FINAL

Town Creek Restoration Project – Option B
Year 1 Monitoring Report

Stanly County, North Carolina

DMS Project ID Number – 95026; NC DEQ Contract No. 003990

Yadkin Pee-Dee River Basin: 03040105060040

Project Info:	Monitoring Year: 1 of 5 Year of Data Collection: 2016 Year of Completed Construction: 2016 Submission Date: December 2017
Submitted To:	NCDEQ – Division of Mitigation Services 1625 Mail Service Center Raleigh, NC 27699 NCDEQ Contract ID No. 003990

Town Creek Restoration Project – Option B
Year 1 Monitoring Report

Stanly County, North Carolina
DMS Project ID Number – 95026; NC DEQ Contract No. 003990
SAW-2014-00016; DWR#14-1259 V2
Yadkin Pee-Dee River Basin: 03040105060040

Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1084

Michael Baker Engineering, Inc.
9716-B Rea Road #56,
Charlotte, NC 28277

TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 2,760 linear feet (LF) and enhanced approximately 943 LF of jurisdictional stream along UT to Town Creek. This report documents and presents the Year 1 monitoring data as required during the five-year monitoring period.

The primary restoration goals of the project are described below:

- Create geomorphically stable conditions along the channels,
- Enhance hydrologic connections between streams and the degraded riparian buffer and overall ecosystem functionality;
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.
- Improve terrestrial habitat and reduce sediment and nutrient loading to the project reaches and the Little Long Creek Watershed.

To accomplish these goals, the following objectives were identified:

- Restore existing incised, eroding, and channelized streams by creating a stable stream channel with access to its floodplain,
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion,
- Prevent cattle from accessing the project boundary by installing permanent fencing and thus reduce excessive bank erosion and undesired nutrient inputs,
- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, and shade the stream to decrease water temperature,
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period.

The Town Creek Restoration Project – Option B (Site) is located in Stanly County, approximately 1.5 miles west of the Town of New London, within cataloging unit 03040105 of the Yadkin Pee-Dee River Basin. The Site is located in a North Carolina Division of Mitigation Services (NCDMS) - Targeted Local Watershed (HUC 03040105060-040). Directions to the Project Site can be found in Figure 1 of Appendix A.

During Year 1 monitoring, the planted acreage performance categories were functioning at 100 percent with no bare areas or low stem density areas to report. No invasive species areas of concern, exceeding the mapping threshold were documented; however, individuals stems of *Ligustrum sinese* (Chinese privet) were noted within the easement. These areas were located predominantly in the areas of the easement not cleared during construction and where mature woody vegetation is present.

Based on data collected from the eight monitoring plots during Year 1 monitoring, the average density of total planted stems per plot ranges from 647 to 850 stems per acre with a tract mean of 754 stems per acre. Therefore, the Year 1 data demonstrate that the Site is on track for meeting the minimum success interim criteria of 320 trees per acre by the end of Year 3. Vegetation stem counts are summarized in Tables 7 and 9 of Appendix C.

The thirteen (13) permanent cross-sections located throughout the Site show minimal adjustment to stream dimension since construction. In addition, Tables 5a through 5f (Appendix B) indicate the Site has remained geomorphically stable with lateral/vertical stability and in-stream structure performance of 100% on all stream reaches and no noted areas of bank scour and/or erosion around structures. Visual observations and a review

of pebble count data collected indicated that stream is sufficiently moving fines through the system. Riffles are comprised of a mix of substrates with the bed material moving towards a mix of coarser substrates. Cross-sectional and pebble count data are provided in Figures 3 and 4, respectively, in Appendix D.

In-stream pressure transducers, TC FL1 and TC FL2, were installed on Reach 1 to document intermittent flow conditions throughout the monitoring year. Since post-construction installation, each gauge has documented at least one period of consecutive stream flow for the required minimum of 30 days, with a maximum of 168 consecutive days for TC FL1 and 150 consecutive days for TC FL2. Figures 5a and 5b in Appendix E, depict the documented flow conditions for each gauge from installation through Monitoring Year 1 relative to local rainfall data, while Table 13 documents both the total cumulative days of flow and the maximum number of consecutives days of flow.

Lastly at least one post-construction bankfull event occurred during MY1. Documentation of the event was recorded on 10/12/2016 and is located in Table 12 in Appendix E.

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 NCDMS' website. All raw data supporting the tables and figures in the appendices is available from NCDMS upon request.

2.0 METHODOLOGY

The five-year monitoring plan for the Site includes criteria to evaluate the success of the stream and vegetation components of the project. Monitoring methods used will follow the NCDMS Monitoring Report Template, Version 1.3 – 1/15/10 and are based on the design approaches and overall project goals. To evaluate success criteria associated with a geomorphically stable channel, hydrologic connectivity, and aquatic habitat diversity, geomorphic monitoring methods will be conducted for project reaches that involve Restoration and Enhancement Level I mitigation. The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations and crest gauges, are shown on the CCPV sheets found in Figure 2 of Appendix B.

Year 1 monitoring data were collected in October and November 2016. All visual site assessment data contained in Appendix B were collected on October 12, 2016. Vegetation data and plot photos were collected on November 10 and 12, 2016, respectively. Sediment data were collected on October 11 and 12, 2016.

Stream survey data were collected on November 3rd and certified on November 9th of 2016. Stream survey data were collected to meet the requirements for a topographic ground survey to the accuracy of Class C Vertical and Class A Horizontal (21 NCAC-56 section .1606) and was geo-referenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the Town Creek Restoration Project Option B's As-built Survey.

2.1 Stream Monitoring

Geomorphic monitoring of the Restoration and Enhancement Level I reaches will be conducted once a year for a minimum of five years following the completion of construction. These activities will evaluate the success criteria associated with a geomorphically stable channel, hydrologic connectivity, and aquatic habitat diversity. The stream parameters to be monitored include stream dimension (cross-sections), pattern (planimetric survey), profile (longitudinal profile survey), visual observation with photographic documentation, and documentation of bank full events. Additionally, monitoring methods for all reaches will include those described under Photo Documentation of Site, Visual Assessment, and Vegetation Monitoring. The methods used and related success criteria are described below for each parameter. Figure 2 shows approximate locations of the proposed monitoring devices throughout the project site.

2.1.1 Morphologic Parameters and Channel Stability

2.1.1.1 Dimension

A total of thirteen (13) permanent cross-sections, nine (9) riffles and four (4) pools, were installed throughout the entire project area. Cross-sections selected for monitoring included representative riffle and pool facets for each of the three project reaches, Reach 2, 3, and 5, which implemented at least 500 linear feet of Restoration or Enhancement I activities.

Each cross-section was marked on both banks with permanent pins to establish the exact transect used. A common benchmark was also chosen to consistently reference and facilitate the comparison of year-to-year data. The cross-sectional surveys are conducted annually and include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER). The monitoring survey includes points measured at all breaks in slope, including top of stream banks, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections are classified using the Rosgen Stream Classification System (Rosgen, 1994), and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

There should be little change in annual cross-sectional surveys from those collected during the post-construction as-built survey. If changes do take place, they will be evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sectional data is presented in Figure 3 of Appendix D.

2.1.1.2 Longitudinal Profile

A longitudinal profile was surveyed for the entire length of channel immediately after construction to document as-built baseline conditions for the first year of monitoring only. The survey was tied to a permanent benchmark and measurements included thalweg, water surface, bankfull, and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth. Yearly longitudinal profiles will not be conducted during subsequent monitoring years unless channel instability has been documented or remedial actions/repairs are required by the USACE or NCDMS.

2.1.1.3 Substrate and Sediment Transport

After construction, there should be minimal change in the pebble count data over time given the current watershed conditions and sediment supply regime. A substrate sample was collected for each riffle cross-sections where constructed riffles were installed (X1, X4, X5, X7, X9, X10, and X12). Samples collected combined with evidence provided by changes in cross-sectional data and visual assessments will reveal changes in sediment gradation that occur over time as the stream adjusts to upstream sediment loads. Significant changes in sediment gradation were evaluated with respect to stream stability and watershed changes. Bed material distribution data are located in Figure 4 of Appendix D.

2.1.2 Stream Hydrology

2.1.2.1 Bankfull Events

The occurrence of bankfull events within the monitoring period were documented by the use of a crest gauge and photographs. The crest gauge will record the highest watermark between site visits, and the gauge will be checked at each site visit to determine if a bankfull event has occurred. The crest gauge was installed the floodplain of Reach 5 within ten feet (horizontal) of the restored channel. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented within a five-year monitoring period. The two bankfull events must occur in separate years; otherwise, the monitoring will continue until two bankfull events have been documented in separate years to demonstrate a floodplain connection has been restored.

2.1.2.2 Flow Documentation

A combination of photographic and flow gauge data were collected from two in-stream pressure transducers (TC FL1 and TC FL2) and a remote in-field camera that were installed on Reach 1. Collected data will document that the restored intermittent stream system continues to exhibit base flow for of at least 30 consecutive days throughout each monitoring year under normal climatic conditions. In order to determine if rainfall amounts were normal for the given year, rainfall gauge data was obtained from the nearest Stanly County weather station (CRONOS Database, NEWL – North Stanly Middle School, if available) and compared to the average monthly rainfall amounts from the Stanly County WETS Table (USDA, 2016). If a normal year of precipitation does not occur during the first five years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year.

Flow data and photographic documentation collected during Year 1 monitoring are located in Appendix E.

2.1.3 Photographic Documentation of Site

Photographs were used to document restoration success visually. Reference stations and cross-section photos were photographed during the as-built survey; this will be repeated for at least five years following construction. Reference photos were taken once a year, from a height of approximately five to six feet. Permanent markers ensure that the same locations (and view directions) are utilized during each monitoring period. Photographers will make an effort to consistently maintain the same area in each photo over time. Selected site photographs are shown in Appendix B for reference stations and Appendix D for cross-sections.

2.1.3.1 Lateral Reference Photos

Reference photo transects were taken of the right and left banks at each permanent cross-section. A survey tape was captured in most photographs which represents the cross-section line located perpendicular to the channel flow. The water line was located in the lower edge of the frame in order to document bank and riparian conditions.

2.1.3.2 Longitudinal Station Photos

Stream reaches were photographed longitudinally beginning at the upstream portion of the Site and moving downstream. Photographs were taken looking both upstream and downstream at delineated locations throughout the restored stream valley. The photograph points were established close enough together to provide an overall view of the reach lengths, primary grade control structures, and valley crenulations. The angle of the photo depends on what angle provides the best view was noted and will be continued in future photos. Site photographs are located in Appendix B.

2.1.4 Visual Assessment

Visual monitoring assessments of all stream sections will be conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs will be used to document system performance and any areas of concern related to stream bank stability, condition of in-stream structures, channel migration, aggradation/degradation, headcuts, live stake mortality, impacts from invasive plant species or animal species, floodplain vegetative conditions, and condition of pools and riffles. The photo locations will be shown on a plan view map and descriptions will be documented in as either stream problem areas (SPAs) or vegetative problem areas (VPAs) in there associated monitoring assessment tables located in Appendix B.

2.2 Vegetation Monitoring

In order to determine if the criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the CVS-NCEEP Protocol for Recording Vegetation, Version 4.0 (2006). The vegetation monitoring plots are a minimum of 2 percent of the planted portion of the site with eight plots established randomly within the planted riparian buffer areas. No monitoring quadrants were established within the undisturbed wooded areas of the project area. The size of individual quadrants are 100 square meters for woody tree species.

Level 1 CVS vegetation monitoring was conducted between spring, after leaf-out has occurred, and fall prior to leaf fall. Individual quadrant data provided during subsequent monitoring events will include species composition, density, survival, and stem height. Relative values were calculated, and importance values were determined. Individual seedlings were marked to ensure that they can be found in succeeding monitoring years. Mortality was determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

The interim measure of vegetative success for the site is the survival of at least 320, 3-year old, planted trees per acre at the end of Year 3 of the monitoring period. The final vegetative success criteria is the survival of 260, 5-year old, planted trees per acre at the end of Year 5 of the monitoring period.

Photographs were used to visually document vegetation success in sample plots and are located in Appendix C.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (formerly NC Ecosystem Enhancement Program). 2012. CVS-NCEEP Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2006. CVS-NCEEP Protocol for Recording Vegetation, Version 4.0.

North Carolina Division of Mitigation Services (formerly NC Ecosystem Enhancement Program). 2010. Procedural Guidance and Content Requirements for EEP Monitoring Reports, v. 1.30, dated 1/15/10. Raleigh, NC.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

State Climate Office of North Carolina, 2016. CRONOS Database, North Stanly Middle School (NEWL), Stanly County, NC. http://climate.ncsu.edu/cronos/?station=NEWL&temporal=sensormeta

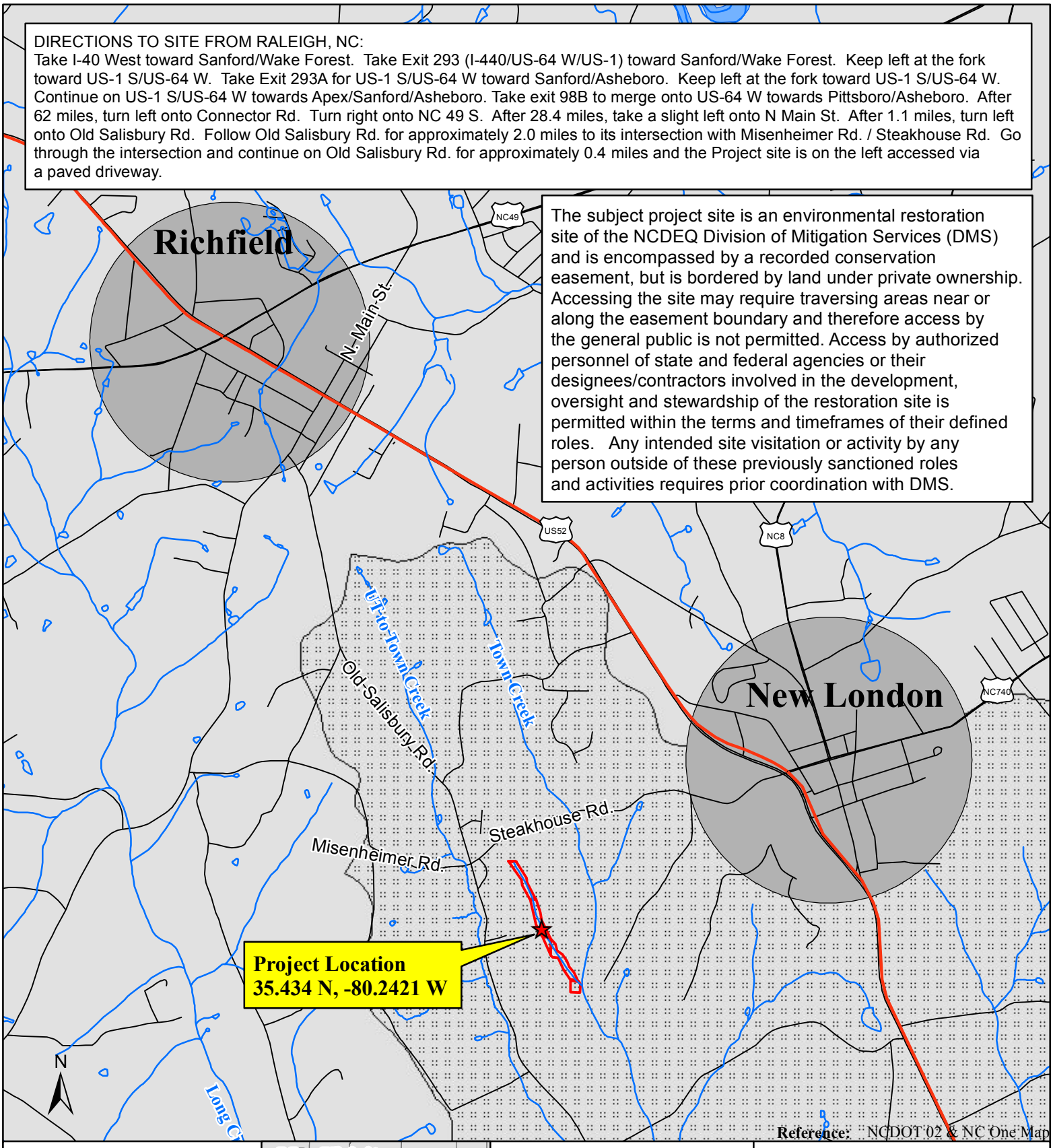
United States Department of Agriculture, 2016. WETS Table. Climate Data for Stanly County, NC. Wets Station: Albemarle, NC 0090, FIPS: 37167, 1971 - 2000. http://agacis.rcc-acis.org/37167/wets

APPENDIX A

Project Vicinity Map and Background Tables

DIRECTIONS TO SITE FROM RALEIGH, NC:
Take I-40 West toward Sanford/Wake Forest. Take Exit 293 (I-440/US-64 W/US-1) toward Sanford/Wake Forest. Keep left at the fork toward US-1 S/US-64 W. Take Exit 293A for US-1 S/US-64 W toward Sanford/Asheboro. Keep left at the fork toward US-1 S/US-64 W. Continue on US-1 S/US-64 W towards Apex/Sanford/Asheboro. Take exit 98B to merge onto US-64 W towards Pittsboro/Asheboro. After 62 miles, turn left onto Connector Rd. Turn right onto NC 49 S. After 28.4 miles, take a slight left onto N Main St. After 1.1 miles, turn left onto Old Salisbury Rd. Follow Old Salisbury Rd. for approximately 2.0 miles to its intersection with Misenheimer Rd. / Steakhouse Rd. Go through the intersection and continue on Old Salisbury Rd. for approximately 0.4 miles and the Project site is on the left accessed via a paved driveway.

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.

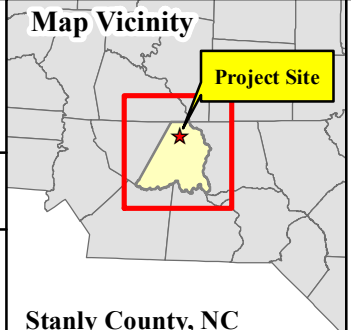


Michael Baker INTERNATIONAL

2017

0 1,500 3,000 Feet

1" = 3000'



LEGEND

- Streams
- Project Boundary
- US Highways
- Roads
- Major Waterways
- Municipalities
- Yadkin (03040105060-040)

Figure 1. Vicinity Map

Town Creek Restoration Site - Option B

Stanly County, NC

NC DMS Project No. 95026
NC DEQ Contract No. 003990

Table 1. Project Mitigation Components
Town Creek Restoration Project - Option B: DMS Project No ID. 95026

Project Component (reach ID, etc.)	Wetland Position and Hydro Type	Existing Footage or Acreage	Stationing	Restored Footage, Acreage, or SF	Creditable Footage, Acreage, or SF	Restoration Level	Approach		Mitigation Credits	Notes/Comments
							Priority Level	Mitigation Ratio (X:1)		
Reach 1		363	10+33 - 13+50	317	317	R	PI	1	317	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Reach 2		737	13+50 - 20+61	711	711	EI	PIII	1.5	474	Dimension and Profile modified in keeping with reference, Planted Buffer, Livestock Exclusion, Permanent Conservation Easement. A 26-ft culverted farm road crossing was implemented between Reach 2 and Reach 3 from Station 20+61 - 20+87.
Reach 3		1,849	20+87 - 37+08	1,621	1,621	R	PI	1	1,621	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Reach 4		234	37+08 - 39+40	232	232	EI	PIII	1.5	155	Dimension and Profile modified in keeping with reference, Planted Buffer, Livestock Exclusion, Permanent Conservation Easement.
Reach 5		849	39+40 - 47+87	847	822	R	PI	1	822	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement and a 27-ft culverted farm road crossing.
Wetland Group 1 (WG1)										
Wetland Group 2 (WG2)										
Buffer Group 1 (BG1)										
Buffer Group 2 (BG2)										
Buffer Group 3 (BG3)										

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	2,760				
Enhancement					
Enhancement I	943				
Enhancement II					
Creation					
Preservation					
High Quality Pres					

Overall Assets Summary

Asset Category	Overall Credits
Stream	**3,389**

General Note - The above component table is intended to be a close complement to the asset map. Each entry in the above table should have clear distinction and appropriate symbology in the asset map.

1 - **Wetland Groups** represent pooled wetland polygons in the map with the same wetland type and restoration level. If some of the wetland polygons within a group are in meaningfully different landscape positions, soil types or have different community targets (as examples), then further segmentation in the table may be warranted. **Buffer groups** represent pooled buffer polygons with common restoration levels.

2 - **Wetland Position and Hydro Type** - Indicates Riparian Riverine, (RR) , riparinan non-riverine (RNR) or Non-Riverine (NR)

3- **Restored** Footage, Acreage or Square Feet (SF)

4 - **Creditible Footage**, Acreage or Square feet - creditible anounts after exclusion and reductions are accounted for, such as utility impacts, crossings, single

* Stream assests are based on the stream length from the As-Built survey. Since the As-Built survey stream lengths exceeded the anticipated design lengths, the stream assets exceeded that of the proposed assests listed in the Mitigation Plan.

Table 2. Project Activity and Reporting History
Town Creek Restoration Project - Option B: DMS Project No ID. 95026

Elapsed Time Since Grading/Planting Complete: 11 Months
Number of Reporting Years: 1

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	N/A	N/A	Aug-14
Mitigation Plan Amended	N/A	N/A	Oct-14
Mitigation Plan Approved	N/A	N/A	Feb-15
Final Design – (at least 90% complete)	N/A	N/A	Feb-15
Construction Begins	N/A	N/A	Oct-15
Temporary S&E mix applied to entire project area	N/A	N/A	Jan-16
Permanent seed mix applied to entire project area	Feb-16	N/A	Jan-16
Planting of live stakes	Feb-16	N/A	Mar-16
Planting of bare root trees	Feb-16	N/A	Mar-16
End of Construction	Feb-16	N/A	Jan-16
Survey of As-built conditions (Year 0 Monitoring-baseline)	Apr-16	May-16	Jun-16
Baseline Monitoring Report	May-16	Jun-16	Nov-16
Year 1 Monitoring	Dec-16	Dec-16	Jan-17
Year 2 Monitoring	Dec-17	N/A	N/A
Year 3 Monitoring	Dec-18	N/A	N/A
Year 4 Monitoring	Dec-19	N/A	N/A
Year 5 Monitoring	Dec-20	N/A	N/A

Table 3. Project Contacts **Town Creek Restoration Project - Option B: DMS Project ID No. 95026**	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Road, Suite 201 Asheville, NC 28806 Contact: Jake Byers, PE, Tel. 828-412-6101
Construction Contractor	
Wright Contracting, LLC.	160 Walker Road Lawndale, NC 28090 Contact: Joe Wright, Tel. 919-663-0810
Planting Contractor	
H.J. Forest Service	P.O. Box 458 Holly Ridge, NC 28445 Contact: Matt Hitch, Tel. 910-512-1743
Seeding Contractor	
Wright Contracting, LLC.	160 Walker Road Lawndale, NC 28090 Contact: Joe Wright, Tel. 919-663-0810
Seed Mix Sources	Green Resources, Tel. 336-855-6363 Mellow Marsh Farm, Tel. 919-742-1200
Nursery Stock Suppliers	Mellow Marsh Farm, Tel. 919-742-1200 Foggy Mountain Nursery, Tel. 336-384-5323 ArborGen, Tel. 843-528-3203
Monitoring Performers	
Michael Baker Engineering, Inc.	9716-B Rea Road, #56 Charlotte, NC 28277 Contact:
Stream Monitoring Point of Contact	Kristi Suggs, Tel. 704-665-2206
Vegetation Monitoring Point of Contact	Kristi Suggs, Tel. 704-665-2206

Table 4. Project Attributes
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Project Information					
Project Name	Town Creek Restoration Project - Option B				
Project County	Stanly				
Project Area (Acres)	11.97				
Project Coordinates	35.434 N, -80.2421 W				
Project Watershed Summary Information					
Physiographic Region	Piedmont				
Ecoregion	Carolina Slate Belt				
Project River Basin	Yadkin - Pee Dee				
USGS Hydrologic Unit Code 8- and 14-digit	03040105 / 03040105060-040				
NCDWR Sub-basin for Project	03-07-13				
Project Drainage Area (Acres)	134.8				
Project Drainage Area Percent Impervious	<5%				
CGIA Land Use Classification	2.01, 412 / Forest (40%) Agriculture (25%) Impervious Cover (7%)				
Within Extent of DMS Watershed Plan	Lower Yadkin RBRP, 2009				
WRC Class (Warm Cool Cold)	Warm				
% Project Easement Fenced/Demarcated	100%				
Beaver activity observed during design phase	No activity observed				
Reach Summary Information					
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**
Restored Length of Reach (LF)	317	711	1,621	232	822
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	59.8	77.8	115.6	119.4	134.8
NCDWR Stream Identification Score	27.25	27.25 - 32.0	32	32	32
NCDWR Water Quality Classification	C, Index #: 13-17-31-1-1				
Existing Morphological Description (Rosgen stream type)	E4b: Incised, unstable & straight	E4 : Incised, unstable & straight	C4: variable; unstable	E4: Incised & unstable	C4 and E4: Incised & straight
Evolutionary Trend	Eb→G→B	E→G→F→Bc	C→G→F→C	E→Gc→F→C	C→Gc→F→C
As-built Morphological Description (Rosgen stream type)	C4	C4	C4	C4	C4
Underlying Mapped Soils	BaD	BaD, BaF	BaF	BaF	OaA
Drainage Class	Well drained	Well drained	Well drained	Well drained	Moderately well drained
Soil Hydric Status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Hydric
Average Channel Slope (ft/ft)	0.0181	0.0180	0.0122	0.0120	0.0128
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	0%	0%	0%	0%	0%
Regulatory Considerations					
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**		
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion		
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion		
Endangered Species Act	Yes	Yes	Categorical Exclusion		
Historic Preservation Act	Yes	Yes	Categorical Exclusion		
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion		
FEMA Floodplain Compliance	No	N/A	Categorical Exclusion		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion		

APPENDIX B

Visual Assessment Data

Fig 2A

Reach 1
(Restoration)

Reach 2
(Enhancement I)

Reach 3
(Restoration)

Fig 2B

Reach 4
(Enhancement I)

Reach 5
(Restoration)

Type

- In-Stream Pressure Transducer
- Crest Gauge
- Photo Points
- Reach Boundary
- Station Markers
- Successful Vegetation Plots
- Cross Section - Pool
- Cross Section - Riffle
- Preexisting Channel
- Stream Top of Bank
- Stream Centerline
- Fencing
- Conservation Easement

NC 911 Board, NCCGIA, NCDOT

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

0 125 250 500 Feet

N

Figure Overview
Current Condition Plan View
Town Creek Restoration Project - Option B
Stanly County, NC

DMS Project No. 95026
Baker Project No. 124526
Date: 2017
Monitoring Year: 1 of 5
Drawn By: RWM
Sheet: 1 of 3

Reach 1 (Restoration)

Reach 2 (Enhancement I)

Reach 3 (Restoration)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00

XS-1 XS-2 XS-3 XS-4 XS-5 XS-6 XS-7

1 2 3 4 5 6

- Station Markers
- In-Stream Pressure Transducer
- Reach Boundary
- Photo Points
- Successful Vegetation Plots
- Cross Section - Pool
- Cross Section - Riffle
- Structures
- Preexisting Channel
- Stream Top of Bank
- Stream Centerline
- Fencing
- Conservation Easement

NC 911 Board, NCCGIA, NCDOT

Michael Baker INTERNATIONAL

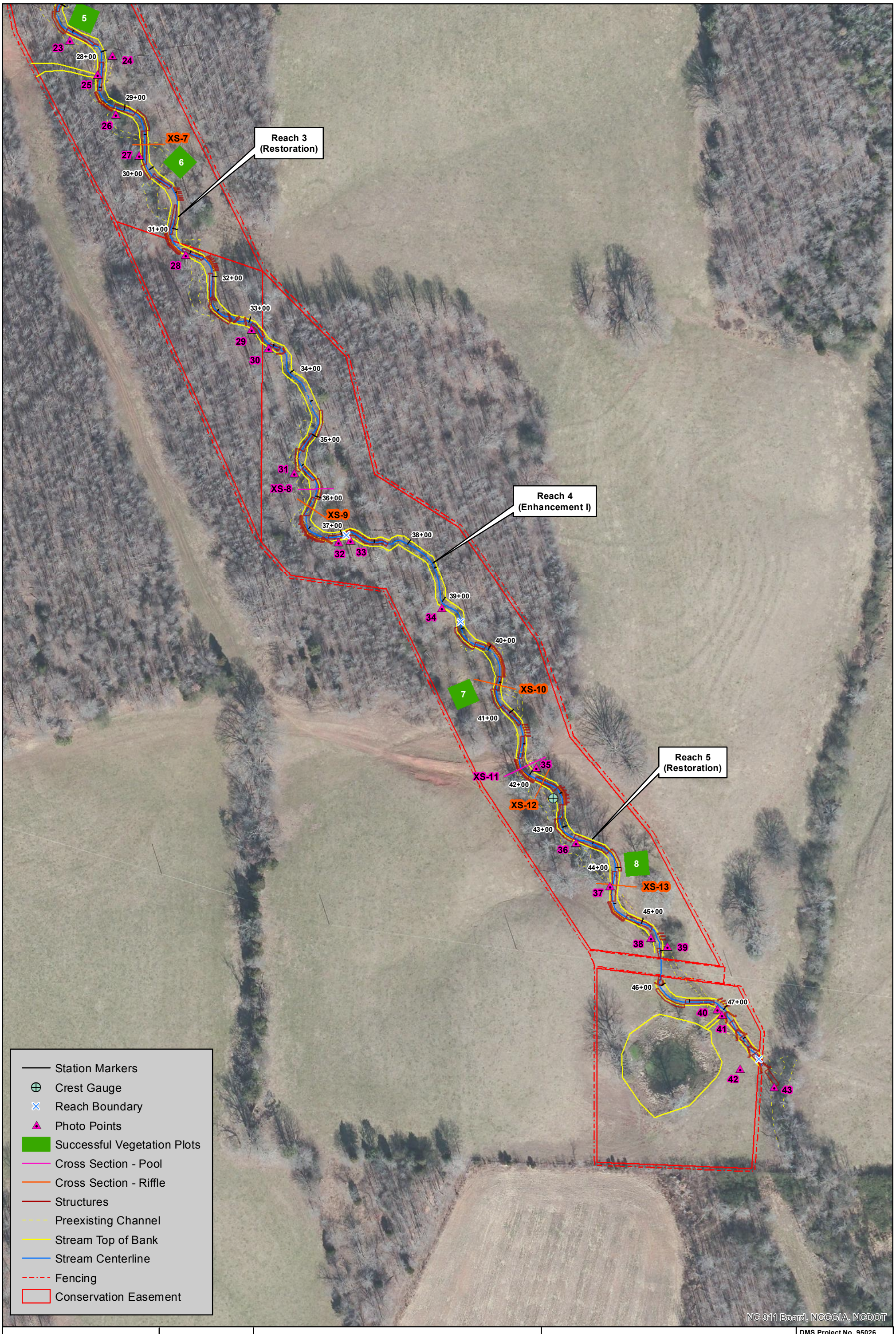
North Carolina Division of Mitigation Services

0 75 150 300 Feet

N

Figure 2A
Current Condition Plan View
Town Creek Restoration Project - Option B
Stanly County, NC

DMS Project No. 95026
Baker Project No. 124526
Date: 2017
Monitoring Year: 1 of 5
Drawn By: RWM
Sheet: 2 of 3



Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

0 75 150 300 Feet

N

Figure 2B
Current Condition Plan View
Town Creek Restoration Project - Option B
Stanly County, NC

DMS Project No. 95026
Baker Project No. 124526
Date: 2017
Monitoring Year: 1 of 5
Drawn By: RWM
Sheet: 3 of 3

Table 5a. Visual Stream Morphology Stability Assessment
Town Creek Restoration Project - Option B: Project No. 95026

Reach ID	**Town Creek - Reach 1**
Assessed Length (LF)	**317**

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			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	8	8			100%			
	3. Pool Condition	1. Depth	9	9			100%			
		2. Length	9	9			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	8	8			100%			
		2. Thalweg centering for pool/glide	9	9			100%			
2. Bank	**1. Scoured /Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	12	12			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	12	12			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	10	10			100%			

Table 5b. Visual Stream Morphology Stability Assessment
Town Creek Restoration Project: Project No. 95026

Reach ID	**Town Creek - Reach 2**
Assessed Length (LF)	**711**

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			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	21	21			100%			
	3. Pool Condition	1. Depth	20	20			100%			
		2. Length	20	20			100%			
	4. Thalweg position	1. Thalweg centering for riffle/run	21	21			100%			
		2. Thalweg centering for pool/glide	20	20			100%			
2. Bank	**1. Scoured /Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	20	20			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	20	20			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	20	20			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	20	20			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	20	20			100%			

Table 5c. Visual Stream Morphology Stability Assessment
Town Creek Restoration Project: Project No. 95026

Reach ID	**Town Creek - Reach 3**
Assessed Length (LF)	**1,621**

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			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	32	32			100%			
	3. Pool Condition	1. Depth	32	32			100%			
		2. Length	32	32			100%			
	4. Thalweg position	1. Thalweg centering for riffle/run	32	32			100%			
		2. Thalweg centering for pool/glide	32	32			100%			
2. Bank	**1. Scoured /Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	66	66			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	15	15			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	66	66			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	15	15			100%			

Table 5d. Visual Stream Morphology Stability Assessment
Town Creek Restoration Project: Project No. 95026

Reach ID	**Town Creek -Reach 4**
Assessed Length (LF)	**232**

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			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	4	4			100%			
	3. Pool Condition	1. Depth	4	4			100%			
		2. Length	4	4			100%			
	4. Thalweg position	1. Thalweg centering for riffle/run	4	4			100%			
		2. Thalweg centering for pool/glide	4	4			100%			
2. Bank	**1. Scoured /Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	0	0			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	0	0			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	0	0			N/A			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	0	0			N/A			

Table 5e. Visual Stream Morphology Stability Assessment
Town Creek Restoration Project: Project No. 95026

Reach ID	**Town Creek -Reach 5**
Assessed Length (LF)	**822**

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			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate	18	18			100%			
	3. Pool Condition	1. Depth	16	16			100%			
		2. Length	16	16			100%			
	4. Thalweg position	1. Thalweg centering for riffle/run	18	18			100%			
		2. Thalweg centering for pool/glide	16	16			100%			
2. Bank	1. Scoured/ Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	31	31			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	5	5			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	31	31			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	5	5			100%			

Table 5f. Stream Problem Areas
Town Creek Restoration Project: Project No. 95026

Town Creek Reach 1			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 1	N/A	N/A	N/A
Town Creek Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 1	N/A	N/A	N/A
Town Creek Reach 3			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 1	N/A	N/A	N/A
Town Creek Reach 4			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 1	N/A	N/A	N/A
Town Creek Reach 5			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 1	N/A	N/A	N/A

Note: The first digit in the Photo Number column references the monitoring year and the second digit references the problem area or photo (which would be identical to a prior years problem area/photo number when persisting from a previous monitoring year).

Table 6a. Vegetation Condition Assessment
Town Creek Restoration Project: Project No. 95026

Reach ID	**Reaches 1 - 5**
Planted Acreage	**10.73**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	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 acres	N/A	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage	**11.97**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	NA	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	N/A	N/A	0	0.00	0.0%

Table 6b. Vegetation Problem Areas Town Creek Restoration Project: Project No. 95026			
Reach 1			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	N/A	N/A	-
Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	N/A	N/A	-
Reach 3			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	N/A	N/A	-
Reach 4			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	N/A	N/A	-
Reach 5			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Invasive/Exotic Populations	N/A	N/A	-

*Note: The first digit in the Photo Number column references the monitoring year and the second digit references the problem area or photo (which would be identical to a prior years problem area/photo number when persisting from a previous monitoring year).

PID 1: Station 10+40 – Upstream (10/12/16)

PID 2: Station 10+60 – Downstream (10/12/16)

PID 3: Station10+70 – Left Floodplain Rock Lined Channel (10/12/16)

PID 4: Station 11+25 – Downstream (10/12/16)

PID 5: Station 12+20 – Downstream (10/12/16)

PID 6: Station 13+60 – Upstream (10/12/16)

PID 7: Station 13+75 – Downstream (10/12/16)

PID 8: Station 14+65 – Left Floodplain Matted Drainage Swale (10/12/16)

PID 9: Station 14+65 – Downstream (10/12/16)

PID 10: Station 16+15 – Upstream (10/12/16)

PID 11: Station 16+90 – Upstream (10/12/16)

PID 12: Station 17+75 – Upstream (10/12/16)

PID 13: Station 18+75 – Upstream (10/12/16)

PID 14: Station 19+25 – Upstream (10/12/16)

PID 15: Station 20+50 – Downstream (10/12/16)

PID 16: Station 20+70 – Upstream (10/12/16)

PID 17: Station 21+75 – Upstream (10/12/16)

PID 18: Station 23+30 – Upstream (10/12/16)

PID 19: Station 23+60 – Upstream (10/12/16)

PID 20: Station 23+60 – Left Bank (10/12/16)

PID 21: Station 24+50 – Upstream (10/12/16)

PID 22: Station 25+50 – Upstream (10/12/16)

PID 23: Station 27+50 – Upstream (10/12/16)

PID 24: Station 28+10 – Upstream (10/12/16)

PID 25: Station 28+35 – Right Floodplain Rock Lined Channel (10/12/16)

PID 26: Station 28+90 – Upstream (10/12/16)

PID 27: Station 29+80 – Downstream (10/12/16)

PID 28: Station 31+40 – Upstream (10/12/16)

PID 29: Station 33+00 – Upstream (10/12/16)

PID 30: Station 33+45 – Downstream (10/12/16)

PID 31: Station 35+50 – Upstream (10/12/16)

PID 32: Station 36+90 – Upstream (10/12/16)

Town Creek – Reach 4

PID 33: Station 37+15–Downstream (10/12/16)

PID 34: Station 39+05 – Upstream (10/12/16)

PID 35: Station 42+00 – Downstream (10/12/16)

PID 36: Station 43+25 – Downstream (10/12/16)

PID 37: Station 44+25 – Downstream (10/12/16)

PID 38: Station 45+30 Downstream (10/12/16)

PID 39: Station 45+50 – Upstream (10/12/16)

PID 40: Station 46+90 – Upstream (10/12/16)

PID 41: Station 47+00 – Right Floodplain Rock Lined Channel from Wetland (10/12/16)

PID 42: Station 47+75 – Upstream (10/12/16)

PID 43: Station 48+05 – Downstream (10/12/16)

APPENDIX C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
Town Creek Restoration Project: Project No. 95026

Wetland/Stream Vegetation Totals (per acre)				
Plot #	**Stream/ Wetland Stems[1]**	**Volunteers[2]**	**Total[3]**	**Success Criteria Met?**
VP1	728	0	728	Yes
VP2	850	0	850	Yes
VP3	769	0	769	Yes
VP4	769	0	769	Yes
VP5	850	0	850	Yes
VP6	728	0	728	Yes
VP7	688	0	688	Yes
VP8	647	0	647	Yes
Project Avg	**754**	**0**	**754**	**Yes**

[1]Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines

[2]Native woody stems. Not planted. No vines.

[3]Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Table 8. CVS Vegetation Plot Metadata Town Creek Restoration Project: Project No. 95026	
Report Prepared By	Russell Myers
Date Prepared	11/18/2016 10:16
database name	124526_TownCreek_cvs-eep-entrytool-v2.3.1.mdb
database location	C:\Users\Russell.Myers\Desktop\UT and Town CVS
computer name	ASHELCTOMSIC
file size	58146816
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95026
project Name	Town Creek Restoration Project - Option B
Description	
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	8

Table 9. CVS Stem Count of Planted Stems by Plot and Species
Town Creek Restoration Project: Project No. 95026

			Current Plot Data (MY1 2016)														
Scientific Name	**Common Name**	**Species Type**	**95026-01-VP1**			**95026-01-VP2**			**95026-01-VP3**			**95026-01-VP4**			**95026-01-VP5**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Asimina triloba	pawpaw	Tree															
Betula nigra	river birch	Tree	2	2	2							1	1	1			
Callicarpa americana	American beautyberry	Shrub				2	2	2									
Carpinus caroliniana	American hornbeam	Tree							2	2	2						
Cercis canadensis	eastern redbud	Tree													7	7	7
Cornus amomum	silky dogwood	Shrub				4	4	4	5	5	5	2	2	2	2	2	2
Diospyros virginiana	common persimmon	Tree							4	4	4						
Fraxinus pennsylvanica	green ash	Tree	1	1	1												
Liriodendron tulipifera	tuliptree	Tree	3	3	3	3	3	3	3	3	3				5	5	5
Platanus occidentalis	American sycamore	Tree	2	2	2												
Quercus alba	white oak	Tree	1	1	1	1	1	1							2	2	2
Quercus falcata	southern red oak	Tree	1	1	1	1	1	1									
Quercus michauxii	swamp chestnut oak	Tree				2	2	2				2	2	2			
Quercus pagoda	cherrybark oak	Tree	1	1	1	1	1	1	2	2	2	3	3	3			
Quercus phellos	willow oak	Tree	6	6	6	7	7	7	3	3	3	11	11	11	5	5	5
Sambucus canadensis	Common Elderberry	Shrub	1	1	1												
Sambucus nigra	European black elderberry	Shrub															
Stem count			18	18	18	21	21	21	19	19	19	19	19	19	21	21	21
size (ares)			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02		
Species count			9	9	9	8	8	8	6	6	6	5	5	5	5	5	5
Stems per ACRE			728	728	728	850	850	850	769	769	769	769	769	769	850	850	850

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

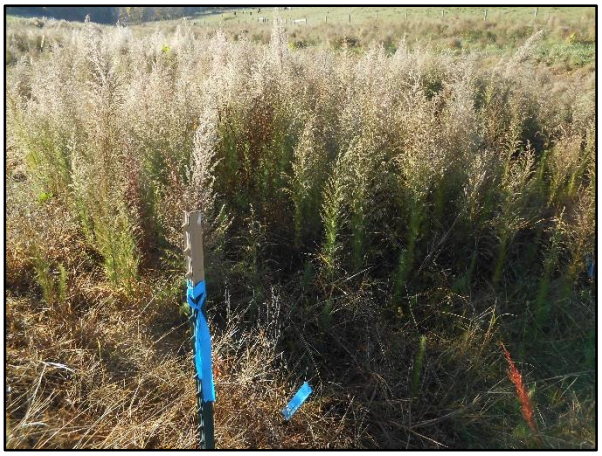
Table 9. CVS Stem Count of Planted Stems by Plot and Species
Town Creek Restoration Project: Project No. 95026

			Current Plot Data (MY1 2016)									Annual Means					
Scientific Name	Common Name	Species Type	95026-01-VP6			95026-01-VP7			95026-01-VP8			MY1 (2016)			MY0 (2016)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Asimina triloba	pawpaw	Tree	1	1	1							1	1	1	1	1	1
Betula nigra	river birch	Tree	1	1	1				4	4	4	8	8	8	12	12	12
Callicarpa americana	American beautyberry	Shrub										2	2	2	1	1	1
Carpinus caroliniana	American hornbeam	Tree	1	1	1							3	3	3	1	1	1
Cercis canadensis	eastern redbud	Tree	4	4	4							11	11	11	11	11	11
Cornus amomum	silky dogwood	Shrub										13	13	13	14	14	14
Diospyros virginiana	common persimmon	Tree										4	4	4	4	4	4
Fraxinus pennsylvanica	green ash	Tree				1	1	1				2	2	2	2	2	2
Liriodendron tulipifera	tuliptree	Tree	1	1	1	6	6	6	5	5	5	26	26	26	27	27	27
Platanus occidentalis	American sycamore	Tree				5	5	5	6	6	6	13	13	13	14	14	14
Quercus alba	white oak	Tree										4	4	4	3	3	3
Quercus falcata	southern red oak	Tree										2	2	2	5	5	5
Quercus michauxii	swamp chestnut oak	Tree	4	4	4							8	8	8	9	9	9
Quercus pagoda	cherrybark oak	Tree				1	1	1				8	8	8	6	6	6
Quercus phellos	willow oak	Tree	6	6	6	4	4	4	1	1	1	43	43	43	47	47	47
Sambucus canadensis	Common Elderberry	Shrub										1	1	1			
Sambucus nigra	European black elderberry	Shrub													2	2	2
Stem count			18	18	18	17	17	17	16	16	16	149	149	149	159	159	159
size (ares)			1			1			1			8			8		
size (ACRES)			0.02			0.02			0.02			0.20			0.20		
Species count			7	7	7	5	5	5	4	4	4	16	16	16	16	16	16
Stems per ACRE			728	728	728	688	688	688	647	647	647	754	754	754	804	804	804

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Town Creek – Vegetation Plot Photos



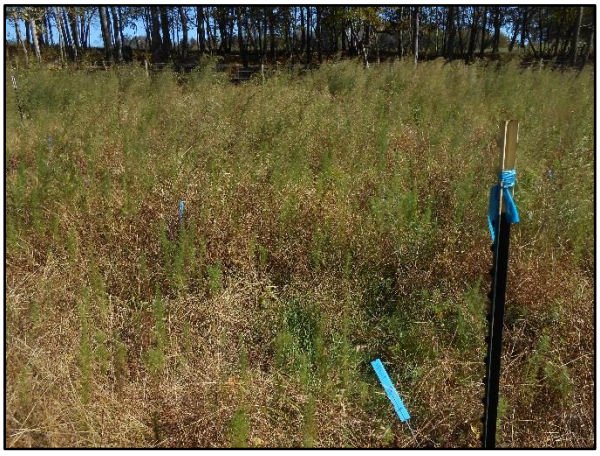
Vegetation Plot 1 (10/12/16)

Vegetation Plot 2 (10/12/16)

Vegetation Plot 3 (10/12/16)

Vegetation Plot 4 (10/12/16)

Vegetation Plot 5 (10/12/16)



Vegetation Plot 6 (10/12/16)

Vegetation Plot 7 (10/12/2016)

Vegetation Plot 8 (10/12/2016)

APPENDIX D

Stream Survey Data

Figure 3. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X1 - Reach 2

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	4.80	8.46	0.57	0.96	14.92	1.06	3.02	586.35	586.41	25.55

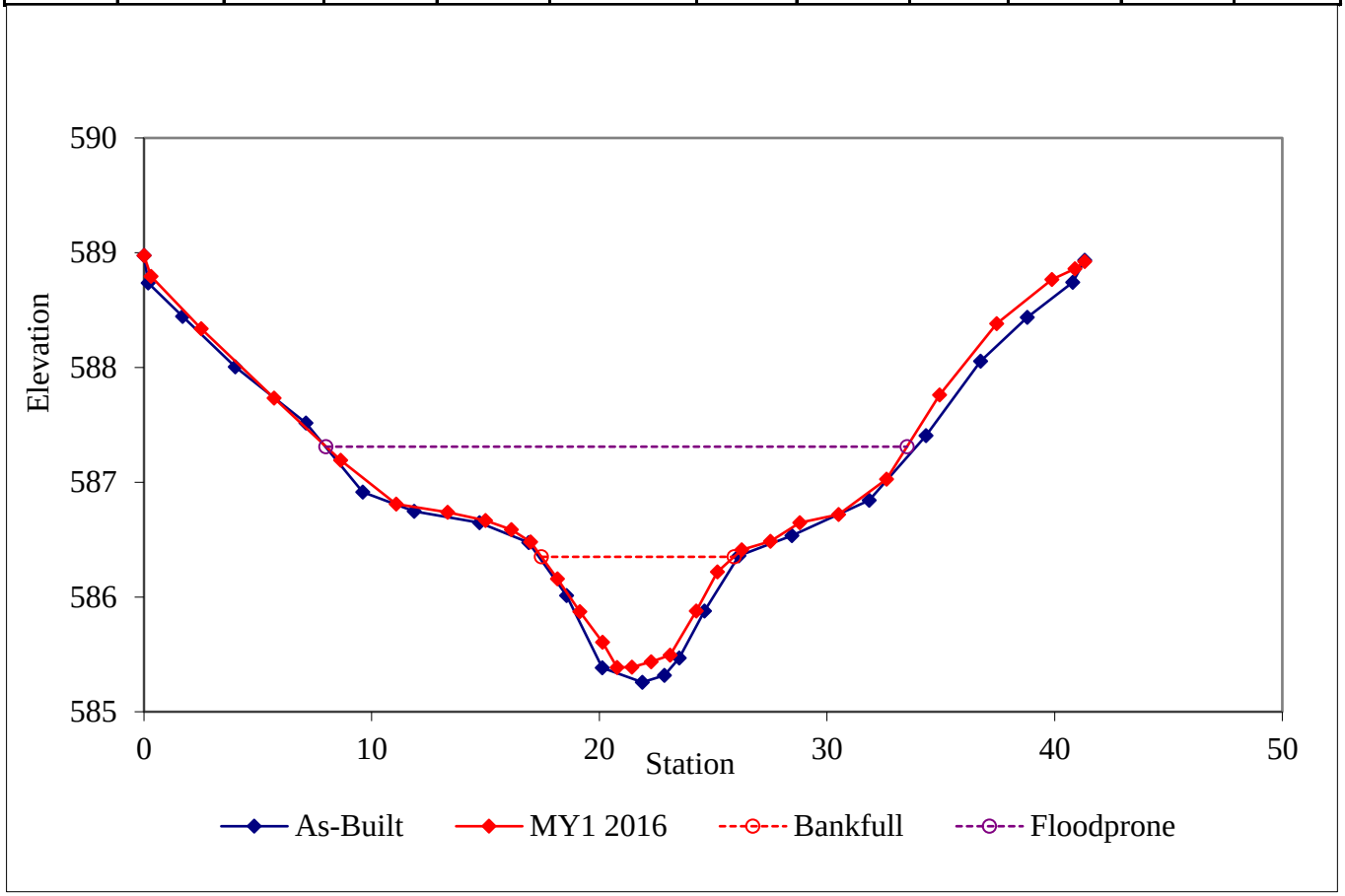


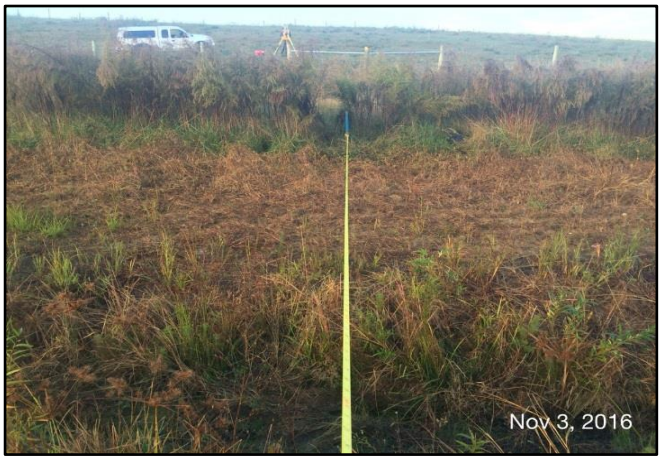
Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X2 - Reach 2

(Monitoring Year 1 - Collected November 2016)

LEFT BANK



RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	7.66	9.13	0.84	1.34	10.88	1.01	3.62	583.31	583.32	33.03

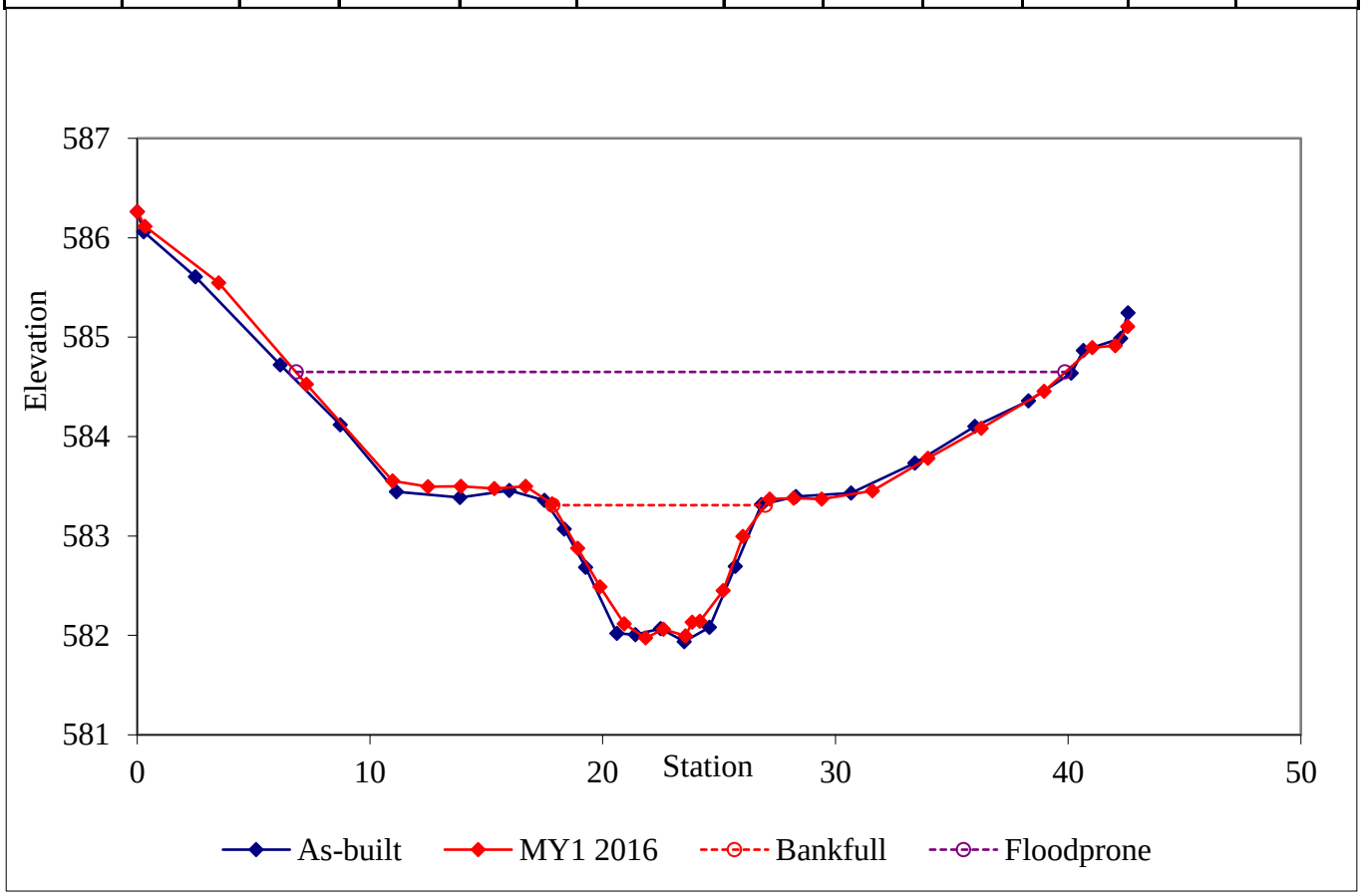


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X3 - Reach 2

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		9.99	8.73	1.14	2.00	7.62	1.00	4.25	582.09	582.09	37.11

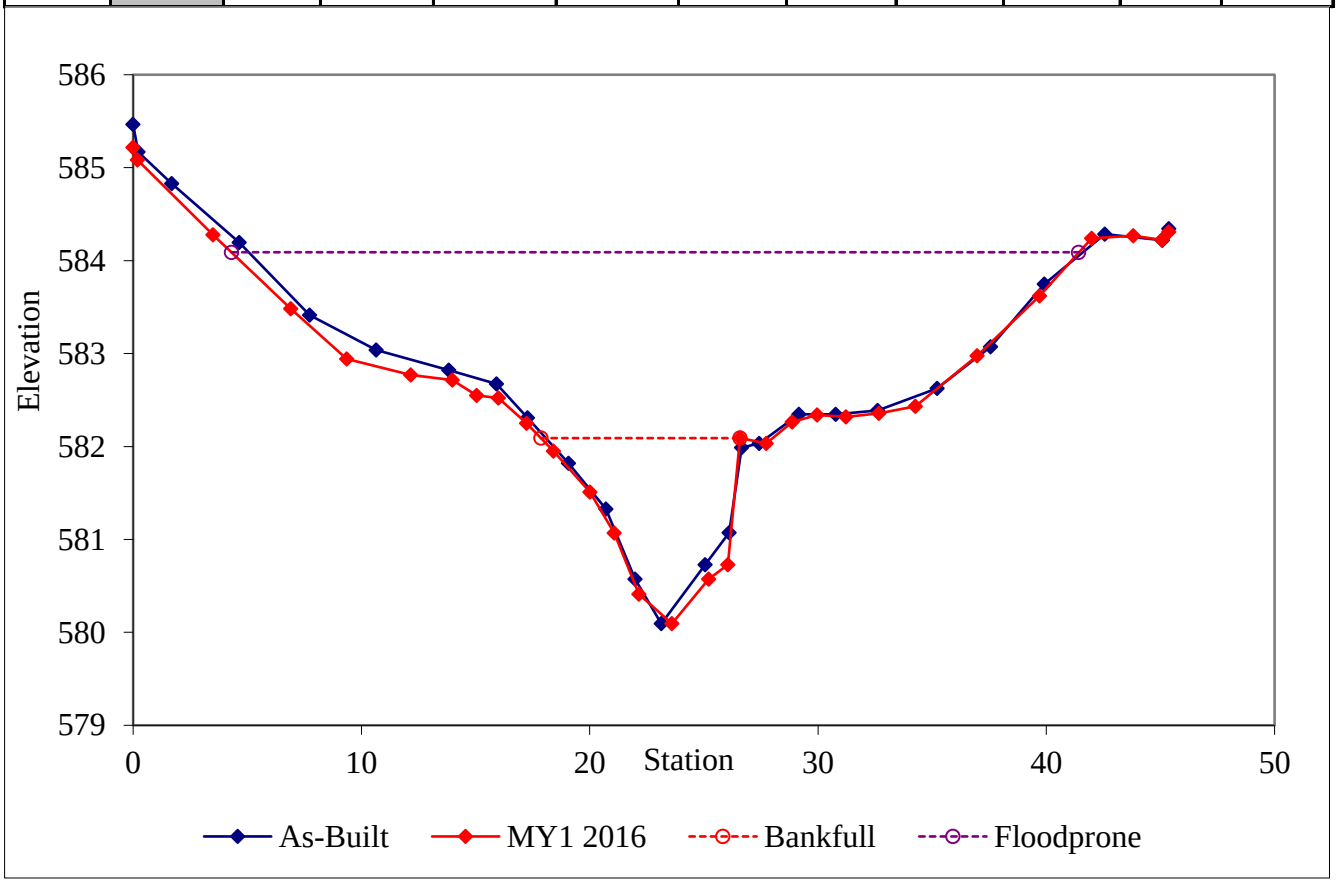


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X4 - Reach 2

(Monitoring Year 1- Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	7.00	9.91	0.71	1.32	14.05	1.05	3.84	576.81	576.88	38.11

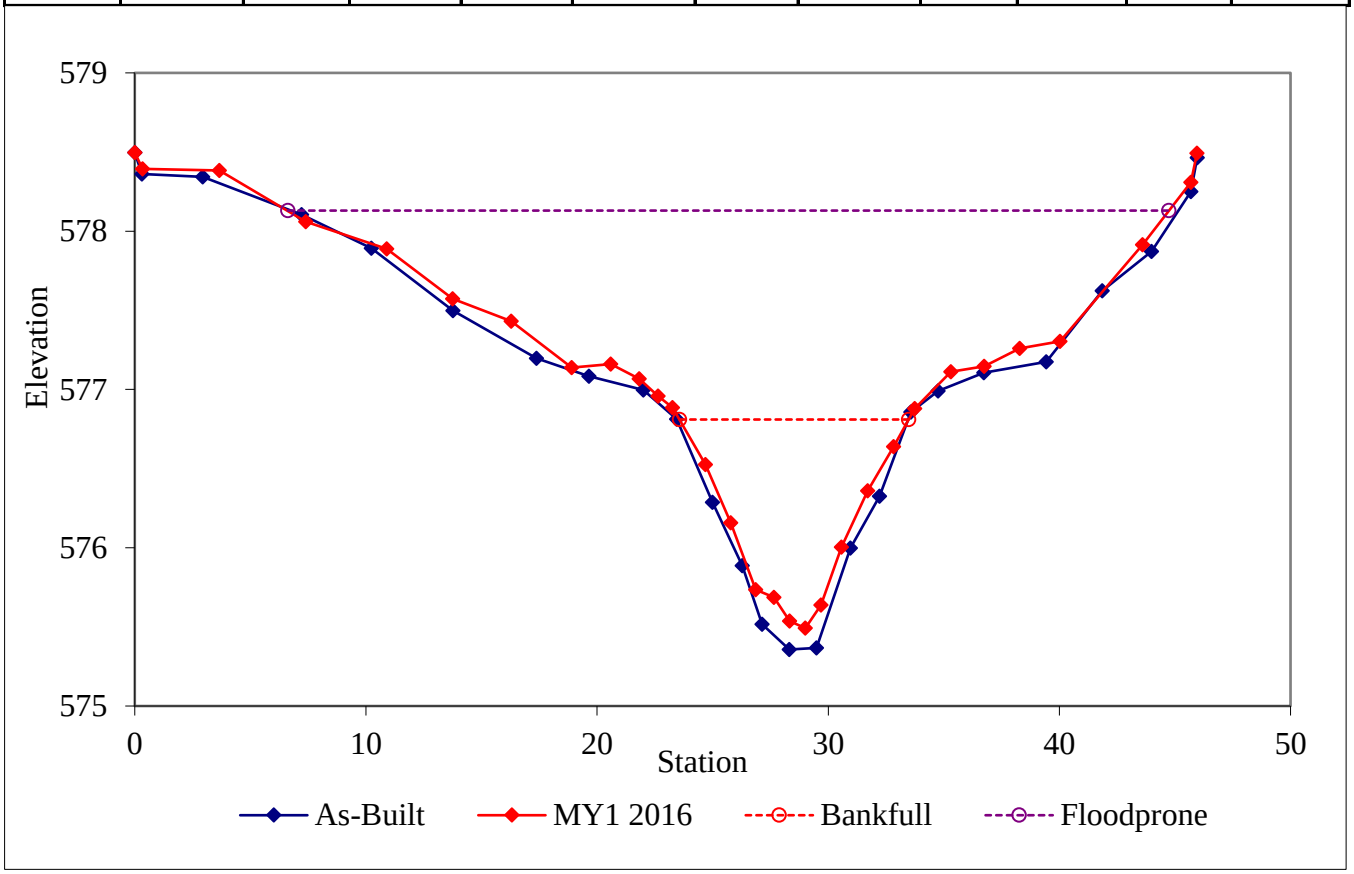


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X5 - Reach 3

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	8.11	11.83	0.69	1.35	17.27	1.09	4.06	568.85	568.98	48.09

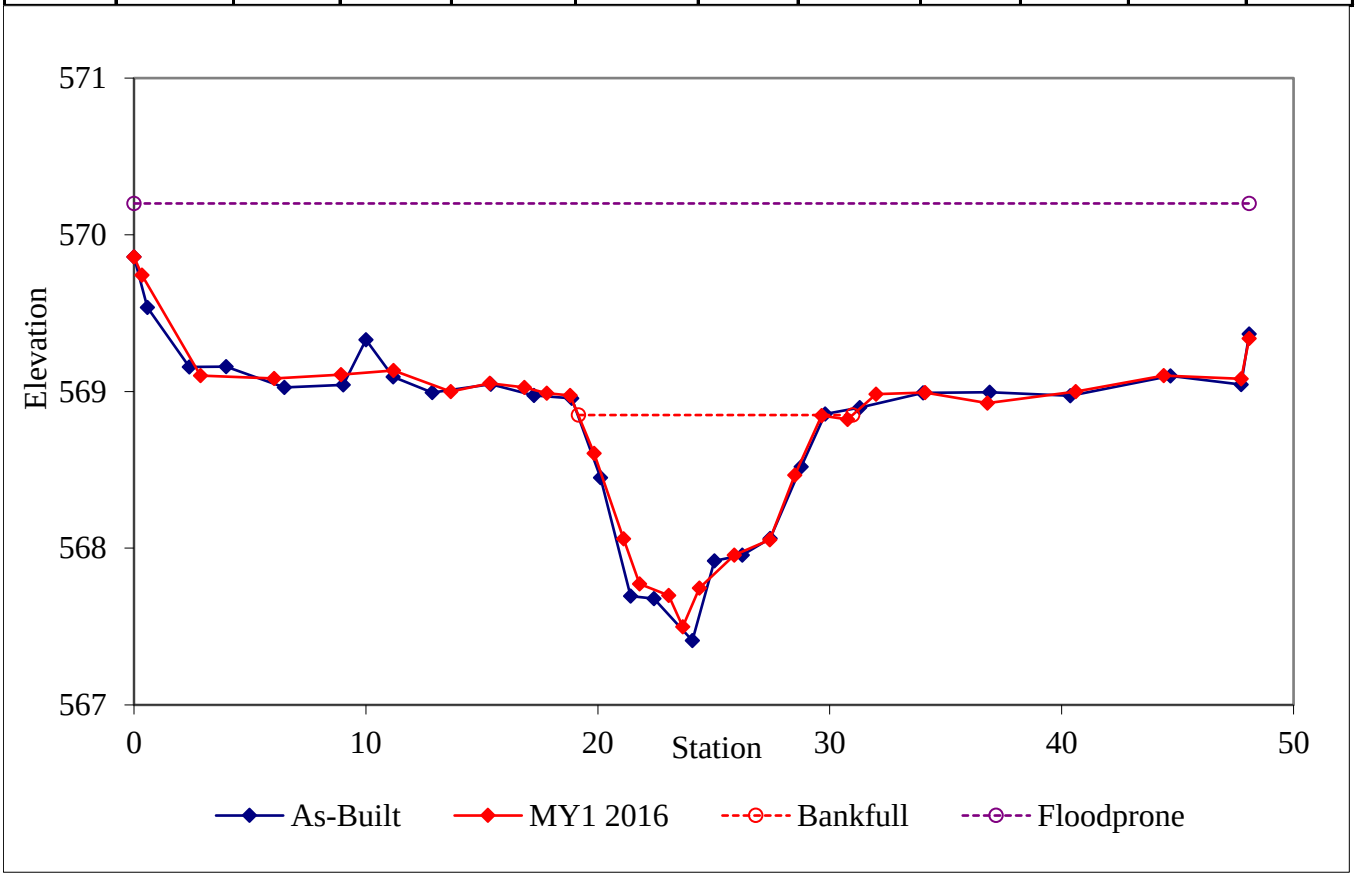


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X6 - Reach 3

(Monitoring Year 1- Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		13.03	19.31	0.67	1.79	28.61	0.99	2.56	568.63	568.61	49.44

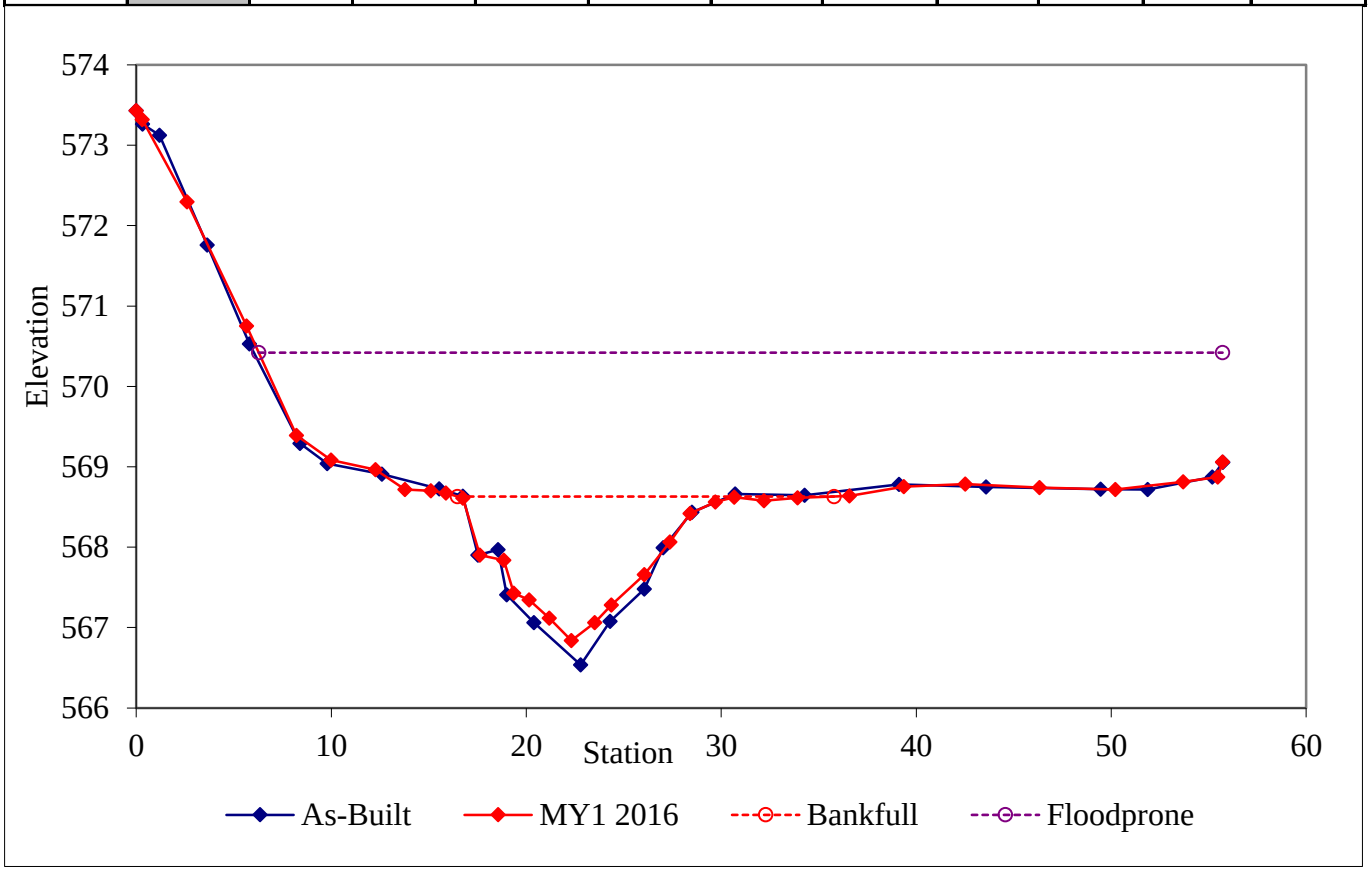


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X7 - Reach 3

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.71	10.72	0.53	0.85	20.15	0.98	3.59	563.96	563.94	0.00

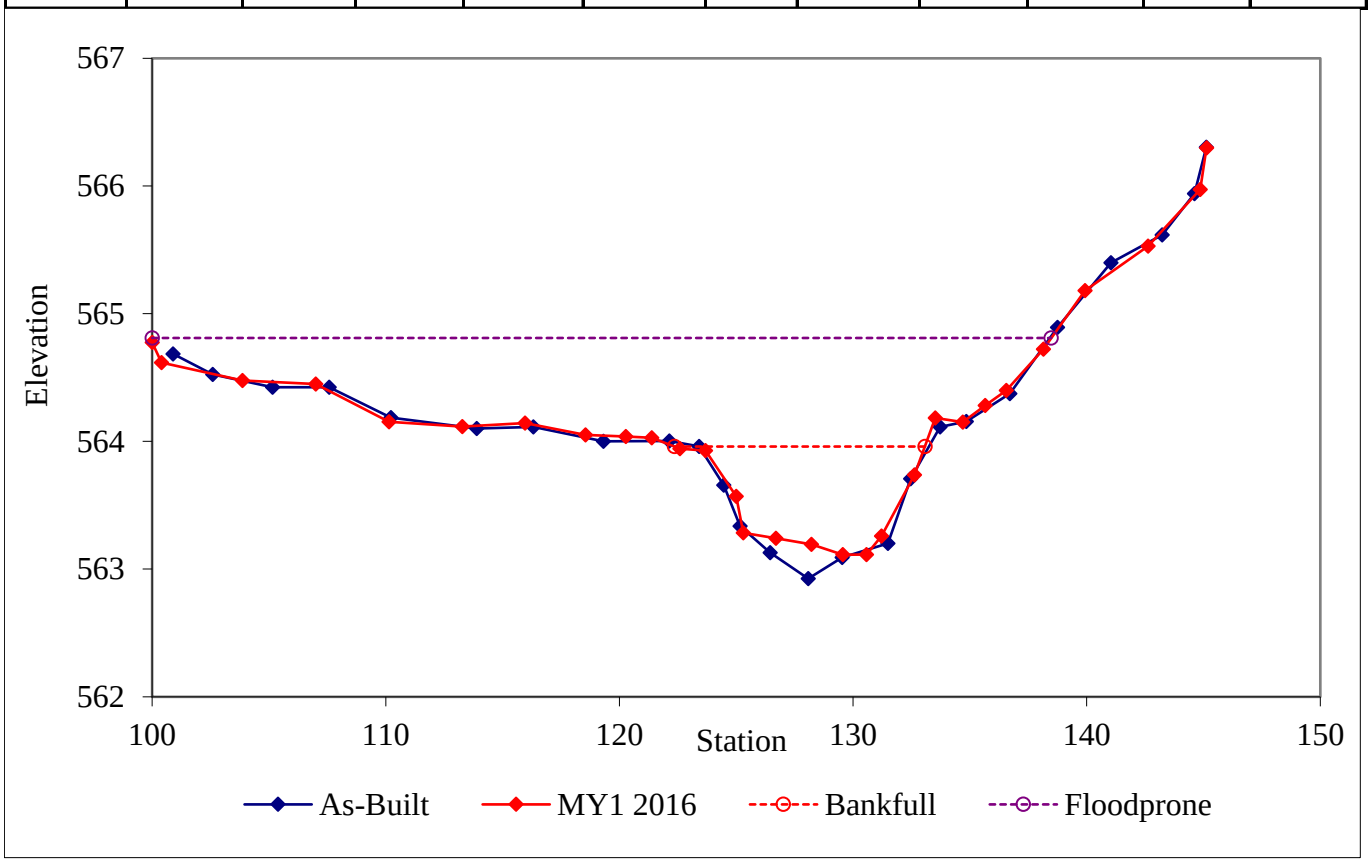


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X8 - Reach 3

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		12.46	12.08	1.03	1.98	11.72	1.03	4.18	555.44	555.49	50.46

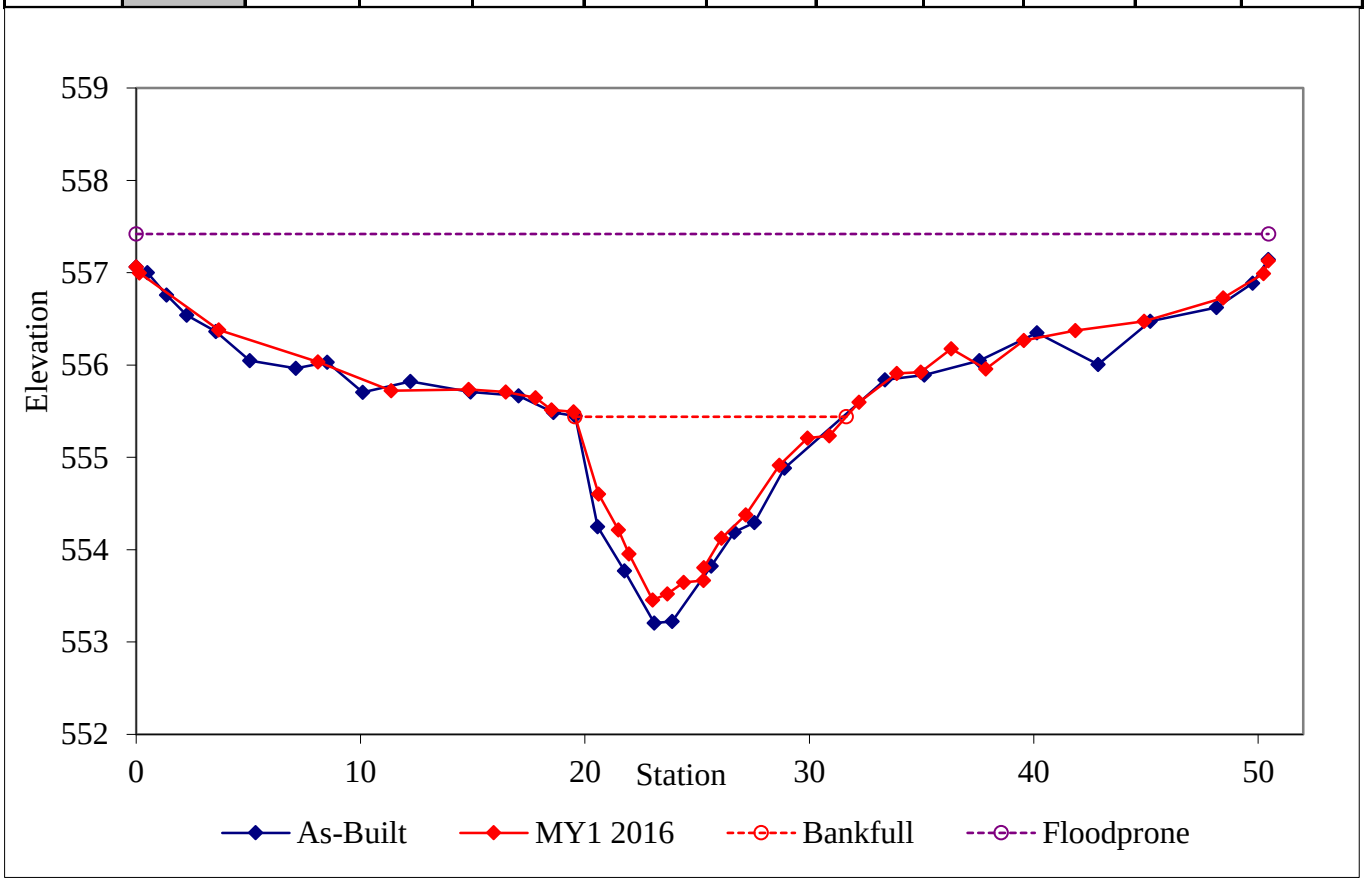


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section
X9 - Reach 3
(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.34	10.04	0.53	0.80	18.85	0.97	3.12	555.19	555.17	31.28

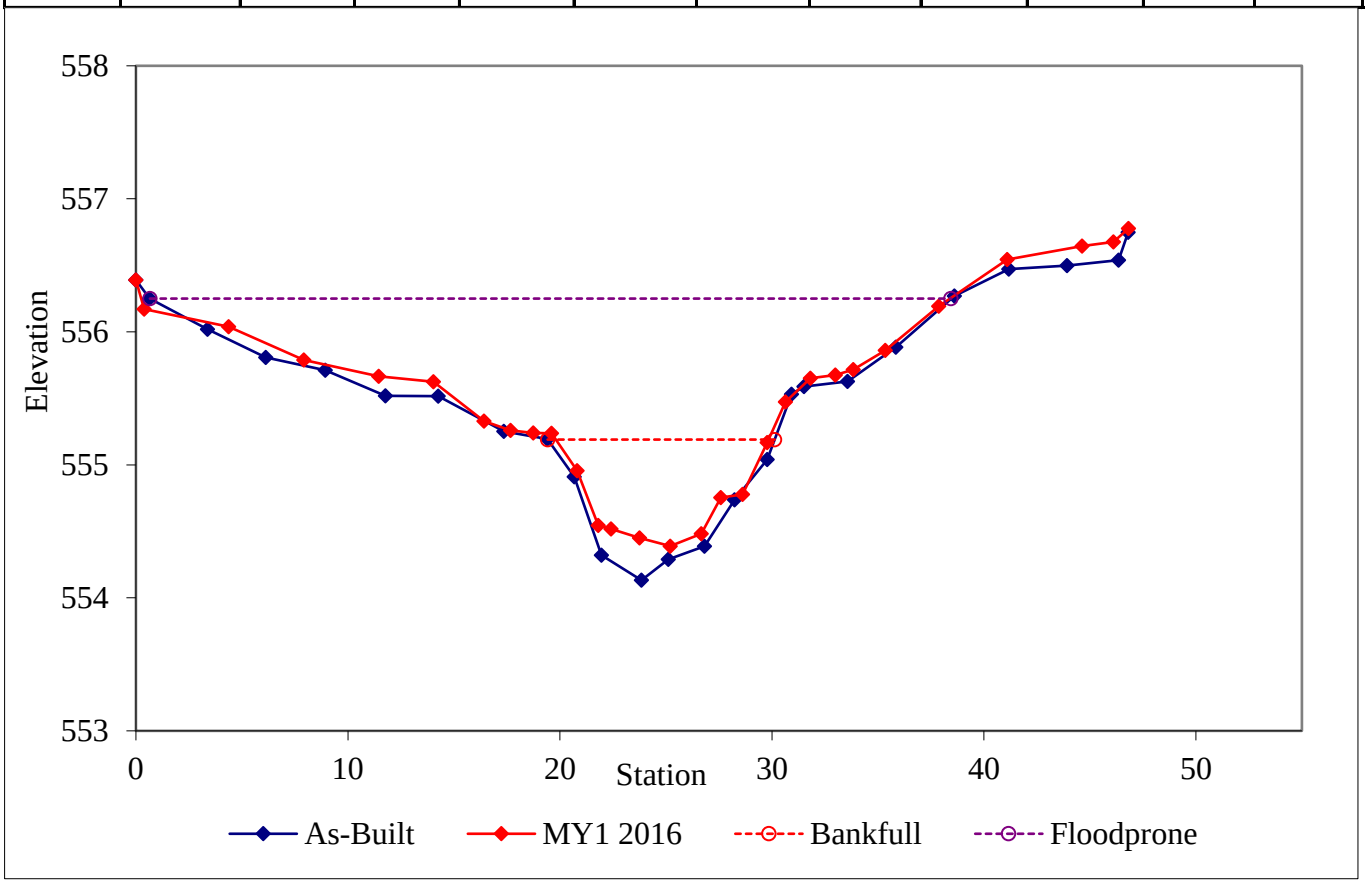


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section
X10 - Reach 5
(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	7.21	10.28	0.70	1.10	14.65	0.99	5.74	550.83	550.82	59.03

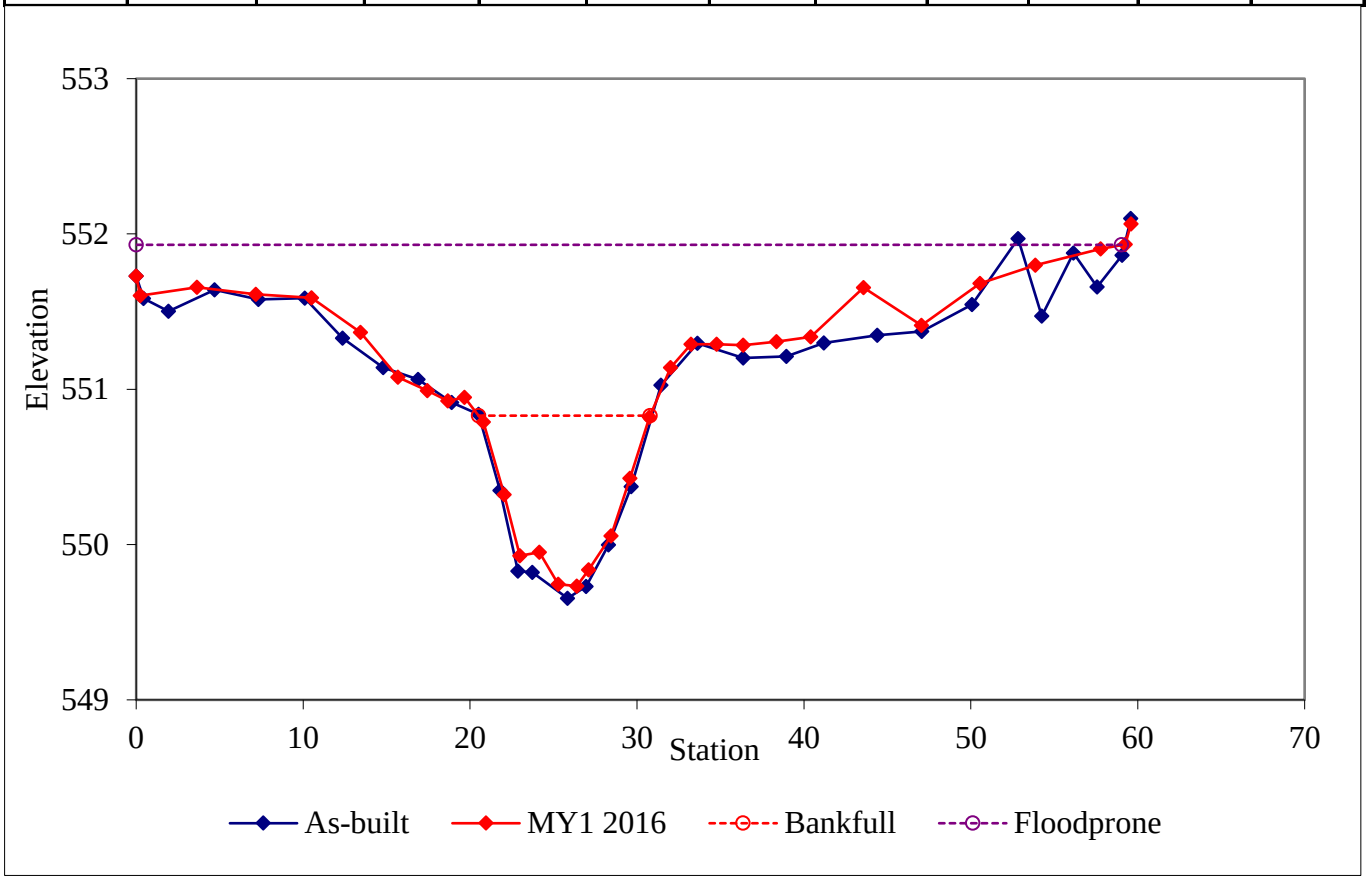


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X11 - Reach 5

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		16.97	16.78	1.01	2.11	16.60	0.97	3.79	549.52	549.58	63.56

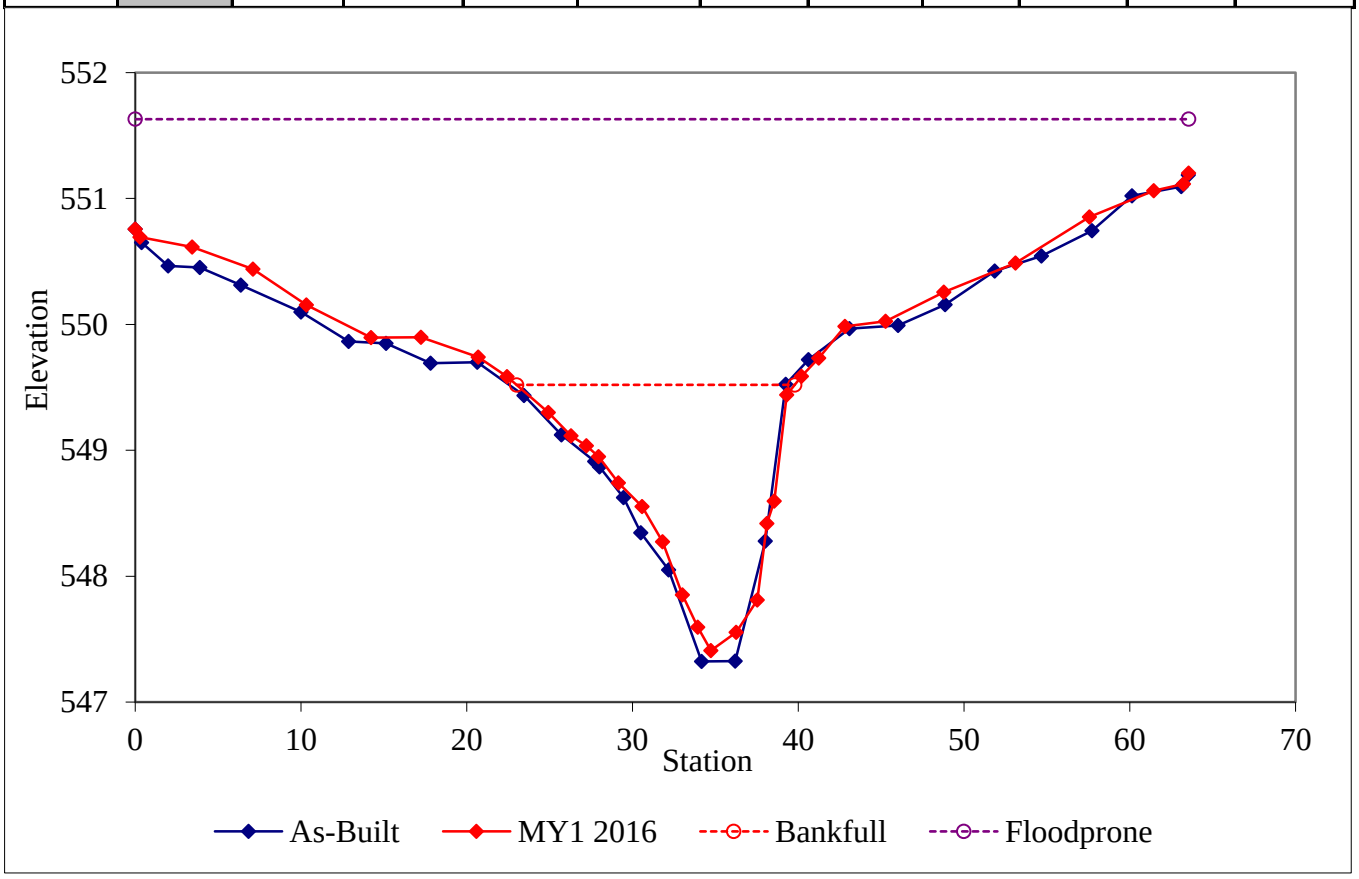


Figure 3 Cont. Cross-sections with Annual Overlays
Town Creek Restoration Project: Project No. 95026

Permanent Cross-section

X12 - Reach 5

(Monitoring Year 1 - Collected November 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.53	10.49	0.53	0.8	19.92	1	3.85	549.04	549.04	40.39

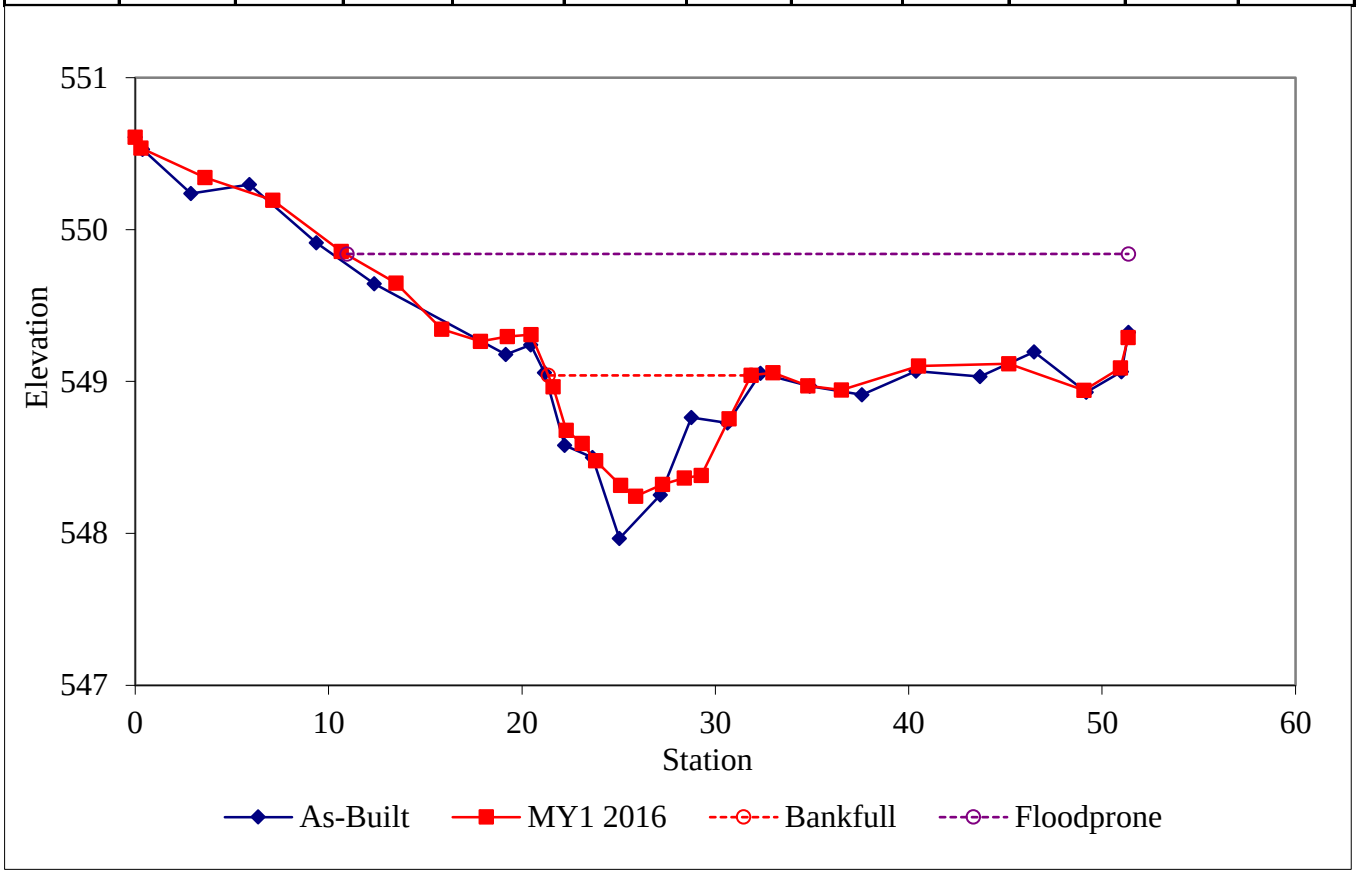
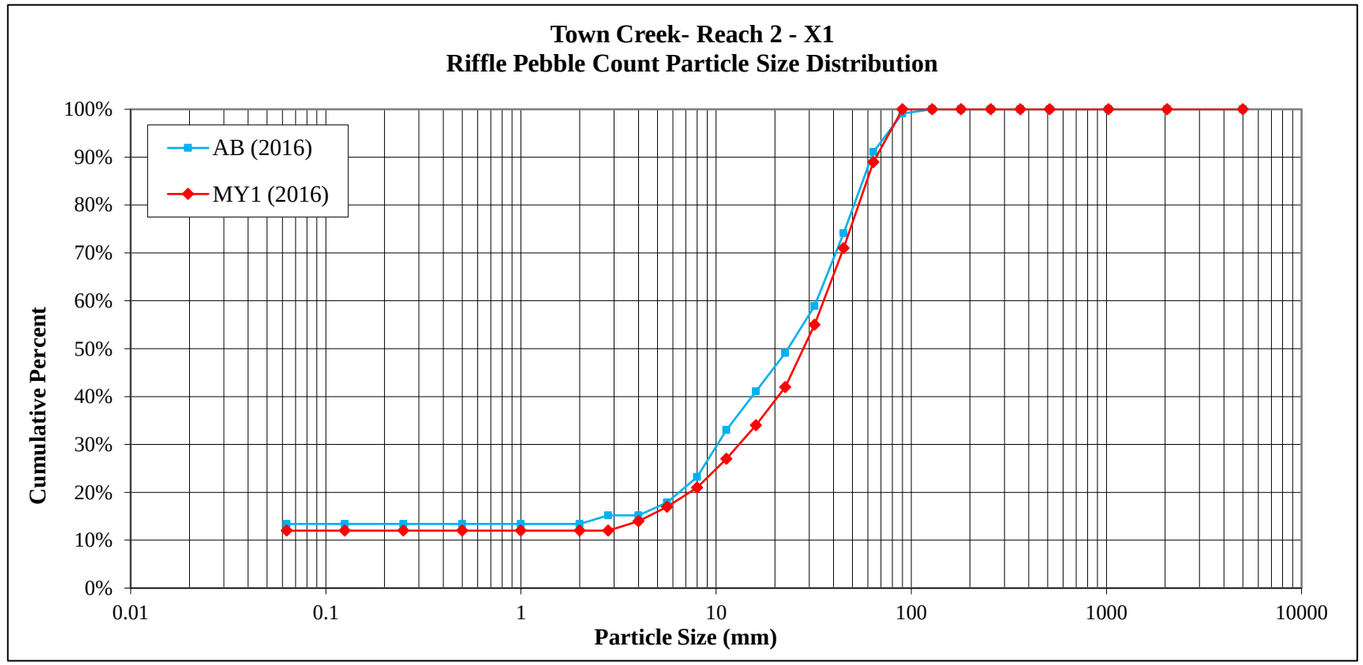


Figure 4. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1
REACH/LOCATION:	Town Creek - Reach 2, XS 1
DATE COLLECTED:	10/11/2016
FIELD COLLECTION BY:	Russell Myers and Andrew Powers
DATA ENTRY BY:	Russell Myers

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	12	12%	12%
SAND	Very Fine	.063 - .125	0	0%	12%
	Fine	.125 - .25	0	0%	12%
	Medium	.25 - .50	0	0%	12%
	Coarse	.50 - 1.0	0	0%	12%
	Very Coarse	1.0 - 2.0	0	0%	12%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	12%
	Very Fine	2.8 - 4.0	2	2%	14%
	Fine	4.0 - 5.6	3	3%	17%
	Fine	5.6 - 8.0	4	4%	21%
	Medium	8.0 - 11.0	6	6%	27%
	Medium	11.0 - 16.0	7	7%	34%
	Coarse	16.0 - 22.6	8	8%	42%
	Coarse	22.6 - 32	13	13%	55%
	Very Coarse	32 - 45	16	16%	71%
	Very Coarse	45 - 64	18	18%	89%
COBBLE	Small	64 - 90	11	11%	100%
	Small	90 - 128	0	0%	100%
	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	100	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	5.01
D_{35} =	16.71
D_{50} =	27.99
D_{84} =	58.03
D_{95} =	77.08
D_{100} =	64 - 90



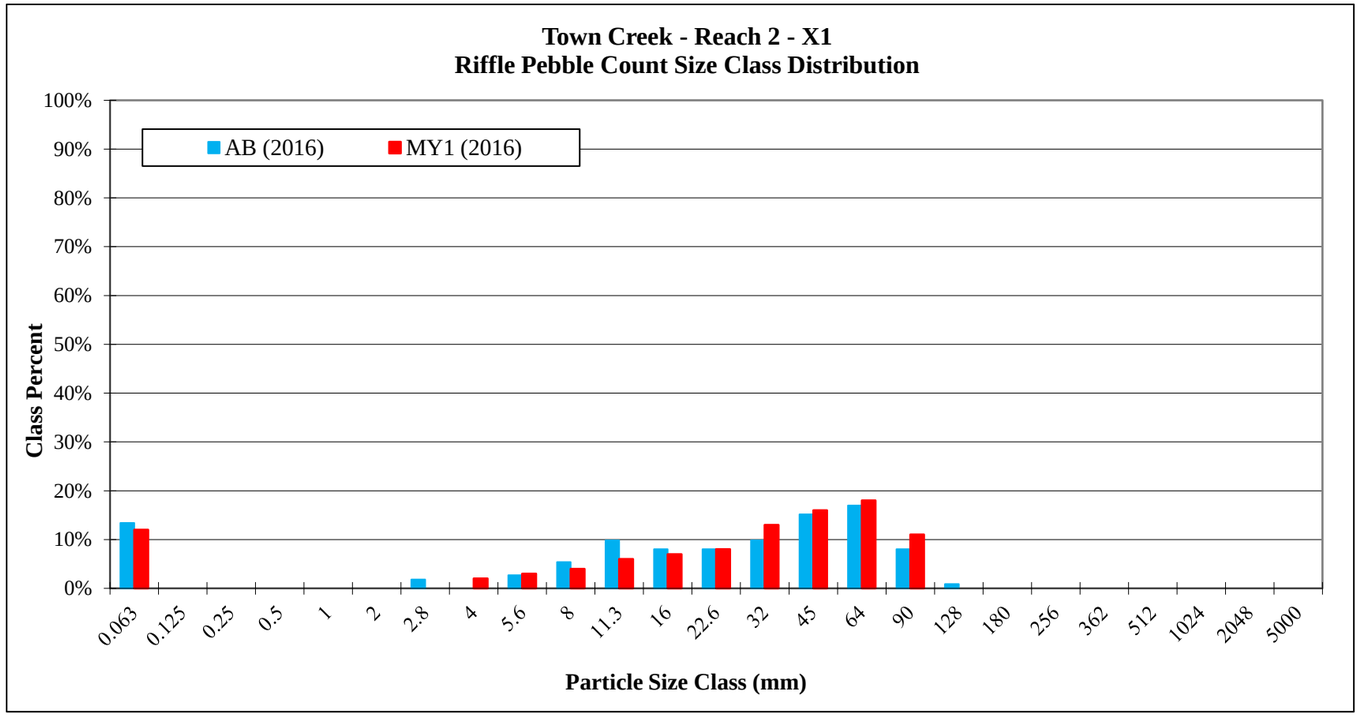
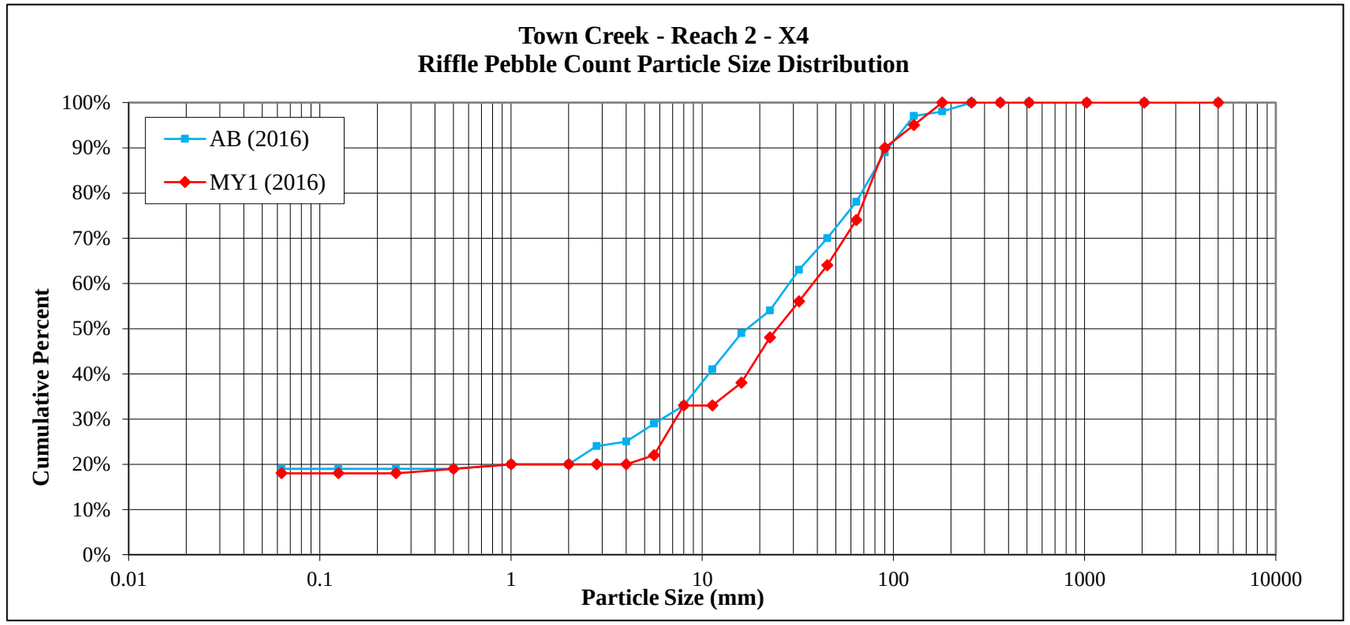


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526	
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1
REACH/LOCATION:	Town Creek - Reach 2, XS 4
DATE COLLECTED:	10/11/2016
FIELD COLLECTION BY:	Russell Myers and Andrew Powers
DATA ENTRY BY:	Russell Myers

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	18	18%	18%
SAND	Very Fine	.063 - .125	0	0%	18%
	Fine	.125 - .25	0	0%	18%
	Medium	.25 - .50	1	1%	19%
	Coarse	.50 - 1.0	1	1%	20%
	Very Coarse	1.0 - 2.0	0	0%	20%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	20%
	Very Fine	2.8 - 4.0	0	0%	20%
	Fine	4.0 - 5.6	2	2%	22%
	Fine	5.6 - 8.0	11	11%	33%
	Medium	8.0 - 11.0	0	0%	33%
	Medium	11.0 - 16.0	5	5%	38%
	Coarse	16.0 - 22.6	10	10%	48%
	Coarse	22.6 - 32	8	8%	56%
	Very Coarse	32 - 45	8	8%	64%
	Very Coarse	45 - 64	10	10%	74%
COBBLE	Small	64 - 90	16	16%	90%
	Small	90 - 128	5	5%	95%
	Large	128 - 180	5	5%	100%
	Large	180 - 256	0	0%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	100	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	<0.063
D_{35} =	12.78
D_{50} =	24.65
D_{84} =	79.20
D_{95} =	128.00
D_{100} =	128 - 180



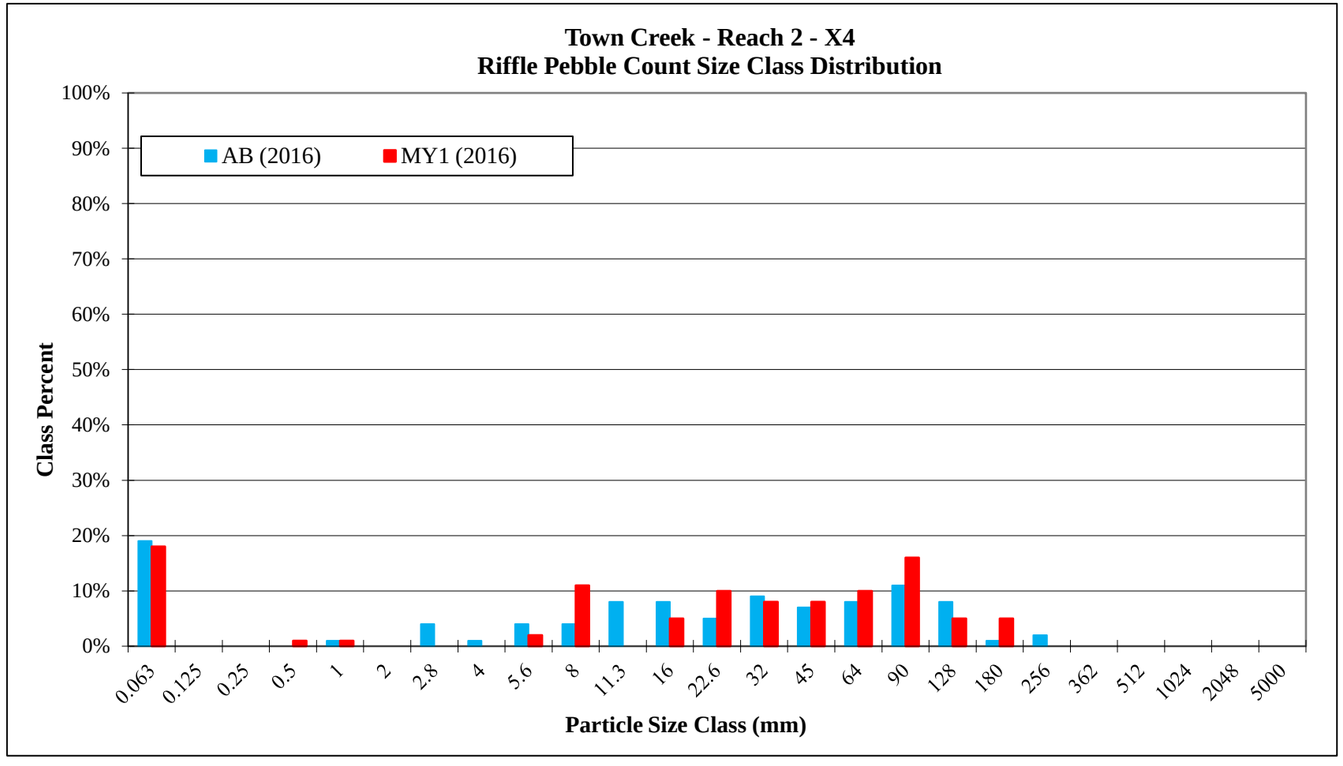
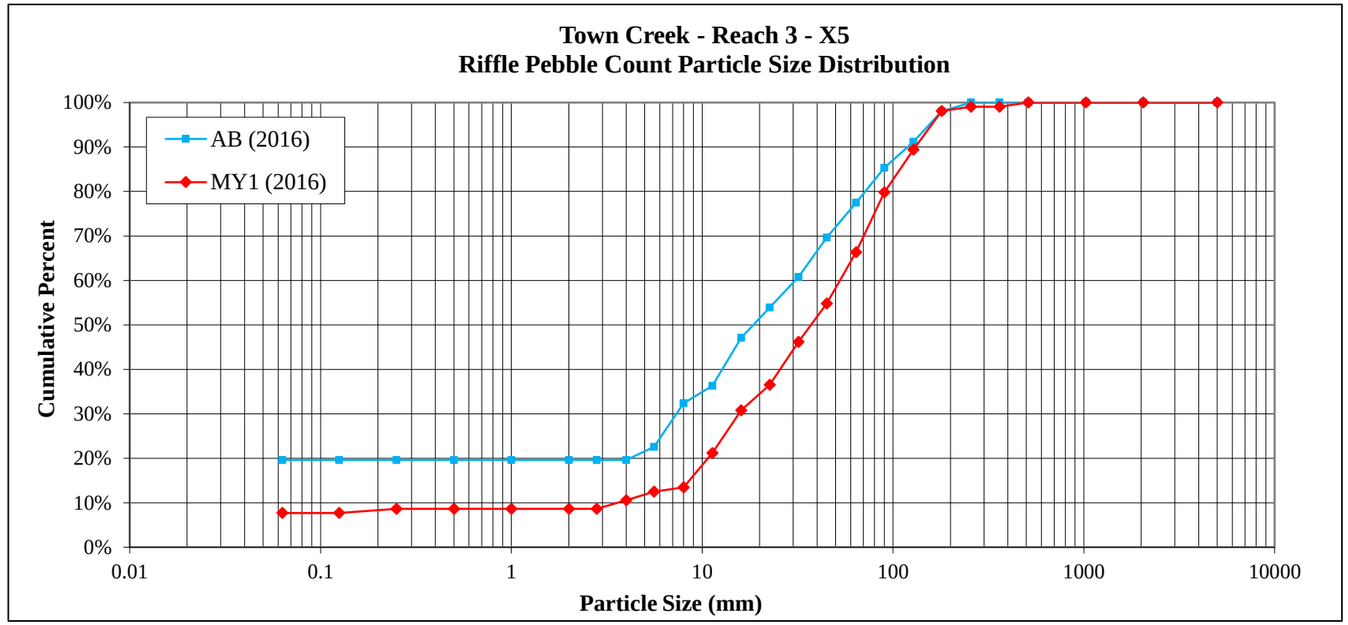


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526					
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1				
REACH/LOCATION:	Town Creek - Reach 3, XS 5				
DATE COLLECTED:	10/12/2016				
FIELD COLLECTION BY:	Russell Myers and Andrew Powers				
DATA ENTRY BY:	Russell Myers				
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	8	8%	8%
SAND	Very Fine	.063 - .125	0	0%	8%
	Fine	.125 - .25	1	1%	9%
	Medium	.25 - .50	0	0%	9%
	Coarse	.50 - 1.0	0	0%	9%
	Very Coarse	1.0 - 2.0	0	0%	9%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	9%
	Very Fine	2.8 - 4.0	2	2%	11%
	Fine	4.0 - 5.6	2	2%	13%
	Fine	5.6 - 8.0	1	1%	13%
	Medium	8.0 - 11.0	8	8%	21%
	Medium	11.0 - 16.0	10	10%	31%
	Coarse	16.0 - 22.6	6	6%	37%
	Coarse	22.6 - 32	10	10%	46%
	Very Coarse	32 - 45	9	9%	55%
	Very Coarse	45 - 64	12	12%	66%
COBBLE	Small	64 - 90	14	13%	80%
	Small	90 - 128	10	10%	89%
	Large	128 - 180	9	9%	98%
	Large	180 - 256	1	1%	99%
BOULDER	Small	256 - 362	0	0%	99%
	Small	362 - 512	1	1%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	104	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	8.89
D_{35} =	20.61
D_{50} =	37.24
D_{84} =	104.94
D_{95} =	159.45
D_{100} =	362 - 512



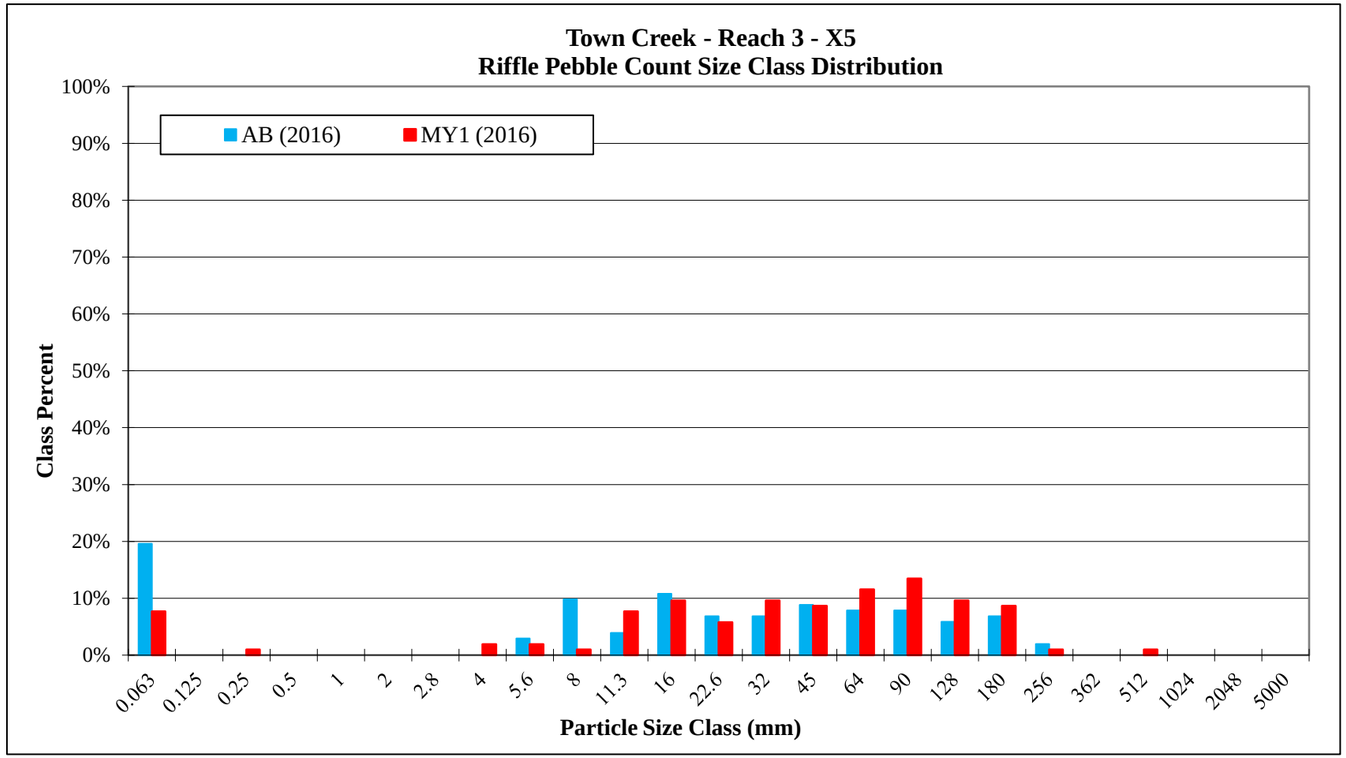
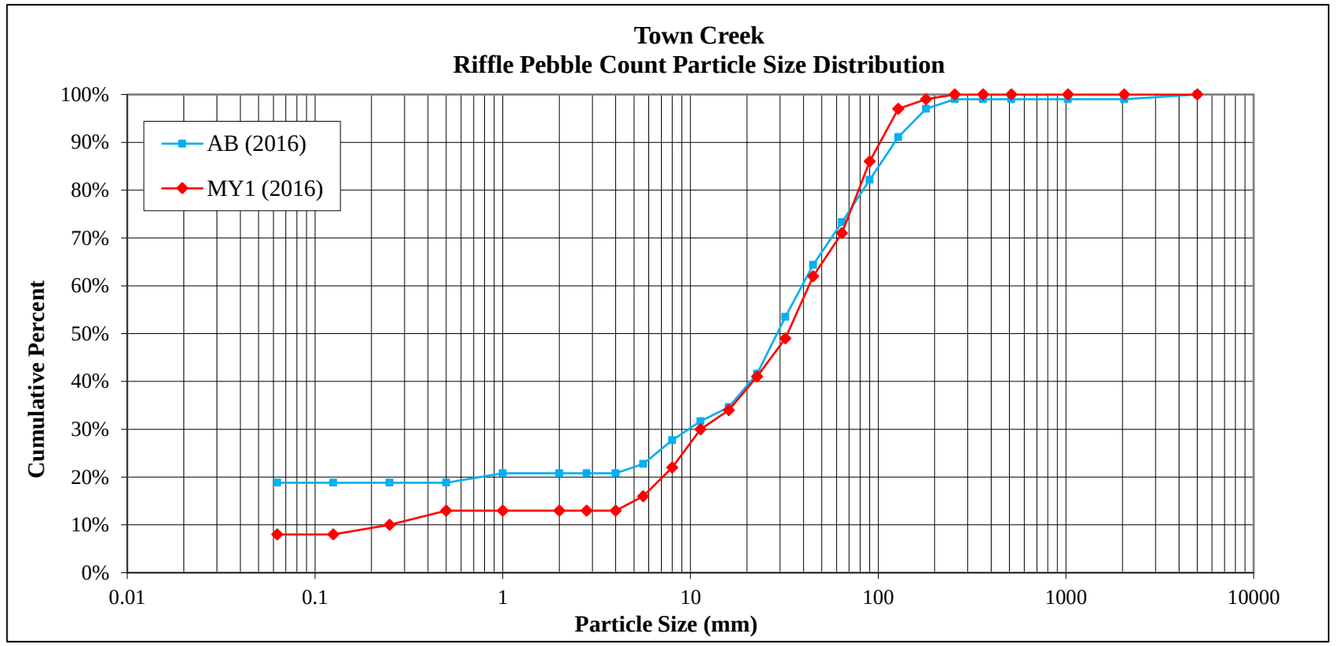


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526					
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1				
REACH/LOCATION:	Town Creek - Reach 3, XS 7				
DATE COLLECTED:	10/12/2016				
FIELD COLLECTION BY:	Russell Myers and Andrew Powers				
DATA ENTRY BY:	Russell Myers				
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	8	8%	8%
SAND	Very Fine	.063 - .125	0	0%	8%
	Fine	.125 - .25	2	2%	10%
	Medium	.25 - .50	3	3%	13%
	Coarse	.50 - 1.0	0	0%	13%
	Very Coarse	1.0 - 2.0	0	0%	13%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	13%
	Very Fine	2.8 - 4.0	0	0%	13%
	Fine	4.0 - 5.6	3	3%	16%
	Fine	5.6 - 8.0	6	6%	22%
	Medium	8.0 - 11.0	8	8%	30%
	Medium	11.0 - 16.0	4	4%	34%
	Coarse	16.0 - 22.6	7	7%	41%
	Coarse	22.6 - 32	8	8%	49%
	Very Coarse	32 - 45	13	13%	62%
	Very Coarse	45 - 64	9	9%	71%
COBBLE	Small	64 - 90	15	15%	86%
	Small	90 - 128	11	11%	97%
	Large	128 - 180	2	2%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	100	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	5.60
D_{35} =	16.81
D_{50} =	32.85
D_{84} =	86.00
D_{95} =	120.06
D_{100} =	180 - 256



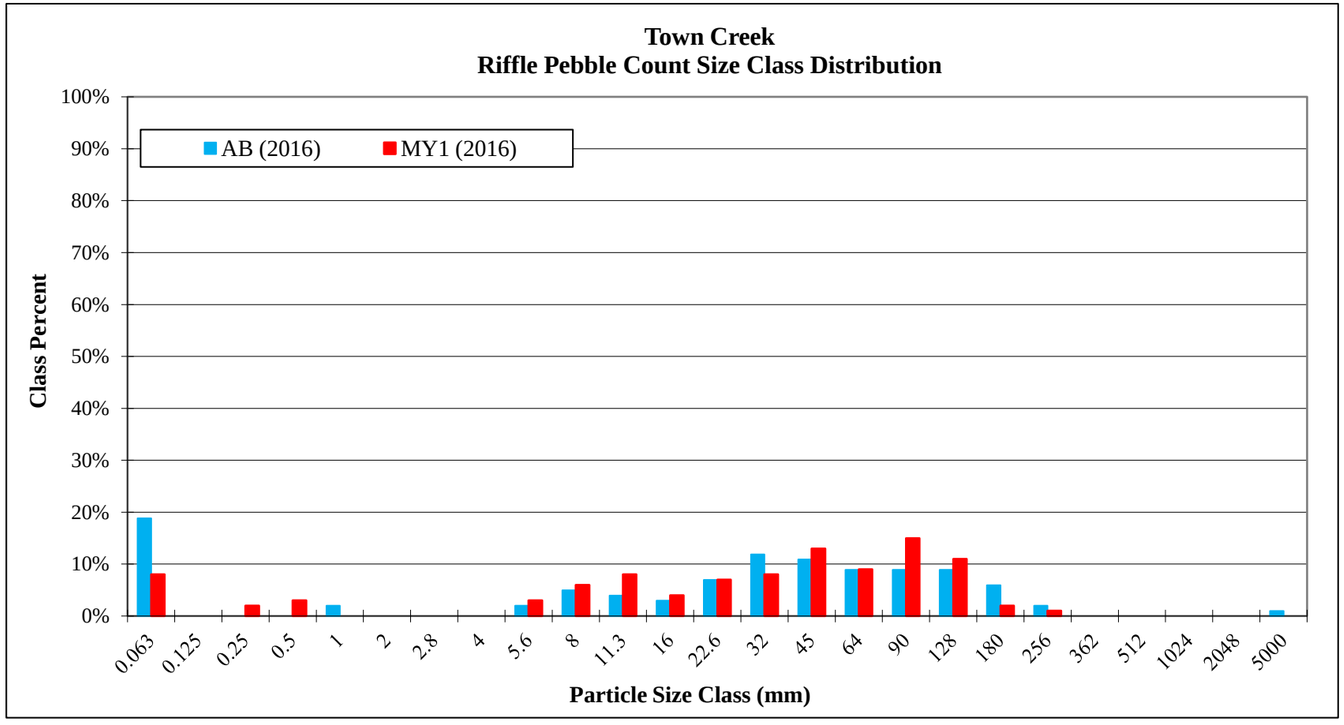
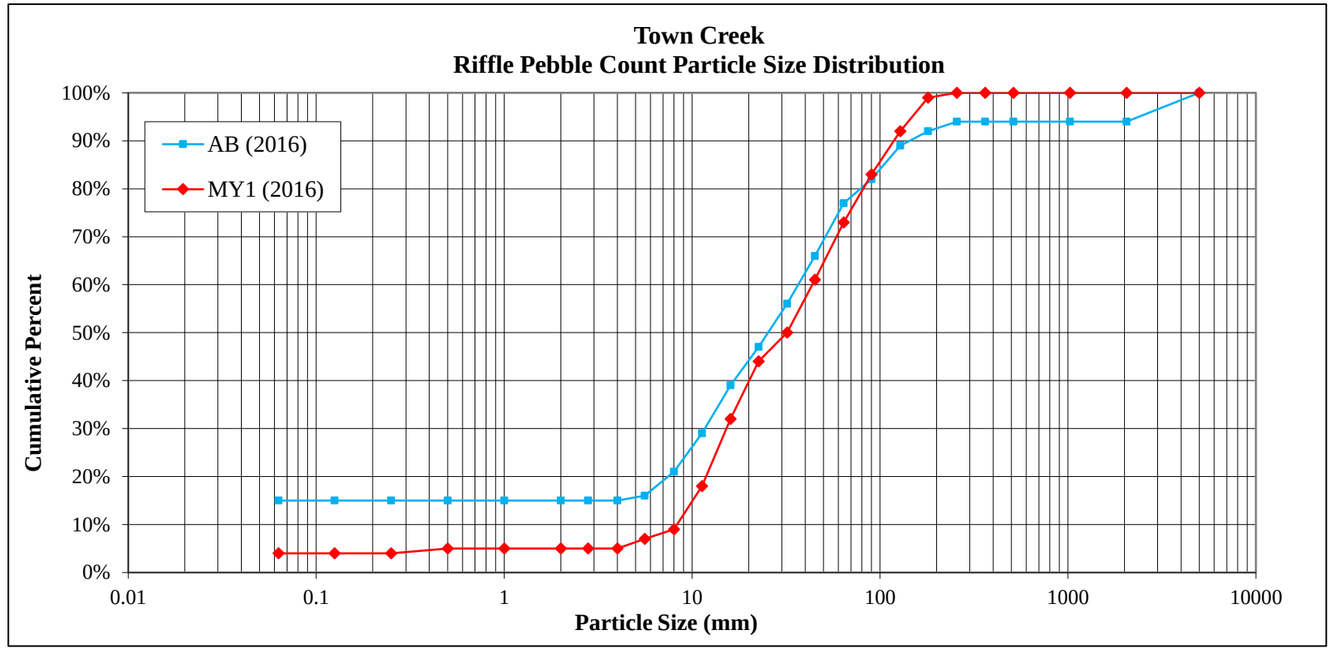


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526					
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1				
REACH/LOCATION:	Town Creek - Reach 3, XS 9				
DATE COLLECTED:	10/12/2016				
FIELD COLLECTION BY:	Russell Myers and Andrew Powers				
DATA ENTRY BY:	Russell Myers				
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	4	4%	4%
SAND	Very Fine	.063 - .125	0	0%	4%
	Fine	.125 - .25	0	0%	4%
	Medium	.25 - .50	1	1%	5%
	Coarse	.50 - 1.0	0	0%	5%
	Very Coarse	1.0 - 2.0	0	0%	5%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	5%
	Very Fine	2.8 - 4.0	0	0%	5%
	Fine	4.0 - 5.6	2	2%	7%
	Fine	5.6 - 8.0	2	2%	9%
	Medium	8.0 - 11.0	9	9%	18%
	Medium	11.0 - 16.0	14	14%	32%
	Coarse	16.0 - 22.6	12	12%	44%
	Coarse	22.6 - 32	6	6%	50%
	Very Coarse	32 - 45	11	11%	61%
	Very Coarse	45 - 64	12	12%	73%
COBBLE	Small	64 - 90	10	10%	83%
	Small	90 - 128	9	9%	92%
	Large	128 - 180	7	7%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	100	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	10.25
D_{35} =	17.44
D_{50} =	32.00
D_{84} =	93.59
D_{95} =	148.14
D_{100} =	180 - 256



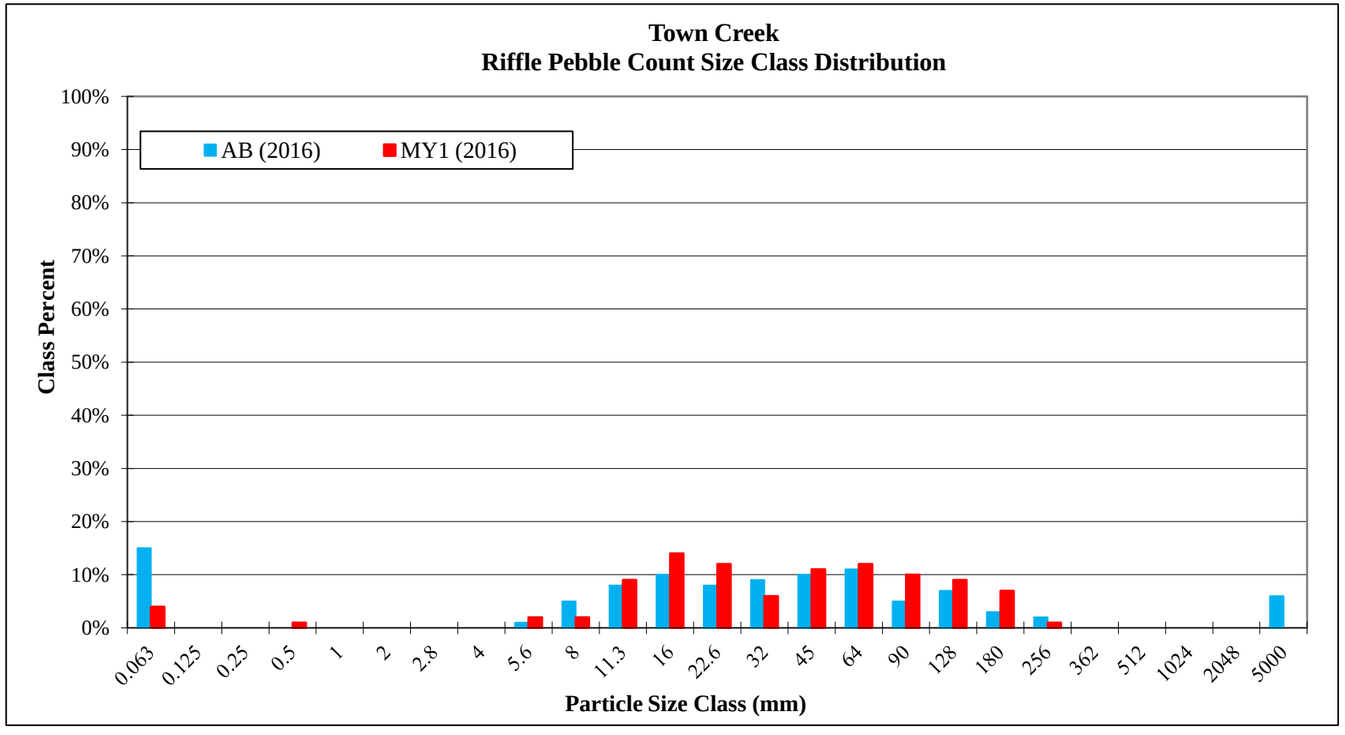
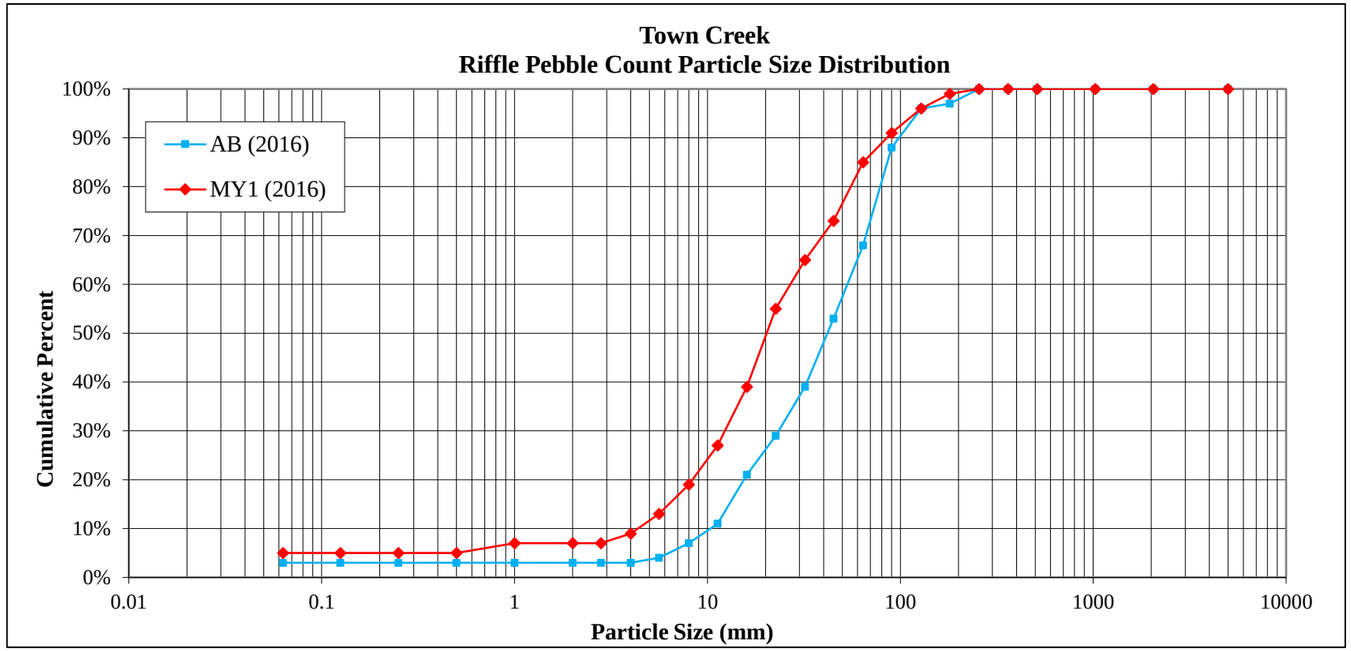


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526					
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1				
REACH/LOCATION:	Town Creek - Reach 5, XS 10				
DATE COLLECTED:	10/12/2016				
FIELD COLLECTION BY:	Russell Myers and Andrew Powers				
DATA ENTRY BY:	Russell Myers				
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	5	5%	5%
SAND	Very Fine	.063 - .125	0	0%	5%
	Fine	.125 - .25	0	0%	5%
	Medium	.25 - .50	0	0%	5%
	Coarse	.50 - 1.0	2	2%	7%
	Very Coarse	1.0 - 2.0	0	0%	7%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	7%
	Very Fine	2.8 - 4.0	2	2%	9%
	Fine	4.0 - 5.6	4	4%	13%
	Fine	5.6 - 8.0	6	6%	19%
	Medium	8.0 - 11.0	8	8%	27%
	Medium	11.0 - 16.0	12	12%	39%
	Coarse	16.0 - 22.6	16	16%	55%
	Coarse	22.6 - 32	10	10%	65%
	Very Coarse	32 - 45	8	8%	73%
	Very Coarse	45 - 64	12	12%	85%
COBBLE	Small	64 - 90	6	6%	91%
	Small	90 - 128	5	5%	96%
	Large	128 - 180	3	3%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	100	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	6.69
D_{35} =	14.12
D_{50} =	20.29
D_{84} =	62.15
D_{95} =	119.29
D_{100} =	180 - 256



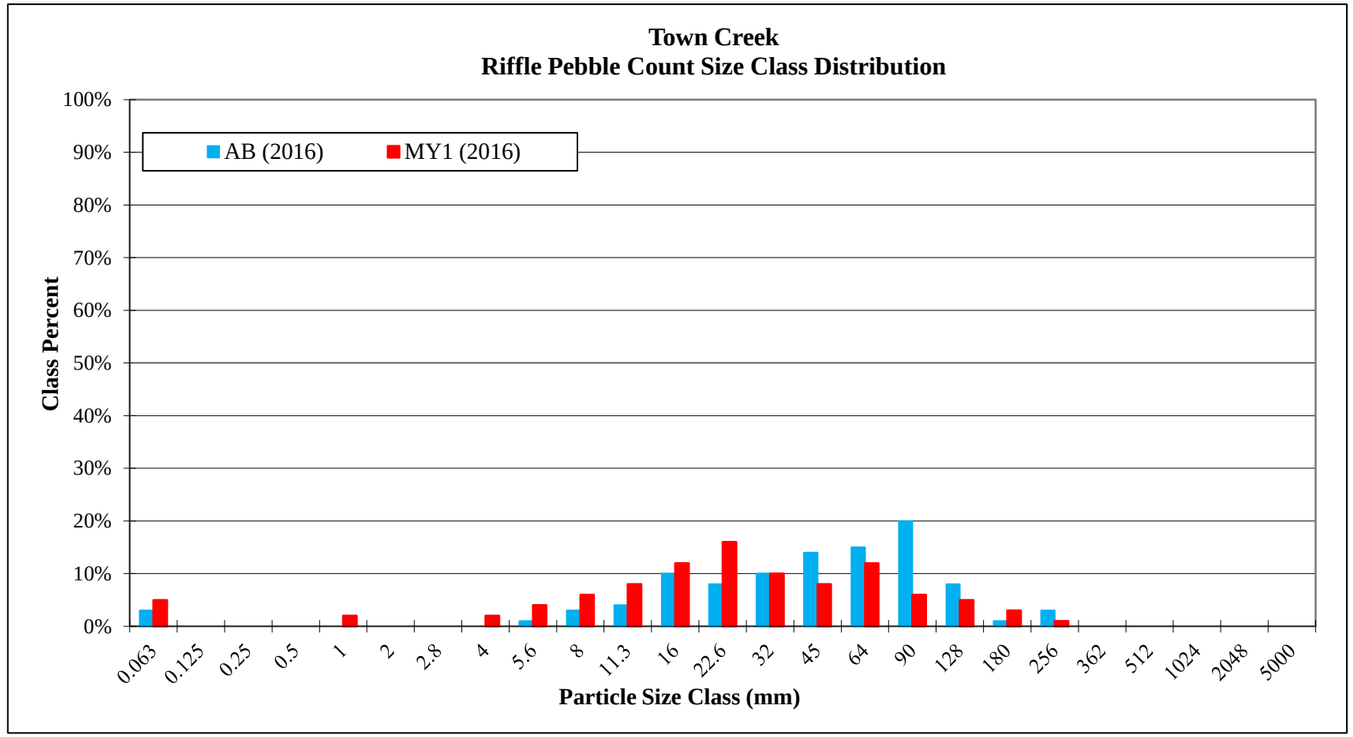
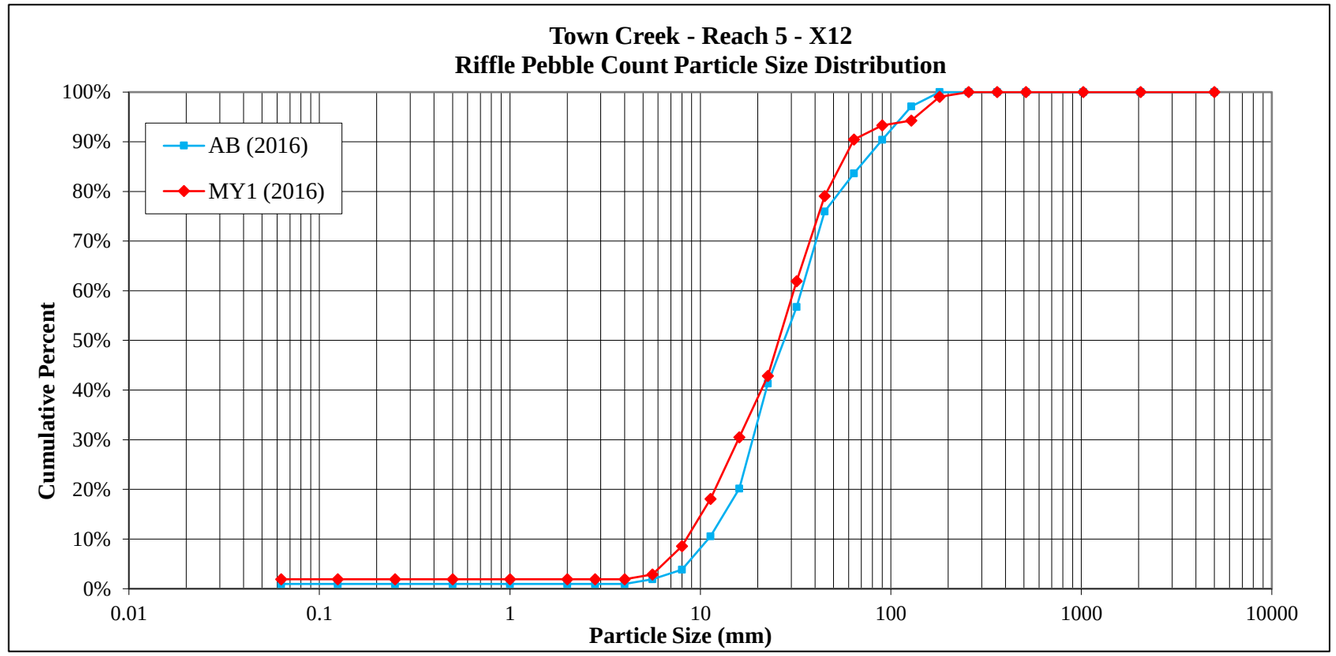


Figure 4 Cont. Riffle Pebble Count Size Class Distribution with Annual Overlays
Town Creek Restoration Project: Project No. 95026

BAKER PROJECT NO. 124526					
SITE OR PROJECT:	Town Creek Stream Restoration Project - Monitoring Year 1				
REACH/LOCATION:	Town Creek - Reach 5, XS 12				
DATE COLLECTED:	10/12/2016				
FIELD COLLECTION BY:	Russell Myers and Andrew Powers				
DATA ENTRY BY:	Russell Myers				
			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
SILT/CLAY	Silt / Clay	< .063	2	2%	2%
SAND	Very Fine	.063 - .125	0	0%	2%
	Fine	.125 - .25	0	0%	2%
	Medium	.25 - .50	0	0%	2%
	Coarse	.50 - 1.0	0	0%	2%
	Very Coarse	1.0 - 2.0	0	0%	2%
GRAVEL	Very Fine	2.0 - 2.8	0	0%	2%
	Very Fine	2.8 - 4.0	0	0%	2%
	Fine	4.0 - 5.6	1	1%	3%
	Fine	5.6 - 8.0	6	6%	9%
	Medium	8.0 - 11.0	10	10%	18%
	Medium	11.0 - 16.0	13	12%	30%
	Coarse	16.0 - 22.6	13	12%	43%
	Coarse	22.6 - 32	20	19%	62%
	Very Coarse	32 - 45	18	17%	79%
	Very Coarse	45 - 64	12	11%	90%
COBBLE	Small	64 - 90	3	3%	93%
	Small	90 - 128	1	1%	94%
	Large	128 - 180	5	5%	99%
	Large	180 - 256	1	1%	100%
BOULDER	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
	Large-Very Large	1024 - 2048	0	0%	100%
BEDROCK	Bedrock	> 2048	0	0%	100%
		Total	105	100%	100%

Cummulative Channel materials (mm)	
D_{16} =	10.26
D_{35} =	18.15
D_{50} =	25.75
D_{84} =	52.42
D_{95} =	134.72
D_{100} =	180 - 256



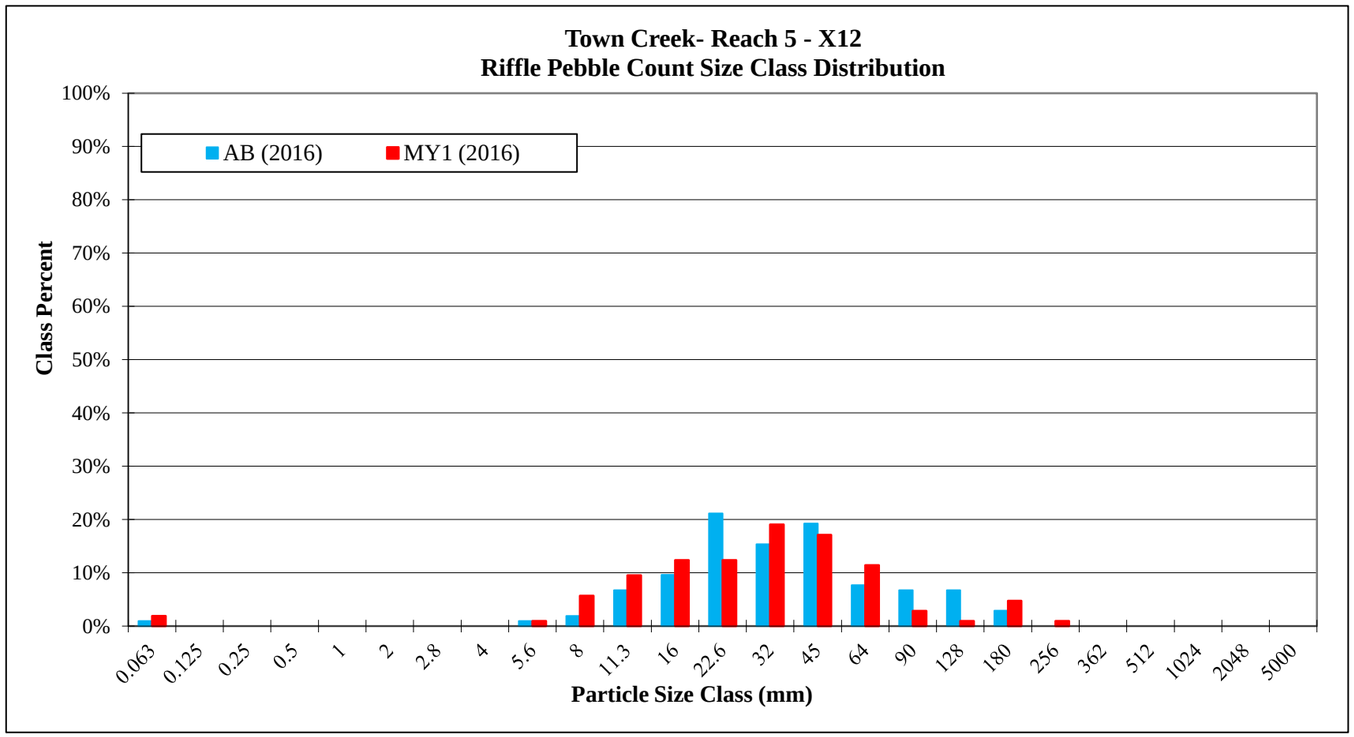


Table 10. Baseline Stream Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026
Reach 1 (317 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						Monitoring Baseline (As-built)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	4.2	5.5	-----	-----	7.2	-----	2	-----	9.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	72.1	-----	-----	76.6	-----	2	20	-----	-----	50	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.7	0.8	-----	-----	1.1	-----	2	-----	0.68	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.8	-----	-----	2.3	-----	2	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	4.2	5.4	-----	-----	5.9	-----	2	-----	6.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	5.22	-----	-----	9.43	-----	2	-----	13.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	10.1	-----	-----	13.8	-----	2	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.3	-----	-----	1.5	-----	2	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	6.9	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	0.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.022	-----	-----	-----	-----	-----	0.012	-----	-----	-----	8
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.0	-----	-----	45.0	-----	-----	12.0	-----	-----	42.0	-----	11
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.2	-----	-----	0.8	-----	11
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.2 / 4.3 / 6.9 / 30.8 / 54.5				-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.09	-----	-----	-----	0.09	-----	-----	-----	-----	-----	0.09	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----			-----	E4b (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----		-----	-----	2.76	-----	-----	-----	2.72	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	15.6	-----	-----	-----	16.3	-----	-----	-----	16.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	301.9	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	363	-----	-----	-----	316	-----	-----	-----	-----	-----	317.0	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.17	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0212	-----	-----	-----	0.0217	-----	-----	-----	-----	-----	0.0181	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 2 (711 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						Monitoring Baseline (As-built)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	4.8	6.6	-----	-----	8.8	-----	2	-----	9.0	-----	-----	-----	-----	8.8	-----	-----	12.0	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	25.5	-----	-----	42.7	-----	2	20	-----	-----	50.0	-----	-----	27.1	-----	-----	42.6	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.8	1.1	-----	-----	1.6	-----	2	-----	0.7	-----	-----	-----	-----	0.7	-----	-----	1.0	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.9	-----	-----	2.4	-----	2	-----	1.0	-----	-----	-----	-----	1.1	-----	-----	2.3	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	5.1	6.9	-----	-----	14.0	-----	2	-----	6.1	-----	-----	-----	-----	5.8	-----	-----	12.0	-----	3
Width/Depth Ratio	-----	-----	-----	-----	5.6	-----	-----	6.2	-----	2	-----	13.3	-----	-----	-----	-----	10.2	-----	-----	13.2	-----	3
Entrenchment Ratio	-----	-----	-----	-----	3.9	-----	-----	4.8	-----	2	-----	-----	-----	>2.2	-----	-----	3.1	-----	-----	3.7	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.5	-----	-----	1.6	-----	2	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	-----	16.7	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	17.1	-----	-----	23.3	-----	2
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0175	-----	-----	-----	-----	-----	0.010	-----	-----	-----	9
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14	-----	-----	45	-----	-----	19.0	-----	-----	63.0	-----	19
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.200	-----	-----	3.4	-----	20
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			<0.063 / 7.2 / 16.7 / 54.5 / 85.7				-----	-----	-----	-----	-----	-----		<0.063 - 4.4 / 8.7 - 12.1 / 17.1 - 23.3 / 55.3 - 77.1 / 75.6 - 117.2				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	0.79	-----	-----	-----	-----	-----	0.65	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	34.9	-----	-----	-----	-----	-----	32.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.1	-----	-----	-----	0.12	-----	-----	-----	-----	-----	0.12	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E4 (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4 / E4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	1.49	-----	-----	-----	3.48	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	19.3	-----	-----	-----	20.9	-----	-----	-----	20.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	695	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	737	-----	-----	-----	708	-----	-----	-----	-----	-----	711	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.06	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0159	-----	-----	-----	0.0177	-----	-----	-----	-----	-----	0.0180	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026
Reach 3 (1,621 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Design						Monitoring Baseline (As-built)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	5.5	6.0	-----	-----	16.1	-----	4	-----	10.0	-----	-----	-----	-----	9.8	-----	-----	10.7	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	32.0	-----	-----	>89	-----	4	2	-----	-----	80.0	-----	-----	37.8	-----	-----	48.1	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.9	0.5	-----	-----	1.3	-----	4	-----	0.7	-----	-----	-----	-----	0.6	-----	-----	0.8	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.3	-----	-----	1.9	-----	4	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.4	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	6.4	5.7	-----	-----	13.6	-----	4	-----	7.0	-----	-----	-----	-----	6.5	-----	-----	8.7	-----	3
Width/Depth Ratio	-----	-----	-----	-----	4.6	-----	-----	35.6	-----	4	-----	14.3	-----	-----	-----	-----	13.1	-----	-----	16.9	-----	3
Entrenchment Ratio	-----	-----	-----	-----	5.0	-----	-----	8.2	-----	4	-----	-----	-----	>.2.2	-----	-----	3.5	-----	-----	4.5	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.1	-----	-----	1.9	-----	4	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	6.5	-----	-----	7.3	-----	2	-----	-----	-----	-----	-----	-----	18.6	-----	-----	28.9	-----	3
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35.0	-----	-----	80.0	-----	-----	22.0	-----	-----	52.1	-----	12
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.0	-----	-----	30.0	-----	-----	28.7	-----	-----	43.6	-----	15
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	3.0	-----	-----	3.0	-----	-----	3.8	-----	3
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	70.0	-----	-----	120.0	-----	-----	90.2	-----	-----	130.9	-----	15.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8.0	-----	-----	3.0	-----	-----	4.9	-----	3
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.016	-----	-----	-----	-----	-----	0.011	-----	-----	-----	23
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36	-----	-----	63	-----	-----	11	-----	-----	80	-----	35
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.2	-----	-----	1.3	-----	34
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		<0.063 / 3.9 - 4.6 / 6.5 - 7.3 / 19.3 - 20.4 / 30.8 - 32.0					-----	-----	-----	-----	-----	-----	<0.063 - 5.6 / 9.9 - 16.3 / 18.6 - 28.9 / 85.1 - 99.5 / 154.8 - >2048 / 180 - >2048					
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	0.3	-----	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	15.7	-----	-----	-----	-----	-----	25.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	C4 / E4 (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	3.6	-----	-----	3.6	-----	2	-----	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	24.8	26.4	-----	-----	28.0	-----	2	-----	26.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1377	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	1,849	-----	-----	-----	1,630	-----	-----	-----	-----	-----	1621	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.31	-----	-----	-----	1.17	-----	-----	-----	-----	-----	1.18	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0111	-----	-----	-----	0.0122	-----	-----	-----	-----	-----	0.0122	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 4 (232 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						Monitoring Baseline (As-built)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	5.7	-----	-----	-----	-----	-----	-----	-----	10.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25	-----	-----	110.0	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.9	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	6.7	-----	-----	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----						-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----				-----			-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.22	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	25.8	-----	-----	-----	28	-----	-----	-----	28	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	202	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	234	-----	-----	-----	232	-----	-----	-----	-----	-----	232	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.21	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0094	-----	-----	-----	0.0113	-----	-----	-----	-----	-----	0.012	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 5 (822 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						Monitoring Baseline (As-built)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	6.1	5.2	-----	-----	17.0	-----	3	-----	10.5	-----	-----	-----	-----	10.2	-----	-----	11.1	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	51.0	-----	-----	84.0	-----	3	25	-----	-----	110.0	-----	-----	43.8	-----	-----	59.4	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.9	0.7	-----	-----	1.5	-----	3	-----	0.8	-----	-----	-----	-----	0.5	-----	-----	0.8	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.6	-----	-----	2.1	-----	3	-----	1.2	-----	-----	-----	-----	0.9	-----	-----	1.2	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	7.4	8.0	-----	-----	12.3	-----	3	-----	8.7	-----	-----	-----	-----	5.7	-----	-----	8.0	-----	3
Width/Depth Ratio	-----	-----	-----	-----	3.5	-----	-----	23.5	-----	3	-----	12.5	-----	-----	-----	-----	13.4	-----	-----	21.5	-----	3
Entrenchment Ratio	-----	-----	-----	-----	3.0	-----	-----	13.2	-----	3	-----	-----	-----	>2.2	-----	-----	4.0	-----	-----	5.7	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.3	-----	-----	1.3	-----	3	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	5.6	-----	-----	8.6	-----	2	-----	-----	-----	-----	-----	-----	27.5	-----	-----	41.8	-----	2
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.0	-----	-----	84.0	-----	-----	23.8	-----	-----	44.2	-----	10
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21.0	-----	-----	31.5	-----	-----	24.5	-----	-----	40.9	-----	9
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	3.0	-----	-----	2.8	-----	-----	3.5	-----	3
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	73.5	-----	-----	126.0	-----	-----	95.2	-----	-----	139.9	-----	9
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8.0	-----	-----	2.9	-----	-----	3.9	-----	3
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.018	-----	-----	-----	11
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	42.0	-----	-----	74.0	-----	-----	25.0	-----	-----	96.0	-----	14
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.7	-----	-----	2.9	-----	-----	0.4	-----	-----	1.1	-----	15
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		<0.063 / 2 - 4.8 / 5.6 - 8.6 / 20.4 - 28.7 / 77 - 87.7					-----	-----	-----	-----	-----	-----		13.2 - 13.6 / 20.4 - 27.8 / 27.5 - 41.8 / 65.1 - 84.1 / 114.6 - 122.5 / 128 - 256				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	0.55	-----	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	19.4	-----	-----	-----	-----	-----	23.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.210	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	C4 / E4	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	2.41	-----	-----	3.15	-----	-----	-----	3.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	28.8	-----	-----	-----	29.6	-----	-----	-----	29.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	742	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	849	-----	-----	-----	809	-----	-----	-----	-----	-----	822	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.17	-----	-----	-----	1.17	-----	-----	-----	-----	-----	1.11	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0133	-----	-----	-----	0.0106	-----	-----	-----	-----	-----	0.0128	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 11a. Cross-section Morphology Data
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 2 (711 LF)

	Cross-section X-1 (Riffle)							Cross-section X-2 (Riffle)							Cross-section X-3 (Pool)							Cross-section X-4 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	8.75	8.46	-	-	-	-	-	9.17	9.13	-	-	-	-	-	11.96	8.73	-	-	-	-	-	10.00	9.91	-	-	-	-	-
BF Mean Depth (ft)	0.66	0.57	-	-	-	-	-	0.90	0.84	-	-	-	-	-	1.00	1.14	-	-	-	-	-	0.84	0.71	-	-	-	-	-
Width/Depth Ratio	13.23	14.92	-	-	-	-	-	10.17	10.88	-	-	-	-	-	11.92	7.62	-	-	-	-	-	11.92	14.05	-	-	-	-	-
BF Cross-sectional Area (ft²)	5.79	4.80	-	-	-	-	-	8.28	7.66	-	-	-	-	-	12.01	9.99	-	-	-	-	-	8.38	7.00	-	-	-	-	-
BF Max Depth (ft)	1.09	0.96	-	-	-	-	-	1.37	1.34	-	-	-	-	-	2.25	2.00	-	-	-	-	-	1.45	1.32	-	-	-	-	-
Width of Floodprone Area (ft)	27.05	25.55	-	-	-	-	-	33.92	33.03	-	-	-	-	-	42.56	37.11	-	-	-	-	-	41.34	38.11	-	-	-	-	-
Entrenchment Ratio	3.09	3.02	-	-	-	-	-	3.70	3.62	-	-	-	-	-	3.56	4.25	-	-	-	-	-	4.13	3.84	-	-	-	-	-
Bank Height Ratio	1.01	1.06	-	-	-	-	-	1.01	1.01	-	-	-	-	-	1.00	1.00	-	-	-	-	-	1.00	1.05	-	-	-	-	-
Wetted Perimeter (ft)	10.07	9.60	-	-	-	-	-	10.97	10.81	-	-	-	-	-	13.96	11.01	-	-	-	-	-	11.68	11.33	-	-	-	-	-
Hydraulic Radius (ft)	0.57	0.50	-	-	-	-	-	0.75	0.71	-	-	-	-	-	0.86	0.91	-	-	-	-	-	0.72	0.62	-	-	-	-	-

Reach 3 (1,621 LF)

	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)							Cross-section X-8 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.65	11.8	-	-	-	-	-	13.63	19.3	-	-	-	-	-	9.84	10.72	-	-	-	-	-	11.92	12.08	-	-	-	-	-
BF Mean Depth (ft)	0.82	0.69	-	-	-	-	-	1.07	0.67	-	-	-	-	-	0.66	0.53	-	-	-	-	-	1.21	1.03	-	-	-	-	-
Width/Depth Ratio	13.05	17.3	-	-	-	-	-	12.77	28.6	-	-	-	-	-	14.87	20.15	-	-	-	-	-	9.85	11.72	-	-	-	-	-
BF Cross-sectional Area (ft²)	8.68	8.11	-	-	-	-	-	14.54	13	-	-	-	-	-	6.51	5.71	-	-	-	-	-	14.42	12.46	-	-	-	-	-
BF Max Depth (ft)	1.44	1.35	-	-	-	-	-	2.09	1.79	-	-	-	-	-	1.03	0.85	-	-	-	-	-	2.24	1.98	-	-	-	-	-
Width of Floodprone Area (ft)	48.09	48.1	-	-	-	-	-	50.26	49.4	-	-	-	-	-	38.30	38.48	-	-	-	-	-	50.45	50.46	-	-	-	-	-
Entrenchment Ratio	4.52	4.06	-	-	-	-	-	3.69	2.56	-	-	-	-	-	3.89	3.59	-	-	-	-	-	4.23	4.18	-	-	-	-	-
Bank Height Ratio	1.00	1.09	-	-	-	-	-	1.00	0.99	-	-	-	-	-	1.00	0.98	-	-	-	-	-	1.00	1.03	-	-	-	-	-
Wetted Perimeter (ft)	12.29	13.21	-	-	-	-	-	15.77	20.65	-	-	-	-	-	11.16	11.78	-	-	-	-	-	14.34	14.14	-	-	-	-	-
Hydraulic Radius (ft)	0.71	0.61	-	-	-	-	-	0.92	0.63	-	-	-	-	-	0.58	0.48	-	-	-	-	-	1.01	0.88	-	-	-	-	-

	Cross-section X-9 (Riffle)																											
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.71	10.04	-	-	-	-	-																					
BF Mean Depth (ft)	0.63	0.53	-	-	-	-	-																					
Width/Depth Ratio	16.87	18.85	-	-	-	-	-																					
BF Cross-sectional Area (ft²)	6.79	5.34	-	-	-	-	-																					
BF Max Depth (ft)	1.06	0.80	-	-	-	-	-																					
Width of Floodprone Area (ft)	37.79	31.28	-	-	-	-	-																					
Entrenchment Ratio	3.53	3.12	-	-	-	-	-																					
Bank Height Ratio	1.00	0.97	-	-	-	-	-																					
Wetted Perimeter (ft)	11.97	11.10	-	-	-	-	-																					
Hydraulic Radius (ft)	0.57	0.48	-	-	-	-	-																					

Table 11a. Cross-section Morphology Data
Town Creek Restoration Project - Option B: DMS Project ID No. 95026
Reach 5 (822 LF)

	Cross-section X-10 (Riffle)							Cross-section X-11 (Pool)							Cross-section X-12 (Riffle)							Cross-section X-13 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.36	10.28	-	-	-	-	-	16.70	16.78	-	-	-	-	-	11.06	10.49	-	-	-	-	-	10.19	10.04	-	-	-	-	-
BF Mean Depth (ft)	0.77	0.70	-	-	-	-	-	1.09	1.01	-	-	-	-	-	0.52	0.53	-	-	-	-	-	0.59	0.51	-	-	-	-	-
Width/Depth Ratio	13.43	14.65	-	-	-	-	-	15.34	16.60	-	-	-	-	-	21.45	19.92	-	-	-	-	-	17.40	19.58	-	-	-	-	-
BF Cross-sectional Area (ft²)	8.00	7.21	-	-	-	-	-	18.19	16.97	-	-	-	-	-	5.71	5.53	-	-	-	-	-	5.97	5.15	-	-	-	-	-
BF Max Depth (ft)	1.18	1.10	-	-	-	-	-	2.20	2.11	-	-	-	-	-	1.07	0.80	-	-	-	-	-	0.91	0.79	-	-	-	-	-
Width of Floodprone Area (ft)	59.38	59.03	-	-	-	-	-	63.54	63.56	-	-	-	-	-	43.79	40.39	-	-	-	-	-	56.59	56.65	-	-	-	-	-
Entrenchment Ratio	5.70	5.74	-	-	-	-	-	3.81	3.79	-	-	-	-	-	3.96	3.85	-	-	-	-	-	5.55	5.64	-	-	-	-	-
Bank Height Ratio	1.01	0.99	-	-	-	-	-	1.00	1.03	-	-	-	-	-	1.01	1.00	-	-	-	-	-	1.00	0.97	-	-	-	-	-
Wetted Perimeter (ft)	11.90	11.68	-	-	-	-	-	18.88	18.80	-	-	-	-	-	12.10	11.55	-	-	-	-	-	11.37	11.06	-	-	-	-	-
Hydraulic Radius (ft)	0.67	0.62	-	-	-	-	-	0.96	0.90	-	-	-	-	-	0.47	0.48	-	-	-	-	-	0.53	0.47	-	-	-	-	-

Table 11b. Stream Reach Morphology Data
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 2 (711 LF)

Parameter	As-built						MY1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	8.8	-----	-----	12.0	-----	3	8.5	9.2	9.1	9.9	0.7	3
Floodprone Width (ft)	27.1	-----	-----	42.6	-----	3	25.6	32.2	33.0	38.1	6.3	3
BF Mean Depth (ft)	0.7	-----	-----	1.0	-----	3	0.6	0.7	0.7	0.8	0.1	3
BF Max Depth (ft)	1.1	-----	-----	2.3	-----	3	1.0	1.2	1.3	1.3	0.2	3
BF Cross-sectional Area (ft^2)	5.8	-----	-----	12.0	-----	3	4.8	6.5	7.0	7.7	1.5	3
Width/Depth Ratio	10.2	-----	-----	13.2	-----	3	10.9	13.3	14.1	14.9	2.1	3
Entrenchment Ratio	3.1	-----	-----	3.7	-----	3	3.0	3.5	3.6	3.8	0.4	3
Bank Height Ratio	1.0	-----	-----	1.0	-----	3	1.0	1.0	1.1	1.1	0.0	3
d50 (mm)	17.1	-----	-----	23.3	-----	2	24.7	-----	-----	28.0	-----	2
Pattern												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	0.010	-----	-----	-----	9	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	19.0	-----	-----	63.0	-----	19	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	0.200	-----	-----	3.4	-----	20	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters							-----	-----	-----	-----	-----	-----
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95		<0.063 - 4.4 / 8.7 - 12.1 / 17.1 - 23.3 / 55.3 - 77.1 / 75.6 - 117.2						<0.063 - 5.0 / 12.8 - 16.7 / 24.7 - 28.0 / 58.0 - 79.2 / 77.1 - 128 / 64 - 180				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters												
Drainage Area (SM)	-----	-----	-----	0.12	-----	-----	-----	-----	-----	0.12	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4 / E4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	695	-----	-----	-----	-----	-----	695	-----	-----	-----	-----
Channel length $(ft)^2$	-----	711	-----	-----	-----	-----	-----	711	-----	-----	-----	-----
Sinuosity	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0180	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table 11b. Stream Reach Morphology Data
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 3 (1,621 LF)

Parameter	As-built						MY1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	9.8	-----	-----	10.7	-----	3	10.0	10.9	10.7	11.8	0.9	3
Floodprone Width (ft)	37.8	-----	-----	48.1	-----	3	31.3	39.3	38.5	48.1	8.4	3
BF Mean Depth (ft)	0.6	-----	-----	0.8	-----	3	0.5	0.6	0.5	0.7	0.1	3
BF Max Depth (ft)	1.0	-----	-----	1.4	-----	3	0.8	1.0	0.9	1.4	0.3	3
BF Cross-sectional Area (ft^2)	6.5	-----	-----	8.7	-----	3	5.3	6.4	5.7	8.1	1.5	3
Width/Depth Ratio	13.1	-----	-----	16.9	-----	3	17.3	18.8	18.9	20.2	1.4	3
Entrenchment Ratio	3.5	-----	-----	4.5	-----	3	3.1	3.6	3.6	4.1	0.5	3
Bank Height Ratio	1.0	-----	-----	1.0	-----	3	1.0	1.0	1.0	1.1	0.1	3
d50 (mm)	18.6	-----	-----	28.9	-----	3	32.0	-----	-----	37.2	-----	3
Pattern												
Channel Beltwidth (ft)	22.0	-----	-----	52.1	-----	12	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	28.7	-----	-----	43.6	-----	15	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	3.0	-----	-----	3.8	-----	3	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90.2	-----	-----	130.9	-----	15.0	-----	-----	-----	-----	-----	-----
Meander Width Ratio	3.0	-----	-----	4.9	-----	3	-----	-----	-----	-----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	0.011	-----	-----	-----	23	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	11	-----	-----	80	-----	35	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	0.2	-----	-----	1.3	-----	34	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	<0.063 - 5.6 / 9.9 - 16.3 / 18.6 - 28.9 / 85.1 - 99.5 / 154.8 - >2048 / 180 - >2048						5.6 - 10.3 / 16.8 - 20.6 / 32 - 37.2 / 86 - 105 / 120.1 - 159.5 / 180 - 512					
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters												
Drainage Area (SM)	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	1377	-----	-----	-----	-----	-----	1377	-----	-----	-----	-----
Channel length $(ft)^2$	-----	1621	-----	-----	-----	-----	-----	1621	-----	-----	-----	-----
Sinuosity	-----	1.18	-----	-----	-----	-----	-----	1.18	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0122	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table 11b. Stream Reach Morphology Data
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

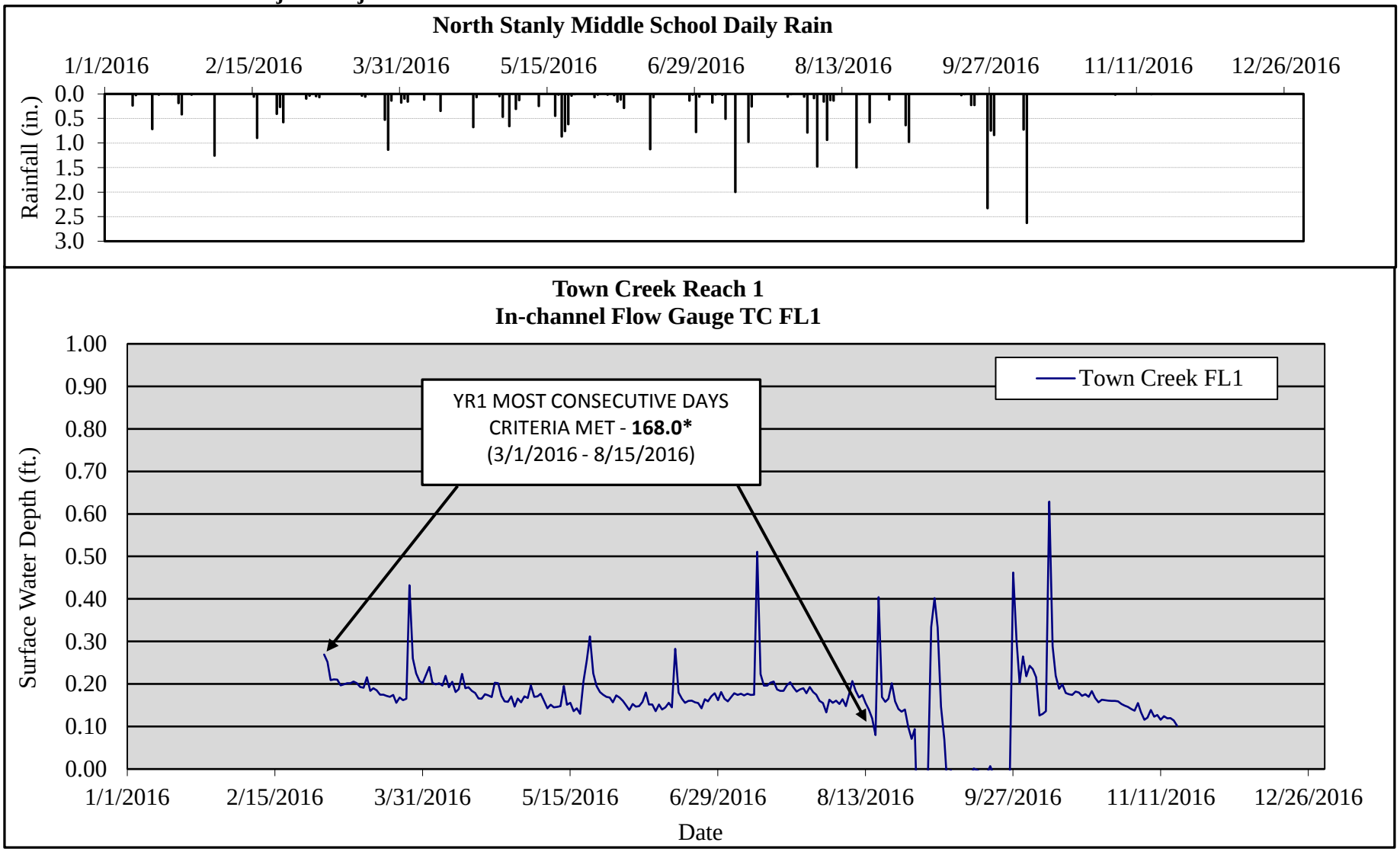
Reach 5 (822 LF)

Parameter	As-built						MY1					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	10.2	-----	-----	11.1	-----	3	10.0	10.3	10.3	10.5	0.2	3
Floodprone Width (ft)	43.8	-----	-----	59.4	-----	3	40.4	52.0	56.7	59.0	10.1	3
BF Mean Depth (ft)	0.5	-----	-----	0.8	-----	3	0.5	0.6	0.5	0.7	0.1	3
BF Max Depth (ft)	0.9	-----	-----	1.2	-----	3	0.8	0.9	0.8	1.1	0.2	3
BF Cross-sectional Area (ft^2)	5.7	-----	-----	8.0	-----	3	5.2	6.0	5.5	7.2	1.1	3
Width/Depth Ratio	13.4	-----	-----	21.5	-----	3	14.7	18.1	19.6	19.9	2.9	3
Entrenchment Ratio	4.0	-----	-----	5.7	-----	3	3.9	5.1	5.6	5.7	1.1	3
Bank Height Ratio	1.0	-----	-----	1.0	-----	3	1.0	1.0	1.0	1.0	0.0	3
d50 (mm)	27.5	-----	-----	41.8	-----	2	20.3	-----	-----	25.7	-----	2
Pattern												
Channel Beltwidth (ft)	23.8	-----	-----	44.2	-----	10	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	24.5	-----	-----	40.9	-----	9	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	2.8	-----	-----	3.5	-----	3	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	95.2	-----	-----	139.9	-----	9	-----	-----	-----	-----	-----	-----
Meander Width Ratio	2.9	-----	-----	3.9	-----	3	-----	-----	-----	-----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	0.018	-----	-----	-----	11	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	25.0	-----	-----	96.0	-----	14	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	0.4	-----	-----	1.1	-----	15	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	13.2 - 13.6 / 20.4 - 27.8 / 27.5 - 41.8 / 65.1 - 84.1 / 114.6 - 122.5 / 128 - 256						6.7 - 10.3 / 14.1 - 18.2 / 20.3 - 25.7 / 52.4 - 62.1 / 119.3 - 134.7 / 180 - 256					
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters												
Drainage Area (SM)	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	742	-----	-----	-----	-----	-----	742	-----	-----	-----	-----
Channel length $(ft)^2$	-----	822	-----	-----	-----	-----	-----	822	-----	-----	-----	-----
Sinuosity	-----	1.11	-----	-----	-----	-----	-----	1.11	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0128	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

APPENDIX E

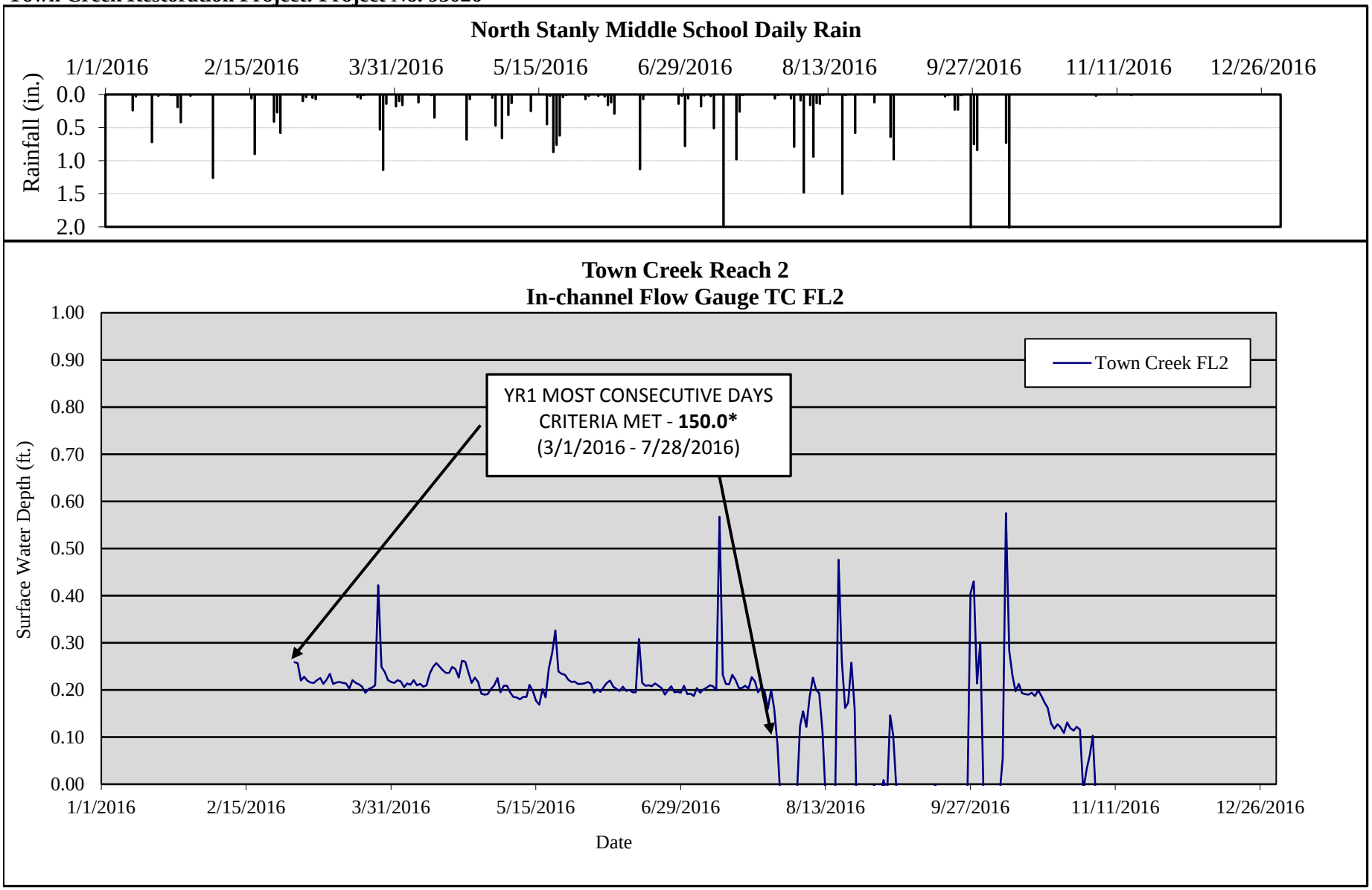
Hydrologic Data

Figure 5a. In-Stream Flow Gauge Graphs
Town Creek Restoration Project: Project No. 95026



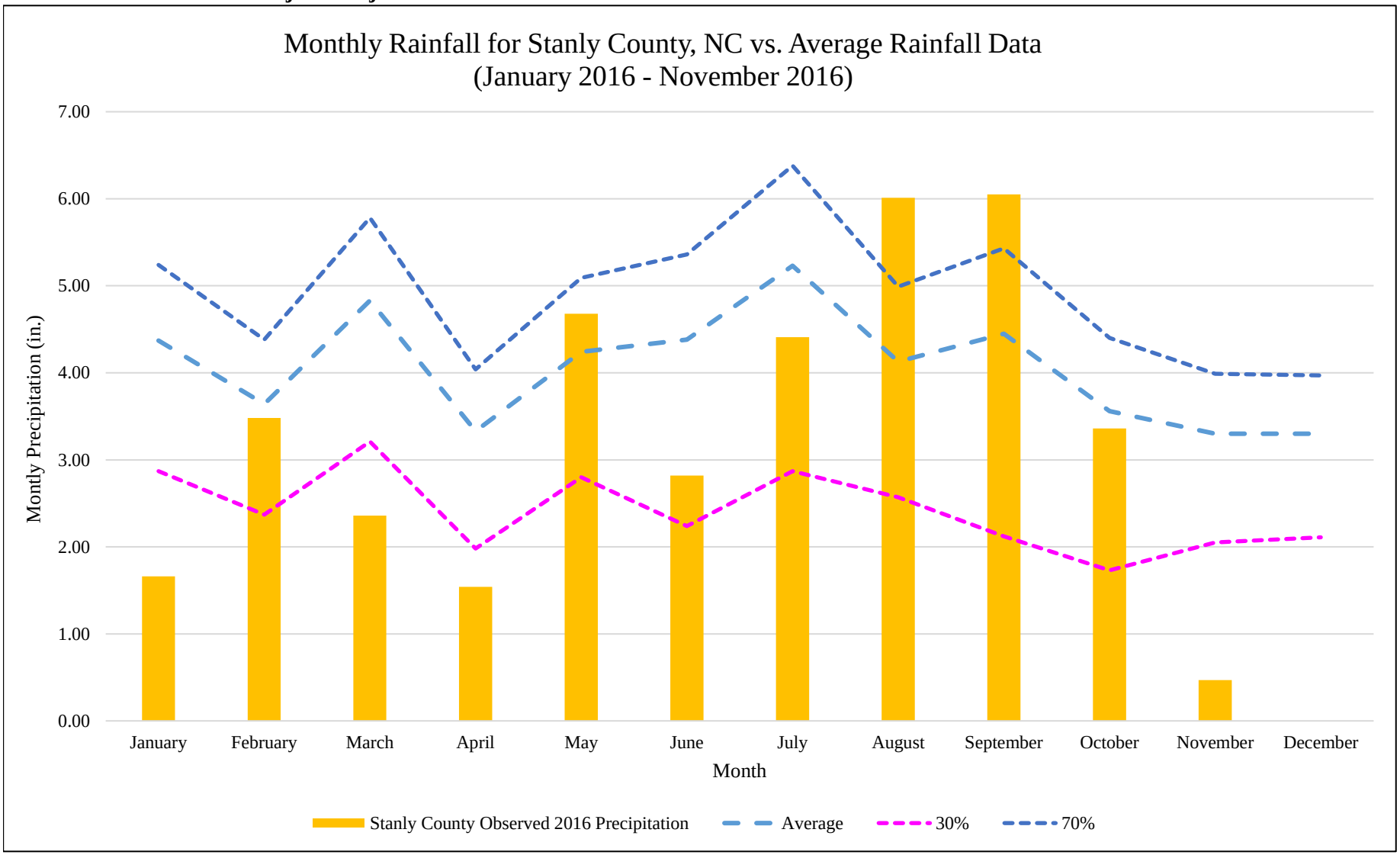
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.1 feet in depth.

Figure 5b. In-Stream Flow Gauge Graphs
Town Creek Restoration Project: Project No. 95026



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.1 feet in depth.

Figure 6. Monthly Rainfall Data
Town Creek Restoration Project: Project No. 95026



Historic rainfall data from WETS Station : ALBEMARLE, NC0090

Observed 2016 Precipitaion from CHRONOS Station NEWL, North Stanly Middle School

Table 12. Verification of Bankfull Events
Town Creek Restoration Project: DMS Project ID No. 95026

Date of Data Collection	Date of Occurrence	Method	Reach Location	Gauge Height (FT)	Photo # (if available)
10/12/2016	Between 5/2016 and 10/12/2016	Crest Gauge	Reach 5 Station 42+50	0.2	Crest Gauge Photo 1

Table 13. Verification of In-stream Flow Conditions
Town Creek Restoration Project: DMS Project ID No. 95026

Flow Gauge ID	Reach Location	Consecutive Days of Flow[1]	Cumulative Days of Flow[2]
TCFL1	Reach 1 Station 11+05	168	231
TCFL2	Reach 2 Station 13+02	150	195

Notes:
[1]Indicates the number of consecutive days within the monitoring year where flow was measured.
[2]Indicates the number of cumulative days within the monitoring year where flow was measured.
Flow success criteria for the Site is stated as: A surface water flow event will be considered intermittent when the flow duration occurs for a minimum of 30 days.
Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.1 feet in depth.

Crest Gauge Photo 1 (10/12/16)

Flow Documentation Photo - TC FL2 Photo (11/13/2016)