and enhancement of a rural Piedmont stream system, which had been impaired due to past agricultural conversion and cattle grazing.

Based on the NCDMS 2009 Cape Fear River Basin Restoration Priority (RBRP) Plan (DMS 2009), the Thomas Creek Restoration Project area is located in an existing targeted local watershed within the Cape Fear River Basin and is located within the Middle Cape Fear / Kenneth and Parker Creeks Local Watershed Planning (LWP) area. The restoration strategy for the Cape Fear River Basin is to promote low impact development, stormwater management, restoration and buffer protection in urbanizing areas, and buffer preservation elsewhere.

The primary goal of the project was to improve ecologic functions through the restoration and enhancement of streams and buffers in a degraded, urbanizing area as described in the NCDMS 2009 Cape Fear RBRP. Detailed project goals are identified below:

- Create geomorphically stable conditions along the unnamed tributaries throughout the Site,
- Protect and improve water quality by reducing streambank erosion, and nutrient/sediment inputs,
- Restore stream and floodplain interaction by connecting historic flow paths and promoting natural flood processes,
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement, and
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature.

To accomplish these goals, the following objectives were identified:

- Restore existing incised, eroding, and channelized streams by providing them access to their relic floodplains,
- Implement agricultural BMPs, including cattle watering stations, to reduce nonpoint source (NPS) inputs to receiving waters,
- Prevent cattle from accessing the conservation easement by installing permanent fencing and thus reduce excessive streambank erosion and undesired nutrient inputs,
- Enhance aquatic habitat value by providing more bedform diversity, creating natural scour pools and reducing sediment from accelerated streambank erosion,

- Plant native species riparian buffer vegetation along streambank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve streambank stability and riparian habitat connectivity, and shade the stream to decrease water temperature, and
- Control invasive species vegetation within much of the project area and, if necessary, continue treatments during the monitoring period.

In accordance with the Mitigation Plan and the project-applicable DMS guidance document “Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation” dated 11/7/2011, no formal vegetation plot monitoring was performed, nor were any stream cross-sectional surveys conducted as part of this Year 4 monitoring effort. A visual assessment of the site is emphasized this year, with the full vegetation and cross-section survey work to resume for the Year 5 monitoring in 2020.

From the Year 4 visual inspection monitoring, all stream reaches appear stable and functioning. All stream riffle beds are vertically stable, the pools are maintaining depth, stream banks are stable and vegetating, and in-stream structures are physically intact and performing as designed as reported in Table 5 (Appendix B). No Stream Problem Areas (SPAs) were identified in Year 4.

As discussed in the Year 3 monitoring report, Baker had previously noted two short sections of minor bank scour along Reach R2 resulting from Hurricane Florence. These areas were graded back by hand and were seeded and replanted with additional livestakes in January 2019 (the exact repair locations are shown in the CCPV). Subsequent inspection of these area revealed that they have remained stable and are vegetating well as shown in the Maintenance and Repair Photographs, which can be found in Appendix B.

The Year 4 visual inspection monitoring also observed that the planted acreage performance categories were functioning at 100 percent with no eroding or bare areas to report, nor any areas of poor growth as reported in Table 6 (Appendix B). No Vegetation Problem Areas (VPAs) were identified in Year 4.

As discussed in the Year 3 monitoring report, Baker had previously noted one area of thin stem density roughly 0.20 acres in size along Reach T1. This area was supplementally planted with bareroot stems in January of 2019 with approximately 40 bareroot stems consisting of a mix of green ash (*Fraxinus pennsylvanica*), tulip poplar (*Liriodendron tulipifera*), sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), and white oak (*Quercus alba*). Subsequent inspection of this planted area during monitoring activities in September and October 2019 revealed they appeared to be alive and growing well, as numerous stems were quickly and easily identified in the field and had leaves and/or bud scars to indicate seasonal growth and all-around vigor. Please see the CCPV in Appendix B for the location of this supplementally planted area.

Also discussed in the Year 3 monitoring report was an area roughly 0.38 acres in size of low vigor/short stems along the left floodplain of upper Reach R3. As noted in the report, soil tests had indicated that the area was in need of soil amendments for improved growth. Accordingly, pelletized lime was applied in January of 2019 and fertilizer was applied in March and September of 2019. Additional soil testing will be conducted again in 2020 and the plants in this area will be inspected for anticipated improved growth and vigor. Please see the CCPV in Appendix B for the location of this amended area.

Additionally, there were no areas of non-native invasive species vegetation observed during the Year 4 monitoring. However, several sections of stream along the upper and middle portions of Reach R2 and the lower portion of Reach R4 were observed to have scattered pockets of native cattail (*Typha latifolia*) growing in the channel. These sections were treated in March and April of 2019 to control their growth as shown in the Maintenance and Repair Photographs in Appendix B. These areas will be monitored in the future and treated again if necessary.

Year 4 flow monitoring demonstrated that both flow gauges (TMCK-FL1 and TMCK-FL2) met the stated success criteria of 30 days or more of consecutive flow through Reaches 2 and 5 respectively. Flow gauge



TMCK-FL1 documented 179 days of consecutive flow in Reach 2, while flow gauge TMCK-FL2 documented 94 days of consecutive flow in Reach 5. The flow gauges demonstrated similar patterns relative to rainfall events as shown in the flow gauge graphs in Appendix E.

During Year 4 monitoring, the Reach R2 crest gauge (crest gauge #1) documented one post-construction bankfull event in April 2019. As bankfull events have now been documented in all four years of monitoring, the project has more than met the bankfull standard required for credit release.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the DMS website. Any raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 4 monitoring activities for the post-construction monitoring period.

## **2.0 METHODOLOGY**

The seven-year monitoring plan for the Site includes criteria to evaluate the success of the stream and vegetation components of the Site. The methodology and report template used to evaluate these components adheres to the DMS guidance documents “Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation” (DMS 2011), and to the Monitoring Report Template, Version 1.5 (DMS 2012), which will continue to serve as the template for subsequent monitoring years. In accordance with these documents and the approved Mitigation Plan, no formal vegetation plot monitoring was performed, nor were any stream cross-sectional surveys conducted as part of this Year 4 monitoring effort. A visual assessment of the site is emphasized this year, with the full vegetation and cross-section survey work to resume for the Year 5 monitoring in 2020.

The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, crest gauges, and flow gauges, are shown on the Current Condition Plan View (CCPV) map found in Appendix B.

All earthwork for project construction was completed in October of 2015, with subsequent as-built survey work completed in November of 2015. All site planting (bareroot stems and live-stakes) was completed in January of 2016. All the Year 4 visual site assessment data contained in Appendix B were obtained in September and October of 2019.

### **2.1 Stream Assessment**

The Project involved the restoration and enhancement of a rural Piedmont stream system that had been impaired due to past agricultural conversion and cattle grazing. Restoration practices involved raising the existing streambed and reconnecting the stream to the relic floodplain to restore natural flood regimes to the system. The existing channels abandoned within the restoration areas were partially to completely filled to decrease surface and subsurface drainage and to raise the local water table. Permanent cattle exclusion fencing was provided around all proposed reaches and riparian buffers, except along reaches where no cattle are located or cattle lack stream access.

### **2.1.1 Morphological Parameters and Channel Stability**

A longitudinal profile was surveyed for the entire length of channel immediately after construction to document as-built baseline conditions for the Monitoring Year 0 only. Annual longitudinal profiles will not be conducted during subsequent monitoring years unless channel instability has been documented or remedial actions/repairs are required by the U.S. Army Corps of Engineers (USACE) or DMS.

As per the Mitigation Plan and DMS monitoring guidance for this project, no cross-section survey data were collected for this Monitoring Year 4 assessment. Consequently, none of the cross-sectional survey graphs (Figure 6) or morphology data (Tables 11a and 11b) are presented in Appendix D as in previous monitoring reports.

### **2.1.2 Hydrology**

To monitor on-site bankfull events, one crest gauge (crest gauge #1) was installed along the downstream portion of Reach R2 at bankfull elevation along the left top of bank at approximately Station 38+90. During Year 4 monitoring, one above-bankfull event was documented in April 2019. Further details of the crest gauge readings are presented in Table 12 in Appendix E, and photographs can be found in Appendix B.

To monitor flow on restored reaches, two flow gauges were installed on site; TMCK-FL1 on Reach 2 (Station 20+75), and TMCK-FL2 on Reach 5 (Station 33+90). The Year 4 flow monitoring data demonstrated that both flow gauges met the stated success criteria of 30 days or more of consecutive flow. The gauges also demonstrated similar patterns relative to rainfall events and can corroborate reported overbank flow events from the crest gauge, as shown in the flow gauge graphs found in Appendix E.

As the observed monthly rainfall data for the project presented in Figure 9 in Appendix E demonstrates, the past 12 months have varied dramatically as compared to historic average precipitation. A total of 46.5 inches of rainfall was observed for the project (using the nearest NC-CRONOS station KTTA), while Wake County averages 43.8 inches of annual rainfall, an excess of just 2.7 inches. However, the winter of 2018-2019 saw much greater than average rainfall totals, while several months in the summer and fall saw much less than average rainfall totals. In fact, the Site was under stage D1 – Moderate Drought conditions as of 10/15/19 as per the NC Drought Management Advisory Council.

### **2.1.3 Photographic Documentation**

Representative stream photographs for Monitoring Year 4 were taken along each Reach in September 2019 and are provided in Appendix B.

### **2.1.4 Visual Stream Morphological Stability Assessment**

The visual stream morphological stability assessment involves the qualitative evaluation of lateral and vertical channel stability, and the integrity and overall performance of in-stream structures throughout the Project reaches as a whole. Habitat parameters and pool depth maintenance are also evaluated. During Year 4 monitoring, Baker staff walked the entire length of each of the Project reaches several times throughout the year, noting geomorphic conditions of the stream bed profile (riffle/pool facets), both stream banks, and engineered in-stream structures. Representative photographs were taken per the Site's Mitigation Plan, and the locations of any SPAs were documented in the field for subsequent mapping on the CCPV figures. There were no SPAs noted during Year 4 monitoring as described above. A more detailed summary of the results for the visual stream stability assessment can be found in Appendix B, which includes supporting data tables and figures, as well as the general stream photos.

## 2.2 Vegetation Assessment

In order to determine if the success criteria were achieved, vegetation-monitoring quadrants were installed and are monitored across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) using the CVS-DMS Data Entry Tool v. 2.3.1 (CVS 2012). The vegetation monitoring plots cover a minimum of 2 percent of the planted portion of the Site with sixteen plots established randomly within the planted riparian buffer areas per Monitoring Levels 1 and 2. The sizes of individual quadrants are 100 square meters for woody tree species.

As per the Mitigation Plan and DMS monitoring guidance for this project, there was no vegetation plot monitoring conducted for the Year 4 monitoring effort, and thus no vegetation data summary tables are included in Appendix C as in previous monitoring reports. However, as reported in Table 6 (Appendix B), the planted acreage performance categories were functioning at 100 percent with no bare areas to report, no current low stem density areas, and no new areas of poor growth rates. No additional Vegetation Problem Areas (VPAs) were identified in Year 4.

## 3.0 REFERENCES

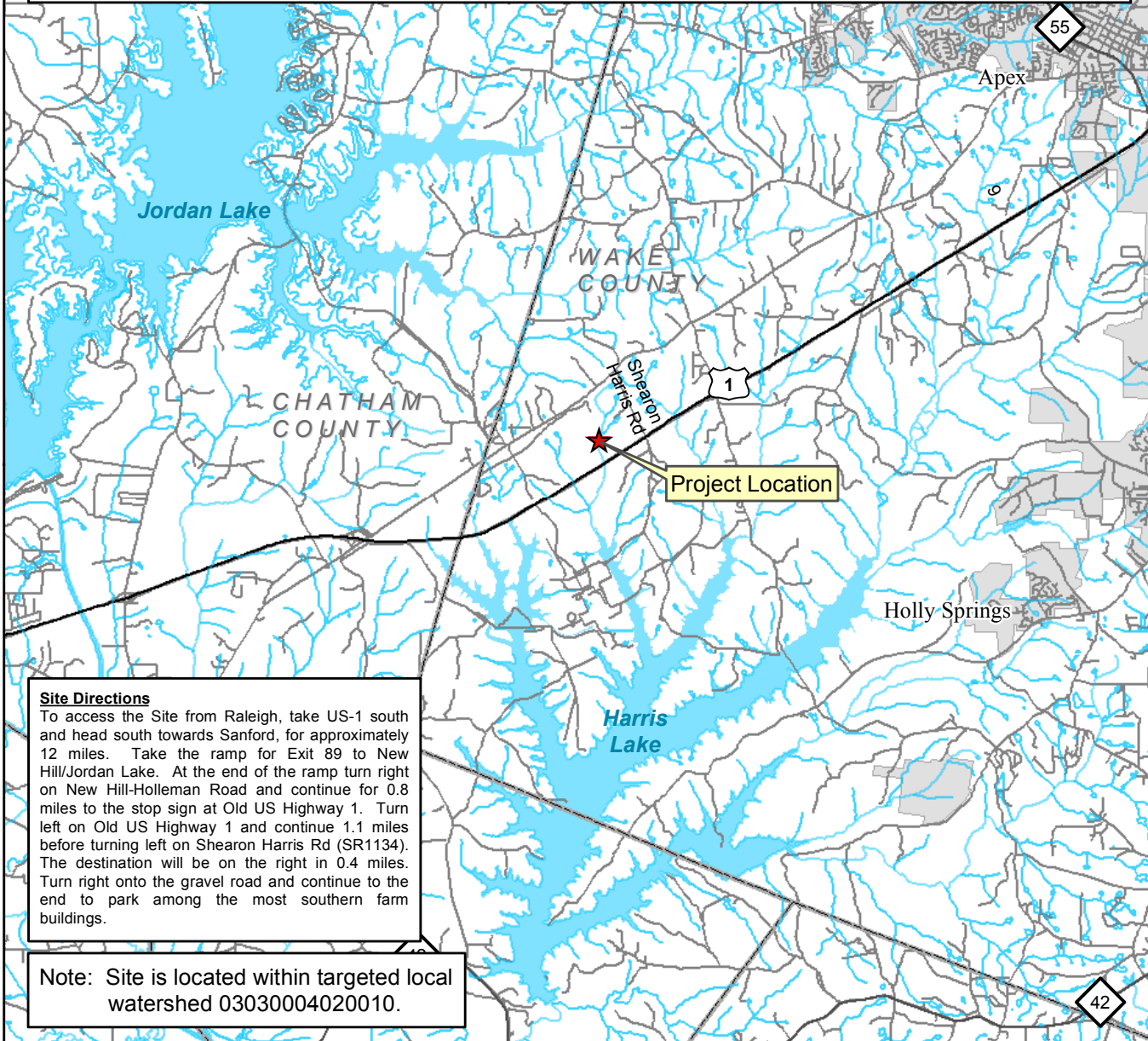
- Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.
- Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.
- North Carolina Division of Mitigation Services (DMS). 2012. NCDMS Monitoring Report Template, Version 1.5, June 8, 2012.
- North Carolina Division of Mitigation Services (DMS). 2011. NCDMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.
- North Carolina Division of Mitigation Services (DMS). 2009. Cape Fear River Basin Restoration Priorities.
- Rosgen, D.L. 1994. A Classification of Natural Rivers. *Catena* 22:169-199.
- Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.



# **Appendix A**

## **Project Vicinity Map and Background Tables**

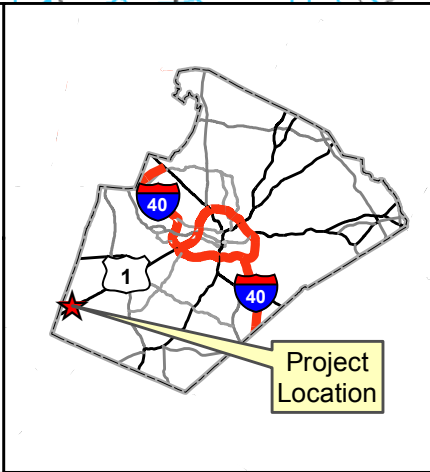
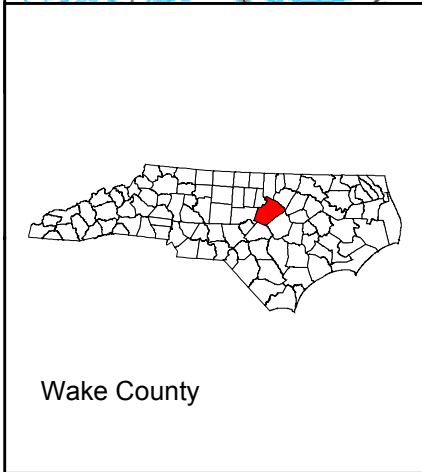
The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary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



**Site Directions**

To access the Site from Raleigh, take US-1 south and head south towards Sanford, for approximately 12 miles. Take the ramp for Exit 89 to New Hill/Jordan Lake. At the end of the ramp turn right on New Hill-Holleman Road and continue for 0.8 miles to the stop sign at Old US Highway 1. Turn left on Old US Highway 1 and continue 1.1 miles before turning left on Shearon Harris Rd (SR1134). The destination will be on the right in 0.4 miles. Turn right onto the gravel road and continue to the end to park among the most southern farm buildings.

Note: Site is located within targeted local watershed 03030004020010.



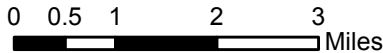
**Figure 1 - Project Vicinity Map  
Thomas Creek Site  
DMS Project ID No. 96074**

**NCDEQ -  
Division of  
Mitigation Services**



**Michael Baker**

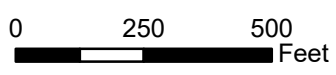
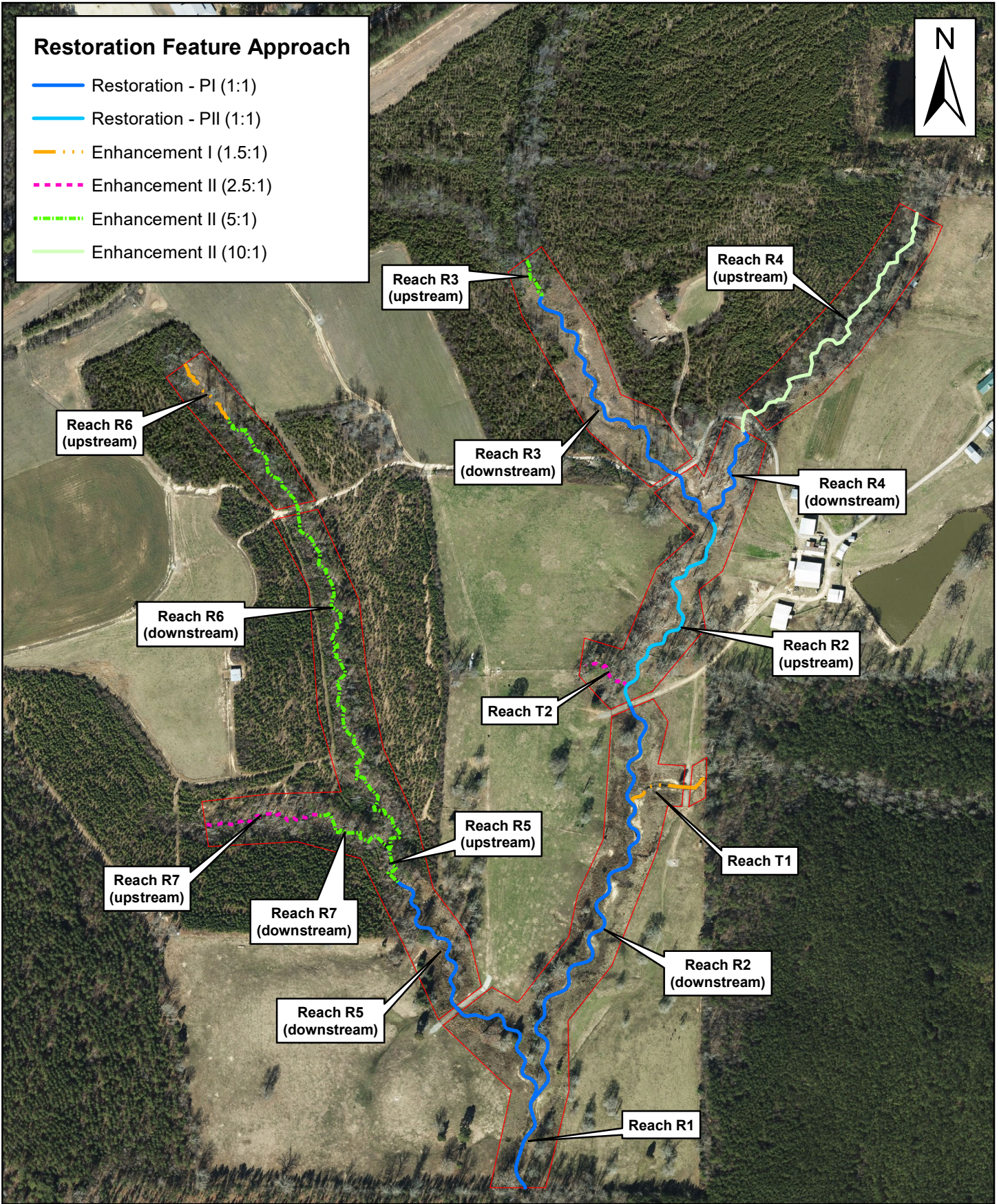
**INTERNATIONAL**





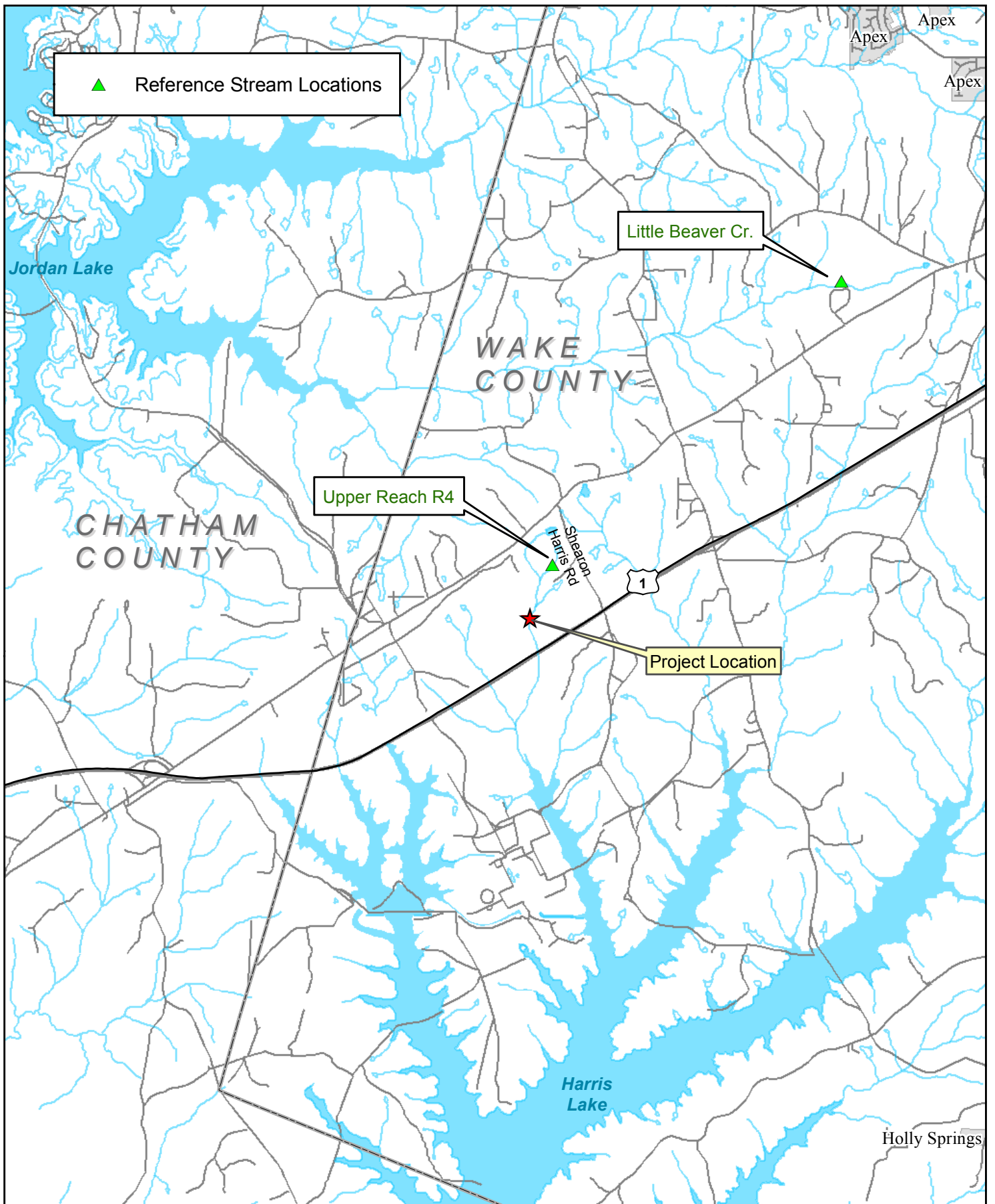
### Restoration Feature Approach

- Restoration - PI (1:1)
- Restoration - PII (1:1)
- - - Enhancement I (1.5:1)
- - - Enhancement II (2.5:1)
- - - Enhancement II (5:1)
- Enhancement II (10:1)

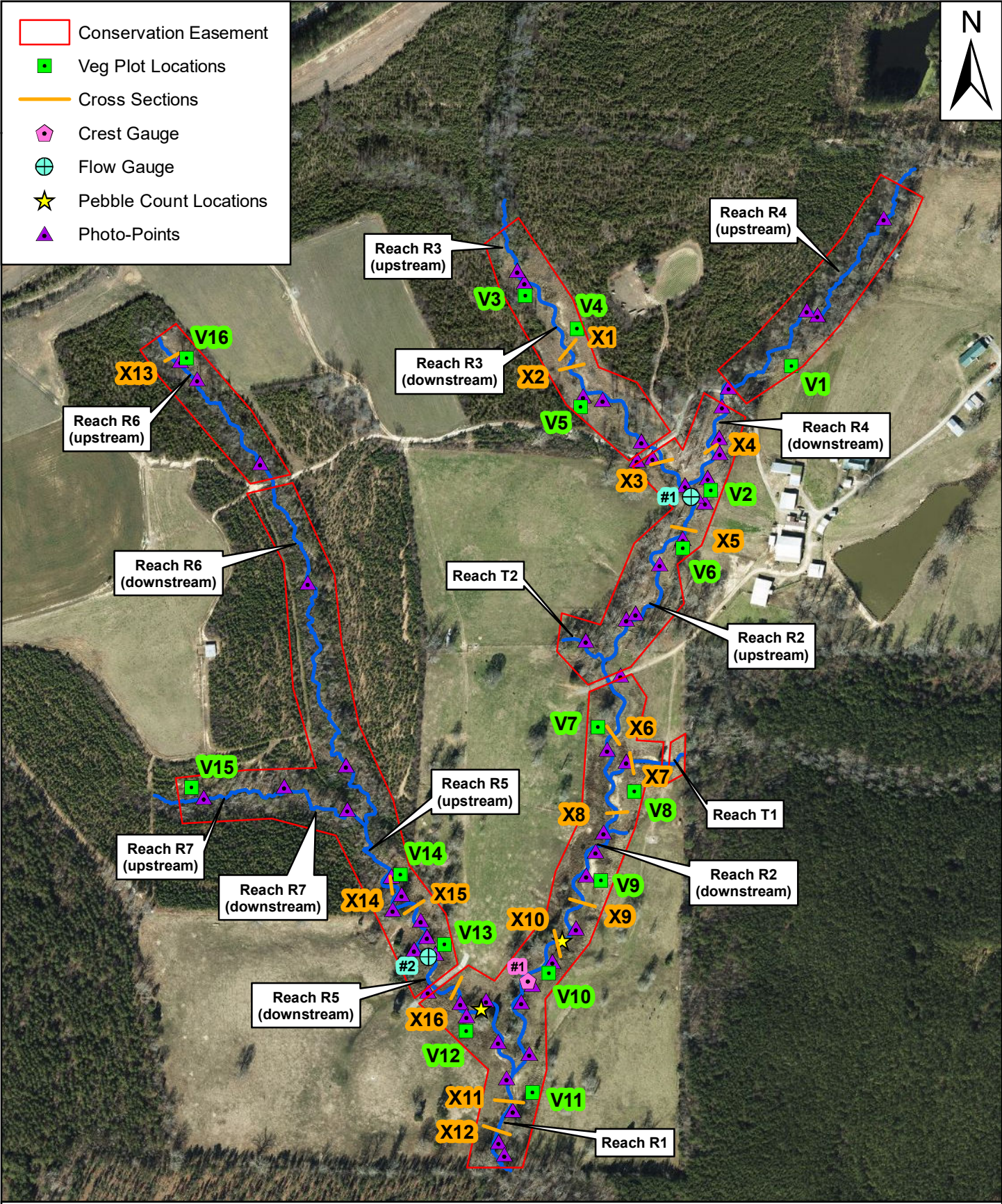


**Figure 2**  
**Restoration Summary Map**  
**Thomas Creek Site**









**Figure 4**  
**Monitoring Features**  
**Overview Map**  
**Thomas Creek Site**



Table 1. Project Components and Mitigation Credits							
Thomas Creek Restoration Project: DMS Project ID No. 96074							
Mitigation Credits							
	Stream (SMUs)	Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R, EI, EII						
Totals	5,706						
Project Components							
Project Component or Reach ID	As-Built Stationing/ Location	Existing Footage/ Acreage (LF)	Approach	Restoration/ Restoration Equivalent (SMU) from Mitigation Plan*	Design Reach Length (LF) from Mitigation Plan**	As-Built Restoration Footage (LF)	Mitigation Ratio
Reach 1	42+01 to 44+99	397	Restoration	266	266	298	1:1
Reach 2 (downstream)†	27+78 to 42+01	1,238	Restoration (PI)	1,384	1,404	1,423	1:1
Reach 2 (upstream)†	20+55 to 27+58 (at CE Break)	757	Restoration (PII)	703	703	703	1:1
Reach 3 (downstream)	11+17 to 18+70 / CE Break / 18+94 to 20+55	937	Restoration	929	949	914	1:1
Reach 3 (upstream)	10+00 to 11+17	130	Enhancement II	26	130	117	5:1
Reach 4 (downstream)	10+41 to 13+83	327	Restoration	361	361	342	1:1
Reach 4 (upstream)	00+99 to 09+95	870	Enhancement II	87	870	896	10:1
Reach 5 (downstream)	29+30 to 34+97 / CE Break / 35+17 to 39+91	883	Restoration	1,044	1,064	1,041	1:1
Reach 5 (upstream)	28+02 to 29+30	137	Enhancement II	27	137	128	5:1
Reach 6 (downstream)	12+10 to 15+55 / CE Break / 15+81 to 28+02	1,592	Enhancement II	320	1,618	1,566	5:1
Reach 6 (upstream)	10+00 to 12+10	210	Enhancement I	140	210	210	1.5:1
Reach 7 (downstream)	13+60 to 16+47	287	Enhancement II	57	286	287	5:1
Reach 7 (upstream)	10+00 to 13+60	360	Enhancement II	144	360	360	2.5:1
Reach T1	10+00 to 10+55 / CE Break / 10+75 to 12+47	242	Enhancement I	155	253	227	1.5:1
Reach T2	10+00 to 11+57	171	Enhancement II	63	158	157	2.5:1
Component Summation							
Restoration Level	Stream (LF)	Riparian Wetland (AC)	Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)		
Restoration	4,721						
Enhancement I	437						
Enhancement II	3,511						
BMP Elements							
Element	Location	Purpose/Function	Notes				
BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area							

Notes:

† Starting in MY2, Reach 2 was broken up into an upstream and downstream component based on restoration approach as per DMS request. None of the actual restored lengths have changed, although the credits for R2 (downstream) were adjusted as explained below.

\* Starting in MY2, the SMU credit numbers used for these reaches were taken directly from the mitigation plan credit table (Table 5.1) as per DMS/IRT instruction, and vary from those presented in the baseline and MY1 monitoring reports. This was done because credits were originally calculated along the as-built thalweg but have been updated to be calculated along stream centerlines for MY2 onward after discussions with the IRT stemming from the April 3, 2017 Credit Release Meeting. Stationing and Restoration Footage numbers reported herein and on all subsequent monitoring reports will remain as reported from the as-built survey. As Reach 1 was not originally subdivided, the credits were reduced from the downstream section where the bulk of differences are expected to have occurred, though the total combined credits equal the original value for R2 as found in the approved mitigation plan.

\*\* Starting in MY3, as per DMS/IRT instruction, this column was added to the table showing the design reach lengths taken from the mitigation plan (Table ES.1). Please note these numbers did not remove non-creditable sections such as easement breaks for crossings from their calculations.

<b>Table 2. Project Activity and Reporting History</b>		
<b>Thomas Creek Restoration Project: DMS Project ID No. 96074</b>		
Elapsed Time Since Grading Completed in Oct. 2015	4 Years, 3 Months	
Elapsed Time Since Planting Completed in Jan. 2016	4 Years	
Number of Reporting Years <sup>1</sup>	4	
<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Actual Completion or Delivery</b>
Mitigation Plan Prepared	N/A	Oct-14
Mitigation Plan Amended	N/A	Mar-15
Mitigation Plan Approved	N/A	Mar-15
Final Design – (at least 90% complete)	N/A	Mar-15
Construction Begins	N/A	Apr-15
Temporary S&E mix applied to entire project area	N/A	Oct-15
Permanent seed mix applied to entire project area	N/A	Oct-15
Planting of live stakes	N/A	Jan-16
Planting of bare root trees	N/A	Jan-16
End of Construction	N/A	Oct-15
Survey of As-built conditions (Year 0 Monitoring-baseline)	Nov-15	Nov-15
Baseline Monitoring Report	Mar-16	Oct-16
Year 1 Monitoring	Nov-16	Jan-17
Year 2 Monitoring	Oct-17	Nov-17
Year 3 Monitoring	Nov-18	Dec-18
Year 4 Monitoring	Oct-19	Jan-20
Year 5 Monitoring	Oct-20	N/A
Year 6 Monitoring	Oct-21	N/A
Year 7 Monitoring	Oct-22	N/A
<sup>1</sup> The number of reports or data points produced excluding the baseline		

<b>Table 3. Project Contacts</b>	
<b>Thomas Creek Restoration Project: DMS Project ID No. 95729</b>	
<b>Designer</b>	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 <u>Contact:</u> Katie McKeithan, Telephone: 919-481-5703
<b>Construction Contractor</b>	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 <u>Contact:</u> Stephen Carroll, Telephone: 919-428-8368
<b>Planting Contractor</b>	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 <u>Contact:</u> Stephen Carroll, Telephone: 919-428-8368
<b>Seeding Contractor</b>	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 <u>Contact:</u> Stephen Carroll, Telephone: 919-428-8368
Seed Mix Source	Green Resources, Telephone: 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm, Telephone: 919-742-1200 ArborGen, Telephone: 843-528-3204
<b>Monitoring Performers</b>	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 <u>Contact:</u>
Stream Monitoring Point of Contact	Scott King, Tel. 919-481-5731
Vegetation Monitoring Point of Contact	Scott King, Tel. 919-481-5731

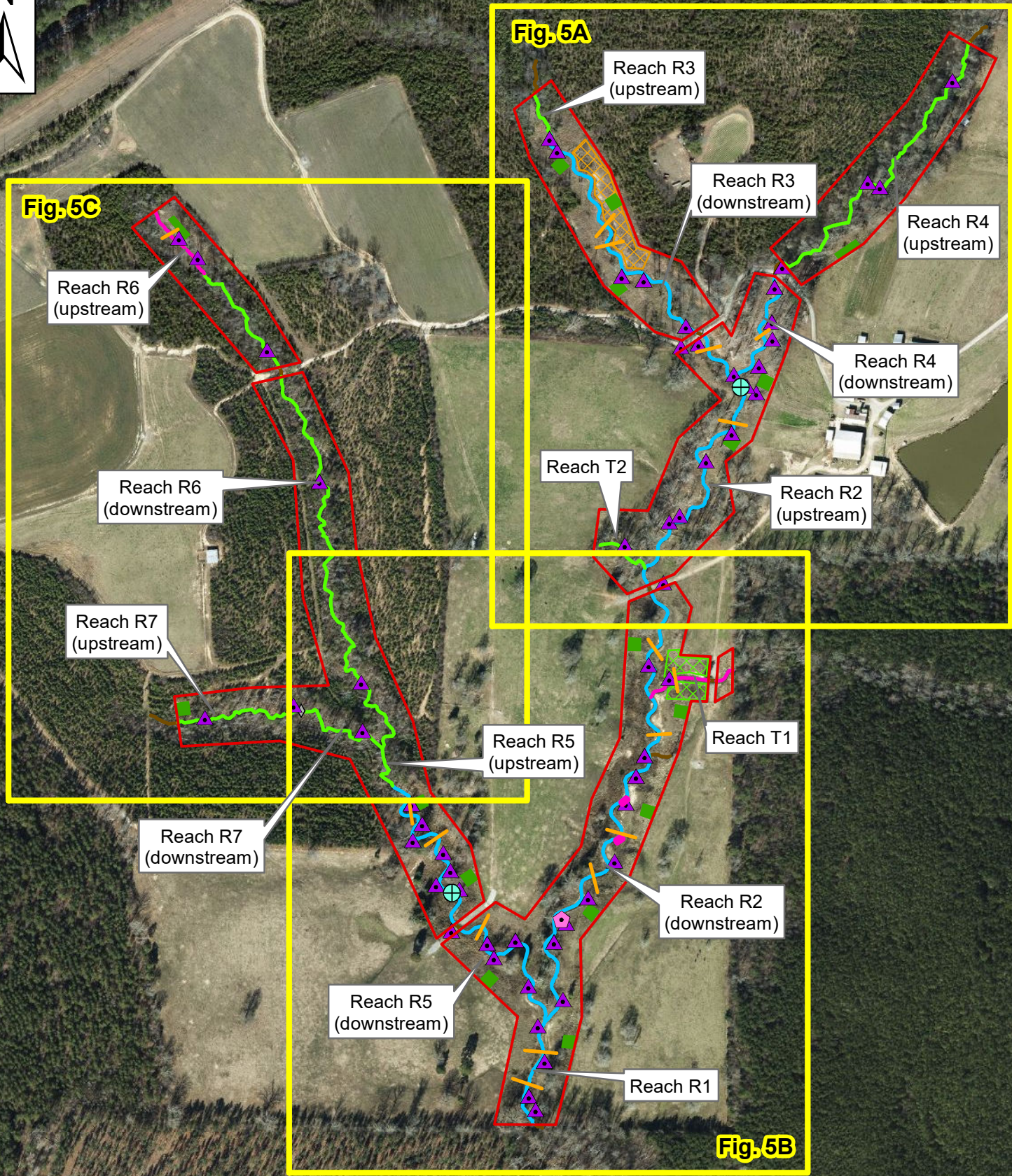
**Table 4. Project Attributes (Pre-Construction Conditions)**  
**Thomas Creek Restoration Project: DMS Project No. ID 96074**

Project Information					
Project Name	Thomas Creek Restoration Project				
County	Wake				
Project Area (acres)	22.7				
Project Coordinates (latitude and longitude)	35.6636 N, -79.9547 W				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Cape Fear				
USGS Hydrologic Unit 8-digit and 14-digit	03030004 / 03030004020010				
NCDWR Sub-basin	03-06-07				
Project Drainage Area (acres)	246 (Reach R1 main stem at downstream extent)				
Project Drainage Area Percent Impervious	<1%				
CGIA / NCEEP Land Use Classification	2.01.01.01, 2.03.01, 2.99.01, 3.02 / Forest (66%) Agriculture (19%) Impervious Cover (1%)				
Reach Summary Information					
Parameters	Reach R1	Reach R2	Reach R3	Reach R4	Reach R5
Length of Reach (linear feet)	397	1,995	1,067	342	1,020
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	246	176	62	36	62
NCDWR Stream Identification Score	37.5	38	25 / 37	31	31 / 34
NCDWR Water Quality Classification	C				
Morphological Description (Rosgen stream type)	Bc	F (upstream)/ Gc (downstream)	Gc (upstream)/ Bc (downstream)	Bc	Bc
Evolutionary Trend	Bc→Gc→F	Bc→Gc→F	Bc→Gc→F	Bc→Gc→F	Bc→Gc→F
Underlying Mapped Soils	WoA	WoA	WoA	WoA	WoA
Drainage Class	Poorly drained	Poorly drained	Poorly drained	Poorly drained	Poorly drained
Soil Hydric Status	Hydric	Hydric	Hydric	Hydric	Hydric
Average Channel Slope (ft/ft)	0.0165	0.0083	0.014	0.0102	0.0172
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	<5%	25%	<5%	<5%	<5%
Parameters	Reach R6	Reach R7	Reach T1	Reach T2	
Length of Reach (linear feet)	1,828	646	242	171	
Valley Classification (Rosgen)	VII	VII	VII	VII	
Drainage Area (acres)	32	14	49	5	
NCDWR Stream Identification Score	25 / 30	23 / 35	23.75	20.75	
NCDWR Water Quality Classification	C				
Morphological Description (Rosgen stream type)	G5c (upstream)/ B5c (downstream)	G5 (upstream)/ B5c (downstream)	B5c	B5c	
Evolutionary Trend	Bc→Gc→F	Bc→Gc→F	Bc→Gc→F	Bc→Gc→F	
Underlying Mapped Soils	WoA	WoA	WoA	WoA	
Drainage Class	Poorly drained	Poorly drained	Poorly drained	Poorly drained	
Soil Hydric Status	Hydric	Hydric	Hydric	Hydric	
Average Channel Slope (ft/ft)	0.015/0.025	0.025	0.02	0.041	
FEMA Classification	N/A	N/A	N/A	N/A	
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	<5%	<5%	
Regulatory Considerations					
Regulation	Applicable	Resolved	Supporting Documentation		
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion (Appendix B)		
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion (Appendix B)		
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)		
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)		
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)		
FEMA Floodplain Compliance	No	Yes	Categorical Exclusion (Appendix B)		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)		

# **Appendix B**

## **Visual Assessment Data**





NCOneMap Orthoimagery 2017

NC Center for Geographic Information & Analysis, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

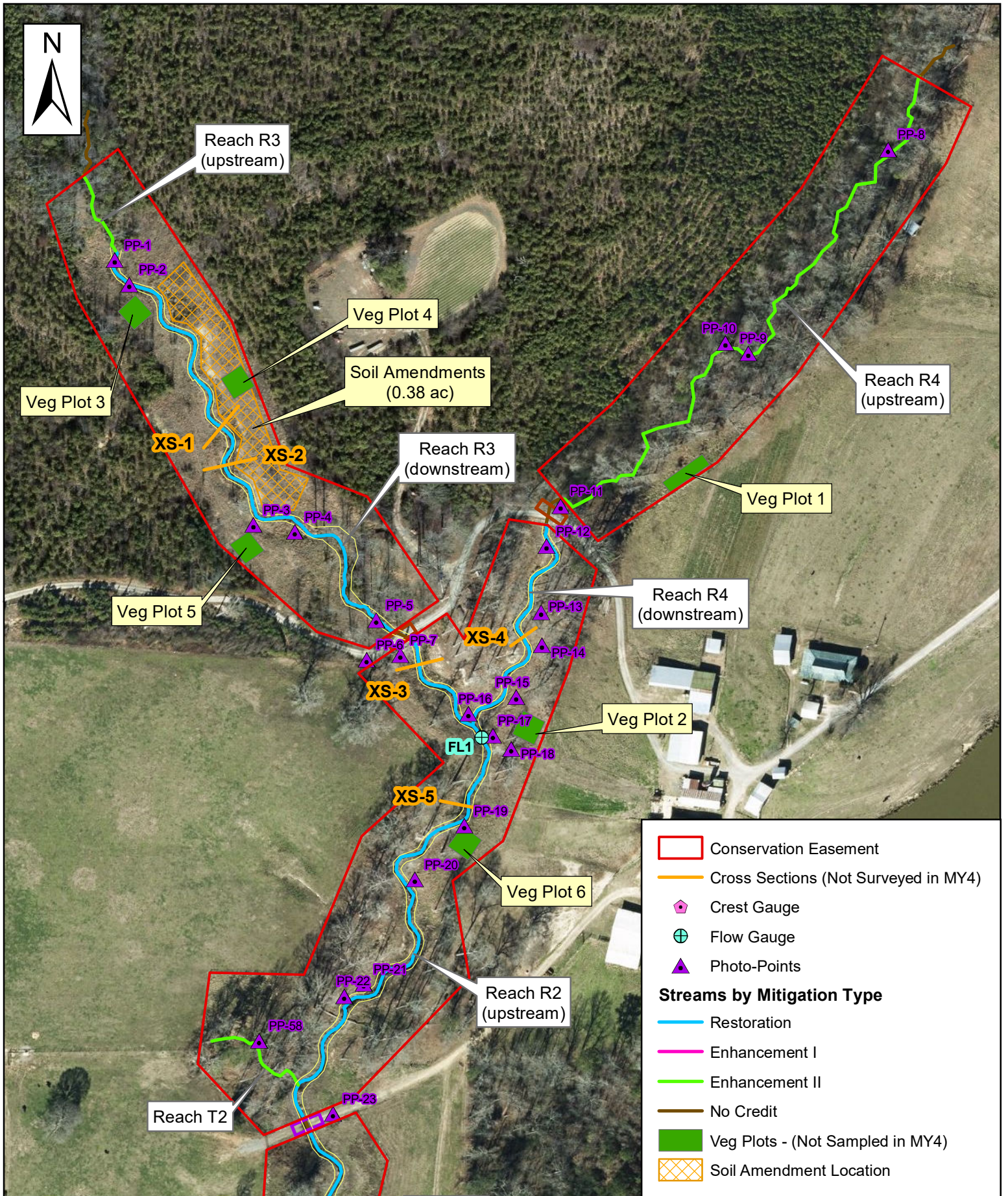
**Michael Baker**  
INTERNATIONAL

0 250 500 Feet

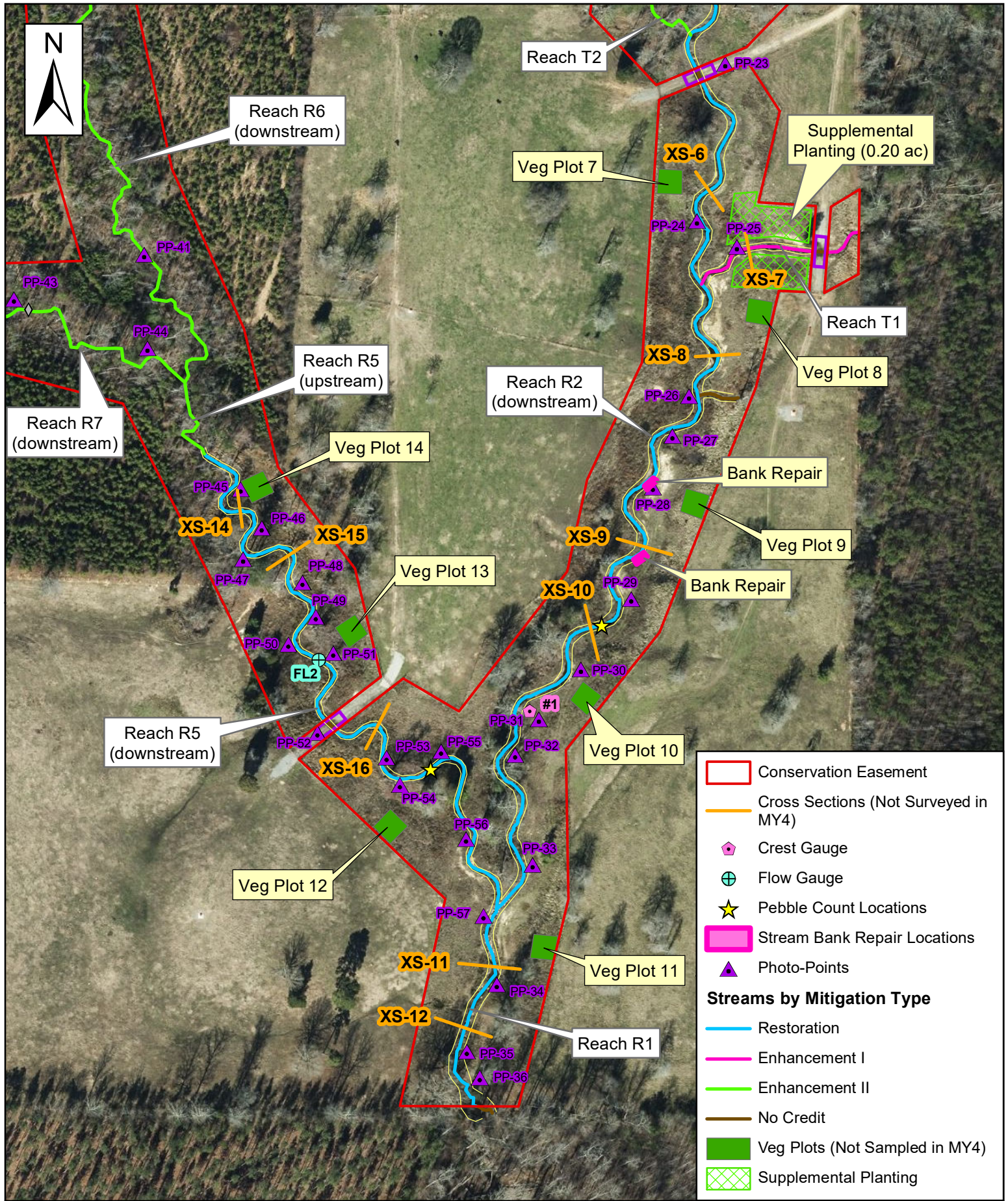
DEQ DMS Project # 96074

**Figure 5 Index Map**  
**Current Condition Plan View**  
**Thomas Creek Site - MY4**









- Conservation Easement
  - Cross Sections (Not Surveyed in MY4)
  - ◆ Crest Gauge
  - ⊕ Flow Gauge
  - ★ Pebble Count Locations
  - Stream Bank Repair Locations
  - ▲ Photo-Points
- Streams by Mitigation Type**
- Restoration
  - Enhancement I
  - Enhancement II
  - No Credit
  - Veg Plots (Not Sampled in MY4)
  - Supplemental Planting



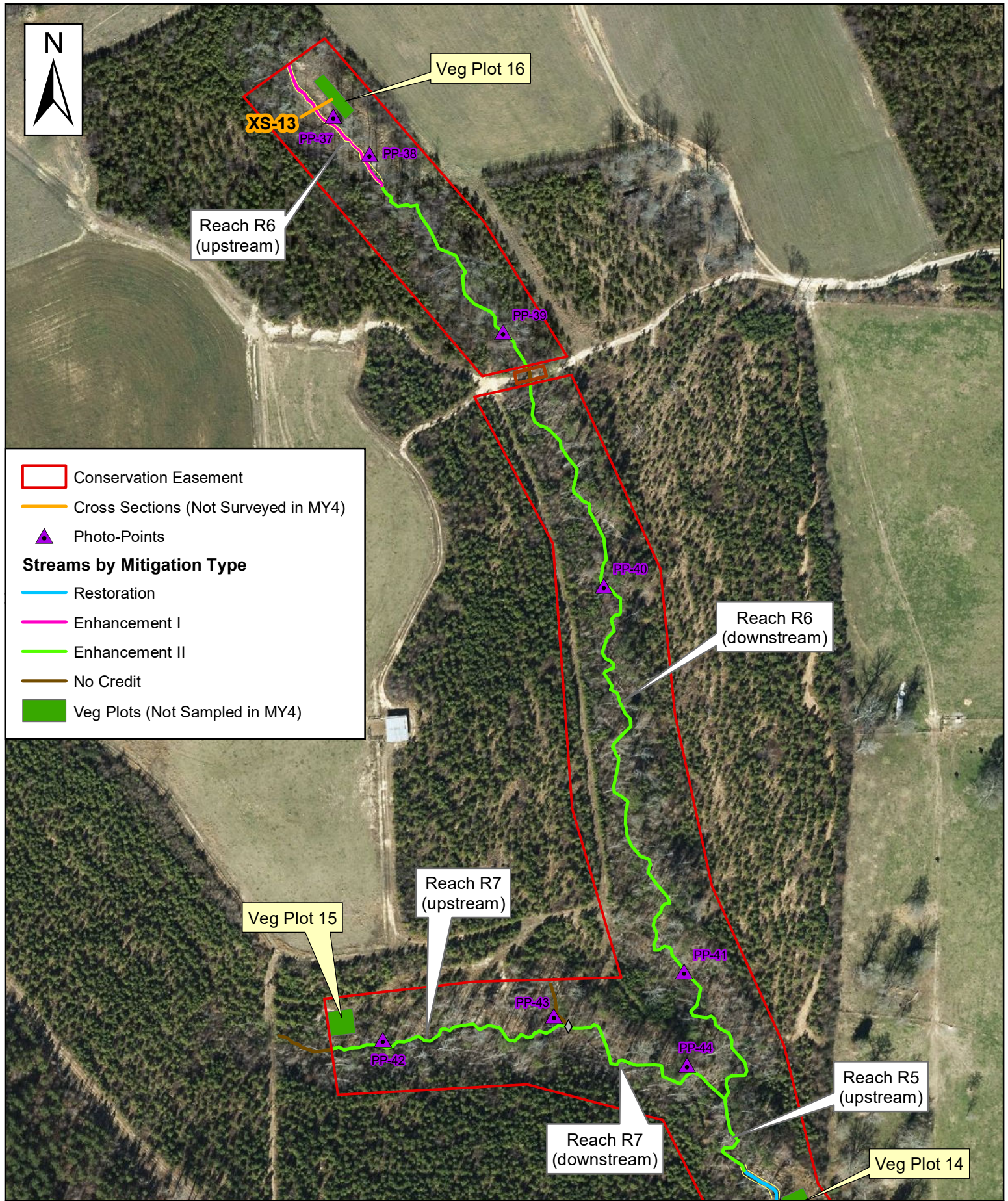




Table 5. Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 1											
Assessed Length (LF): 298											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	3	3			100%				
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	3	3			100%				
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	3	3			100%				
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	3	3			100%				
		2. Thalweg centering at downstream of meander bend (Glide)	3	3			100%				
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%
		3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
					<b>Totals</b>	0	0	100%	0	0	100%
3. Engineering Structures	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	2	2			100%			
			2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	3	3			100%		
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	3	3			100%			
		4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	3	3			100%			

Table 5. Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 2											
Assessed Length (LF): 2,126											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	38	38			100%				
		1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	41	41			100%				
	3. Meander Pool Condition	2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	41	41			100%				
4. Thalweg Position		1. Thalweg centering at upstream of meander bend (Run)	41	41			100%				
		2. Thalweg centering at downstream of meander bend (Glide)	41	41			100%				
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%
		3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
					<b>Totals</b>	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	27	27			100%				
		2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	24	24			100%			
			2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	27	27			100%		
		3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	27	27			100%			
		4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	13	13			100%			

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 3											
Assessed Length (LF): 1,031											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	16	16			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	15	15			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	15	15			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	15	15			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	15	15			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%	
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%	
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	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	2	2			100%				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	10	10			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	10	10			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	7	7			100%				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 4											
Assessed Length (LF): 1,238											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	8	8			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	8	8			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	8	8			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	8	8			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%	
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%	
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	4	4			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	4	4			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	4	4			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	3	3			100%				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 5											
Assessed Length (LF): 1,169											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	17	17			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	18	18			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	18	18			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	18	18			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	18	18			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%	
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%	
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	16	16			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	16	16			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	16	16			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	15	15			100%				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 6											
Assessed Length (LF): 1,776											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	6	6			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	5	5			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	5	5			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	5	5			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	5	5			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%	
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%	
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	0	0			-				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	0	0			-				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	0	0			-				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	0	0			-				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	0	0			-				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach 7											
Assessed Length (LF): 647											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	5	5			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	6	6			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	6	6			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	6	6			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	6	6			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%
		3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	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 or around sills or arms	2	2			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	2	2			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	2	2			100%				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach T1											
Assessed Length (LF): 227											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	4	4			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	5	5			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	5	5			100%				
4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	5	5			100%					
	2. Thalweg centering at downstream of meander bend (Glide)	5	5			100%					
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
		2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%
		3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	1	1			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%				

Table 5. Continued Visual Stream Morphology Stability Assessment											
Thomas Creek Restoration Project: DMS Project ID No. 96074											
Reach ID: Reach T2											
Assessed Length (LF): 157											
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.	
1. Bed	1. Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. Degradation - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	3	3			100%				
	3. Meander Pool Condition	1. Depth - Sufficient (Max Pool Depth/Mean Bkf Depth $\geq$ 1.5)	2	2			100%				
		2. Length - Sufficient (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	2	2			100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%				
		2. Thalweg centering at downstream of meander bend (Glide)	2	2			100%				
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%	0	0	100%	
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%	0	0	100%	
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%	
				<b>Totals</b>			0	0	100%	0	0
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	1	1			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%				
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%				
	3. Bank Position	Bank erosion within the structures extent of influence <b>does not</b> exceed 15%	1	1			100%				
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio $\geq$ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%				



<b>Table 6. Vegetation Conditions Assessment</b>						
<b>Thomas Creek Restoration Project: DMS Project ID No. 96074</b>						
<b>Planted Acreage: 14.4</b>						
<b>Vegetation Category</b>	<b>Defintions</b>	<b>Mapping Threshold (acres)</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	N/A	0	0.00	0.0%
<b>Total</b>				<b>0</b>	<b>0.00</b>	<b>0.0%</b>
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	N/A*	0*	0.38	2.6%
<b>Cumulative Total</b>				<b>0</b>	<b>0.38</b>	<b>2.6%</b>
<b>Easement Acreage: 22.7</b>						
<b>Vegetation Category</b>	<b>Defintions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	N/A	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	N/A	0	0.00	0.0%

\* Note: The area of low vigor noted here refers to the previously reported VPA that is being addressed as described in the report text. At DMS request, it is not shown on the CCPV so as to not to create confusion between potential new VPAs for the current MY4 and those from previous monitoring years.



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-1: Reach 3, view upstream, Station 11+50



PP-2: Reach 3, view downstream, Station 12+00



PP-3: Reach 3, view upstream, Station 15+75



PP-4: Reach 3, view downstream, Station 16+25



PP-5: Reach 3, view downstream towards pipe crossing,  
Station 18+50



PP-6: Reach 3, stream crossing, Station 18+80



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-7: Reach 3, Station 19+00



PP-8: Reach 4, view downstream at Station 01+90



PP-9: Reach 4, view downstream at Station 05+75



PP-10: Reach 4, view downstream at Station 06+10



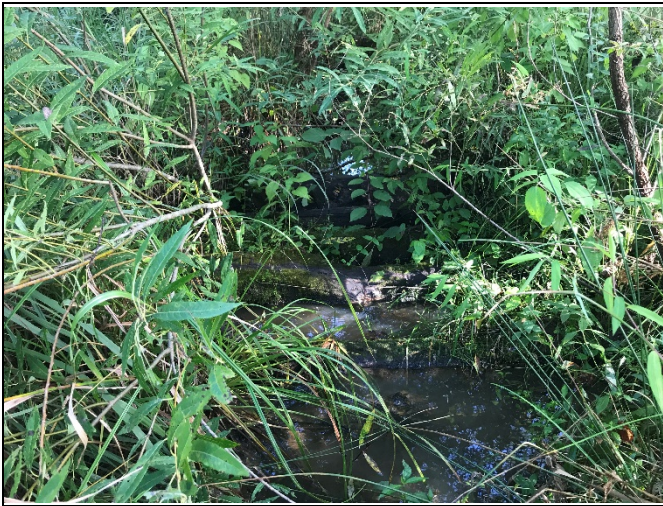
PP-11: Reach 4, view upstream at Station 10+10



PP-12: Reach 4, view upstream at Station 10+50



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-13: Reach 4, view upstream at Station 11+75



PP-14: Reach 4, view downstream at Station 12+25



PP-15: Reach 4, view upstream at Station 13+00



PP-16: Reach 2, view upstream at Station 20+60



PP-17: Reach 2, Flow Gauge #1 at Station 20+75



PP-18: Reach 2, view of stabilized drainage on left bank at Station 20+80



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-19: Reach 2, view upstream at Station 22+00



PP-20: Reach 2, view upstream at Station 23+00



PP-21: Reach 2, view upstream at Station 25+25



PP-22: Reach 2, view downstream at Station 25+50



PP-23: Reach 2, view of crossing at Station 27+75



PP-24: Reach 2, view downstream at Station 30+20



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-25: Reach T1, view upstream at Station 11+75



PP-26: Reach 2, view of drainage on left bank at Station 32+90



PP-27: Reach 2, view downstream at Station 33+25



PP-28: Reach 2, view downstream at Station 34+30



PP-29: Reach 2, view downstream at Station 36+90



PP-30: Reach 2, view upstream at Station 38+25



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-31: Reach 2, Crest Gauge at Station 38+90



PP-32: Reach 2, view downstream at Station 39+40



PP-33: Reach 2, view upstream at Station 41+50



PP-34: Reach 1, view upstream at Station 42+75



PP-35: Reach 1, view downstream at Station 43+25



PP-36: Reach 1, view of drainage on left bank at Station 44+00



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-37: Reach 6, view upstream at Station 10+75



PP-38: Reach 6, view upstream at Station 11+50



PP-39: Reach 6, view upstream at Station 15+25



PP-40: Reach 6, view upstream at Station 18+90



PP-41: Reach 6, view upstream at Station 25+50



PP-42: Reach 7, view upstream at Station 10+40



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-43: Reach 7, view of stabilized drainage at Station 13+50



PP-44: Reach 7, view upstream at Station 15+00



PP-45: Reach 5, view upstream at Station 30+25



PP-46: Reach 5, view downstream at Station 30+75



PP-47: Reach 5, view downstream at Station 31+40



PP-48: Reach 5, view downstream at Station 32+50



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-49: Reach 5, view upstream at Station 33+10



PP-50: Reach 5, view downstream at Station 33+75



PP-51: Reach 5, Flow Gauge #2 at Station 33+90



PP-52: Reach 5, view of crossing at Station 35+00



PP-53: Reach 5, view upstream at Station 36+40



PP-54: Reach 5, view upstream at Station 36+75



**Thomas Creek: MY4 Stream Station Photo-Points (from 9/6/19)**



PP-55: Reach 5, view downstream at Station 37+30



PP-56: Reach 5, view upstream at Station 38+50



PP-57: Reach 5, view upstream at Station 39+90  
(the confluence of R5 and R2)



PP-58: Reach T2, view upstream at Station 10+80



Thomas Creek: MY4 Crest Gauge Photographs



Crest Gauge on Reach R2 at Station 38+90



Overbank event of 0.89 ft on 4/19/19



Overbank event of 0.89 ft on 4/19/19



Flow/scour paths and standing water in floodplain near crest gauge on Reach R2.



## Thomas Creek: MY4 Maintenance and Repair Photographs



Previous bank scour from Hurricane Florence, left bank of R2, Station 34+75 (BEFORE)



Previous bank scour from Hurricane Florence, left bank of R2, Station 35+75 (BEFORE)



R2 Station 34+75: Bank regraded with matting, seeds, and livestock stakes planted in January 2019 (AFTER)



R2 Station 35+75: Bank regraded, with seeds and livestock stakes planted in January 2019 (AFTER)



R2 Station 34+75: Bank stabilizing in April 2019



R2 Station 35+75: Bank stabilizing in April 2019



## Thomas Creek: MY4 Maintenance and Repair Photographs



R2 Station 34+75: Bank stabilizing in September 2019



R2 Station 35+75: Bank stabilizing in September 2019



Cattail (*Typha latifolia*) treated in lower Reach R4 in March and April 2019



Cattail (*Typha latifolia*) treated in upper Reach R2 in March and April 2019



Cattail (*Typha latifolia*) treated in middle Reach R2 in March and April 2019

# **Appendix C**

## **Vegetation Plot Data\***

**\*No vegetation plot monitoring was required for Year 4.**

# **Appendix D**

## **Stream Survey Data\***

**\*No cross-section survey monitoring was required for Year 4.**



Table 10. Baseline Stream Summary																												
Thomas Creek Restoration Project: DMS Project ID No. 96074																												
Reach 1 - Length 298 ft																												
Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Little Beaver Creek (Wake County)						Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Rifle</b>																												
BF Width (ft)	----	11.6	11.9	----	----	----	9.0	----	----	----	----	----	----	----	----	12.5	----	----	----	----	----	----	13.9	----	----	----	----	
Floodprone Width (ft)	----	----	----	----	----	----	9.0	----	----	----	----	----	----	----	----	>25	----	----	----	----	----	----	30.6	----	----	----	----	
BF Mean Depth (ft)	----	1.2	1.5	----	----	----	1.2	----	----	----	----	----	----	----	----	0.9	----	----	----	----	----	----	0.8	----	----	----	----	
BF Max Depth (ft)	----	----	----	----	----	----	1.9	----	----	----	----	----	----	----	----	1.1	----	----	----	----	----	----	1.1	----	----	----	----	
BF Cross-sectional Area (ft <sup>2</sup> )	----	----	11.2	----	----	----	11.2	----	----	----	----	----	----	----	----	11.2	----	----	----	----	----	----	11.1	----	----	----	----	
Width/Depth Ratio	----	----	----	----	----	----	7.2	----	----	12.0	----	----	18.0	----	----	14.0	----	----	----	----	----	----	17.4	----	----	----	----	
Entrenchment Ratio	----	----	----	----	----	----	1.8	----	----	1.4	----	----	2.2	----	----	>2.2	----	----	----	----	----	----	2.2	----	----	----	----	
Bank Height Ratio	----	----	----	----	----	----	2.5	----	----	1.0	----	----	1.1	----	----	1.0	----	----	----	----	----	----	1.0	----	----	----	----	
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Pattern</b>																												
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	30.0	----	----	----	----	----	----	34.4	----	----	----	----	
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	25.0	----	----	35.0	----	----	----	----	33.1	----	----	----	----	
Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	2.0	----	----	3.0	----	2.0	----	----	2.8	----	----	----	----	2.4	----	----	----	----	
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	105.0	----	----	----	----	----	----	103.4	----	----	----	----	
Meander Width Ratio	----	----	----	----	----	----	----	----	----	3.5	----	----	8.0	----	----	2.4	----	----	----	----	----	----	2.5	----	----	----	----	
<b>Profile</b>																												
Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	24.0	----	----	----	----	
Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.028	----	----	----	----	----	----	0.025	----	----	----	----	
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	24	----	----	60	----	----	----	----	64.0	----	----	----	----	
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.4	----	----	----	----	----	----	2.5	----	----	----	----	
Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Substrate and Transport Parameters</b>																												
R2% / Ra% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	0.15 / 0.27 / 0.34 / 0.75 / 1.39	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Additional Reach Parameters</b>																												
Drainage Area (SM)	----	----	----	----	----	----	0.38	----	----	----	----	----	----	----	----	0.38	----	----	----	----	----	----	0.38	----	----	----	----	
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Rosen Classification	----	----	----	----	----	----	E	----	----	----	----	C5	----	----	----	C5	----	----	----	----	----	----	C5	----	----	----	----	
BF Velocity (fps)	----	3.4	4.0	----	----	----	3.9	----	----	3.5	----	5	----	----	----	4	----	----	----	----	----	----	----	----	----	----	----	
BF Discharge (cfs)	----	27.6	44.6	----	----	----	44.6	----	----	----	----	----	----	----	----	44.6	----	----	----	----	----	----	----	----	----	----	----	
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	271.1	----	----	----	----	
Channel length (ft)	----	----	----	----	----	----	397	----	----	----	----	----	----	----	----	266	----	----	----	----	----	----	324.3	----	----	----	----	
Sinuosity	----	----	----	----	----	----	1.18	----	----	1.1	----	1.3	----	----	----	1.22	----	----	----	----	----	----	1.2	----	----	----	----	
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	0.0028	----	----	0.002	----	0.015	----	----	----	0.022	----	----	----	----	----	----	0.0168	----	----	----	----	
BF slope (ft/ft)	----	----	----	----	----	----	0.0050	----	----	----	----	----	----	----	----	0.0165	----	----	----	----	----	----	0.0201	----	----	----	----	
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
BEHI VL% / L% / M% / H% / VHP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	

1 - Pre-Existing Condition measurement taken on existing sandbed riffle



Table 10 continued. Baseline Stream Summary																													
Thomas Creek Restoration Project: DMS Project ID No. 96074																													
Reach 2 - Length 2,126 ft																													
Parameter	USGS Gauge	Regional Curve				Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
												Little Beaver Creek (Wake County)																	
												Min	Mean	Med	Max	SD	n												
<b>Dimension and Substrate - Rifle</b>																													
BF Width (ft)	----	11.6	11.9	----	6.5	----	----	9.4	----	----	----	----	----	----	----	9.2	----	----	10.4	----	----	10.2	10.3	----	10.4	----	----		
Floodprone Width (ft)	----	----	----	----	9.0	----	----	13.2	----	----	----	----	----	----	----	----	>18	----	----	----	----	38.2	58.5	----	74.5	----	----		
BF Mean Depth (ft)	----	1.2	1.5	----	0.6	----	----	1.2	----	----	----	----	----	----	----	0.7	----	----	0.7	----	----	0.7	0.8	----	1.0	----	----		
BF Max Depth (ft)	----	----	----	----	1.6	----	----	2.6	----	----	----	----	----	----	----	0.8	----	----	1.0	----	----	1.0	1.2	----	1.5	----	----		
BF Cross-sectional Area (ft <sup>2</sup> )	----	6.0	7.7	----	7.7	----	----	15.7	----	----	----	----	----	----	----	6.0	----	----	7.7	----	----	7.4	8.6	----	10.2	----	----		
Width/Depth Ratio	----	----	----	----	3.4	----	----	5.4	----	10.0	----	----	15.0	----	----	14.0	----	----	14.0	----	----	10.1	12.5	----	14.8	----	----		
Entrenchment Ratio	----	----	----	----	1.4	----	----	1.4	----	----	----	----	>2.2	----	----	----	>2.2	----	----	----	3.7	5.7	----	7.2	----	----			
Bank Height Ratio	----	----	----	----	2.2	----	----	3.3	----	1.0	----	----	1.1	----	----	----	1.0	----	----	----	0.9	1.0	----	1.0	----	----			
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
<b>Pattern</b>																													
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	32.0	----	----	45.0	----	----	----	56.6	----	----	----	----		
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	17.0	----	----	30.0	----	----	22.0	----	----	----	----			
Rc-Bankfull width (ft)	----	----	----	----	----	----	----	----	----	2.0	----	----	3.0	----	----	2.0	----	----	3.0	----	----	2.1	----	----	----	----			
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	75.0	----	----	107.0	----	----	83.2	----	----	----	----			
Meander Width Ratio	----	----	----	----	----	----	----	----	----	7.0	----	----	14.0	----	----	3.3	----	----	4.7	----	----	5.5	----	----	----	----			
<b>Profile</b>																													
Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	17.7	----	----	----	----	----		
Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.0094	----	----	0.02	----	----	0.012	----	----	----	----			
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	25	----	----	75	----	----	50.8	----	----	----	----			
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.7	----	----	1.9	----	----	1.7	----	----	----	----			
Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Substrate and Transport Parameters</b>																													
R7% / Ra7% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
d16 / d35 / d50 / d84 / d95	----	----	----	----	----	0.11	0.22	0.32	0.85	1.89	----	----	----	----	----	----	----	----	----	----	----	20.2	47.6	62.5	133.1	173.1			
Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Additional Reach Parameters</b>																													
Drainage Area (SM)	----	----	----	----	0.153	----	----	0.275	----	----	----	----	----	----	----	----	----	0.275	----	----	----	0.275	----	----	----	----			
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Rosen Classification	----	----	----	----	G5c	----	----	F5	----	----	----	----	C5	----	----	----	----	C5	----	----	----	----	----	----	----	----			
BF Velocity (fps)	----	3.2	3.9	----	3.8	----	----	3.9	----	3.5	----	----	5	----	----	3.8	----	----	3.9	----	----	----	----	----	----	----			
BF Discharge (cfs)	----	17.8	29.7	----	22.9	----	----	35.0	----	----	----	----	----	----	----	23.0	----	----	29.7	----	----	----	----	----	----	----			
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2549.3	----	----	----	----			
Channel length (ft)	----	----	----	----	----	----	----	1,995	----	----	----	----	----	----	----	----	----	1,089	----	----	----	3413.7	----	----	----	----			
Sinuosity	----	----	----	----	1.17	----	----	----	----	1.2	----	----	1.5	----	----	----	----	1.20	----	----	----	1.3	----	----	----				
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	0.0082	----	----	----	----	0.002	----	----	0.01	----	----	0.0047	----	0.0083	----	----	----	0.0092	----	----	0.0123				
BF slope (ft/ft)	----	----	----	----	0.0098	----	----	----	----	----	----	----	----	----	----	----	----	0.01	----	----	----	----	----	----	----				
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
BEHI VL% / L% / M% / H% / VHP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			

1 - Pre-Existing Condition measurement taken on existing sandbed rifle, As-Built measurement taken on constructed rock rifle

Table 10 continued, Baseline Stream Summary																													
Thomas Creek Restoration Project: DMS Project ID No. 96074																													
Reach 3 - Length 1,031 ft																													
Parameter	USGS Gauge	Regional Curve				Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
												Thomas Creek Site Upper Reach 4 (On-site)																	
												Min	Mean	Med	Max	SD	n												
<b>Dimension and Substrate - Rifle</b>																													
BF Width (ft)	----	11.6	11.9	----	4.5	----	----	5.3	----	----	----	----	----	----	----	----	7.0	----	----	----	----	----	7.5	8.4	----	9.3	----		
Floodprone Width (ft)	----	----	----	----	6.7	----	----	9.5	----	----	----	----	----	----	----	----	>16	----	----	----	----	----	37.3	46.3	----	55.3	----		
BF Mean Depth (ft)	----	1.2	1.5	----	0.7	----	----	0.8	----	----	----	----	----	----	----	----	0.7	----	----	----	----	----	0.6	0.7	----	0.8	----		
BF Max Depth (ft)	----	----	----	----	1.0	----	----	1.5	----	----	----	----	----	----	----	----	0.7	----	----	----	----	----	0.9	0.9	----	1.29	----		
BF Cross-sectional Area (ft <sup>2</sup> )	----	26.8	36.2	----	3.0	----	----	4.3	----	----	----	----	----	----	----	----	4.1	----	----	----	----	----	4.5	5.9	----	7.3	----		
Width/Depth Ratio	----	----	----	----	6.5	----	----	6.7	----	----	----	----	----	----	----	10	----	----	14.0	----	----	----	11.9	12.1	----	12.3	----		
Entrenchment Ratio	----	----	----	----	1.5	----	----	1.8	----	----	----	----	----	----	----	>2.2	----	----	----	----	----	----	5.0	5.5	----	5.9	----		
Bank Height Ratio	----	----	----	----	2.3	----	----	3.2	----	----	----	----	----	----	1.0	----	----	1.1	----	----	----	----	1.0	1.0	----	1.0	----		
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
<b>Pattern</b>																													
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	18	----	----	28	----	----	----	32.2	----	----	----		
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	----	----	21	----	----	----	19.1	----	----	----	----		
Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2	----	----	3	----	----	----	----	2.3	----	----	----	----		
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	70	----	----	80	----	----	----	77.5	----	----	----	----		
Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.6	----	----	4.0	----	----	----	3.8	----	----	----	----		
<b>Profile</b>																													
Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	12.5	----	----	----	----		
Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.1	----	----	2.0	----	----	----	----	0.031	----	----	----	----		
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	28.0	----	----	48.0	----	----	----	47.2	----	----	----		
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.5	----	----	----	----	----	1.3	----	----	----	----		
Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
<b>Substrate and Transport Parameters</b>																													
R7% / Ra% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	.014 / .029 / 0.41 / 1.16 / 3.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Additional Reach Parameters</b>																													
Drainage Area (SM)	----	----	----	----	----	----	----	0.083	----	----	----	----	----	----	----	----	----	----	0.083	----	----	----	----	0.083	----	----	----		
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Rosen Classification	----	----	----	----	----	----	----	B5c	----	----	----	----	----	----	----	----	----	E/C5	----	----	----	----	----	----	----	----	----		
BF Velocity (fps)	----	3.0	3.6	----	3.8	----	----	2.3	----	----	3.5	----	----	5	----	----	----	----	3.8	----	----	----	----	----	----	----	----		
BF Discharge (cfs)	----	9.4	16.5	----	12.2	----	----	16.5	----	----	----	----	----	----	----	----	----	----	16.5	----	----	----	----	----	----	----	----		
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	873	----	----	----		
Channel length (ft)	----	----	----	----	----	----	----	1,067	----	----	----	----	----	----	----	----	----	----	1,231	----	----	----	1,051	----	----	----	----		
Simosity	----	----	----	----	----	----	----	1.22	----	----	1.20	----	----	1.50	----	----	----	----	1.20	----	----	----	1.2	----	----	----	----		
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	----	0.0150	----	----	----	----	----	----	----	----	----	----	0.0150	----	----	----	----	0.0092	----	----	----		
BF slope (ft/ft)	----	----	----	----	----	----	----	0.0182	----	----	0.005	----	----	0.015	----	----	----	----	0.0182	----	----	----	----	0.0123	----	----	----		
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
BEHI VL% / L% / M% / H% / VP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		

1 - Pre-Existing Condition measurement taken on existing sandbed rifle

Table 10 continued. Baseline Stream Summary																													
Thomas Creek Restoration Project: DMS Project ID No. 96074																													
Reach 4 - Length 1,238 ft																													
Parameter	USGS Gauge	Regional Curve				Pre-Existing Condition					Reference Reach(es) Data					Design					As-built								
		LL	UL	Eq		Min	Mean	Med	Max	SD	n	Thomas Creek Site Upper Reach 4 (On-site)					Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	
<b>Dimension and Substrate - Rifle</b>																													
BF Width (ft)	----	11.6	11.9	----	----	----	----	4.5	----	----	----	----	----	----	----	----	----	6.3	----	----	----	----	----	----	6.8	----	----	----	
Floodprone Width (ft)	----	----	----	----	----	----	----	9.9	----	----	----	----	----	----	----	----	----	>13	----	----	----	----	----	----	21.9	----	----	----	
BF Mean Depth (ft)	----	1.2	1.5	----	----	----	----	0.7	----	----	----	----	----	----	----	----	----	0.5	----	----	----	----	----	----	0.5	----	----	----	
BF Max Depth (ft)	----	----	----	----	----	----	----	1.4	----	----	----	----	----	----	----	----	----	0.6	----	----	----	----	----	----	0.9	----	----	----	
BF Cross-sectional Area (ft²)	----	----	3.1	----	----	----	----	3.1	----	----	----	----	----	----	----	----	----	3.1	----	----	----	----	----	----	3.6	----	----	----	
Width/Depth Ratio	----	----	----	----	----	----	----	6.4	----	----	----	10.0	----	----	----	----	----	14.0	----	----	12.0	----	----	----	12.7	----	----	----	
Entrenchment Ratio	----	----	----	----	----	----	----	2.2	----	----	----	----	----	----	----	----	----	>2.2	----	----	----	----	----	----	3.2	----	----	----	
Bank Height Ratio	----	----	----	----	----	----	----	3.0	----	----	----	1.0	----	----	----	----	----	1.1	----	----	----	----	----	----	1.0	----	----	----	
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.0	----	----	----
<b>Pattern</b>																													
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	20.0	----	----	29.0	----	----	----	34.0	----	----	----	
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	12.0	----	----	18.0	----	----	----	16.9	----	----	----	
Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	2.0	----	----	----	----	----	3.0	----	----	3.0	----	----	----	2.5	----	----	----	
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	60.0	----	----	75.0	----	----	----	66.2	----	----	----	
Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	3.5	----	----	----	----	----	8.0	----	----	4.6	----	----	----	5.0	----	----	----	
<b>Profile</b>																													
Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15.4	----	----	----	----
Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.029	----	----	----	----	0.035	----	----	----	----
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	28-	----	----	43	----	----	----	42.8	----	----	----	----
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.5	----	----	----	----	1.3	----	----	----	----
Pool Volume (ft³)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Substrate and Transport Parameters</b>																													
R7% / Ra% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Reach Shear Stress (competency) lb/ft²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Max part size (mm) mobilized at bankfull (Roggen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Stream Power (transport capacity) W/m²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Additional Reach Parameters</b>																													
Drainage Area (SM)	----	----	----	----	----	----	0.056	----	----	----	----	----	----	----	----	----	----	----	----	0.056	----	----	----	----	0.056	----	----	----	----
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Roggen Classification	----	----	----	----	----	----	B5c	----	----	----	----	----	----	----	----	----	----	----	----	C5	----	----	----	----	----	C5	----	----	----
BF Velocity (fps)	----	3.2	3.9	----	----	----	3.6	----	----	----	3.5	----	----	----	----	----	----	5	----	----	3.6	----	----	----	----	----	----	----	----
BF Discharge (cfs)	----	17.8	29.7	----	----	----	11.1	----	----	----	----	----	----	----	----	----	----	----	----	11.1	----	----	----	----	----	----	----	----	----
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	285.55	----	----	----	----
Channel length (ft)	----	----	----	----	----	----	1,197	----	----	----	----	----	----	----	----	----	----	----	----	1,201	----	----	----	----	342.91	----	----	----	----
Sinuosity	----	----	----	----	----	----	1.16	----	----	----	1.20	----	----	----	----	----	----	----	----	1.13	----	----	----	----	1.20	----	----	----	----
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	0.0121	----	----	----	0.005	----	----	----	----	----	----	----	----	0.015	----	----	----	----	0.0156	----	----	----	----
BF slope (ft/ft)	----	----	----	----	----	----	0.0105	----	----	----	0.005	----	----	----	----	----	----	----	----	0.015	----	----	----	----	0.0188	----	----	----	----
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
BEHI VL% / L% / M% / H% / VHP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

1 - Pre-Existing Condition measurement taken on existing sandbed rifle



Table 10 continued. Baseline Stream Summary Thomas Creek Restoration Project: DMS Project ID No. 96074																												
Reach 5 - Length 1,169 ft																												
Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Little Beaver Creek (Wake County)																	
		LL	UL	Eq	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Riffle</b>																												
BF Width (ft)	----	11.6	11.9	----	4.4	----	----	8.9	----	----	----	----	----	----	----	----	6.8	8.6	----	----	----	----	8.6	----	----	----	----	
Floodprone Width (ft)	----	----	----	----	7.8	----	----	>30	----	----	----	----	----	----	----	----	>16	49.9	----	----	----	49.9	----	----	----	----		
BF Mean Depth (ft)	----	1.2	1.5	----	0.4	----	----	1.0	----	----	----	----	----	----	----	----	0.5	0.9	----	----	----	0.9	----	----	----	----		
BF Max Depth (ft)	----	----	----	----	0.8	----	----	1.6	----	----	----	----	----	----	----	----	0.7	1.2	----	----	----	1.2	----	----	----	----		
BF Cross-sectional Area (ft <sup>2</sup> )	----	----	4.0	----	3.4	----	----	4.5	----	----	----	----	----	----	----	----	3.6	6.8	----	----	----	6.8	----	----	----	----		
Width/Depth Ratio	----	----	----	----	4.2	----	----	3.4	----	10.0	----	----	14.0	----	----	----	13.0	8.4	----	----	----	8.4	----	----	----	----		
Entrenchment Ratio	----	----	----	----	1.8	----	----	5.4	----	----	----	----	>2.2	----	----	----	>2.3	6.6	----	----	----	6.6	----	----	----	----		
Bank Height Ratio	----	----	----	----	2.4	----	----	1.0	----	1.0	----	----	1.1	----	----	----	1.0	1.0	----	----	----	1.0	----	----	----	----		
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Pattern</b>																												
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	28	----	----	45	----	----	----	58.6	----	----	----	----	
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	14	----	----	20	----	----	----	17.5	----	----	----	----		
Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2	----	----	3	----	----	----	2.0	----	----	----	----		
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	60	----	----	90	----	----	----	81.5	----	----	----	----		
Meander Width Ratio	----	----	----	----	----	----	----	----	----	3.5	----	----	8	----	4.1	----	----	6.6	----	----	----	6.8	----	----	----	----		
<b>Profile</b>																												
Riffle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15.2	----	----	----	----	----	
Riffle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.0265	----	----	----	----	----	0.0196	----	----	----	----	----	
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	25	----	----	55	----	----	----	57.8	----	----	----	----		
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.3	----	----	----	----	----	1.7	----	----	----	----		
Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Substrate and Transport Parameters</b>																												
R <sub>p</sub> / Ra% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<sup>1</sup> d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	17.6 / 36.9 / 53.7 / 130.6 / 184.8	----	----	----	----		
Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Additional Reach Parameters</b>																												
Drainage Area (SM)	----	----	----	----	0.097	----	----	0.083	----	----	----	----	----	----	----	----	----	0.097	----	----	----	0.097	----	----	----	----		
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Rosen Classification	----	----	----	----	B5c	----	----	C	----	----	----	C5	----	----	----	----	C5	----	----	----	----	----	----	----	----	----		
BF Velocity (fps)	----	3.4	3.7	----	3.7	----	----	4.2	----	3.5	----	----	5	----	----	----	3.3	----	----	----	----	----	----	----	----	----		
BF Discharge (cfs)	----	9.4	14.7	----	14.4	----	----	16.5	----	----	----	----	----	----	----	----	12.0	----	----	----	----	----	----	----	----	----		
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	726.02	----	----	----	----		
Channel length (ft)	----	----	----	----	1.022	----	----	1.42	----	1.20	----	----	1.50	----	----	1.828	----	----	----	----	----	1069.32	----	----	----	----		
Simosity	----	----	----	----	1.31	----	----	1.42	----	1.20	----	----	1.50	----	----	1.828	----	----	----	----	----	1.47	----	----	----	----		
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	----	0.0177	----	0.005	----	----	0.015	----	----	0.0124	----	----	----	----	0.0123	----	----	----	----			
BF slope (ft/ft)	----	----	----	----	----	----	----	0.0133	----	0.005	----	----	0.015	----	----	0.0134	----	----	----	----	0.0185	----	----	----	----			
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
BEHI VL% / L% / M% / H% / V1H% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		

1 - Pre-Existing Condition measurement taken on existing sandbed riffle, As-Built measurement taken on constructed rock riffle

Table 10 continued. Baseline Stream Summary																													
Thomas Creek Restoration Project: DMS Project ID No. 96074																													
Reach 6 - Length 1,776 ft																													
Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built						
											Thomas Creek Site Upper Reach 4 (On-site)																		
		LL	UL	Eq	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	
<b>Dimension and Substrate - Rifle</b>																													
	BF Width (ft)	----	----	----	3.2	----	----	4.3	----	----	----	----	----	----	----	----	----	4.6	----	----	----	----	----	6.3	----	----	----	----	
	Floodprone Width (ft)	----	----	----	4.5	----	----	6.5	----	----	----	----	----	----	----	----	----	>9	----	----	----	----	----	19.4	----	----	----	----	
	BF Mean Depth (ft)	----	----	----	----	----	----	0.60	----	----	----	----	----	----	----	----	----	0.3	----	----	----	----	----	0.3	----	----	----	----	
	BF Max Depth (ft)	----	----	----	----	----	----	0.9	----	----	----	----	----	----	----	----	----	0.4	----	----	----	----	----	0.6	----	----	----	----	
	BF Cross-sectional Area (ft²)	----	----	----	1.8	----	----	2.5	----	----	----	----	----	----	----	----	----	1.5	----	----	----	----	----	2.1	----	----	----	----	
	Width/Depth Ratio	----	----	----	0.9	----	----	5.8	----	----	12.0	----	----	18.0	----	----	----	14.0	----	----	----	----	----	18.7	----	----	----	----	
	Entrenchment Ratio	----	----	----	1.4	----	----	1.5	----	----	1.4	----	----	2.2	----	----	----	>2.0	----	----	----	----	----	3.1	----	----	----	----	
	Bank Height Ratio	----	----	----	2.9	----	----	4.4	----	----	1.0	----	----	1.1	----	----	----	1.0	----	----	----	----	----	0.8	----	----	----	----	
	d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
<b>Pattern</b>																													
	Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Profile</b>																													
	Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	12.5	----	----	----	----	----
	Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.04	----	----	----	----	----	0.027	----	----	----	----	----
	Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	34.6	----	----	----	----
	Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.0	----	----	----	----	----	1.2	----	----	----	----	----
	Pool Volume (ft³)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Substrate and Transport Parameters</b>																													
	R7% / Ra% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Reach Shear Stress (competency) lb/ft²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Max part size (mm) mobilized at bankfull (Roggen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Stream Power (transport capacity) W/m²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Additional Reach Parameters</b>																													
	Drainage Area (SM)	----	----	----	0.019	----	----	0.050	----	----	----	----	----	----	----	----	----	----	0.05	----	----	----	----	----	0.05	----	----	----	
	Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	Roggen Classification	----	----	----	B5c	----	----	G5c	----	----	----	----	B5c	----	----	----	----	----	----	----	----	----	----	----	----	----	C5	----	
	BF Velocity (fps)	----	----	----	2.8	----	----	4.1	----	----	4	----	----	6	----	----	----	----	3.3	----	----	----	----	----	----	----	----	----	
	BF Discharge (cfs)	----	----	----	5.1	----	----	10.2	----	----	----	----	----	----	----	----	----	----	12	----	----	----	----	----	----	----	----	----	
	Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	201	----	----	----	----	
	Channel length (ft)	----	----	----	----	----	----	1,828	----	----	----	----	----	----	----	----	----	1,808	----	----	----	----	----	210	----	----	----	----	
	Similarity	----	----	----	----	----	----	1.13	----	----	1.10	----	----	1.30	----	----	----	1.05	----	----	----	----	----	1.04	----	----	----	----	
	Water Surface Slope (Channel) (ft/ft)	----	----	----	0.0148	----	----	0.0250	----	----	----	----	----	----	----	----	----	----	0.030	----	----	----	----	----	----	----	----	----	
	BF slope (ft/ft)	----	----	----	0.0250	----	----	0.0361	----	----	0.005	----	----	0.015	----	----	----	----	0.033	----	----	----	----	----	----	----	----	----	
	Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	BEHI VL% / L% / M% / H% / VHP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

1 - Pre-Existing Condition measurement taken on existing sandbed riffle

Table 10 continued. Baseline Stream Summary Thomas Creek Restoration Project: DMS Project ID No. 96074																												
Reach 7 - Length 647 ft																												
Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Thomas Creek Site Upper Reach 4 (On-site)																	
		LL	UL	Eq	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
<b>Dimension and Substrate - Rifle</b>																												
	BF Width (ft)	----	----	----	----	----	----	3.6	----	----	----	----	----	----	----	----	----	4.6	----	----	----	----	----	----	----	----	----	----
	Floodprone Width (ft)	----	----	----	----	----	----	5.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	BF Mean Depth (ft)	----	----	----	----	----	----	0.4	----	----	----	----	----	----	----	----	----	----	0.3	----	----	----	----	----	----	----	----	----
	BF Max Depth (ft)	----	----	----	----	----	----	0.6	----	----	----	----	----	----	----	----	----	----	0.4	----	----	----	----	----	----	----	----	----
	BF Cross-sectional Area (ft <sup>2</sup> )	----	----	----	----	----	----	1.6	----	----	----	----	----	----	----	----	----	----	1.5	----	----	----	----	----	----	----	----	----
	Width:Depth Ratio	----	----	----	----	----	----	8.4	----	----	12.0	----	----	18.0	----	----	----	----	14.0	----	----	----	----	----	----	----	----	----
	Entrenchment Ratio	----	----	----	----	----	----	1.5	----	----	1.4	----	----	2.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Bank Height Ratio	----	----	----	----	----	----	4.2	----	----	1.0	----	----	1.1	----	----	----	----	1.0	----	----	----	----	----	----	----	----	----
	d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Pattern</b>																												
	Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Profile</b>																												
	Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.0	----	----	----	----	----	----	----	----	----
	Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Substrate and Transport Parameters</b>																												
	R <sub>7</sub> % / Ra <sub>7</sub> % / P <sub>7</sub> % / G <sub>7</sub> % / S <sub>7</sub> %	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	d <sub>16</sub> / d <sub>35</sub> / d <sub>50</sub> / d <sub>84</sub> / d <sub>95</sub>	----	----	----	----	----	0.012 / 0.29 / 0.43 / 0.87 / 1.39	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Max part size (mm) mobilized at bankfull (Rosgen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
<b>Additional Reach Parameters</b>																												
	Drainage Area (SM)	----	----	----	----	----	0.022	----	----	----	----	----	----	----	----	----	----	----	0.022	----	----	----	----	----	----	----	0.022	
	Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	Rosgen Classification	----	----	----	----	----	B5	----	----	----	----	----	B5c	----	----	----	----	----	B5c	----	----	----	----	----	----	----	----	
	BF Velocity (fps)	----	----	----	----	3.6	----	----	----	----	4	----	----	6	----	----	----	----	3.33	----	----	----	----	----	----	----	----	
	BF Discharge (cfs)	----	----	----	----	----	5.7	----	----	----	----	----	----	----	----	----	----	----	5	----	----	----	----	----	----	----	----	
	Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	Channel length (ft)	----	----	----	----	----	646	----	----	----	----	----	----	----	----	----	----	----	646	----	----	----	----	----	----	----	----	
	Sinuosity	----	----	----	----	----	1.11	----	----	1.10	----	----	1.30	----	----	----	----	----	1.11	----	----	----	----	----	----	----	----	
	Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	0.025	----	----	----	----	----	----	----	----	----	----	----	0.032	----	----	----	----	----	----	----	----	
	BF slope (ft/ft)	----	----	----	----	----	0.036	----	----	0.005	----	----	0.015	----	----	----	----	----	0.036	----	----	----	----	----	----	----	----	
	Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	BEHI VL% / LS% / M% / H% / VEH% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	

1 - Pre-Existing Condition measurement taken on existing sandbed rifle



Table 10 continued. Baseline Stream Summary Thomas Creek Restoration Project: DMS Project ID No. 96074																														
Reach T1 - Length 227 ft																														
Parameter	USGS Gauge	Regional Curve				Pre-Existing Condition					Reference Reach(es) Data					Design					As-built									
											Thomas Creek Site Upper Reach 4 (On-site)																			
											Min	Mean	Med	Max	SD											n	Min	Mean	Med	Max
<b>Dimension and Substrate - Rifle</b>																														
BF Width (ft)	----	----	----	----	----	----	7.2	----	----	----	----	----	----	7.0	----	----	----	----	8.5	----	----									
Floodprone Width (ft)	----	----	----	----	----	----	10.8	----	----	----	----	----	----	----	----	----	----	----	30.6	----	----									
BF Mean Depth (ft)	----	----	----	----	----	----	0.4	----	----	----	----	----	----	0.6	----	----	----	----	0.6	----	----									
BF Max Depth (ft)	----	----	----	----	----	----	0.7	----	----	----	----	----	----	0.7	----	----	----	----	0.9	----	----									
BF Cross-sectional Area (ft <sup>2</sup> )	----	----	----	----	----	----	2.8	----	----	----	----	----	----	3.8	----	----	----	----	5.3	----	----									
Width/Depth Ratio	----	----	----	----	----	----	18.6	----	----	12.0	----	----	18.0	----	----	----	----	----	13.6	----	----									
Entrenchment Ratio	----	----	----	----	----	----	1.5	----	----	1.4	----	----	2.2	----	----	----	----	----	3.6	----	----									
Bank Height Ratio	----	----	----	----	----	----	2.6	----	----	1.0	----	----	1.1	----	----	----	----	----	1.0	----	----									
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
<b>Pattern</b>																														
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	32.5	----	----									
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	13.5	----	----	18.0	----	14.0	----	----									
Rc:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	2.0	----	2.6	----	----	1.7	----	----									
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	48.0	----	----									
Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3.8	----	----									
<b>Profile</b>																														
Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	14.7	----	----									
Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	0.0135	----	----	----	----	0.0113	----	----									
Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	25	----	42	----	----	41.2	----	----									
Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	1.4	----	----	----	----	1.4	----	----									
Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
<b>Substrate and Transport Parameters</b>																														
R <sub>2</sub> % / Ra <sub>2</sub> % / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
SC% / Sa% / G% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
<b>Additional Reach Parameters</b>																														
Drainage Area (SM)	----	----	----	----	----	----	0.077	----	----	----	----	----	----	----	----	0.077	----	----	----	0.077	----									
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Rosen Classification	----	----	----	----	----	----	B5c	----	----	----	----	B5c	----	----	----	B5c	----	----	----	C5	----									
BF Velocity (fps)	----	----	----	----	----	----	5.0	----	----	----	----	----	----	----	----	3.66	----	----	----	----	----									
BF Discharge (cfs)	----	----	----	----	----	----	14.0	----	----	----	----	----	----	----	----	13.9	----	----	----	----	----									
Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	218	----									
Channel length (ft)	----	----	----	----	----	----	242	----	----	----	----	----	----	----	----	253	----	----	----	227	----									
Sinuosity	----	----	----	----	----	----	1.09	----	1.10	----	1.30	----	----	----	1.16	----	----	----	----	1.04	----									
Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	0.0203	----	----	----	----	----	----	----	----	0.004	----	----	----	----	----									
BF slope (ft/ft)	----	----	----	----	----	----	0.0120	----	0.005	----	0.015	----	----	----	0.005	----	----	----	----	----	----									
Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
BEHI VL% / L% / M% / H% / VEH% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									

1 - Pre-Existing Condition measurement taken on existing sandbed riffle

Table 10 continued. Baseline Stream Summary																									
Thomas Creek Restoration Project: DMS Project ID No. 96074																									
Reach 12 - Length 157 ft																									
Parameter	USGS Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data					Design					As-built				
											Thomas Creek Site Upper Reach 4 (On-site)														
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n			
<b>Dimension and Substrate - Rifle</b>																									
	BF Width (ft)	----	----	----	----	----	----	2.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Floodprone Width (ft)	----	----	----	----	----	----	3.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Mean Depth (ft)	----	----	----	----	----	----	0.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Max Depth (ft)	----	----	----	----	----	----	0.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Cross-sectional Area (ft <sup>2</sup> )	----	----	----	----	----	----	0.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Width/Depth Ratio	----	----	----	----	----	----	5.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Entrenchment Ratio	----	----	----	----	----	----	1.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Bank Height Ratio	----	----	----	----	----	----	2.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Pattern</b>																									
	Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Rc-Bankfull width (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Profile</b>																									
	Rifle Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Rifle Slope (ft/ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Pool Length (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Pool to Pool Spacing (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Pool Volume (ft <sup>3</sup> )	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Substrate and Transport Parameters</b>																									
	Ri% / Ru% / P% / G% / S%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	SC% / Sa% / C% / B% / Be%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	d16 / d35 / d50 / d84 / d95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Reach Shear Stress (competency) lb/ft <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Max part size (mm) mobilized at bankfull (Roggen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Stream Power (transport capacity) W/m <sup>2</sup>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
<b>Additional Reach Parameters</b>																									
	Drainage Area (SM)	----	----	----	----	----	----	0.008	----	----	----	----	----	----	----	----	0.008	----	----	----	----	0.008			
	Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Roggen Classification	----	----	----	----	----	----	B5c	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Velocity (fps)	----	----	----	----	----	----	3.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Discharge (cfs)	----	----	----	----	----	----	2.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Valley Length	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Channel length (ft)	----	----	----	----	----	----	171	----	----	----	----	----	----	----	----	157	----	----	----	----	157			
	Simosity	----	----	----	----	----	----	1.17	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	----	0.0414	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF slope (ft/ft)	----	----	----	----	----	----	0.0417	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Bankfull Floodplain Area (acres)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BEHI VL% / L% / M% / H% / VHP% / E%	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Channel Stability or Habitat Metric	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Biological or Other	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			

1 - Pre-Existing Condition measurement taken on existing sandbed rifle

# **Appendix E**

## **Hydrologic Data**

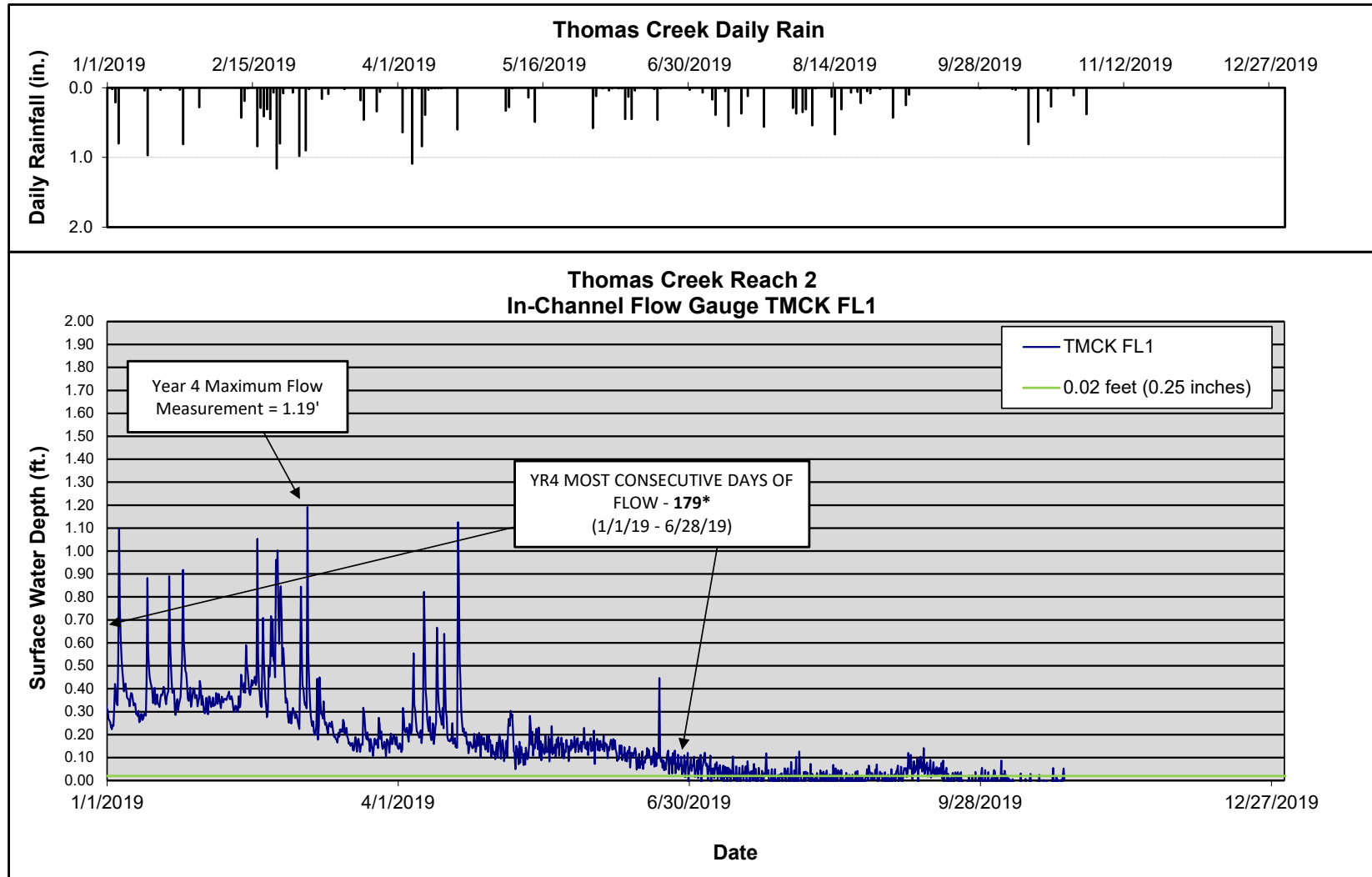


<b>Table 12. Verification of Bankfull Events</b>			
<b>Thomas Creek Restoration Project: DMS Project ID No. 96074</b>			
<b>Date of Data Collection</b>	<b>Reach 2 Crest Gauge (feet)</b>	<b>Estimated Occurrence of Bankfull Event</b>	<b>Method of Data Collection</b>
<b>Year 1 Monitoring (2016)</b>			
10/27/2016	1.1	10/8/2016 (Hurricane Matthew)	Crest Gauge
<b>Year 2 Monitoring (2017)</b>			
05/02/2017	0.21	4/25/2017 (3.2" rain event)	Crest Gauge
<b>Year 3 Monitoring (2018)</b>			
04/23/2018	0.97	4/15/2018 (1.8" rain event)	Crest Gauge
10/10/2018	1.49	9/15-17/2018 (6.1" from Hurricane Florence)	Crest Gauge
<b>Year 4 Monitoring (2019)</b>			
04/25/2019	0.89	4/19/2019 (0.71" rain event)	Crest Gauge

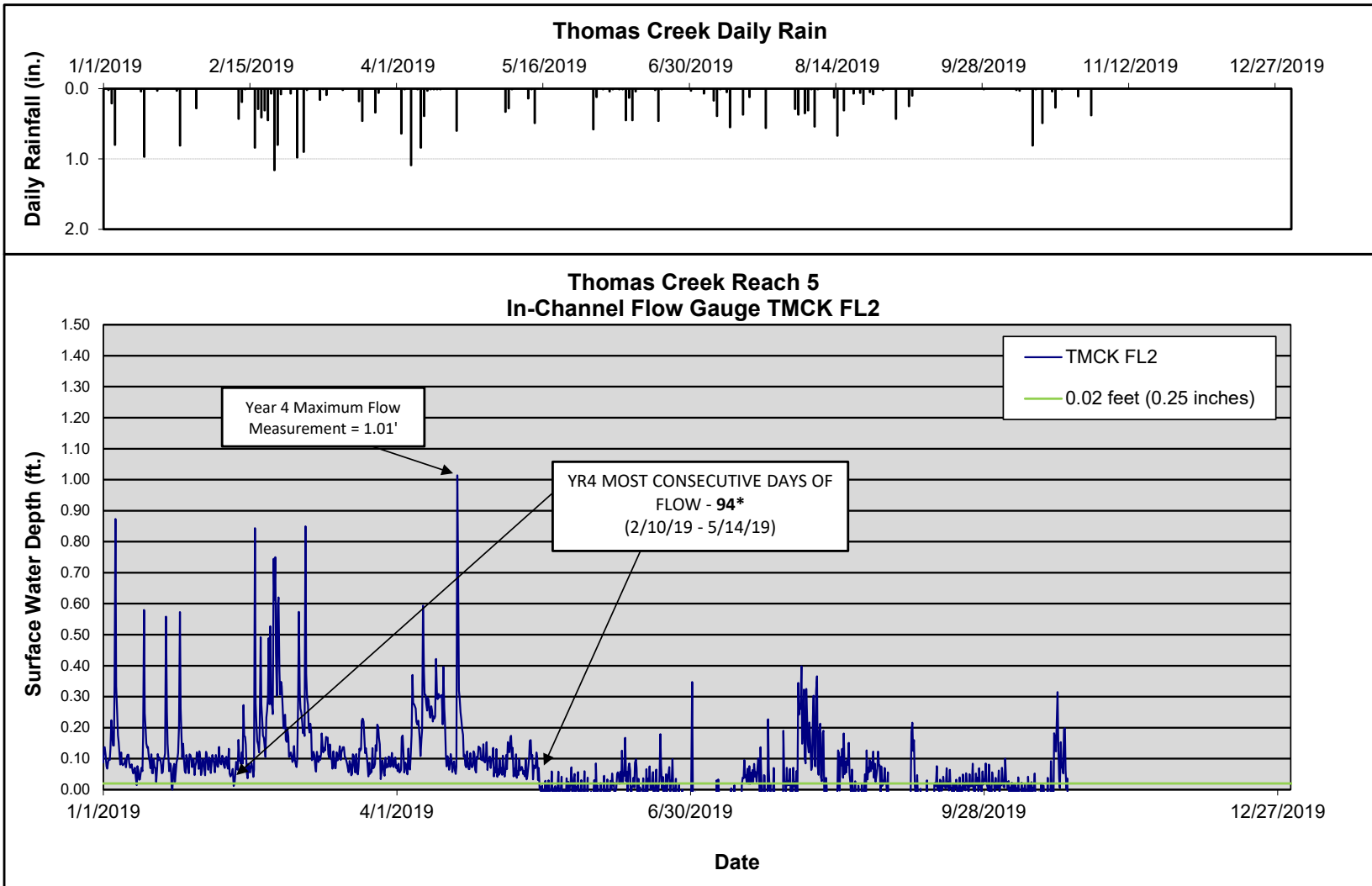
Note: Crest gauge readings can be corroborated with associated spikes in the flow gauge reading graphs (see Appendix E).

<b>Table 13. Flow Gauge Success</b>														
<b>Thomas Creek Restoration Project: DMS Project ID No. 96074</b>														
<b>Flow Gauge ID</b>	<b>Most Consecutive Days Meeting Criteria<sup>1</sup></b>							<b>Cumulative Days Meeting Criteria<sup>2</sup></b>						
	<b>Year 1 (2016)</b>	<b>Year 2 (2017)</b>	<b>Year 3 (2018)</b>	<b>Year 4 (2019)</b>	<b>Year 5 (2020)</b>	<b>Year 6 (2021)</b>	<b>Year 7 (2022)</b>	<b>Year 1 (2016)</b>	<b>Year 2 (2017)</b>	<b>Year 3 (2018)</b>	<b>Year 4 (2019)</b>	<b>Year 5 (2020)</b>	<b>Year 6 (2021)</b>	<b>Year 7 (2022)</b>
<b>Reach 2 Flow Gauge #1 (Installed March 30, 2016)</b>														
TCFL1	229	248	357	179				229	248	357	240			
<b>Reach 5 Flow Gauge #2 (Installed March 30, 2016)</b>														
TCFL2	126	138	82	94				182	218	204	191			
<b>Notes:</b>														
<sup>1</sup> Indicates the single greatest number of consecutive days within the monitoring year where flow was measured.														
<sup>2</sup> Indicates the total number of days within the monitoring year where flow was measured.														
Success Criteria: A restored stream reach will be considered at least intermittent when the flow duration occurs for a minimum of 30 consecutive days during the monitoring year.														
Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.02 feet (0.25 inches) in depth.														

**Figure 8. Flow Gauge Graphs**



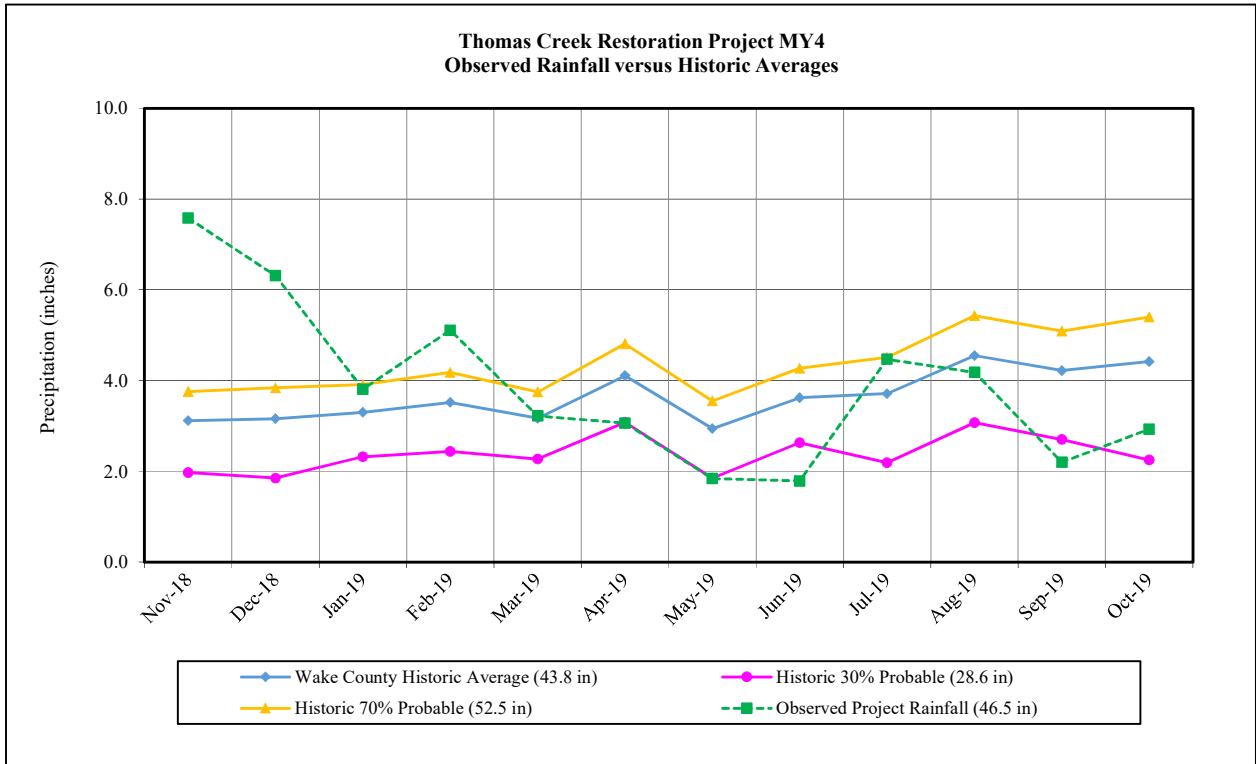
\* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.02 feet (0.25 inches) in depth.



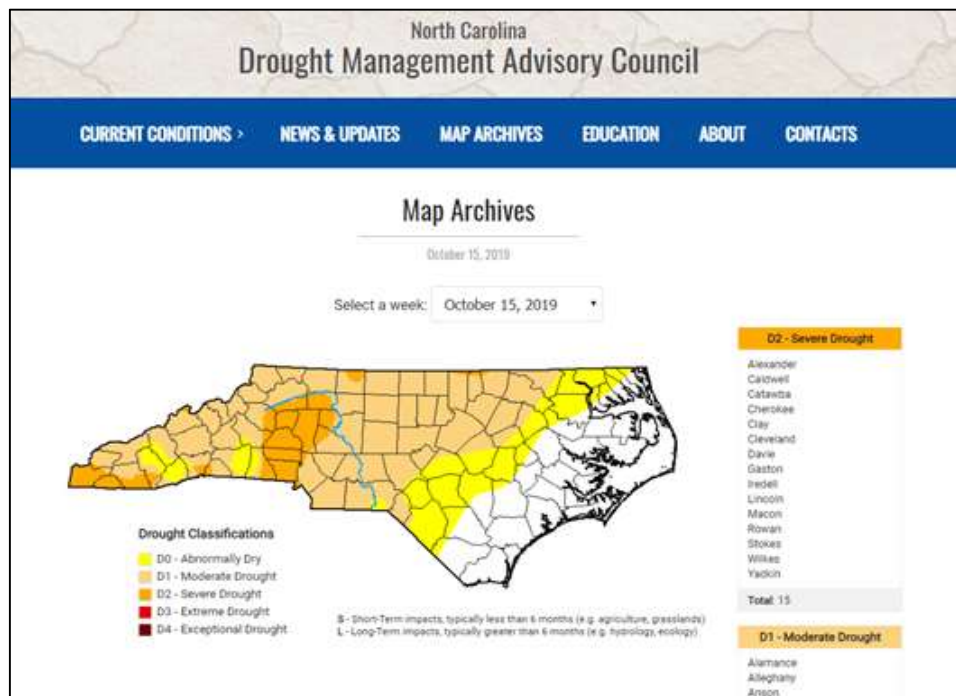
\* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.02 feet (0.25 inches) in depth.



Figure 9. Observed Rainfall Versus Historic Averages



Note: Historic average annual rainfall for Wake County is 43.8", while the observed project rainfall recorded a total of 46.5" over the previous 12 months (from 11/1/2018 to 10/31/2019). Project rainfall data was collected from the nearest NC-CRONOS station KTTA.



Note: The project site in Wake County did experience drought conditions throughout much of the summer and fall months resulting in a D1 - Moderate Drought as of October 15, 2019 ([www.ncdrought.org](http://www.ncdrought.org)).