UT to Town Creek Restoration Project – Option A
Final Monitoring Report/Closeout Report

Stanly County, North Carolina

DMS Project ID Number – 94648; NC DEQ Contract No. 003277

Yadkin Pee-Dee River Basin: 03040105060040

Project Info:	Monitoring Year: 5 Year of Data Collection: 2020 Year of Completed Construction: 2016 Submission Date: January 2021
Submitted To:	NCDEQ – Division of Mitigation Services 1625 Mail Service Center Raleigh, NC 27699 NCDEQ Contract ID No. 003277

Mitigation Project Name	**UT to Town Creek**	**USACE Action ID**	**2013-01280**
DMS ID	**94648**	**DWR Permit**	**2014-1024**
River Basin	**Yadkin**	**Date Project Instituted**	**8/20/2010**
Cataloging Unit	**03040105**	**Date Prepared**	**4/20/2020**
County	**Stanly**	**Stream/Wet. Service Area**	**Yadkin 03040105**

Todd J Tugwell 9/21/2020

Signature & Date of Official Approving Credit Release

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

Credit Release Milestone	**Warm Stream Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	1,933.345	0.000	1,933.345	2016	12/22/2016
3 - Year 1 Monitoring	10.00%	10.00%	644.448	0.000	644.448	2017	10/20/2017
4 - Year 2 Monitoring	10.00%	10.00%	640.360	16.354	624.006	2018	8/13/2018
5 - Year 3 Monitoring	10.00%	10.00%	640.360	0.000	640.360	2019	4/26/2019
6 - Year 4 Monitoring	10.00%	10.00%	640.360	0.000	640.360	2020	4/20/2020
7 - Year 5 Monitoring	15.00%					2021	
Stream Bankfull Standard	15.00%	15.00%	960.540	0.000	960.540	2018	8/13/2018
			Totals		4,802.699		

Total Gross Credits	6,403.600
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	5,443.059
Total Percentage Released	85.00%
Remaining Unreleased Credits	960.541

Credit Release Milestone	**Riparian Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	0.924	0.000	0.924	2016	12/22/2016
3 - Year 1 Monitoring	10.00%	10.00%	0.308	0.000	0.308	2017	10/20/2017
4 - Year 2 Monitoring	10.00%	10.00%	0.308	0.000	0.308	2018	8/13/2018
5 - Year 3 Monitoring	10.00%	10.00%	0.308	0.000	0.308	2019	4/26/2019
6 - Year 4 Monitoring	10.00%	10.00%	0.308	0.000	0.308	2020	4/20/2020
7 - Year 5 Monitoring	10.00%					2021	
8 - Year 6 Monitoring	10.00%					2022	
9 - Year 7 Monitoring	10.00%					2023	
Stream Bankfull Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Totals		2.156		

Total Gross Credits	3.080
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2.156
Total Percentage Released	70.00%
Remaining Unreleased Credits	0.924

Mitigation Project Name	**UT to Town Creek**	**USACE Action ID**	**2013-01280**
DMS ID	**94648**	**DWR Permit**	**2014-1024**
River Basin	**Yadkin**	**Date Project Instituted**	**8/20/2010**
Cataloging Unit	**03040105**	**Date Prepared**	**4/20/2020**
County	**Stanly**	**Stream/Wet. Service Area**	**Yadkin 03040105**

Notes

8/13/2018: Adjustment required due to IRT concerns on how the as-built credits were calculated.
8/13/2018: Adjustments to the original ledger were necessary to accurately account and show the Bonus credits associated with the project.

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Warm Stream	Restoration	5,554.000
Warm Stream	Enhancement I	447.000
Warm Stream	Enhancement II	344.000
Riparian	Restoration	2.560
Riparian	Creation	1.560

Debits

							Stream Restoration Credits	Riparian Restoration
Beginning Balance (mitigation credits)							**6,403.600**	**3.080**
Released Credits							**0.000**	**2.156**
Unrealized Credits							**0.000**	**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**		
NCDOT Stream & Wetland ILF Program	REQ-007422	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431		2,221.600	
NCDOT Stream & Wetland ILF Program	REQ-007422	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431		178.800	
NCDOT Stream & Wetland ILF Program	REQ-007422	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431		55.040	
NCDOT Stream & Wetland ILF Program	REQ-007422	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431		122.353	
NCDOT Stream & Wetland ILF Program	REQ-006144	P-5208A P-5208C P-5208G	RR Improvements from Haydock to Junker	2010-01630				0.430
NCDOT Stream & Wetland ILF Program	REQ-006299	R-2559 R-3329	R-2559 - R-3329 - Monroe Bypass/Connector	2009-00876	2002-0672			0.308
NCDOT Stream & Wetland ILF Program	REQ-006299	R-2559 R-3329	R-2559 - R-3329 - Monroe Bypass/Connector	2009-00876	2002-0672			0.338
NCDOT Stream & Wetland ILF Program	REQ-006299	R-2559 R-3329	R-2559 - R-3329 - Monroe Bypass/Connector	2009-00876	2002-0672			0.156
NCDOT Stream & Wetland ILF Program	REQ-007424	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431			0.256
NCDOT Stream & Wetland ILF Program	REQ-007424	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431			0.052
NCDOT Stream & Wetland ILF Program	REQ-007424	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431			0.256
NCDOT Stream & Wetland ILF Program	REQ-007424	R-2248E	I-485 - Charlotte Outer Loop	2011-01237	2011-0431			0.052
Total Credits Debited							**2,577.793**	**1.848**
Remaining Available balance (Released credits)							**2,865.266**	**0.308**
Remaining balance (Unreleased credits)							**960.541**	**0.924**

Michael Baker
INTERNATIONAL

We Make a Difference

January 28, 2021

Harry Tsomides, Project Manager
NCDEQ - Division of Mitigation Services
5 Ravenscroft Drive, Ste. 102
Asheville, NC 28801

Subject: Response to DMS Comments for DRAFT Monitoring Year 5 Report
UT to Town Creek Restoration Project – Option A
Yadkin River Basin – CU# 03040105 – Stanly County, NC
NCDMS Project ID No. 94648; NCDEQ Contract No. 003277

Dear Mr. Tsomides:

Please find enclosed the Final Year 5 Monitoring Report/Closeout Report and our responses to the Division of Mitigation Services (DMS) review comments received on December 18, 2020 regarding the UT to Town Creek Restoration Project – Option A, located in Stanly County, NC. In response to the referenced review comments, we have revised the Final Year 5 Monitoring Document, as needed. Each response has been grouped with its corresponding comment and is outlined below.

- *This report will serve as the 2021 close out report since it is being proposed for close out. If Baker wishes to add anything to the report it considers pertinent to close out, please do so and explain in the responses. Please indicate on the cover page that this is an MY5/Close Out Report. Stream morphological, hydrological and vegetative data for all 5 years should be included.*
  Response: Monitoring Year 5 report has been revised to serve as both MY5/Closeout Report. Changes include; Stream morphological, hydrological and vegetative data for all 5 years of monitoring. Also, an additional summary has been added in the executive summary.
- *Please update the asset table to the current version (attached to this email), including significant digits. Please note that the second part of Table 1 should be a project credits table rather than a component summation table.*
  Response: Table 1 has been revised to include significant digits.
- *Since this will serve as the close out report, please include the supplemental wetland study and memo as part of this report as previously planned. Please include a background of why the study is being performed and what the results indicate. Georeferenced PDF maps should accompany the data, showing what areas are being proposed as 'expansion' areas and what areas are being offset by the additional areas. Acreage calculations should be included in a table and showing that the gained areas being proposed equal or exceed the 'abandoned' areas. If the study cannot be completed in time for this report, please explain why, and by what date Baker plans to have the data ready for submittal to the IRT.*
  Response: The supplemental wetland study has been included in Appendix G.
- *Please include the June 2019 IRT site meeting minutes in an Appendix.*
  Response: The IRT meeting minutes have been included in Appendix F.
- *Please optimize/compress the report PDF if possible.*
  Response: The report file has been compressed for submission.

Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518 | Office: 919-463-5488

Digital Submission Comments

- *Please update the photo point shapefile attribute table so that photo point unique ID's include the ID number and reach (i.e. 10 R6, etc.).*
  Response: **Photo point shapefile has been updated and included in the digital submission file per DMS request.**
- *Please submit photos as JPEG's.*
  Response: Photos have been included in the digital submission file.
- *Please submit the MY 5 CVS minidatabase.*
  Response: CVS minidatabase has been included in the digital submission file.
- *Please be sure that all cross section calculations are using MY5 data, and verify that the data being used in the BHR calculations are accurate. For example, it appears that XS 1 is still using MY4 data based on cell N29, while the XS 13 LTOB is listed as 565.3, but it is 565.057. The BHR calculations should be using the current monitoring year's low top of bank depth in the numerator, and in the denominator the depth at the elevation that achieves the MY0 cross sectional area in the MY5 channel should be used.*
  Response: Revisions have been made to figure 3 and table 11a and 11b per DMS request.

Sincerely,

Andrew Powers

Environmental Associate

UT to Town Creek Restoration Project – Option A
Year 5 Monitoring Report/Closeout Report

Stanly County, North Carolina

DMS Project ID Number – 94648; NC DEQ Contract No. 003277

SAW-2013-01280; DWR#14-1024

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.
8000 Regency Parkway, Suite 600
Cary, NC 27518

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1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc., (Michael Baker) restored 5,554 linear feet (LF) and enhanced 791 LF (447 LF of Enhancement I and 344 LF of Enhancement II) of perennial and intermittent stream along an Unnamed Tributary (UT) to Town Creek and three additional unnamed tributaries. Also as part of this Project, Michael Baker restored and created 4.12 acres of riparian wetlands and enhanced 1.00 acre of riparian wetlands and constructed two wetland best management practices (BMPs) upstream of the mitigation areas. Though no mitigation credit is being sought for wetland enhancement, additional stream mitigation credit is being sought for the inclusion of the proposed stormwater BMPs and the extended riparian buffer width within the conservation easement. This report documents and presents the Year 5 monitoring data as required during the monitoring period.

The primary goals of the Project were to improve aquatic habitat degradation by improving ecologic functions and reducing non-points source loads from agricultural run-off to the impaired areas as described in the Lower Yadkin – Pee Dee River Basin Restoration Priorities (RBRP) and as identified below:

- Improve aquatic and terrestrial habitat through increasing dissolved oxygen concentrations, reduction in nutrient and sediment loading, improving substrate and in-stream cover, and reduction of in-stream water temperature;
- Improve both aquatic and riparian aesthetics;
- Create geomorphically stable conditions along UT to Town Creek and its tributaries through the Project area;
- Prevent cattle from accessing the project area thereby protecting riparian and wetland vegetation and reducing excessive bank erosion;
- Restore historical wetlands, create new wetlands, and enhance/preserve existing wetlands to improve terrestrial habitat and reduce sediment and nutrient loading to UT to Town Creek and the Little Long Creek Watershed.

To accomplish these goals, the following objectives were identified:

- Restore, enhance, create, and protect riparian wetlands and buffers to reduce nutrient and pollutant loading by particle settling, vegetation filtering and nutrient uptake;
- Construct wetland BMPs on the upstream extent of Reaches 4 and 7 to improve water quality by capturing and retaining stormwater run-off from the adjacent cattle pastures to allow for the biological removal of nutrient pollutant loads and for sediment to settle out of the water column;
- Restore existing incised, eroding, and channelized streams by creating stable channels with access to their geomorphic floodplains;
- 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;
- Control invasive species vegetation within the project reaches;
- Establish native stream bank, riparian floodplain, and wetland vegetation, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, shade the stream to decrease water temperature, and provide improved wildlife habitat quality.

UT to Town Creek Restoration Project – Option A (site) is located in Stanly County, approximately 1.7 miles west of the Town of New London, within cataloging unit 03040105 of the Yadkin Pee-Dee River Basin (see Figure 1). The site is located in a North Carolina Division of Mitigation Services (NCDMS) - Targeted Local Watershed (03040105060040). The Project involved stream restoration and enhancement, as well as wetland restoration, creation, and enhancement along UT to Town Creek and several of its tributaries, which had been impaired due to historical pasture conversion and cattle grazing.

During Year 5 monitoring, vegetation conditions were performing over 90% for planted acreage and close to 100% for invasive/encroachment area categories. As noted in Table 6b, an area (VPA5-1) of low herbaceous vegetation and poor growth rates has continued to persist from MY2. This area is located along Reach 2 between Vegetation Plot 14 and 13 and consists of approximately 0.11 acres. This area has been supplemental planted with gallon plants, annual seed, perennial grass plugs and appropriate amount of lime in May 2020, but due to harsh temperatures and compacted clay soils this area is expected to have a high mortality.

Supplement planting was conducted in January 2020 for vegetation problem areas reported in year 4 monitoring report (VPA4-1 and VPA4-3) noted with poor growth performance. Planted species consisted of woody bare root, potted plantings, that were installed at a planting density of 50 plants/acre. Their successful growth will provide shade and an input of organic material that will allow for some of the existing herbaceous vegetation to spread to this area. The planted species consisted of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), white oak (*Quercus alba*), willow oak (*Quercus phellos),* and black gum (*Nyssa sylvantica)*. Stream problems areas (SPA5-1 – SPA5-3) documented during year 5 were beaver dams along Reach 2 between the culvert crossing and the confluence of Reach 6. The beaver have been professionally trapped and removed from the project along with their dams. However, the dams had created backwater which killed some vegetation, additionally the beaver had chewed and fallen trees throughout Reach 2. However, the banks still look stable with no erosion and new vegetation is resprouting. These SPAs will be livestaked and seeded to ensure stable banks this winter. Both SPA and VPA data and photographic documentation collected during Year 5 monitoring are located in Appendix B. See Tables 5a through 5h for SPA data documentation and Tables 6a through 6b for VPA data documentation.
The presence of parrot feather (*Myriophyllum aquaticum*) throughout the mainstem (Reaches 1, 2, and 3) of the project have persisted; however, its abundance have been dramatically reduced. Treatments were conducted during May and June 2020 by chemical application. A request for recommendations to assist in the control of parrot feather was initiated by Michael Baker to the NC Department of Environmental Quality (NCDEQ) prior to the close of Monitoring Year 2, a response was received in early November 2018, and Michael Baker has been following NCDEQ's proposed protocol.

In Monitoring Year 5, no areas of invasive species were documented due to none of the areas exceeding the mapping threshold of 1000 square feet (SF) and treatments throughout 2020. Two treatment sessions were performed in May and June treating invasive species throughout the entire site. Species targeted consist of primarily Chinese privet (*Ligustrum sinese*) along with multi-flora rose (*Rosa multiflora*) and princess tree (*Paulownia tomentosa*). The presence of these invasive species tend to occur predominantly in areas of the easement where mature woody vegetation is present and along the easement fence line. Tables summarizing the vegetative assessment areas can be found in Appendix B.

Based on data collected from the twenty monitoring plots during Year 5 monitoring, the average density of total planted stems per plot ranges from 445 to 769 stems per acre with a tract mean of 615 stems per acre. Therefore, the Year 5 data demonstrate that the site has exceeded the minimum success criteria of 260 trees per acre by the end of Year 5. The presence of volunteer woody vegetation was noted in vegetation plots; however, these species were not included in the average vegetation plot densities calculated for assessing the project's interim success criteria. Vegetation stem counts are summarized in Tables 7 and 9 of Appendix C.

The nineteen (19) permanent cross-sections located throughout the site show minimal adjustment to stream dimension since construction. Longitudinal profiles for Reach 1, 2, 3, and 6 have remained geomorphically stable throughout the Year 5 post-construction monitoring period. Pools are well maintained and grade control

structures (constructed riffles, rock j-hooks, log vanes, and boulder steps) continue to maintain the overall profile desired. As indicated in Tables 5a through 5h (Appendix B), the site's lateral/vertical stability and in-stream structure performance has maintained at or close to 100% through Monitoring Year 5. Visual observations and a review of reach-wide pebble count data collected indicates that each Reach is sufficiently moving fines through the system. Riffles are comprised of a mix of substrates with the bed material continuing to move towards a mix of coarser substrates. Even with the presence of beaver dams the average reach wide pebble count shows a mix of coarser substrates. Cross-sectional, longitudinal profile, and pebble count data are provided in Figures 3, 4, and 5 respectively, in Appendix D.

Groundwater monitoring data collected during the growing season (March 27 through November 5) of Years 2, 3, 4, and 5 documented that all ten groundwater monitoring wells exhibited soil saturation within 12 inches of the ground surface for the minimum success criteria of nine percent (9%) or 20 consecutive days during the growing season (eight of ten wells meet in Monitoring Year 1 as well, the two non-meeting wells did not function properly within the growing season). During Monitoring Year 5, 7 of the 10 monitoring wells exhibited the highest percentage of consecutive days (100%) meeting saturated conditions, as well as, having the highest number of cumulative days (222) meeting conditions. See Appendix E for a plot of wetland gauge data as it relates to monthly precipitation for Monitoring Year 5 (Figure 6). Monitoring Year 5 wetland restoration success results are depicted in Table 12, and a summary of wetland attainment for all ten monitoring gauges is depicted in Table 12a. See Figure 2 in Appendix B, for a depiction of wetland mitigation areas and corresponding gauge locations. Additional wetland studies will be conducted per June 2019 IRT meeting to map wetland and non-wetland areas to reflect the wetland conditions throughout the site. This study will involve soil testing for hydric indicators in both mapped and unmapped wetland areas during the wet time of the year generally late winter to early spring. Results from this study will be supplemented with a memorandum upon completion.

In-stream pressure transducers were installed on Reach 6 (R6_W1 and R6_W2) and 7 (R7_W1 and R7_W2) to document intermittent flow conditions on restored streams 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 for all five monitoring years. Reach 6 (R6_W2) experienced the longest period of consecutive stream flow with 322 days. Figure 7 in Appendix E, depict the documented flow conditions for each gauge through Monitoring Year 5 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. Per IRT request, two flow cameras approximately halfway down both Reach 4 and Reach 5 to document flow throughout Monitoring Year 5 were placed in August of 2019. These locations can be found on the CCPV in Appendix B. Throughout Monitoring Year 5, Reaches 4 and 5 have shown flow, especially during the spring months. Photos are reported in the hydrologic photo log located in Appendix E.

Currently, both BMPs are functioning as designed. Minor accumulated silt is present in Reach 7's BMP; however, ample storage capacity continues to be available. No downstream sedimentation on Reach 7 has been noted as result of the BMP's performance.

At least two post-construction bankfull events were observed and documented during Monitoring Year 5 . As of Monitoring Year 5, two bankfull events have been documented in separate years, thus the site has met the minimum success requirement for bankfull flow. Information on bankfull events is provided in Table 14 of Appendix E. Photo documentation is also included in Appendix E.

The past five monitoring years have proven that the site has met success criteria for; vegetation, wetlands, stream flow, and channel bank stability. The Vegetation plots data shows that over the 5 years there is consistent vegetation density, height, and vigor throughout the site. The asbuilt stem density averaged 739 stems/acre where in 5 years the stem density averaged at 615 stems/acre. This meets the closeout success criteria and proves that the site has established vegetation. The stream flow gauges on reaches 6 and 7 have shown an increasing trend in consecutive days of flow for the 5 years of monitoring. Also, meeting success criteria for 4 out of 5 years. The wetland groundwater gauges show an increasing trend in consecutive days meeting success criteria for 5 years. Also, all gauges have passed the success criteria for all 5 years except for UTTC AW1 and

UTTC AW5 in year 1 due to gauge malfunction. This proves the wetlands are preforming as designed. Lastly, the cross sections and longitudinal profile throughout the 5 monitoring years shows channel stability with no incision and erosion. Slight deposition and sediment transportation have been recorded over the monitoring years, through pebble counts, as expected showing the stream stability has performed as designed. Included in Appendix B are before and after photos from MY0 and MY5 to show the bank stability and vegetation establishment over the course of 5 years.

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 monitoring plan for the site includes criteria to evaluate the success of the stream, wetland, and vegetation components of the project. Stream and vegetation monitoring will be conducted for five years, while wetland monitoring will be conducted for seven years. Monitoring methods used will follow the NCDMS Monitoring Report Template, Version 1.2.1 – 12/01/09 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 success criteria for the proposed Enhancement Level II reaches/sections will follow the methods described in sections 2.1.3, 2.1.4, and 2.2, whereas, wetland restoration and creation mitigation will follow those outlined in sections 2.3. The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, ground water gauges, flow gauges, and crest gauges, are shown on the CCPV sheets found in Figure 2 of Appendix B.

Year 5 monitoring data were collected from September through November 2020. All visual site assessment data contained in Appendix B were collected on October 15th of 2020. Vegetation data and plot photos were collected on October 12th of 2020. Sediment data were collected on October 14th of 2020.

Stream survey data were collected from September 1st up through September 9th of 2020. 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 UT to Town Creek Restoration Project Option A'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 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), profile (longitudinal profile survey), visual observation with photographic documentation, documentation of bankfull events and documentation of hydrologic conditions for restored intermittent reaches. 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 nineteen (19) permanent cross-sections, twelve (12) riffles and seven (7) pools, were installed throughout the entire project area. Cross-sections selected for monitoring included representative riffles and pools for each of the four project reaches, Reach 1, 2, 3, and 6, 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 channel, 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).

2.1.1.2 Longitudinal Profile

Longitudinal profiles were surveyed for portions of the restored lengths of Reaches 1, 2, 3, and 6 and are provided in Figure 4 of Appendix D. Longitudinal profiles were replicated annually during the five-year monitoring period.

Measurements taken during longitudinal profiles include thalweg, water surface, and the top of low bank. All measurements were taken at the head of each feature (e.g., riffle, run, pool, glide) and the maximum pool depth. Surveys were tied to a permanent benchmark.

The pools should remain relatively deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools. Bed form observations should be consistent with those observed for channels of the design stream type as well as other design information.

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. Reachwide pebble counts were collected for Reaches 1, 2, 3, and 6. 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.

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 in the floodplain of Reach 3 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 in-stream pressure transducers and remote in-field cameras that were installed on restored intermitted reaches. R7_W1 and R7_W2 were installed on Reach 7, while R6_W1 and R6_W2 were installed on Reach 6. Two additional flow cameras have been placed on Reach 4 and 5 to collect pictures of flow per IRT request. Collected data documents the restored intermittent stream systems continue 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, 2020). 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 for the required duration.

Flow data and photographic documentation collected during Year 5 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 has been repeated for 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 made an effort to consistently maintain the same area in each photograph 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 center of the photograph 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 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 were conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs were 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 are shown on a plan view map and descriptions are 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

To determine if the criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Level 1, Version 4.2 (Lee 2008). The total number of quadrants was calculated using the CVS-NCEEP Entry Tool Database version 2.3.1 (CVS-NCEEP 2012) with twenty (20) 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 includes 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.

2.3 Wetland Monitoring

Ten groundwater monitoring stations were installed in restored, created, and enhanced wetland areas similar to those from preconstruction monitoring to document hydrologic conditions at the Project site. The wetland gauges are depicted on the CCPV figures (Figure 2) found in Appendix B. Installation and monitoring of the groundwater stations have been conducted in accordance with the USACE standard methods outlined in the *ERDC TN-WRAP-05-2* (USACE 2005). To determine if the rainfall is normal for the given year, rainfall amounts were tallied using data obtained from the Stanly County WETS Station (USDA 2020)and from the automated weather station at the North Stanly Middle School (NEWL) in New London, approximately 1.5 miles southeast of the project site on Old Salisbury Road. Data from the NEWL station was obtained from the CRONOS Database located on the State Climate Office of North Carolina's website (2020).

Success criteria for wetland hydrology was met when each wetland site is saturated within 12 inches of the soil surface for 9 percent of the growing season as documented in the approved Mitigation Plan. To document the hydrologic conditions of the restored site, each groundwater monitoring station has been monitored for five years post-construction or until wetland success criteria are met. Visual inspection of proposed wetland areas was conducted to document any visual indicators that would be typical of jurisdictional wetlands. This could include, but is not limited to, vegetation types present, surface flow patterns, stained leaves, and ponded water. Wetland plants are documented along with other visual indicators noted above. Wetland restoration and creation areas that exhibit all three wetland indicators (the presence of hydric soils, wetland hydrology, and wetland vegetation) after construction and through the monitoring period validate wetland restoration and creation success.

2.4 BMP Monitoring

Implementation of wetland BMPs located at the upstream extent of Reaches 4 and 7 are visually monitored for vegetative survivability and permanent pool storage capacity using photo documentation during the five year monitoring period. Maintenance measures were implemented during the five year monitoring period to replace dead vegetative material and to remove excess sedimentation from permanent pools as necessary.

3.0 REFERENCES

Lee, M., Peet R., Roberts, S., Wentworth, T. 2008. CVS-EEP Protocol for Recording Vegetation Level 1-2 Plot Sampling Only. Version 4.2.

North Carolina Division of Mitigation Services (formerly NC Ecosystem Enhancement Program). 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.

2009. Lower Yadkin Pee-Dee River Basin Restoration Priorities, revised January 2009. Raleigh, NC.

2009. Procedural Guidance and Content Requirements for EEP Monitoring Report, v. 1.2.1. Raleigh, NC.

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

State Climate Office of North Carolina, 2020. CRONOS Database, North Stanly Middle School (NEWL), Stanly County, NC. http://climate.ncsu.edu/cronos/?station=NEWL&temporal=sensormeta

United States Department of Agriculture, 2020. WETS Table. Climate Data for Stanly County, NC. Wets Station: Albemarle, NC 0090, FIPS: 37167, 1971 - 2018. http://agacis.rcc-acis.org/37167/wets

United States Army Corps of Engineers. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

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 right accessed via a dirt farm road.

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.

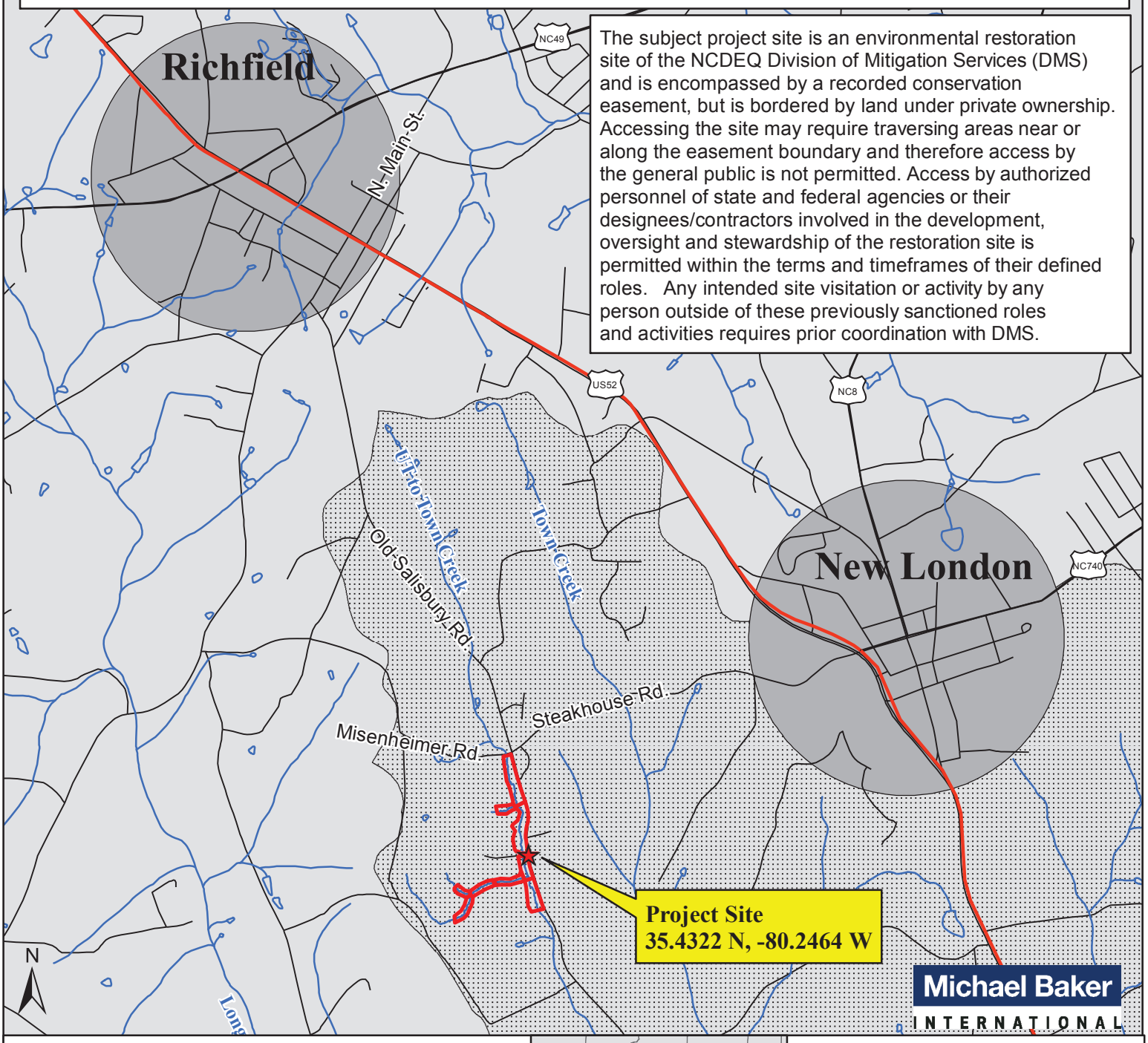


Figure 1. Vicinity Map

UT to Town Creek Restoration Project - Option A

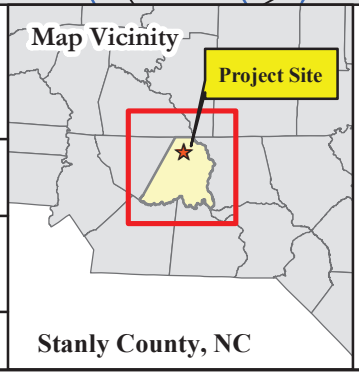
Stanly County, NC

Reference: NCDOT 02 & NC One Map

NC DMS Project No. 94648
NCDEQ Contract No. 003277

2020

0 1,500 3,000 Feet 1" = 3000'



LEGEND

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

Table 1. Project Mitigation Components
UT to Town Creek Restoration Project - Option A: DMS Project No ID. 94648

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		1181	10+00 - 22+04	1,204	1,204	R	PI	1:1	1204.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement. Mitigation ratio of 1:1.0668 for buffer widths in excess of 50-ft.
Reach 2		1672	22+04 - 40+46	1,842	1,782	R	PI	1:1	1782.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement, and a 60-ft culverted farm road crossing. Mitigation ratio of 1:1.07 for buffer widths in excess of 50-ft.
Reach 3		721	40+46 - 48+75	829	829	R	PI	1:1	829.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement. Mitigation ratio of 1:1.1 for buffer widths in excess of 50-ft.
Reach 4		404	10+00 - 14+47	447	447	EI	PIII	1:1	447.000	Dimension and Profile modified in keeping with reference, Planted Buffer, Livestock Exclusion, Permanent Conservation Easement, and Headwater Constructed Wetland. Mitigation Ratio of 1:1 as result of water quality benefits from the implementation of headwater constructed wetland.
Reach 5		324	10+00 - 13+44	344	344	EII	PIV	2.5:1	137.600	Dimension modified and structure implementation in keeping with reference, Planted Buffer, Livestock Exclusion, and Permanent Conservation Easement.
Reach 6		1349	14+47 - 28+13	1,366	1,340	R	P1	1:1	1340.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement, and a 26-ft culverted farm road crossing.
Reach 7		386	10+00 - 13+99	399	399	R	P1	1:1	399.000	Headwater Constructed Wetland, Full Channel Restoration, Planted Buffer, Livestock Exclusion, and Permanent Conservation Easement.
Reach 1, 2, 3		-	-	-	-	-	-	-	265.000	Additional stream credits calculated and approved by DMS on 6/21/18 for buffers in excess of 50-ft along Reach 1 - 3.
Wetland Group 1 (WG1)	RNR	0		2.560	2.560	R		1:1	2.560	Minor floodplain grading, of 12-inches or less, to restore floodplain hydrolgy and remediate compaction, based on hydric soil investigation. Planted, Excluded Livestock and Permanent Conservation Easement.
Wetland Group 2 (WG2)	RNR	0		1.560	1.560	C		3:1	0.520	Floodplain grading, of 12-inches or greater, to restore relic floodplain hydrolgy and remediate compaction, based on hydric soil investigation. Planted, Excluded Livestock and Permanent Conservation Easement.

Length and Area Summations by Mitigation Category

Restoration Level	Stream	Riparian Wetland		Non-riparian Wetland	Credited Buffer
	(linear feet)	(acres)		(acres)	(square feet)
		Riverine	Non-Riverine		
Restoration	5554.000	2.560			
Enhancement					
Enhancement I	447.000				
Enhancement II	344.000				
Creation		1.560			
Preservation					
High Quality Pres					

* Creditable stream footage is based on as-built lengths as approved in the Mitigation Plan.

Overall Assets Summary

Asset Category	Overall Credits
Stream (ft)	**6,403.600**
RP Wetland (ac)	**3.080**

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

Table 2. Project Activity and Reporting History
UT to Town Creek Restoration Project - Option A: DMS Project No ID. 94648

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	N/A	N/A	Apr-14
Mitigation Plan Amended	N/A	N/A	Dec-14
Mitigation Plan Approved	N/A	N/A	Dec-14
Final Design – (at least 90% complete)	N/A	N/A	Jan-15
Construction Begins	N/A	N/A	Jul-15
Temporary S&E mix applied to entire project area	N/A	N/A	Jan-16
Permanent seed mix applied to entire project area	N/A	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
Planting of herbaceous plugs	Jun-16	N/A	May-16
End of Construction	Dec-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	Nov-16	Dec-16
Invasive Treatment	N/A	N/A	Mar-17
Year 2 Monitoring	Dec-17	Nov-17	Dec-17
Additional Riparian Planting	N/A	N/A	Mar-18
Invasive Treatment	N/A	N/A	Apr-18
Year 3 Monitoring	Dec-18	Nov-18	Dec-18
Year 4 Monitoring	Dec-19	Nov-19	Dec-19
Additional Riparian Planting	N/A	N/A	Sep-19
Invasive Treatment	N/A	N/A	Jun-19
Year 5 Monitoring	Dec-20	Dec-20	Jan-21
Additional Riparian Planting	N/A	N/A	Jan-20
Invasive Treatment	N/A	N/A	Apr-20
Wetland Boundary Study	N/A	Jan-21	Jan-21
Year 6 Wetland Monitoring	Dec-21	N/A	N/A
Year 7 Wetland Monitoring	Dec-22	N/A	N/A

Table 3. Project Contacts UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Kathleen M. McKeithan, PE, Tel. 919-481-5703
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.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact:
Stream Monitoring Point of Contact	Andrew Powers, Tel. 919-481-5732
Vegetation Monitoring Point of Contact	Andrew Powers, Tel. 919-481-5732

Table 4. Project Attributes
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Project County	Stanly
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Project River Basin	Yadkin - Pee Dee
USGS HUC for Project (14 digit)	03040105060040
NCDWQ Sub-basin for Project	03-07-13
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

Restoration Component Attribute Table

	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**
Drainage Area (ac.)	532.1	616.6	766.7	53.7	48.9	127.8	29.2
Stream Order	2	2	3	1	1	2	1
Restored Length (LF)	1,204	1,782	829	447	344	1,340	399
Perennial (P)/Intermittent (I)	P	P	P	I	I	I	I
Watershed Type (Rural, Urban, etc.)	R	R	R	R	R	R	R
Watershed LULC Distribution							
Rural Residential	6%	1%	0%	1%	2%	0%	0%
Ag-Row Crop	8%	0%	0%	14%	4%	0%	10%
Ag-Livestock	57%	85%	70%	59%	17%	88%	64%
Forested	8%	0%	0%	17%	62%	0%	21%
Other/Open Area	8%	0%	0%	0%	9%	0%	0%
Commercial	10%	0%	0%	0%	0%	0%	0%
Roadway	3%	4%	2%	3%	<1%	0%	0%
Wooded-Livestock	0%	10%	28%	6%	4%	12%	5%
Open Water	0%	0%	0%	0%	<1%	0%	0%
Watershed Impervious Cover (%)	19%	5%	2%	4%	<4%	<1%	<1%
NCDWR AU/Index#	13-17-31-1-1						
NCDWQ Classification	C						
303(d) Listed	No						
303 (d) Listing Stressor	N/A						
Total Acreage of Easement	5.35	8.01	3.79	1.97	1.06	3.55	1.36
Total Vegetated Easement Acreage	4.81	6.97	3.48	1.63	0.94	3.22	1.26
Total Planted Acreage for Restoration	4.81	6.97	3.48	1.63	0.94	3.22	1.26
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**
Rosgen Classification (existing)	E4	E4	E4	B4	B4	B4	B4a
Rosgen Classification (as-built)	C4	C4	C4	B4	B4	C4b	B4a
Valley Type	VIII	VIII	VIII	II	II	II	II
Valley Slope	0.0092	0.0092	0.0089	0.023	0.0447	0.0243	0.0495
Trout Waters Designation	No						
Species of Concern, edangered etc. (Y/N)	No*, Yes**						
Dominant Soil Series and Characteristics							
Series	OaA	OaA	OaA	GoF	GoF	GoF	BaD
Depth	46”	46”	46”	36”	36”	36”	40”
Clay %	10-35%	10-35%	10-35%	5-27%	5-27%	5-27%	Oct-55
K	0.28	0.28	0.28	0.05	0.05	0.05	0.15-0.24
T	4	4	4	4	4	4	3

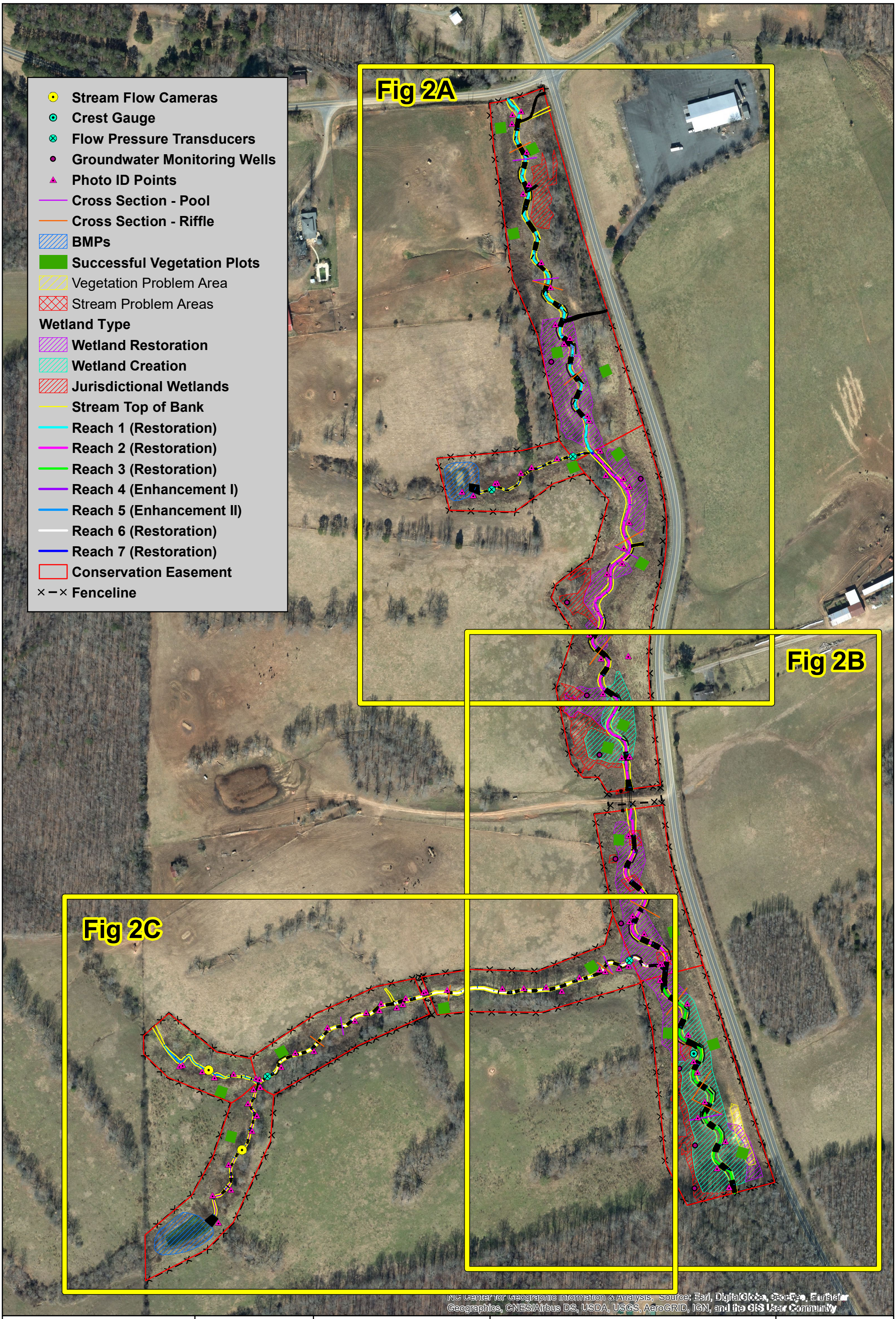
* Bald Eagle (*Haliaeetus leucocephalus*) a BGEPA species is listed as occurring in Stanly County; however, suitable habitat is not located within the Project area or within two miles of the Site.

** Schweinitz’s Sunflower (*Helianthus schweinitzii*) A federally endangered species is listed as occurring within Stanly County and though suitable habitat is present, a field study was conducted and no species were located within the Project area. NCNHP database indicated there are no known populations of these species within two miles of the study area.

(NRCS, 2010a; NCDENR, 2007 & 2008; USFWS, 2012; NCNHP, 2012)

APPENDIX B

Visual Assessment Data



Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

N

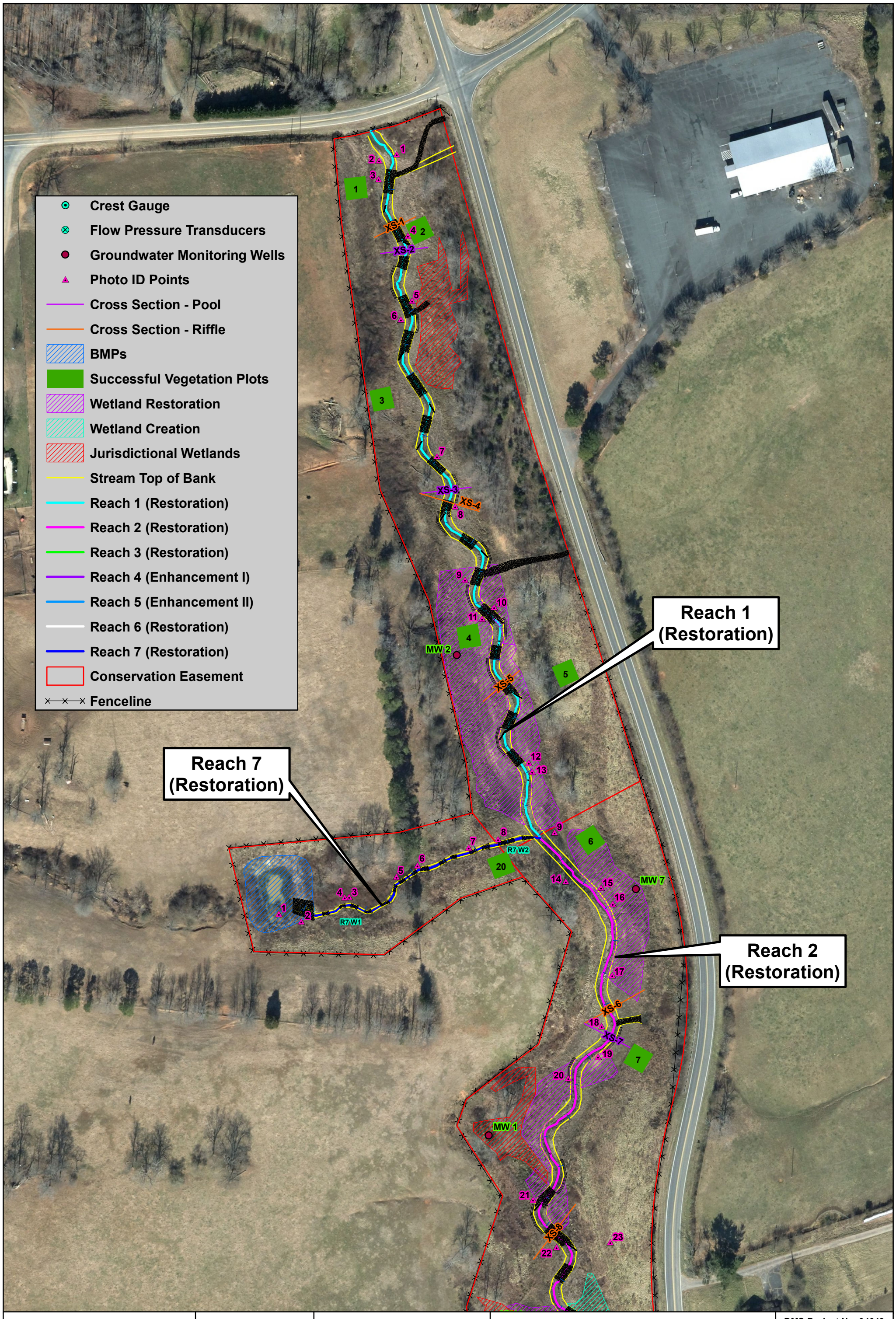
0 125 250 Feet

1" = 250'

Figure 2 Overview
Current Condition Plan View

UT to Town Creek Restoration Project - Option A
Stanly County, NC

DMS Project No. 94648
Monitoring Year: 5
Drawn By: ADP
Date: 2020
Sheet: 1 of 4



Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

N

0 62.5 125 Feet

1" = 125'

Figure 2A
Current Condition Plan View

UT to Town Creek Restoration Project - Option A
Stanly County, NC

DMS Project No. 94648
Monitoring Year: 5
Drawn By: ADP
Date: 2020
Sheet 2 of 4

- Crest Gauge
- Flow Pressure Transducers
- Groundwater Monitoring Wells
- Photo ID Points
- Cross Section - Pool
- Cross Section - Riffle
- BMPs
- Successful Vegetation Plots
- Vegetation Problem Area
- Stream Problem Areas
- Wetland Restoration
- Wetland Creation
- Jurisdictional Wetlands
- Stream Top of Bank
- Reach 1 (Restoration)
- Reach 2 (Restoration)
- Reach 3 (Restoration)
- Reach 4 (Enhancement I)
- Reach 5 (Enhancement II)
- Reach 6 (Restoration)
- Reach 7 (Restoration)
- Conservation Easement
- Fenceline

Reach 2 (Restoration)

Reach 6 (Restoration)

Reach 3 (Restoration)

MW 1 MW 3 MW 9 MW 8 MW 4 MW 5 MW 10 MW 6

SPA 5-1 SPA 5-2 SPA 5-3

VPA 5-1

R6 W2

XS-8 XS-9 XS-10 XS-11 XS-12 XS-13 XS-14 XS-15 XS-16 XS-17

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

N

0 62.5 125 Feet

1" = 125'

Figure 2B
Current Condition Plan View

UT to Town Creek Restoration Project - Option A
Stanly County, NC

DMS Project No. 94648
Monitoring Year: 5
Drawn By: ADP
Date: 2020
Sheet: 3 of 4

Reach 5
(Enhancement II)

Reach 4
(Enhancement I)

Reach 6
(Restoration)

Reach 3
(Restoration)

- Additional Flow Camera
- Crest Gauge
- Flow Pressure Transducers
- Groundwater Monitoring Wells
- Photo ID Points
- Cross Section - Pool
- Cross Section - Riffle
- BMPs
- Successful Vegetation Plots
- Stream Problem Areas
- Wetland Restoration
- Wetland Creation
- Jurisdictional Wetlands
- Stream Top of Bank
- Reach 1 (Restoration)
- Reach 2 (Restoration)
- Reach 3 (Restoration)
- Reach 4 (Enhancement I)
- Reach 5 (Enhancement II)
- Reach 6 (Restoration)
- Reach 7 (Restoration)
- Conservation Easement
- Fenceline

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

0 62.5 125 Feet

1" = 125'

N

Figure 2C
Current Condition Plan View

UT to Town Creek Restoration Project - Option A
Stanly County, NC

DMS Project No. 94648
Monitoring Year: 5
Drawn By: ADP
Date: 2020
Sheet: 4 of 4

Table 5a. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 1**
Assessed Length (LF)	**1,204**

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	18	18			100%			
		2. Length	18	18			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	18	18			100%			
		2. Thalweg centering for pool/glide	18	18			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	19	19			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%	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	10	10			100%			

Table 5b. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 2**
Assessed Length (LF)	**1,782**

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			3	100	97%	0	0	97%
	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	3	100	97%	0	0	97%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	9			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	9	9			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	9	9			100%			

Table 5c. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 3**
Assessed Length (LF)	**829**

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	11	11			100%			
	3. Pool Condition	1. Depth	10	10			100%			
		2. Length	10	10			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	11	11			100%			
		2. Thalweg centering for pool/glide	10	10			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.	6	6			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	6	6			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	6	6			100%			

Table 5d. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 4**
Assessed Length (LF)	**447**

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	15	15			100%			
	3. Pool Condition	1. Depth	12	12			100%			
		2. Length	12	12			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	15	15			100%			
		2. Thalweg centering for pool/glide	12	12			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.	12	12			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	12	12			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	11	11			100%			

Table 5e. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 5**
Assessed Length (LF)	**344**

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	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	4	4			100%			

Table 5f. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 6**
Assessed Length (LF)	**1,340**

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	33	33			100%			
	3. Pool Condition	1. Depth	34	34			100%			
		2. Length	34	34			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	33	33			100%			
		2. Thalweg centering for pool/glide	34	34			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	26	26			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%	26	26			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	20	20			100%			

Table 5g. Visual Stream Morphology Stability Assessment
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach ID	**UT to Town Creek - Reach 7**
Assessed Length (LF)	**399**

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	14	14			100%			
	3. Pool Condition	1. Depth	12	12			100%			
		2. Length	12	12			100%			
	4.Thalweg position	1. Thalweg centering for riffle/run	14	14			100%			
		2. Thalweg centering for pool/glide	12	12			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	14	14			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	14	14			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	14	14			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth	13	13			100%			

Table 5h. Stream Problem Areas
UT to Town Creek Restoration Project - Option A: Project No. 94846

Reach 1			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	N/A	N/A	N/A
Reach 2			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
Beaver Dams	35+50, 36+50, 39+50 - 40+20	Beavers have dammed 3 areas of the stream located between the confluence of R2 and R6 and the culvert crossing on R2. Due to the beavers, banks lost vegetation and trees had been cut.	SPA 5-1 - SPA 5-3
Reach 3			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	N/A	N/A	N/A
Reach 4			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	N/A	N/A	N/A
Reach 5			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	N/A	N/A	N/A
Reach 6			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	N/A	N/A	N/A
Reach 7			
Feature Issue	**Station No.**	**Suspected Cause**	**Photo Number**
No issues in Year 5	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
UT to Town Creek Restoration Project: Project No. 94648

Reach ID	**Reaches 1 - 7**
Planted Acreage	**22.31**

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	VPA5-1	1	0.11	0.5%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY4 or 5 stem count criteria.	0.1 acres	N/A	0	0.00	0.0%
			Total	1	0.11	0.4%
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	VPA5-1	1	0.11	0.5%
			Cumulative Total	2	0.22	0.9%

Easement Acreage	**25.09**

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	N/A	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%

*Poor growth rate areas were noted where supplemental bare root and gallon container plantings were installed during MY5.

Table 6b. Vegetation Problem Areas
UT to Town Creek Restoration Project: Project No. 94648

Feature Issue	Station No.	Suspected Cause	Problem Area / Photo Number
Reach 1			
Invasive/Exotic Populations	Reachwide in various locations	Myriophyllum aquaticum (parrot feather) growing in various locations along the channel reach due low flow conditions present during the monitoring assessment.	No VPA was associated with this problem area because it is a reachwide issue that's been treated since MY3.
Reach 2			
Invasive/Exotic Populations	Reachwide in various locations	Myriophyllum aquaticum (parrot feather) growing in various locations along the channel reach due low flow conditions present during the monitoring assessment.	No VPA was associated with this problem area because it is a reachwide issue that's been treated since MY3.
Reach 3			
Invasive/Exotic Populations	Reachwide in various locations	Myriophyllum aquaticum (parrot feather) growing in various locations along the channel reach due low flow conditions present during the monitoring assessment.	No VPA was associated with this problem area because it is a reachwide issue that's been treated since MY3.
Bare Areas	46+50 - 48+60	Poor soils noted in an area where supplemental seeding and grass plugs were installed durning MY5.	VPA 5-1
Poor growth rates	46+50 - 48+60	Poor growth rates were noted in areas where supplemental bare root and gallon container plantings were installed during MY5.	VPA 5-1
Reach 4			
Invasive/Exotic Populations	N/A	*Ligustrum sinese* (Chinese privet)	No VPA was associated with this problem area because very minimal amounts are scattered throughout the reach.
Reach 5			
Invasive/Exotic Populations	N/A	*Ligustrum sinese* (Chinese privet)	No VPA was associated with this problem area because very minimal amounts are scattered throughout the reach.
Reach 6			
Invasive/Exotic Populations	N/A	*Ligustrum sinese* (Chinese privet)	No VPA was associated with this problem area because very minimal amounts are scattered throughout the reach.
Reach 7			
Invasive/Exotic Populations	N/A	*Ligustrum sinese* (Chinese privet)	No VPA was associated with this problem area because very minimal amounts are scattered throughout the reach.

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)

Stream Station Photos

UT to Town Creek – Reach 1

PID 1: Station 10+50 – Upstream (10/15/2020)

PID 2: Station 10+50 – Downstream (10/15/20)

PID 3: Station 10+80 – Left Floodplain (10/15/20)

PID 4: Station 11+90 – Downstream (10/15/20)

PID 5: Station 12+85 – Upstream (10/15/20)

PID 6: Station 13+05 – Left Floodplain (10/15/20)

UT to Town Creek – Reach 1

PID 7: Station 15+30 – Upstream (10/15/20)

PID 8: Station 16+25 – Downstream (10/15/20)

PID 9: Station 17+75 – Left Floodplain (10/15/20)

PID 10: Station 18+10– Downstream (10/15/20)

PID 11: Station 18+10 – Upstream (10/15/20)

PID 12: Station 20+90 – Downstream (10/15/20)

PID 13: Station 21+00 – Upstream (10/15/20)

PID 14: Station 22+75 – Upstream (10/15/20)

PID 15: Station 23+25 – Upstream (10/15/20)

PID 16: Station 23+50 – Downstream (10/15/20)

PID 17: Station 24+60– Upstream (10/15/20)

PID 18: Station 25+30– Left Floodplain (10/15/20)

PID 19: Station 25+90– Downstream (10/15/20)

PID 20: Station 26+50– Downstream (10/15/20)

PID 21: Station 28+75 – Downstream (10/15/20)

PID 22: Station 29+35 – Upstream (10/15/20)

PID 23: Station 29+50 – Downstream Project View from Floodplain Knoll (10/15/20)

PID 24: Station 30+60 – Upstream (10/15/20)

PID 25: Station 33+10 – Upstream (10/15/20)

PID 26: Station 33+10 – Downstream (10/15/20)

PID 27: Station 35+50 – Upstream (10/15/20)

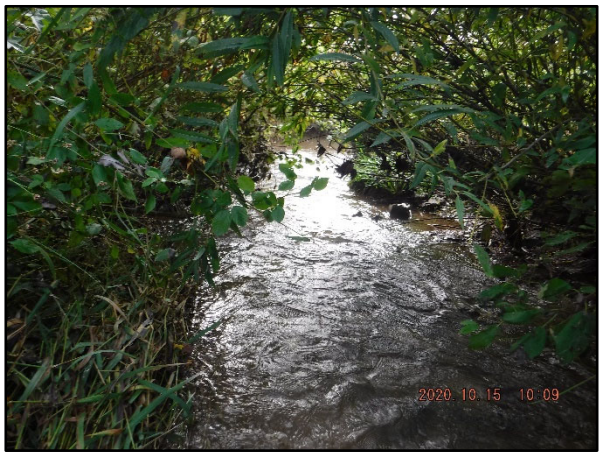
PID 28: Station 38+30 – Upstream (10/15/20)

PID 29: Station 38+40 – Downstream (10/15/20)

PID 30: Station 39+10 – Downstream (10/15/20)

PID 31: Station 40+25 – Downstream (10/15/20)

PID 32: Station 40+80 – Upstream (10/15/20)



PID 33: Station 41+80 – Upstream (10/15/20)

PID 34: Station 43+00 – Downstream (10/15/20)

PID 35: Station 44+00 – Downstream (10/15/20)

PID 36: Station 44+25 – Upstream (10/15/20)

PID 37: Station 45+50 – Downstream (10/15/20)

PID 38: Station 45+95 – Upstream (10/15/20)

PID 39: Station 46+80 – Upstream (10/15/20)

PID 40: Station 47+75 – Upstream (10/15/20)

PID 41: Station 48+60 – Downstream (10/15/20)

UT to Town Creek – Reach 4

PID 1: Station 09+80 – Upstream (2/24/20)

PID 2: Station 10+60 – Upstream (10/15/20)

PID 3: Station 11+20 – Upstream (10/15/20)

PID 4: Station 11+75 – Upstream (10/15/20)

PID 5: Station 12+95 – Upstream (10/15/20)

PID 6: Station 13+45 – Downstream (10/15/20)

PID 7: Station 13+80 – Upstream (10/15/20)

PID 8: Station 14+ 20 – Upstream (10/15/20)

UT to Town Creek – Reach 5

PID 1: Station 10+70 – Upstream (10/15/20)

PID 2: Station 10+75 – Downstream (10/15/20)

PID 3: Station 11+75 – Upstream (10/15/20)

PID 4: Station 12+20 – Upstream (10/15/20)

PID 5: Station 12+65 – Upstream (10/15/20)

PID 6: Station 13+30 – Upstream (10/15/20)

UT to Town Creek – Reach 5

PID 7: Station 13+43 – Upstream (10/15/20)

UT to Town Creek – Reach 6

PID 1: Station14+55 – Upstream (10/15/20)

PID 2: Station 15+30 – Upstream (10/15/20)

PID 3: Station 16+00 – Upstream (10/15/20)

PID 4: Station 16+50 – Upstream (10/15/20)

PID 5: Station 17+25 – Upstream (10/15/20)

PID 6: Station 18+00 – Upstream (10/15/20)

UT to Town Creek – Reach 6

PID 7: Station 18+50 – Upstream (10/15/20)

PID 8: Station 18+90 – Downstream (10/15/20)

PID 9: Station 19+05 – Upstream (10/15/20)

PID 10: Station 19+50 – Left Floodplain (10/15/20)

PID 11: Station 19+50 – Upstream (10/15/20)

PID 12: Station 19+85 – Upstream (10/15/20)

UT to Town Creek – Reach 6

PID 13: Station 20+50 - Upstream (10/15/20)

PID 14: Station 20+50 - Downstream (10/15/20)

PID 15: Station 21+00 – Upstream (10/15/20)

PID 16: Station 22+75 – Upstream (10/15/20)

PID 17: Station 23+40 – Upstream (10/15/20)

PID 18: Station 24+00 – Upstream (10/15/20)

UT to Town Creek – Reach 6

PID 19: Station 24+50 – Upstream (10/15/20)

PID 20: Station 23+25 – Upstream (10/15/20)

PID 21: Station 25+80 - Downstream (10/15/20)

PID 22: Station 25+85 – Upstream (10/15/20)

PID 23: Station 26+50 – Upstream (10/15/20)

PID 24: Station 26+75 – Upstream (10/15/20)

PID 25: Station 28+00 – Upstream (10/15/20)

PID 26: Station 28+14 – Upstream (10/15/20)

UT to Town Creek – Reach 7

PID 1: Station 09+40: Upstream (10/15/20)

PID 2: Station 09+90 – Upstream (10/15/20)

PID 3: Station 10+70 – Upstream (10/15/20)

PID 4: Station 10+80 – Downstream (10/15/20)

PID 5: Station 11+75 – Upstream (10/15/20)

PID 6: Station 12+20 – Upstream (10/15/20)

PID 7: Station 12+90 – Upstream (10/15/20)

PID 8: Station 13+50 – Upstream (10/15/20)

PID 9: Station 13+99 – Upstream (10/15/20)

UT to Town Creek – Culvert Photos

Reach 1 Culvert Downstream (10/15/20)

Reach 2 Culvert Upstream (10/15/20)

Reach 2 Culvert Downstream (11/18/20)

Reach 6 Culvert Upstream (10/15/20)

Reach 6 Culvert Downstream (10/15/20))

Stream Problem Areas

UT to Town Creek – Reach 2

SPA 5-1 - Station 35+50 – Former beaver dam downstream of culvert caused water to back up and banks to lose vegetation (11/24/20)

UT to Town Creek – Reach 2

SPA 5-1 - Station 35+50 – Former beaver dam downstream of culvert caused water to back up and banks to lose vegetation (11/24/20)

UT to Town Creek – Reach 2

SPA 5-2 - Station 36+50 – Former beaver dam caused water to back up and banks to lose vegetation (11/24/20)

UT to Town Creek – Reach 2

SPA 5-2 - Station 36+50 – Former beaver dam caused water to back up and banks to lose vegetation (10/15/20)

UT to Town Creek – Reach 2

SPA 5-3 - Station 39+50 to 40+20 – Beaver dam caused water to back up and banks to lose vegetation (10/15/20)

UT to Town Creek – Reach 2

SPA 5-3 - Station 39+50 to 40+20 – Former beaver dam caused water to back up and banks to lose vegetation (11/24/20)

Vegetation Problem Area Photos

VPA 5-1– Photo of bare areas, areas of poor growth rates, and areas were supplemental plantings were installed. (11/18/20)

VPA 5-1 – Photo of bare areas, areas of poor growth rates, and areas were supplemental plantings were installed. (5/26/2020)

VPA 5-1 – Photo of bare areas and areas of poor growth rates, as well as areas were supplemental plantings were installed. (5/26/20)

VPA 5-1 -- Photo of bare areas, areas of poor growth rates, and areas were supplemental plantings were installed. (3/25/20)

Before and After Photos (MY0 and MY5)

Reach 2 MY0

Reach 2 MY5

Reach 3 MY0

Reach 3 MY5

Reach 6 MY0

Reach 6 MY5

Before and After Photos (MY0 and MY5)

Reach 7 BMP MY0

Reach 7 BMP MY5

Reach 7 MY0

Reach 7 MY5

Reach 6 MY0

Reach 6 MY5

APPENDIX C

Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary
UT to Town Creek Restoration Project: Project No. 94648

Wetland/Stream Vegetation Totals (per acre)				
Plot #	**Stream/Wetland Stems[2]**	**Volunteers[3]**	**Total[4]**	**Success Criteria Met?**
VP1	769	81	850	Yes
VP2	688	0	688	Yes
VP3	728	0	728	Yes
VP4	445	162	567	Yes
VP5	648	40	688	Yes
VP6	567	40	850	Yes
VP7	486	0	486	Yes
VP8	648	121	769	Yes
VP9	526	162	688	Yes
VP10	728	0	728	Yes
VP11	769	40	850	Yes
VP12	526	243	648	Yes
VP13	486	81	567	Yes
VP14	607	162	809	Yes
VP15	688	0	688	Yes
VP16	688	40	728	Yes
VP17	526	81	648	Yes
VP18	769	121	809	Yes
VP19	526	81	607	Yes
VP20	486	0	567	Yes
Project Avg	**615**	**81**	**696**	**Yes**

[1]Buffer Stems: Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.

[2]Stream/ Wetland Stems: Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines.

[3]Volunteers: Native woody stems. Not planted. No vines.

[4]Total: Planted + volunteer native woody stems. Includes live stakes.

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.	
Report Prepared By	Drew Powers
Date Prepared	11/25/2020 11:14
database name	UTtoTown_84648_MY5_cvs-eep-entrytool-v2.3.1_2020.mdb
database location	L:\Projects\120857_UT Town Creek\Documents\Reports\Monitoring\MY5_2020\Vegetation
computer name	CARYLAPOWERS1
file size	51433472
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	94648
project Name	UT to Town Creek Restoration Project - Option A
Description	This project proposes to restore 5,597 linear feet (LF) and enhance 791 LF (444 LF of Enhancement I and 347 LF of Enhancement II) of stream along an Unnamed Tributary (UT) to Town Creek and three additional unnamed tributaries and to restore, enhance, and
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	101576
Required Plots (calculated)	20
Sampled Plots	20

Table 9. CVS Stem Count of Planted Stems by Plot and Species
UT to Town Creek Restoration Project: Project No. 94648

			Current Plot Data (MY5 2020)																									
			94648-01-VP1			94648-01-VP2			94648-01-VP3			94648-01-VP4			94648-01-VP5			94648-01-VP6			94648-01-VP7			94648-01-VP8		
Scientific Name	**Common Name**	**Species Type**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**	**P**	**V**	**T**
Acer rubra	Red Maple	Tree																								
Acer negundo	boxelder	Tree							1		1															
Alnus serrulata	hazel alder	Shrub																								
Asimina triloba	pawpaw	Tree																								
Betula nigra	river birch	Tree	1		1	1		1	4		4	2		2	2		2	4		4						
Callicarpa americana	American beautyberry	Shrub	1		1													2		2	5		5			
Carpinus caroliniana	American hornbeam	Tree	1		1	2		2	1		1	2		2												
Carya glabra	pignut hickory	Tree																								
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cercis canadensis	eastern redbud	Tree																			1		1			
Cornus amomum	silky dogwood	Shrub										4		4							4		4			
Cornus florida	flowering dogwood	Tree																								
Diospyros virginiana	common persimmon	Tree	4		4	3		3							4	1	5							1		1
Fraxinus pennsylvanica	green ash	Tree																								
Liquidambar styraciflua	Sweetgum	Tree																								
Liriodendron tulipifera	tuliptree	Tree		2	2							1		1												
Nyssa sylvatica	blackgum	Tree											2	2												
Platanus occidentalis	American sycamore	Tree	1		1	1		1	4		4	1		1	2		2	4	1	5				12	3	15
Quercus	oak	Tree																								
Quercus alba	white oak	Tree																			2		2			
Quercus falcata	southern red oak	Tree	2		2	1		1				1	2	3				1		1						
Quercus lyrata	overcup oak	Tree	1		1										1		1									
Quercus michauxii	swamp chestnut oak	Tree	6		6				2		2				1		1									
Quercus pagoda	cherrybark oak	Tree				3		3	1		1															
Quercus phellos	willow oak	Tree	2		2	6		6	5		5				6		6	3		3				2		2
Quercus rubra	northern red oak	Tree																								
Rhus glabra	smooth sumac	Shrub																								
Salix nigra	black willow	Tree																						1		1
Sambucus canadensis	Common Elderberry	Shrub																								
Sambucus nigra	European black elderberry	Shrub																								
Ulmus americana	American elm	Tree																					1			1
Ulmus alata	Winged elm	Tree																								
Unknown		Shrub or Tree																								
		Stem count	19	2	21	17	0	17	18	0	18	11	4	15	16	1	17	14	1	15	12	0	13	16	3	20
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	9	2	10	8	8	8	7	2	9	8	1	9	6	1	7	7	1	8	5	1	6	5	0	5
		Stems per ACRE	769	81	850	688	0	688	728	0	728	445	162	607	647	40	688	567	40	607	486	0	526	647	121	809

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%

P = Planted
V = Volunteers
T = Total

Table 9. CVS Stem Count of Planted Stems by Plot and Species - Continued
UT to Town Creek Restoration Project: Project No. 94648

			Current Plot Data (MY5 2020)																									
			94648-01-VP9			94648-01-VP10			94648-01-VP11			94648-01-VP12			94648-01-VP13			94648-01-VP14			94648-01-VP15			94648-01-VP16			94648-01-VP17		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubra	Red Maple	Tree											5	5															
Acer negundo	boxelder	Tree																										2	2
Alnus serrulata	hazel alder	Shrub																											
Asimina triloba	pawpaw	Tree																									2		2
Betula nigra	river birch	Tree										3		3										1		1			
Callicarpa americana	American beautyberry	Shrub				2		2																					
Carpinus caroliniana	American hornbeam	Tree	3		3																								
Carya glabra	pignut hickory	Tree																											
Cephalanthus occidentalis	common buttonbush	Shrub							5		5	2		2										4		4			
Cercis canadensis	eastern redbud	Tree		2	2	1		1	1		1										6		6						
Cornus amomum	silky dogwood	Shrub	2		2	2		2	1		1	1		1	1		1	4		4	4		4	3		3	1		1
Cornus florida	flowering dogwood	Tree	3		3																								
Diospyros virginiana	common persimmon	Tree							2		2				7		7				1		1	2		2			
Fraxinus pennsylvanica	green ash	Tree	1		1	8		8				2		2	2		2	2	1	3	2		2				7		7
Liquidambar styraciflua	Sweetgum	Tree																		1									
Liriodendron tulipifera	tuliptree	Tree	1		1				1	1	2	3	1	4				2		2	1		1						
Nyssa sylvatica	blackgum	Tree				1		1	3		3	2		2	1	1	2		2	2				4		4			
Platanus occidentalis	American sycamore	Tree		1	1				1		1							3	1	4									
Quercus	oak	Tree																											
Quercus alba	white oak	Tree	1		1	2		2													1		1	1		1			
Quercus falcata	southern red oak	Tree	1		1																								
Quercus lyrata	overcup oak	Tree	1		1										1		1	1		1	1		1						
Quercus michauxii	swamp chestnut oak	Tree																											
Quercus pagoda	cherrybark oak	Tree							5		5					1	1	2		2									
Quercus phellos	willow oak	Tree																1		1	1		1	1		1	2		2
Quercus rubra	northern red oak	Tree																											
Rhus glabra	smooth sumac	Shrub		1	1																								
Salix nigra	black willow	Tree																											
Sambucus canadensis	Common Elderberry	Shrub																											
Sambucus nigra	European black elderberry	Shrub				2		2																1		1	1		1
Ulmus americana	American elm	Tree																							1	1			
Ulmus alata	Winged elm	Tree																											
Unknown		Shrub or Tree																											
		Stem count	13	4	17	18	0	18	19	1	20	13	6	19	12	2	14	15	4	20	17	0	17	17	1	18	13	2	15
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	8	0	8	7	1	7	9	0	9	6	1	6	5	1	5	7	2	7	8	0	8	8	1	9	5	3	8
		Stems per ACRE	526	162	688	728	0	728	769	40	809	526	243	769	486	81	567	607	162	809	688	0	688	688	40	728	526	81	607

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%

P = Planted
V = Volunteers
T = Total

Table 9. CVS Stem Count of Planted Stems by Plot and Species - Continued
UT to Town Creek Restoration Project: Project No. 94648

			Current Plot Data (MY5 2020)												Annual Totals													
			94648-01-VP18			94648-01-VP19			94648-01-VP20			MY5 (2020)			MY4 (2019)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubra	Red Maple	Tree											5	5															
Acer negundo	boxelder	Tree										1	2	3	1	1	2	1	1	2	1		1						
Alnus serrulata	hazel alder	Shrub														1	1												
Asimina triloba	pawpaw	Tree				1		1				3		3	3		3	3		3	2		2	6		6	5		5
Betula nigra	river birch	Tree										18		18	18		18	17		17	17		17	18		18	21		21
Callicarpa americana	American beautyberry	Shrub										10		10	10		10	10		10	13		13	16		16	7		7
Carpinus caroliniana	American hornbeam	Tree										9		9	10		10	10	2	12	10		10	10		10	16		16
Carya glabra	pignut hickory	Tree														1	1												
Cephalanthus occidentalis	common buttonbush	Shrub										11		11	11		11	11		11	10		10	8		8	5		5
Cercis canadensis	eastern redbud	Tree	6		6							15	2	17	18		18	18		18	20		20	24		24	29		29
Cornus amomum	silky dogwood	Shrub				2		2				29		29	29	1	30	30	1	31	30		30	29		29	31		31
Cornus florida	flowering dogwood	Tree	1		1				1		1	5		5	7		7	7		7	9		9	13		13	21		21
Diospyros virginiana	common persimmon	Tree	2		2	4		4	4		4	34	1	35	35	4	39	34		39	32		32	29		29	7		7
Fraxinus pennsylvanica	green ash	Tree	8	1	9	5		5				37	2	39	39	5	44	39	2	41	39		39	40		40	43		43
Liquidambar styraciflua	Sweetgum	Tree											1	1															
Liriodendron tulipifera	tuliptree	Tree				1		1	1		1	11	4	15	13	16	29	14	21	35	12		12	11		11	12		12
Nyssa sylvatica	blackgum	Tree	1		1							12	5	17	12	2	14	11		11	13		13	12		12	9		9
Platanus occidentalis	American sycamore	Tree	1		1				1		1	31	6	37	31	1	32	31	1	32	30		30	29		29	31		31
Quercus	oak	Tree																									3		3
Quercus alba	white oak	Tree							1		1	8		8	9		9	9		9	10		10	10		10	12		12
Quercus falcata	southern red oak	Tree							1		1	7	2	9	7		7	7		7	7		7	19		19	15		15
Quercus lyrata	overcup oak	Tree										6		6	7		7	7	1	8	15		15	10		10	16		16
Quercus michauxii	swamp chestnut oak	Tree										9		9	9		9	9		9	9		9	14		14	29		29
Quercus pagoda	cherrybark oak	Tree										11	1	12	11	1	12	11		11	8		8	4		4			
Quercus phellos	willow oak	Tree							3		3	32		32	33		33	33		33	32		32	29		29	27		27
Quercus rubra	northern red oak	Tree																						2		2			
Rhus glabra	smooth sumac	Shrub											1	1															
Salix nigra	black willow	Tree										1		1	1		1	1	8	9	1		1						
Sambucus canadensis	Common Elderberry	Shrub																						6		6	19		19
Sambucus nigra	European black elderberry	Shrub										4		4	5		5	5		5	11		11	7		7			
Ulmus americana	American elm	Tree		2	2		2	2			1		8	8															
Ulmus alata	Winged elm	Tree														3	3												
Unknown		Shrub or Tree																									7		7
		Stem count	19	3	22	13	2	15	12	0	13	304	40	344	319	36	355	318	42	360	331	0	331	346	0	346	365	0	365
		size (ares)	1			1			1			1			20			20			20			20			20		
		size (ACRES)	0.02			0.02			0.02			0.49			0.49			0.49			0.49			0.49			0.49		
		Species count	5	3	8	6	1	7	5	2	6	7	1	7	22	11	25	22	9	22	22	0	22	22	0	22	21	0	21
		Stems per ACRE	769	121	890	526	81	607	486	0	526	615	81	696	645	73	718	643	85	728	670	0	670	700	0	700	739	0	739

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%

P = Planted
V = Volunteers
T = Total

Vegetation Plot Photos

Vegetation Plot 1 (10/14/2020)

Vegetation Plot 2 (10/14/2020)

Vegetation Plot 3 (10/14/2020)

Vegetation Plot 4 (10/14/2020)

Vegetation Plot 5 (10/14/2020)

Vegetation Plot 6 (10/14/2020)

Vegetation Plot 7 (10/14/2020)

Vegetation Plot 8 (9/23/2020)

Vegetation Plot 9 (10/14/2020)

Vegetation Plot 10 (9/23/2020)

Vegetation Plot 11 (9/23/2020)

Vegetation Plot 12 (9/23/2020)

Vegetation Plot 13 (8/12/2020)

Vegetation Plot 14 (8/12/2020)

Vegetation Plot 15 (9/23/2020)

Vegetation Plot 16 (8/12/2020)

Vegetation Plot 17 (10/14/2020)

Vegetation Plot 18 (8/12/2020)

Vegetation Plot 19 (8/12/2020)

Vegetation Plot 20 (10/14/2020)

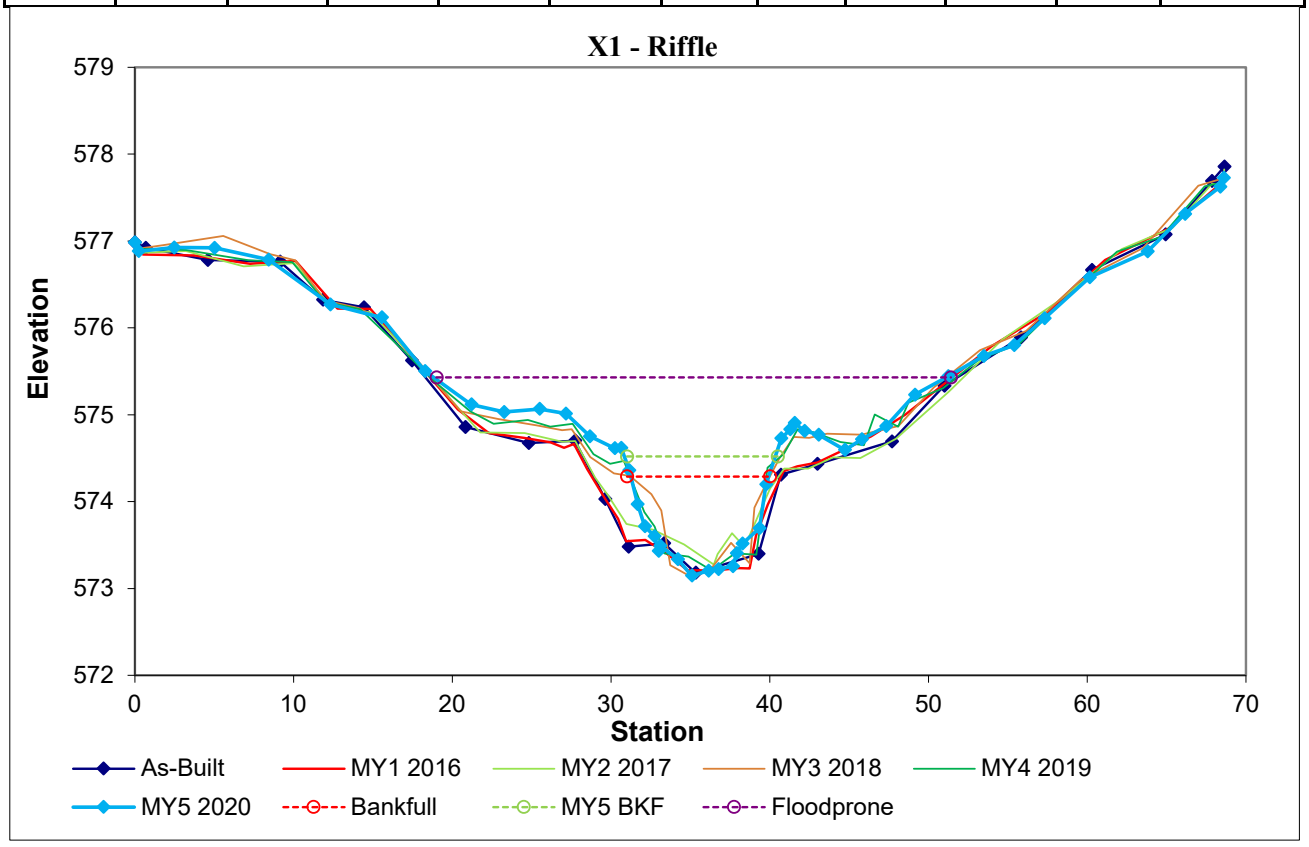
Appendix D

Stream Survey Data

Figure 3. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X1 Riffle - Reach 1 (Station 11+61)
Monitoring Year 5 - Collected September 2020

	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	7.1	8.7	0.8	1.1	10.7	1.1	3.7	574.3	574.6	32.4



*BHR = 1.1 is based on as-built bkf area of 9.1 at an elevation of 574.52. Remainder of data based on actual bankfull elevation from as-built which is 574.3. Thalweg elevation is 573.147.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X2 Pool - Reach 1 (Station 12+00)
Monitoring Year 5 - Collected September 2020

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		18.5	11.3	1.6	2.7	6.8			574.7	575.0	70.6

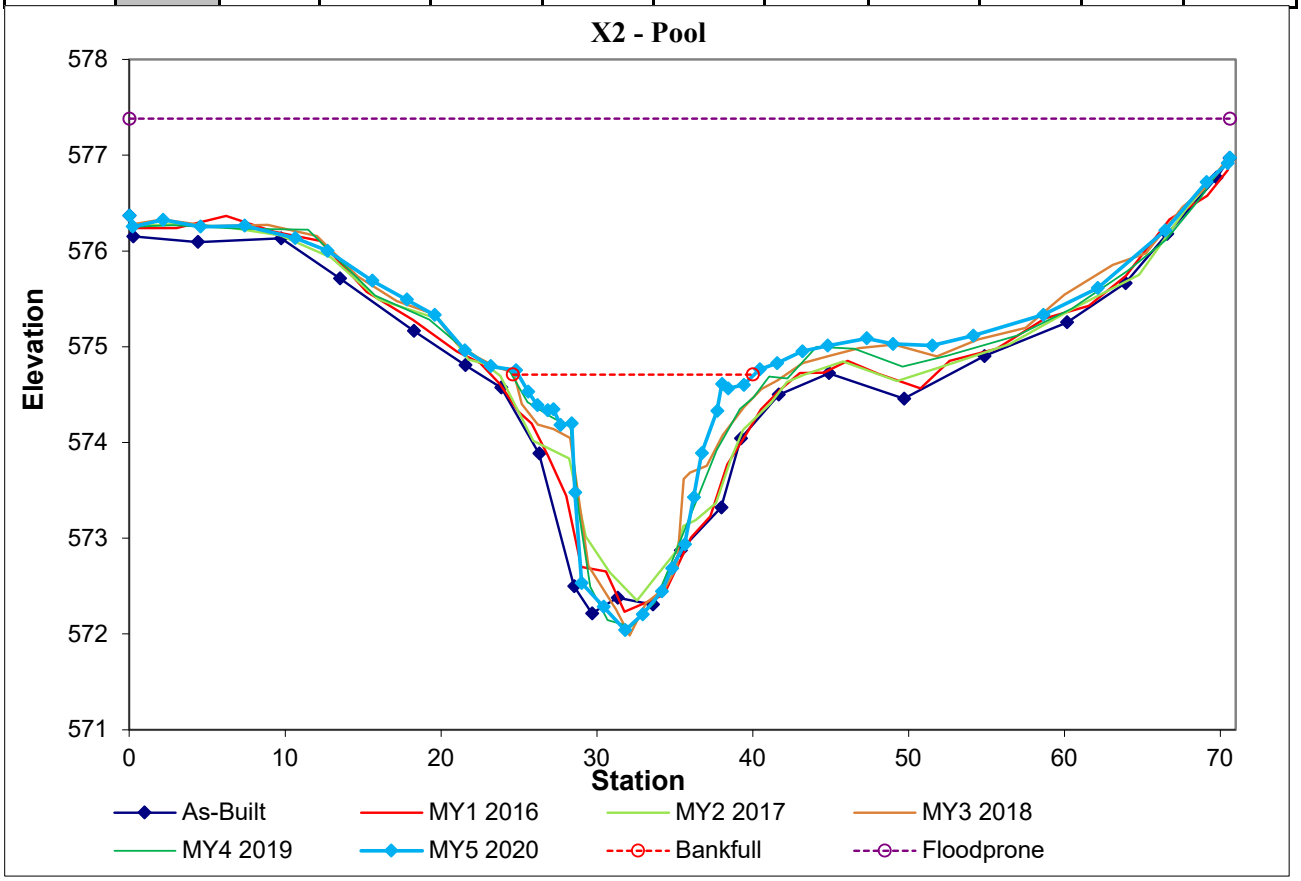


Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X3 Pool - Reach 1 (Station 15+99)
Monitoring Year 5 - Collected September 2020

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		21.5	12.6	1.7	2.8	7.4			571.7	571.6	77.7

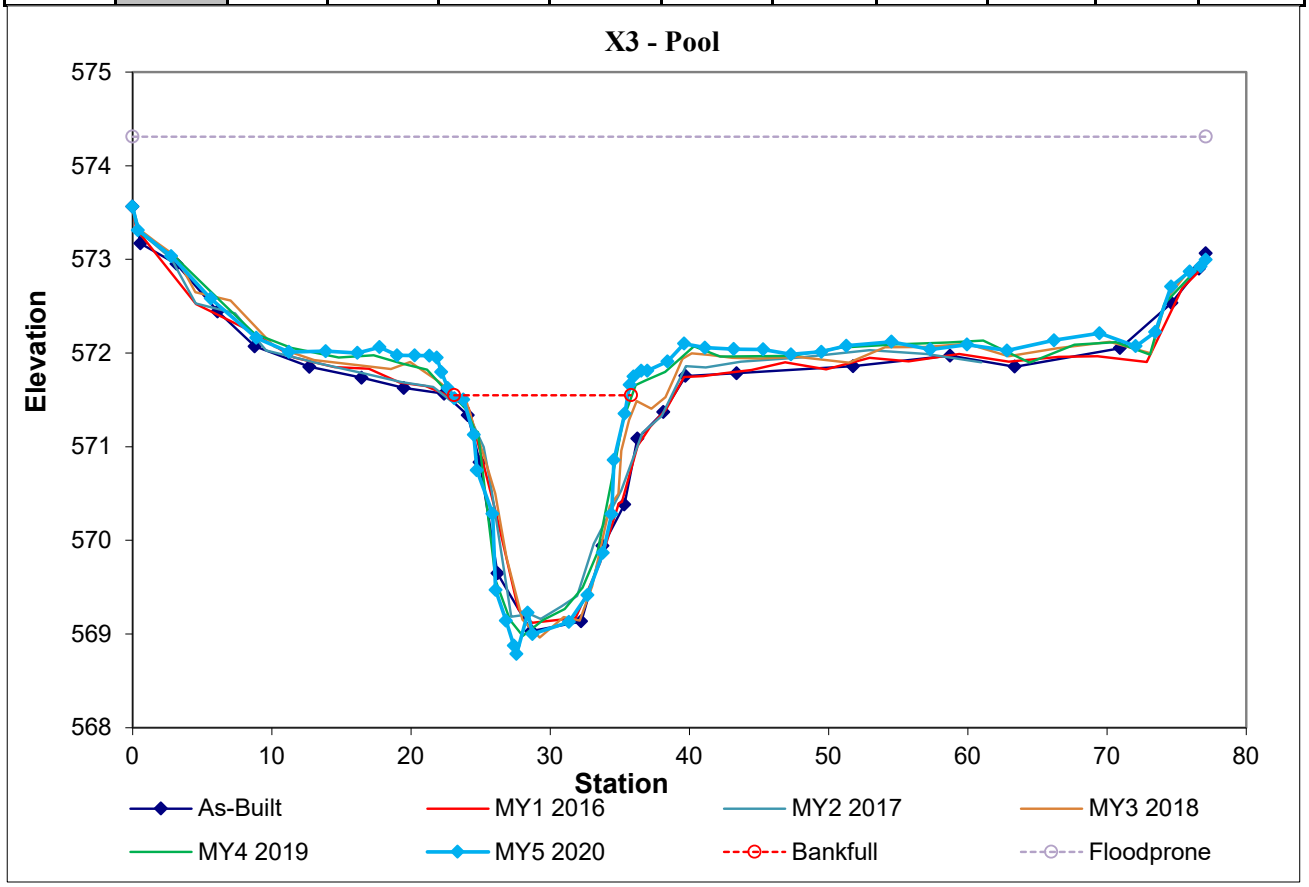


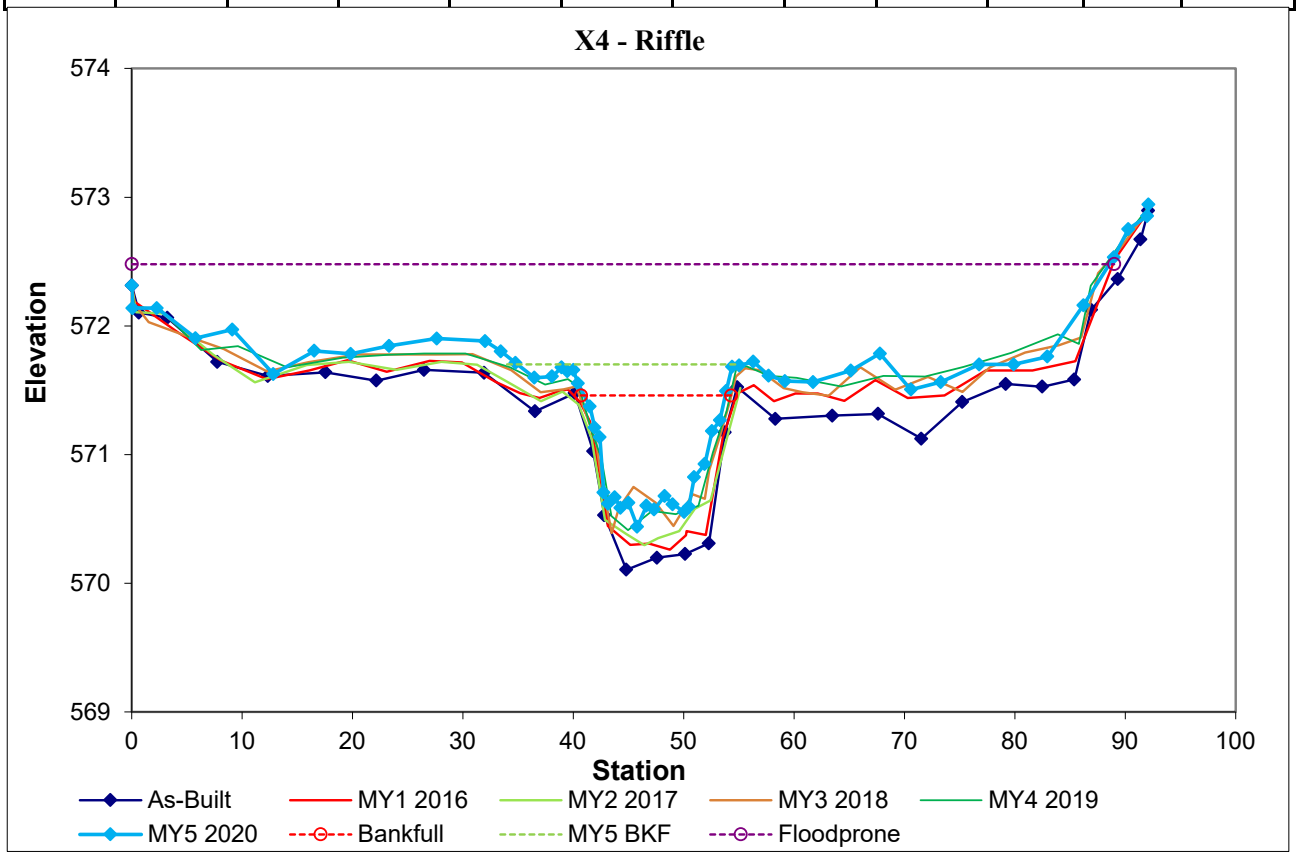
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X4 Riffle - Reach 1 (Station 16+18)
Monitoring Year 5 - Collected September 2020

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	8.5	12.8	0.7	1.0	19.3	1.0	6.9	571.5	571.7	88.5

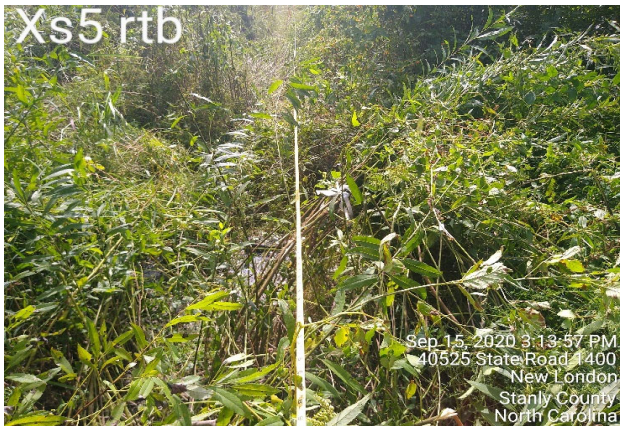


*BHR = 1.0 is based on as-built bkf area of 13.9 at an elevation of 571.7. Remainder of data based on actual bankfull elevation from as-built which is 571.5. Thalweg elevation is 570.44.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

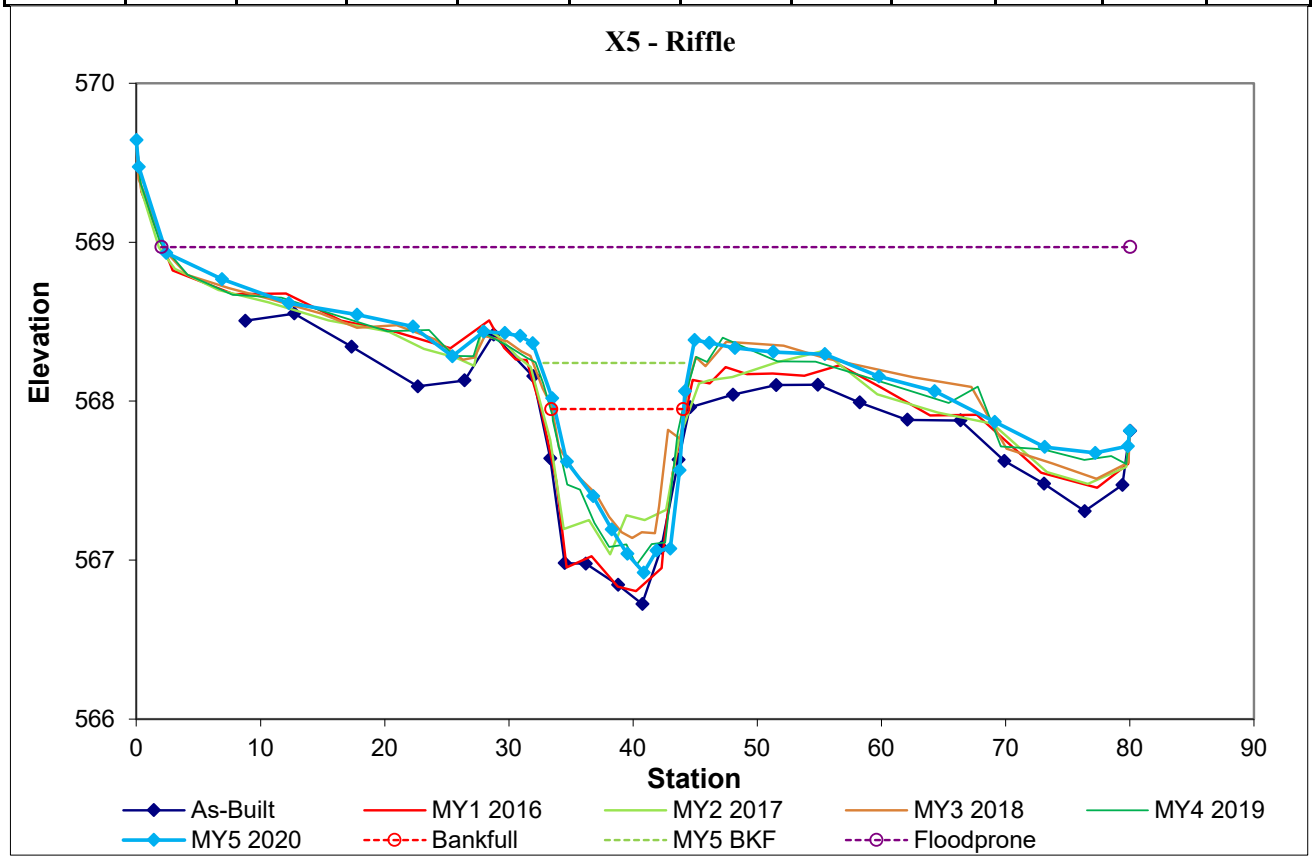
Permanent Cross-section
X5 Riffle - Reach 1 (Station 19+41)
Monitoring Year 5 - Collected September 2020

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	6.9	10.4	0.7	1.0	15.6	1.1	7.4	568.0	568.4	77.3



*BHR = 1.1 is based on as-built bkf area of 10.1 at an elevation of 568.24. Remainder of data based on actual bankfull elevation from as-built which is 568.0. Thalweg elevation is 567.92

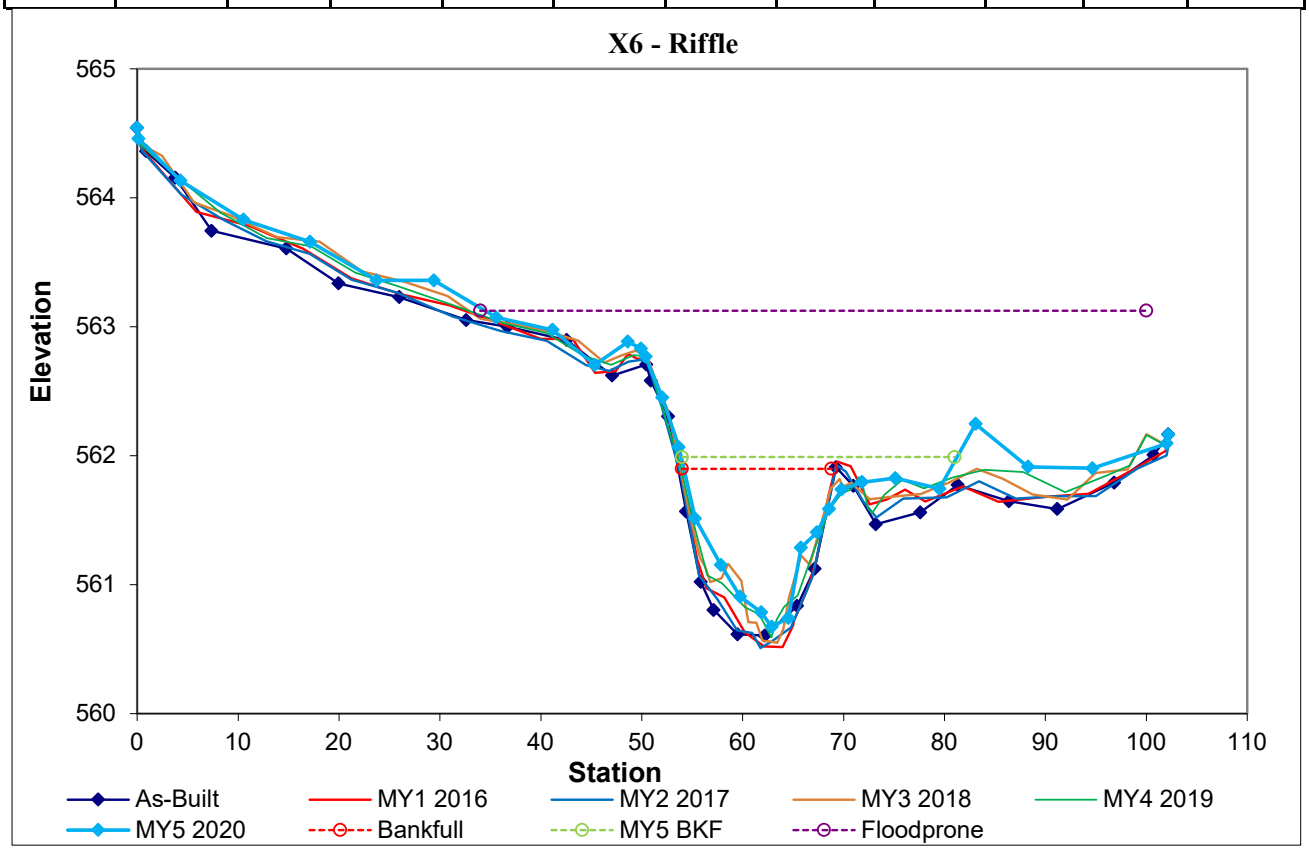
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X6 Riffle - Reach 2 (Station 25+16)
Monitoring Year 5 - Collected September 2020

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	12.5	25.3	0.5	1.2	51.2	0.8	2.9	561.9	561.7	72.4



*BHR = 0.8 is based on as-built bkf area of 14.8 at an elevation of 561.99. Remainder of data based on actual bankfull elevation from as-built which is 561.9. Thalweg elevation is 560.674.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X7 Pool - Reach 2 (Station 25+60)
Monitoring Year 5 - Collected September 2020

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		18.1	15.6	1.2	2.5	13.5			561.6	561.9	76.3

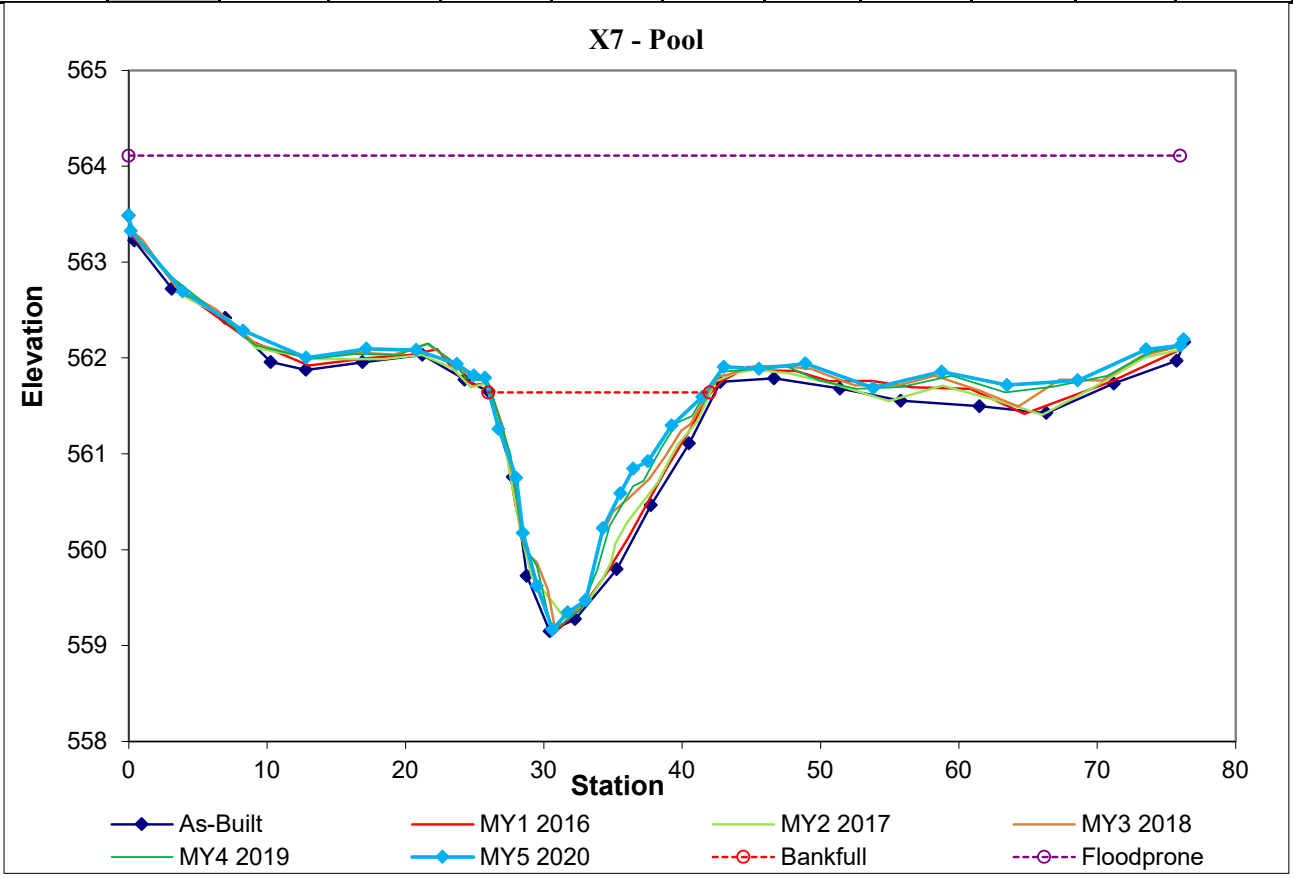
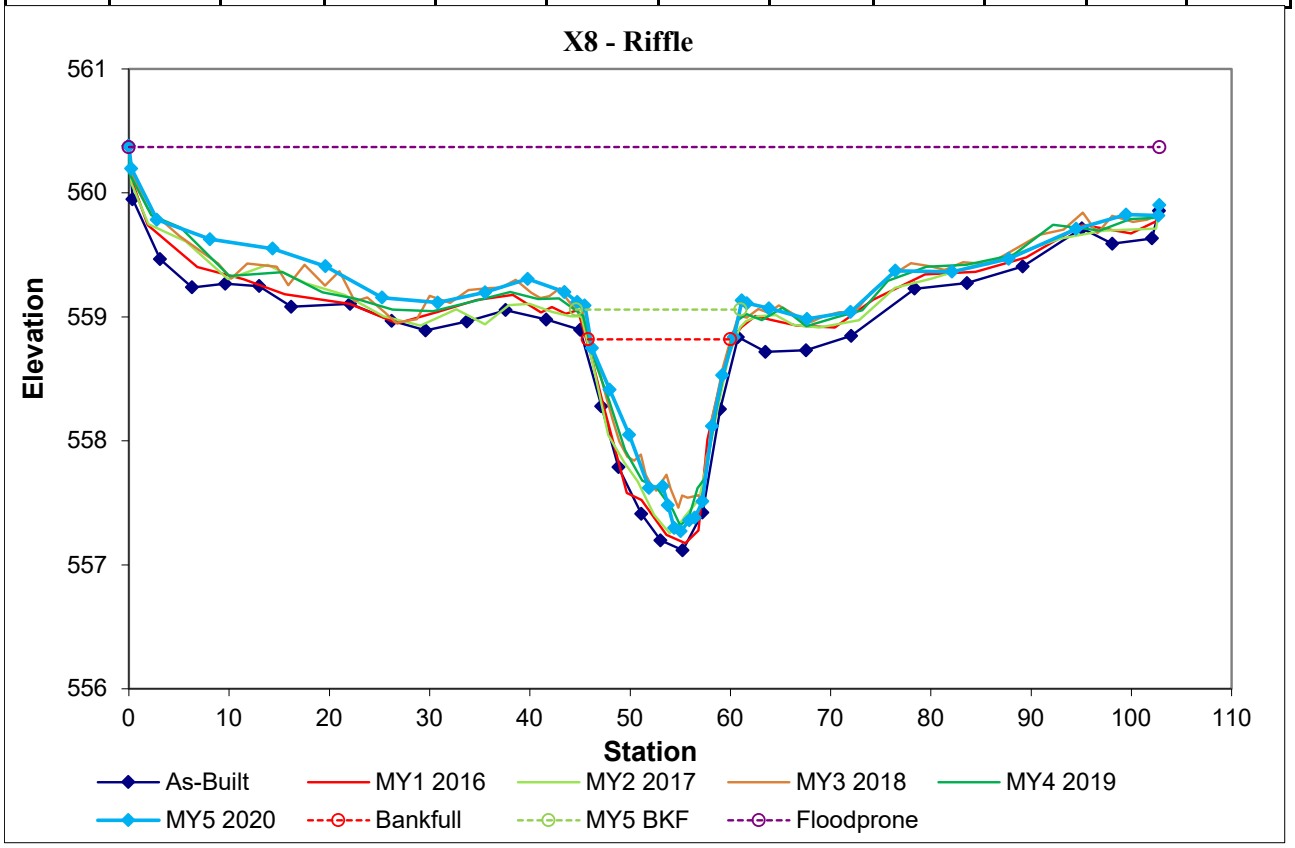


Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X8 Riffle - Reach 2 (Station 29+17)
Monitoring Year 5 - Collected September 2020

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	12.5	14.2	0.9	1.5	16.3	1.0	7.2	558.8	559.1	102.7



*BHR = 1.0 is based on as-built bkf area of 16.5 at an elevation of 559.06. Remainder of data based on actual bankfull elevation from as-built which is 558.8. Thalweg elevation is 557.27.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X9 Pool - Reach 2 (Station 37+60)
Monitoring Year 5 - Collected September 2020

	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		33.8	18.2	1.9	2.7	9.8			552.7	553.0	95.4

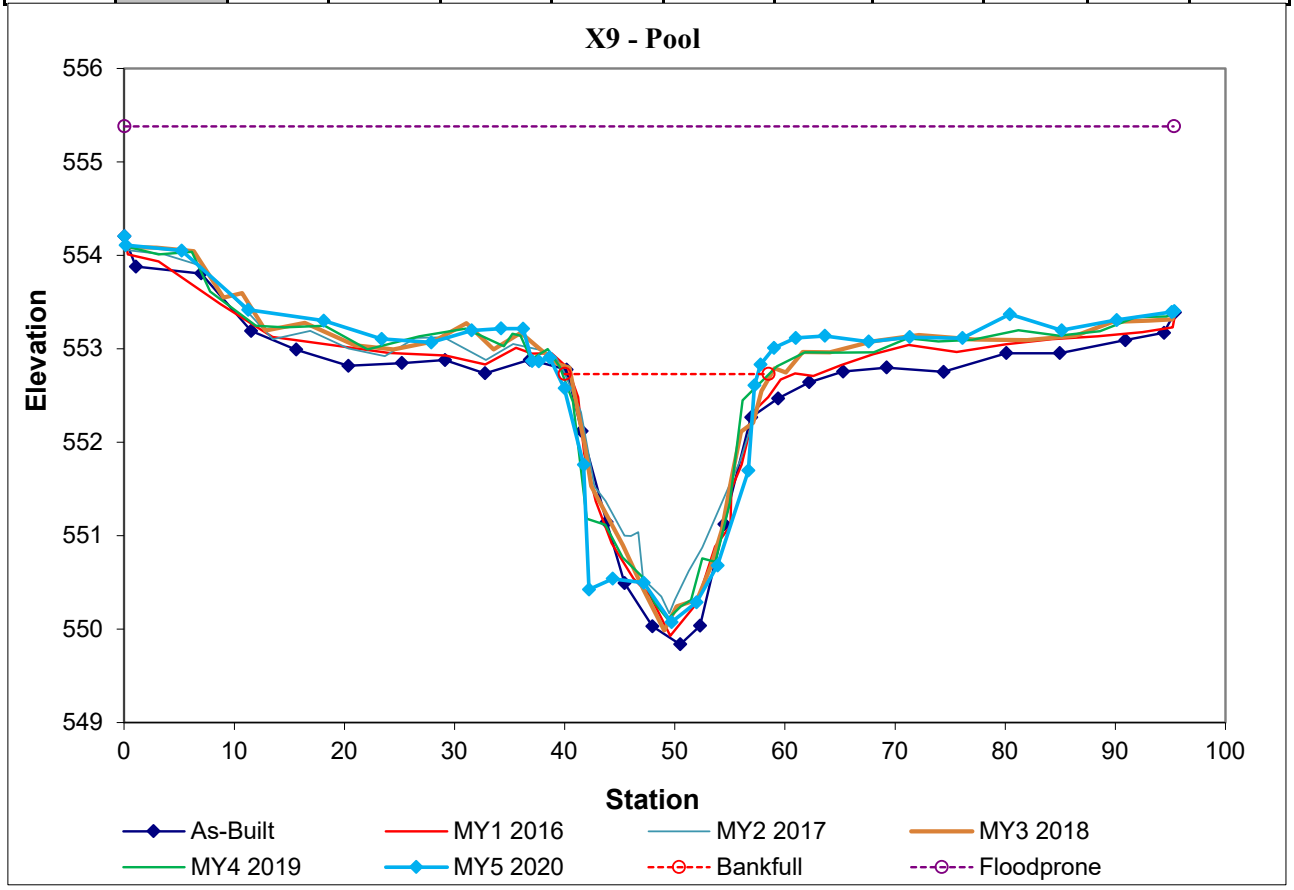


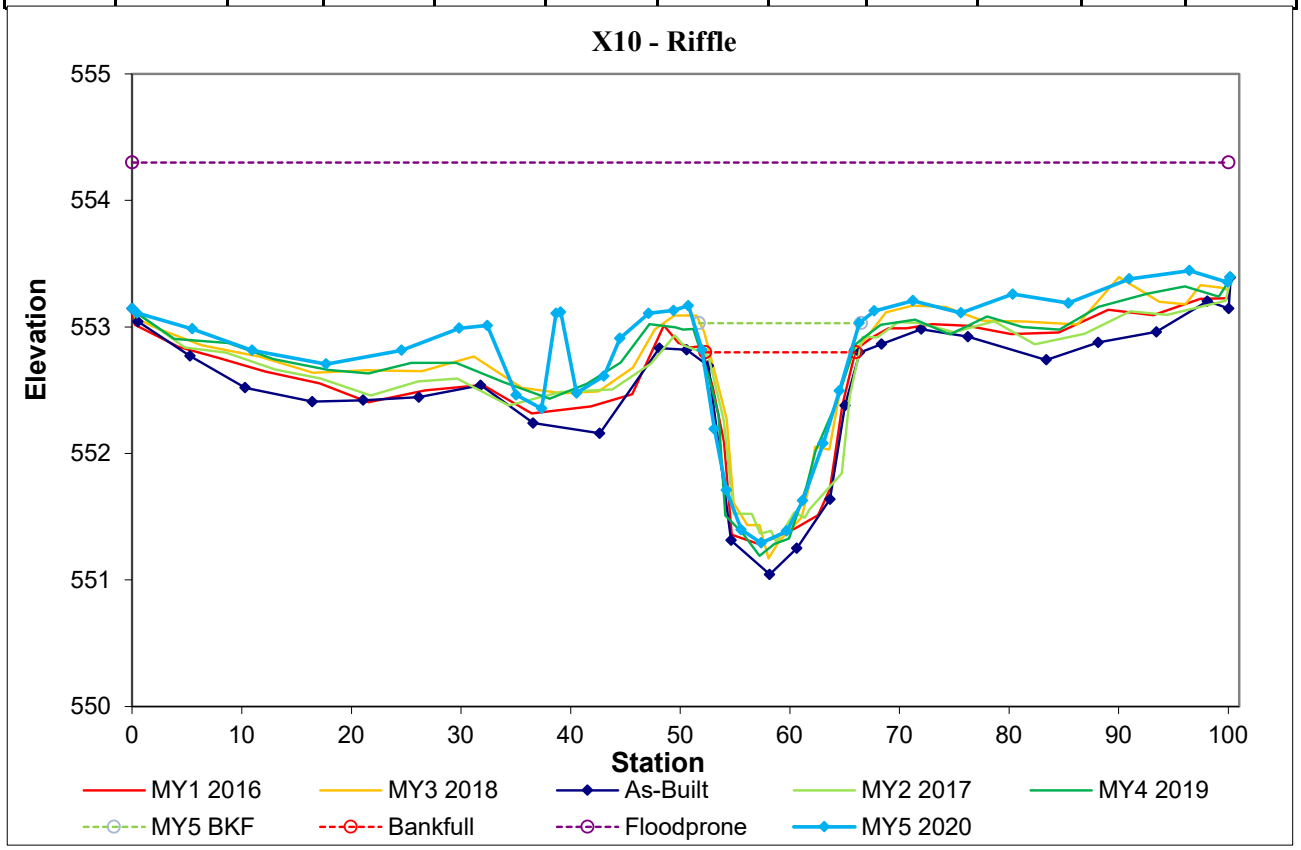
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X10 Riffle - Reach 2 (Station 37+91)
Monitoring Year 5 - Collected September 2020

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	13.6	13.5	1.0	1.5	13.5	1.0	7.4	552.8	553.0	100.1



*BHR = 1.0 is based on as-built bkf area of 17.0 at an elevation of 553.005. Remainder of data based on actual bankfull elevation from as-built which is 552.8. Thalweg elevation is 551.293.

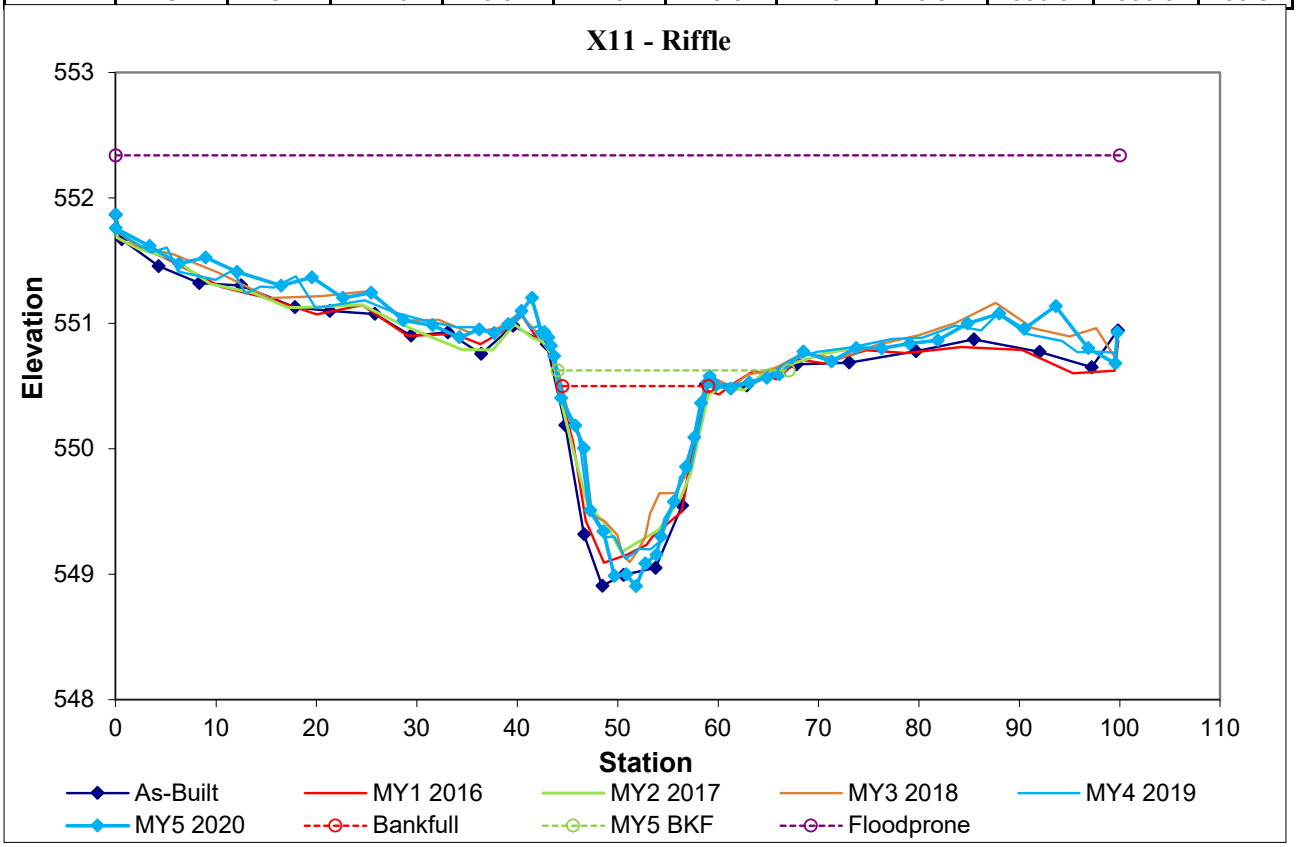
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X11 Riffle - Reach 3 (Station 41+62)
Monitoring Year 5 Collected September 2020

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	13.7	14.6	0.9	1.6	15.6	1.0	6.8	550.5	550.5	99.8



*BHR = .9 is based on as-built bkf area of 16.3 at an elevation of 550.625. Remainder of data based on actual bankfull elevation from as-built which is 550.5. Thalweg elevation is 548.903.

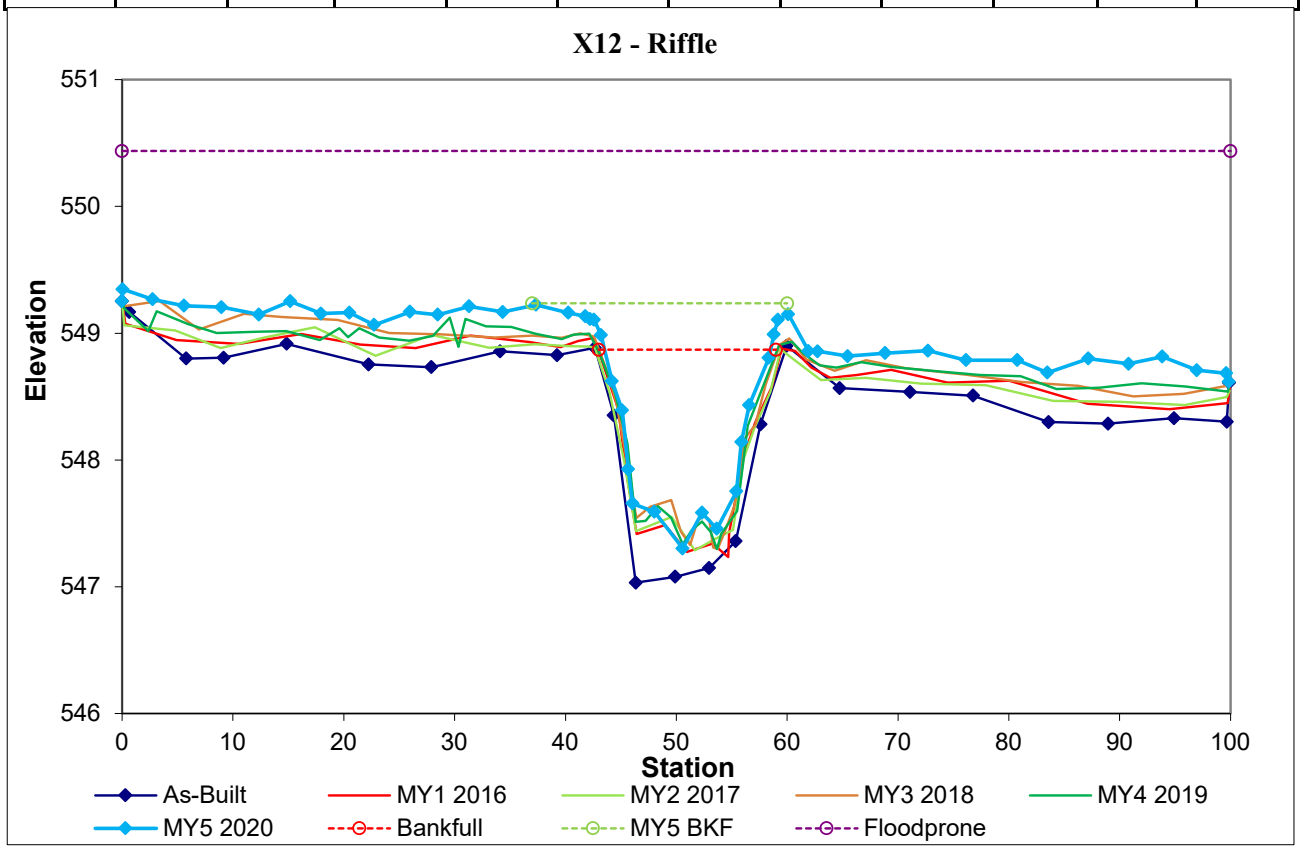
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X12 Riffle - Reach 3 (Station 44+80)
Monitoring Year 5- Collected September 2020

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	15.1	15.0	1.0	1.6	14.9	0.9	6.7	548.9	549.1	99.9



*BHR = 0.9 is based on as-built bkf area of 21.5 at an elevation of 549.235. Remainder of data based on actual bankfull elevation from as-built which is 548.9. Thalweg elevation is 547.30.

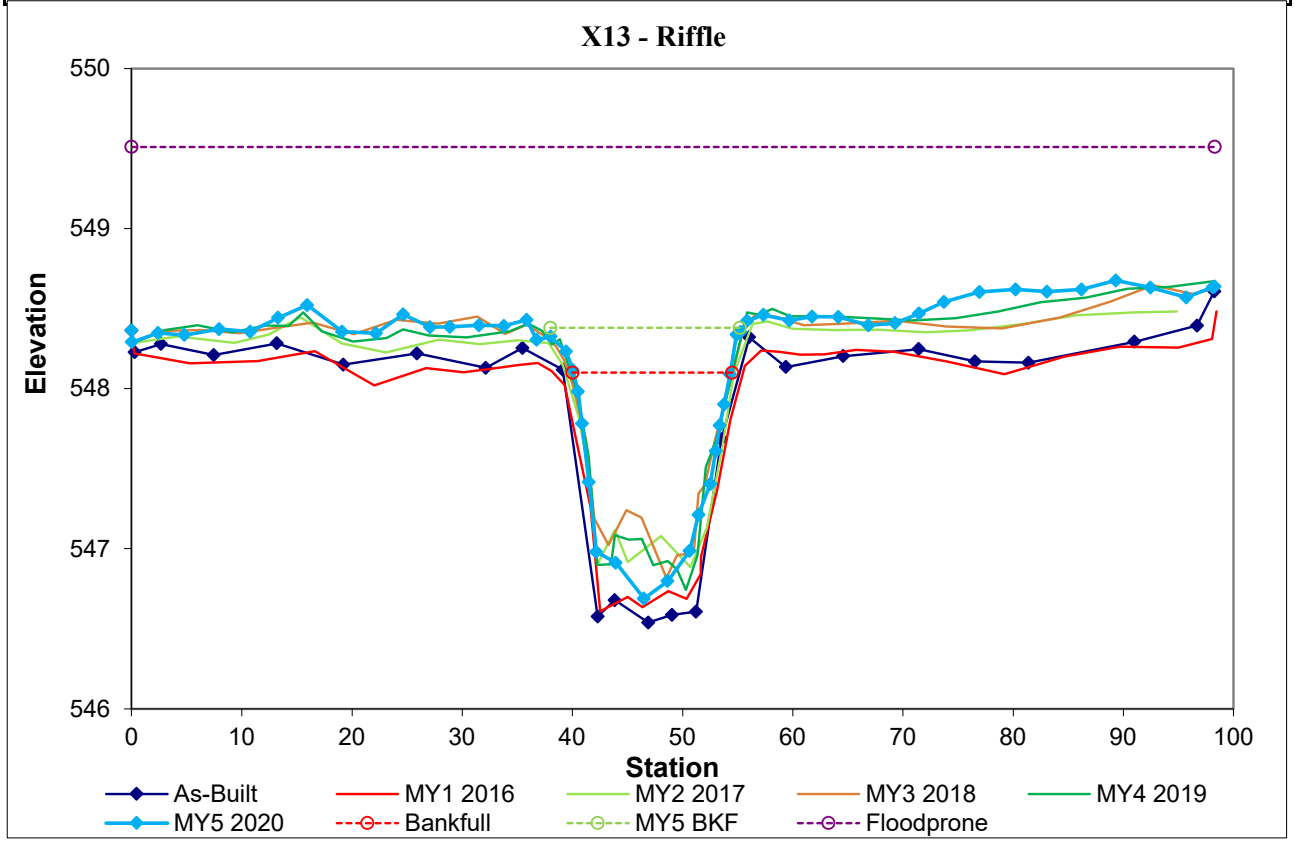
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X13 Riffle - Reach 3 (Station 45+61)
Monitoring Year 5 - Collected September 2020

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	14.0	14.3	1.0	1.4	14.5	0.8	6.9	548.1	548.1	98.3



*BHR = 0.8. is based on as-built bkf area of 18.3 at an elevation of 548.38. Remainder of data based on actual bankfull elevation from as-built which is 548.1. Thalweg elevation is 546.689.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X14 Pool - Reach 3 (Station 45+95)
Monitoring Year 5 - Collected September 2020

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		32.1	17.7	1.8	3.1	9.8			547.9	548.1	98.7

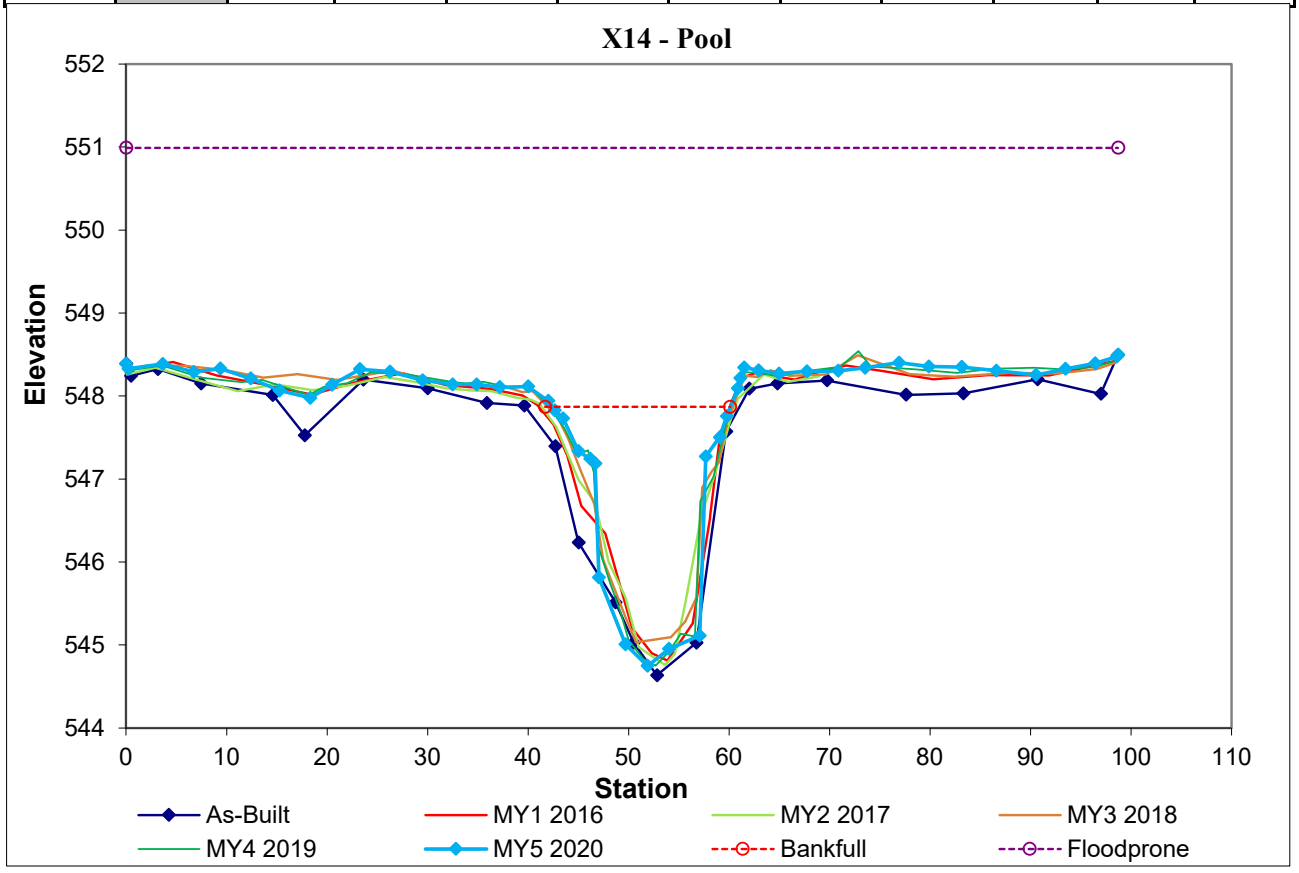


Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X15 Pool - Reach 6 (Station 26+17)
Monitoring Year 5 - Collected September 2020

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		8.6	10.5	0.8	1.5	12.8			553.8	553.9	60.3

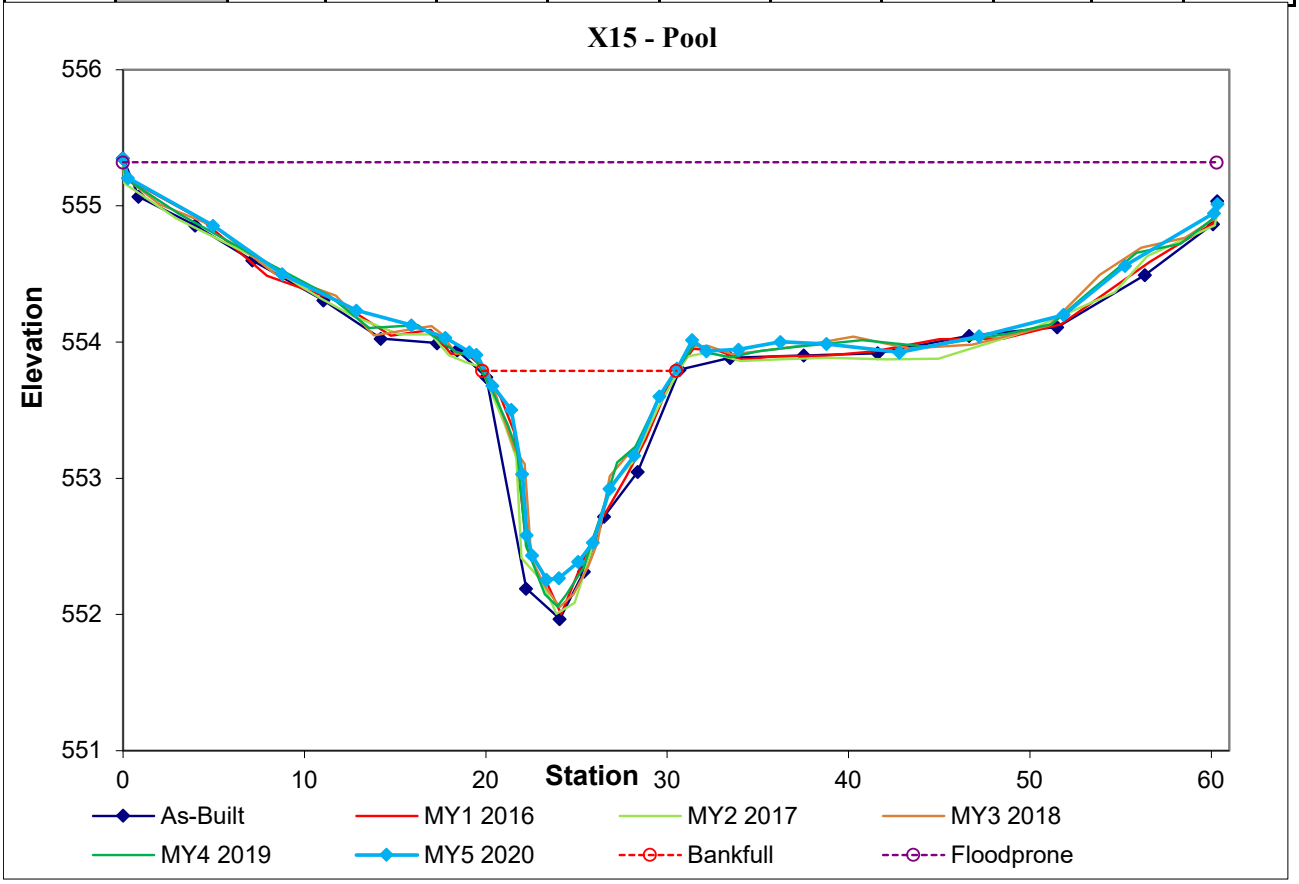


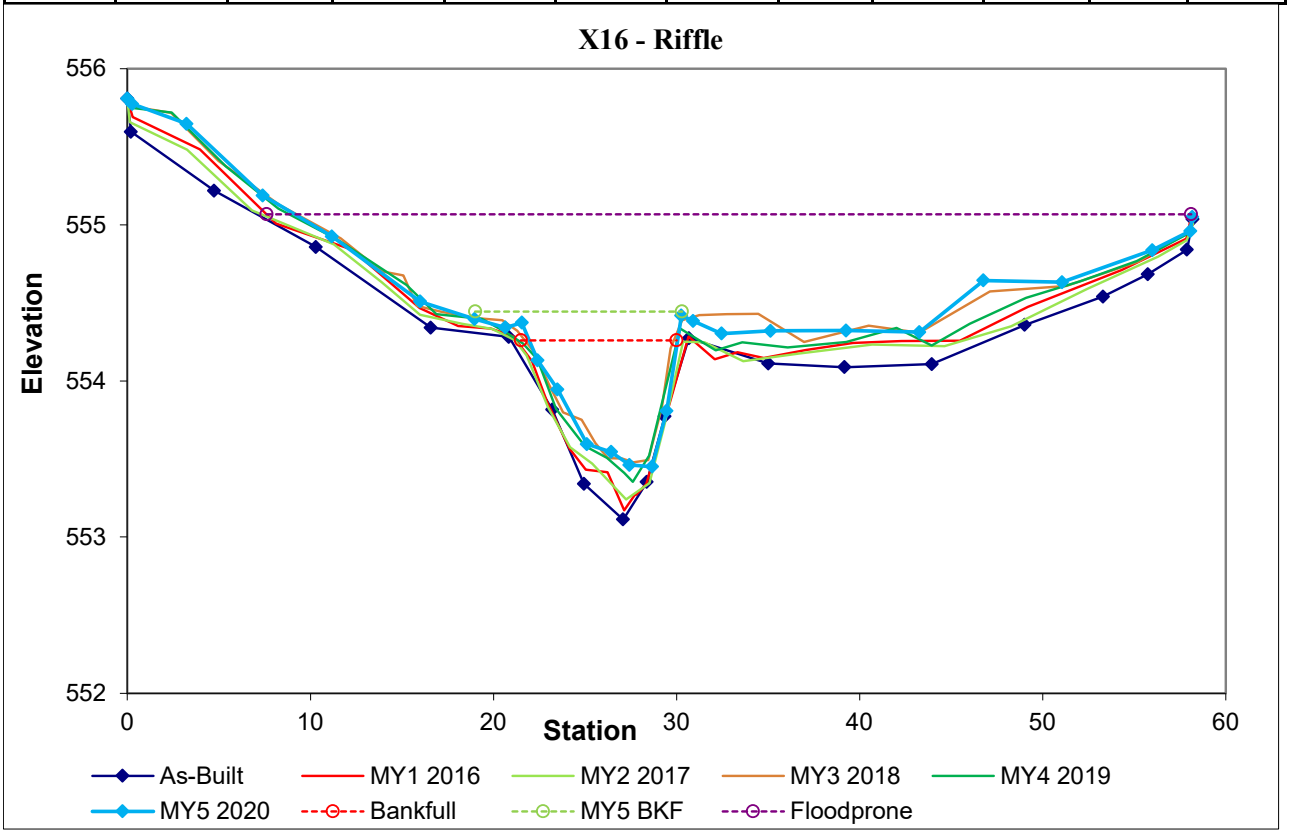
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X16 Riffle - Reach 6 (Station 26+02)
Monitoring Year 5 - Collected September 2020

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	4.4	8.1	0.5	0.8	15.1	0.9	6.2	554.3	554.4	50.6



*BHR = 0.9 is based on as-built bkf area of 6.2 at an elevation of 554.445. Remainder of data based on actual bankfull elevation from as-built which is 554.3. Thalweg elevation is 553.462.

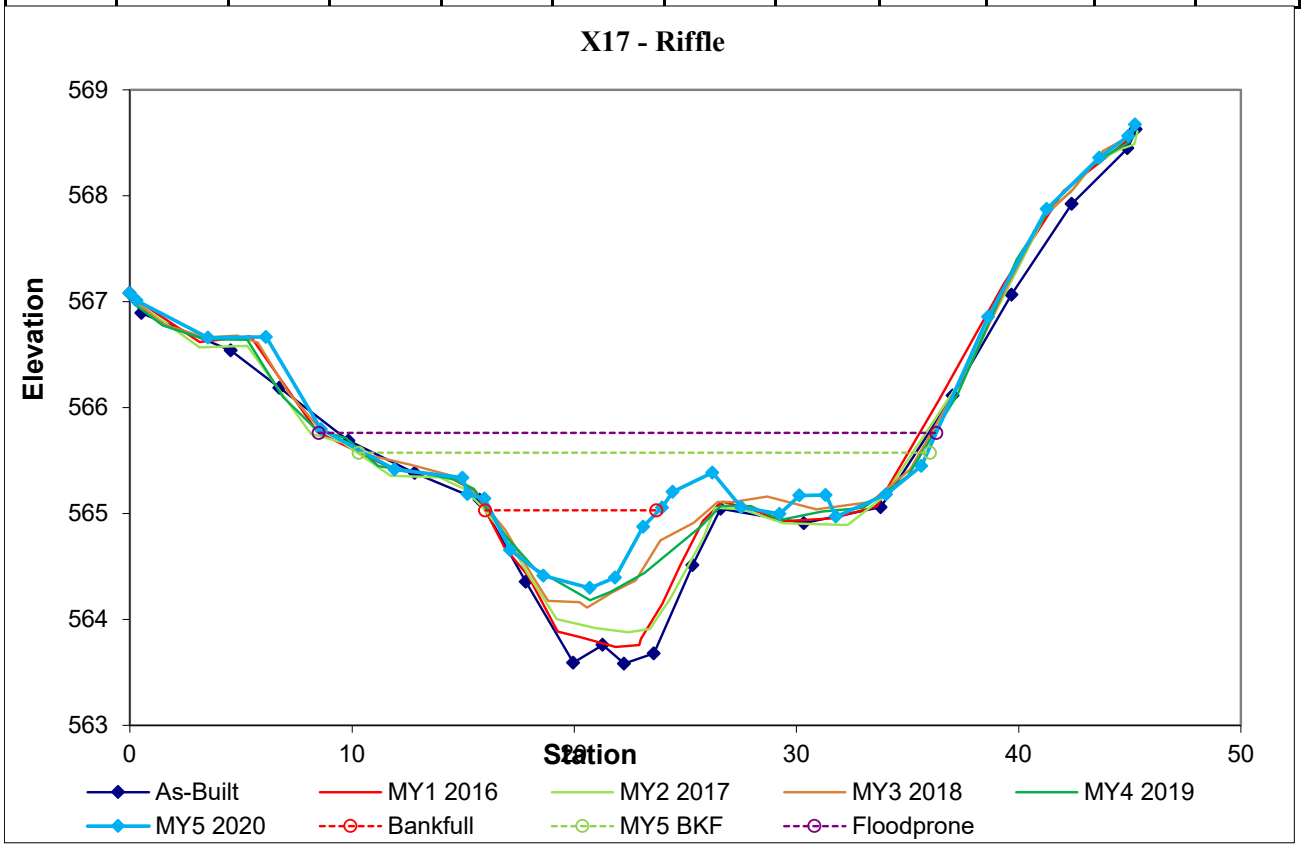
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X17 Riffle - Reach 6 - (Station 21+06)
Monitoring Year 5 - Collected September 2020

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	3.7	9.4	0.4	0.7	24.2	0.8	3.0	565.0	565.3	28.5



*BHR = 0.8 is based on as-built bkf area of 9.8 at an elevation of 565.575. Remainder of data based on actual bankfull elevation from as-built which is 565.03. Thalweg elevation is 564.298.

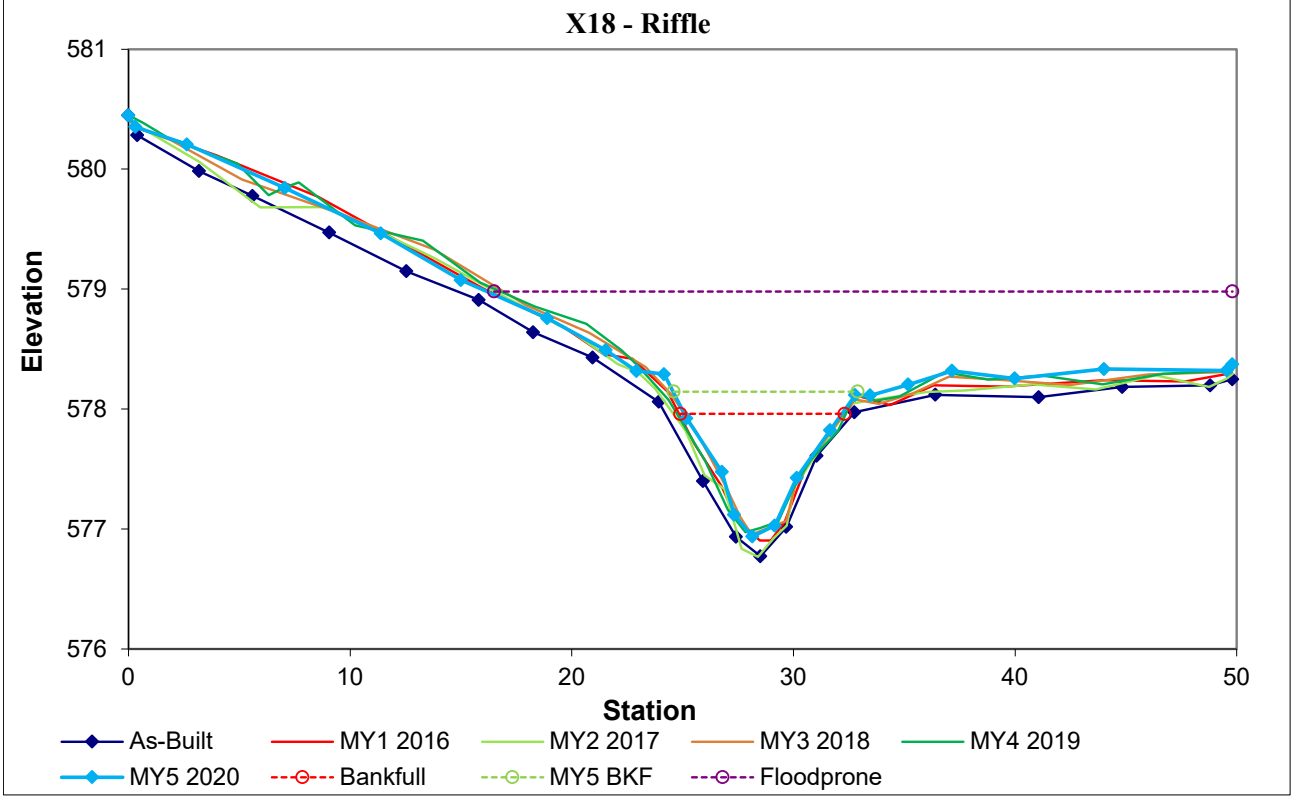
Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X18 Riffle - Reach 6 (Station 16+80)
Monitoring Year 5 - Collected September 2020

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	3.8	7.1	0.5	1.0	13.3	1.0	4.6	578.0	578.1	32.6



*BHR = 1.0 is based on as-built bkf area of 5.3 at an elevation of 578.145. Remainder of data based on actual bankfull elevation from as-built which is 578.0. Thalweg elevation is 576.936.

Figure 3 Continued. Cross-sections with Annual Overlays
UT to Town Creek Restoration Project - Option A: Project No. 94648

Permanent Cross-section
X19 Pool - Reach 6 (Station 17+69)
Monitoring Year 5 - Collected September 2020

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		7.4	12.9	0.6	1.3	22.4			575.8	575.8	39.2

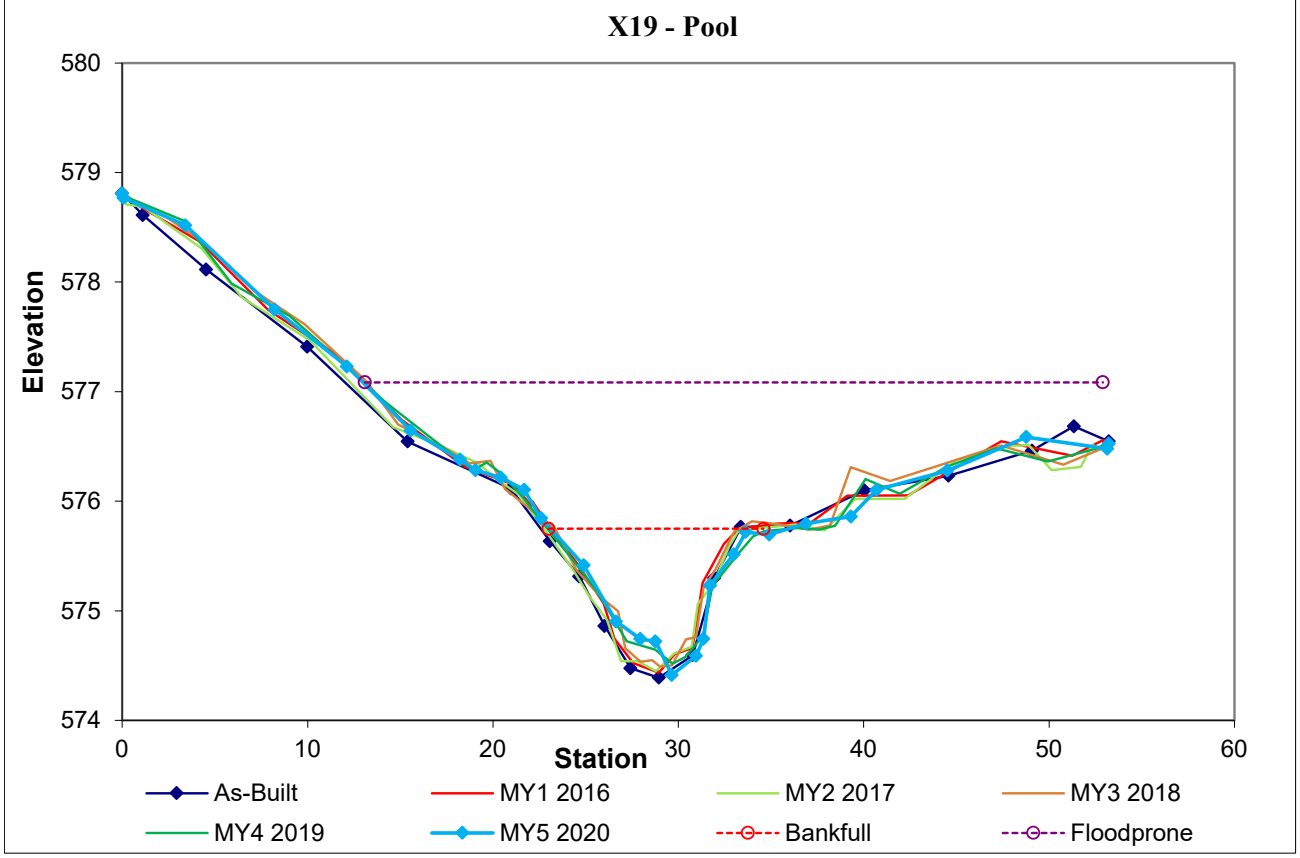


Table 10. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 1 (1,204 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data											
											UT to Rocky Creek						Spencer Creek Upstream					
		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	11.0	9.0	-----	-----	11.9	-----	2	-----	12.2	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	77.0	-----	-----	-----	-----	-----	72.4	-----	-----	-----	-----	-----	228.5	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.4	1.2	-----	-----	1.5	-----	2	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.8	-----	-----	2.1	-----	2	-----	1.8	-----	-----	-----	-----	-----	1.9	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	18.9	-----	13.8	-----	-----	-----	-----	-----	16.3	-----	-----	-----	-----	-----	10.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	5.8	-----	-----	10.3	-----	2	-----	9.1	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	6.5	-----	-----	8.6	-----	2	-----	6	-----	-----	-----	-----	-----	26.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.2	-----	-----	1.2	-----	2	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	50.0	-----	-----	-----	-----	-----	22.6	-----	-----	-----	-----	-----	8.6	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	31	-----	-----	101	-----	-----	-----	-----	-----	-----	-----	-----	24	-----	-----	52	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	17	-----	-----	77	-----	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	22.1	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	1.4	-----	-----	8.6	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	2.5	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	63	-----	-----	144	-----	-----	-----	-----	-----	-----	-----	-----	54	-----	-----	196	-----	-----
Meander Width Ratio	-----	-----	-----	-----	2.6	-----	-----	11.2	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	6	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.011	-----	-----	0.056	-----	-----	0.0606	-----	-----	0.089	-----	-----	0.1	-----	-----	0.067	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	65.6	-----	-----	206.5	-----	-----	26.3	-----	-----	81.3	-----	-----	13	-----	-----	46.5	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	2.8	-----	-----	-----	1	-----	2.2	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		11.3 / 33.0 / 50.0 / 128.0 / >2048						<0.063 / 2.4 / 22.6 / 120 / 256						0.06 / 3 / 8.6 / 77 / 180				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	0.61	-----	-----	0.71	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	32	-----	-----	37.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.830	-----	-----	-----	-----	-----	1.05	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----			-----	C4 (incised	-----	-----	-----	-----	-----	E4b	-----	-----	-----	-----	-----	E4 / C4	-----	-----
BF Velocity (fps)	-----	-----	-----	-----		-----	-----	3.6	-----	-----	-----	-----	-----	5.5	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	77.8	-----	-----	-----	50	-----	-----	-----	-----	-----	85	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	1181	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0080	-----	-----	-----	-----	-----	0.0235	-----	-----	-----	-----	-----	0.0132	-----	-----
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.

[1] Reach 1 data based on two riffle cross-sections and one pool cross-section.

Table 10 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 1 (1,204 LF)

Parameter	Reference Reach(es) Data												Design						As-built					
	Richland Creek						Morgan Branch																	
	Min	Mean	Med	Max	SD	n	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)	16.2	-----	-----	16.7	-----	-----	-----	33.2	-----	-----	-----	-----	-----	13.5	-----	-----	-----	-----	11.8	-----	-----	14.4	-----	3
Floodprone Width (ft)	50	-----	-----	53	-----	-----	-----	77.5	-----	-----	-----	-----	45	-----	-----	63	-----	-----	33.1	-----	-----	91.8	-----	3
BF Mean Depth (ft)	0.9	-----	-----	0.9	-----	-----	-----	2.3	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	0.8	-----	-----	1.0	-----	3
BF Max Depth (ft)	1.4	-----	-----	1.5	-----	-----	-----	2.8	-----	-----	-----	-----	-----	1.4	-----	-----	-----	-----	1.2	-----	-----	1.4	-----	3
BF Cross-sectional Area (ft^2)	15	-----	-----	15.5	-----	-----	-----	75.1	-----	-----	-----	-----	-----	13.8	-----	-----	-----	-----	9.1	-----	-----	13.9	-----	3
Width/Depth Ratio	18	-----	-----	18.6	-----	-----	-----	14.1	-----	-----	-----	-----	-----	13.2	-----	-----	-----	-----	14.4	-----	-----	15.2	-----	3
Entrenchment Ratio	3.0	-----	-----	3.3	-----	-----	-----	2.3	-----	-----	-----	-----	3.3	-----	-----	4.7	-----	-----	2.8	-----	-----	6.4	-----	3
Bank Height Ratio	-----	1	-----	2.5	-----	-----	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	45	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	50	-----	-----	-----	-----	-----	31.2	-----	-----	-----	-----
Pattern																								
Channel Beltwidth (ft)	25	-----	-----	40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	42.0	51.6	-----	72.9	-----	18
Rc:Bankfull width (ft/ft)	0.9	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.6	-----	-----	-----	15
Profile																								
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.5	35.0	35.4	62.8	12.7	18
Riffle Slope (ft/ft)	0.013	-----	-----	0.0413	-----	-----	0.014	-----	-----	0.024	-----	-----	0.01	-----	-----	0.017	-----	-----	0.008	0.017	0.017	0.031	0.006	18
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	37.3	-----	-----	95.8	-----	-----	146	-----	-----	277.0	-----	-----	20.3	-----	-----	67.5	-----	-----	38.0	64.0	64.0	81.7	11.0	17
Pool Max Depth (ft)	-----	2.5	-----	-----	-----	-----	-----	4.1	-----	-----	-----	-----	2.1	-----	-----	3.6	-----	-----	2.50	-----	-----	2.52	0.0	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----
d16 / d35 / d50 / d84 / d95			6.0 / - / 45 / 125 / -						- / 1.2 / 3 / 77 / 800					11.3 / 33.0 / 50.0 / 128.0 / >2048						4.0 / 18.4 / 31.2 / 96.6 / >2048 / >2048				
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.41	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	26.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																								
Drainage Area (SM)	-----	-----	-----	1	-----	-----	-----	-----	-----	8.35	-----	-----	-----	-----	-----	0.830	-----	-----	-----	0.83	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	3.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	524	-----	-----	-----	13.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,082	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,192	-----	-----	-----	-----	-----	1,206	-----	-----	-----	-----
Sinuosity	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.11	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.007	-----	-----	-----	0.0094	-----	-----	-----	-----	-----	0.0096	-----	-----	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 2 (1,782 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Reference Reach(es) Data											
											UT to Rocky Creek						Spencer Creek Upstream					
		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	11.3	-----	12.6	-----	-----	-----	1	-----	12.2	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	81.0	-----	-----	-----	-----	-----	72.4	-----	-----	-----	-----	-----	228.5	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.4	-----	1.2	-----	-----	-----	1	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.6	-----	-----	-----	1	-----	1.8	-----	-----	-----	-----	-----	1.9	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	19.6	-----	14.5	-----	-----	-----	1	-----	16.3	-----	-----	-----	-----	-----	10.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	11.0	-----	-----	-----	1	-----	9.1	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	6.4	-----	-----	-----	1	-----	6	-----	-----	-----	-----	-----	26.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	1.3	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	50.0	-----	-----	-----	-----	-----	22.6	-----	-----	-----	-----	-----	8.6	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	60	-----	185	-----	-----	-----	-----	-----	-----	-----	-----	-----	24	-----	-----	52	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	21	-----	80	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	22.1	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	1.7	-----	6.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	2.5	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	100	-----	340	-----	-----	-----	-----	-----	-----	-----	-----	-----	54	-----	-----	196	-----	-----
Meander Width Ratio	-----	-----	-----	-----	7.9	-----	27	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	6	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.01	-----	0.033	-----	-----	-----	0.0606	-----	-----	0.089	-----	-----	0.1	-----	-----	0.067	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	49	-----	319	-----	-----	-----	26.3	-----	-----	81.3	-----	-----	13	-----	-----	46.5	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	2.1	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		11.3 / 33.0 / 50.0 / 128.0 / >2048						<0.063 / 2.4 / 22.6 / 120 / 256						0.06 / 3 / 8.6 / 77 / 180				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	0.77	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	42.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.9	-----	-----	-----	-----	-----	1.05	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	:4 (incisec	-----	-----	-----	-----	-----	E4b	-----	-----	-----	-----	-----	E4 / C4	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	3.8	-----	-----	-----	-----	-----	5.5	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	81.2	-----	-----	-----	55	-----	-----	-----	-----	-----	85	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	1,672	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.009	-----	-----	-----	-----	-----	0.0235	-----	-----	-----	-----	-----	0.0132	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 2 (1,782 LF)

Parameter	Reference Reach(es) Data												Design						As-built					
	Richland Creek						Morgan Branch																	
	Min	Mean	Med	Max	SD	n	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)	16.2	-----	-----	16.7	-----	-----	-----	33.2	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----	15.4	-----	-----	15.6	-----	3
Floodprone Width (ft)	50	-----	-----	53	-----	-----	-----	77.5	-----	-----	-----	-----	83	-----	-----	104.0	-----	-----	74.9	-----	-----	102.7	-----	3
BF Mean Depth (ft)	0.9	-----	-----	0.9	-----	-----	-----	2.3	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	3
BF Max Depth (ft)	1.4	-----	-----	1.5	-----	-----	-----	2.8	-----	-----	-----	-----	-----	1.4	-----	-----	-----	-----	1.3	-----	-----	1.8	-----	3
BF Cross-sectional Area (ft^2)	15	-----	-----	15.5	-----	-----	-----	75.1	-----	-----	-----	-----	-----	14.7	-----	-----	-----	-----	14.8	-----	-----	17.0	-----	3
Width/Depth Ratio	18	-----	-----	18.6	-----	-----	-----	14.1	-----	-----	-----	-----	-----	13.3	-----	-----	-----	-----	14.2	-----	-----	16.5	-----	3
Entrenchment Ratio	3.0	-----	-----	3.3	-----	-----	-----	2.3	-----	-----	-----	-----	5.9	-----	-----	7.4	-----	-----	4.8	-----	-----	6.7	-----	3
Bank Height Ratio	-----	1	-----	2.5	-----	-----	-----	1	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	45	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	50	-----	-----	-----	-----	-----	20.9	-----	-----	-----	-----
Pattern																								
Channel Beltwidth (ft)	25	-----	-----	40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	48.6	54.7	-----	65.6	-----	7
Rc:Bankfull width (ft/ft)	0.9	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.0	-----	-----	-----	8
Profile																								
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16.4	48.9	39.1	101.3	37.2	21
Riffle Slope (ft/ft)	0.013	-----	-----	0.0413	-----	-----	0.014	-----	-----	0.024	-----	-----	-----	-----	-----	-----	-----	-----	0.003	0.018	0.018	0.035	0.0	21
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	37.3	-----	-----	95.8	-----	-----	146	-----	-----	277.0	-----	-----	21	-----	-----	70	-----	-----	46.0	75.4	70.0	130.2	23.5	19
Pool Max Depth (ft)	-----	2.5	-----	-----	-----	-----	-----	4.1	-----	-----	-----	-----	2.1	-----	-----	3.7	-----	-----	2.5	-----	-----	2.9	0.3	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95			6.0 / - / 45 / 125 / -						- / 1.2 / 3 / 77 / 800					11.3 / 33.0 / 50.0 / 128.0 / >2048						<0.063 / 12.2 / 20.9 / 68.5 / 151.8 / >2048				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																								
Drainage Area (SM)	-----	-----	-----	1	-----	-----	-----	-----	-----	8.35	-----	-----	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	3.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	524	-----	-----	-----	55	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,549	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,833	-----	-----	-----	-----	-----	1,842	-----	-----	-----	-----
Sinuosity	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.007	-----	-----	-----	0.0127	-----	-----	-----	-----	-----	0.0077	-----	-----	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 3 (829 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data											
											UT to Rocky Creek						Spencer Creek Upstream					
		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	12.9	9.8	-----	-----	12.7	-----	2	-----	12.2	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	230.3	-----	-----	-----	-----	-----	72.4	-----	-----	-----	-----	-----	228.5	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.6	1.5	-----	-----	1.8	-----	2	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	2.9	-----	-----	3.2	-----	2	-----	1.8	-----	-----	-----	-----	-----	1.9	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	24.3	18.0	-----	-----	18.9	-----	2	-----	16.3	-----	-----	-----	-----	-----	10.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	5.4	-----	-----	8.6	-----	2	-----	9.1	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	18.1	-----	-----	23.5	-----	2	-----	6	-----	-----	-----	-----	-----	26.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	15.0	-----	-----	-----	-----	-----	22.6	-----	-----	-----	-----	-----	8.6	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	40	-----	-----	65	-----	-----	-----	-----	-----	-----	-----	-----	24	-----	-----	52	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	34	-----	-----	61	-----	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	22.1	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	1.7	-----	-----	4.9	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	2.5	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	63	-----	-----	199	-----	-----	-----	-----	-----	-----	-----	-----	54	-----	-----	196	-----	-----
Meander Width Ratio	-----	-----	-----	-----	5	-----	-----	20.3	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	6	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.014	-----	-----	0.03	-----	-----	0.0606	-----	-----	0.089	-----	-----	0.1	-----	-----	0.067	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	38	-----	-----	132	-----	-----	26.3	-----	-----	81.3	-----	-----	13	-----	-----	46.5	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	2.6	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		1.0 / 11.0 / 15.0 /64.0 / 150.0						<0.063 / 2.4 / 22.6 / 120 / 256						0.06 / 3 / 8.6 / 77 / 180				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	0.3	-----	-----	0.33	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	15.8	-----	-----	16.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.05	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	C4 (incisec	-----	-----	-----	-----	-----	E4b	-----	-----	-----	-----	-----	E4 / C4	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	3.4	-----	-----	3.6	-----	-----	-----	-----	-----	5.5	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	101.6	-----	-----	-----	65.0	-----	-----	-----	-----	-----	85	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	721	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.008	-----	-----	-----	-----	-----	0.0235	-----	-----	-----	-----	-----	0.0132	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 3 (829 LF)

Parameter	Reference Reach(es) Data												Design						As-built					
	Richland Creek						Morgan Branch																	
	Min	Mean	Med	Max	SD	n	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)	16.2	-----	-----	16.7	-----	-----	-----	33.2	-----	-----	-----	-----	-----	15.5	-----	-----	-----	-----	14.9	-----	-----	17.1	-----	3
Floodprone Width (ft)	50	-----	-----	53	-----	-----	-----	77.5	-----	-----	-----	-----	104	-----	-----	218.0	-----	-----	99.3	-----	-----	99.8	-----	3
BF Mean Depth (ft)	0.9	-----	-----	0.9	-----	-----	-----	2.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	1.1	-----	-----	1.3	-----	3
BF Max Depth (ft)	1.4	-----	-----	1.5	-----	-----	-----	2.8	-----	-----	-----	-----	-----	1.6	-----	-----	-----	-----	1.6	-----	-----	1.8	-----	3
BF Cross-sectional Area (ft^2)	15	-----	-----	15.5	-----	-----	-----	75.1	-----	-----	-----	-----	-----	18.2	-----	-----	-----	-----	16.3	-----	-----	21.5	-----	3
Width/Depth Ratio	18	-----	-----	18.6	-----	-----	-----	14.1	-----	-----	-----	-----	-----	13.2	-----	-----	-----	-----	13.5	-----	-----	14.0	-----	3
Entrenchment Ratio	3.0	-----	-----	3.3	-----	-----	-----	2.3	-----	-----	-----	-----	6.7	-----	-----	14.1	-----	-----	5.8	-----	-----	6.7	-----	3
Bank Height Ratio	-----	1	-----	2.5	-----	-----	-----	1	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	45	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	15	-----	-----	-----	-----	-----	21.8	-----	-----	-----	-----
Pattern																								
Channel Beltwidth (ft)	25	-----	-----	40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	31.0	-----	-----	47.0	-----	-----	54.5	63.2	-----	71.8	-----	9
Rc:Bankfull width (ft/ft)	0.9	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8.0	-----	-----	-----	3.2	-----	-----	-----	7
Profile																								
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25.2	46.1	43.3	67.0	15.4	11
Riffle Slope (ft/ft)	0.013	-----	-----	0.0413	-----	-----	0.014	-----	-----	0.024	-----	-----	0.005	-----	-----	0.006	-----	-----	0.005	0.020	0.016	0.055	0.0	11
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	37.3	-----	-----	95.8	-----	-----	146	-----	-----	277.0	-----	-----	62	-----	-----	109	-----	-----	63.7	77.7	77.2	90.9	8.3	9
Pool Max Depth (ft)	-----	2.5	-----	-----	-----	-----	-----	4.1	-----	-----	-----	-----	2.4	-----	-----	4.11	-----	-----	3.2	-----	-----	3.2	-----	1
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95			6.0 / - / 45 / 125 / -						- / 1.2 / 3 / 77 / 800					1.0 / 11.0 / 15.0 / 64.0 / 150.0						2.0 / 12.6 / 21.8 / 74.1 / 128.0 / 128 - 180				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.23	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																								
Drainage Area (SM)	-----	-----	-----	1	-----	-----	-----	-----	-----	8.35	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	3.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	524	-----	-----	-----	65.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	695	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	803	-----	-----	-----	-----	-----	829	-----	-----	-----	-----
Sinuosity	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.16	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.007	-----	-----	-----	0.0032	-----	-----	-----	-----	-----	0.0062	-----	-----	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 6 (1,340 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Reference Reach(es) Data											
											UT to Rocky Creek						Spencer Creek Upstream					
		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	-----	6.1	-----	-----	-----	1	-----	12.2	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	9.7	-----	-----	-----	1	-----	72.4	-----	-----	-----	-----	-----	228.5	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.9	-----	0.8	-----	-----	-----	1	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.3	-----	-----	-----	1	-----	1.8	-----	-----	-----	-----	-----	1.9	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	6.7	-----	4.7	-----	-----	-----	1	-----	16.3	-----	-----	-----	-----	-----	10.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	7.8	-----	-----	-----	1	-----	9.1	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	1.6	-----	-----	-----	1	-----	6	-----	-----	-----	-----	-----	26.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	1.9	-----	-----	-----	1	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	32.0	-----	-----	-----	-----	-----	22.6	-----	-----	-----	-----	-----	8.6	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	40	-----	-----	65	-----	-----	-----	-----	-----	-----	-----	-----	24	-----	-----	52	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	8	-----	-----	69	-----	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	22.1	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	1.3	-----	-----	11.4	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	2.5	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	49	-----	-----	141	-----	-----	-----	-----	-----	-----	-----	-----	54	-----	-----	196	-----	-----
Meander Width Ratio	-----	-----	-----	-----	6.6	-----	-----	10.7	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	6	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0606	-----	-----	0.089	-----	-----	0.1	-----	-----	0.067	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	24.0	-----	-----	259.0	-----	-----	26.3	-----	-----	81.3	-----	-----	13	-----	-----	46.5	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	1.4	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	11.3 / 22.6 / 32.0 / 90 / 150						<0.063 / 2.4 / 22.6 / 120 / 256						0.06 / 3 / 8.6 / 77 / 180					
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	0.97	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	53.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	1.05	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	B4	-----	-----	-----	-----	-----	E4b	-----	-----	-----	-----	-----	E4 / C4	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	5.5	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	25.8	-----	-----	-----	14	-----	-----	-----	-----	-----	85	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	1,349	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.023	-----	-----	-----	-----	-----	0.0235	-----	-----	-----	-----	-----	0.0132	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 6 (1,340 LF)

Parameter	Reference Reach(es) Data												Design						As-built					
	Richland Creek						Morgan Branch																	
	Min	Mean	Med	Max	SD	n	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)	16.2	-----	-----	16.7	-----	-----	-----	33.2	-----	-----	-----	-----	-----	10.0	-----	-----	-----	-----	8.5	-----	-----	10.5	-----	-----
Floodprone Width (ft)	50	-----	-----	53	-----	-----	-----	77.5	-----	-----	-----	-----	19	-----	-----	87.0	-----	-----	33.1	-----	-----	55.4	-----	-----
BF Mean Depth (ft)	0.9	-----	-----	0.9	-----	-----	-----	2.3	-----	-----	-----	-----	-----	0.6	-----	-----	-----	-----	0.6	-----	-----	0.9	-----	-----
BF Max Depth (ft)	1.4	-----	-----	1.5	-----	-----	-----	2.8	-----	-----	-----	-----	-----	0.9	-----	-----	-----	-----	1.2	-----	-----	1.5	-----	-----
BF Cross-sectional Area (ft^2)	15	-----	-----	15.5	-----	-----	-----	75.1	-----	-----	-----	-----	-----	6.3	-----	-----	-----	-----	5.3	-----	-----	9.8	-----	-----
Width/Depth Ratio	18	-----	-----	18.6	-----	-----	-----	14.1	-----	-----	-----	-----	-----	15.9	-----	-----	-----	-----	11.4	-----	-----	15.1	-----	-----
Entrenchment Ratio	3.0	-----	-----	3.3	-----	-----	-----	2.3	-----	-----	-----	-----	1.9	-----	-----	8.7	-----	-----	3.1	-----	-----	5.7	-----	-----
Bank Height Ratio	-----	1	-----	2.5	-----	-----	-----	1	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	-----
d50 (mm)	-----	45	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	28.3	-----	-----	-----	-----
Pattern																								
Channel Beltwidth (ft)	25	-----	-----	40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	0.9	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																								
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.0	21.8	20.6	50.9	9.8	33
Riffle Slope (ft/ft)	0.013	-----	-----	0.0413	-----	-----	0.014	-----	-----	0.024	-----	-----	0.025	-----	-----	0.041	-----	-----	0.002	0.039	0.036	0.095	0.0	33
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	37.3	-----	-----	95.8	-----	-----	146	-----	-----	277.0	-----	-----	-----	50.0	-----	-----	-----	-----	17.5	39.2	38.8	82.7	14.2	34
Pool Max Depth (ft)	-----	2.5	-----	-----	-----	-----	-----	4.1	-----	-----	-----	-----	1.3	-----	-----	2.2	-----	-----	1.4	-----	-----	1.8	-----	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95			6.0 / - / 45 / 125 / -						- / 1.2 / 3 / 77 / 800					11.3 / 22.6 / 32.0 / 90.0 / 150.0						8.7 / 21.5 / 28.3 / 73.4 / 160.7 / >2048				
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.67	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																								
Drainage Area (SM)	-----	-----	-----	1	-----	-----	-----	-----	-----	8.35	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	C4b	-----	-----	-----	-----	-----	C4b	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	2.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	524	-----	-----	-----	14	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1259	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,370	-----	-----	-----	-----	-----	1366	-----	-----	-----	-----
Sinuosity	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	-----	-----	-----	1.09	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.007	-----	-----	-----	0.0226	-----	-----	-----	-----	-----	0.0226	-----	-----	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 7 (399 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Reference Reach(es) Data											
											UT to Rocky Creek						Spencer Creek Upstream					
		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	3.2	-----	5.0	-----	-----	-----	1	-----	12.2	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	7.5	-----	-----	-----	1	-----	72.4	-----	-----	-----	-----	-----	228.5	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.6	-----	0.3	-----	-----	-----	1	-----	1.3	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	0.5	-----	-----	-----	1	-----	1.8	-----	-----	-----	-----	-----	1.9	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	2.6	-----	1.6	-----	-----	-----	1	-----	16.3	-----	-----	-----	-----	-----	10.6	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	15.7	-----	-----	-----	1	-----	9.1	-----	-----	-----	-----	-----	7.3	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	1.5	-----	-----	-----	1	-----	6	-----	-----	-----	-----	-----	26.3	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	2.6	-----	-----	-----	1	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	17.5	-----	-----	-----	-----	-----	22.6	-----	-----	-----	-----	-----	8.6	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	30	-----	-----	48	-----	-----	-----	-----	-----	-----	-----	-----	24	-----	-----	52	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	7	-----	-----	41	-----	-----	-----	-----	-----	-----	-----	-----	5.4	-----	-----	22.1	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	1.4	-----	-----	8.2	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	2.5	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	26	-----	-----	101	-----	-----	-----	-----	-----	-----	-----	-----	54	-----	-----	196	-----	-----
Meander Width Ratio	-----	-----	-----	-----	6	-----	-----	9.6	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	-----	6	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	0.0227	-----	-----	0.0578	-----	-----	0.0606	-----	-----	0.089	-----	-----	0.1	-----	-----	0.067	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	19	-----	-----	259	-----	-----	26.3	-----	-----	81.3	-----	-----	13	-----	-----	46.5	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----	-----	2.5	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----		8.5 / 12.4 / 17.5 / 50.6 / 81.6						<0.063 / 2.4 / 22.6 / 120 / 256						0.06 / 3 / 8.6 / 77 / 180				
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	0.65	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	38.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.046	-----	-----	-----	-----	-----	1.05	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	B4	-----	-----	-----	-----	-----	E4b	-----	-----	-----	-----	-----	E4 / C4	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	5.5	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	9.6	-----	-----	-----	4.7	-----	-----	-----	-----	-----	85	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	386	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	-----	1.10	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.045	-----	-----	-----	-----	-----	0.0235	-----	-----	-----	-----	-----	0.0132	-----	-----
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 Cont. Baseline Stream Summary Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648
Reach 7 (399 LF)

Parameter	Reference Reach(es) Data												Design						As-built					
	Richland Creek						Morgan Branch																	
	Min	Mean	Med	Max	SD	n	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)	16.2	-----	-----	16.7	-----	-----	-----	33.2	-----	-----	-----	-----	-----	5.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	50	-----	-----	53	-----	-----	-----	77.5	-----	-----	-----	-----	10	-----	-----	38.0	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	0.9	-----	-----	0.9	-----	-----	-----	2.3	-----	-----	-----	-----	-----	0.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	1.4	-----	-----	1.5	-----	-----	-----	2.8	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	15	-----	-----	15.5	-----	-----	-----	75.1	-----	-----	-----	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	18	-----	-----	18.6	-----	-----	-----	14.1	-----	-----	-----	-----	-----	15.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	3.0	-----	-----	3.3	-----	-----	-----	2.3	-----	-----	-----	-----	2	-----	-----	7.6	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	1	-----	2.5	-----	-----	-----	1	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	45	-----	-----	-----	-----	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																								
Channel Beltwidth (ft)	25	-----	-----	40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	14.3	-----	-----	26.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	0.9	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	90	-----	-----	94	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	1.5	-----	-----	2.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																								
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	8.2	15.3	12.4	32.5	8.0	14
Riffle Slope (ft/ft)	0.013	-----	-----	0.0413	-----	-----	0.014	-----	-----	0.024	-----	-----	0.045	-----	-----	0.073	-----	-----	0.015	0.062	0.046	0.171	0.049	14
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	37.3	-----	-----	95.8	-----	-----	146	-----	-----	277.0	-----	-----	8.0	-----	-----	25.0	-----	-----	15.0	27.8	28.0	42.5	10.2	12
Pool Max Depth (ft)	-----	2.5	-----	-----	-----	-----	-----	4.1	-----	-----	-----	-----	0.6	-----	-----	1.1	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																								
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95			6.0 / - / 45 / 125 / -						- / 1.2 / 3 / 77 / 800						-----						-----			
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																								
Drainage Area (SM)	-----	-----	-----	1	-----	-----	-----	-----	-----	8.35	-----	-----	-----	-----	-----	0.0	-----	-----	-----	-----	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	B4a	-----	-----	-----	-----	-----	B4a	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.6	-----	-----	-----	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	524	-----	-----	-----	4.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	382	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	399	-----	-----	-----	-----	-----	413	-----	-----	-----	-----
Sinuosity	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	-----	-----	-----	1.08	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	0.0133	-----	-----	-----	-----	-----	0.007	-----	-----	-----	0.0407	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
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
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 1 (1,204 LF)

	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							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)	11.8	12.0	11.6	8.8	8.6	8.7		22.2	19.7	19.7	17.5	17.9	11.3		16.4	16.4	16.5	15.2	12.9	12.6		14.4	14.7	15.5	13.8	13.5	12.8	
BF Mean Depth (ft)	0.8	0.8	0.6	0.7	0.8	0.8		1.2	1.3	1.1	1.2	1.2	1.6		1.4	1.3	1.3	1.3	1.6	1.7		1.0	0.8	0.8	0.7	0.7	0.7	
Width/Depth Ratio	15.2	15.7	19.7	12.7	11.0	10.7		18.0	15.7	17.3	14.7	15.2	6.8		11.6	12.3	13.1	11.4	8.2	7.4		15.0	17.6	20.1	20.2	18.7	19.3	
BF Cross-sectional Area (ft²)	9.1	9.2	6.9	6.1	6.7	7.1		27.4	24.8	22.5	20.7	21.2	18.5		23.2	21.7	20.9	20.2	20.3	21.5		13.9	12.4	12.0	9.3	9.7	8.5	
BF Max Depth (ft)	1.1	1.1	1.1	1.1	1.1	1.1		2.3	2.5	2.4	2.7	2.6	2.7		2.5	2.4	2.4	2.6	2.6	2.8		1.3	1.3	1.3	1.1	1.0	1.0	
Width of Floodprone Area (ft)	33.1	32.5	32.3	32.5	32.4	32.4		70.6	70.7	70.6	70.6	70.6	70.6		77.1	77.3	77.1	77.1	77.1	77.7		91.8	90.2	90.0	88.8	88.5	88.5	
Entrenchment Ratio	2.8	2.8	2.7	3.7	3.8	3.7		-	-	-	-	-			-	-	-	-	-			6.4	6.3	6.2	6.7	6.6	6.9	
*Bank Height Ratio	1.0	1.0	1.0	1.1	1.3	1.1		-	-	-	-	-			-	-	-	-	-			1.0	0.9	1.0	0.9	0.9	1.0	
Wetted Perimeter (ft)	13.3	13.5	12.8	9.7	9.3	9.3		24.7	22.3	22.0	19.1	19.3	12.8		19.2	19.0	19.0	16.7	14.5	14.9		16.4	16.4	17.0	14.2	13.8	13.3	
Hydraulic Radius (ft)	0.7	0.7	0.5	0.6	0.7	0.8		1.1	1.1	1.0	1.1	1.1	1.4		1.2	1.1	1.1	1.2	1.4	1.4		0.8	0.8	0.7	0.7	0.7	0.6	
d50 (mm)	-	-	-	-	-			-	-	-	-	-			-	-	-	-	-			-	-	-	-	-		

* Max BKF depth was calculated from the As-built survey. BH ratio was calculated using current year's low bank depth divided by the as-built year's max BKF depth. ER was calculated using the current year's floodprone width divided by the as-built BKF width.

	Cross-section X-5 (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)	12.1	12.1	11.9	10.7	10.7	10.4																						
BF Mean Depth (ft)	0.8	0.9	0.6	0.5	0.7	0.7																						
Width/Depth Ratio	14.4	14.1	19.9	20.9	16.3	15.6																						
BF Cross-sectional Area (ft²)	10.1	10.3	7.1	5.5	7.0	6.9																						
BF Max Depth (ft)	1.1	1.1	1.1	0.8	1.0	1.0																						
Width of Floodprone Area (ft)	71.2	79.0	77.2	74.6	77.3	77.3																						
Entrenchment Ratio	5.9	6.6	6.4	7.2	7.3	7.4																						
*Bank Height Ratio	1.0	1.2	1.0	1.0	1.0	1.1																						
Wetted Perimeter (ft)	13.7	13.8	13.1	11.0	11.0	10.8																						
Hydraulic Radius (ft)	0.7	0.7	0.5	0.5	0.6	0.6																						
d50 (mm)	-	-	-	-	-																							

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

Reach 2 (1,782 LF)

	Cross-section X-6 (Riffle)							Cross-section X-7 (Pool)							Cross-section X-8 (Riffle)							Cross-section X-9 (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)	15.6	15.4	15.5	12.4	17.6	25.3		16.3	15.9	16.0	15.7	15.5	15.6		15.4	14.6	14.7	14.2	14.2	14.2		24.3	20.3	22.3	18.2	18.8	18.2	
BF Mean Depth (ft)	1.0	1.0	1.0	0.8	0.7	0.5		1.4	1.4	1.3	1.2	1.2	1.2		1.1	1.0	1.0	0.9	0.9	0.9		1.4	1.5	1.2	1.6	1.6	1.9	
Width/Depth Ratio	16.5	16.2	16.4	17.9	23.8	51.2		11.5	11.6	12.2	13.0	12.7	13.5		14.5	14.1	15.2	16.5	15.8	16.3		17.9	13.4	18.6	11.4	11.9	9.8	
BF Cross-sectional Area (ft²)	14.8	14.6	14.8	12.4	13.0	12.5		23.2	21.8	21.0	19.1	18.9	18.1		16.5	15.1	14.3	12.2	12.9	12.5		33.1	30.9	26.8	29.2	29.5	33.8	
BF Max Depth (ft)	1.3	1.3	1.3	1.4	1.3	1.2		2.5	2.5	2.4	2.5	2.5	2.5		1.6	1.6	1.6	1.4	1.5	1.5		2.9	2.8	2.6	2.7	2.6	2.7	
Width of Floodprone Area (ft)	74.9	77.3	77.6	71.9	72.4	72.4		75.8	76.4	76.3	76.3	76.3	76.3		102.7	102.7	102.7	102.6	102.7	102.7		95.4	95.5	95.4	95.4	95.4	95.4	
Entrenchment Ratio	4.8	5.0	5.0	4.8	4.1	2.9		-	-	-	-	-			6.7	6.7	6.7	7.3	7.2	7.2		-	-	-	-	-		
*Bank Height Ratio	1.0	1.1	1.1	0.8	0.9	0.8		-	-	-	-	-			1.0	1.0	1.0	0.9	1.0	1.0		-	-	-	-	-		
Wetted Perimeter (ft)	17.5	17.3	17.4	15.3	17.9	25.6		19.2	18.7	18.6	16.8	13.6	16.7		17.6	16.7	16.7	14.8	14.7	14.7		27.1	23.4	24.7	19.3	20.1	20.1	
Hydraulic Radius (ft)	0.8	0.8	0.9	0.8	0.7	0.5		1.2	1.2	1.1	1.1	1.1	1.1		0.9	0.9	0.9	0.8	0.9	0.8		1.2	1.3	1.1	1.5	1.5	1.7	
d50 (mm)	-	-	-	-	-			-	-	-	-	-			-	-	-	-	-			-	-	-	-	-		

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

	Cross-section X-10 (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)	15.5	13.9	14.5	13.2	13.8	13.5																						
BF Mean Depth (ft)	1.1	1.1	1.0	1.0	1.0	1.0																						
Width/Depth Ratio	14.2	12.8	14.5	13.7	14.0	13.5																						
BF Cross-sectional Area (ft²)	17.0	15.1	14.4	12.7	13.7	13.6																						
BF Max Depth (ft)	1.8	1.8	1.8	1.6	1.6	1.5																						
Width of Floodprone Area (ft)	100.0	100.2	100.2	100.2	100.1	100.1																						
Entrenchment Ratio	6.4	6.5	6.5	7.6	7.2	7.4																						
*Bank Height Ratio	0.9	0.9	0.8	0.9	1.0	1.0																						
Wetted Perimeter (ft)	17.7	16.1	16.5	13.9	14.5	14.0																						
Hydraulic Radius (ft)	1.0	0.9	0.9	0.9	0.9	1.0																						
d50 (mm)	-	-	-	-	-																							

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

Table 11a Cont. Cross-section Morphology Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 3 (829 LF)

	Cross-section X-11 (Riffle)							Cross-section X-12 (Riffle)							Cross-section X-13 (Riffle)							Cross-section X-14 (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)	14.9	17.1	15.0	14.7	14.5	14.6		17.1	16.5	16.7	16.2	16.2	15.0		16.0	17.2	15.3	14.9	14.7	14.3		21.3	19.0	19.2	18.4	18.0	17.7	
BF Mean Depth (ft)	1.1	0.9	0.9	0.8	0.9	0.9		1.3	1.1	1.1	1.0	1.0	1.0		1.2	1.0	0.9	0.8	0.9	1.0		1.8	1.7	1.6	1.6	1.7	1.8	
Width/Depth Ratio	13.5	20.2	16.8	18.1	16.1	15.6		13.7	15.5	15.9	16.4	16.4	14.9		14.0	17.3	17.4	18.6	16.5	14.5		11.7	11.1	12.0	11.2	10.3	9.8	
BF Cross-sectional Area (ft²)	16.3	14.5	13.3	11.9	13.2	13.7		21.5	17.6	17.5	15.9	16.0	15.1		18.3	17.2	13.5	11.9	13.0	14.0		39.0	32.5	30.6	30.4	31.4	32.1	
BF Max Depth (ft)	1.5	1.5	1.5	1.4	1.4	1.6		1.8	1.8	1.8	1.6	1.6	1.6		1.6	1.6	1.6	1.3	1.4	1.4		3.2	3.1	3.1	2.8	3.1	3.1	
Width of Floodprone Area (ft)	99.8	99.9	99.8	99.8	99.8	99.8		99.7	100.0	99.9	99.9	99.9	99.9		98.3	98.4	98.4	98.3	98.3	98.3		98.7	98.8	98.7	98.7	98.7	98.7	
Entrenchment Ratio	6.7	6.7	6.7	6.8	6.9	6.8		5.8	5.8	5.8	6.2	6.2	6.7		6.1	6.2	6.2	6.6	6.7	6.9		-	-	-	-	-		
*Bank Height Ratio	1.0	0.9	0.7	0.9	1.0	1.0		1.0	0.9	0.9	0.9	0.9	0.9		1.0	0.9	0.8	0.9	1.0	0.8		-	-	-	-	-		
Wetted Perimeter (ft)	17.1	18.8	16.7	15.1	15.0	15.2		19.6	18.7	18.8	16.8	16.9	15.6		18.3	19.2	17.1	15.4	15.3	14.8		25.0	22.4	22.4	20.1	20.4	20.7	
Hydraulic Radius (ft)	1.0	0.8	0.8	0.8	0.9	0.9		1.1	0.9	0.9	0.9	0.9	1.0		1.0	0.9	0.8	0.8	0.8	0.9		1.6	1.5	1.4	1.5	1.5	1.6	
d50 (mm)	-	-	-	-	-			-	-	-	-	-			-	-	-	-	-			-	-	-	-	-		

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

Reach 6 (1,347 LF)

	Cross-section X-15 (Pool)							Cross-section X-16 (Riffle)							Cross-section X-17 (Riffle)							Cross-section X-18 (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)	11.0	10.6	10.9	10.5	10.7	10.5		9.7	9.3	9.2	8.1	8.7	8.1		10.5	10.3	10.3	9.8	13.6	9.4		8.5	7.5	7.6	7.2	7.6	7.1	
BF Mean Depth (ft)	1.0	0.9	0.9	0.9	0.9	0.8		0.6	0.6	0.6	0.5	0.5	0.5		0.9	0.8	0.8	0.5	0.4	0.4		0.6	0.6	0.6	0.5	0.6	0.5	
Width/Depth Ratio	10.9	12.0	11.9	12.1	12.6	12.8		15.1	15.2	14.8	16.1	16.6	15.1		11.4	12.6	13.3	18.7	35.0	24.2		13.5	13.0	12.7	13.4	13.7	13.3	
BF Cross-sectional Area (ft²)	11.1	9.4	9.9	9.1	9.2	8.6		6.2	5.7	5.7	4.1	4.6	4.4		9.8	8.4	7.9	5.2	5.3	3.7		5.3	4.3	4.6	3.9	4.2	3.8	
BF Max Depth (ft)	1.8	1.8	1.8	1.7	1.7	1.5		1.2	1.2	1.2	0.8	0.9	0.8		1.5	1.5	1.5	0.9	0.8	0.4		1.2	1.2	1.2	1.0	1.0	1.0	
Width of Floodprone Area (ft)	60.3	60.3	60.4	60.5	60.3	60.3		55.4	52.9	53.1	53.5	50.6	50.6		33.1	30.5	30.3	28.6	28.5	28.5		37.3	34.0	34.8	32.8	32.6	32.6	
Entrenchment Ratio	-	-	-	-	-			5.7	5.5	5.5	6.6	5.8	6.2		3.1	2.9	2.9	2.9	2.1	3.0		4.4	4.0	4.1	4.5	4.3	4.6	
*Bank Height Ratio	-	-	-	-	-			0.6	0.8	0.9	0.9	1.0	0.9		1.0	0.9	0.8	0.8	0.6	0.8		1.0	1.0	1.1	1.0	1.0	1.0	
Wetted Perimeter (ft)	13.0	12.4	12.7	11.3	11.5	11.3		11.0	10.6	10.4	8.4	9.0	8.4		12.4	11.9	11.8	10.1	13.7	9.7		9.7	8.6	8.8	7.6	7.9	7.5	
Hydraulic Radius (ft)	0.9	0.8	0.8	0.8	0.8	0.8		0.6	0.5	0.5	0.5	0.5	0.5		0.8	0.7	0.7	0.5	0.4	0.4		0.5	0.5	0.5	0.5	0.5	0.5	
d50 (mm)	-	-	-	-	-			-	-	-	-	-			-	-	-	-	-			-	-	-	-	-		

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

	Cross-section X-19 (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)	10.8	10.1	10.5	9.7	13.2	12.9																						
BF Mean Depth (ft)	0.8	0.7	0.8	0.7	0.6	0.6																						
Width/Depth Ratio	13.7	14.1	13.8	13.1	22.5	22.4																						
BF Cross-sectional Area (ft²)	8.4	7.3	7.9	7.1	7.7	7.4																						
BF Max Depth (ft)	1.4	1.3	1.3	1.3	1.2	1.3																						
Width of Floodprone Area (ft)	41.4	40.1	40.8	39.7	39.2	39.2																						
Entrenchment Ratio	-	-	-	-	-																							
*Bank Height Ratio	-	-	-	-	-																							
Wetted Perimeter (ft)	12.3	11.6	12.0	10.2	13.6	13.4																						
Hydraulic Radius (ft)	0.7	0.6	0.7	0.7	0.6	0.6																						
d50 (mm)	-	-	-	-	-																							

*BHR is based on the bkf elevation that yields the as-built bkf area for each cross-section. Remainder of data based on actual bankfull elevation from as-built for each cross-section.

Table 11b. Stream Reach Morphology Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 1 (1,204 LF)

Parameter	As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	11.8	-----	-----	14.4	-----	3	12.0	12.9	12.1	14.7	1.6	3	11.6	13.0	11.9	15.5	2.2	3	8.8	11.1	10.7	13.8	2.5	3	8.6	10.9	10.7	13.5	2.5	3	8.7	10.6	10.4	12.8	2.1	3
Floodprone Width (ft)	33.1	-----	-----	91.8	-----	3	32.5	67.2	79.0	90.2	30.6	3	32.3	66.5	77.2	90.0	30.3	3	32.5	65.3	74.6	88.8	29.3	3	32.4	66.1	77.3	88.5	29.7	3	32.4	66.1	77.3	88.5	29.7	3
BF Mean Depth (ft)	0.8	-----	-----	1.0	-----	3	0.8	0.8	0.8	0.9	0.0	3	0.6	0.7	0.6	0.8	0.1	3	0.5	0.6	0.7	0.7	0.1	3	0.7	0.7	0.7	0.8	0.1	3	0.7	0.7	0.7	0.8	0.1	3
*BF Max Depth (ft)	1.1	-----	-----	1.3	-----	3	1.1	1.2	1.1	1.3	0.1	3	1.1	1.2	1.1	1.3	0.1	3	0.8	1.0	1.1	1.1	0.2	3	1.0	1.0	1.0	1.1	0.1	3	1.0	1.0	1.0	1.1	0.1	3
BF Cross-sectional Area (ft^2)	9.1	-----	-----	13.9	-----	3	9.2	10.6	10.3	12.4	1.6	3	6.9	8.7	7.1	12.0	2.9	3	5.5	7.0	6.1	9.3	2.0	3	6.7	7.8	7.0	9.7	1.7	3	6.9	7.5	7.1	8.5	0.9	3
Width/Depth Ratio	14.4	-----	-----	15.2	-----	3	14.1	15.8	15.7	17.6	1.7	3	19.7	19.9	19.9	20.1	0.2	3	12.7	17.9	20.2	20.9	4.5	3	11.0	15.3	16.3	18.7	3.9	3	10.7	15.2	15.6	19.3	4.3	3
*Entrenchment Ratio	2.8	-----	-----	6.4	-----	3	2.8	5.2	6.3	6.6	2.1	3	2.7	5.1	6.2	6.4	2.1	3	3.7	5.9	6.7	7.2	1.9	3	3.8	5.9	6.6	7.3	1.9	3	3.7	6.0	6.9	7.4	2.0	3
*Bank Height Ratio	1.0	-----	-----	1.0	-----	3	0.9	1.0	1.0	1.2	0.1	3	1.0	1.0	1.0	1.0	0.0	3	0.9	1.0	1.0	1.1	0.1	3	1.0	1.1	1.0	1.3	0.2	3	1.0	1.1	1.1	1.1	0.1	3
d50 (mm)	-----	31.2	-----	-----	-----	-----	-----	64.0	-----	-----	-----	-----	-----	77.1	-----	-----	-----	-----	-----	42.8	-----	-----	-----	-----	-----	62.5	-----	-----	-----	-----	-----	62.5	-----	-----	-----	-----
Pattern																																				
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	42.0	51.6	-----	72.9	-----	18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	2.6	-----	-----	-----	15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																				
Riffle Length (ft)	15.5	35.0	35.4	62.8	12.7	18	13	28	22	60	16	12	20.0	28.0	26.3	45.0	7.5	12	17.9	28.4	27.6	48.5	9.9	12	16.0	30.1	28.0	60.2	12.4	12	13.9	27.8	30.0	74.6	17.1	12
Riffle Slope (ft/ft)	0.008	0.017	0.017	0.031	0.006	18	0.007	0.020	0.018	0.033	0.008	12	0.002	0.016	0.016	0.032	0.008	12	0.003	0.014	0.013	0.031	0.008	12	-0.004	0.015	0.015	0.032	0.009	12	-0.004	0.012	0.014	0.029	0.010	12
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	38.0	64.0	64.0	81.7	11.0	17	57.6	66.2	61.4	83	9.7	10	51.9	67.0	66.7	83.1	11.3	10	54.8	67.0	66.6	81.3	9.7	12	53.6	65.7	63.5	83.7	10.8	12	46.6	64.8	64.5	75.5	10.2	10
Pool Max Depth (ft)	2.5	-----	-----	2.5	0.0	2	2.43	-----	-----	2.48	0.0353553	2	2.3	-----	-----	2.4	0.0	2	2.6	-----	-----	2.7	0.1	2	2.6	-----	-----	2.6	0.0	2	2.6	-----	-----	2.6	0.0	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameter																																				
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	4.0 / 18.4 / 31.2 / 96.6 / >2048						19.0 / 46.0 / 64.0 / 101.2 / 125.5						22.6 / 58.6 / 77.1 / 145.5 / 190.9						18.2 / 31.5 / 42.8 / 108.1 / 147.8						20.14 / 43.46 / 62.51 / 120.70 / 162.50						6.31 / 14.84 / 25.15 / 80.33 / 128.00					
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameter																																				
Drainage Area (SM)	-----	0.83	-----	-----	-----	-----	-----	0.83	-----	-----	-----	-----	-----	0.83	-----	-----	-----	-----	-----	0.83	-----	-----	-----	-----	-----	0.83	-----	-----	-----	-----	-----	0.83	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C3	-----	-----	-----	-----	-----	C3	-----	-----	-----	-----	-----	C3	-----	-----	-----	-----	-----	C3	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	1,082	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	1,206	-----	-----	-----	-----	-----	750	-----	-----	-----	-----	-----	750	-----	-----	-----	-----	-----	750	-----	-----	-----	-----	-----	750	-----	-----	-----	-----	-----	750	-----	-----	-----	-----
Sinuosity	-----	1.11	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0096	-----	-----	-----	-----	-----	0.009	-----	-----	-----	-----	-----	0.008	-----	-----	-----	-----	-----	0.008	-----	-----	-----	-----	-----	0.008	-----	-----	-----	-----	-----	0.008	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Max BKF depth was calculated from the As-built survey. BH ratio was calculated using current year's low bank depth divided by the as-built year's max BKF depth. ER was calculated using the current year's floodprone width divided by the as-built BKF width.

Table 11b Cont. Stream Reach Morphology Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 2 (1,782 LF)

Parameter	As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	15.4	-----	-----	15.6	-----	3	13.9	14.8	15.1	15.4	0.8	3	14.5	14.9	14.7	15.5	0.6	3	13.2	14.1	14.2	14.9	0.9	3	13.8	15.2	14.2	17.6	2.1	3	13.5	17.7	14.2	25.3	6.6	3
Floodprone Width (ft)	74.9	-----	-----	102.7	-----	3	77.3	93.4	100.2	102.7	14.0	3	77.6	93.5	100.2	102.7	13.8	3	71.9	91.6	100.2	102.6	17.1	3	72.4	91.7	100.1	102.7	16.8	3	72.4	91.7	100.1	102.7	16.8	3
BF Mean Depth (ft)	1.0	-----	-----	1.1	-----	3	1.0	1.0	1.0	1.1	0.1	3	1.0	1.0	1.0	1.0	0.0	3	0.8	0.9	0.9	1.0	0.1	3	0.7	0.9	0.9	1.0	0.2	3	0.5	0.8	0.9	1.0	0.3	3
*BF Max Depth (ft)	1.3	-----	-----	1.8	-----	3	1.3	1.6	1.6	1.8	0.2	3	1.3	1.6	1.6	1.8	0.2	3	1.4	1.5	1.4	1.6	0.1	3	1.3	1.5	1.5	1.6	0.2	3	1.2	1.4	1.5	1.5	0.2	3
BF Cross-sectional Area (ft^2)	14.8	-----	-----	17.0	-----	3	14.6	14.9	15.1	15.1	0.2	3	14.3	14.5	14.4	14.8	0.3	3	12.2	12.4	12.4	12.7	0.3	3	12.9	13.2	13.0	13.7	0.4	3	12.5	12.9	12.5	13.6	0.6	3
Width/Depth Ratio	14.2	-----	-----	16.5	-----	3	12.8	14.4	14.1	16.2	1.7	3	14.5	15.3	15.2	16.4	0.9	3	13.7	16.0	16.5	17.9	2.1	3	14.0	17.9	15.8	23.8	5.2	3	13.5	27.0	16.3	51.2	21.0	3
*Entrenchment Ratio	4.8	-----	-----	6.7	-----	3	5.0	6.0	6.5	6.7	0.9	3	5.0	6.0	6.5	6.7	0.9	3	4.8	6.6	7.3	7.6	1.5	3	4.1	6.2	7.2	7.2	1.8	3	2.9	5.8	7.2	7.4	2.5	3
*Bank Height Ratio	0.9	-----	-----	1.0	-----	3	0.9	1.0	1.0	1.1	0.1	3	0.8	1.0	1.0	1.1	0.1	3	0.8	0.9	0.9	0.9	0.1	3	0.9	1.0	1.0	1.0	0.1	3	0.8	0.9	1.0	1.0	0.1	3
d50 (mm)	-----	20.9	-----	-----	-----	-----	-----	46.8	-----	-----	-----	-----	-----	54.7	-----	-----	-----	-----	-----	42.5	-----	-----	-----	-----	-----	33.1	-----	-----	-----	-----	-----	33.1	-----	-----	-----	-----
Pattern																																				
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	48.6	54.7	-----	65.6	-----	7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	3.0	-----	-----	-----	8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																				
Riffle Length (ft)	16.4	48.9	39.1	101.3	37.2	21	21	32	32	43	9	13	14.5	30.1	28.6	50.0	9.0	14	16.8	32.1	31.9	65.5	12.3	14	10.8	31.4	29.0	68.0	13.3	14	11.3	30.4	33.6	101.9	22.9	12
Riffle Slope (ft/ft)	0.003	0.018	0.018	0.035	0.0	21	0	0	0	0	0	13	0.004	0.016	0.014	0.033	0.009	14	0.002	0.012	0.011	0.027	0.008	14	-0.008	0.007	0.007	0.025	0.008	14	-0.002	0.016	0.022	0.071	0.019	12
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	46.0	75.4	70.0	130.2	23.5	19	46.1	65.9	66.3	95.2	14	12	42.9	66.7	66.2	95.4	15.7	12	43.7	73.5	72.3	109.1	20.0	12	36.5	72.6	71.7	111.9	22.2	12	46.4	77.4	85.3	139.7	32.1	9
Pool Max Depth (ft)	2.5	-----	-----	2.9	0.3	2	2.51	-----	-----	2.8	0.205061	2	2.5	-----	-----	2.6	0.1	2	2.5	-----	-----	2.7	0.1	2	2.5	-----	-----	2.6	0.1	2	2.5	-----	-----	2.6	0.1	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameter																																				
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	<0.063 / 12.2 / 20.9 / 68.5 / 151.8						16.0 / 28.8 / 46.8 / 2048.0 / >2048						22.6 / 39.0 / 54.7 / 94.1 / 119.8						16.5 / 28.0 / 42.5 / 107.3 / 2496.5						11.98 / 23.45 / 33.11 / 87.42/ 2399.59						16.00 / 27.68 / 45.00 / 87.25 / 160.66					
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameter																																				
Drainage Area (SM)	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----	-----	0.96	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	1,549	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	1,842	-----	-----	-----	-----	-----	1006	-----	-----	-----	-----	-----	1,006	-----	-----	-----	-----	-----	1,006	-----	-----	-----	-----	-----	1,006	-----	-----	-----	-----	-----	1,006	-----	-----	-----	-----
Sinuosity	-----	1.19	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0077	-----	-----	-----	-----	-----	0.0069	-----	-----	-----	-----	-----	0.007	-----	-----	-----	-----	-----	0.007	-----	-----	-----	-----	-----	0.007	-----	-----	-----	-----	-----	0.007	-----	-----	-----	-----
BF slope (ft/ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Max BKF depth was calculated from the As-built survey. BH ratio was calculated using current year's low bank depth divided by the as-built year's max BKF depth. ER was calculated using the current year's floodprone width divided by the as-built BKF width.

Table 11b Cont. Stream Reach Morphology Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 3 (829 LF)

Parameter	As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	14.9	-----	-----	17.1	-----	3	16.5	17.0	17.1	17.2	0.4	3	15.0	15.7	15.3	16.7	0.9	3	14.7	15.3	14.9	16.2	0.8	3	14.5	15.1	14.7	16.2	0.9	3	14.3	14.6	14.6	15.0	0.4	3
Floodprone Width (ft)	98.3	-----	-----	99.8	-----	3	98.4	99.4	99.9	100.0	0.8	3	98.4	99.3	99.8	99.9	0.9	3	98.3	99.3	99.8	99.9	0.9	3	98.3	99.3	99.8	99.9	0.9	3	98.3	99.3	99.8	99.9	0.9	3
BF Mean Depth (ft)	1.1	-----	-----	1.3	-----	3	0.9	1.0	1.0	1.1	0.1	3	0.9	0.9	0.9	1.1	0.1	3	0.8	0.9	0.8	1.0	0.1	3	0.9	0.9	0.9	1.0	0.1	3	0.9	1.0	1.0	1.0	0.1	3
*BF Max Depth (ft)	1.5	-----	-----	1.8	-----	3	1.5	1.6	1.6	1.8	0.1	3	1.5	1.6	1.6	1.8	0.1	3	1.3	1.4	1.4	1.6	0.2	3	1.4	1.5	1.4	1.6	0.1	3	1.4	1.5	1.6	1.6	0.1	3
BF Cross-sectional Area (ft^2)	16.3	-----	-----	21.5	-----	3	14.5	16.5	17.2	17.6	1.7	3	13.3	14.8	13.5	17.5	2.4	3	11.9	13.2	11.9	15.9	2.3	3	13.0	14.1	13.2	16.0	1.7	3	13.7	14.3	14.0	15.1	0.7	3
Width/Depth Ratio	13.7	-----	-----	14.9	-----	3	15.5	17.7	17.3	20.2	2.4	3	15.9	16.7	16.8	17.4	0.8	3	16.4	17.7	18.1	18.6	1.2	3	16.1	16.3	16.4	16.5	0.2	3	14.5	15.0	14.9	15.6	0.6	3
*Entrenchment Ratio	5.8	-----	-----	6.7	-----	3	5.8	6.2	6.2	6.7	0.4	3	5.8	6.2	6.2	6.7	0.4	3	6.2	6.5	6.6	6.8	0.3	3	6.2	6.6	6.7	6.9	0.4	3	6.7	6.8	6.8	6.9	0.1	3
*Bank Height Ratio	1.0	-----	-----	1.0	-----	3	0.9	0.9	0.9	0.9	0.0	3	0.7	0.8	0.8	0.9	0.1	3	0.9	0.9	0.9	0.9	0.0	3	0.9	1.0	1.0	1.0	0.1	3	0.8	0.9	0.9	1.0	0.1	3
d50 (mm)	-----	21.8	-----	-----	-----	-----	-----	53.7	-----	-----	-----	-----	-----	17.4	-----	-----	-----	-----	-----	24.0	-----	-----	-----	-----	-----	22.1	-----	-----	-----	-----	-----	22.1	-----	-----	-----	-----
Pattern																																				
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	54.5	63.2	-----	71.8	-----	9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	3.2	-----	-----	-----	7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																				
Riffle Length (ft)	25.2	46.1	43.3	67.0	15.4	11	17	25	24	33	6	7	22.9	28.6	29.6	37.8	5.0	7	14.9	23.2	21.3	39.4	8.5	7	15.7	23.7	24.4	30.5	5.4	7	14.4	27.8	29.0	43.4	9.1	7
Riffle Slope (ft/ft)	0.005	0.020	0.016	0.055	0.0	11	0	0	0	0	0	7	0.009	0.024	0.019	0.039	0.012	7	0.009	0.015	0.015	0.019	0.003	7	0.005	0.018	0.017	0.035	0.011	7	-0.002	0.026	0.028	0.077	0.025	7
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	63.7	77.7	77.2	90.9	8.3	9	66.8	77	81.2	83	7.5	5	67.0	77.9	74.3	88.7	9.2	5	54.4	79.7	85.1	98.6	16.7	5	65.8	79.2	80.2	92.8	9.8	5	71.2	76.7	78.5	90.3	7.4	5
Pool Max Depth (ft)	3.2	-----	-----	3.2	-----	1	-----	3.06	-----	-----	-----	1	-----	3.2	-----	-----	-----	1	-----	2.8	-----	-----	-----	1	-----	3.1	-----	-----	-----	1	-----	3.1	-----	-----	-----	1
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameter																																				
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	2.0 / 12.6 / 21.8 / 74.1 / 128.0						16.0 / 36.9 / 53.7 / 112.6 / 214.7						<0.063 / <0.063 / 17.4 / 119.3 / 165.3						11.7 / 16.9 / 24.0 / 70.0 / 135.1						10.54 / 15.29 / 22.09 / 71.09 / 114.16						7.32 / 13.16 / 17.75 / 92.93 / 135.48					
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameter																																				
Drainage Area (SM)	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	695	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	829	-----	-----	-----	-----	-----	496	-----	-----	-----	-----	-----	496	-----	-----	-----	-----	-----	496	-----	-----	-----	-----	-----	496	-----	-----	-----	-----	-----	496	-----	-----	-----	-----
Sinuosity	-----	1.19	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0062	-----	-----	-----	-----	-----	0.00637	-----	-----	-----	-----	-----	0.006	-----	-----	-----	-----	-----	0.006	-----	-----	-----	-----	-----	0.006	-----	-----	-----	-----	-----	0.006	-----	-----	-----	-----
BF slope (ft/ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Max BKF depth was calculated from the As-built survey. BH ratio was calculated using current year's low bank depth divided by the as-built year's max BKF depth. ER was calculated using the current year's floodprone width divided by the as-built BKF width.

Table 11b Cont. Stream Reach Morphology Data
UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648

Reach 6 (1,347 LF)

Parameter	As-built						MY1						MY2						MY3						MY4						MY5					
Dimension and Substrate - Riffle	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	8.5	-----	-----	10.5	-----	3	7.5	9.0	9.3	10.3	1.4	3	7.6	9.0	9.2	10.3	1.3	3	7.2	8.4	8.1	9.8	1.3	3	7.6	10.0	8.7	13.6	3.2	3	7.1	8.2	8.1	9.4	1.2	3
Floodprone Width (ft)	33.1	-----	-----	55.4	-----	3	30.5	39.1	34.0	52.9	12.1	3	30.3	39.4	34.8	53.1	12.1	3	28.6	38.3	32.8	53.5	13.3	3	28.5	37.2	32.6	50.6	11.8	3	28.5	37.2	32.6	50.6	11.8	3
BF Mean Depth (ft)	0.6	-----	-----	0.9	-----	3	0.6	0.7	0.6	0.8	0.1	3	0.6	0.7	0.6	0.8	0.1	3	0.5	0.5	0.5	0.5	0.0	3	0.4	0.5	0.5	0.6	0.1	3	0.4	0.5	0.5	0.5	0.1	3
*BF Max Depth (ft)	1.2	-----	-----	1.5	-----	3	1.2	1.3	1.2	1.5	0.2	3	1.2	1.3	1.2	1.5	0.2	3	0.8	0.9	0.9	1.0	0.1	3	0.8	0.9	0.9	1.0	0.1	3	0.7	0.8	0.8	1.0	0.2	3
BF Cross-sectional Area (ft^2)	5.3	-----	-----	9.8	-----	3	4.3	6.1	5.7	8.4	2.1	3	4.6	6.1	5.7	7.9	1.7	3	3.9	4.4	4.1	5.2	0.7	3	4.2	4.7	4.6	5.3	0.6	3	3.7	4.0	3.8	4.4	0.4	3
Width/Depth Ratio	11.4	-----	-----	15.1	-----	3	12.6	13.6	13.0	15.2	1.4	3	12.7	13.6	13.3	14.8	1.1	3	13.4	16.1	16.1	18.7	2.7	3	13.7	21.8	16.6	35.0	11.6	3	13.3	17.5	15.1	24.2	5.8	3
*Entrenchment Ratio	3.1	-----	-----	5.7	-----	3	2.9	4.1	4.0	5.5	1.3	3	2.9	4.2	4.1	5.5	1.3	3	2.9	4.7	4.5	6.6	1.9	3	2.1	4.1	4.3	5.8	1.9	3	3.0	4.6	4.6	6.2	1.6	3
*Bank Height Ratio	0.6	-----	-----	1.0	-----	3	0.8	0.9	0.9	1.0	0.1	3	0.8	0.9	0.9	1.1	0.1	3	0.8	0.9	0.9	1.0	0.1	3	0.6	0.9	1.0	1.0	0.2	3	0.8	0.9	0.9	1.0	0.1	3
d50 (mm)	-----	28.3	-----	-----	-----	-----	-----	34.3	-----	-----	-----	-----	-----	56.4	-----	-----	-----	-----	-----	44.6	-----	-----	-----	-----	-----	44.6	-----	-----	-----	-----	-----	44.6	-----	-----	-----	-----
Pattern																																				
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																				
Riffle Length (ft)	5.0	21.8	20.6	50.9	9.8	33	10	23	21	54	12	12	8.3	18.1	17.6	34.6	6.9	18	4.9	17.2	17.4	40.6	8.9	19	7.1	18.6	19.7	37	8.1	19	11.0	18.2	20.2	34.9	7.8	10
Riffle Slope (ft/ft)	0.002	0.039	0.036	0.095	0.0	33	0	0	0	0	0	12	0.003	0.025	0.023	0.064	0.016	18	0.005	0.032	0.027	0.094	0.024	19	-0.018	0.018	0.017	0.048	0.018	19	-0.005	0.011	0.010	0.029	0.012	10
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	17.5	39.2	38.8	82.7	14.2	34	30	41	39	62	9	16	28.1	40.4	40.1	56.1	7.7	15	18.8	39.7	39.8	56.2	9.5	18	24.7	41.6	40.0	67.8	12.4	18	31.1	53.5	55.9	82.8	19.1	10
Pool Max Depth (ft)	1.4	-----	-----	1.8	-----	2	1	-----	-----	2	-----	2	1.3	-----	-----	1.8	-----	2	1.3	-----	-----	1.7	0.3	2	1.2	-----	-----	1.7	0.4	2	1.2	-----	-----	1.7	0.4	2
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameter																																				
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	8.7 / 21.5 / 28.3 / 73.4 / 160.7						14.4 / 22.6 / 34.3 / 86.4 / >2048						29.03 / 45.00 / 56.44 / 108.85 / 160.66						24.0 / 34.5 / 44.6 / 80.0 / 146.2						19.45/ 32.68 / 44.55 / 88.78 / 177.71						8.66 / 15.46 / 20.64 / 52.63 / 80.33					
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameter																																				
Drainage Area (SM)	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	C4b	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	1259	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	1366	-----	-----	-----	-----	-----	751	-----	-----	-----	-----	-----	751	-----	-----	-----	-----	-----	751	-----	-----	-----	-----	-----	751	-----	-----	-----	-----	-----	751	-----	-----	-----	-----
Sinuosity	-----	1.09	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	0.0226	-----	-----	-----	-----	-----	0.02266	-----	-----	-----	-----	-----	0.023	-----	-----	-----	-----	-----	0.023	-----	-----	-----	-----	-----	0.023	-----	-----	-----	-----	-----	0.023	-----	-----	-----	-----
BF slope (ft/ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Max BKF depth was calculated from the As-built survey. BH ratio was calculated using current year's low bank depth divided by the as-built year's max BKF depth. ER was calculated using the current year's floodprone width divided by the as-built BKF width.

Figure 4. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

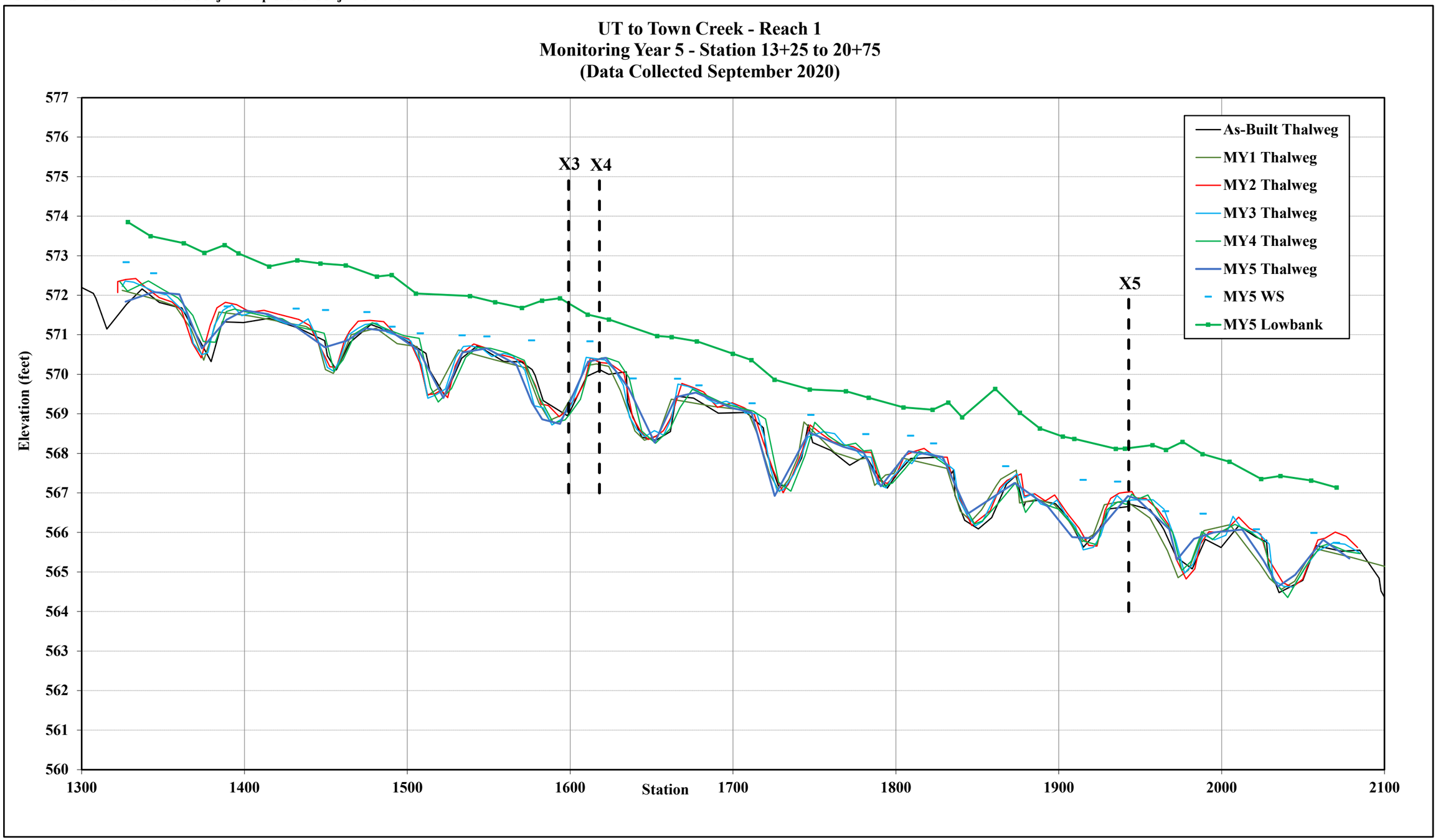


Figure 4 Cont. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

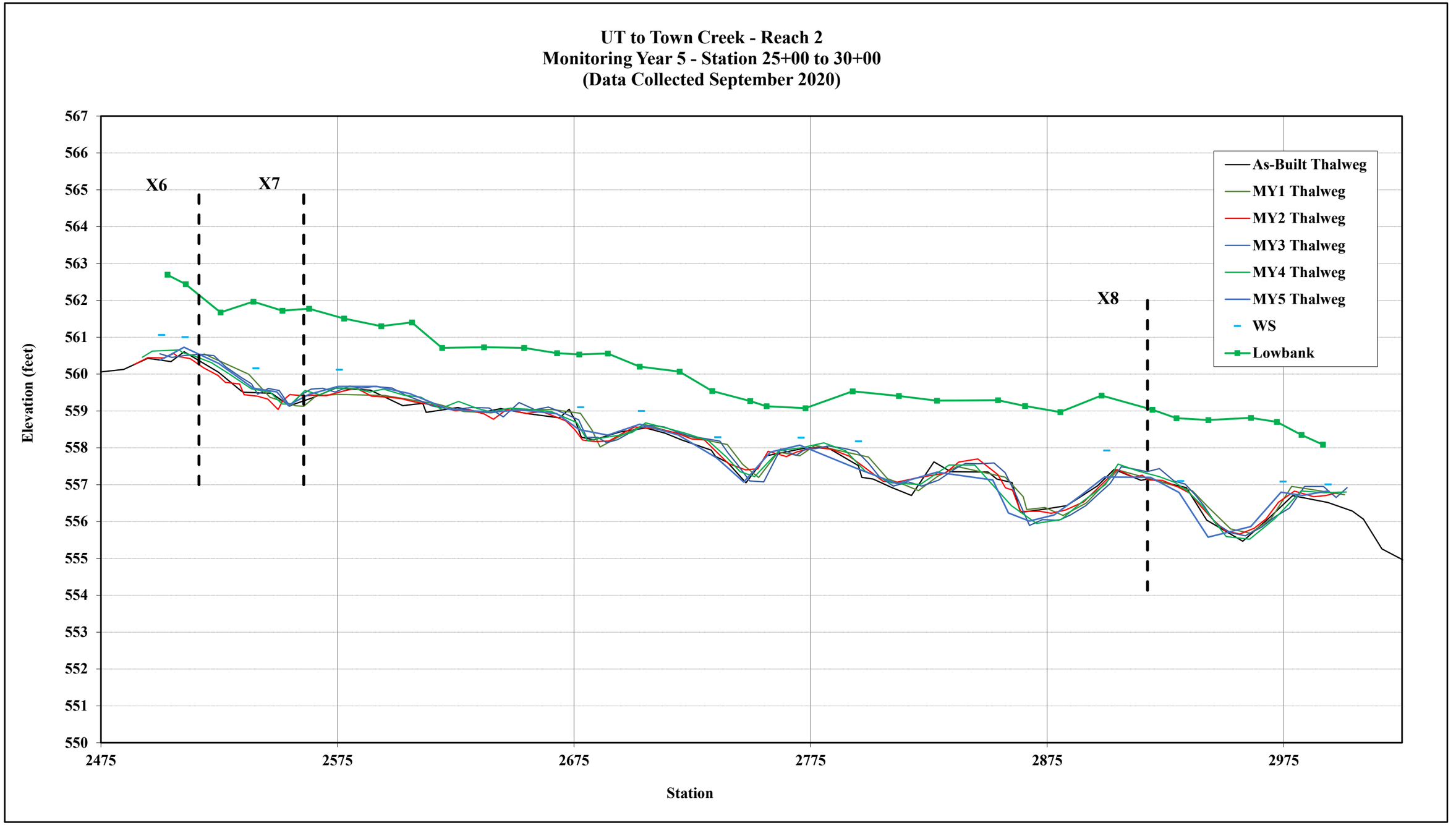


Figure 4 Cont. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

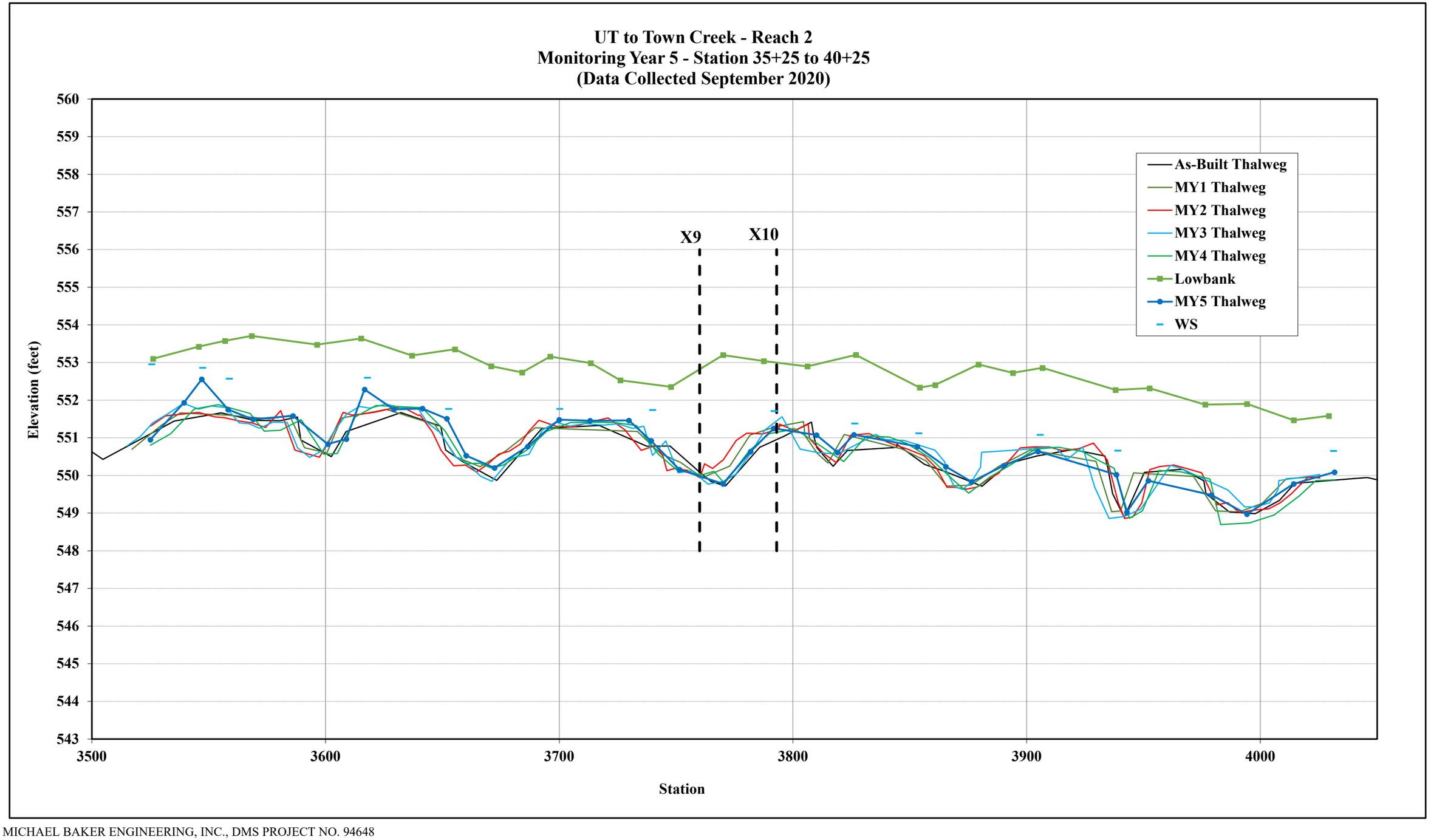


Figure 4 Cont. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

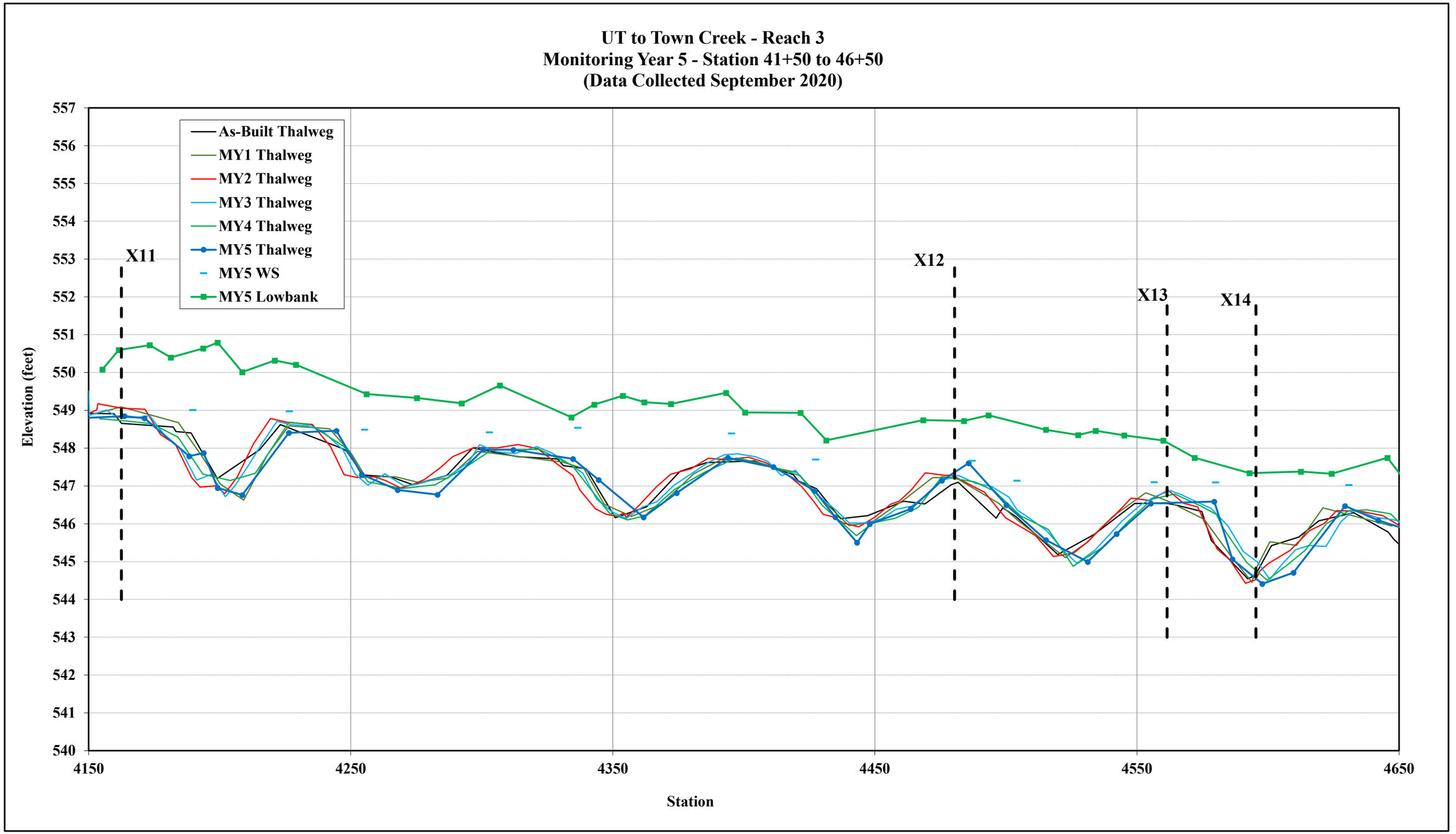


Figure 4 Cont. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

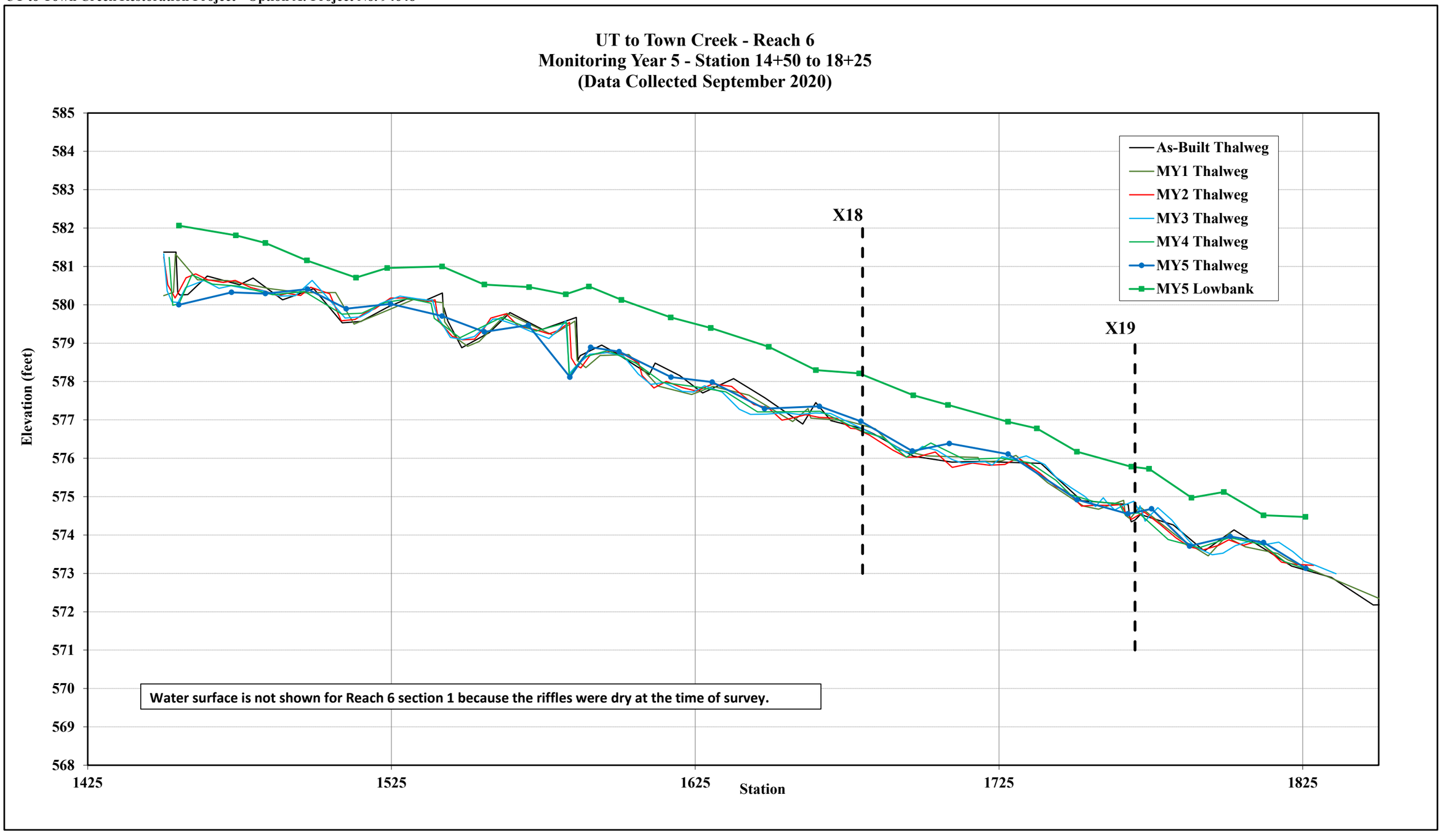


Figure 4 Cont. Year 5 Profile
UT to Town Creek Restoration Project - Option A: Project No. 94648

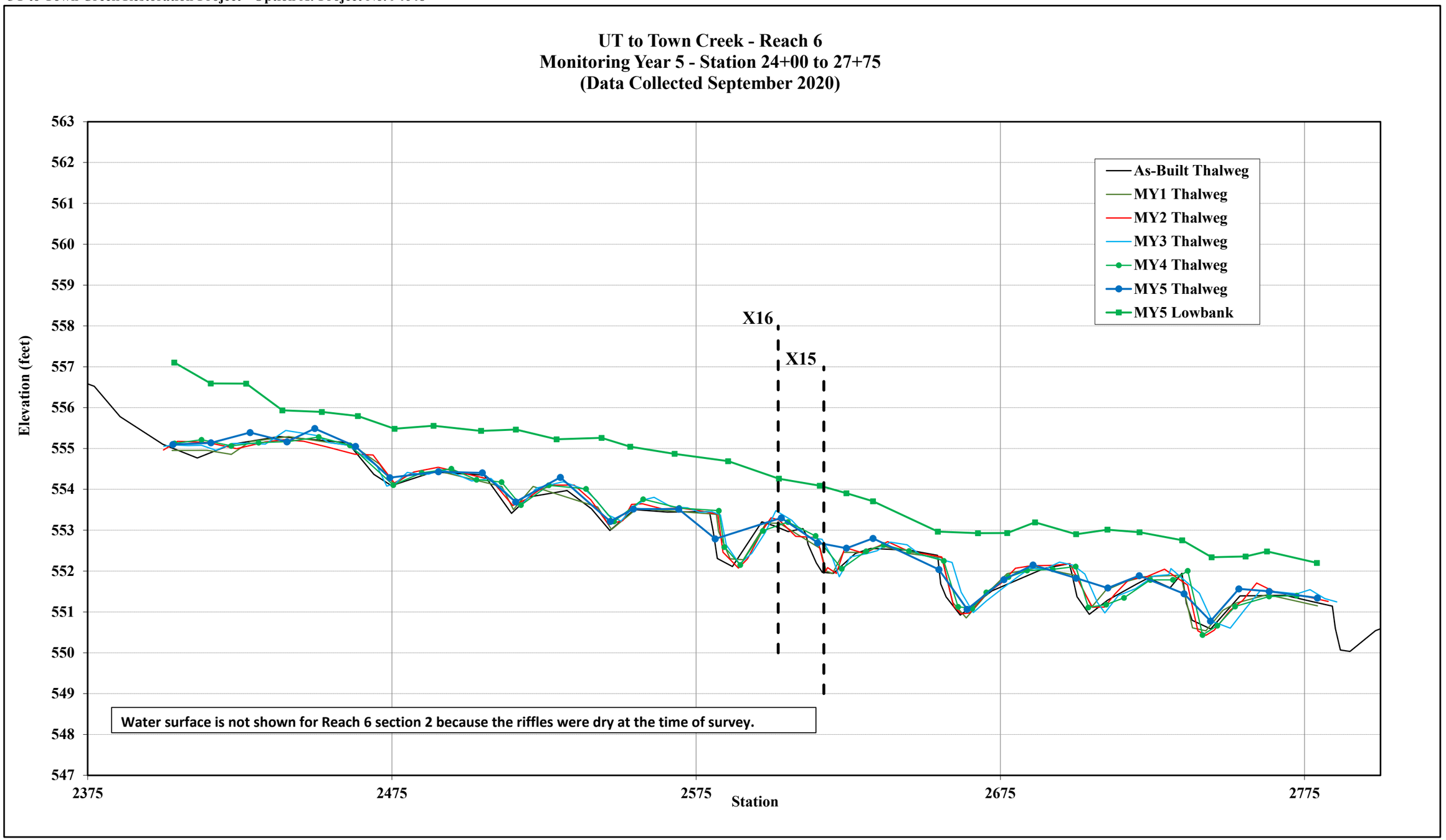


Figure 5a. Reachwide Pebble Count Distribution with Annual Overlays
UT to Town Creek Restoration Project: Project No. 94648

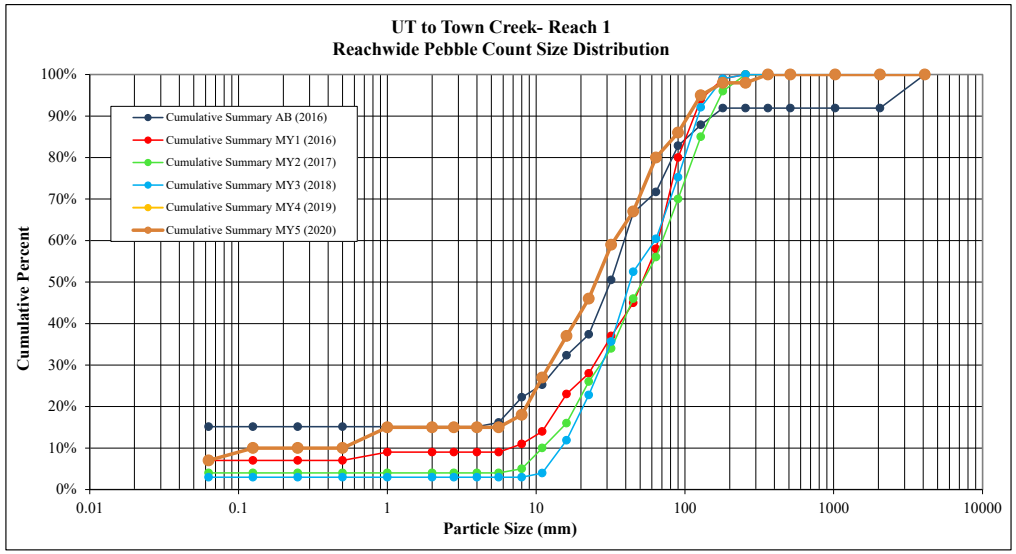
SITE OR PROJECT:	UT To Town Creek - Year 5
REACH/LOCATION:	Reach 1 (5 Riffles & 5 Pools)
DATE COLLECTED:	10/14/2020
FIELD COLLECTION BY:	AP, JY
DATA ENTERED BY:	JY

			PARTICLE CLASS			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
	Silt / Clay	< .063	2	5	7	7%	7%	4%	4%	10%	10%
Sand	Very Fine	.063 - .125	3		3	3%	10%	6%	10%		10%
Sand	Fine	.125 - .25					10%		10%		10%
Sand	Medium	.25 - .50					10%		10%		10%
Sand	Coarse	.50 - 1.0	2	3	5	5%	15%	4%	14%	6%	16%
Sand	Very Coarse	1.0 - 2.0					15%		14%		16%
Gravel	Very Fine	2.0 - 2.8					15%		14%		16%
Gravel	Very Fine	2.8 - 4.0					15%		14%		16%
Gravel	Fine	4.0 - 5.6					15%		14%		16%
Gravel	Fine	5.6 - 8.0	3		3	3%	18%	6%	20%		16%
Gravel	Medium	8.0 - 11.0	5	4	9	9%	27%	10%	29%	8%	24%
Gravel	Medium	11.0 - 16.0	7	3	10	10%	37%	14%	43%	6%	31%
Gravel	Coarse	16.0 - 22.6	3	6	9	9%	46%	6%	49%	12%	43%
Gravel	Coarse	22.6 - 32	6	7	13	13%	59%	12%	61%	14%	57%
Gravel	Very Coarse	32 - 45	3	5	8	8%	67%	6%	67%	10%	67%
Gravel	Very Coarse	45 - 64	5	8	13	13%	80%	10%	76%	16%	84%
Cobble	Small	64 - 90	3	3	6	6%	86%	6%	82%	6%	90%
Cobble	Small	90 - 128	6	3	9	9%	95%	12%	94%	6%	96%
Cobble	Large	128 - 180	2	1	3	3%	98%	4%	98%	2%	98%
Cobble	Large	180 - 256					98%		98%		98%
Boulder	Small	256 - 362	1	1	2	2%	100%	2%	100%	2%	100%
Boulder	Small	362 - 512					100%		100%		100%
Boulder	Medium	512 - 1024					100%		100%		100%
Boulder	Large-Very Large	1024 - 2048					100%		100%		100%
	Bedrock	> 2048					100%		100%		100%
		Total	**51**	**49**	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Cummulative Channel materials	
D16 =	6.31
D35 =	14.84
D50 =	25.15
D84 =	80.33
D95 =	128.00
D100 =	256 - 362

Riffle Channel materials	
D16 =	6.43
D35 =	12.81
D50 =	23.26
D84 =	94.55
D95 =	138.21
D100 =	256 - 362

Pool Channel materials	
D16 =	0.96
D35 =	18.11
D50 =	26.89
D84 =	65.17
D95 =	121.41
D100 =	256 - 362



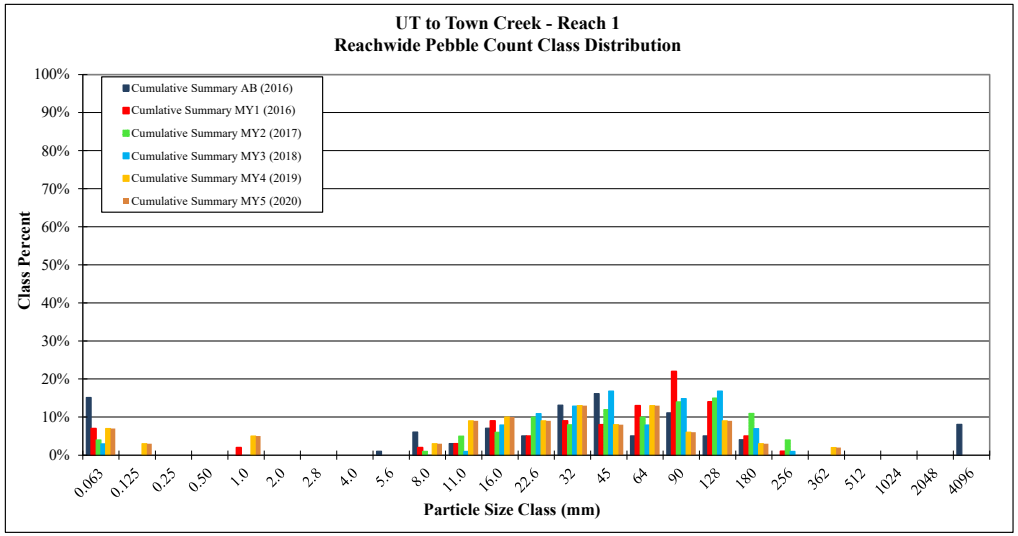


Figure 5b. Reachwide Pebble Count Distribution with Annual Overlays
UT to Town Creek Restoration Project: Project No. 94648

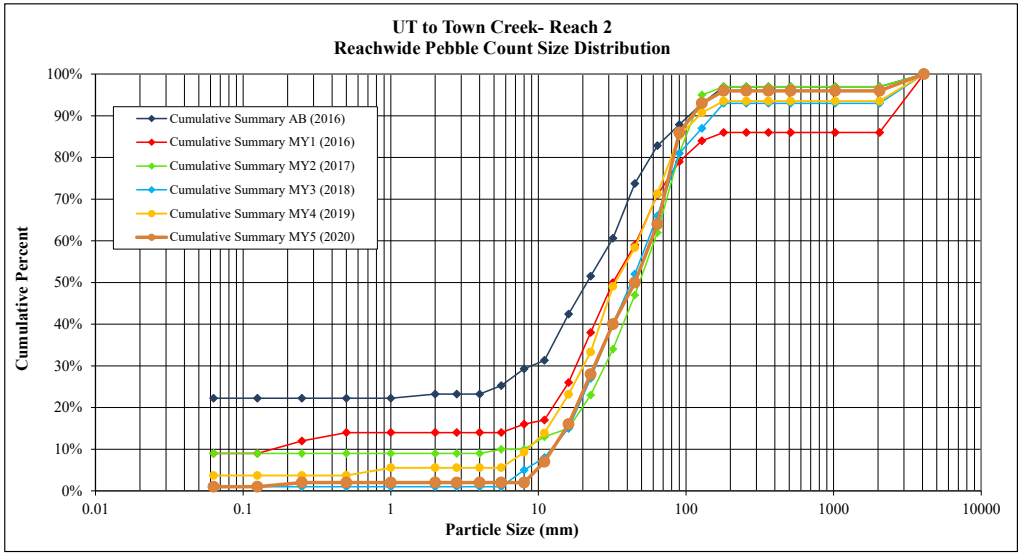
SITE OR PROJECT:	UT To Town Creek - Year 5
REACH/LOCATION:	Reach 2 (5 Riffles & 5 Pools)
DATE COLLECTED:	10/14/2020
FIELD COLLECTION BY:	AP, JY
DATA ENTERED BY:	JY

			PARTICLE CLASS			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
	Silt / Clay	< .063		1	1	1%	1%		0	2	2
Sand	Very Fine	.063 - .125					1%		0		2
	Fine	.125 - .25	1		1	1%	2%	2	2		2
	Medium	.25 - .50					2%		2		2
	Coarse	.50 - 1.0					2%		2		2
	Very Coarse	1.0 - 2.0					2%		2		2
Gravel	Very Fine	2.0 - 2.8					2%		2		2
	Very Fine	2.8 - 4.0					2%		2		2
	Fine	4.0 - 5.6					2%		2		2
	Fine	5.6 - 8.0					2%		2		2
	Medium	8.0 - 11.0	3	2	5	5%	7%	6	8	4	6
	Medium	11.0 - 16.0	5	4	9	9%	16%	10	18	8	14
	Coarse	16 - 22.6	4	8	12	12%	28%	8	25	16	31
	Coarse	22.6 - 32	6	6	12	12%	40%	12	37	12	43
	Very Coarse	32 - 45	7	3	10	10%	50%	14	51	6	49
	Very Coarse	45 - 64	7	7	14	14%	64%	14	65	14	63
Cobble	Small	64 - 90	12	10	22	22%	86%	24	88	20	84
	Small	90 - 128	4	3	7	7%	93%	8	96	6	90
	Large	128 - 180	2	1	3	3%	96%	4	100	2	92
	Large	180 - 256					96%		100		92
Boulder	Small	256 - 362					96%		100		92
	Small	362 - 512					96%		100		92
	Medium	512 - 1024					96%		100		92
	Large-Very Large	1024 - 2048					96%		100		92
	Bedrock	> 2048		4	4	4%	100%		100	8	100
		Total	**51**	**49**	**100**	**100%**	**100%**	**100**	**100**	**100**	**100**

Cummulative Channel materials	
D16 =	16.00
D35 =	27.68
D50 =	45.00
D84 =	87.25
D95 =	160.66
D100 =	> 2048

Riffle Channel materials	
D16 =	15.02
D35 =	29.94
D50 =	43.92
D84 =	84.64
D95 =	121.95
D100 =	128 - 180

Pool Channel materials	
D16 =	16.59
D35 =	25.60
D50 =	46.15
D84 =	91.71
D95 =	2679.04
D100 =	> 2048



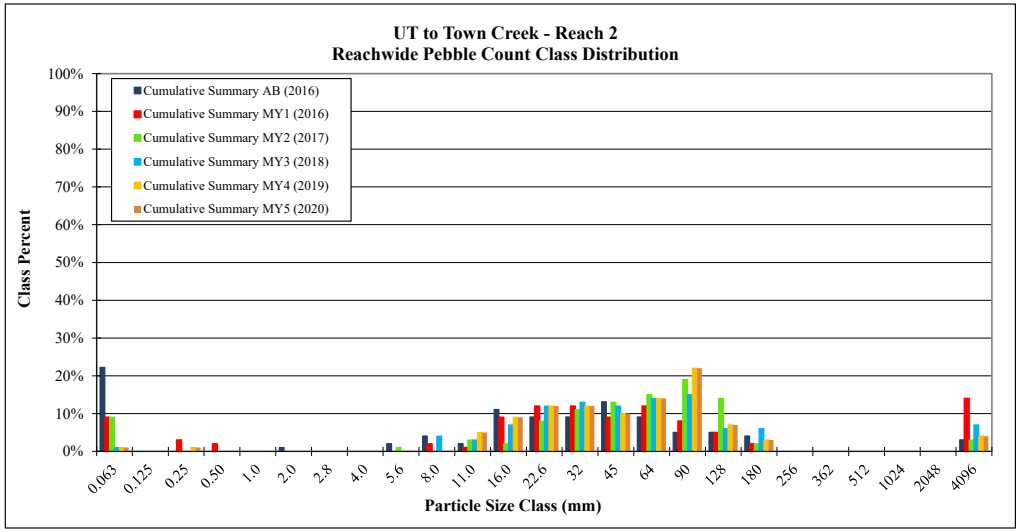


Figure 5c. Reachwide Pebble Count Distribution with Annual Overlays
UT to Town Creek Restoration Project: Project No. 94648

PEBBLE COUNT DATA SHEET

SITE OR PROJECT:	UT To Town Creek - Year 5
REACH/LOCATION:	Reach 3 (5 Riffles & 5 Pools)
DATE COLLECTED:	10/14/2020
FIELD COLLECTION BY:	AP,JY
DATA ENTERED BY:	JY

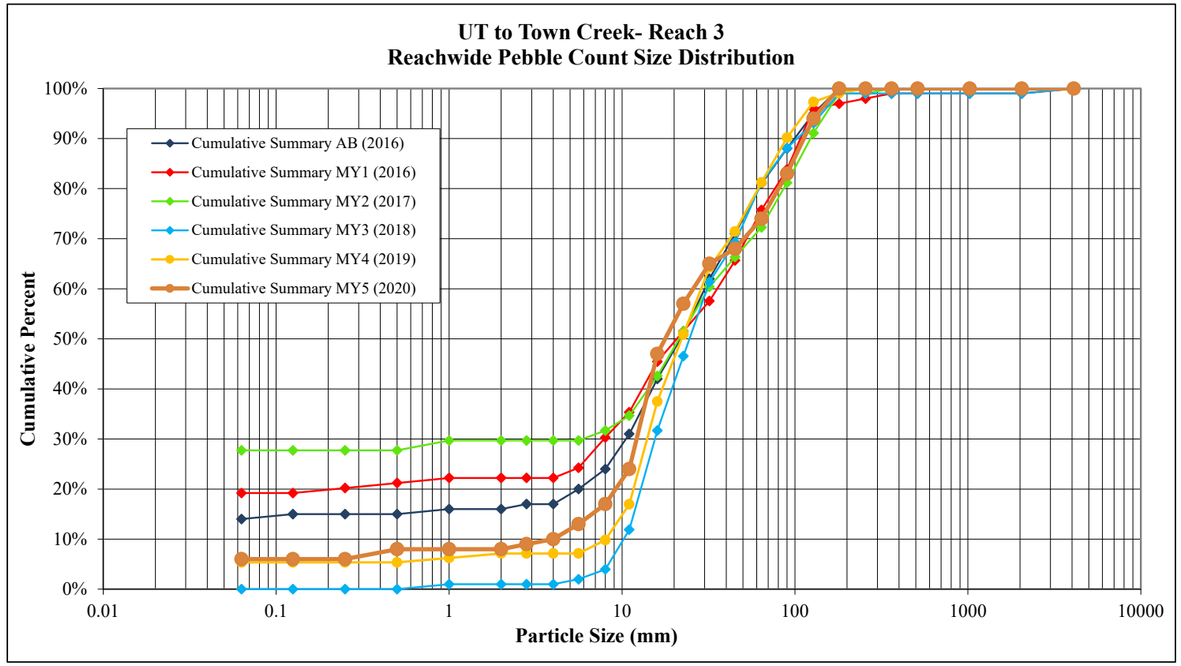
SEDIMENT ANALYSIS DATA SHEET

			PARTICLE CLASS			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
	Silt / Clay	< .063	2	4	6	6%	6%	4	4	8	8
Sand	Very Fine	.063 - .125					6%		4		8
	Fine	.125 - .25					6%		4		8
	Medium	.25 - .50	2		2	2%	8%	4	8		8
	Coarse	.50 - 1.0					8%		8		8
	Very Coarse	1.0 - 2.0					8%		8		8
Gravel	Very Fine	2.0 - 2.8	1		1	1%	9%	2	10		8
	Very Fine	2.8 - 4.0	1		1	1%	10%	2	12		8
	Fine	4.0 - 5.6	3		3	3%	13%	6	18		8
	Fine	5.6 - 8.0	2	2	4	4%	17%	4	22	4	12
	Medium	8.0 - 11.0	2	5	7	7%	24%	4	27	10	22
	Medium	11.0 - 16.0	10	13	23	23%	47%	20	47	25	47
	Coarse	16 - 22.6	3	7	10	10%	57%	6	53	14	61
	Coarse	22.6 - 32	2	6	8	8%	65%	4	57	12	73
	Very Coarse	32 - 45		3	3	3%	68%		57	6	78
	Very Coarse	45 - 64		6	6	6%	74%		57	12	90
Cobble	Small	64 - 90	6	3	9	9%	83%	12	69	6	96
	Small	90 - 128	10	1	11	11%	94%	20	90	2	98
	Large	128 - 180	5	1	6	6%	100%	10	100	2	100
	Large	180 - 256					100%		100		100
Boulder	Small	256 - 362					100%		100		100
	Small	362 - 512					100%		100		100
	Medium	512 - 1024					100%		100		100
	Large-Very Large	1024 - 2048					100%		100		100
	Bedrock	> 2048					100%		100		100
			49	51	100	100%	100%	100	100	100	100

Cummulative	
Channel materials	
D_{16} =	7.32
D_{35} =	13.16
D_{50} =	17.75
D_{84} =	92.93
D_{95} =	135.48
D_{100} =	128 - 180

Riffle	
Channel materials	
D_{16} =	4.92
D_{35} =	12.85
D_{50} =	19.02
D_{84} =	115.82
D_{95} =	152.31
D_{100} =	128 - 180

Pool	
Channel materials	
D_{16} =	9.18
D_{35} =	13.40
D_{50} =	17.23
D_{84} =	53.16
D_{95} =	84.55
D_{100} =	128 - 180



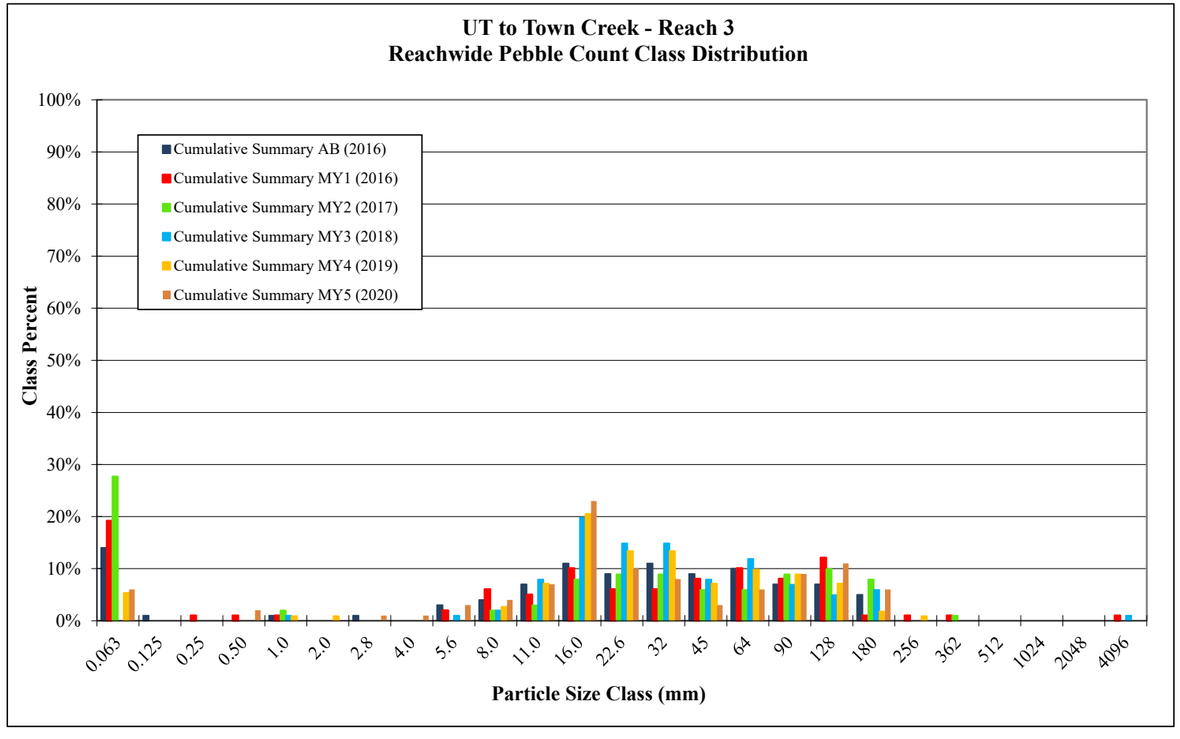


Figure 5d. Reachwide Pebble Count Distribution with Annual Overlays
UT to Town Creek Restoration Project: Project No. 94648

SITE OR PROJECT:	UT To Town Creek - Year 5
REACH/LOCATION:	Reach 6 (6 Riffles & 4 Pools)
DATE COLLECTED:	10/14/2020
FIELD COLLECTION BY:	AP, JY
DATA ENTERED BY:	JY

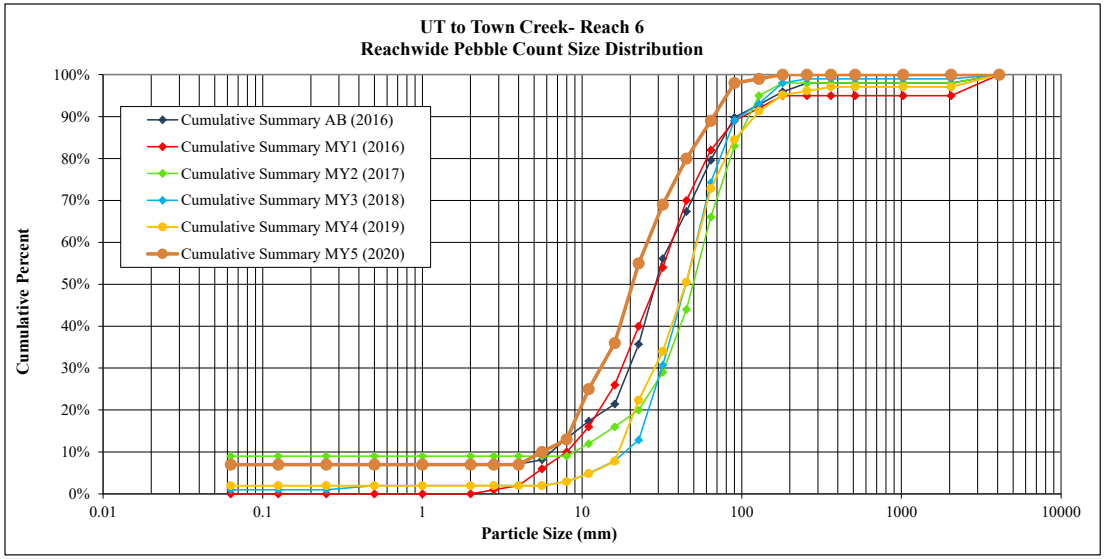
SEDIMENT ANALYSIS DATA SHEET

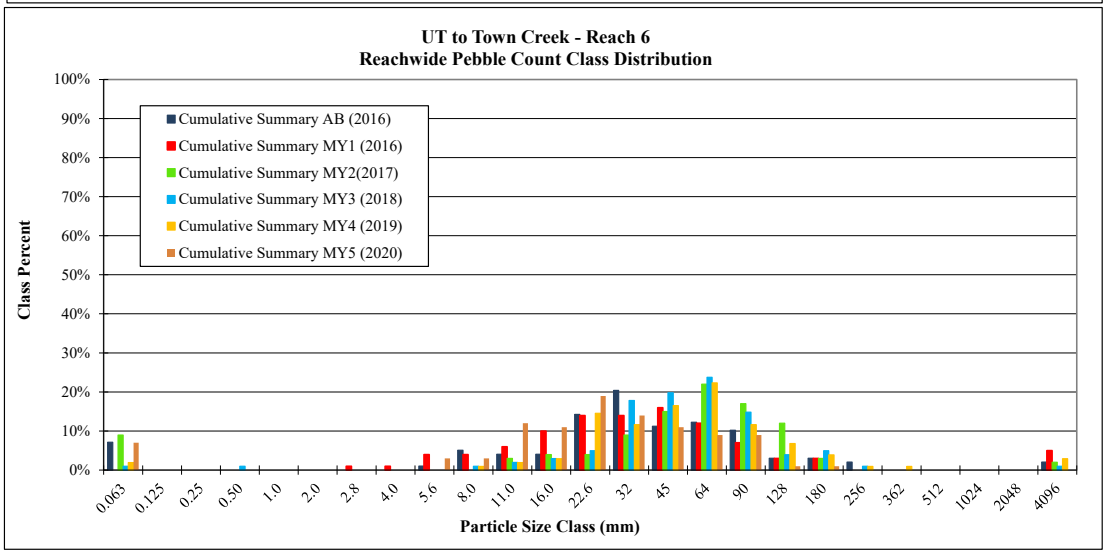
			PARTICLE CLASS			Reach Summary		Riffle Summary		Pool Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Pool	Total	Class %	% Cum	Class %	% Cum	Class %	% Cum
	Silt / Clay	< .063	3	4	7	7%	7%	5	5	9	9
Sand	Very Fine	.063 - .125					7%		5		9
	Fine	.125 - .25					7%		5		9
	Medium	.25 - .50					7%		5		9
	Coarse	.50 - 1.0					7%		5		9
	Very Coarse	1.0 - 2.0					7%		5		9
Gravel	Very Fine	2.0 - 2.8					7%		5		9
	Very Fine	2.8 - 4.0					7%		5		9
	Fine	4.0 - 5.6	1	2	3	3%	10%	2	7	5	14
	Fine	5.6 - 8.0	1	2	3	3%	13%	2	9	5	18
	Medium	8.0 - 11.0	7	5	12	12%	25%	13	21	11	30
	Medium	11.0 - 16.0	5	6	11	11%	36%	9	30	14	43
	Coarse	16 - 22.6	11	8	19	19%	55%	20	50	18	61
	Coarse	22.6 - 32	8	6	14	14%	69%	14	64	14	75
	Very Coarse	32 - 45	7	4	11	11%	80%	13	77	9	84
	Very Coarse	45 - 64	5	4	9	9%	89%	9	86	9	93
Cobble	Small	64 - 90	7	2	9	9%	98%	13	98	5	98
	Small	90 - 128		1	1	1%	99%		98	2	100
	Large	128 - 180	1		1	1%	100%	2	100		100
	Large	180 - 256					100%		100		100
Boulder	Small	256 - 362					100%		100		100
	Small	362 - 512					100%		100		100
	Medium	512 - 1024					100%		100		100
	Large-Very Large	1024 - 2048					100%		100		100
	Bedrock	> 2048					100%		100		100
			56	44	100			100	100	100	100

Cummulative	
Channel materials	
D16 =	8.66
D35 =	15.46
D50 =	20.64
D84 =	52.63
D95 =	80.33
D100 =	128 - 180

Riffle	
Channel materials	
D16 =	9.58
D35 =	17.36
D50 =	22.60
D84 =	59.82
D95 =	82.45
D100 =	128 - 180

Pool	
Channel materials	
D16 =	6.74
D35 =	12.78
D50 =	18.21
D84 =	44.85
D95 =	73.35
D100 =	90 - 128





Appendix E

Hydrologic Data

Figure 6. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

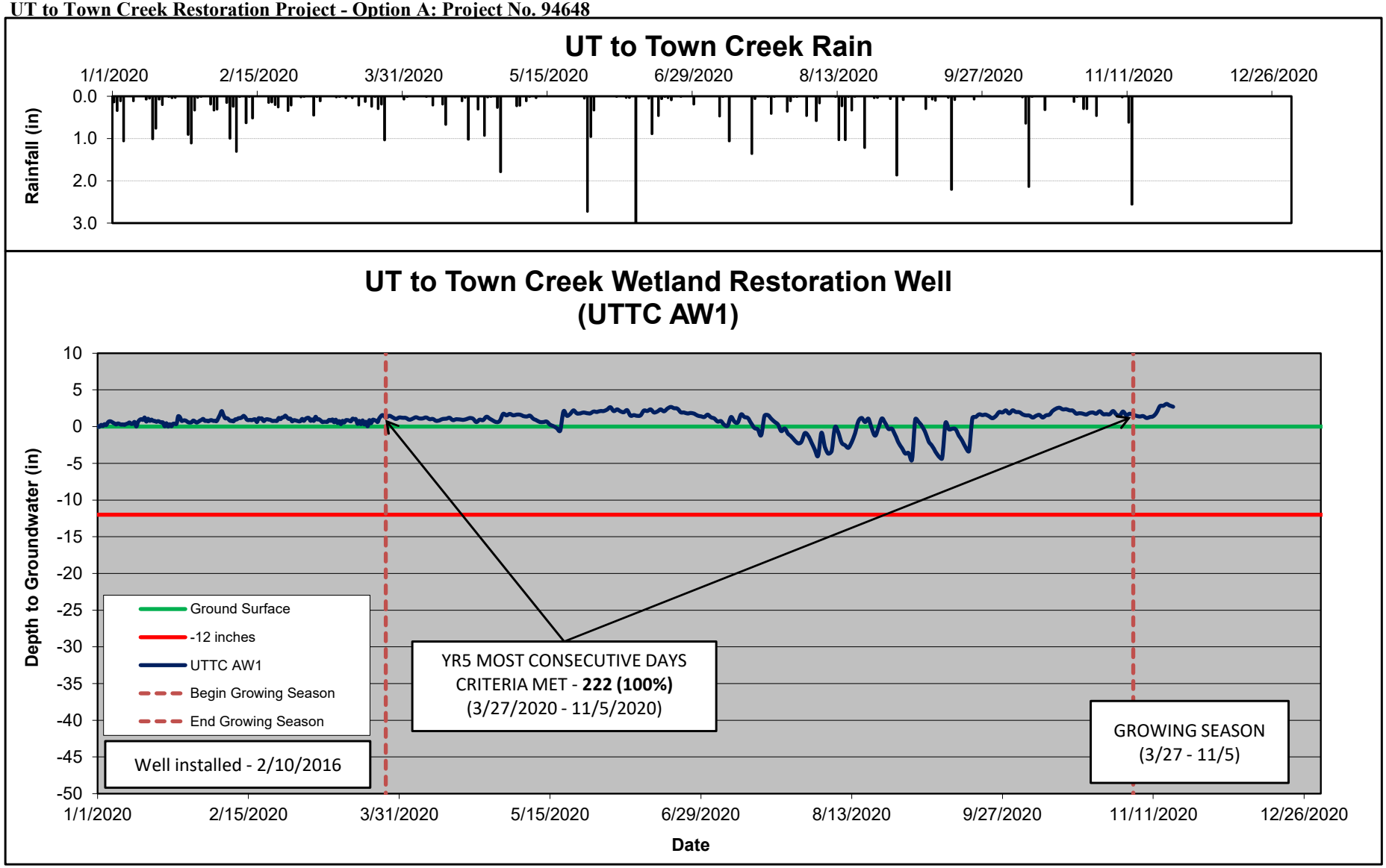


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

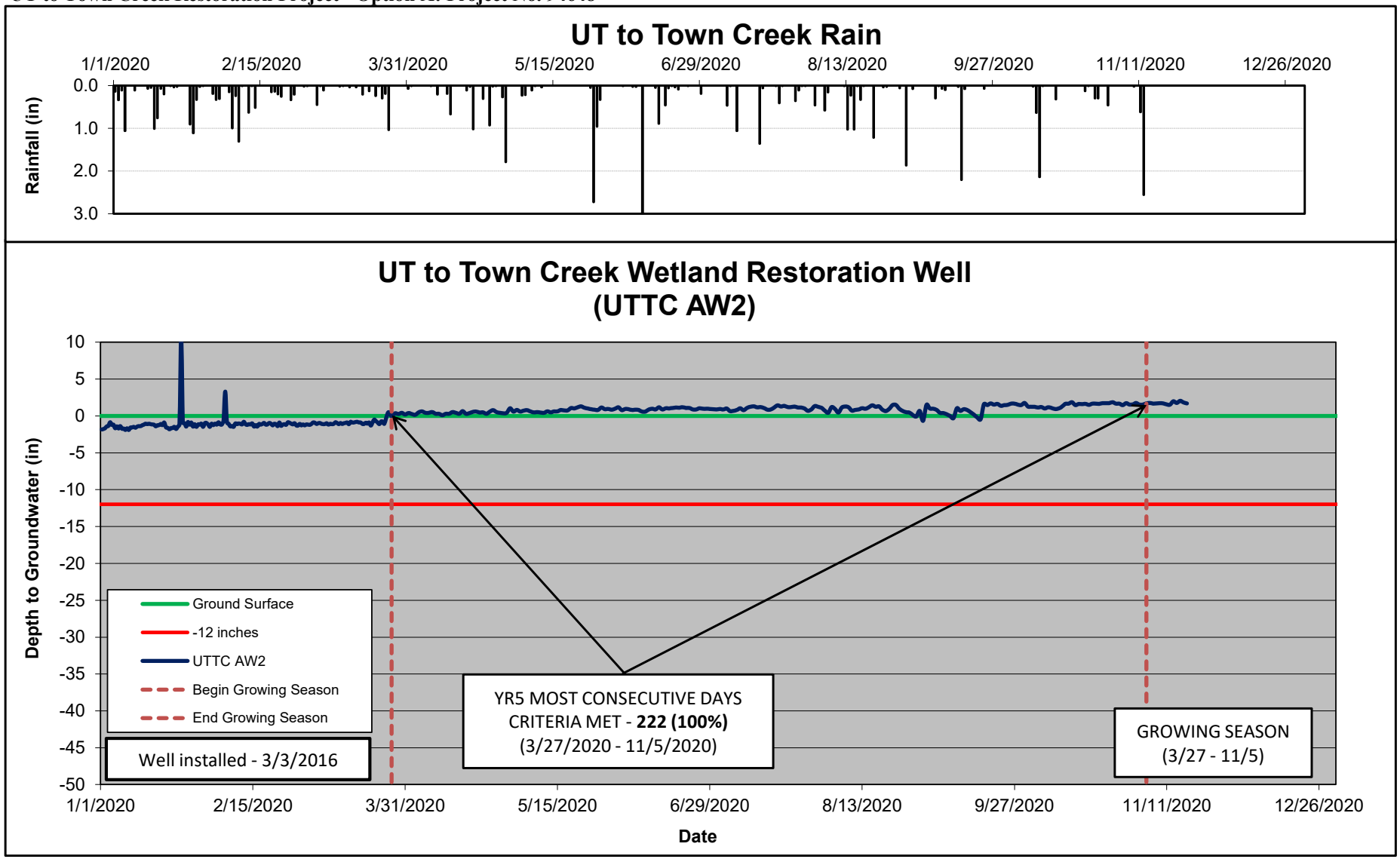


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

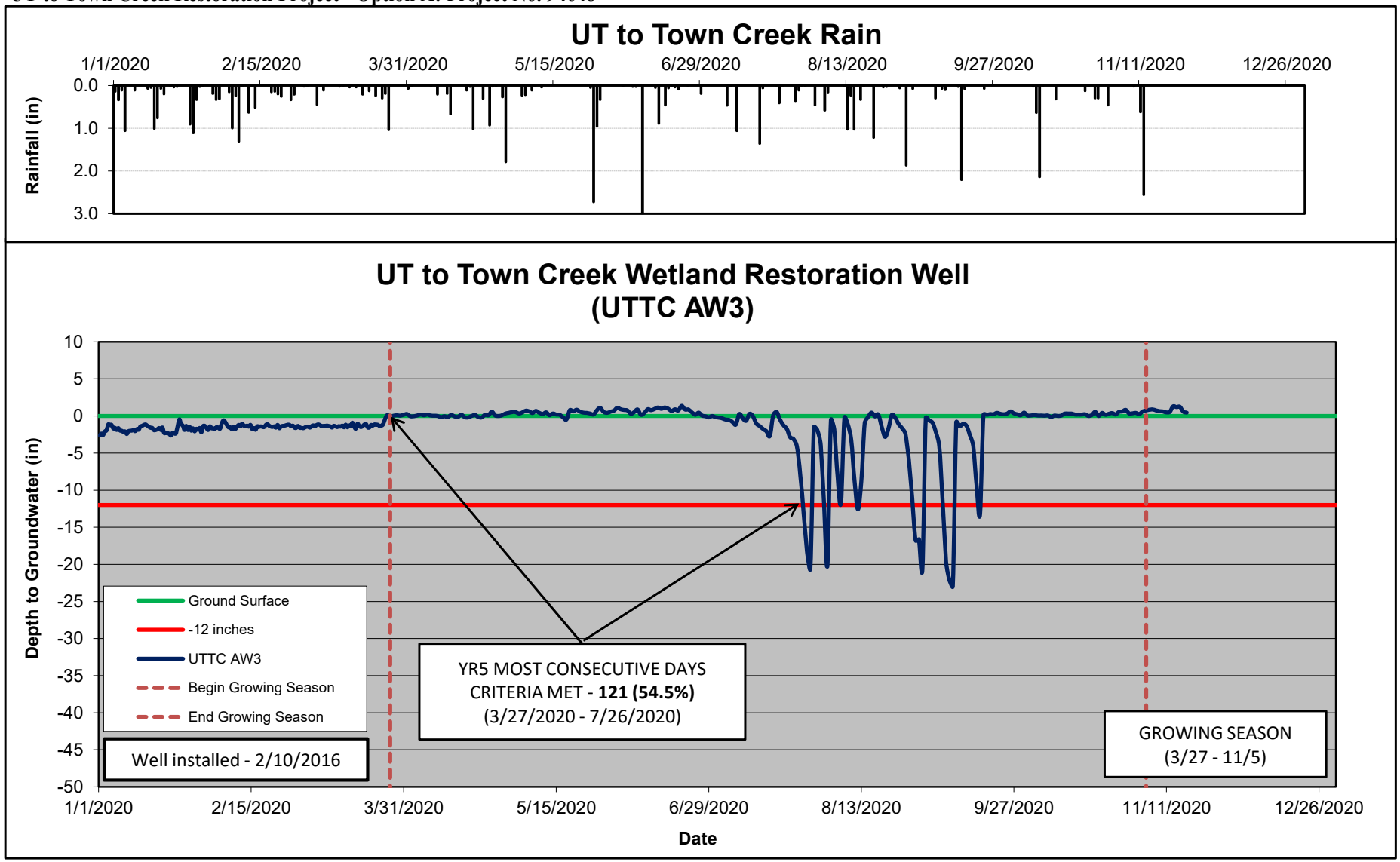


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

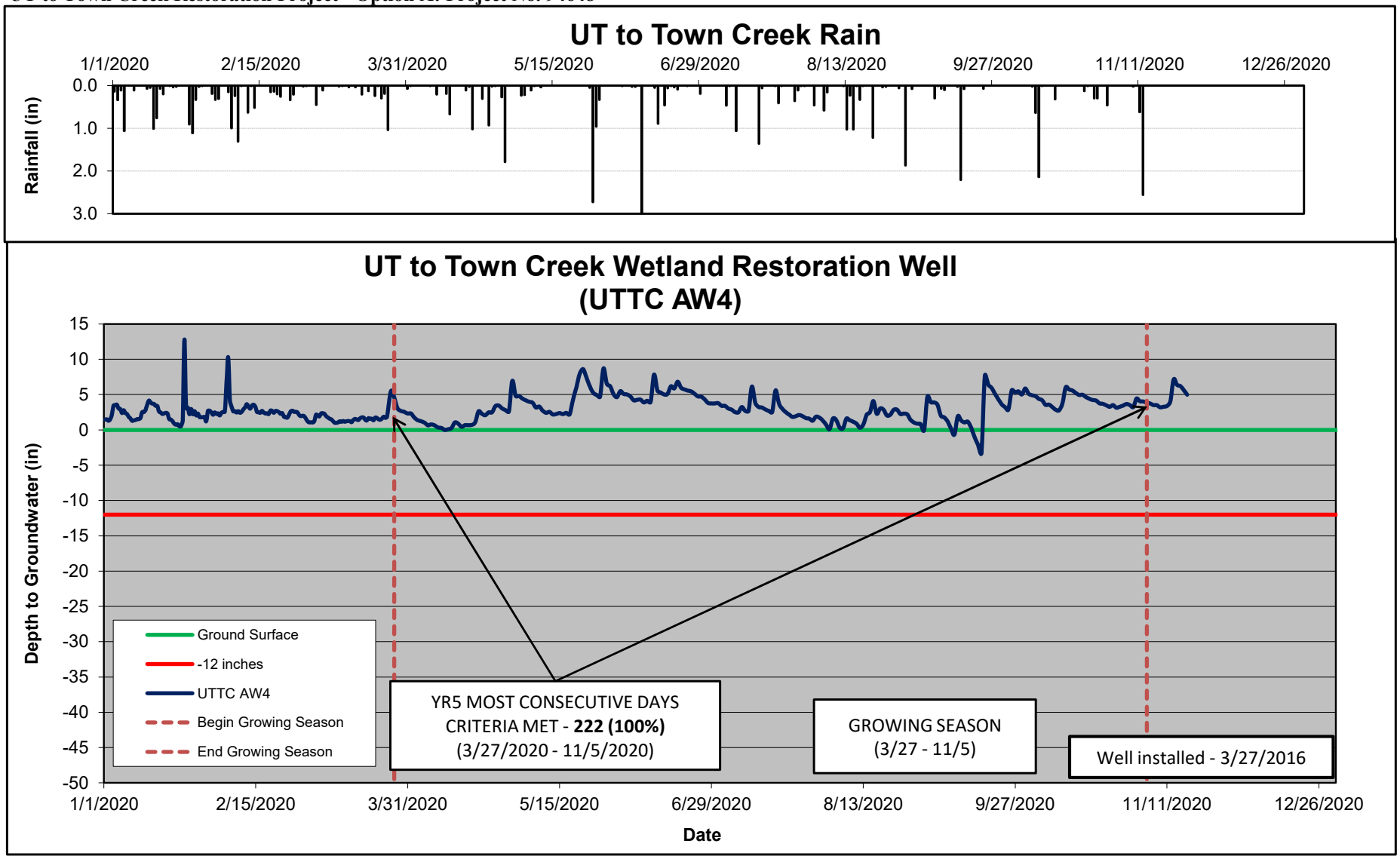


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

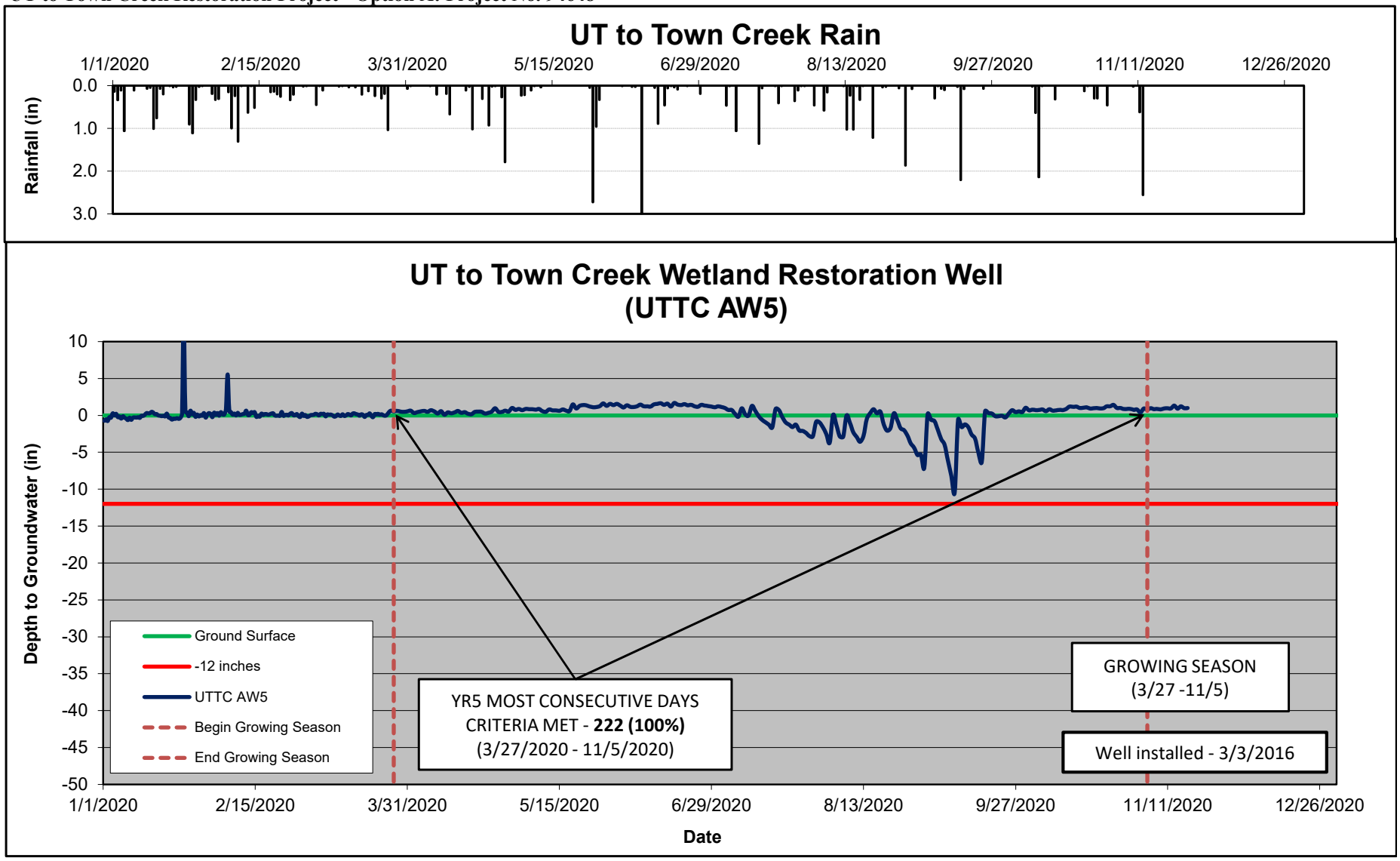
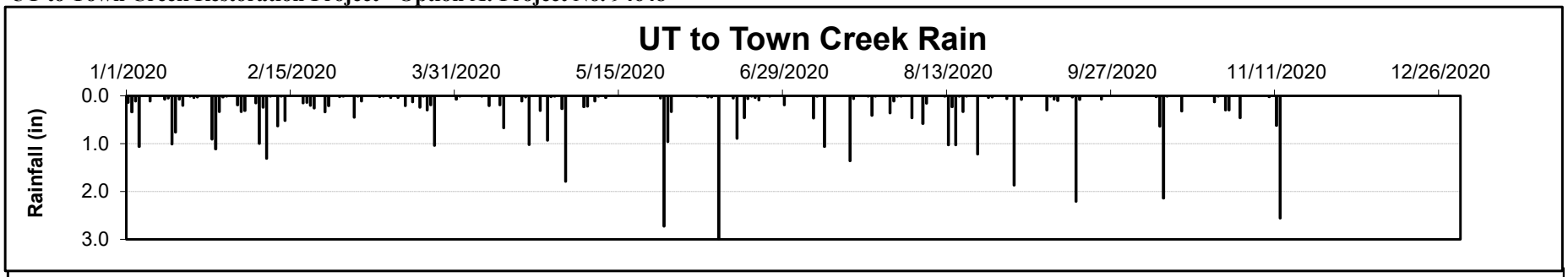


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



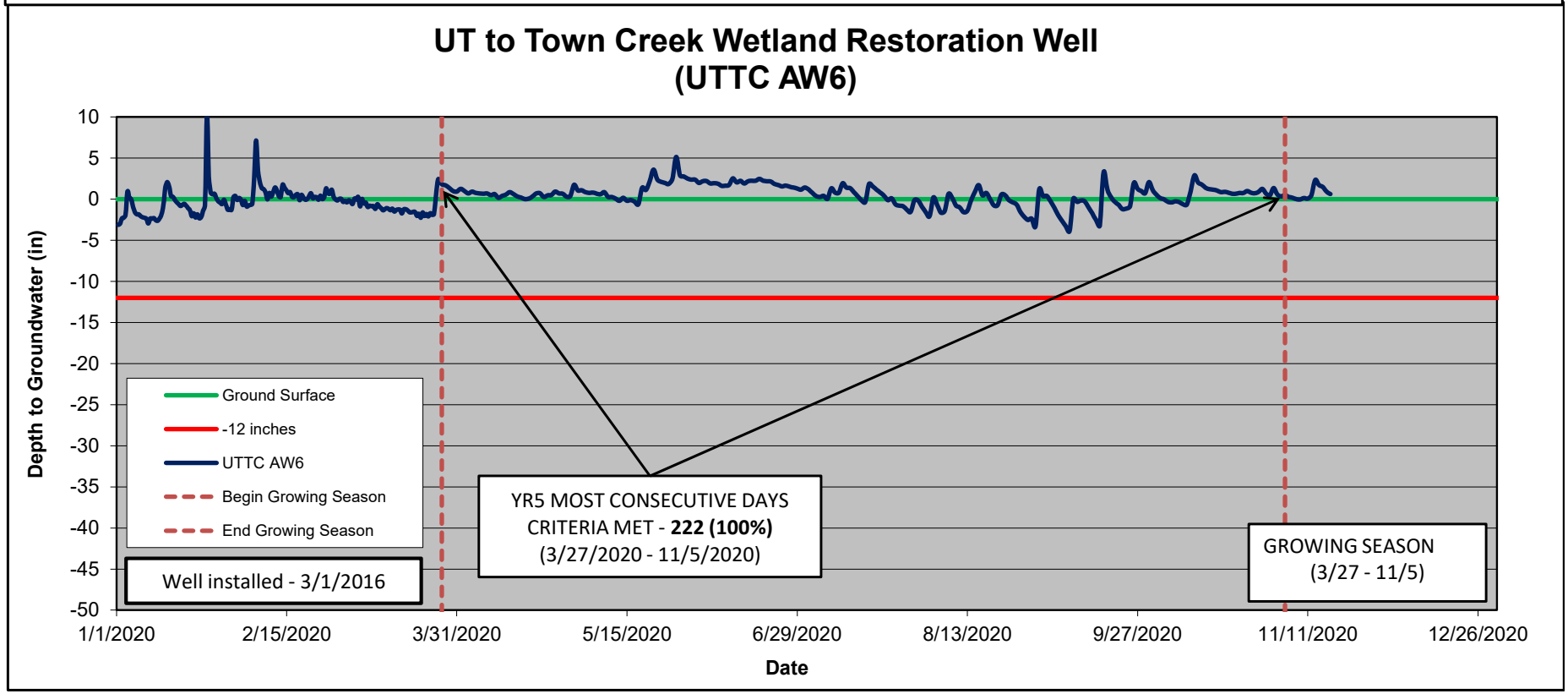


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

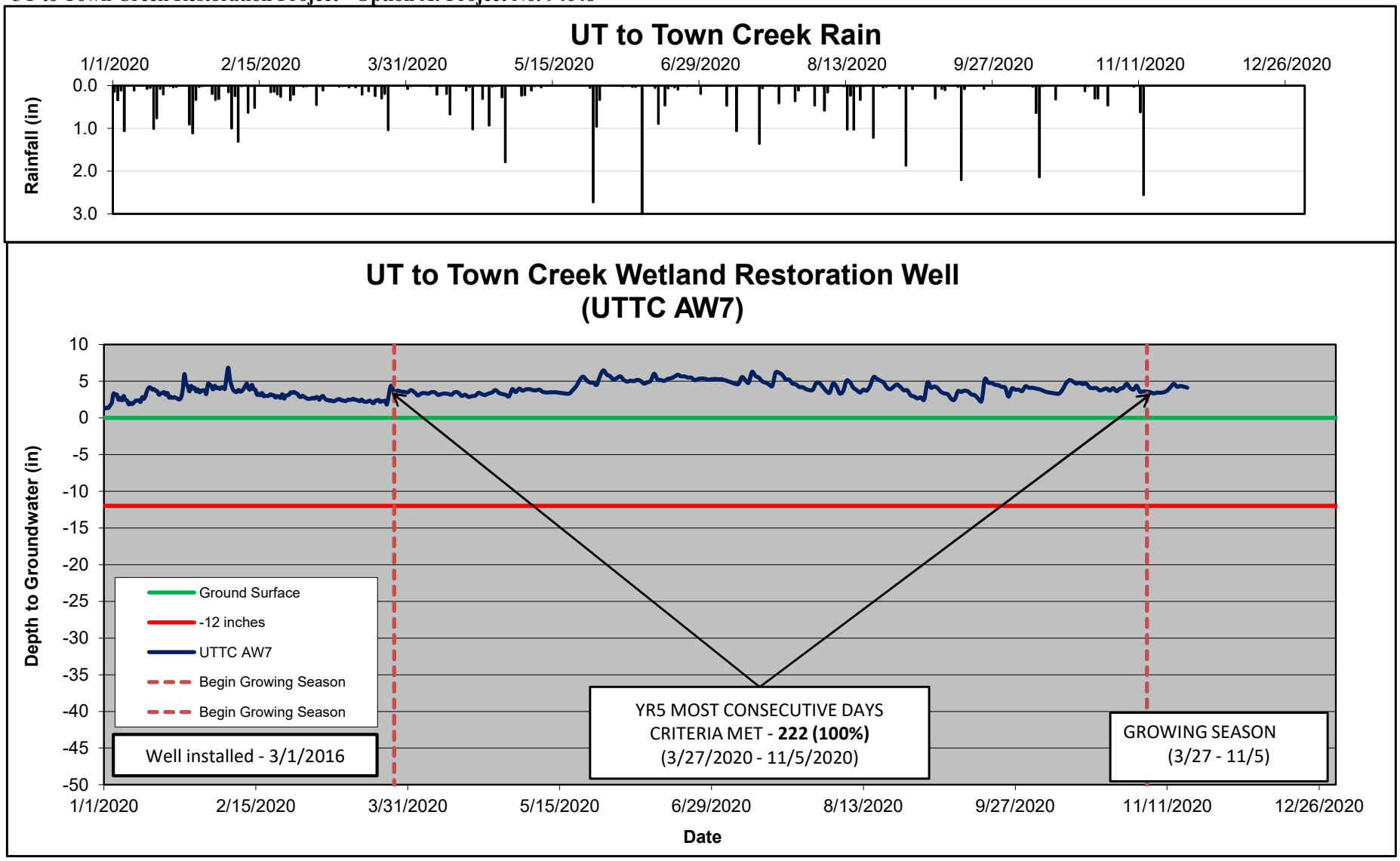


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

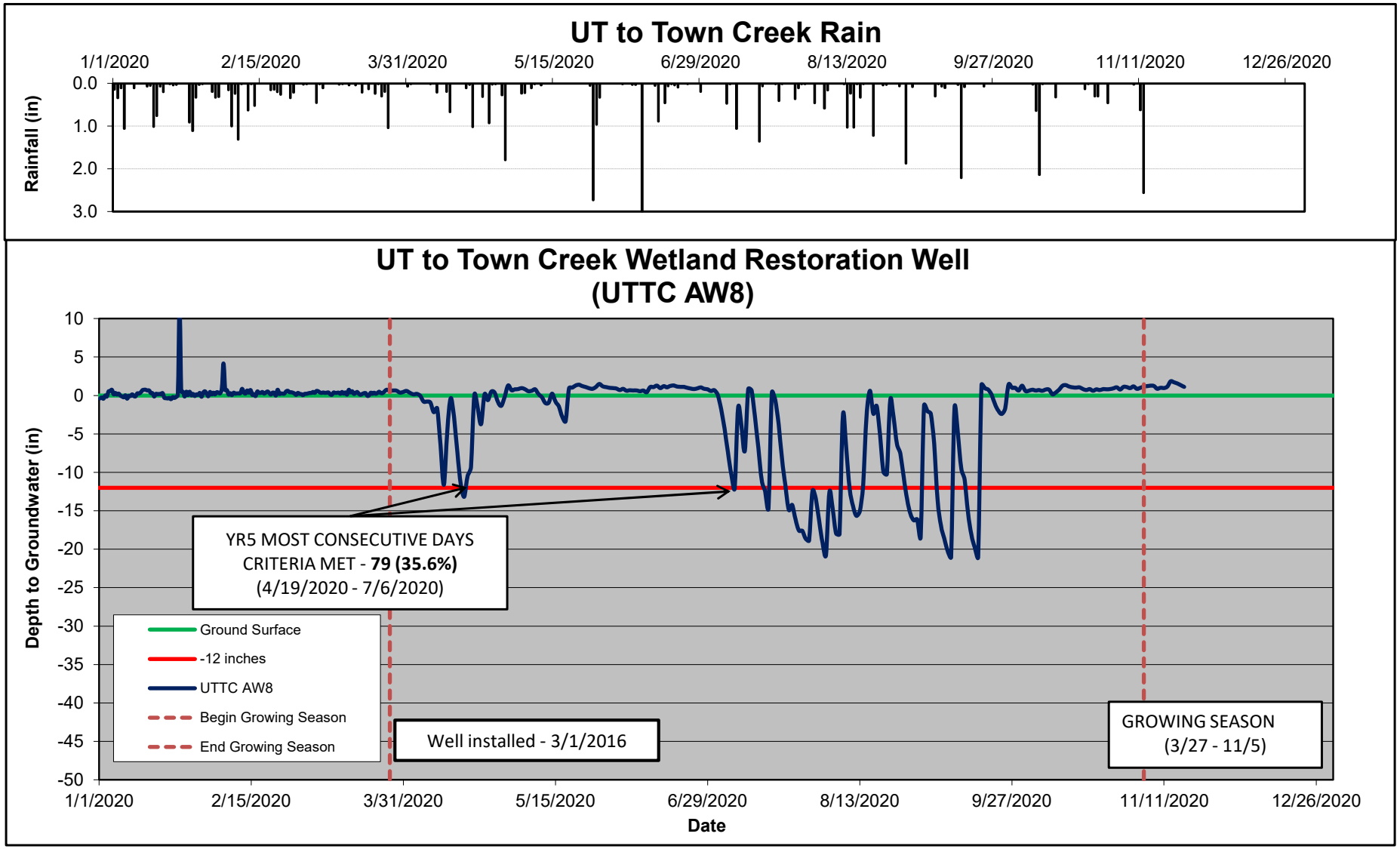


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648

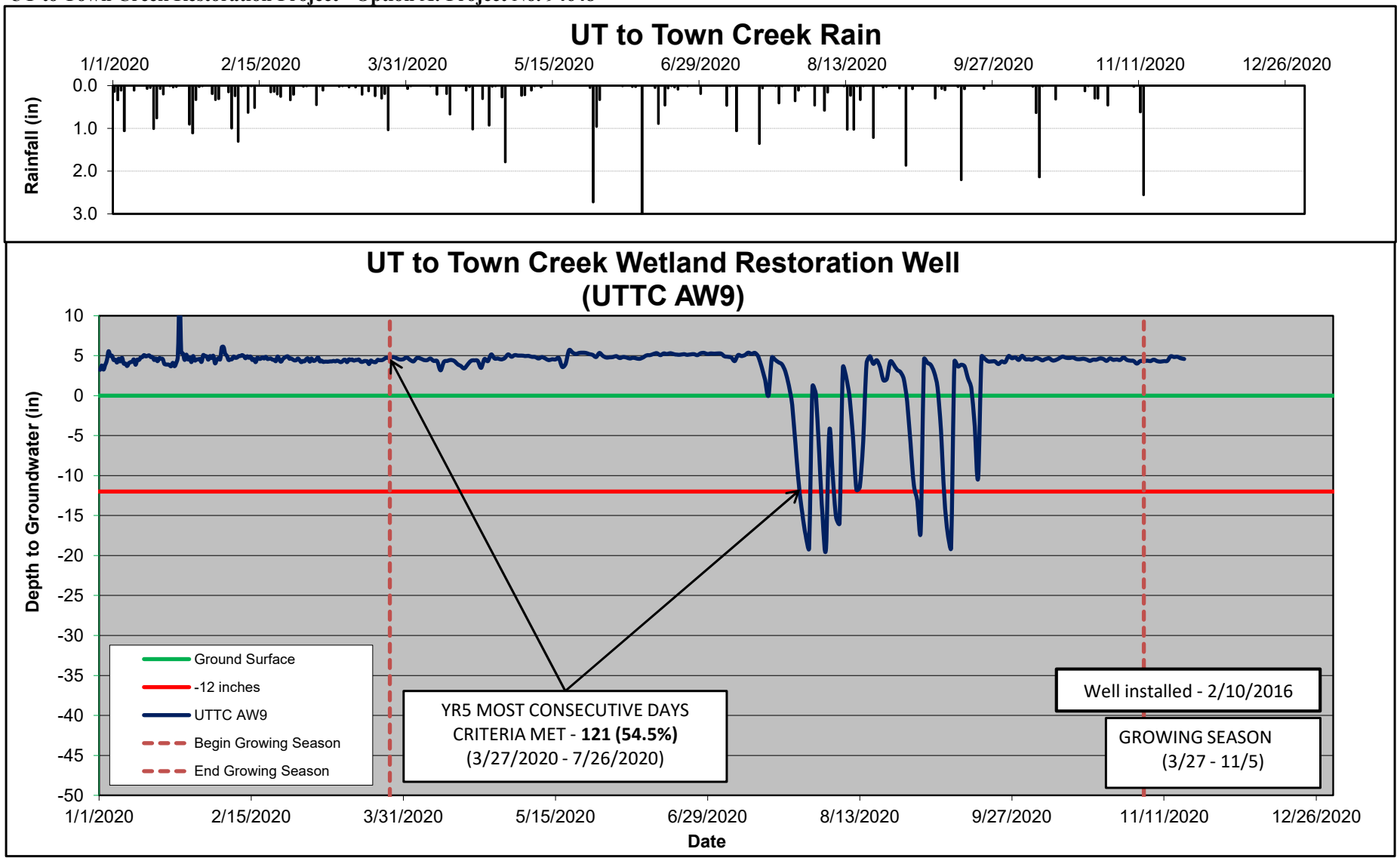
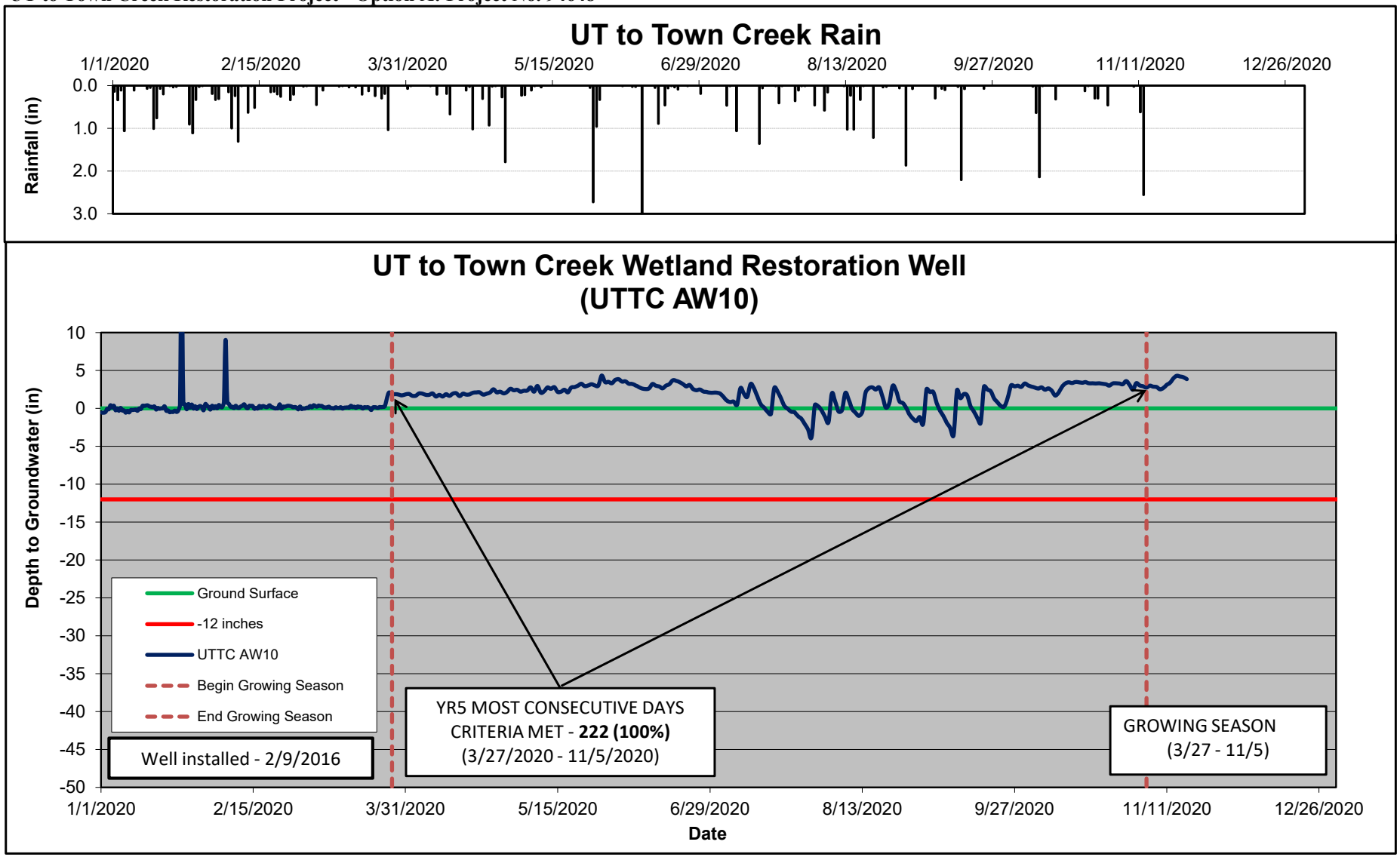


Figure 6 Cont. Wetland Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



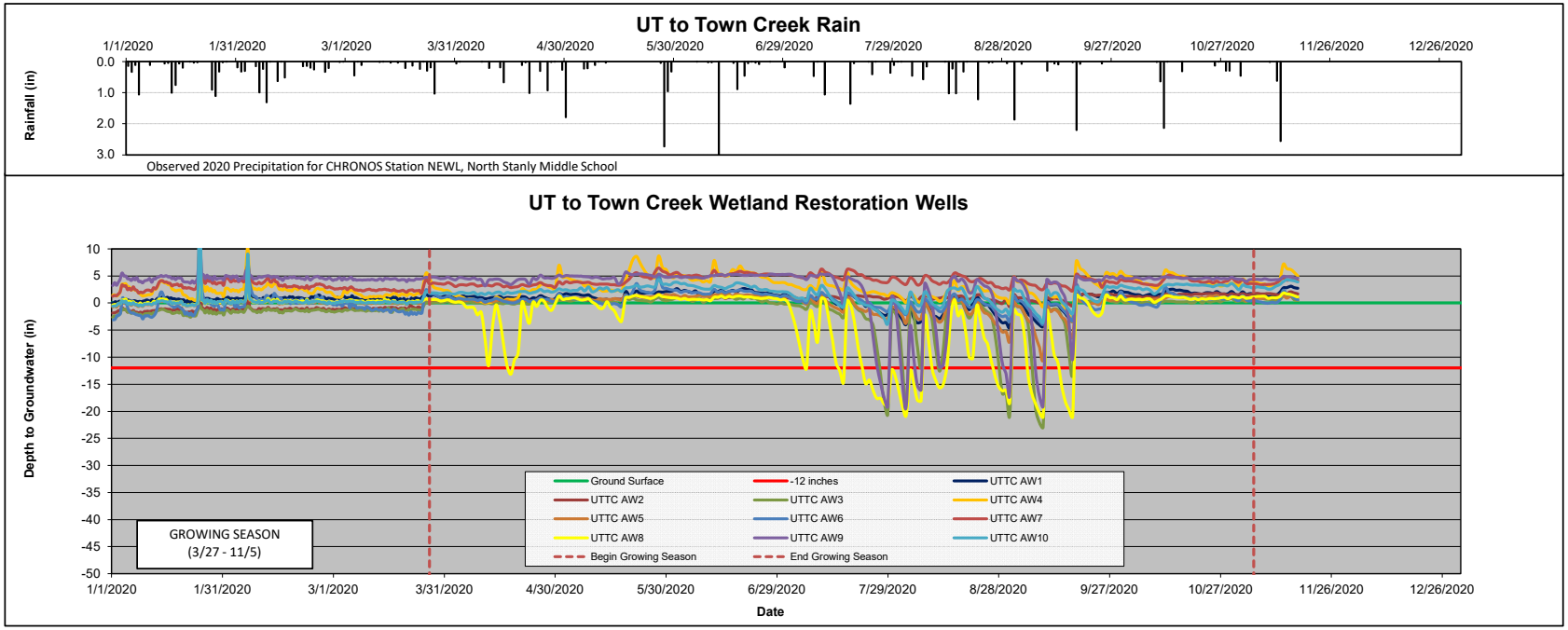
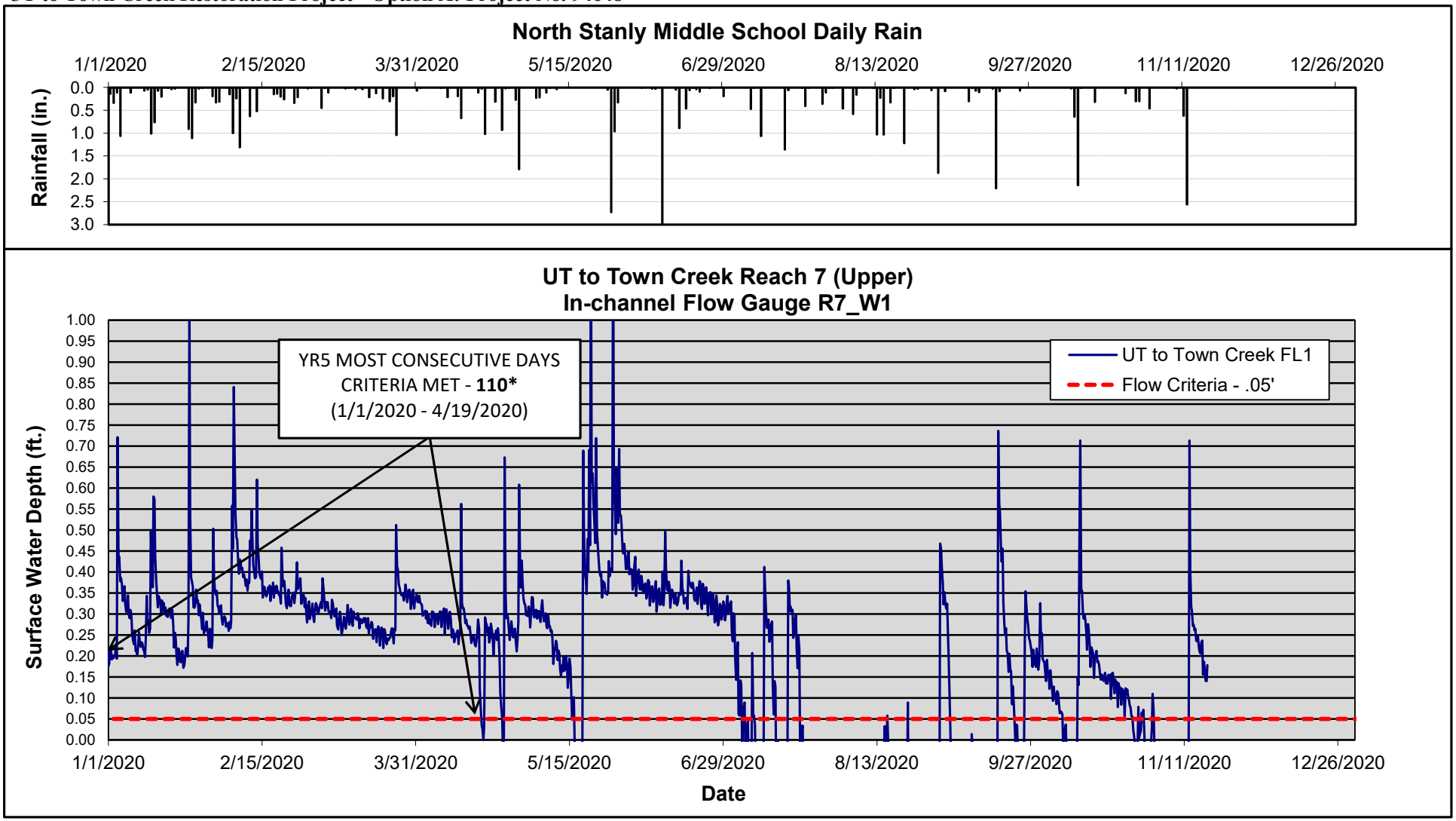
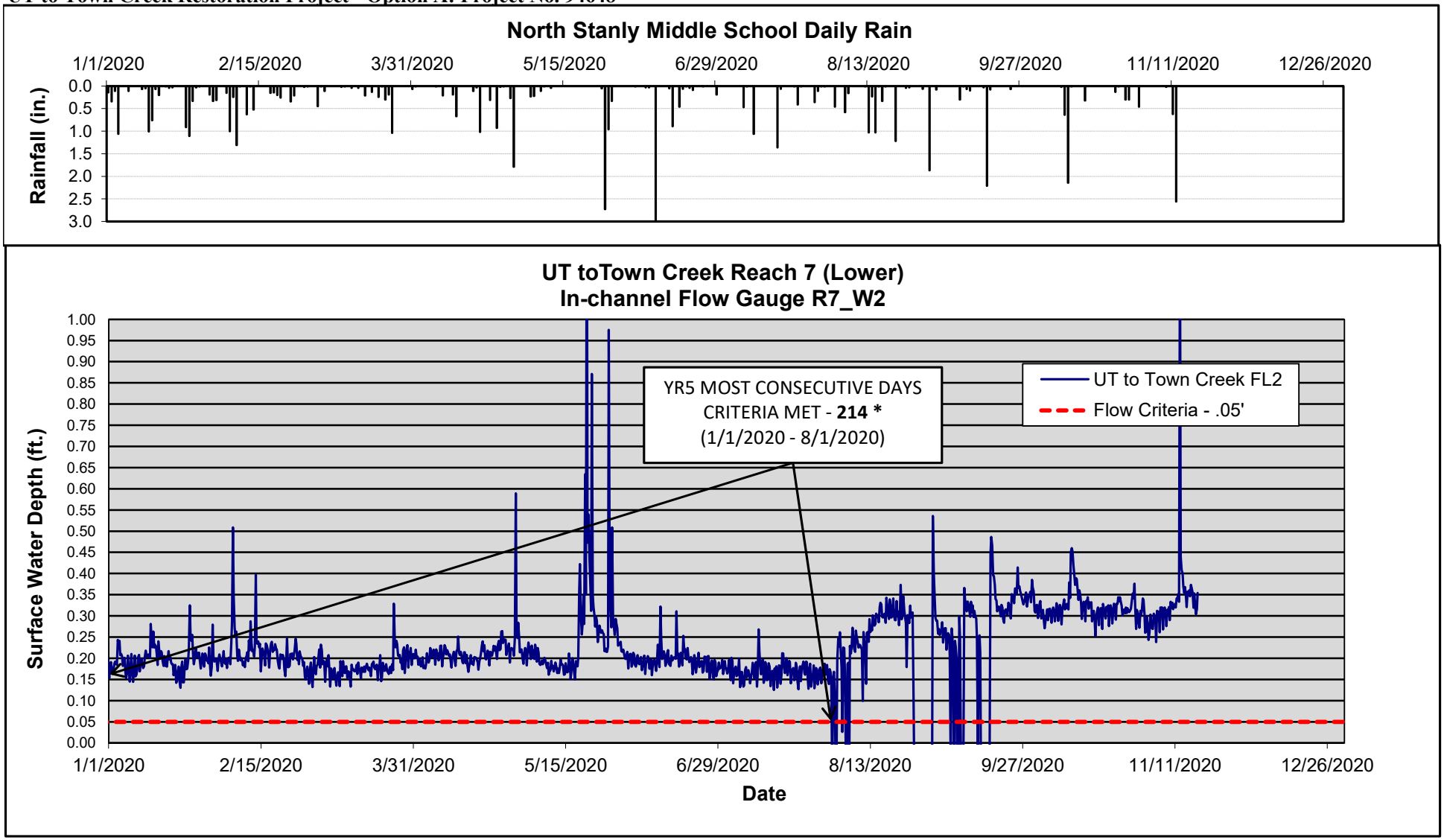

UT to Town Creek Rain
Rainfall (in)
1/1/2020
1/31/2020
3/1/2020
3/31/2020
4/30/2020
5/30/2020
6/29/2020
7/29/2020
8/28/2020
9/27/2020
10/27/2020
11/26/2020
12/26/2020
0.0
1.0
2.0
3.0
Observed 2020 Precipitation for CHRONOS Station NEWL, North Stanly Middle School
UT to Town Creek Wetland Restoration Wells
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
GROWING SEASON
(3/27 - 11/5)
Ground Surface
-12 inches
UTTC AW1
UTTC AW2
UTTC AW3
UTTC AW4
UTTC AW5
UTTC AW6
UTTC AW7
UTTC AW8
UTTC AW9
UTTC AW10
Begin Growing Season
End Growing Season
Date

Figure 7. In-stream Flow Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



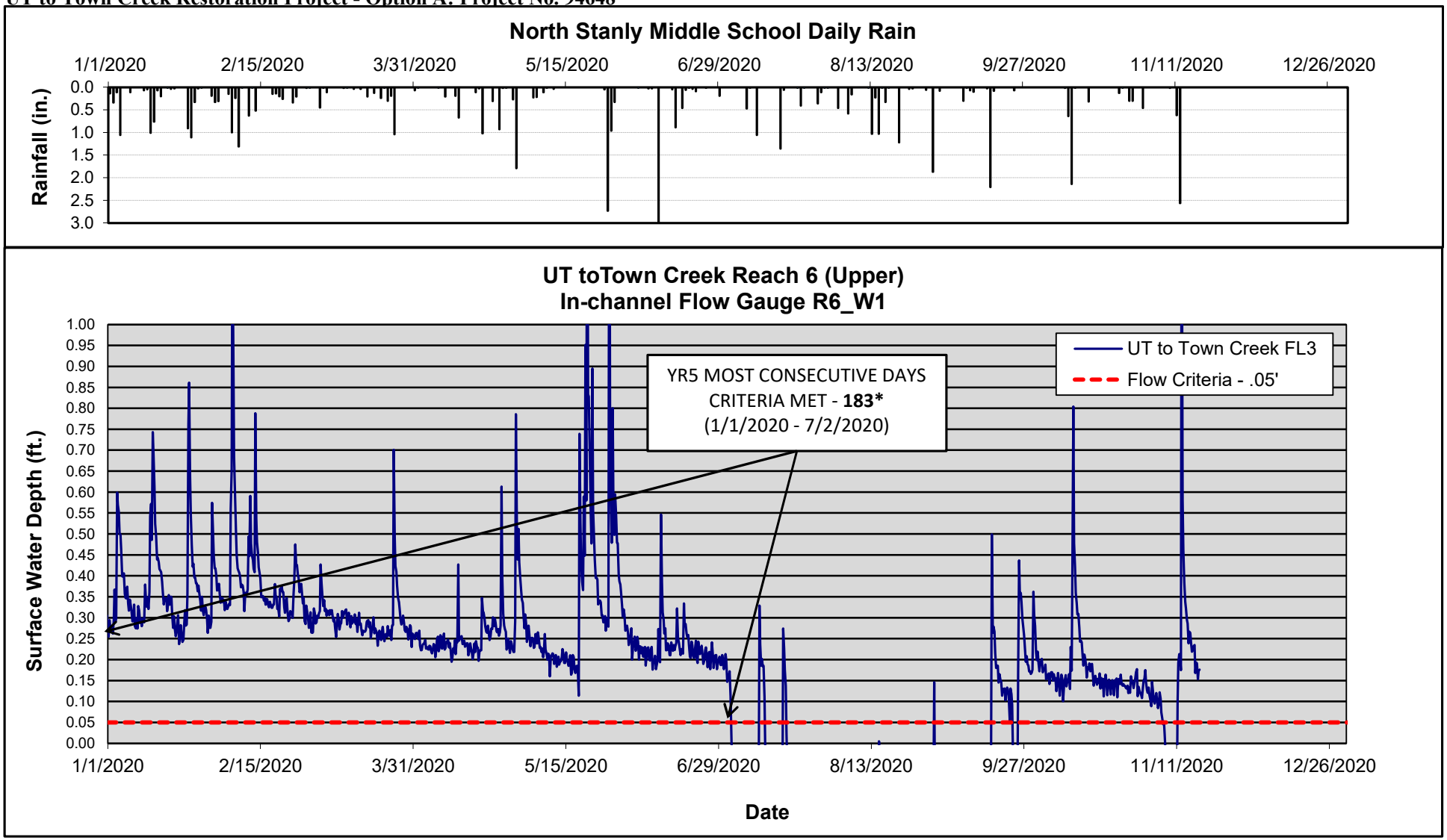
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 7 Cont. In-stream Flow Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



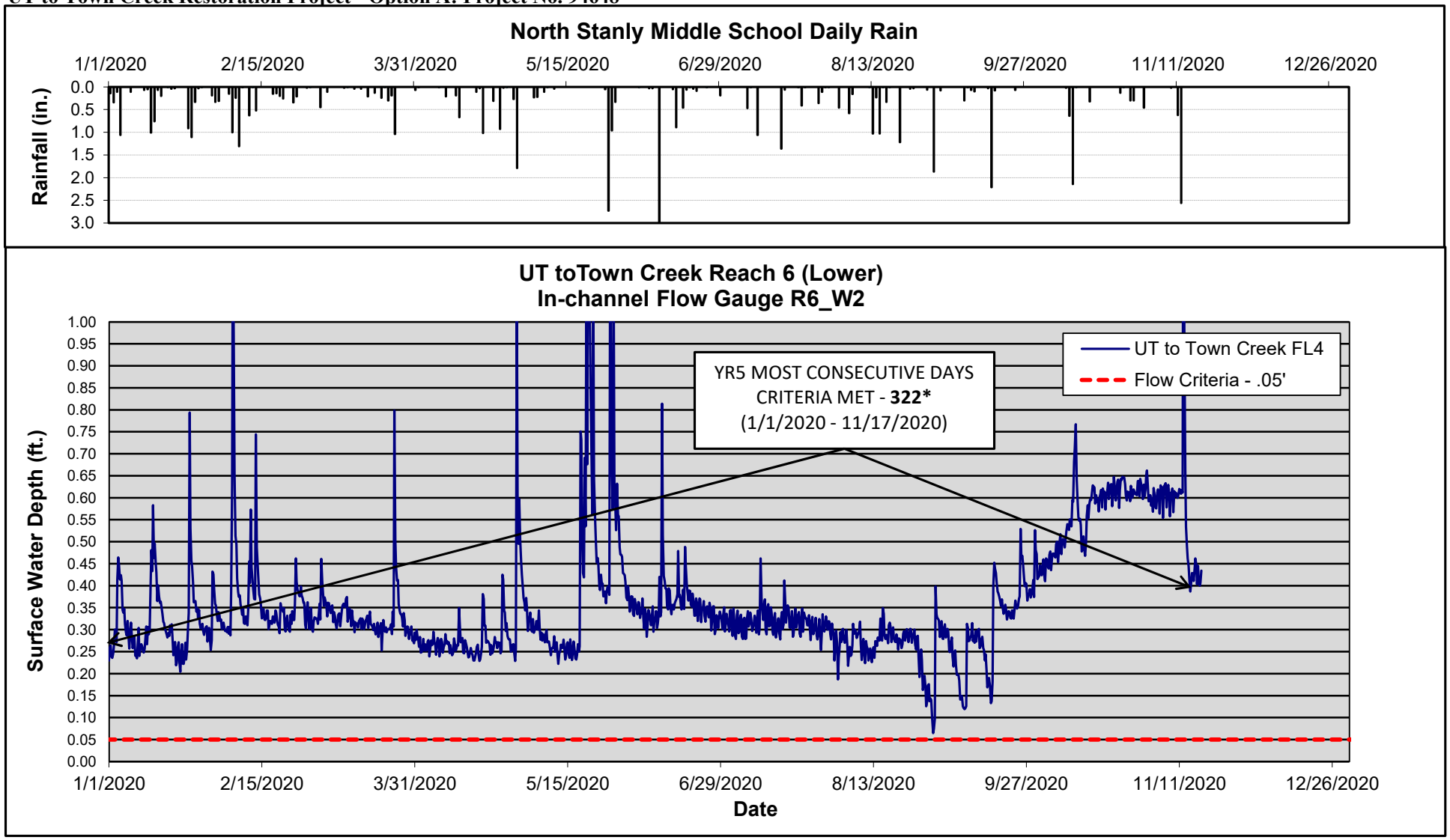
* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 7 Cont. In-stream Flow Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 7 Cont. In-stream Flow Gauge Graphs
UT to Town Creek Restoration Project - Option A: Project No. 94648



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Table 12. Wetland Restoration Area Well Success
UT to Town Creek Restoration Project - Option A: Project No. 94648

Well ID	Automated Well Type	Wetland Mitigation Type	*Percentage of Consecutive Days <12 inches from Ground Surface[1]	Most Consecutive Days Meeting Criteria[2]	*Percentage of Cumulative Days <12 inches from Ground Surface[1]	Cumulative Days Meeting Criteria[3]	Number of Instances where Water Table rose to <12 inches from Ground Surface[4]
Cross-sectional Well Arrays							
UTTC AW1	Reference	Jurisdictional	100.0	222.0	100.0	222.0	1
UTTC AW2	Groundwater	Restoration	100.0	222.0	100.0	222.0	1
UTTC AW3	Groundwater	Restoration	54.5	121.0	95.0	211.0	7
UTTC AW4	Groundwater	Restoration	100.0	222.0	100.0	222.0	1
UTTC AW5	Groundwater	Creation	100.0	222.0	100.0	222.0	1
UTTC AW6	Reference	Jurisdictional	100.0	222.0	100.0	222.0	1
UTTC AW7	Groundwater	Restoration	100.0	222.0	100.0	222.0	1
UTTC AW8	Groundwater	Restoration	35.6	79.0	83.8	186.0	9
UTTC AW9	Groundwater	Creation	54.5	121.0	95.5	212.0	6
UTTC AW10	Groundwater	Creation	100.0	222.0	100.0	222.0	1

Notes:

[1]Indicates the percentage of most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface.

[2]Indicates the most consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[3]Indicates the cumulative number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[4]Indicates the number of instances within the monitored growing season when the water table rose to 12 inches or less from the soil surface.

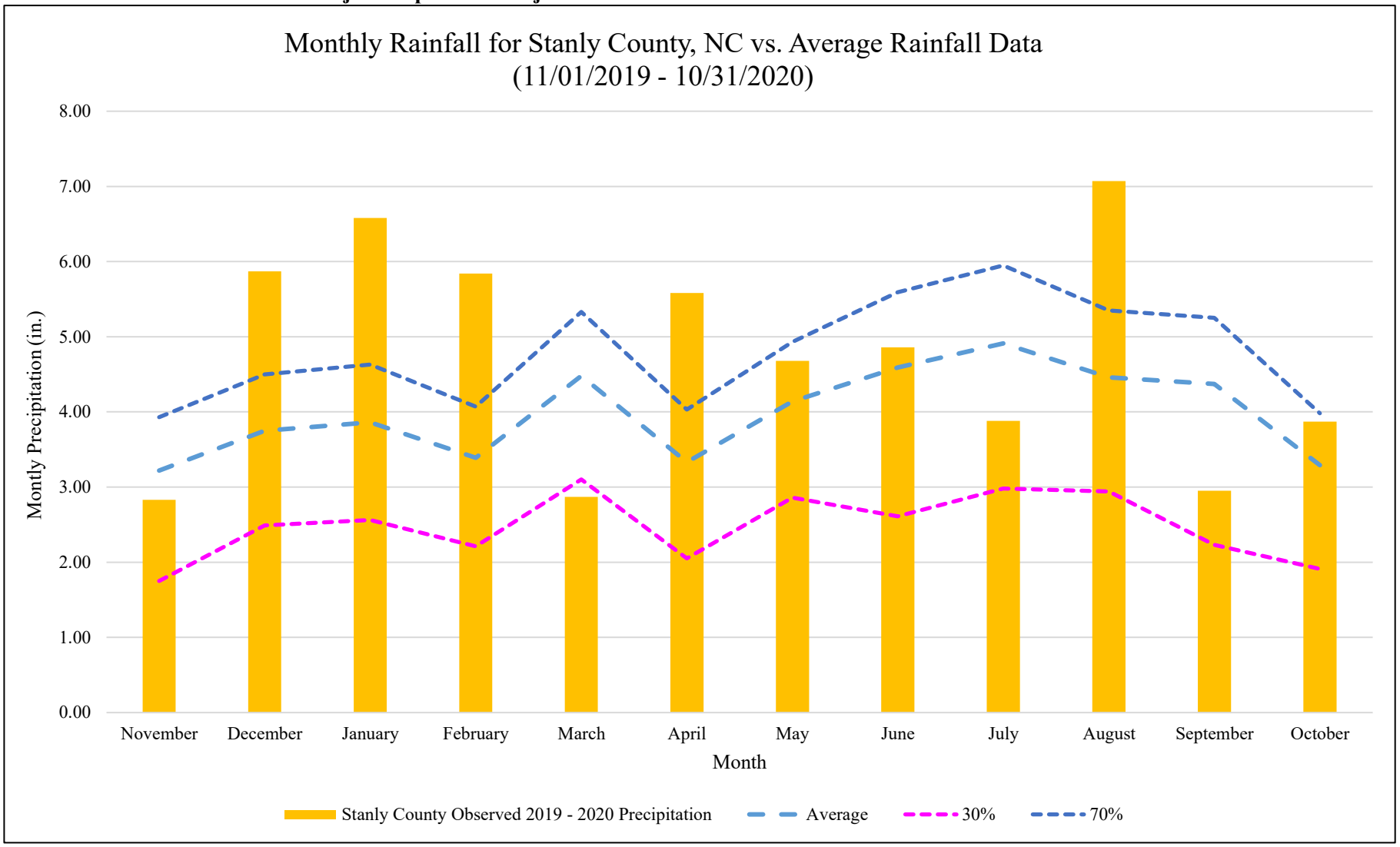
Growing season for Stanly County is from March 27 to November 5 and is 222 days long.

Growing season percentage for success is 9% of 222 days = 20 days; where water table is 12 inches or less from the ground surface

HIGHLIGHTED indicates wells that *did not* to meet the success criteria for the most consecutive number of days within the monitored growing season with a water 12 inches or less from the soil surface.

All In-Situ groundwater monitoring dataloggers were installed by 3/27/2016. Installation of the dataloggers was completed following construction in Spring 2016 when groundwater levels are normally closer to the ground surface.

Figure 8. Monthly Rainfall Data
UT to Town Creek Restoration Project - Option A: Project No. 94648



Historic rainfall data from WETS Station : ALBEMARLE, NC0090

Observed 2019 - 2020 Precipitaion from CHRONOS Station NEWL, North Stanly Middle School

Table 12a. Wetland Gauge Attainment Data
UT to Town Creek Restoration Project - Option A: Project No. 94648

Summary of Groundwater Gauge Results for MY1-MY5					
Gauge	**Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)**				
	MY 1 (2016)	**MY2 (2017)**	**MY3 (2018)**	**MY4 (2019)**	**MY5 (2020)**
UTTC AW1	No/10 days (5%)	Yes/25 days (12%)	Yes/ 110.0 days (49.5%)	Yes/ 114 days (51.1%)	Yes/ 222 days (100%)
UTTC AW2	Yes/218 days (100%)	Yes/218 days (100%)	Yes/ 115.5 days (52%)	Yes/ 95 days (42.6%)	Yes/ 222 days (100%)
UTTC AW3	Yes/188 days (86%)	Yes/218 days (100%)	Yes/ 73.5 days (33.1%)	Yes/ 64 days (28.6%)	Yes/ 121 days (54.5%)
UTTC AW4	Yes/200 days (92%)	Yes/218 days (100%)	Yes/ 97.5 days (43.9%)	Yes/ 67 days (30.0%)	Yes/ 222 days (100%)
UTTC AW5	No/10 days (5%)	Yes/25 days (12%)	Yes/ 79.5 days (35.8%)	Yes/ 69 days (30.9%)	Yes/ 222 days (100%)
UTTC AW6	Yes/218 days (100%)	Yes/218 days (100%)	Yes/ 108.5 days (48.9%)	Yes/ 116 days (52.0%)	Yes/ 222 days (100%)
UTTC AW7	Yes/188 days (86%)	Yes/218 days (100%)	Yes/ 222.0 days (100%)	Yes/ 186 days (83.6%)	Yes/ 222 days (100%)
UTTC AW8	Yes/200 days (92%)	Yes/218 days (100%)	Yes/ 52.0 days (23.4%)	Yes/ 51 days (22.7%)	Yes/ 79 days (35.6%)
UTTC AW9	Yes/188 days (86%)	Yes/218 days (100%)	Yes/ 72.5 days (32.7%)	Yes/ 63 days (28.2%)	Yes/ 121 days (54.5%)
UTTC AW10	Yes/200 days (92%)	Yes/218 days (100%)	Yes/ 82.5 days (37.2%)	Yes/ 90 days (40.3%)	Yes/ 222 days (100%)
*Gauge 1 and 5 were not working properly during much of the 2016 growing season.					
**Growing season percentage for success is 9% of 222 days = 20 days					

Table 13. Verification of In-stream Flow Conditions UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648			
	Flow Gauge ID	**Consecutive Days of Flow[1]**	**Cumulative Days of Flow[2]**
Monitoring Year 1	**Reach 7 Flow Gauges**		
	R7_W1	22.0	80.0
	R7_W2	76.0	134.0
	Reach 6 Flow Gauges		
	R6_W1	47.0	74.0
	R6_W2	50.0	140.0
Monitoring Year 2	**Reach 7 Flow Gauges**		
	R7_W1	73.0	156.0
	R7_W2	117.0	190.0
	Reach 6 Flow Gauges		
	R6_W1	67.0	168.0
	R6_W2	204.0	204.0
Monitoring Year 3	**Reach 7 Flow Gauges**		
	R7_W1	42.0	191.0
	R7_W2	140.0	246.0
	Reach 6 Flow Gauges		
	R6_W1	110.0	193.0
	R6_W2	162.0	278.0
Monitoring Year 4	**Reach 7 Flow Gauges**		
	R7_W1	141.0	150.0
	R7_W2	165.0	182.0
	Reach 6 Flow Gauges		
	R6_W1	129.0	153.0
	R6_W2	148.0	180.0
Monitoring Year 5	**Reach 7 Flow Gauges**		
	R7_W1	110.0	220.0
	R7_W2	214.0	301.0
	Reach 6 Flow Gauges		
	R6_W1	183.0	185.0
	R6_W2	322.0	322.0

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 0.05 feet in depth.

Table 14. Verification of Bankfull Events UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648				
Date of Data Collection	**Date of Occurrence**	**Method**	**Gauge Height (FT)**	**Photo # (if available)**
1/25/2017	Between 11/3/2016 and 1/25/2017	Crest Gauge	0.08	N/A
5/3/2017	Between1/25/2017 and 5/3/2017	Crest Gauge	0.11	N/A
6/6/2018	Between 4/18/18 and 6/6/2018	Crest Gauge	0.83	Crest Gauge Photos MY3-1,
8/23/2018	Between 6/6/2018 and 8/23/2018	Crest Gauge	0.99	Crest Gauge Photos MY3-3,
9/26/2018	Between 8/23/2018 and 9/26/2018	Crest Gauge	1.68	Crest Gauge Photos MY3-5,
11/14/2018	Between 9/26/2018 and 11/14/2018	Crest Gauge	1.24	Crest Gauge Photos MY3-7,
3/20/2019	Between 1/11/2019 and 2/24/2019	Crest Gauge	0.57	Crest Gauge Photos MY4-1
10/30/2019	Between 8/14/2019 and 8/22/2019	Crest Gauge	0.34	Crest Gauge Photos MY4-2
2/24/2020	Between 1/25/2020 and 2/8/2020	Crest Gauge	1.04	Crest Gauge Photos MY5-1
11/18/2020	11/12/2020	Crest Gauge	1.39	Crest Gauge Photos MY5-2

Appendix F
IRT Meeting Minutes

Michael Baker
INTERNATIONAL

Meeting Minutes

UT to TOWN RESTORATION PROJECT

DMS Project ID. 94648
NC DEQ Contract# 003277
USACE Action ID: 2008-02655
Yadkin Pee-Dee River Basin: 03040105060040

Date Prepared:	June 13, 2019
Meeting Date, Time, Location:	June 11, 2019, 2:00 PM On-site (Stanly County, NC)
Attendees:	USACE – Todd Tugwell, Steve Kichefski DWR – Mac Haupt DMS – Matthew Reid, Paul Wiesner Baker – Drew Powers, Katie McKeithan, Scott King
Subject:	Credit release site walkover with IRT
Recorded By:	Drew Powers, Katie McKeithan, Scott King

An on-site meeting was held on June 11th, 2019 at 2:00 PM to discuss UT to Town Restoration Project (Full Delivery) in Stanly County, NC. The purposes of this meeting were to:

1. Discuss credits to be released and to get ready for project closeout; and
2. Identify and discuss potential concerns/issues based on field observations.

General recent weather conditions have been hot and dry for several weeks in the area apart from a few recent afternoon showers.

The group met at the entrance of the path leading to the site off Old Salisbury Road (in the middle of the project) in Albemarle, NC. A general site overview and map orientation was provided and discussed.

Reach 4

The group then started walking into the site towards the top of Reach 4 to discuss the intermittent flow and overall condition of the wetland BMP. Upon assessing Reach 4 it was noted that there was minimum vegetation growing in the stream bed and sediment is being flushed out of the system. Mac, Todd, and Steve discussed with Scott that it will be helpful to install either a flow gauge or flow camera to help document the flow of Reach 4 and 5, about ¾ of the way up each reach.

We then walked up the reach to look at the BMP. It was commented that the concrete level spreaders are no longer the preferred method for BMP outlets, but that it appears to be functioning well. There was a significant amount of clear, standing water present within the deep pool section of the BMP. No gullies or rills were observed flowing into the BMP, and established vegetation is present all around the BMP. Upon observation in this low-water condition the group did not feel the functioning of the BMP was threatened by excess sedimentation and no maintence was suggested. The group did express some

concern that the BMP was fairly deep, and that it may be reducing the amount of water flowing into its downstream system.

We then walked downstream to the confluence of Reaches 4 and 5 to look at the flow gauge and it the stream condition. There was no water present in the stream, but staining on the PVC pipe and streambed along with a general lack of streambed vegetation implies that water is routinely in the channel.

Reach 6

The group congregated at the pipe crossing where Travis Wilson (WRC) had a concern with the installation of the pipe. In the as-built plans it was noted that the pipe was installed on top of bedrock; and therefore the pipe is perched above the downstream water surface. DMS, USACE, and DWR all agreed that there is not much that we can do about the situation now and that resetting the pipe would not be needed. It was also commented that for future sites that a bottomless pipe could be a good option, though the general consensus was that in this specific case it does not appear that would have helped as the native bedrock in this section appears to be naturally perched in this location. The group continued down the reach to the confluence of Reach 6 and 3.

Reach 3

When looking at Reach 3 it was commented that the vegetation looked good, especially for the slate belt region. It was apparent that many of the trees were growing with good height for a 4-year project and the smaller trees were ones that were supplemental planted in 2018. A bare area located on the left bank at the bottom of Reach 3 was noted in the MY3 report shown as a vegetation problem area (VPA). We commented that we have reseeded and replanted it and will continue to monitor this area. Mac took a soil sample on the left flood plain in a wetland area upstream of the confluence with Reach 6 and down to ~6 inches did not see the expected hydric soils. He commented that we will need to revisit the site and do a thorough inspection of our wetland boundaries prior to closeout, adjusting the exact, final boundaries to our field assessments. Mac pointed out that final boundaries may have shifted some and pointed out areas that looked wetter near where he took his soil boring. Todd then inspected nearby Well 5 and saw no issues with the installation of the well and measured 11 inches to water surface in the well. Mac did another soil sample near the well and saw very hydric soils throughout the sample. Paul stated that the well success criteria is 9% and all wells for this site have met that criteria for all monitoring years. We then walked upstream to the double culverts located at the break of Reach 2 and 3 where Todd and Mac commented that they did not like how wide the downstream section of channel was constructed and asked this be avoided in the future. However, we showed that both the construction and as-built plans indicated it was built as designed and the stream was stable. It was noted that this section of channel is all bedrock.

Paul Wiesner pointed out that problem areas of invasive species (privet and parrot feather) were noted in the MY3 report, primarily along sections of the main channel. We replied that two treatment efforts have been made so far this year starting in March 2019 to address all invasive species throughout the site, and we plan to continue to monitor and treat these species for the life of the project.

Reach 7

The group then headed to Reach 7 to inspect the intermittent channel and wetland BMP. Towards the middle of the reach water was flowing in the channel with good vegetation establishing along the banks

and within the buffer. We then walked to the top of the reach to the BMP. Harry had commented on the MY3 report that he had observed turbid water and potential sedimentation following a rain event during his winter inspection, and asked how Michael Baker planned to monitor the BMP for any potential maintenance needs. The group inspected the BMP under the current, low water-level conditions and noted that the there is only a small amount of sediment (roughly 6" of a primarily silt/clay material) captured in the deeper pool portion of the BMP. The standing water that was present at the bottom of the pool was quite turbid. However, after observation in this low-water condition the group did not feel the functioning of the BMP was threatened by excess sedimentation and no maintence was suggested at this time. No gullies or rills were observed flowing into the BMP, and established vegetation is present all around the BMP. Scott explained that both of the project BMPs were designed to a depth in anticipation of some sedimentation for the period after construction before vegetation could establish when some amount of erosion can usually be expected. Scott also mentioned that we will keep an eye on the sedimentation/fill and confirm that ample storage room is maintained within both of the project BMP's. We can do that through visual inspections in the dry season when remaining storage capacity can be directly observed. The group also expressed some concern that the BMP may be reducing the amount of water flowing into its downstream system, though given the flowing water observed in the channel downstream this was not as much of a concern here.

Paul brought up that it was noted on the MY3 report that a tree or two was down on Reach 1 and we confirmed that they have been cleaned up and that all fencing is in good condition.

This concluded the walkover and below are a few notes that were discussed back at the vehicles before departure.

- Credit release: Todd and Mac agreed to all credits being released for MY3
- A gauge or flow camera should be installed on Reach 4 and 5 (about ¾ of the way up)
- The wetland boundaries need to be re-evaluated to represent the actual boundaries in the field, particularly with regard to hydric soil formation
- The pipe crossing on Reach 6 is sufficient
- A photo point of each project culvert location will be added to the monitoring report

This represents Michael Baker Engineering's best interpretation of the meeting discussions. If anyone should find any information contained in these meeting notes to be in error and/or incomplete based on individual comments or conversations, please notify me with corrections/additions as soon as possible.

Most sincerely,

Andrew Powers
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Cary, NC 27518
Phone: 919-481-5732
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Appendix G
Wetland Boundary Adjustment

Michael Baker
INTERNATIONAL

Memorandem

UT to Town Creek Restoration Project: Wetland Boundary Adjustment

DMS Project ID. 94648
NC DEQ Contract# 003277
USACE Action ID: SAW-2013-01280, DWR# 14-1024
Yadkin Pee-Dee River Basin: 03040105-060040

Date Prepared:	January 15, 2021
Subject:	Wetland boundary adjustments for upcoming project closeout
Recorded By:	Scott King, LSS, PWS

The UT to Town Creek Restoration Project proposed to restore a total of 2.56 acres of wetlands and create an additional 1.56 acres of wetlands within the floodplains along both sides of Reaches 1, 2, and 3 (see Figure 1). The groundwater well monitoring conducted over the previous five years has demonstrated that all the wetlands have clearly met the hydrology success criteria of 9% as stated in the mitigation plan (often by a substantial number of days). However, during the IRT field visit on 6/11/19 a few soil borings dug in the general vicinity of groundwater well #4 appeared to be more marginal to upland in appearance. The borings were dug in this location as the area appeared to be less 'wet' overall than the rest of the surrounding wetland area. The IRT suggested conducting a closer review of the wetlands prior to closeout to adjust the boundary as needed. It was suggested that while some of the area of concern seemed likely to be removed as credited wetland, there certainly appeared to be wet areas adjacent to these potentially removed areas. The IRT encouraged Baker to look for and add any new wetland areas to potentially make up for any upland area that required removal.

As such, Baker conducted a field inspection on 1/12/21 of the wetlands along the floodplain of Reaches 2 and 3 for the purpose of making appropriate adjustments the final credited wetland boundary. This field review used a range of data in its evaluation including soil borings captured by GPS, on-site vegetation assessment, and hydrologic field indicators (observed water tables, standing water, staining, etc). The vegetation found throughout the floodplains of Reaches 1, 2, and 3 appears to be dominated by hydrophytic species, while as mentioned previously the groundwater well data for the wetlands have clearly met the success criteria. Thus, the wetland boundary adjustment effort focused on (though was by no means exclusive to) the hydric soil wetland parameter.

The area questioned by the IRT around groundwater well #4 and the nearby confluence of Reaches 2 and 6 was easily located and is roughly 3,000 ft^2 (0.069 ac) in size. The area was closely inspected to evaluate the soils and overall classification as a wetland. The area is not as thick in vegetation as the surrounding wetland area, though there are still abundant soft rush, sedges, and assorted shrubs and herbaceous vegetation growing here. Pockets of shallow standing water were observed throughout. The soil was found to be fairly dense and gravelly, though hydric soil indicators were clearly present for much of the area. The notable exception was found in a bend on the left bank of Reach 2 opposite of well #4 (see Figure 2). In this area of proposed wetland Restoration, roughly 2,000 ft^2 in size, much

more marginal hydric and upland soils were observed. There is a clear break observed towards the back of this bend where the soils shift dramatically to being much more hydric, with standing water much more pronounced. It is believed that this is the actual area where Mac Haupt first questioned the soils during the IRT walkover on 6/11/19. This area was subsequently removed from the credited wetland Restoration acreage.

The remainder of the floodplain on lower Reaches 2 and 3 were inspected to determine if any additional area could be added to the credited wetlands. During the course of the field assessment, a relatively clear visual wetland boundary was apparent running roughly along the outer floodplain edge, a boundary that extended out past existing wetland Restoration and Creation areas. A few seeps were detected along the side-slopes outside the floodplain as well. Large portions of this newly added area were quite wet, with extensive standing water and very hydrophytic vegetation including rushes, sedges, buttonbush, silky dogwood, black willow, and tag alder. Strong hydric soils were observed throughout this area as well (see attached photo-log) These wetlands were added to the project credited area as Creation at the established 3:1 ratio.

In the office, the soil boring GPS points were imported into GIS for further desktop analysis. Using these points along with recent aerial imagery and the as-built baseline topographic contour data, new wetland boundaries were drawn for the revised restoration and creation wetland areas. The new adjusted boundary appears to generally follow the contour break between the relatively flat floodplain and the outer side-slopes fairly well (as was observed in the field), with a few obvious seeps clearly observed along the side-slopes. The new boundary also appears to follow visual indicators shown in the most recent aerial photograph from 2019.

The new revised wetlands on the project total 2.415 acres for the Restoration component and 2.449 acres for the Creation component, for a total of 3.231 Riparian Wetland Credits. See revised project credits detailed in the table below:

Table 1. Adjusted Wetland Areas

	Area (ac)	Ratio	Credits
Original Wetlands			
Riparian, Restoration	2.56	1:1	2.560
Riparian, Creation	1.56	3:1	0.520
		Total Credits	3.080
Adjusted Wetlands			
Riparian, Restoration	2.415	1:1	2.415
Riparian, Creation	2.449	3:1	0.816
		Total Credits	3.231
		Riparian Wetland Credit Difference	**0.151**

Additionally, in late autumn of 2019 Baker staff had previously confirmed that hydric soils were present in both the wetland Restoration and Creation areas along Reach 1 and upper Reach 2 (above the culvert crossing). However, no effort was made to expand the wetland boundaries in these locations as the IRT had suggested in the field visit that the most promising areas were likely to be found in the lower portion of the project. No GPS points were collected during this previous confirmation effort.

It should also be noted that there are an additional ~1 acre of existing jurisdictional wetlands that were enhanced for *no credit* on the project. These wetlands had cattle excluded, were planted, and almost certainly experienced improved hydrology along with the adjacent restored wetlands.

Most sincerely,

Scott King, LSS, PWS

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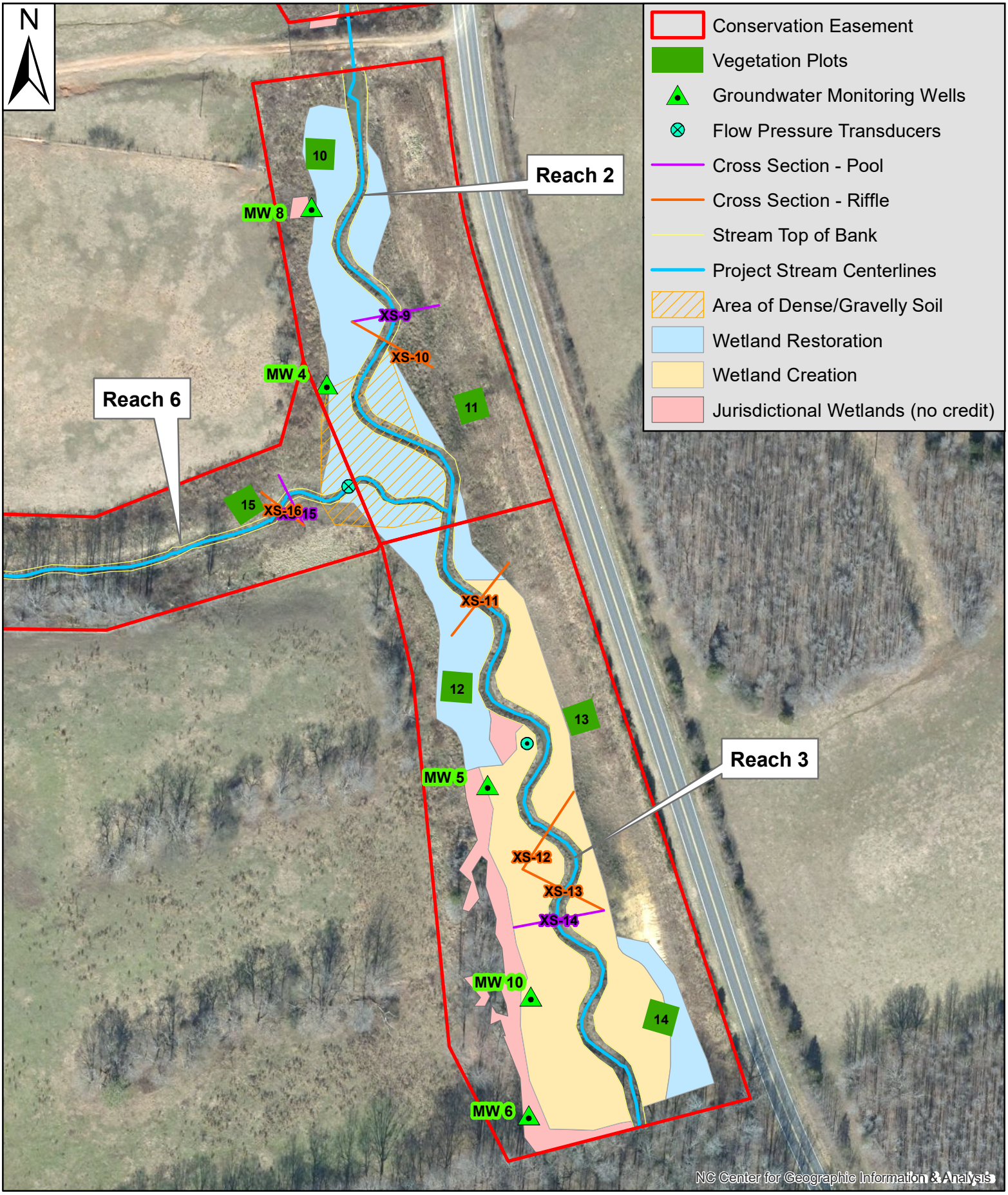
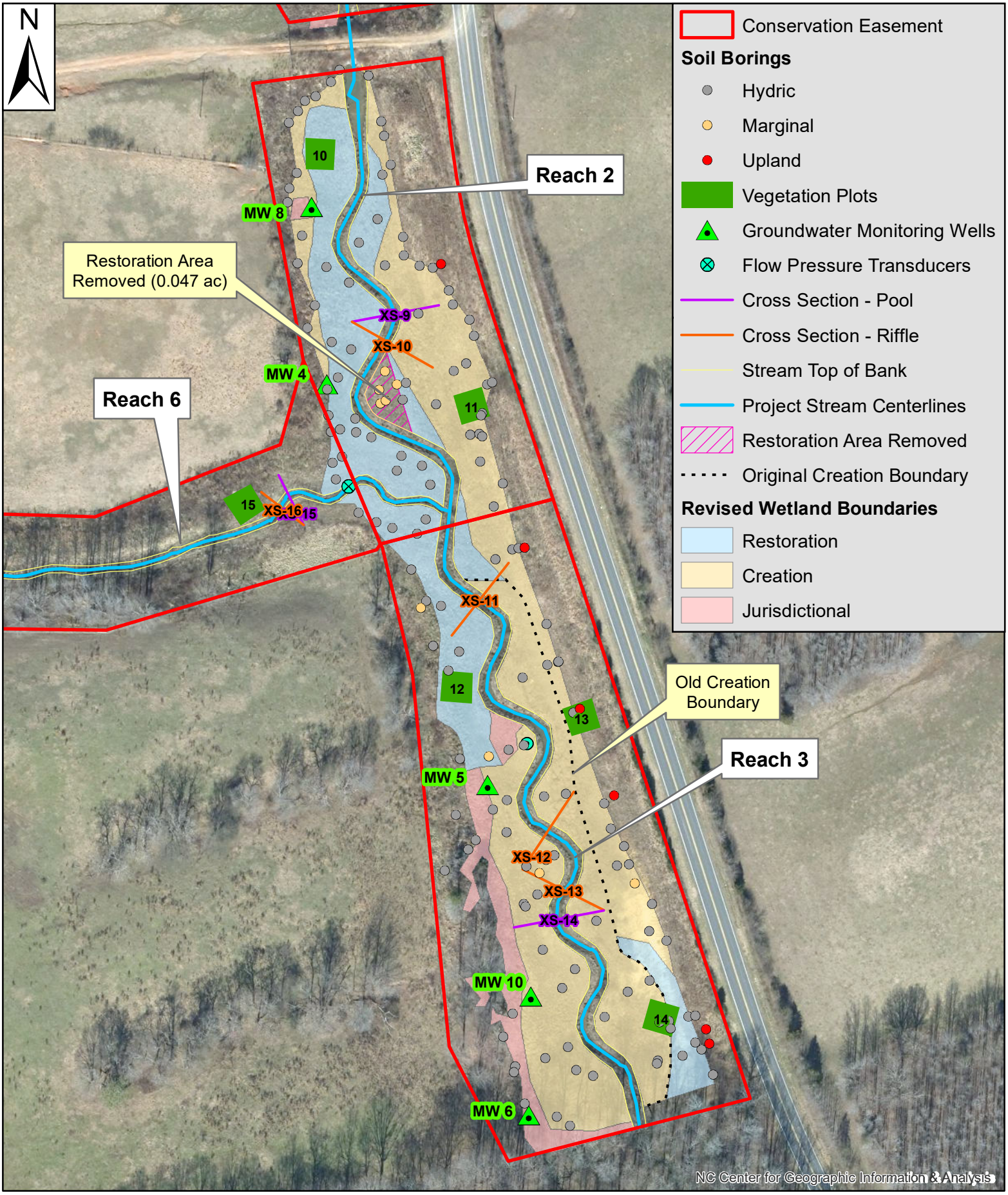
919-219-6339 [M]



Michael Baker INTERNATIONAL

0 50 100 200 300 Feet

Figure 1.
UT to Town Creek
Orginal Wetland Boundaries



Michael Baker INTERNATIONAL

0 50 100 200 300 Feet

Figure 2.
UT to Town Creek
Wetland Boundary Adjustment

UT to Town Creek: Wetland Boundary Adjustment Photographs (1/12/21)

Soft rush in area with shallow standing water

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

UT to Town Creek: Wetland Boundary Adjustment Photographs (1/12/21)

Hydric soil

Hydric Soil

Wetland vegetation and standing water in floodplain

Hydric soil

Sedges and shallow standing water in floodplain

Hydric soil

UT to Town Creek: Wetland Boundary Adjustment Photographs (1/12/21)

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

UT to Town Creek: Wetland Boundary Adjustment Photographs (1/12/21)

Wetland vegetation and standing water in floodplain

Wetland vegetation and standing water in floodplain

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

UT to Town Creek: Wetland Boundary Adjustment Photographs (1/12/21)

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil

Wetland vegetation and standing water in floodplain

Hydric soil