| | | | | | |
|---|---|---|---|---|---|
| **Mitigation Project Name** | UT to Town Creek Stream and Wetland Restoration Site | **County** | Stanly | **USACE Action ID** | 2013-01280 |
| **DMS ID** | 94648 | **Date Project Instituted** | 8/20/2010 | **NCDWR Permit No** | 2014-1024 |
| **River Basin** | Yadkin | **Date Prepared** | 8/27/2018 | | |
| **Cataloging Unit** | 03040105 | | | | |

| Credit Release Milestone | Stream Credits | | | | | | Wetland Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Scheduled Releases (Stream) | Warm | Cool | Cold | Anticipated Release Year (Stream) | Actual Release Date (Stream) | Scheduled Releases (Forested) | Riparian Riverine | Riparian Non-riverine | Non-riparian | Scheduled Releases (Coastal) | Coastal | Anticipated Release Year (Wetland) | Actual Release Date (Wetland) |
| Potential Credits (Mitigation Plan) | | 6,403.600 | | | | | | 3.080 | | | | | | |
| Potential Credits (As-Built Survey) | | 6,444.484 | | | | | | 3.080 | | | | | | |
| Potential Credits (IRT Approved)* | | 6,403.600 | | | | | | 3.080 | | | | | | |
| 1 (Site Establishment) | N/A | | | | N/A | N/A | N/A | | | | N/A | | N/A | N/A |
| 2 (Year 0 / As-Built) | 30% | 1,933.345 | | | 2016 | 12/22/2016 | 30% | 0.924 | | | 30% | | 2016 | 12/22/2016 |
| 3 (Year 1 Monitoring) | 10% | 644.448 | | | 2017 | 10/20/2017 | 10% | 0.308 | | | 10% | | 2017 | 10/20/2017 |
| IRT Adjustment* | | -16.354 | | | | 8/13/2018 | | | | | | | | |
| 4 (Year 2 Monitoring) | 10% | 640.360 | | | 2018 | 8/13/2018 | 10% | 0.308 | | | 15% | | 2018 | 8/13/2018 |
| 5 (Year 3 Monitoring) | 10% | | | | 2019 | | 15% | | | | 20% | | 2019 | |
| 6 (Year 4 Monitoring) | 10% | | | | 2020 | | 5% | | | | 10% | | 2020 | |
| 7 (Year 5 Monitoring) | 15% | | | | 2021 | | 15% | | | | 15% | | 2021 | |
| 8 (Year 6 Monitoring) | n/a | | | | N/A | | 5% | | | | N/A | | N/A | |
| 9 (Year 7 Monitoring) | n/a | | | | N/A | | 10% | | | | N/A | | N/A | |
| Stream Bankfull Standard | 15% | 960.540 | | | 2018 | 8/13/2018 | N/A | | | | N/A | | N/A | |
| Total Credits Released to Date | | 4,162.340 | | | | | | 1.540 | | | | | | |

*NOTE: Adjustment required due to IRT concerns on how the as-built credits were calculated
08/13/2018: Adjustments to the original ledger were necessary to accurately account and show the Bonus credits associated with this project.

DEBITS (released credits only)

| | | | Ratios | 1 | 1 | 2.5 | 1 | 1 | 3 | 2 | 5 | 1 | 3 | 2 | 5 | 1 | 3 | 2 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Stream Restoration | Stream Enhancement I | Stream Enhancement II | Stream - BONUS | Riparian Restoration | Riparian Creation | Riparian Enhancement | Riparian Preservation | Nonriparian Restoration | Nonriparian Creation | Nonriparian Enhancement | Nonriparian Preservation | Coastal Marsh Restoration | Coastal Marsh Creation | Coastal Marsh Enhancement | Coastal Marsh Preservation |
| IRT Approved As-Built Amounts (feet and acres) | | | | 5,554.000 | 447.000 | 344.000 | 0.000 | 2.560 | 1.560 | | | | | | | | | | |
| IRT Approved As-Built Amounts (mitigation credits) | | | | 5,554.000 | 447.000 | 137.600 | 265.000 | 2.560 | 0.520 | | | | | | | | | | |
| Percentage Released | | | | 65% | 65% | 65% | 65% | 50% | 50% | | | | | | | | | | |
| Released Amounts (feet / acres) | | | | 3,610.100 | 290.550 | 223.600 | 172.250 | 1.280 | 0.780 | | | | | | | | | | |
| Released Amounts (credits) | | | | 3,610.100 | 290.550 | 89.440 | 172.250 | 1.280 | 0.260 | | | | | | | | | | |
| NCDWR Permit | USACE Action ID | Project Name | | | | | | | | | | | | | | | | | |
| | 2010-01630 | NCDOT TIP P-5208A / C / G | | | | | | 0.430 | | | | | | | | | | | |
| 2002-0672 | 2009-00876 | NCDOT R-2559 / R-3329 - Monroe Bypass & Connector, Union County | | | | | | 0.338 | 0.468 | | | | | | | | | | |
| 2011-0431 | 2011-01237 | NCDOT TIP R-2248E - Charlotte Outer Loop | | 2,221.600 | 178.800 | 137.600 | | 0.256 | 0.156 | | | | | | | | | | |
| 2011-0431 | 2011-01237 | NCDOT TIP R-2248E - Charlotte Outer Loop | | 122.354 | | | | 0.256 | 0.156 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Remaining Amounts (feet / acres) | | | | 1,266.146 | 111.750 | 86.000 | | 0.000 | 0.000 | | | | | | | | | | |
| Remaining Amounts (credits) | | | | 1,266.146 | 111.750 | 34.400 | | 0.000 | 0.000 | | | | | | | | | | |

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:

1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 15% reserve of credits is to be held back until the bankfull event performance standard has been met

# UT to Town Creek Restoration Project – Option A
# Year 3 Monitoring 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: 3 of 7<br>Year of Data Collection: 2018<br>Year of Completed Construction: 2016<br>Submission Date: December 2018 |
| Submitted To: | NCDEQ – Division of Mitigation Services<br>1625 Mail Service Center<br>Raleigh, NC 27699<br>NCDEQ Contract ID No. 003277 |

# UT to Town Creek Restoration Project – Option A
# Year 3 Monitoring 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

Michael Baker
INTERNATIONAL

We Make a Difference

December 31, 2018

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

**Subject:** Task 9: Annual Final Monitoring Report – Monitoring Year 3 & Response to Comments
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 3 Monitoring Report and our responses to the Division of Mitigation Services (DMS) review comments received on December 14, 2018 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 3 Monitoring Document, as needed. Each response has been grouped with its corresponding comment and is outlined below.

**DMS Field Visit (10/30/2018)**

**Invasive vegetation –** Invasive vegetation continue to be a problem (mostly Chinese privet, multiflora rose; also small cattail areas but these will grow quickly). Some privet 10-12 feet tall. While this report indicates ongoing treatment, DMS recommends aggressive site wide treatment soon, followed by periodic spot checks, to prevent biomass form getting even larger.

***Response –*** *As previously discussed, Michael Baker acknowledges that invasive exotic species do continue to persist throughout the site. Multiple site-wide and spot treatment herbicidal control applications in the form of both cut and paint as well as foliar spray have been conducted throughout the site during MY1 – MY3. As requested, Michael Baker plans to continue to conduct these site-wide and spot treatments throughout the remaining monitoring years for exotic invasive species. Additionally, DMS noted areas of concern have been added to the MY3 documented vegetative problem areas (VPAs) to ensure that these areas are not overlooked in the future.*

**Parrot feather** – Parrot feather along the main stem. Thank you for initiating contact with NCDEQ on feasible treatment alternatives. Please keep us updated on what is decided.

***Response –*** *As requested, Michael Baker will update DMS with recommendations made by the NCDEQ's Aquatic Weed Control Program for the control of parrot feather in a live stream.*

**Flow Status of Reach 4 & 5** – Flow status of reaches 4 and 5; last year I recommended putting a flow gage on reach 4 (E1 reach). The flow looked a little better this year, but it has been a high flow year. I would still recommend adding a gauge and/or camera on this reach to document flow since the channel was hydrologically modified with the BMP pond.

***Response –*** *Michael Baker understands your concern; however, this is common for intermittent Piedmont streams that lie within or near the Slate Belt and the inclusion of a flow gauge on Reach 4 was not required as part of the Mitigation Plan for the project; therefore, Michael Baker will continue to evaluate and consider this request*.



Michael Baker Engineering, Inc.
Ballantyne One, 15720 Brixham Hill Avenue, Suite 300; Office 336
Charlotte, NC 28277 | Office: 704.665.2200

**Bare areas** – Bare areas / little or no riparian vegetation towards the lower end of the main channel.

***Response –*** *As previously stated, additional bare root and potted plantings were installed at a planting density of 640 plants/ac in bare areas throughout the site in March 2018. These areas totaled over 1 acre and included the downstream section along Reach 3. The planting areas have been depicted on the CCPV maps for MY3 and noted as VPAs in Table 6a and 6b. As for herbaceous species, post-construction applications of herbaceous seed mix along with compost and mulch do not take. We have tried them in the past on this project as well as others within the Slate Belt. The hard pan rocky soils are not conducive for post-construction applications, even if you try to scarify the soil. They seed but the medium just gets washed off site during the next rain event. Therefore, we have planted woody species in the hope that they take and will provide shade and an input of organic material that will allow for some of the existing herbaceous veg to spread to this area. We plan to keep an eye on these areas.*

**Fallen Trees** – Trees fallen up to stream bank along Reach 1; keep an eye on, address as necessary if it causes an erosion problem.

***Response –*** *We acknowledge this issue, will monitor the area, and will address the issue as needed to maintain stabilization and minimize erosion.*

**MY03 Report Comments/Concerns:**

**Wetland Gauge Attainment Table** – Wetland Gauge Attainment Table is missing.

Table 13. – Wetland gauge attainment data

Summary of Groundwater Gauge Results for Years 1 through 5

| Gauge | Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage) | | | | |
|---|---|---|---|---|---|
| | Year 1 (2006) | Year 2 (2007) | Year 3 (2008) | Year 4 (2009) | Year 5 (2010) |
| GW1 | Yes/88 days (27.3 percent) | Yes/70 days (20.7 percent) | Yes/91 days (27.9 percent) | | |
| GW8 | Yes/37 days (11.5 percent) | No/25 days (8.5 percent) | Yes/88 days (26.4 percent) | | |
| GW7 | Yes/89 days (28.5 percent) | Yes/70 days (20.7 percent) | Yes/90 days (27.1 percent) | | |
| GW6 | Yes/88 days (28.1 percent) | Yes/70 days (20.7 percent) | Yes/89 days (26.8 percent) | | |
| GW9 | Yes/38 days (11.7 percent) | No/24 days (8.0 percent) | Yes/89 days (26.8 percent) | | |
| GW14 | No/7 days (2.0 percent) | No/3 days (2.1 percent) | No/14 days (3.8 percent) | | |
| GW13 | No/2 days (0.8 percent) | No/1 day (0.4 percent) | No/4 days (1.7 percent) | | |
| GW12 | No/5 days (2.1 percent) | No/5 days (2.1 percent) | No/8 days (3.3 percent) | | |
| GW11 | No/4 days (1.5 percent) | No/1 day (0.4 percent) | No/6 days (2.7 percent) | | |
| GW14 | No/18 days (7.4 percent) | No/14 days (5.8 percent) | Yes/34 days (23.1 percent) | | |
| GW13 | No/24 days (9.9 percent) | No/34 days (15.8 percent) | Yes/74 days (50.4 percent) | | |

While report Table 12 summarizes the current year's data nicely, the table above shows the performance over time, at-a-glance.

***Response –*** *A wetland summary table (Table 12a) depicting yearly monitoring results for all 10 wetland gauges has been added to the report, and the report text has been revised as needed.*

**Table 1** – Table 1 indicates that additional buffer credits (notes column) were approved by DMS on 6/21/18. The additional buffer credits cannot be approved by DMS; only the IRT has authority to approve additional stream credits due to wider buffer. In a 5/1/18 email I sent following the meeting, I summarized what was discussed at the meeting pertinent to the site, with regard to IRT-approved additional stream credits determined by the most recent buffer method, as well as parrot feather treatments. (a)Please review that email and address each concern noted; (b) Please update the table notes accordingly, and (c) in the overall assets summary, these should be noted as Additional Stream Credits (not "credited buffer") and footnoted to reference the IRT approval.

***Response –*** *Table 1 has been revised, referenced, and footnoted as requested.*

**Table 2** – This table should indicate the month-year of both stream monitoring (Oct 2018), and vegetation data collection (Sep 2018).

***Response –*** *As requested, Table 2 has been revised to include the month-year of both stream monitoring and vegetation data collection. Additionally, the revision was made for MY1 and MY2.*

**BMP monitoring** – It is indicated that "Maintenance measures will be implemented during the 5-year monitoring period to replace dead vegetative material and to remove excess sedimentation from permanent pools, as needed." How will permanent pool storage capacity be monitored using photo documentation as indicated? Excess sedimentation has been observed in the Reach 7 BMP pond following rain events (see photo I sent on 2/12/2018); it was noted at that time that Baker would consider excavating if this BMP were impacted by silt. How does Baker plan to monitor siltation over time in this BMP to guide any decision making?

***Response –*** *Michael Baker will monitor the BMP by measuring the accumulated silt elevation within the pond's permanent pool. When the elevation of the accumulated silt keeps the BMP from functioning, Michael Baker will have the sediment excavated. This text has been added to Section 2.4 in the monitoring report.*

**Table 6a** – Invasive Areas of Concern indicates 0 polygons and 0.00 combined acreage. Even if individual "polygons" are below the 1000 SF threshold, the acreage of invasives as a concern should not be zero, based on my field assessment. Please provider an accurate estimate of acreage needing treatment for this table, as the existing numbers indicate the site is invasive-free which is not the case. Similarly, Bare Areas and Areas of Poor Growth or Vigor (e.g., Reach 3) should be cataloged accordingly.

***Response –*** *Table 6a and Table 6b have been revised to include vegetative problem areas (VPAs) throughout the project area. Figures 2 through 2c have been updated to reflect VPA locations. The MY3 report text has been updated to reflect VPA corrections.*

**Cross section graphs** – should indicate whether it is a pool or a riffle. Understood that the x-section table has this information, but it also needs to be on the graphs so the reader can have some context without having to flip back and forth.

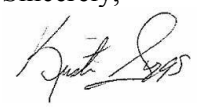
***Response –*** *The indication of whether the cross-section is a riffle or pool has been added to both the cross-section heading and the graph for each cross-section.*

**Crest gauge photos** – Suggest supplementing these photos with actual wrack line photos; crest gauges can vary in their reliability and wrack lines present a readily-identifiable means of photo documenting floodplain access.

***Response –*** *As requested, wrack line photo documentation has been included with each MY3 crest gauge photo to corroborate bankfull documentation.*

If you have any questions or concerns, please feel free to contact me at (704) 579-4828 or via my email address at ksuggs@mbakerintl.com.

Sincerely,



Kristi Suggs
Project Manager

Cc: File

# TABLE OF CONTENTS

# 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 3 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 3 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 (VP2-2) of sparse herbaceous vegetation has continued to persist from MY2. This area is located along Reach 3 near Vegetation Plot 14 and consists of approximately 0.11 acres. Areas of poor growth performance are present within the floodplains of Reach 1, 2, 3, and 6. Lack of herbaceous vegetation and poor growth performance is likely due to poor soils that are frequently inundated by overbank storm flows and offsite drainage.

Supplement planting was conducted in mid-March 2018 for VPA areas (VPA3-6 through VPA3-9) noted with poor growth performance. Planted species consisted of woody bare root and potted plantings that were installed at a planting density of 640 plans/acre. Their successful growth will provide shade and an input of organic material that will allow for some of the existing herbaceous veg to spread to this area. The planted species consisted of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), possumhaw viburnum (*Viburnum nudum*), and American beautyberry (*Callicarpa Americana*). Supplemental planting areas are mapped and are depicted in Figures 2 – 2c.

The presence of parrot feather (*Myriophyllum aquaticum*) throughout the mainstem (Reaches 1, 2, and 3) of the project have persisted; however, its abundance has been reduced. This is likely due to a wetter growing season and an increase in continuous base flow conditions. 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. Response from NCDEQ was recently received in early November 2018. Currently, Michael Baker and NCDEQ are discussing any potential control avenues available for the aquatic species in a live stream.

In MY3, a total of five discrete areas of invasive species were documented; however, none of the areas exceeded the mapping threshold of 1000 square feet (SF). These areas totaled approximately 0.14 acres or 0.6% of the easement area and consisted primarily of *Ligustrum sinese* (Chinese privet) along with *Rosa multiflora* (Multi-flora rose) and *Paulownia tomentosa* (princess tree). The presence of these invasive species continue to persist predominantly in areas of the easement where mature woody vegetation is present and along the easement fence line. Treatment control applications for invasive species were conducted in April and June of 2018 for areas of concern that were documented in MY2 as well as for areas that had re-sprouted from previous treatment applications. All invasive species will continue to be monitored throughout the site and treated as needed. Tables summarizing the vegetative assessment areas can be found in Appendix B.

Based on data collected from the twenty monitoring plots during Year 3 monitoring, the average density of total planted stems per plot ranges from 486 to 890 stems per acre with a tract mean of 644 stems per acre. Therefore, the Year 3 data demonstrate that the site has exceeded the minimum interim success criteria of 320 trees per acre by the end of Year 3 and is on track for meeting 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 VP1, VP4, VP5, VP6, VP7, VP10, VP12, VP14, VP15, VP18, and VP19; 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 3 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 3. Areas of concern consist of primarily of erosional features just downstream of the culverts at the head of Reach 1 and on Reach 6. These erosional impacts are likely the result of high flood velocities from large storm events, including two large hurricanes (Florence and Michael). Though impacts are visible, the stream seems to be structurally stable and vegetation should recolonize quickly. Additionally, an area of sill erosion (SPA2-1) documented on Reach 6 in MY2 has subsequently stabilized and is no longer of issue. No other areas of bank scour and/or erosion around structures were noted. 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. 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 and 3 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. During MY3, UTTC MW7 exhibited the highest percentage of consecutive days (100%) meeting saturated conditions, as well as, the having the highest number of cumulative days (222) meeting conditions. UTTC MW8 continued to have the lowest percentage of consecutive days (23.5%) meeting saturated conditions, as well as, the having the lowest number of cumulative days (52) meeting conditions; however, hydrologic saturation continues to improve. It should also be noted that UTTC MW8 is located in a jurisdictional wetland and outside the boundary of the wetland areas where credit is being generated (See CCPV in Appendix B). See Appendix E for a plot of wetland gauge data as it relates to monthly precipitation for Monitoring Year 3 (Figure 6). MY3 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.

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 three monitoring years. R6_W2 experienced the longest period of consecutive stream flow with 162 days. Figure 7 in Appendix E, depict the documented flow conditions for each gauge through Monitoring Year 3 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.

Currently, both BMPs are functioning as designed. Accumulated silt is present in Reach 7's BMP but has not exceeded functional storage capacity. No downstream sedimentation on Reach 7 has been noted as result of the BMP's performance.

Lastly, at least four post-construction bankfull events were observed and documented during MY3 with two of the recorded events greater than one foot above bankfull. As of MY3, 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.

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 3 monitoring data were collected from September through November 2018. All visual site assessment data contained in Appendix B were collected on November 11th of 2018. Vegetation data and plot photos were collected on September 5th and 25th of 2018. Sediment data were collected on November 26th of 2018.

Stream survey data were collected from October 3rd through October 15th of 2018 and were certified on October 18th of 2018. 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).

Cross-sectional data was collected in October 2018. The nineteen (19) permanent cross-sections located throughout the site show minimal adjustment to stream dimension since construction. 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 3. Cross-sectional data is presented in Figure 3 of Appendix D.

#### 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 will be 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.

Longitudinal profiles for Reach 1, 2, 3, and 6 were collected in October 2018 and have remained geomorphically stable throughout the Year 3 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 3.

#### 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.

Visual observations and a review of reach-wide pebble count data collected on September 26, 2018 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. Bed material distribution data are located in Figure 5 of Appendix D.

### 2.1.2 Stream Hydrology

#### 2.1.2.1 Bankfull Events

The occurrence of bankfull events within the monitoring period were documented by the use of a crest gauge and photographs. The crest gauge will record the highest watermark between site visits, and the gauge will be checked at each site visit to determine if a bankfull event has occurred. The crest gauge was installed 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.

Two bankfull flow events have been documented in separate years, MY2 had two bankfull events and MY3 had 4 bankfull events, thus the site has met the bankfull flow requirement. Bankfull data and photographic documentation collected during Year 3 monitoring are located in Appendix E.

#### 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 Reach 7, while R6_W1 and R6_W2 were installed on Reach 6. Collected data will document that 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, 2018). 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.

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 three monitoring years. In MY3, R6_W2 experienced the longest period of consecutive stream flow with 162 days. Figure 7 depicts the documented flow conditions for each gauge through Monitoring Year 3 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. Flow data and photographic documentation collected during Year 3 monitoring are located in Appendix E.

### 2.1.3 Photographic Documentation of Site

Photographs were used to document restoration success visually. Reference stations and cross-section photos were photographed during the as-built survey; this will be repeated for five years following construction. Reference photos were taken once a year, from a height of approximately five to six feet. Permanent markers ensure that the same locations (and view directions) are utilized during each monitoring period. Photographers will make an effort to consistently maintain the same area in each 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 will be conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs will be used to

document system performance and any areas of concern related to stream bank stability, condition of in-stream structures, channel migration, aggradation/degradation, headcuts, live stake mortality, impacts from invasive plant species or animal species, floodplain vegetative conditions, and condition of pools and riffles. The photo locations will be shown on a plan view map and descriptions will be documented in as either stream problem areas (SPAs) or vegetative problem areas (VPAs) in there associated monitoring assessment tables located in Appendix B.

The site's lateral/vertical stability and in-stream structure performance has maintained at or close to 100% through Monitoring Year 3. Areas of concern consist of primarily of erosional features just downstream of the culverts at the head of Reach 1 and on Reach 6. These erosional impacts are likely the result of high flood velocities from large storm events, including two large hurricanes (Florence and Michael). Though impacts are visible, the stream seems to be structurally stable and vegetation should recolonize quickly. Additionally, an area of sill erosion (SPA2-1) documented on Reach 6 in MY2 has subsequently stabilized and is no longer of issue. No other areas of bank scour and/or erosion around structures were noted.

During Year 3 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 (VP2-2) of sparse herbaceous vegetation has continued to persist from MY2. This area is located along Reach 3 near Vegetation Plot 14 and consists of approximately 0.11 acres. Areas of poor growth performance are present within the floodplains of Reach 1, 2, 3, and 6. Lack of herbaceous vegetation and poor growth performance is likely due to poor soils that are frequently inundated by overbank storm flows and offsite drainage.

Supplement planting was conducted in mid-March 2018 for VPA areas (VPA3-6 through VPA3-9) noted with poor growth performance. Planted species consisted of woody bare root and potted plantings that were installed at a planting density of 640 plans/acre. No herbaceous species were included because previous experience with post-construction herbaceous seeding in the Slate Belt has shown that herbaceous seed mix along with compost and mulch will not take in the hard pan rocky soils even if the soil is scarified. The seed and medium are washed off site during the next rain event. Therefore, we have planted woody species. Their successful growth will provide shade and an input of organic material that will allow for some of the existing herbaceous veg to spread to this area. The planted species consisted of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), possumhaw viburnum (*Viburnum nudum*), and American beautyberry (*Callicarpa Americana*). Supplemental planting areas are mapped and are depicted in Figures 2 – 2c.

The presence of parrot feather (*Myriophyllum aquaticum*) throughout the mainstem (Reaches 1, 2, and 3) of the project have persisted; however, its abundance has been reduced. This is likely due to a wetter growing season and an increase in continuous base flow conditions. 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. Response from NCDEQ was recently received in early November 2018. Currently, Michael Baker and NCDEQ are discussing any potential control avenues available for the aquatic species in a live stream.

In MY3, a total of five discrete areas of invasive species were documented; however, none of the areas exceeded the mapping threshold of 1000 square feet (SF). These areas totaled approximately 0.14 acres or 0.6% of the easement area and consisted primarily of *Ligustrum sinese* (Chinese privet) along with *Rosa multiflora* (Multi-flora rose) and *Paulownia tomentosa* (princess tree). The presence of these invasive species continue to persist predominantly in areas of the easement where mature woody vegetation is present and along the easement fence line. Treatment control applications for invasive species were conducted in April and June of 2018 for areas of concern that were documented in MY2

as well as for areas that had re-sprouted from previous treatment applications. All invasive species will continue to be monitored throughout the site and treated as needed.

Both SPA and VPA data and photographic documentation collected during Year 3 monitoring are located in Appendix B. See Tables 5a through 5h for SPA data documentation and Tables 6a through 6b for VPA data documentation.

## 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 will include species composition, density, survival, and stem height. Relative values were calculated, and importance values were determined. Individual seedlings were marked to ensure that they can be found in succeeding monitoring years. Mortality was determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

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

Vegetation plot data was collected in September 2018. Based on data collected from the twenty monitoring plots during Year 3 monitoring, the average density of total planted stems per plot ranges from 486 to 890 stems per acre with a tract mean of 644 stems per acre. Therefore, the Year 3 data demonstrate that the site has exceeded the minimum interim success criteria of 320 trees per acre by the end of Year 3 and is on track for meeting 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 VP1, VP4, VP5, VP6, VP7, VP10, VP12, VP14, VP15, VP18, and VP19; 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. Photographs were used to visually document vegetation success in sample plots and are located in Appendix C.

## 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 2018) 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 Rd. Data from the NEWL station was obtained from the CRONOS Database located on the State Climate Office of North Carolina's website (2018).

Success criteria for wetland hydrology will be 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 will be monitored for seven years post-construction or until wetland success criteria are met. Visual inspection of proposed wetland areas

will be 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 will be 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 will validate wetland restoration and creation success.

Groundwater monitoring data collected during the growing season (March 27 through November 5) of Years 2 and 3 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. During MY3, UTTC MW7 exhibited the highest percentage of consecutive days (100%) meeting saturated conditions, as well as, the having the highest number of cumulative days (222) meeting conditions. UTTC MW8 continued to have the lowest percentage of consecutive days (23.5%) meeting saturated conditions, as well as, the having the lowest number of cumulative days (52) meeting conditions; however, hydrologic saturation continues to improve. It should also be noted that UTTC MW8 is located in a jurisdictional wetland and outside the boundary of the wetland areas where credit is being generated (See CCPV in Appendix B). See Appendix E for a plot of wetland gauge data as it relates to monthly precipitation for Monitoring Year 3 (Figure 6). MY3 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.

## 2.4 BMP Monitoring

Implementation of wetland BMPs located at the upstream extent of Reaches 4 and 7 were visually monitored for vegetative survivability and permanent pool storage capacity using photo documentation during the 5-Year monitoring period. Maintenance measures will be implemented during the 5-Year monitoring period to replace dead vegetative material and to remove excess sedimentation from permanent pools.

Michael Baker will monitor the excess sedimentation in the BMPs by measuring the accumulated silt elevation within the pond's permanent pool. When the elevation of the accumulated silt keeps the BMP from functioning, Michael Baker will have the sediment excavated.

Currently, both BMPs are functioning as designed. Accumulated silt is present in Reach 7's BMP but has not exceeded functional storage capacity. No downstream sedimentation on Reach 7 has been noted as result of the BMP's performance.

# 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, 2018. CRONOS Database, North Stanly Middle School (NEWL), Stanly County, NC. http://climate.ncsu.edu/cronos/?station=NEWL&temporal=sensormeta

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

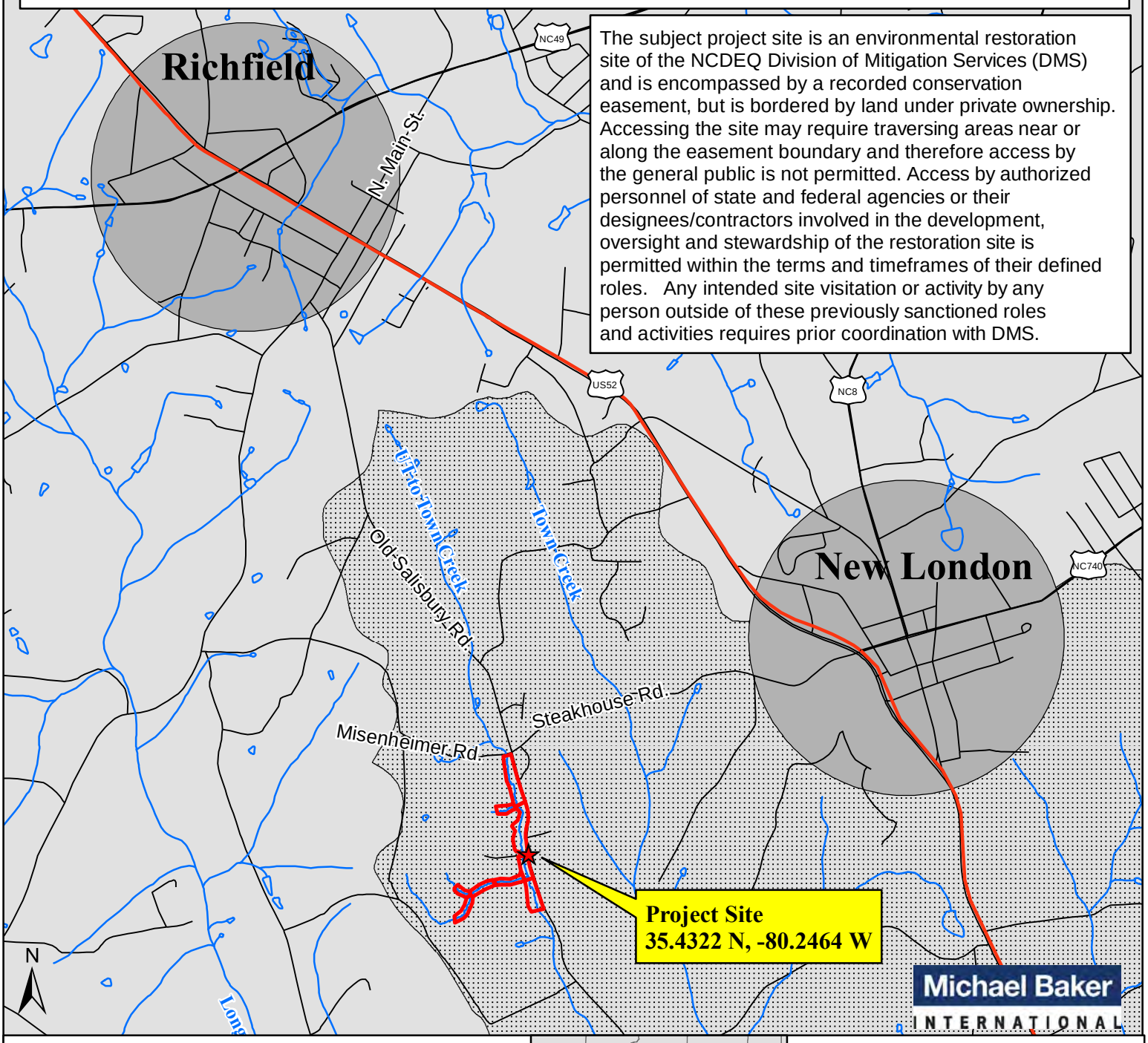
United States Army Corps of Engineers. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

# 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**

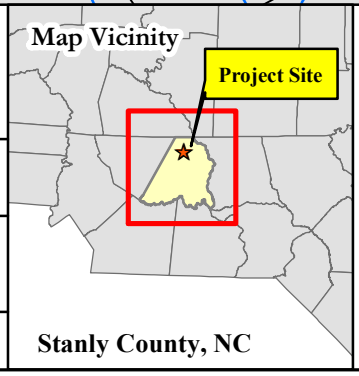
*Stanly County, NC*

**Reference:** NCDOT 02 & NC One Map

**NC DMS Project No. 94648**
**NCDEQ Contract No. 003277**

**2018**

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 | 1204.0 | Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement. |
| Reach 2 | | 1672 | 22+04 - 40+46 | 1,842 | 1,782 | R | PI | 1:1 | 1782.0 | Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement, and a 60-ft culverted farm road crossing. |
| Reach 3 | | 721 | 40+46 - 48+75 | 829 | 829 | R | PI | 1:1 | 829.0 | Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement. |
| Reach 4 | | 404 | 10+00 - 14+47 | 447 | 447 | EI | PIII | 1:1 | 447.0 | 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 | 137.6 | 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 | 1340.0 | 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 | 399.0 | Headwater Constructed Wetland, Full Channel Restoration, Planted Buffer, Livestock Exclusion, and Permanent Conservation Easement. |
| Additional Stream Credits** | | | | | | | | | 265.0 | Additional credits calculated by Michael Baker. Credit calculations for buffers in excess of 50-ft along Reach 1 - 3 were approved by the IRT during the Credit Release Meeting on 04/24/2018. |
| | | | | | | | | | | |
| Wetland Group 1 (WG1) | RNR | 0 | | 2.56 | 2.56 | R | | 1:1 | 2.6 | 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 | | 1.56 | 1.56 | C | | 3:1 | 0.5 | 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. |
| | | | | | | | | | | |
| Buffer Group 1 (BG1) | | | | | | | | | | |
| | | | | | | | | | | |

**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 | 2.56 | | | |
| Enhancement | | | | | |
| Enhancement I | 447 | | | | |
| Enhancement II | 344 | | | | |
| Creation | | 1.56 | | | |
| Preservation | | | | | |
| High Quality Pres | | | | | |
| Additional Stream Credits | 265 | | | | |

**Overall Assets Summary**

| Asset Category | Overall Credits |
|---|---|
| | |
| **Stream*** | **6,138.6** |
| **RP Wetland** | **3.1** |
| **Additional Stream Credits**** | **265.0** |

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

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

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

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

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

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

** Additional Stream Credits approved by IRT on 04/24/2018

**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 Stream Monitoring | - | Nov-16 | - |
| Year 1 Vegetation Monitoring | - | Nov-16 | - |
| Year 1 Monitoring Report | Dec-16 | Nov-16 | Dec-16 |
| Invasive Treatment | N/A | N/A | Mar-17 |
| Year 2 Stream Monitoring | - | Nov-17 | - |
| Year 2 Vegetation Monitoring | - | Nov-17 | - |
| Year 2 Monitoring Report | Dec-17 | Nov-17 | Dec-17 |
| Additioanl Riparian Planting | N/A | N/A | Mar-18 |
| Invasive Treatment | N/A | N/A | Apr-18 |
| Invasive Treatment | N/A | N/A | Jun-18 |
| Year 3 Stream Monitoring | - | Oct-18 | - |
| Year 3 Vegetation Monitoring | - | Sep-18 | - |
| Year 3 Monitoring Report | Dec-18 | Nov-18 | Dec-18 |
| Year 4 Monitoring | Dec-19 | N/A | N/A |
| Year 5 Monitoring | Dec-20 | N/A | N/A |
| Year 6 Wetland Monitoring | Dec-21 | N/A | N/A |
| Year 7 Wetland Monitoring | Dec-22 | N/A | N/A |

| Table 3. Project Contacts<br>UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648 | |
|---|---|
| **Designer** | |
| Michael Baker Engineering, Inc. | 8000 Regency Parkway, Suite 600<br>Cary, NC 27518<br>Contact:<br>Kathleen M. McKeithan, PE, Tel. 919-481-5703 |
| **Construction Contractor** | |
| Wright Contracting, LLC. | 160 Walker Road<br>Lawndale, NC 28090<br>Contact:<br>Joe Wright, Tel. 919-663-0810 |
| **Planting Contractor** | |
| H.J. Forest Service | P.O. Box 458<br>Holly Ridge, NC 28445<br>Contact:<br>Matt Hitch, Tel. 910-512-1743 |
| **Seeding Contractor** | |
| Wright Contracting, LLC. | 160 Walker Road<br>Lawndale, NC 28090<br>Contact:<br>Joe Wright, Tel. 919-663-0810 |
| Seed Mix Sources | Green Resources, Tel. 336-855-6363<br>Mellow Marsh Farm, Tel. 919-742-1200 |
| Nursery Stock Suppliers | Mellow Marsh Farm, Tel. 919-742-1200<br>Foggy Mountain Nursery, Tel. 336-384-5323<br>ArborGen, Tel. 843-528-3203 |
| **Monitoring Performers** | |
| Michael Baker Engineering, Inc. | 15720 Brixham Hill Ave., Suite 300, Office 336<br>Charlotte, NC 28277<br>Contact: |
| Stream Monitoring Point of Contact | Kristi Suggs, Tel. 704-665-2206 |
| Vegetation Monitoring Point of Contact | Kristi Suggs, Tel. 704-665-2206 |

| **Table 4. Project Attributes**<br>**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 |

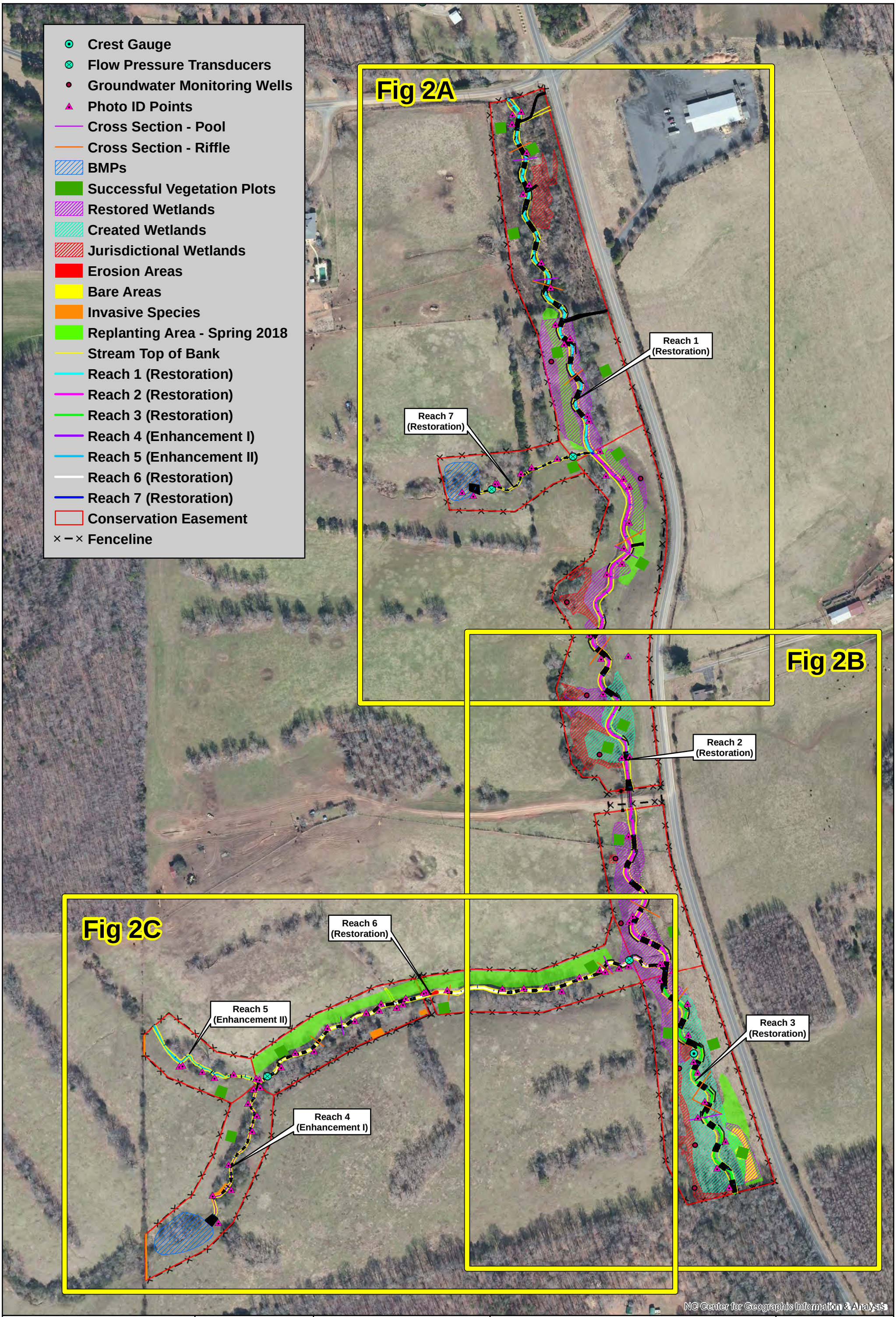
* Bald Eagle (*Haliaeetus leucocephalus* ) a BGEPA species is listed as occurring in Stanly County; however, suitable habitat is not located within the Project area or within two miles of the Site.

** 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

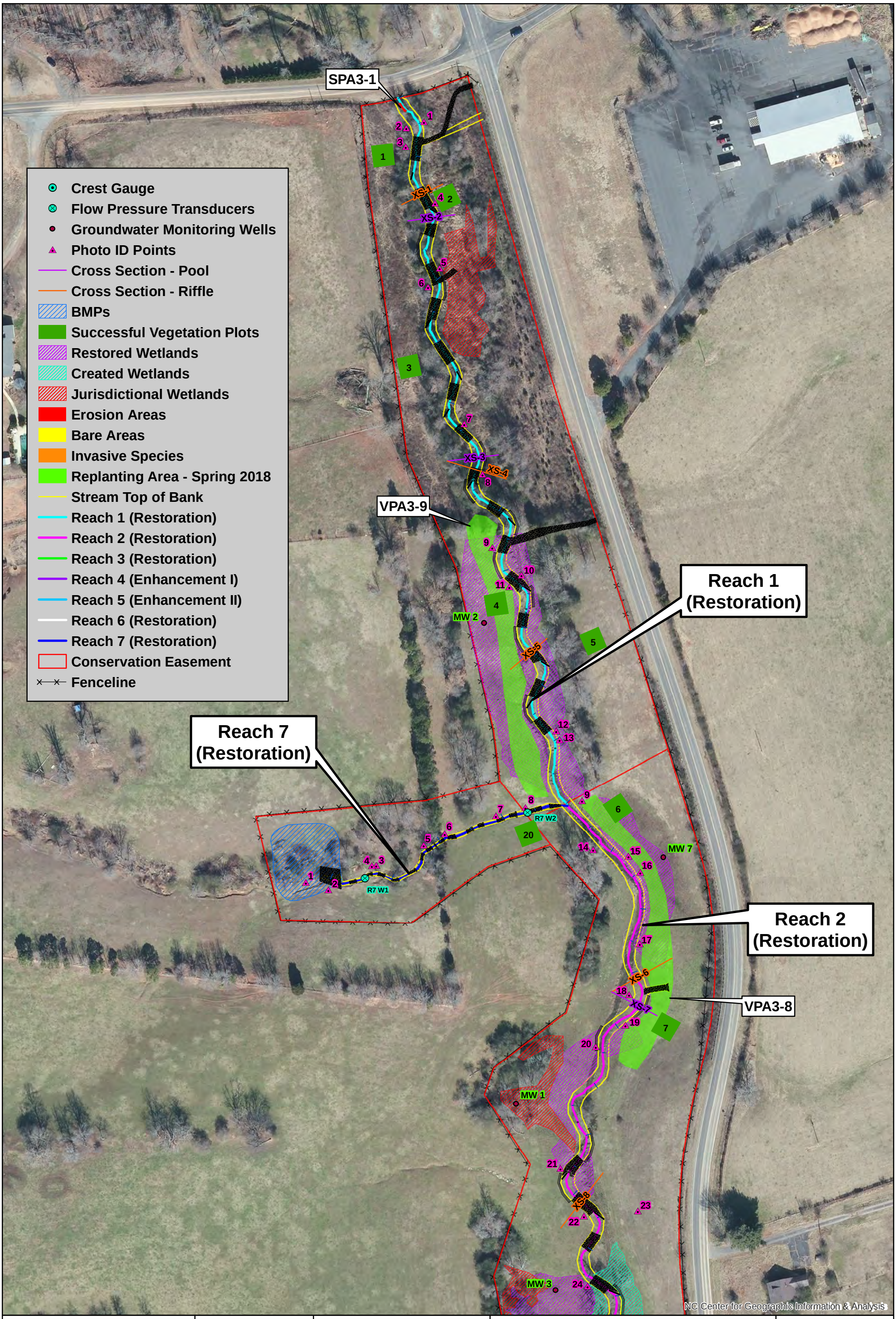
0 125 250 Feet

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: 3 of 7 |
| Drawn By: KLS |
| Date: 2018 |
| 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: 3 of 7 |
| Drawn By: KLS |
| Date: 2018 |
| Sheet 2 of 4 |

Reach 2 (Restoration)

Reach 6 (Restoration)

VPA3-6

SPA3-2

Reach 3 (Restoration)

VPA3-7

VPA2-2

- Crest Gauge
- Flow Pressure Transducers
- Groundwater Monitoring Wells
- Photo ID Points
- Cross Section - Pool
- Cross Section - Riffle
- BMPs
- Successful Vegetation Plots
- Restored Wetlands
- Created Wetlands
- Jurisdictional Wetlands
- Erosion Areas
- Bare Areas
- Invasive Species
- Replanting Area - Spring 2018
- 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

NC Center for Geographic Information & Analysis

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services

N

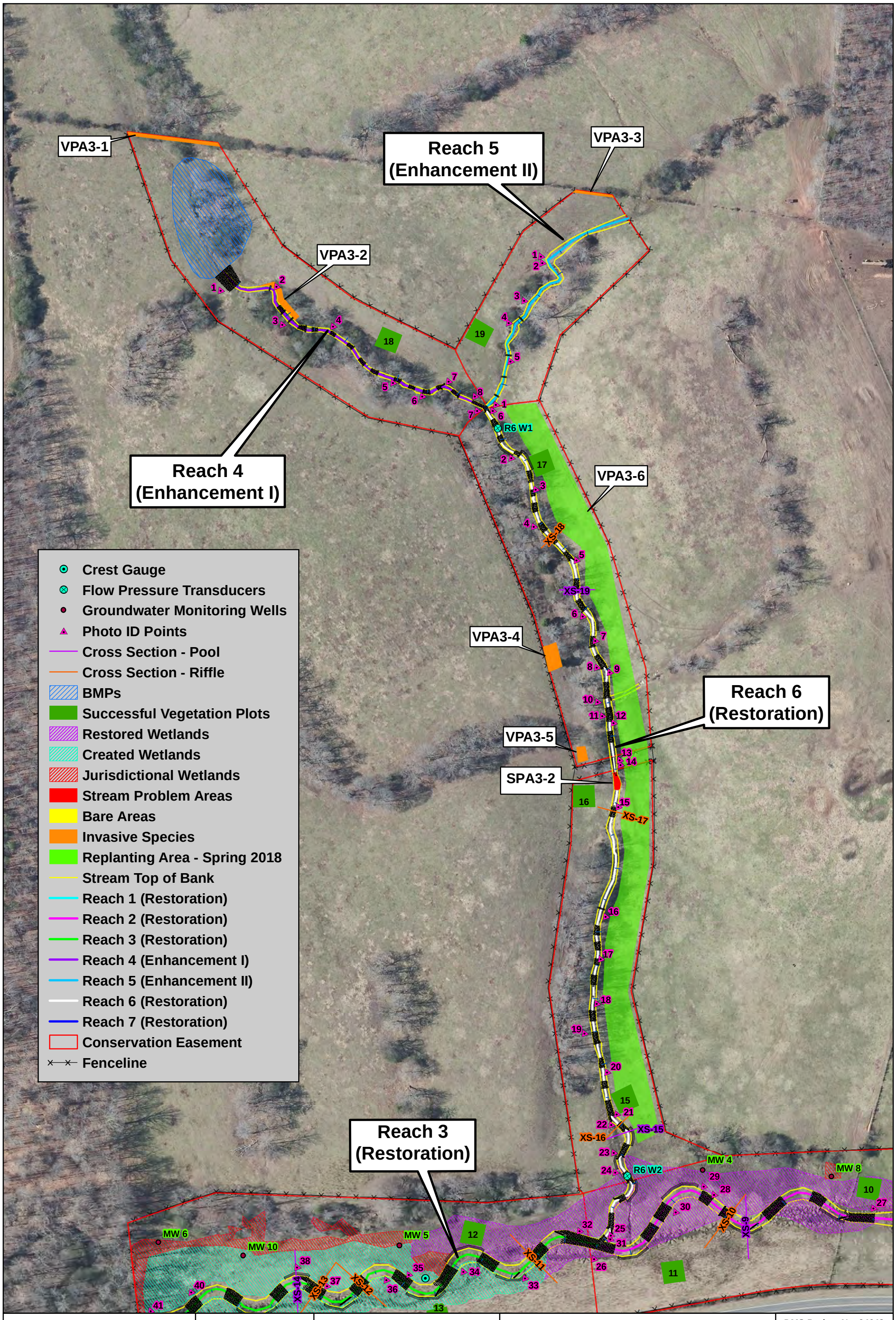
0 62.5 125 Feet

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: 3 of 7 |
| Drawn By: KLS |
| Date: 2018 |
| Sheet: 3 of 4 |




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: 3 of 7 |
| Drawn By: KLS |
| Date: 2018 |
| 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 | | | 1 | 40 | 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** | 1 | 40 | 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. | 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 | | | 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. | 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 | | | 1 | 40 | 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** | 1 | 40 | 97% | 0 | 0 | 97% |
| 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** |
| Stream banks eroding downstream of the culvert | 10+10 | Flooding during 2018 eroded bank material from the area immediately downstream of the culvert at the beginning of the project. Vegetation is gone but area seems stable and will be monitored in MY4. | SPA 3-1 |
| **Reach 2** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| No issues in Year 3 | N/A | N/A | N/A |
| **Reach 3** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| No issues in Year 3 | N/A | N/A | N/A |
| **Reach 4** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| No issues in Year 3 | N/A | N/A | N/A |
| **Reach 5** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| No issues in Year 3 | N/A | N/A | N/A |
| **Reach 6** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| Stream banks eroding downstream of the culvert | 20+50 | Flooding during 2018 eroded bank material from the area immediately downstream of the culvert. All soil material that was placed on bedrock has eroded away. Vegetation is gone but area seems stable since the banks are now primarily bedrock. This area will be monitored in MY4. | SPA 3-2 |
| **Reach 7** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Photo Number** |
| No issues in Year 3 | 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 | VPA2-2 | 1 | 0.11 | 0.5% |
| **2. Low Stem Density Areas** | Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria. | 0.1 acres | N/A | 0 | 0.00 | 0.0% |
| | | | **Total** | 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 | VPA3-6 - VPA3-9 | 4 | 2.00 | 9.0% |
| | | | **Cumulative Total** | 5 | 2.11 | 9.4% |

| | |
|---|---|
| **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 | VPA3-1 - VPA3-5 | 5 | 0.14 | 0.6% |
| **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 MY3.

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

| **Reach 1** | | | |
|---|---|---|---|
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| 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 is located in various sections along the Reach 1. |
| Poor growth rates* | 16+75 - 21+85 | Poor growth rates were noted in areas where supplemental bare root and gallon container plantings were installed during MY3. | VPA3-9 |
| **Reach 2** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| 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 is located in various sections along the Reach 2. |
| Poor growth rates* | 22+15 - 26+60 | Poor growth rates were noted in areas where supplemental bare root and gallon container plantings were installed during MY3. | VPA3-8 |
| **Reach 3** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| 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 is located in various sections along the Reach 3. |
| Bare Areas | 46+50 - 48+60 | Poor soils | VPA2-2 |
| Poor growth rates* | 44+50 - 48+60 | Poor growth rates were noted in areas where supplemental bare root and gallon container plantings were installed during MY3. | VPA 3-7 |
| **Reach 4** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| Invasive/Exotic Populations | N/A | *Ligustrum sinese* (Chinese privet) growing in along easement fence line at the upstream extent of Reach 4 (above BMP). | VPA3-1 |
| Invasive/Exotic Populations | 10+25 - 11+15 | *Ligustrum sinese* (Chinese privet) growing in along easement fence line at the upstream extent of Reach 4 (above BMP). | VPA3-2 |
| **Reach 5** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| Invasive/Exotic Populations | 9+25 -10+00 | *Ligustrum sinese* (Chinese privet) growing in along easement fence line at the upstream extent of Reach 5. | VPA 3-3 |
| **Reach 6** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| Invasive/Exotic Populations | 18+30 -18+75 | *Ligustrum sinese* (Chinese privet) and Paulownia tomentosa (Princess tree) growing in along easement fence line. | VPA3-4 |
| Invasive/Exotic | 20+10 - 20+30 | *Rosa multiflora* (multiflora rose) growing in along easement fence line . | VPA3-5 |
| Poor growth rates* | 14+50 - 26+25 | Poor growth rates were noted in areas where supplemental bare root and gallon container plantings were installed during MY3. | VPA3-6 |
| **Reach 7** | | | |
| **Feature Issue** | **Station No.** | **Suspected Cause** | **Problem Area / Photo Number** |
| No Problems | N/A | - | - |

*Poor growth rate areas were noted where supplemental bare root and gallon container plantings were installed during MY3.

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 (10/11/16)**

**PID 2: Station 10+50 – Downstream (10/11/16)**

**PID 3: Station 10+80 – Left Floodplain (10/11/16)**

**PID 4: Station 11+90 – Downstream (10/11/16)**

**PID 5: Station 12+85 – Upstream (10/11/16)**

**PID 6: Station 13+05 – Left Floodplain (10/11/16)**

**PID 7: Station 15+30 – Upstream (10/11/16)**

**PID 8: Station 16+25 – Downstream (10/11/16)**

**PID 9: Station 17+75 – Left Floodplain (10/11/16)**

## *UT to Town Creek Reach 1*

**PID 10: Station 18+10– Downstream (10/11/16)**

**PID 11: Station 18+10 – Upstream (10/11/16)**

**PID 12: Station 20+90 – Downstream (10/11/16)**

**PID 13: Station 21+00 – Upstream (10/11/16)**

**PID 14: Station 22+75 – Upstream (10/11/16)**

**PID 15: Station 23+25 – Upstream (10/11/16)**

**PID 16: Station 23+50 – Downstream (10/11/16)**

**PID 17: Station 24+60– Upstream (10/11/16)**

**PID 18: Station 25+30– Left Floodplain (10/11/16)**

**PID 19: Station 25+90– Downstream (10/11/16)**

**PID 20: Station 26+50– Downstream (10/11/16)**

**PID 21: Station 28+75 – Downstream (10/11/16)**

**PID 22: Station 29+35 – Upstream (10/11/16)**

**PID 23: Station 29+50 – Downstream Project View from Floodplain Knoll (10/11/16)**

**PID 24: Station 30+60 – Upstream (10/11/16)**

**PID 25: Station 33+10 – Upstream (10/11/16)**

**PID 26: Station 33+10 – Downstream (10/11/16)**

**PID 27: Station 35+50 – Upstream (10/11/16)**

**PID 28: Station 38+30 – Upstream (10/11/16)**

**PID 29: Station 38+40 – Downstream (10/11/16)**

**PID 30: Station 39+10 – Downstream (10/11/16)**

**PID 31: Station 40+25 – Downstream (10/11/16)**

**PID 32: Station 40+80 – Upstream (10/11/16)**

**PID 33: Station 41+80 – Upstream (10/11/16)**

**PID 34: Station 43+00 – Downstream (10/11/16)**

**PID 35: Station 44+00 – Downstream (10/11/16)**

**PID 36: Station 44+25 – Upstream (10/11/16)**

**PID 37: Station 45+50 – Downstream (10/11/16)**

**PID 38: Station 45+95 – Upstream (10/11/16)**

**PID 39: Station 46+80 – Upstream (10/11/16)**

**PID 40: Station 47+75 – Upstream (10/11/16)**

**PID 41: Station 48+60 – Downstream (10/11/16)**

## *UT to Town Creek – Reach 4*

**PID 1: Station 09+80 – Upstream (10/11/16)**

**PID 2: Station 10+60 – Upstream (10/11/16)**

**PID 3: Station 11+20 – Upstream (10/11/16)**

**PID 4: Station 11+75 – Upstream (10/11/16)**

**PID 5: Station 12+95 – Upstream (10/11/16)**

**PID 6: Station 13+45 – Downstream (10/11/16)**

**PID 7: Station 13+80 – Upstream (10/11/16)**

**PID 8: Station 14+ 20 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 5*

**PID 1: Station 10+70 – Upstream (10/11/16)**

**PID 2: Station 10+75 – Downstream (10/11/16)**

**PID 3: Station 11+75 – Upstream (10/11/16)**

**PID 4: Station 12+20 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 5*

**PID 5: Station 12+65 – Upstream (10/11/16)**

**PID 6: Station 13+30 – Upstream (10/11/16)**

**PID 7: Station 13+43 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 6*

**PID 1: Station14+55 – Upstream (10/11/16)**

**PID 2: Station 15+30 – Upstream (10/11/16)**

**PID 3: Station 16+00 – Upstream (10/11/16)**

**PID 4: Station 16+50 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 6*

**PID 5: Station 17+25 – Upstream (10/11/16)**

**PID 6: Station 18+00 – Upstream (10/11/16)**

**PID 7: Station 18+50 – Upstream (10/11/16)**

**PID 8: Station 18+90 – Downstream (10/11/16)**

## *UT to Town Creek – Reach 6*

**PID 9: Station 19+05 – Upstream (10/11/16)**

**PID 10: Station 19+50 – Left Floodplain (10/11/16)**

**PID 11: Station 19+50 – Upstream (10/11/16)**

**PID 12: Station 19+85 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 6*

**PID 13: Station 20+50 - Upstream (10/11/16)**

**PID 14: Station 20+50 - Downstream (10/11/16)**

**PID 15: Station 21+00 – Upstream (10/11/16)**

**PID 16: Station 22+75 – Upstream (10/11/16)**

**PID 17: Station 23+40 – Upstream (10/11/16)**

**PID 18: Station 24+00 – Upstream (10/11/16)**

**PID 19: Station 24+50 – Upstream (10/11/16)**

**PID 20: Station 23+25 – Upstream (10/10/2016)**

**PID 21: Station 25+80 - Downstream (10/11/16)**

**PID 22: Station 25+85 – Upstream (10/11/16)**

**PID 23: Station 26+50 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 6*

**PID 24: Station 26+75 – Upstream (10/11/16)**

**PID 25: Station 28+00 – Upstream (10/11/16)**

**PID 26: Station 28+14 – Upstream (10/11/16)**

## *UT to Town Creek – Reach 7*

**PID 1: Station 09+40: Upstream (10/11/16)**

**PID 2: Station 09+90 – Upstream (10/11/16)**

**PID 3: Station 10+70 – Upstream (10/11/16)**

**PID 4: Station 10+80 – Downstream (10/11/16)**

**PID 5: Station 11+75 – Upstream (10/11/16)**

**PID 6: Station 12+20 – Upstream (10/11/16)**

**PID 7: Station 12+90 – Upstream (10/11/16)**

**PID 8: Station 13+50 – Upstream (10/11/16)**

**PID 9: Station 13+99 – Upstream (10/11/16**

# Stream Problem Area Photos

## UT to Town Creek – Reach 1

**SPA 3-1 - Station 10+10 – Stream banks downstream of culvert have eroded and washed away during flooding in 2018 (11/14/18)**

**SPA 3-1 - Station 10+10 – Stream banks downstream of culvert have eroded and washed away during flooding in 2018 (11/14/18)**

## UT to Town Creek – Reach 6

**SPA 3-2 - Station 20+50 – Stream banks downstream of culvert have eroded and washed away during flooding in 2018 (11/14/18)**

**SPA 3-2 - Station 20+50 – Stream banks downstream of culvert have eroded and washed away during flooding in 2018 (11/14/18)**

# Vegetation Problem Area Photos

**VPA3-1 through VPA3-5 - Representative photo of Chinese privet growing in VPAs along Reach 4, 5, and 6. (02/08/18)**

**VPA 3-7 – Station 46+50 – Downstream photo of bare areas and areas of poor growth rates, as well as areas were supplemental plantings were installed. (07/17/18)**

**VPA3-4 – Regrowth of Princess tree (*Paulownia tomentosa*) growing in easement. (06/06/18)**

**VPA 3-7 – Station 48+60 – Upstream photo of bare areas, areas of poor growth rates, and areas were supplemental plantings were installed. (06/06/18)**

**VPA 3-8 – Station 23+00 – Floodplain photo of areas of poor growth rates and where supplemental plantings were installed. (07/17/18)**

**Parrot feather (*Myriophyllum aquaticum*) growing in channel along Reach 2. (07/17/18)**


**Parrot feather (*Myriophyllum aquaticum*) growing in channel along Reach 3. (06/06/18)**

# 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** | 728 | 364 | 1093 | Yes |
| **VP2** | 728 | 0 | 728 | Yes |
| **VP3** | 728 | 0 | 728 | Yes |
| **VP4** | 526 | 364 | 890 | Yes |
| **VP5** | 648 | 81 | 728 | Yes |
| **VP6** | 769 | 81 | 850 | Yes |
| **VP7** | 526 | 40 | 567 | Yes |
| **VP8** | 728 | 0 | 728 | Yes |
| **VP9** | 486 | 0 | 486 | Yes |
| **VP10** | 769 | 40 | 809 | Yes |
| **VP11** | 890 | 0 | 890 | Yes |
| **VP12** | 486 | 121 | 607 | Yes |
| **VP13** | 486 | 0 | 486 | Yes |
| **VP14** | 769 | 40 | 809 | Yes |
| **VP15** | 688 | 243 | 931 | Yes |
| **VP16** | 648 | 0 | 648 | Yes |
| **VP17** | 526 | 0 | 526 | Yes |
| **VP18** | 728 | 40 | 769 | Yes |
| **VP19** | 526 | 81 | 607 | Yes |
| **VP20** | 486 | 0 | 486 | Yes |
| **Project Avg** | **644** | **85** | **728** | **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. CVS Vegetation Plot Metadata**
**UT to Town Creek Restoration Project: Project No. 94648**

| | |
|---|---|
| **Report Prepared By** | Russell Myers |
| **Date Prepared** | 10/2/2018 13:39 |
| | |
| **database name** | UTtoTown_84648_MY2_cvs-eep-entrytool-v2.3.1_2017.mdb |
| **database location** | \\Chabfs1\cdata\Projects\120857\Documents\Reports\Monitoring\MY2\AppC |
| **computer name** | CARYLAPOWERS1 |
| **file size** | 49188864 |
| | |
| **DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------** | |
| **Metadata** | Description of database file, the report worksheets, and a summary of project(s) and project data. |
| **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 create 5.12 acres of riparian wetlands. |
| **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 (MY3 2018) | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 negundo* | boxelder | Tree | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | |
| *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 | 1 | 3 | | 1 | 1 | 1 | | 1 | | | | | | |
| *Cephalanthus occidentalis* | common buttonbush | Shrub | | | | | | | | | | | | | | | | | | | | | | | | |
| *Cercis canadensis* | eastern redbud | Tree | | | | | | | | | | | | | | | | 4 | | 4 | 1 | | 1 | | | |
| *Cornus amomum* | silky dogwood | Shrub | | | | | | | | | | 4 | | 4 | | | | | | | 4 | | 4 | | | |
| *Cornus florida* | flowering dogwood | Tree | | | | 1 | | 1 | | | | | | | | | | | | | 1 | | 1 | | | |
| *Diospyros virginiana* | common persimmon | Tree | 3 | 3 | 6 | 3 | | 3 | | | | | | | 4 | | 4 | | | | | | | 1 | | 1 |
| *Fraxinus pennsylvanica* | green ash | Tree | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | |
| *Liriodendron tulipifera* | tuliptree | Tree | | 6 | 6 | | | | | | | 1 | 7 | 8 | | | | | 2 | 2 | | | | | | |
| *Nyssa sylvatica* | blackgum | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Platanus occidentalis* | American sycamore | Tree | 1 | | 1 | 1 | | 1 | 4 | | 4 | 1 | | 1 | 2 | | 2 | 4 | | 4 | | 1 | 1 | 12 | | 12 |
| *Quercus* | oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Quercus alba* | white oak | Tree | | | | | | | | | | | | | | | | | | | 2 | | 2 | | | |
| *Quercus falcata* | southern red oak | Tree | 2 | | 2 | 1 | | 1 | | | | 1 | | 1 | | | | 1 | | 1 | | | | | | |
| *Quercus lyrata* | overcup oak | Tree | 1 | | 1 | | | | | | | | | | 1 | 1 | 2 | | | | | | | 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 | | | | 3 | | 3 |
| *Quercus rubra* | northern red oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Salix nigra* | black willow | Tree | | | | | | | | | 6 | | 1 | 1 | | | | | | | | | | 1 | | 1 |
| *Sambucus canadensis* | Common Elderberry | Shrub | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sambucus nigra* | European black elderberry | Shrub | | | | | | | | | | 1 | | 1 | | | | | | | | | | | | |
| Unknown | | Shrub or Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| | | **Stem count** | 18 | 9 | 27 | 18 | 0 | 18 | 18 | 0 | 24 | 13 | 9 | 22 | 16 | 2 | 18 | 19 | 2 | 21 | 13 | 1 | 14 | 18 | 0 | 18 |
| | | **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 | 0 | 8 | 7 | 0 | 8 | 8 | 3 | 9 | 6 | 2 | 7 | 7 | 1 | 8 | 5 | 1 | 6 | 5 | 0 | 5 |
| | | **Stems per ACRE** | 728.4 | 364.2 | 1092.7 | 728.4 | 0.0 | 728.4 | 728.4 | 0.0 | 971.2 | 526.1 | 364.2 | 890.3 | 647.5 | 80.9 | 728.4 | 768.9 | 80.9 | 849.8 | 526.1 | 40.5 | 566.6 | 728.4 | 0.0 | 728.4 |

**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%**

**Pnols = Planted No Live Stakes**
**P-all = Planted Includes Live Stakes**
**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 (MY3 2018) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94648-01-VP9 | | | 94648-01-VP10 | | | 94648-01-VP11 | | | 94648-01-VP12 | | | 94648-01-VP13 | | | 94648-01-VP14 | | | 94648-01-VP15 | | | 94648-01-VP16 | | |
| **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 negundo* | boxelder | Tree | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| *Asimina triloba* | pawpaw | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Betula nigra* | river birch | Tree | | | | | | | | | | 3 | | 3 | | | | | | | | | | | | |
| *Callicarpa americana* | American beautyberry | Shrub | | | | 2 | | 2 | | | | | | | | | | | | | | | | | | |
| *Carpinus caroliniana* | American hornbeam | Tree | 3 | | 3 | | | | | | | | | | | | | | | | | | | | | |
| *Cephalanthus occidentalis* | common buttonbush | Shrub | | | | | | | 5 | | 5 | 2 | | 2 | | | | | | | | | | 4 | | 4 |
| *Cercis canadensis* | eastern redbud | Tree | | | | 1 | | 1 | 1 | | 1 | | | | | | | | | | 6 | | 6 | | | |
| *Cornus amomum* | silky dogwood | Shrub | 2 | | 2 | 2 | | 2 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 5 | | 5 | 4 | | 4 | 3 | | 3 |
| *Cornus florida* | flowering dogwood | Tree | 3 | | 3 | | | | | | | | | | | | | | | | | | | | | |
| *Diospyros virginiana* | common persimmon | Tree | | | | | | | 3 | | 3 | | | | 7 | | 7 | | | | 1 | 2 | 3 | 2 | | 2 |
| *Fraxinus pennsylvanica* | green ash | Tree | 1 | | 1 | 9 | | 9 | | | | 2 | | 2 | 2 | | 2 | 2 | 1 | 3 | 2 | | 2 | | | |
| *Liriodendron tulipifera* | tuliptree | Tree | | | | | | | 2 | | 2 | 3 | 2 | 5 | | | | 5 | | 5 | 1 | 4 | 5 | | | |
| *Nyssa sylvatica* | blackgum | Tree | | | | 1 | | 1 | 3 | | 3 | 1 | | 1 | 1 | | 1 | | | | | | | 4 | | 4 |
| *Platanus occidentalis* | American sycamore | Tree | | | | | | | 1 | | 1 | | | | | | | 3 | | 3 | | | | | | |
| *Quercus* | oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Quercus alba* | white oak | Tree | 1 | | 1 | 2 | | 2 | 1 | | 1 | | | | | | | | | | 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 | | | | | | | 2 | | 2 | | | | | | |
| *Quercus phellos* | willow oak | Tree | | | | | | | | | | | | | | | | 1 | | 1 | 1 | | 1 | 1 | | 1 |
| *Quercus rubra* | northern red oak | Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| *Salix nigra* | black willow | Tree | | | | | | | | | | | 1 | 1 | | | | | | | | | | | | |
| *Sambucus canadensis* | Common Elderberry | Shrub | | | | | | | | | | | | | | | | | | | | | | | | |
| *Sambucus nigra* | European black elderberry | Shrub | | | | 2 | | 2 | | | | | | | | | | | | | | | | 1 | | 1 |
| Unknown | | Shrub or Tree | | | | | | | | | | | | | | | | | | | | | | | | |
| | | **Stem count** | 12 | 0 | 12 | 19 | 1 | 20 | 22 | 0 | 22 | 12 | 3 | 15 | 12 | 0 | 12 | 19 | 1 | 20 | 17 | 6 | 23 | 16 | 0 | 16 |
| | | **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** | 7 | 0 | 7 | 7 | 1 | 8 | 9 | 0 | 9 | 6 | 2 | 7 | 5 | 0 | 5 | 7 | 1 | 7 | 8 | 2 | 8 | 7 | 0 | 7 |
| | | **Stems per ACRE** | 485.6 | 0 | 485.6 | 768.903 | 40.4686 | 809.4 | 890.3 | 0 | 890.3 | 485.6 | 121.406 | 607.0 | 485.6 | 0 | 485.6 | 768.9 | 40.4686 | 809.4 | 688.0 | 242.811 | 930.8 | 647.5 | 0 | 647.5 |

**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%**

**Pnols = Planted No Live Stakes**
**P-all = Planted Includes Live Stakes**
**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 (MY3 2018) | | | | | | | | | | | | Annual Totals | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94648-01-VP17 | | | 94648-01-VP18 | | | 94648-01-VP19 | | | 94648-01-VP20 | | | 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** |
| *Acer negundo* | boxelder | Tree | | | | | | | | | | | | | 1 | 1 | 2 | 1 | | 1 | | | | | | |
| *Asimina triloba* | pawpaw | Tree | 2 | | 2 | | | | 1 | 1 | 1 | | | | 3 | | 3 | 2 | | 2 | 6 | | 6 | 5 | | 5 |
| *Betula nigra* | river birch | Tree | | | | | | | | | | | | | 17 | | 17 | 17 | | 17 | 18 | | 18 | 21 | | 21 |
| *Callicarpa americana* | American beautyberry | Shrub | | | | | | | | | | | | | 10 | | 10 | 13 | | 13 | 16 | | 16 | 7 | | 7 |
| *Carpinus caroliniana* | American hornbeam | Tree | | | | | | | | | | | | | 10 | 2 | 12 | 10 | | 10 | 10 | | 10 | 16 | | 16 |
| *Cephalanthus occidentalis* | common buttonbush | Shrub | | | | | | | | | | | | | 11 | | 11 | 10 | | 10 | 8 | | 8 | 5 | | 5 |
| *Cercis canadensis* | eastern redbud | Tree | | | | 5 | | 5 | | | | | | | 18 | | 18 | 20 | | 20 | 24 | | 24 | 29 | | 29 |
| *Cornus amomum* | silky dogwood | Shrub | 1 | | 1 | | 1 | 1 | 2 | | 2 | | | | 30 | 1 | 31 | 30 | | 30 | 29 | | 29 | 31 | | 31 |
| *Cornus florida* | flowering dogwood | Tree | | | | 1 | | 1 | | | | 1 | | 1 | 7 | | 7 | 9 | | 9 | 13 | | 13 | 21 | | 21 |
| *Diospyros virginiana* | common persimmon | Tree | | | | 2 | | 2 | 4 | | 4 | 4 | | 4 | 34 | 5 | 39 | 32 | | 32 | 29 | | 29 | 7 | | 7 |
| *Fraxinus pennsylvanica* | green ash | Tree | 7 | | 7 | 8 | | 8 | 5 | 1 | 6 | | | | 39 | 2 | 41 | 39 | | 39 | 40 | | 40 | 43 | | 43 |
| *Liriodendron tulipifera* | tuliptree | Tree | | | | | | | 1 | | 1 | 1 | | 1 | 14 | 21 | 35 | 12 | | 12 | 11 | | 11 | 12 | | 12 |
| *Nyssa sylvatica* | blackgum | Tree | | | | 1 | | 1 | | | | | | | 11 | | 11 | 13 | | 13 | 12 | | 12 | 9 | | 9 |
| *Platanus occidentalis* | American sycamore | Tree | | | | 1 | | 1 | | | | 1 | | 1 | 31 | 1 | 32 | 30 | | 30 | 29 | | 29 | 31 | | 31 |
| *Quercus* | oak | Tree | | | | | | | | | | | | | | | | | | | | | | 3 | | 3 |
| *Quercus alba* | white oak | Tree | | | | | | | | | | 1 | | 1 | 9 | | 9 | 10 | | 10 | 10 | | 10 | 12 | | 12 |
| *Quercus falcata* | southern red oak | Tree | | | | | | | | | | 1 | | 1 | 7 | | 7 | 7 | | 7 | 19 | | 19 | 15 | | 15 |
| *Quercus lyrata* | overcup oak | Tree | | | | | | | | | | | | | 7 | 1 | 8 | 15 | | 15 | 10 | | 10 | 16 | | 16 |
| *Quercus michauxii* | swamp chestnut oak | Tree | | | | | | | | | | | | | 9 | | 9 | 9 | | 9 | 14 | | 14 | 29 | | 29 |
| *Quercus pagoda* | cherrybark oak | Tree | | | | | | | | | | | | | 11 | | 11 | 8 | | 8 | 4 | | 4 | | | |
| *Quercus phellos* | willow oak | Tree | 2 | | 2 | | | | | | | 3 | | 3 | 33 | | 33 | 32 | | 32 | 29 | | 29 | 27 | | 27 |
| *Quercus rubra* | northern red oak | Tree | | | | | | | | | | | | | | | | | | | 2 | | 2 | | | |
| *Salix nigra* | black willow | Tree | | | | | | | | | | | | | 1 | 8 | 9 | 1 | | 1 | | | | | | |
| *Sambucus canadensis* | Common Elderberry | Shrub | | | | | | | | | | | | | | | | | | | 6 | | 6 | 19 | | 19 |
| *Sambucus nigra* | European black elderberry | Shrub | 1 | | 1 | | | | | | | | | | 5 | | 5 | 11 | | 11 | 7 | | 7 | | | |
| Unknown | | Shrub or Tree | | | | | | | | | | | | | | | | | | | | | | 7 | | 7 |
| | | **Stem count** | 13 | 0 | 13 | 18 | 1 | 19 | 13 | 2 | 14 | 12 | 0 | 12 | 318 | 42 | 360 | 331 | 0 | 331 | 346 | 0 | 346 | 365 | 0 | 365 |
| | | **size (ares)** | 1 | | | 1 | | | 1 | | | 1 | | | 20 | | | 20 | | | 20 | | | 20 | | |
| | | **size (ACRES)** | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.49 | | | 0.49 | | | 0.49 | | | 0.49 | | |
| | | **Species count** | 5 | 0 | 5 | 6 | 1 | 7 | 5 | 2 | 5 | 7 | 0 | 7 | 22 | 9 | 22 | 22 | 0 | 22 | 22 | 0 | 22 | 21 | 0 | 21 |
| | | **Stems per ACRE** | 526.1 | 0.0 | 526.1 | 728.4 | 40.5 | 768.9 | 526.1 | 80.9 | 566.6 | 485.6 | 0.0 | 485.6 | 643.5 | 85.0 | 728.4 | 669.8 | 0.0 | 669.8 | 700.1 | 0.0 | 700.1 | 738.6 | 0.0 | 738.6 |

**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%**

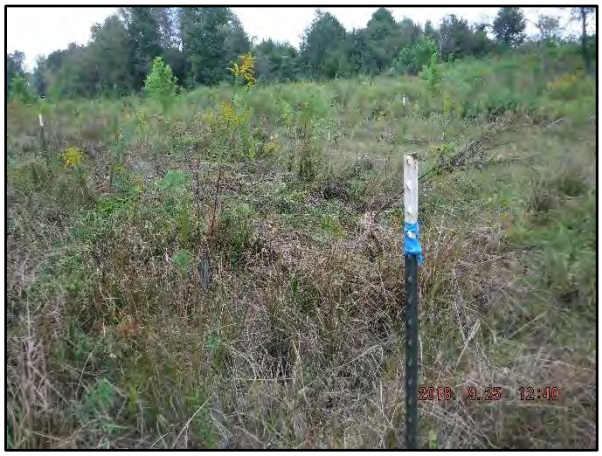
**Pnols = Planted No Live Stakes**
**P-all = Planted Includes Live Stakes**
**T = Total**

# Vegetation Plot Photos

**Vegetation Plot 1 (09/25/2018)**

**Vegetation Plot 2 (09/25/2018)**

**Vegetation Plot 3 (09/25/2018)**



**Vegetation Plot 4 (09/25/2018)**

**Vegetation Plot 5 (09/25/2018)**

**Vegetation Plot 6 (09/05/2018)**

**Vegetation Plot 7 (09/05/2018)**

**Vegetation Plot 8 (09/05/2018)**

**Vegetation Plot 9 (09/05/2018)**

**Vegetation Plot 10 (09/05/2018)**

**Vegetation Plot 11 (09/05/2018)**

**Vegetation Plot 12 (09/05/2018)**

**Vegetation Plot 13 (09/05/2018)**

**Vegetation Plot 14 (09/05/2018)**

**Vegetation Plot 15 (09/05/2018)**


**Vegetation Plot 16 (9/25/2018)**

**Vegetation Plot 17 (09/25/2018)**


**Vegetation Plot 18 (09/25/2018)**

**Vegetation Plot 19 (09/25/2018)**

**Vegetation Plot 20 (09/25/2018)**

# Appendix D

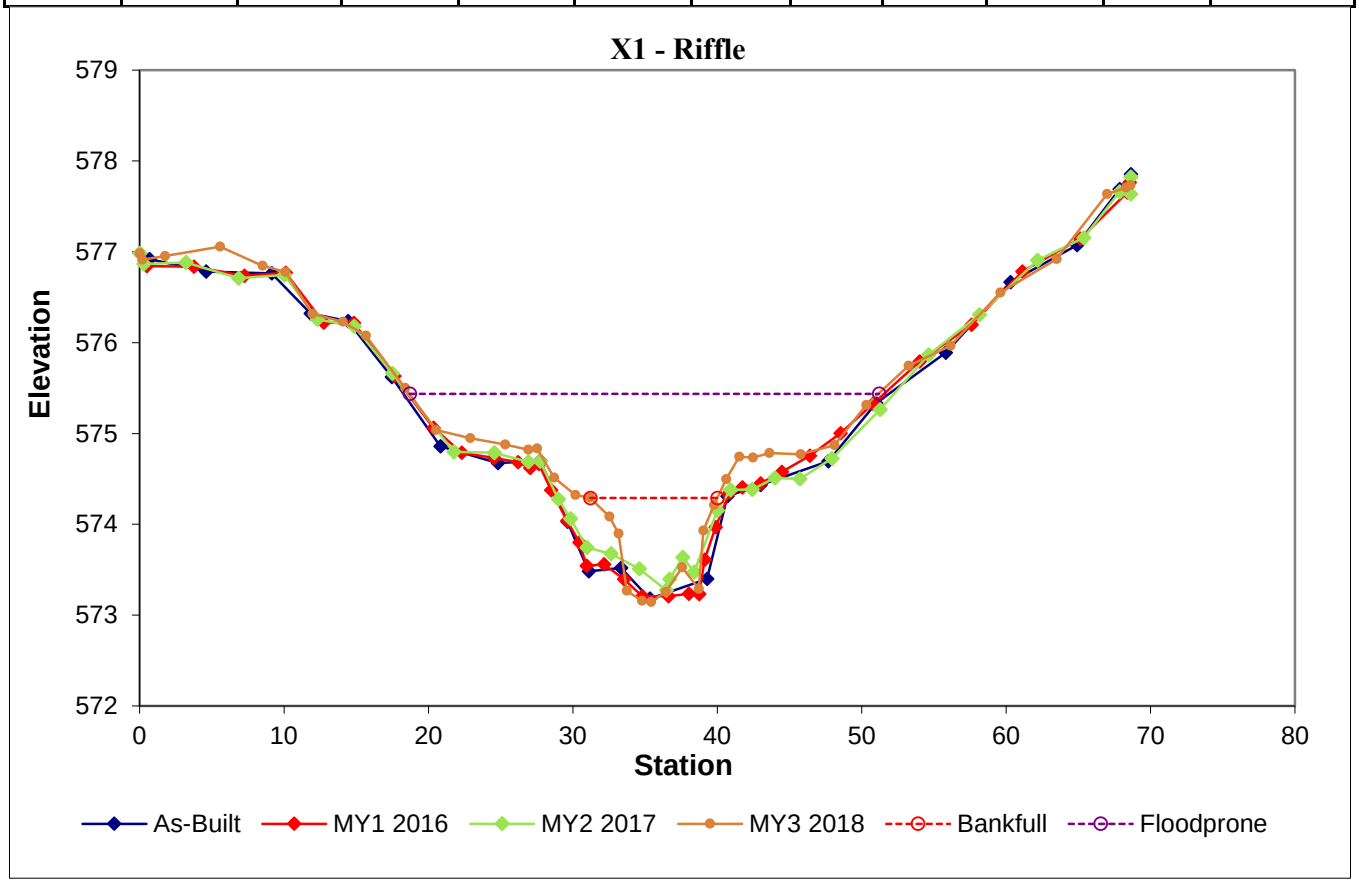
## Stream Survey Data

**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 3 - Collected October 2018**



| | 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 | 6.1 | 8.8 | 0.7 | 1.1 | 12.7 | 1.1 | 3.7 | 574.3 | 574.7 | 32.5 |




*BHR = 1.1 is based on as-built bkf area of 9.1 at an elevation of 574.565. Remainder of data based on actual bankfull elevation from as-built which is 574.3.

**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 3 - Collected October 2018**


**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 | | 20.7 | 17.5 | 1.2 | 2.7 | 14.7 | - | - | 574.7 | 574.6 | 70.6 |

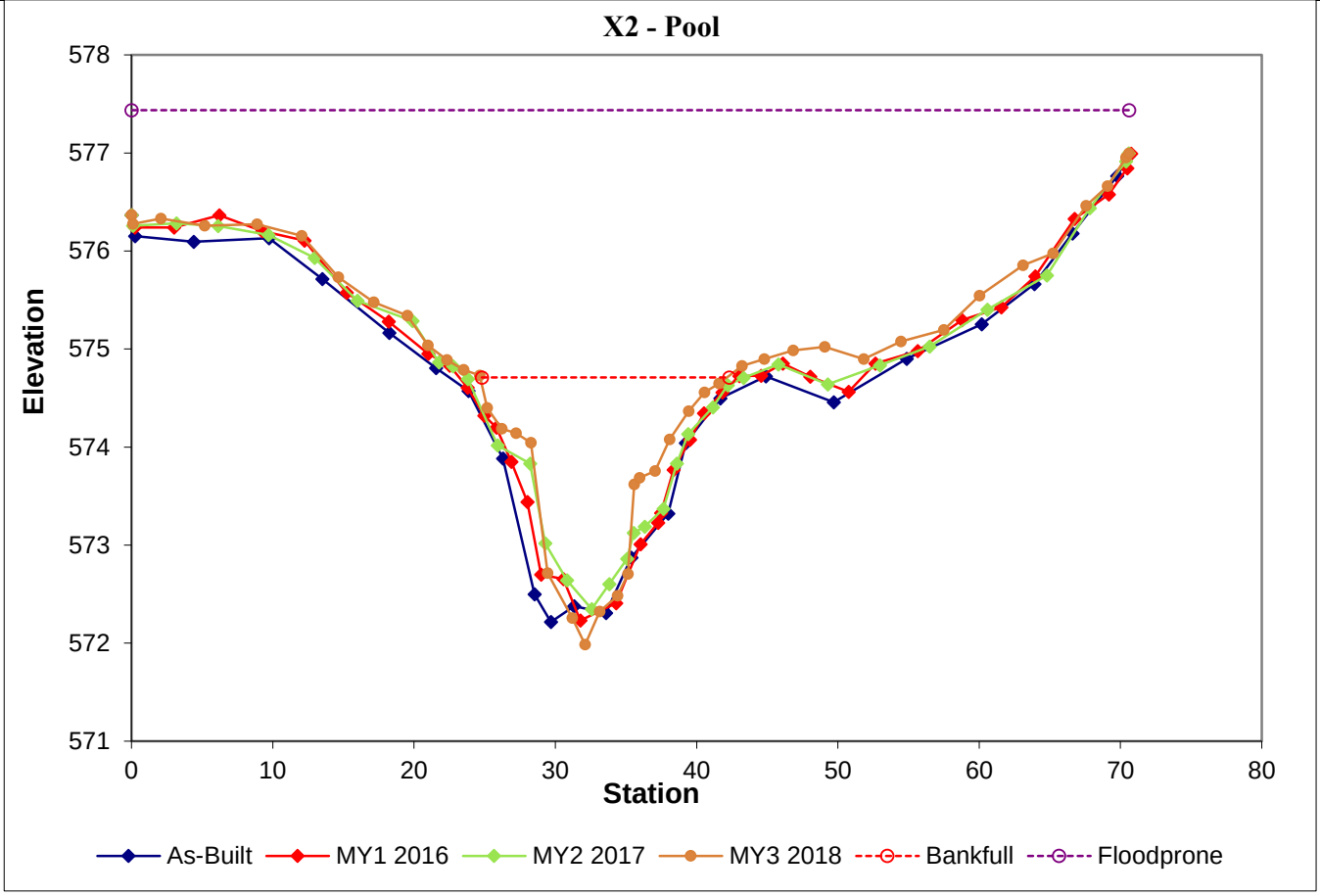


**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X3 Pool - Reach 1 (Station 15+99)**
**Monitoring Year 3 - Collected October 2018**


**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 | | 20.2 | 15.2 | 1.3 | 2.6 | 11.4 | - | - | 571.6 | 571.5 | 77.1 |

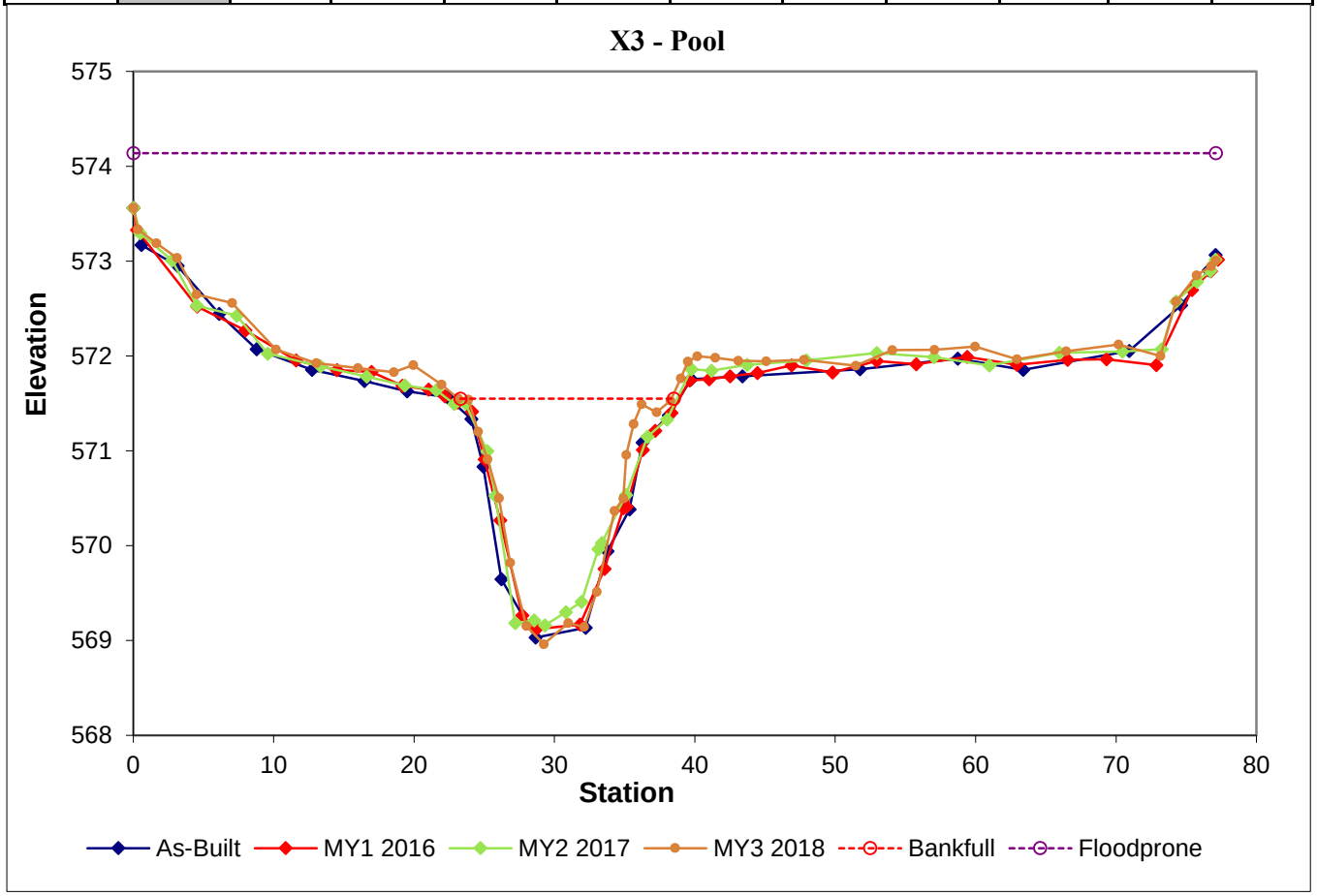


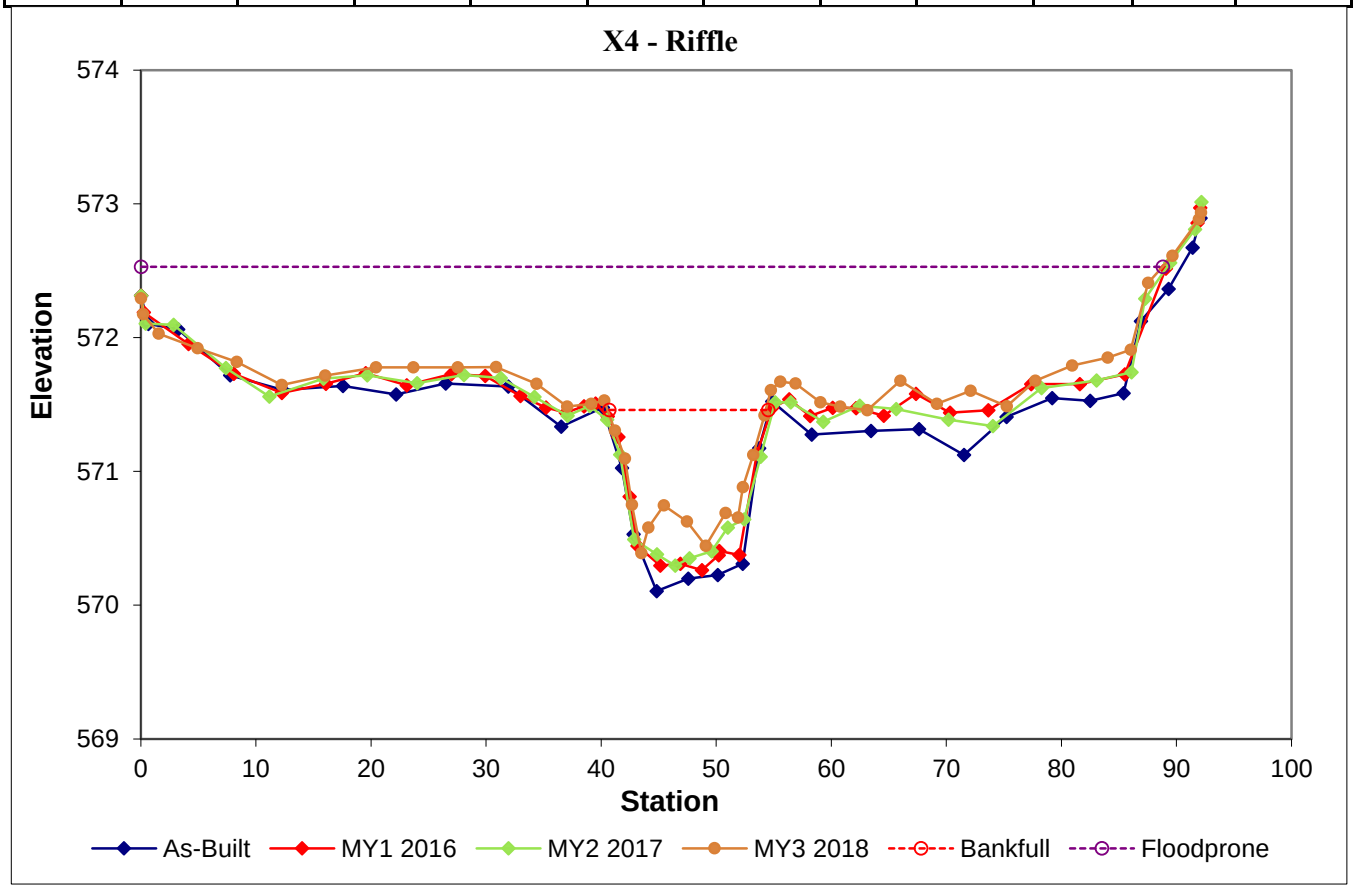
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X4 Riffle - Reach 1 (Station 16+18)**
**Monitoring Year 3 - Collected October 2018**


**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 | 9.3 | 13.8 | 0.7 | 1.1 | 20.2 | 0.9 | 6.7 | 571.5 | 571.5 | 88.8 |




*BHR = 0.9 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.

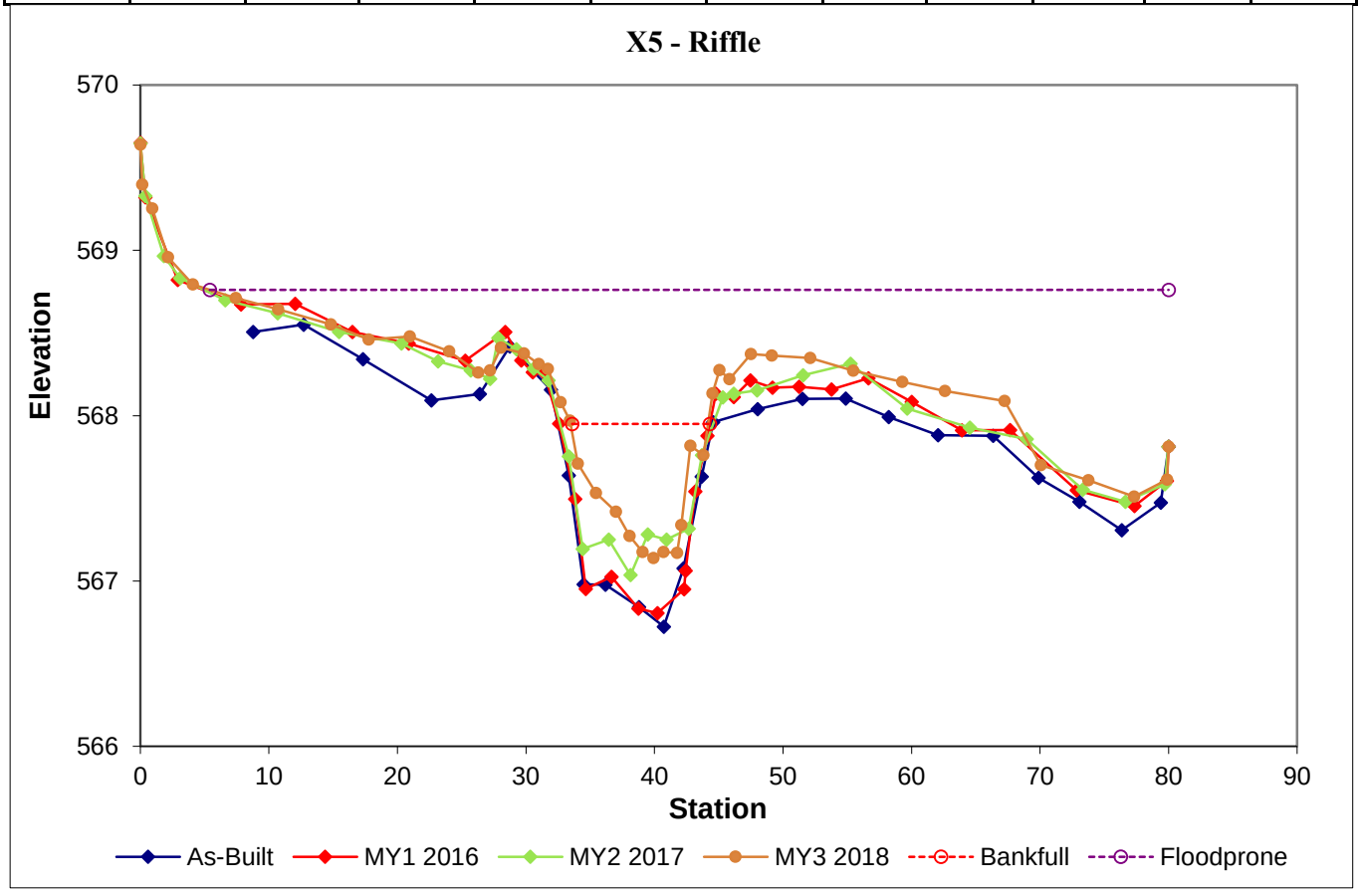
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X5 Riffle - Reach 1 (Station 19+41)**
**Monitoring Year 3 - Collected October 2018**


LEFT BANK


RIGHT BANK

| Feature | Stream Type | BKF Area | BKF Width | BKF Depth | Max BKF Depth | W/D | BH Ratio* | ER | BKF Elev | TOB Elev | WFPA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Riffle | C | 5.5 | 10.7 | 0.5 | 0.8 | 20.9 | 1.0 | 7.2 | 568.0 | 568.3 | 74.6 |




*BHR = 1.0 is based on as-built bkf area of 10.1 at an elevation of 568.257. Remainder of data based on actual bankfull elevation from as-built which is 568.0.

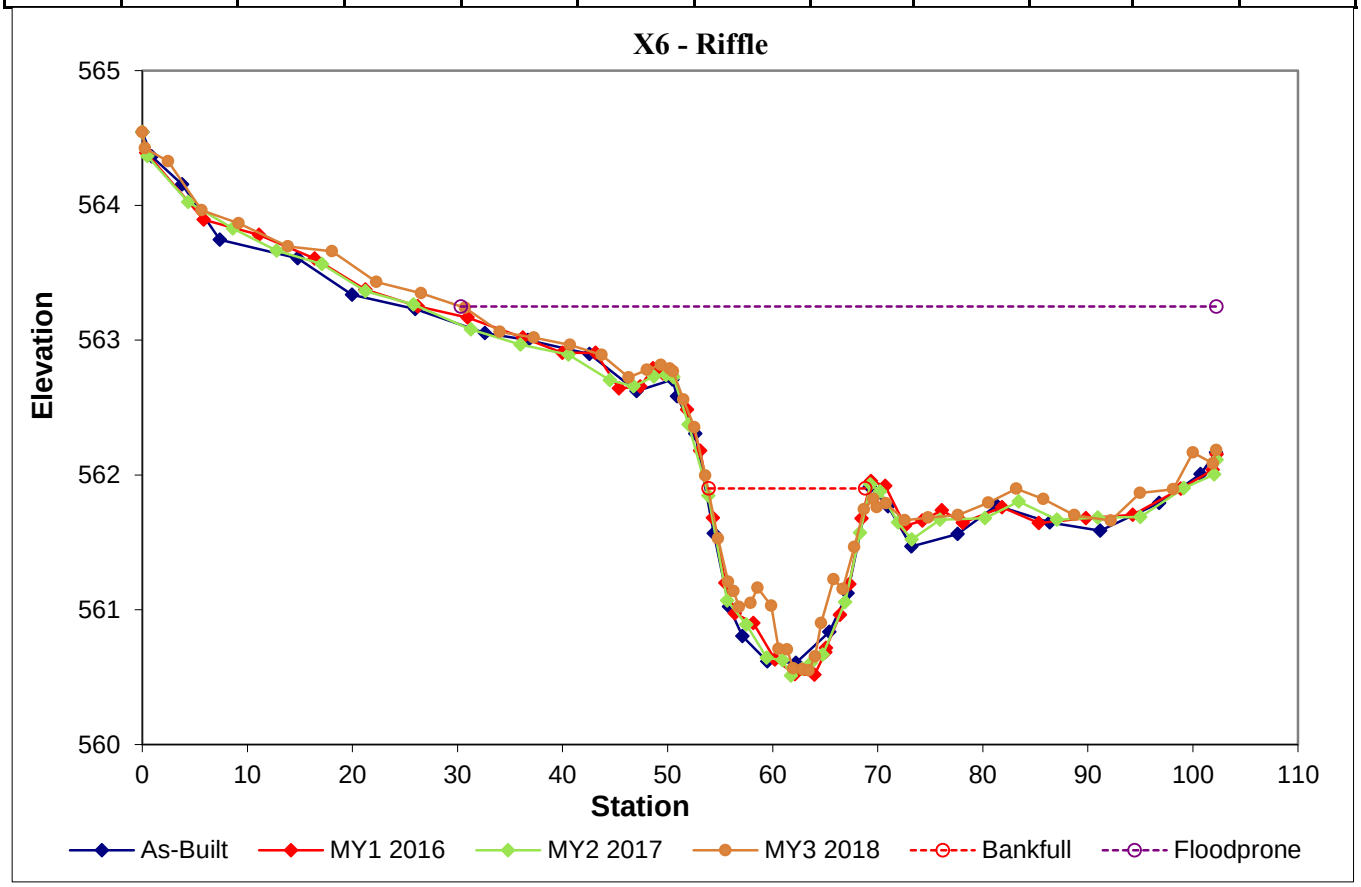
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X6 Riffle - Reach 2 (Station 25+16)**
**Monitoring Year 3 - Collected October 2018**


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 | 12.4 | 14.9 | 0.8 | 1.4 | 17.9 | 0.8 | 4.8 | 561.9 | 561.8 | 71.9 |




*BHR = 0.8 is based on as-built bkf area of 14.8 at an elevation of 562.059. Remainder of data based on actual bankfull elevation from as-built which is 561.9.

**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 3 - Collected October 2018**


**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 | | 19.1 | 15.7 | 1.2 | 2.5 | 13.0 | - | - | 561.6 | 561.7 | 76.3 |

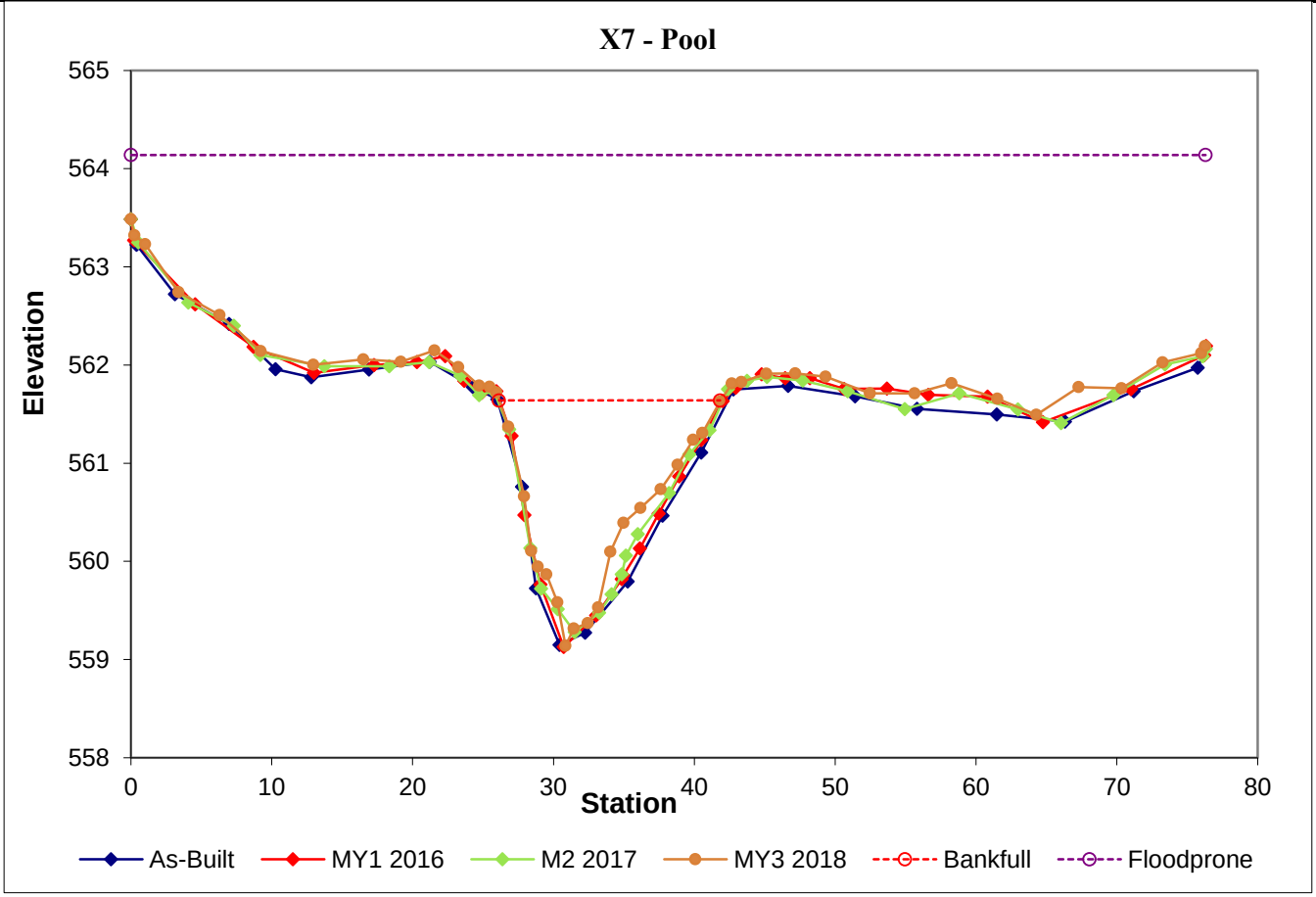


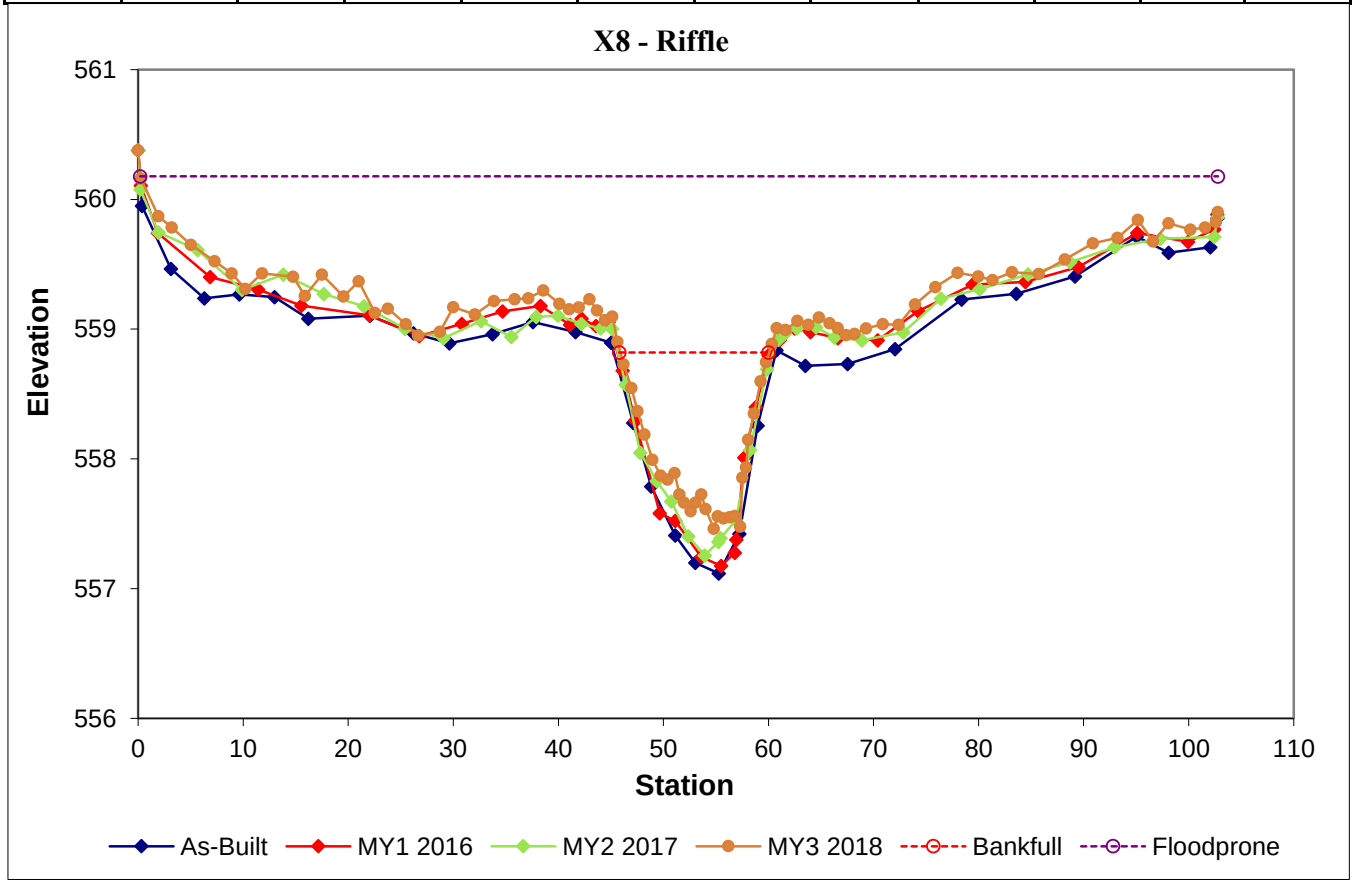
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X8 Riffle - Reach 2 (Station 29+17)**
**Monitoring Year 3 - Collected October 2018**


**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 | 12.2 | 14.2 | 0.9 | 1.4 | 16.5 | 0.9 | 7.3 | 558.8 | 559.0 | 102.6 |




*BHR = 0.9 is based on as-built bkf area of 16.5 at an elevation of 559.095. Remainder of data based on actual bankfull elevation from as-built which is 558.8.

**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 3 - Collected October 2018**



| | 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 | | 29.2 | 18.2 | 1.6 | 2.7 | 11.4 | - | - | 552.7 | 552.8 | 95.4 |

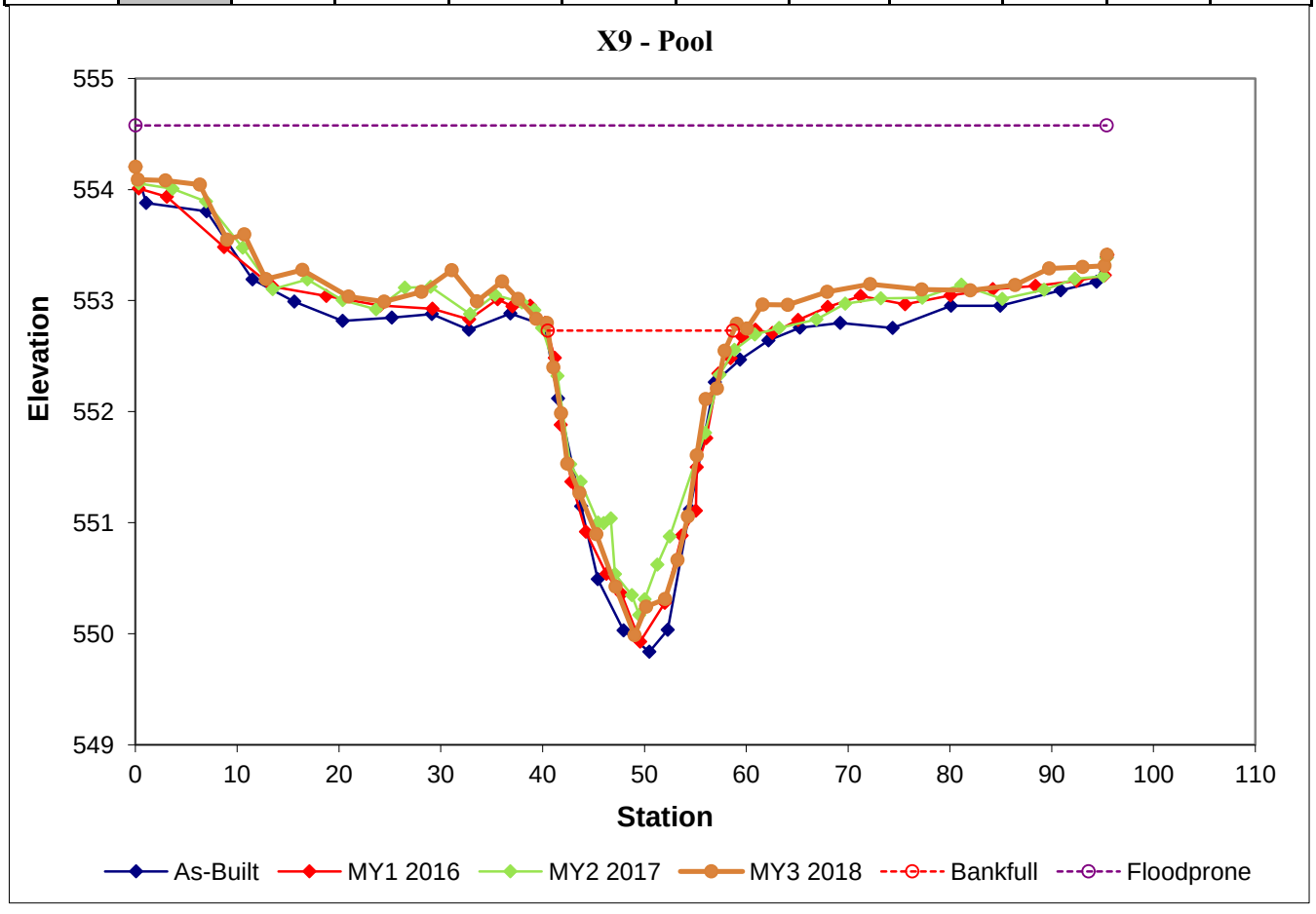


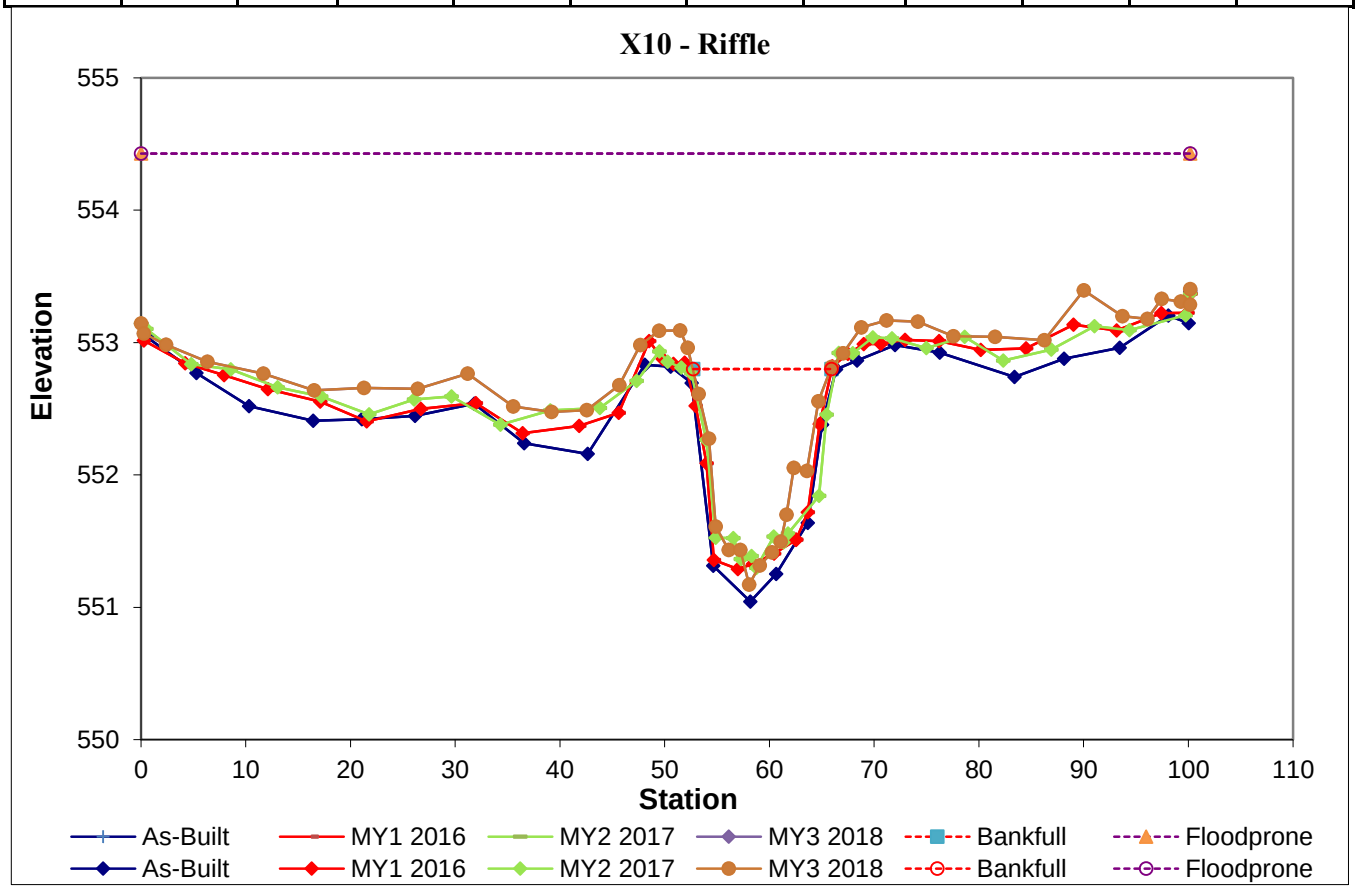
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X10 Riffle - Reach 2 (Station 37+91)**
**Monitoring Year 3 - Collected October 2018**


**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 | 12.7 | 13.2 | 1.0 | 1.6 | 13.7 | 0.9 | 7.6 | 552.8 | 552.8 | 100.2 |




*BHR = 0.9 is based on as-built bkf area of 17.0 at an elevation of 553.09. Remainder of data based on actual bankfull elevation from as-built which is 552.8.

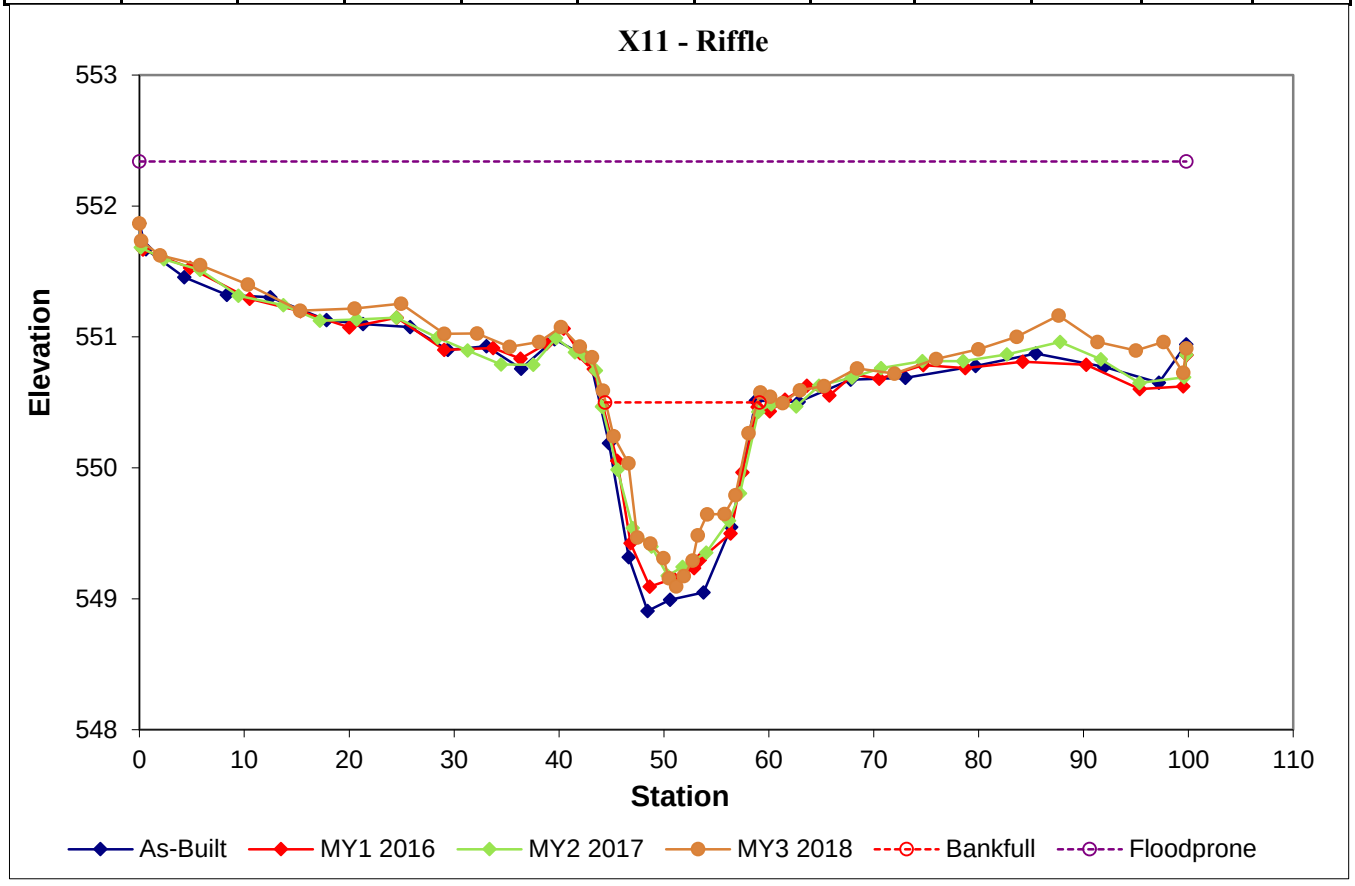
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X11 Riffle - Reach 3 (Station 41+62)**
**Monitoring Year 3 Collected October 2018**


**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 | 11.9 | 14.7 | 0.8 | 1.4 | 18.1 | 0.9 | 6.8 | 550.5 | 550.6 | 99.8 |




*BHR = 0.9 is based on as-built bkf area of 16.3 at an elevation of 550.72. Remainder of data based on actual bankfull elevation from as-built which is 550.5.

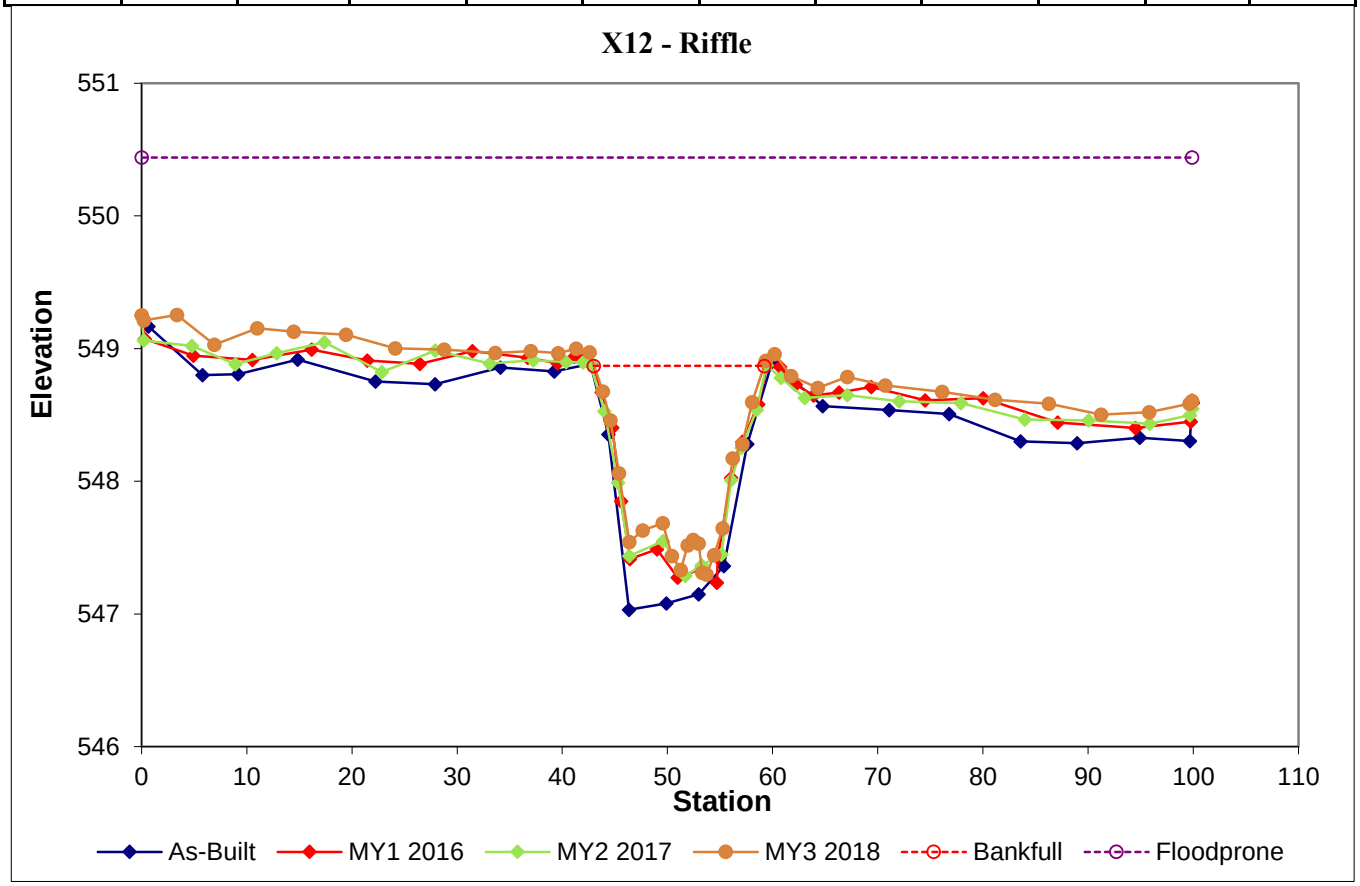
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X12 Riffle - Reach 3 (Station 44+80)**
**Monitoring Year 3 - Collected October 2018**


**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 | 15.9 | 16.2 | 1.0 | 1.6 | 16.4 | 0.9 | 6.2 | 548.9 | 548.9 | 99.9 |




*BHR = 0.9 is based on as-built bkf area of 21.5 at an elevation of 549.08. Remainder of data based on actual bankfull elevation from as-built which is 548.9.

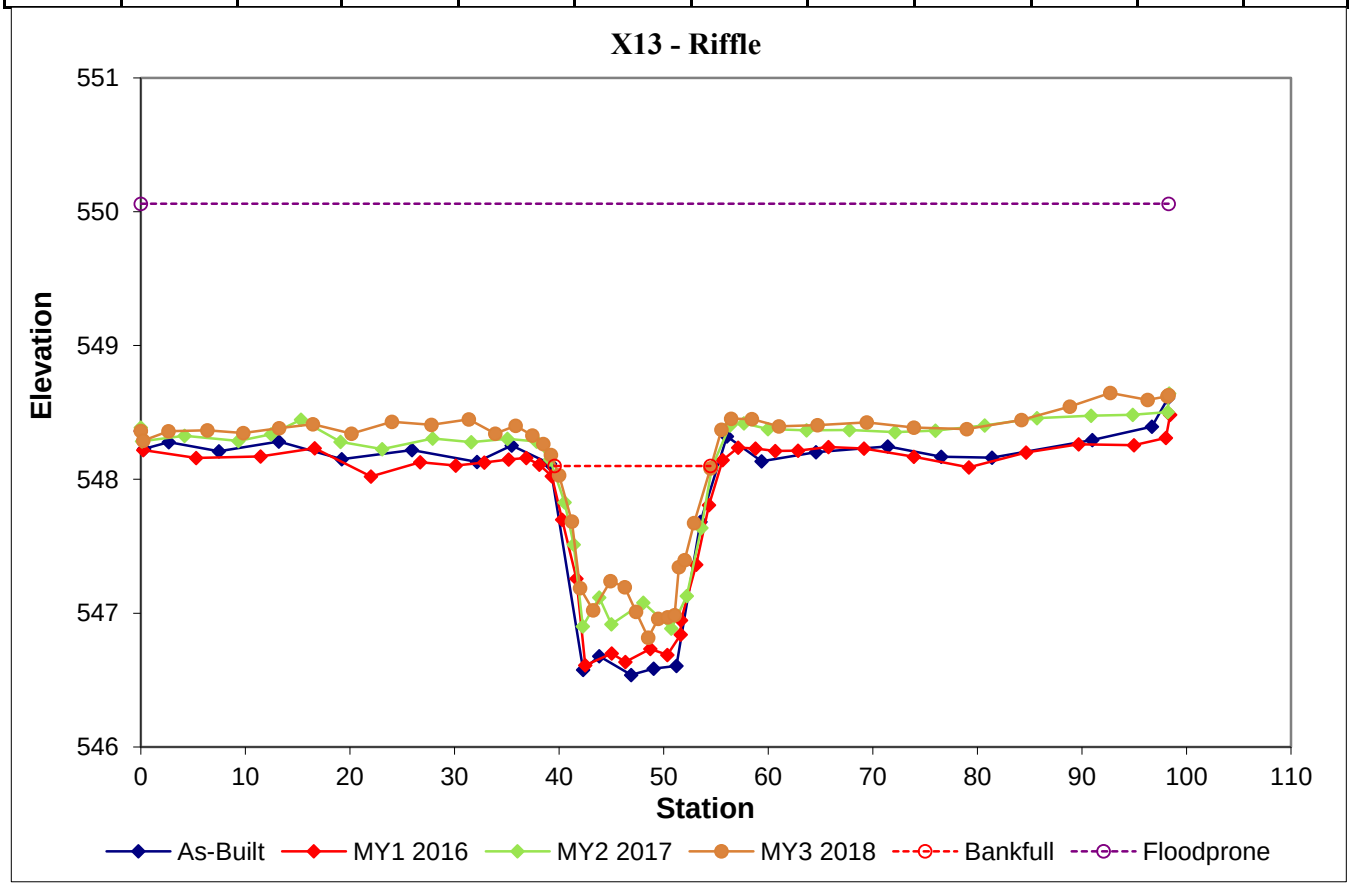
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X13 Riffle - Reach 3 (Station 45+61)**
**Monitoring Year 3 - Collected October 2018**


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 | 11.9 | 14.9 | 0.8 | 1.3 | 18.6 | 0.9 | 6.6 | 548.1 | 548.2 | 98.3 |




*BHR = 0.9 is based on as-built bkf area of 18.3 at an elevation of 548.405. Remainder of data based on actual bankfull elevation from as-built which is 548.1.

**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 3 - Collected October 2018**


**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 | | 30.4 | 18.4 | 1.6 | 2.8 | 11.2 | - | - | 547.9 | 548.1 | 98.7 |

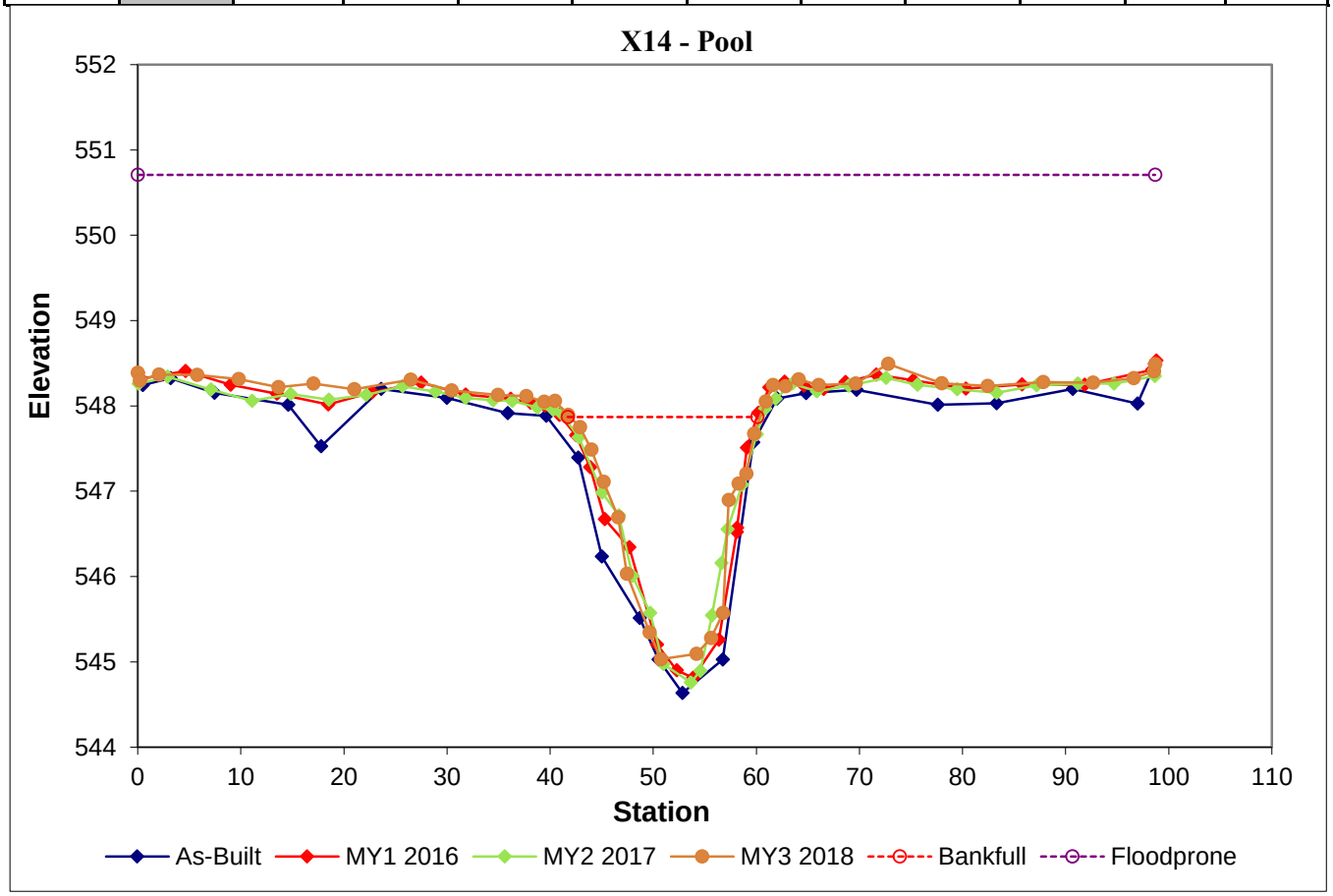


**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X15 Pool - Reach 6 (Station 26+17)**
**Monitoring Year 3 - Collected October 2018**


**LEFT BANK**


**RIGHT BANK**

| Feature | Stream Type | BKF Area | BKF Width | BKF Depth | Max BKF Depth | W/D | BH Ratio* | ER | BKF Elev | TOB Elev | WFPA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pool | | 9.1 | 10.5 | 0.9 | 1.7 | 12.1 | - | - | 553.8 | 554.0 | 60.5 |

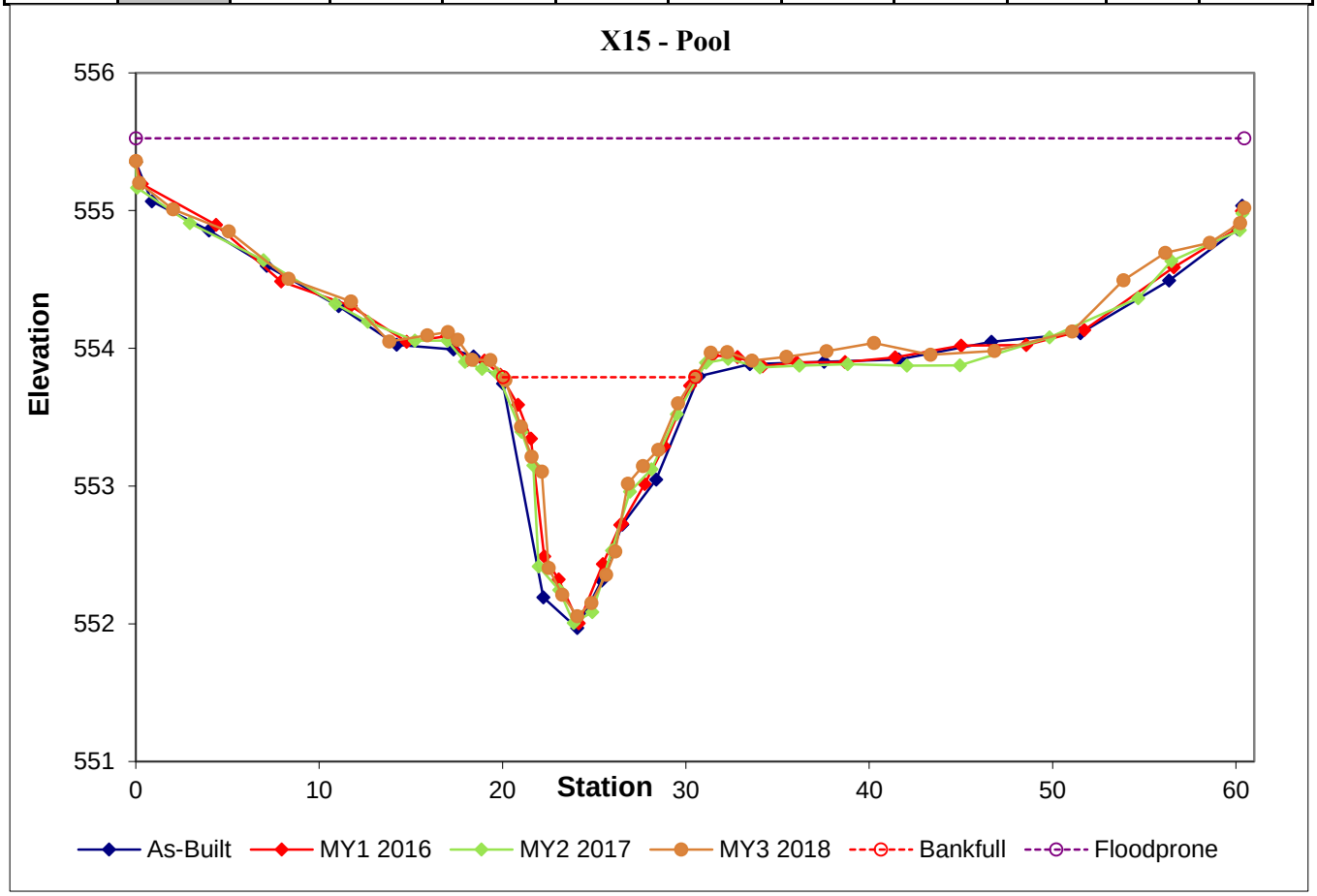


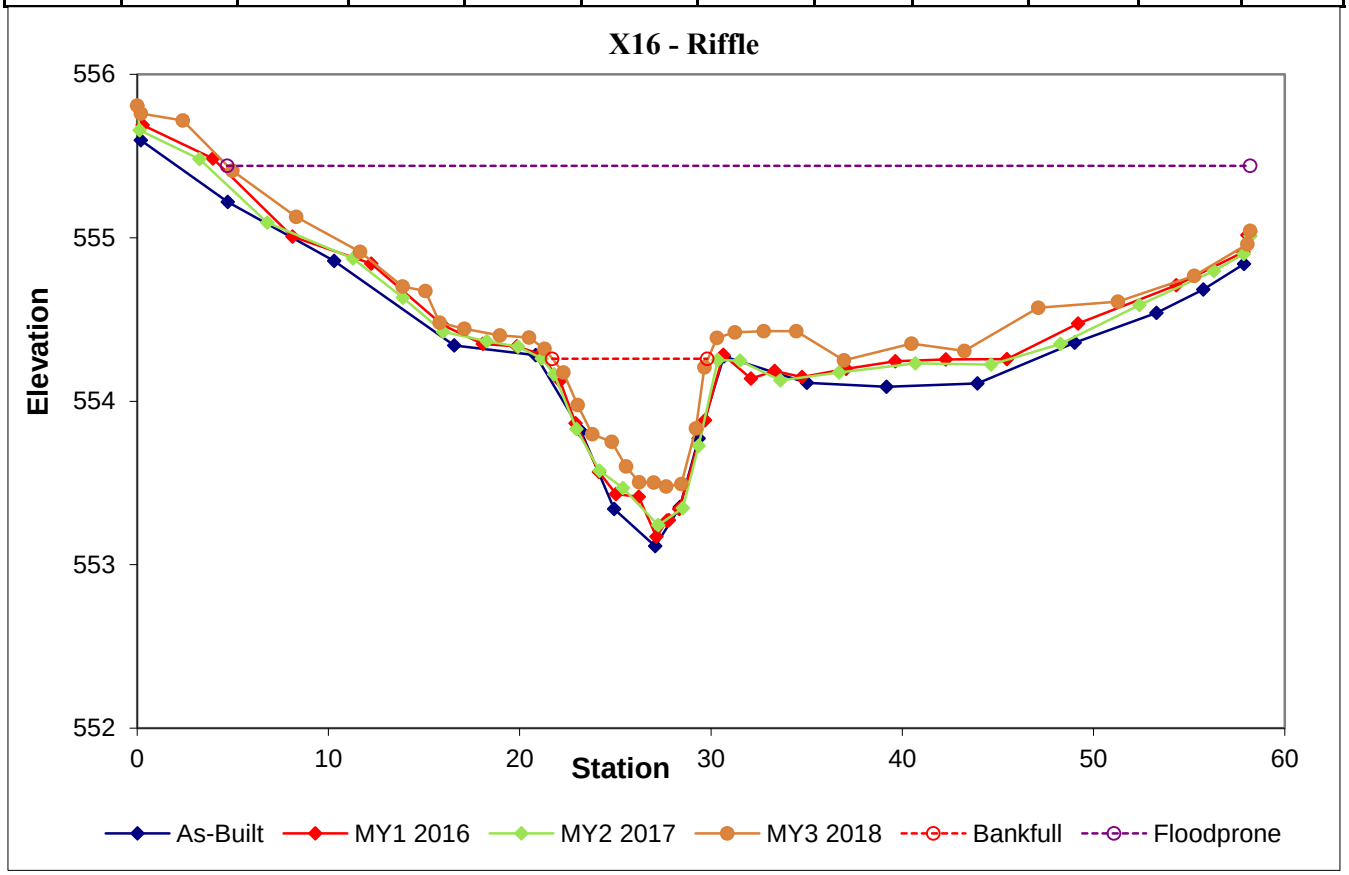
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X16 Riffle - Reach 6 (Station 26+02)**
**Monitoring Year 3 - Collected October 2018**


**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 | 4.1 | 8.1 | 0.5 | 0.8 | 16.1 | 0.9 | 6.6 | 554.3 | 554.3 | 53.5 |




*BHR = 0.9 is based on as-built bkf area of 6.2 at an elevation of 554.458. Remainder of data based on actual bankfull elevation from as-built which is 554.3.

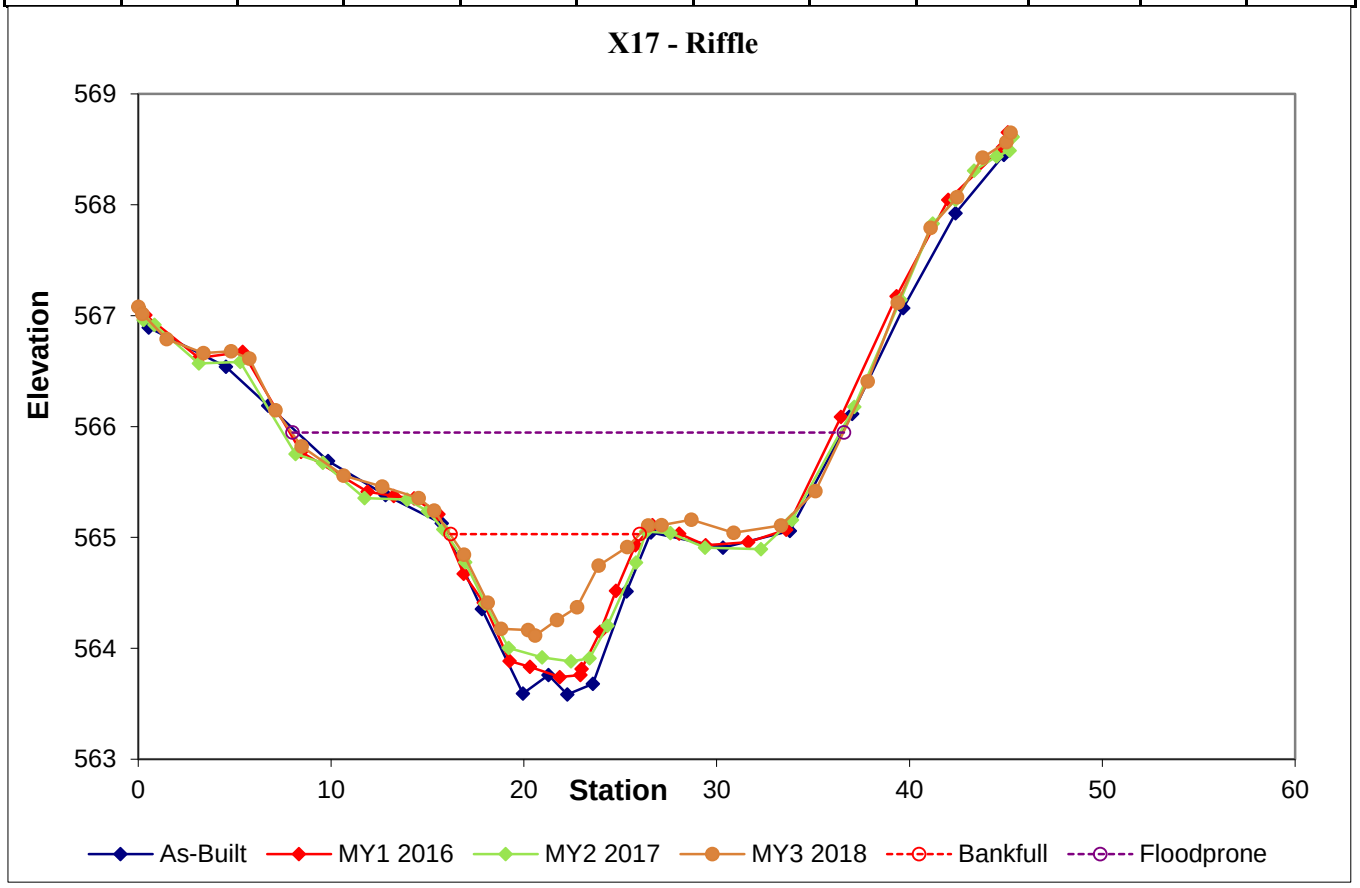
**Figure 3 Continued. Cross-sections with Annual Overlays**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

**Permanent Cross-section**
**X17 Riffle - Reach 6 - (Station 21+06)**
**Monitoring Year 3 - Collected October 2018**


**LEFT BANK**


**RIGHT BANK**

| Feature | Stream Type | BKF Area | BKF Width | BKF Depth | Max BKF Depth | W/D | BH Ratio* | ER | BKF Elev | TOB Elev | WFPA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Riffle | C | 5.2 | 9.8 | 0.5 | 0.9 | 18.7 | 0.8 | 2.9 | 565.0 | 565.1 | 28.6 |

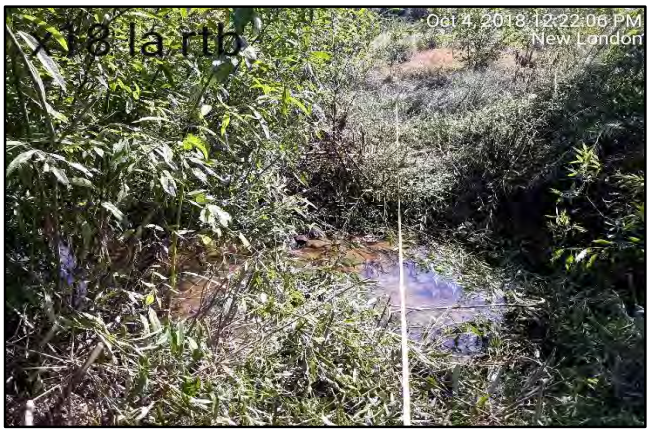



*BHR = 0.8 is based on as-built bkf area of 9.8 at an elevation of 565.31. Remainder of data based on actual bankfull elevation from as-built which is 565.0.

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

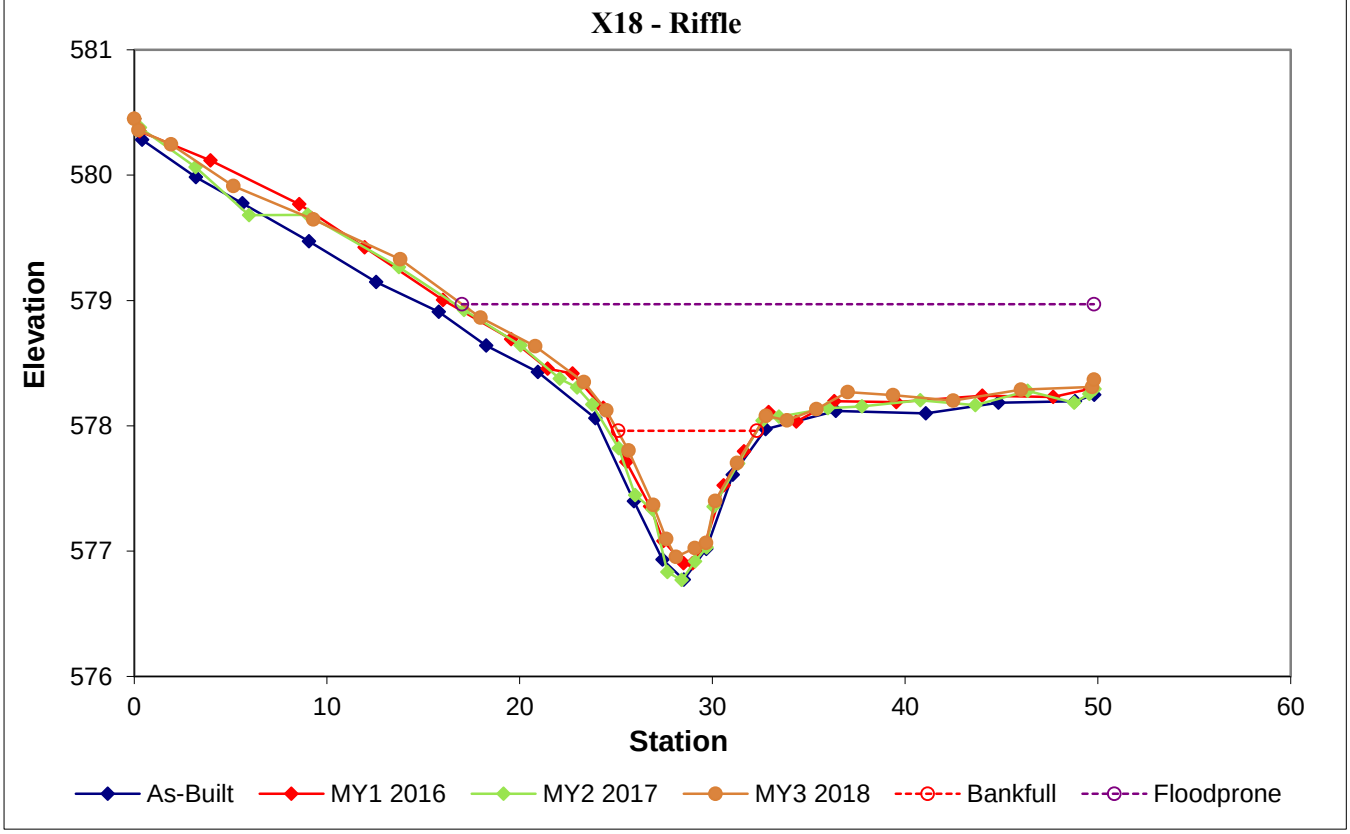
**Permanent Cross-section**
**X18 Riffle - Reach 6 (Station 16+80)**
**Monitoring Year 3 - Collected October 2018**


**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 | 3.9 | 7.2 | 0.5 | 1.0 | 13.4 | 1.0 | 4.5 | 578.0 | 578.1 | 32.8 |




*BHR = 1.0 is based on as-built bkf area of 5.3 at an elevation of 578.12. Remainder of data based on actual bankfull elevation from as-built which is 578.0.

**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 3 - Collected October 2018**


**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 | | 7.1 | 9.7 | 0.7 | 1.3 | 13.1 | - | - | 575.8 | 575.7 | 39.7 |

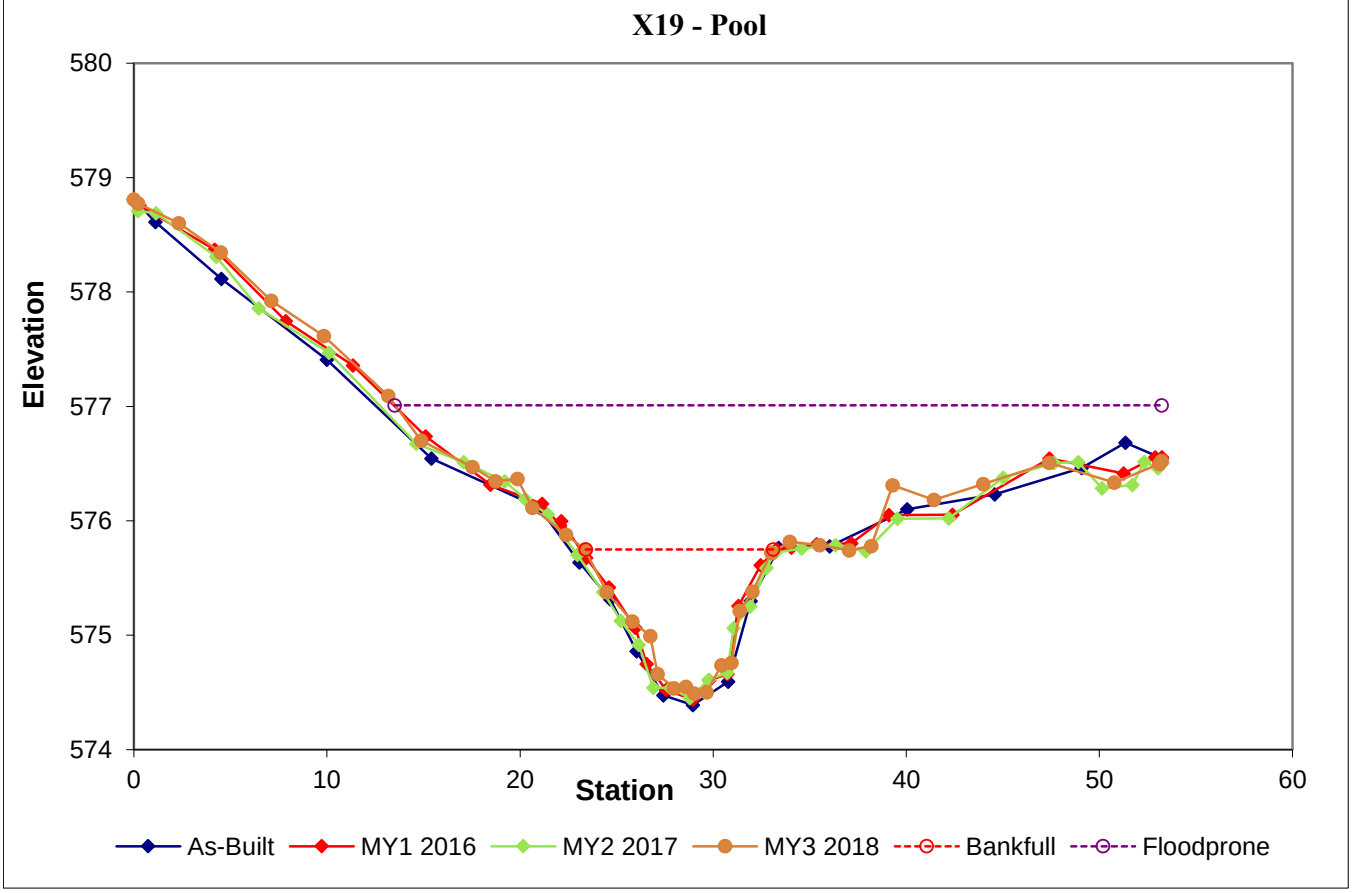


**Table 10. Baseline Stream Summary Data**
**UT to Town Creek Restoration Project - Option A: DMS Project ID No. 94648**
**Reach 1 (1,204 LF)**

| 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 | ----- | ----- | ----- | ----- | | | ----- | :4 (incisec | ----- | ----- | ----- | ----- | ----- | 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 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 4 (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) $lb/ft^2$ | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 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) $lb/f^2$ | ----- | ----- | ----- | ----- | ----- | 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) $lb/ft^2$ | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 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) $lb/f^2$ | ----- | ----- | ----- | ----- | ----- | 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) $lb/f^2$ | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 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 | | | | 22.2 | 19.7 | 19.7 | 17.5 | | | | 16.4 | 16.4 | 16.5 | 15.2 | | | | 14.4 | 14.7 | 15.5 | 13.8 | | | |
| BF Mean Depth (ft) | 0.8 | 0.8 | 0.6 | 0.7 | | | | 1.2 | 1.3 | 1.1 | 1.2 | | | | 1.4 | 1.3 | 1.3 | 1.3 | | | | 1.0 | 0.8 | 0.8 | 0.7 | | | |
| Width/Depth Ratio | 15.2 | 15.7 | 19.7 | 12.7 | | | | 18.0 | 15.7 | 17.3 | 14.7 | | | | 11.6 | 12.3 | 13.1 | 11.4 | | | | 15.0 | 17.6 | 20.1 | 20.2 | | | |
| BF Cross-sectional Area (ft²) | 9.1 | 9.2 | 6.9 | 6.1 | | | | 27.4 | 24.8 | 22.5 | 20.7 | | | | 23.2 | 21.7 | 20.9 | 20.2 | | | | 13.9 | 12.4 | 12.0 | 9.3 | | | |
| BF Max Depth (ft) | 1.1 | 1.1 | 1.1 | 1.1 | | | | 2.3 | 2.5 | 2.4 | 2.7 | | | | 2.5 | 2.4 | 2.4 | 2.6 | | | | 1.3 | 1.3 | 1.3 | 1.1 | | | |
| Width of Floodprone Area (ft) | 33.1 | 32.5 | 32.3 | 32.5 | | | | 70.6 | 70.7 | 70.6 | 70.6 | | | | 77.1 | 77.3 | 77.1 | 77.1 | | | | 91.8 | 90.2 | 90.0 | 88.8 | | | |
| Entrenchment Ratio | 2.8 | 2.8 | 2.7 | 3.7 | | | | - | - | - | - | | | | - | - | - | - | | | | 6.4 | 6.3 | 6.2 | 6.7 | | | |
| *Bank Height Ratio | 1.0 | 1.0 | 1.0 | 1.1 | | | | - | - | - | - | | | | - | - | - | - | | | | 1.0 | 0.9 | 1.0 | 0.9 | | | |
| Wetted Perimeter (ft) | 13.3 | 13.5 | 12.8 | 9.7 | | | | 24.7 | 22.3 | 22.0 | 19.1 | | | | 19.2 | 19.0 | 19.0 | 16.7 | | | | 16.4 | 16.4 | 17.0 | 14.2 | | | |
| Hydraulic Radius (ft) | 0.7 | 0.7 | 0.5 | 0.6 | | | | 1.1 | 1.1 | 1.0 | 1.1 | | | | 1.2 | 1.1 | 1.1 | 1.2 | | | | 0.8 | 0.8 | 0.7 | 0.7 | | | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Mean Depth (ft) | 0.8 | 0.9 | 0.6 | 0.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width/Depth Ratio | 14.4 | 14.1 | 19.9 | 20.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Cross-sectional Area (ft²) | 10.1 | 10.3 | 7.1 | 5.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Max Depth (ft) | 1.1 | 1.1 | 1.1 | 0.8 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width of Floodprone Area (ft) | 71.2 | 79.0 | 77.2 | 74.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| Entrenchment Ratio | 5.9 | 6.6 | 6.4 | 7.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Bank Height Ratio | 1.0 | 1.2 | 1.0 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wetted Perimeter (ft) | 13.7 | 13.8 | 13.1 | 11.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydraulic Radius (ft) | 0.7 | 0.7 | 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.

**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 | | | | 16.3 | 15.9 | 16.0 | 15.7 | | | | 15.4 | 14.6 | 14.7 | 14.2 | | | | 24.3 | 20.3 | 22.3 | 18.2 | | | |
| BF Mean Depth (ft) | 1.0 | 1.0 | 1.0 | 0.8 | | | | 1.4 | 1.4 | 1.3 | 1.2 | | | | 1.1 | 1.0 | 1.0 | 0.9 | | | | 1.4 | 1.5 | 1.2 | 1.6 | | | |
| Width/Depth Ratio | 16.5 | 16.2 | 16.4 | 17.9 | | | | 11.5 | 11.6 | 12.2 | 13.0 | | | | 14.5 | 14.1 | 15.2 | 16.5 | | | | 17.9 | 13.4 | 18.6 | 11.4 | | | |
| BF Cross-sectional Area (ft²) | 14.8 | 14.6 | 14.8 | 12.4 | | | | 23.2 | 21.8 | 21.0 | 19.1 | | | | 16.5 | 15.1 | 14.3 | 12.2 | | | | 33.1 | 30.9 | 26.8 | 29.2 | | | |
| BF Max Depth (ft) | 1.3 | 1.3 | 1.3 | 1.4 | | | | 2.5 | 2.5 | 2.4 | 2.5 | | | | 1.6 | 1.6 | 1.6 | 1.4 | | | | 2.9 | 2.8 | 2.6 | 2.7 | | | |
| Width of Floodprone Area (ft) | 74.9 | 77.3 | 77.6 | 71.9 | | | | 75.8 | 76.4 | 76.3 | 76.3 | | | | 102.7 | 102.7 | 102.7 | 102.6 | | | | 95.4 | 95.5 | 95.4 | 95.4 | | | |
| Entrenchment Ratio | 4.8 | 5.0 | 5.0 | 4.8 | | | | - | - | - | - | | | | 6.7 | 6.7 | 6.7 | 7.3 | | | | - | - | - | - | | | |
| *Bank Height Ratio | 1.0 | 1.1 | 1.1 | 0.8 | | | | - | - | - | - | | | | 1.0 | 1.0 | 1.0 | 0.9 | | | | - | - | - | - | | | |
| Wetted Perimeter (ft) | 17.5 | 17.3 | 17.4 | 15.3 | | | | 19.2 | 18.7 | 18.6 | 16.8 | | | | 17.6 | 16.7 | 16.7 | 14.8 | | | | 27.1 | 23.4 | 24.7 | 19.3 | | | |
| Hydraulic Radius (ft) | 0.8 | 0.8 | 0.9 | 0.8 | | | | 1.2 | 1.2 | 1.1 | 1.1 | | | | 0.9 | 0.9 | 0.9 | 0.8 | | | | 1.2 | 1.3 | 1.1 | 1.5 | | | |
| 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-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 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Mean Depth (ft) | 1.1 | 1.1 | 1.0 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width/Depth Ratio | 14.2 | 12.8 | 14.5 | 13.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Cross-sectional Area (ft²) | 17.0 | 15.1 | 14.4 | 12.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Max Depth (ft) | 1.8 | 1.8 | 1.8 | 1.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width of Floodprone Area (ft) | 100.0 | 100.2 | 100.2 | 100.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Entrenchment Ratio | 6.4 | 6.5 | 6.5 | 7.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Bank Height Ratio | 0.9 | 0.9 | 0.8 | 0.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| Wetted Perimeter (ft) | 17.7 | 16.1 | 16.5 | 13.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydraulic Radius (ft) | 1.0 | 0.9 | 0.9 | 0.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | | | | 17.1 | 16.5 | 16.7 | 16.2 | | | | 16.0 | 17.2 | 15.3 | 14.9 | | | | 21.3 | 19.0 | 19.2 | 18.4 | | | |
| BF Mean Depth (ft) | 1.1 | 0.9 | 0.9 | 0.8 | | | | 1.3 | 1.1 | 1.1 | 1.0 | | | | 1.2 | 1.0 | 0.9 | 0.8 | | | | 1.8 | 1.7 | 1.6 | 1.6 | | | |
| Width/Depth Ratio | 13.5 | 20.2 | 16.8 | 18.1 | | | | 13.7 | 15.5 | 15.9 | 16.4 | | | | 14.0 | 17.3 | 17.4 | 18.6 | | | | 11.7 | 11.1 | 12.0 | 11.2 | | | |
| BF Cross-sectional Area (ft²) | 16.3 | 14.5 | 13.3 | 11.9 | | | | 21.5 | 17.6 | 17.5 | 15.9 | | | | 18.3 | 17.2 | 13.5 | 11.9 | | | | 39.0 | 32.5 | 30.6 | 30.4 | | | |
| BF Max Depth (ft) | 1.5 | 1.5 | 1.5 | 1.4 | | | | 1.8 | 1.8 | 1.8 | 1.6 | | | | 1.6 | 1.6 | 1.6 | 1.3 | | | | 3.2 | 3.1 | 3.1 | 2.8 | | | |
| Width of Floodprone Area (ft) | 99.8 | 99.9 | 99.8 | 99.8 | | | | 99.7 | 100.0 | 99.9 | 99.9 | | | | 98.3 | 98.4 | 98.4 | 98.3 | | | | 98.7 | 98.8 | 98.7 | 98.7 | | | |
| Entrenchment Ratio | 6.7 | 6.7 | 6.7 | 6.8 | | | | 5.8 | 5.8 | 5.8 | 6.2 | | | | 6.1 | 6.2 | 6.2 | 6.6 | | | | - | - | - | - | | | |
| *Bank Height Ratio | 1.0 | 0.9 | 0.7 | 0.9 | | | | 1.0 | 0.9 | 0.9 | 0.9 | | | | 1.0 | 0.9 | 0.8 | 0.9 | | | | - | - | - | - | | | |
| Wetted Perimeter (ft) | 17.1 | 18.8 | 16.7 | 15.1 | | | | 19.6 | 18.7 | 18.8 | 16.8 | | | | 18.3 | 19.2 | 17.1 | 15.4 | | | | 25.0 | 22.4 | 22.4 | 20.1 | | | |
| Hydraulic Radius (ft) | 1.0 | 0.8 | 0.8 | 0.8 | | | | 1.1 | 0.9 | 0.9 | 0.9 | | | | 1.0 | 0.9 | 0.8 | 0.8 | | | | 1.6 | 1.5 | 1.4 | 1.5 | | | |
| 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 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 | | | | 9.7 | 9.3 | 9.2 | 8.1 | | | | 10.5 | 10.3 | 10.3 | 9.8 | | | | 8.5 | 7.5 | 7.6 | 7.2 | | | |
| BF Mean Depth (ft) | 1.0 | 0.9 | 0.9 | 0.9 | | | | 0.6 | 0.6 | 0.6 | 0.5 | | | | 0.9 | 0.8 | 0.8 | 0.5 | | | | 0.6 | 0.6 | 0.6 | 0.5 | | | |
| Width/Depth Ratio | 10.9 | 12.0 | 11.9 | 12.1 | | | | 15.1 | 15.2 | 14.8 | 16.1 | | | | 11.4 | 12.6 | 13.3 | 18.7 | | | | 13.5 | 13.0 | 12.7 | 13.4 | | | |
| BF Cross-sectional Area (ft²) | 11.1 | 9.4 | 9.9 | 9.1 | | | | 6.2 | 5.7 | 5.7 | 4.1 | | | | 9.8 | 8.4 | 7.9 | 5.2 | | | | 5.3 | 4.3 | 4.6 | 3.9 | | | |
| BF Max Depth (ft) | 1.8 | 1.8 | 1.8 | 1.7 | | | | 1.2 | 1.2 | 1.2 | 0.8 | | | | 1.5 | 1.5 | 1.5 | 0.9 | | | | 1.2 | 1.2 | 1.2 | 1.0 | | | |
| Width of Floodprone Area (ft) | 60.3 | 60.3 | 60.4 | 60.5 | | | | 55.4 | 52.9 | 53.1 | 53.5 | | | | 33.1 | 30.5 | 30.3 | 28.6 | | | | 37.3 | 34.0 | 34.8 | 32.8 | | | |
| Entrenchment Ratio | - | - | - | - | | | | 5.7 | 5.5 | 5.5 | 6.6 | | | | 3.1 | 2.9 | 2.9 | 2.9 | | | | 4.4 | 4.0 | 4.1 | 4.5 | | | |
| *Bank Height Ratio | - | - | - | - | | | | 0.6 | 0.8 | 0.9 | 0.9 | | | | 1.0 | 0.9 | 0.8 | 0.8 | | | | 1.0 | 1.0 | 1.1 | 1.0 | | | |
| Wetted Perimeter (ft) | 13.0 | 12.4 | 12.7 | 11.3 | | | | 11.0 | 10.6 | 10.4 | 8.4 | | | | 12.4 | 11.9 | 11.8 | 10.1 | | | | 9.7 | 8.6 | 8.8 | 7.6 | | | |
| Hydraulic Radius (ft) | 0.9 | 0.8 | 0.8 | 0.8 | | | | 0.6 | 0.5 | 0.5 | 0.5 | | | | 0.8 | 0.7 | 0.7 | 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 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Mean Depth (ft) | 0.8 | 0.7 | 0.8 | 0.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width/Depth Ratio | 13.7 | 14.1 | 13.8 | 13.1 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Cross-sectional Area (ft²) | 8.4 | 7.3 | 7.9 | 7.1 | | | | | | | | | | | | | | | | | | | | | | | | |
| BF Max Depth (ft) | 1.4 | 1.3 | 1.3 | 1.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| Width of Floodprone Area (ft) | 41.4 | 40.1 | 40.8 | 39.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| Entrenchment Ratio | - | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | |
| *Bank Height Ratio | - | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | |
| Wetted Perimeter (ft) | 12.3 | 11.6 | 12.0 | 10.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydraulic Radius (ft) | 0.7 | 0.6 | 0.7 | 0.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| 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.

**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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |
| 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 |
| 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 |
| *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 |
| 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 |
| 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 |
| *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 |
| *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 |
| d50 (mm) | ----- | 31.2 | ----- | ----- | ----- | ----- | ----- | 64.0 | ----- | ----- | ----- | ----- | ----- | 77.1 | ----- | ----- | ----- | ----- | ----- | 42.8 | ----- | ----- | ----- | ----- |
| **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 |
| 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 |
| 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 |
| 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 |
| Pool Volume ($ft^3$) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| **Substrate and Transport Parameters** | | | | | | | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 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 | | | | |
| 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) | ----- | 0.83 | ----- | ----- | ----- | ----- | ----- | 0.83 | ----- | ----- | ----- | ----- | ----- | 0.83 | ----- | ----- | ----- | ----- | ----- | 0.83 | ----- | ----- | ----- | ----- |
| Impervious cover estimate (%) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Rosgen Classification | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C3 | ----- | ----- | ----- | ----- | ----- | C3 | ----- | ----- | ----- | ----- |
| BF Velocity (fps) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| BF Discharge (cfs) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Valley Length | ----- | 1,082 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Channel length $(ft)^2$ | ----- | 1,206 | ----- | ----- | ----- | ----- | ----- | 750 | ----- | ----- | ----- | ----- | ----- | 750 | ----- | ----- | ----- | ----- | ----- | 750 | ----- | ----- | ----- | ----- |
| Sinuosity | ----- | 1.11 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Water Surface Slope (Channel) (ft/ft) | ----- | 0.0096 | ----- | ----- | ----- | ----- | ----- | 0.009 | ----- | ----- | ----- | ----- | ----- | 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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |
| 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 |
| 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 |
| *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 |
| 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 |
| 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 |
| *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 |
| *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 |
| d50 (mm) | ----- | 20.9 | ----- | ----- | ----- | ----- | ----- | 46.8 | ----- | ----- | ----- | ----- | ----- | 54.7 | ----- | ----- | ----- | ----- | ----- | 42.5 | ----- | ----- | ----- | ----- |
| **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 |
| 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 |
| 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 |
| 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 |
| Pool Volume ($ft^3$) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| **Substrate and Transport Parameters** | | | | | | | | | | | | | | | | | | | | | | | | |
| Ri% / Ru% / P% / G% / S% | ----- | ----- | ----- | ----- | ----- | ---- | ----- | ----- | ----- | ----- | ----- | ---- | ----- | ----- | ----- | ----- | ----- | ---- | ----- | ----- | ----- | ----- | ----- | ---- |
| SC% / Sa% / G% / B% / Be% | ----- | ----- | ----- | ----- | ----- | --- | ----- | ----- | ----- | ----- | ----- | --- | ----- | ----- | ----- | ----- | ----- | --- | ----- | ----- | ----- | ----- | ----- | --- |
| d16 / d35 / d50 / d84 / d95 | | <0.063 / 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 | | | | |
| 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) | ----- | 0.96 | ----- | ----- | ----- | ----- | ----- | 0.96 | ----- | ----- | ----- | ----- | ----- | 0.96 | ----- | ----- | ----- | ----- | ----- | 0.96 | ----- | ----- | ----- | ----- |
| Impervious cover estimate (%) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Rosgen Classification | ----- | 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 | ----- | ----- | ----- | ----- |
| Sinuosity | ----- | 1.19 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Water Surface Slope (Channel) (ft/ft) | ----- | 0.0077 | ----- | ----- | ----- | ----- | ----- | 0.0069 | ----- | ----- | ----- | ----- | ----- | 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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |
| 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 |
| 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 |
| *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 |
| 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 |
| 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 |
| *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 |
| *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 |
| d50 (mm) | ----- | 21.8 | ----- | ----- | ----- | ----- | ----- | 53.7 | ----- | ----- | ----- | ----- | ----- | 17.4 | ----- | ----- | ----- | ----- | ----- | 24.0 | ----- | ----- | ----- | ----- |
| **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 |
| 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 |
| 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 |
| Pool Max Depth (ft) | 3.2 | ----- | ----- | 3.2 | ----- | 1 | ----- | 3.06 | ----- | ----- | ----- | 1 | ----- | 3.2 | ----- | ----- | ----- | 1 | ----- | 2.8 | ----- | ----- | ----- | 1 |
| Pool Volume ($ft^3$) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| **Substrate and Transport Parameters** | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | | | |
| 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) | ----- | 1.2 | ----- | ----- | ----- | ----- | ----- | 1.2 | ----- | ----- | ----- | ----- | ----- | 1.2 | ----- | ----- | ----- | ----- | ----- | 1.2 | ----- | ----- | ----- | ----- |
| Impervious cover estimate (%) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Rosgen Classification | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- |
| BF Velocity (fps) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| BF Discharge (cfs) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Valley Length | ----- | 695 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Channel length $(ft)^2$ | ----- | 829 | ----- | ----- | ----- | ----- | ----- | 496 | ----- | ----- | ----- | ----- | ----- | 496 | ----- | ----- | ----- | ----- | ----- | 496 | ----- | ----- | ----- | ----- |
| Sinuosity | ----- | 1.19 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Water Surface Slope (Channel) (ft/ft) | ----- | 0.0062 | ----- | ----- | ----- | ----- | ----- | 0.00637 | ----- | ----- | ----- | ----- | ----- | 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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |
| 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 |
| 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 |
| *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 |
| 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 |
| 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 |
| *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 |
| *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 |
| d50 (mm) | ----- | 28.3 | ----- | ----- | ----- | ----- | ----- | 34.3 | ----- | ----- | ----- | ----- | ----- | 56.4 | ----- | ----- | ----- | ----- | ----- | 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 |
| 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 |
| 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 |
| Pool Max Depth (ft) | 1.4 | ----- | ----- | 1.8 | ----- | 2 | 1 | ----- | ----- | 2 | ----- | 2 | 1.3 | ----- | ----- | 1.8 | ----- | 2 | 1.3 | ----- | ----- | 1.7 | 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 | | | 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 | | | |
| 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) | ----- | 0.2 | ----- | ----- | ----- | ----- | ----- | 0.2 | ----- | ----- | ----- | ----- | ----- | 0.2 | ----- | ----- | ----- | ----- | ----- | 0.2 | ----- | ----- | ----- | ----- |
| Impervious cover estimate (%) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Rosgen Classification | ----- | C4b | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- | ----- | C4 | ----- | ----- | ----- | ----- |
| BF Velocity (fps) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| BF Discharge (cfs) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Valley Length | ----- | 1259 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Channel length $(ft)^2$ | ----- | 1366 | ----- | ----- | ----- | ----- | ----- | 751 | ----- | ----- | ----- | ----- | ----- | 751 | ----- | ----- | ----- | ----- | ----- | 751 | ----- | ----- | ----- | ----- |
| Sinuosity | ----- | 1.09 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Water Surface Slope (Channel) (ft/ft) | ----- | 0.0226 | ----- | ----- | ----- | ----- | ----- | 0.02266 | ----- | ----- | ----- | ----- | ----- | 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 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

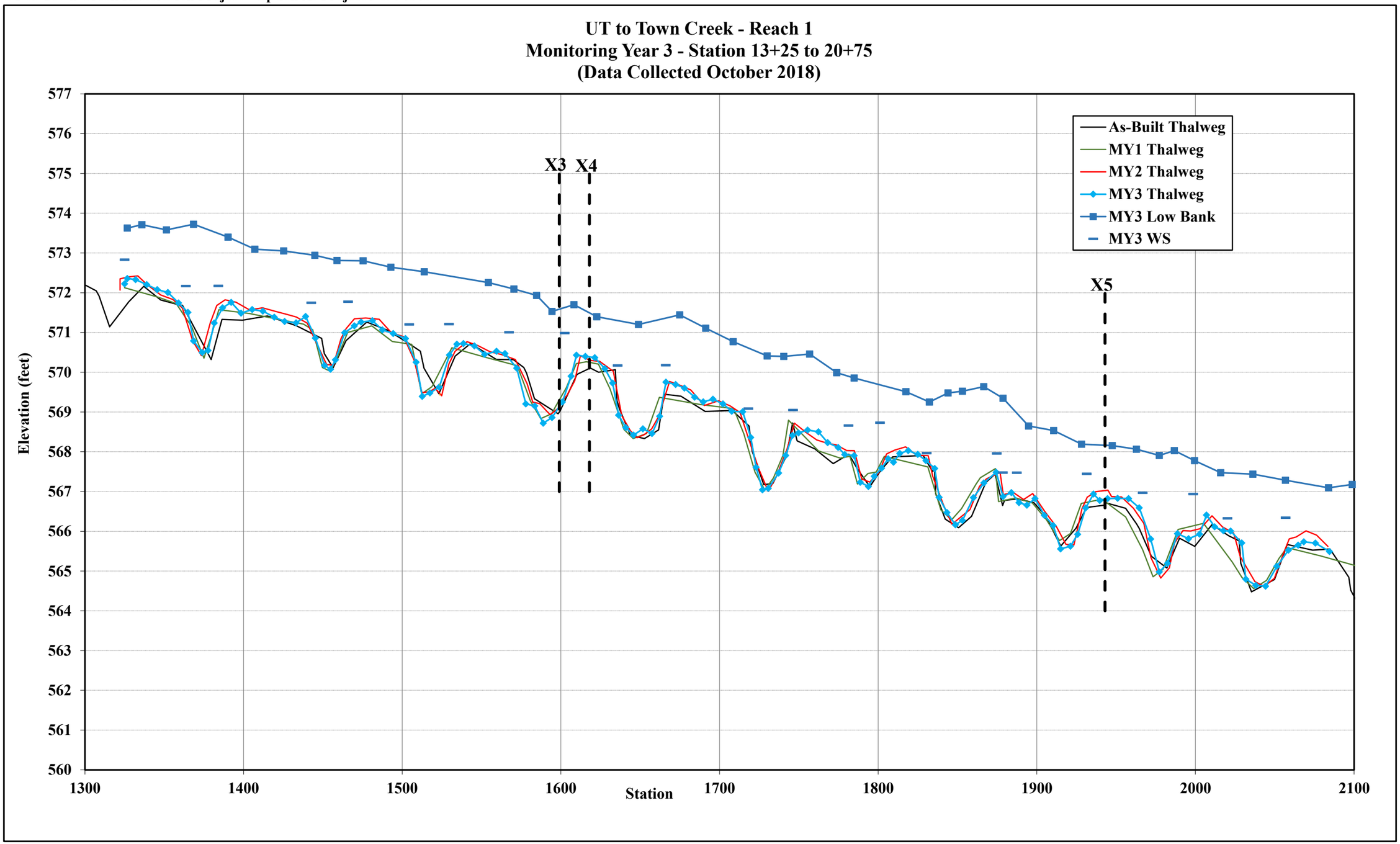


**Figure 4 Cont. Year 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

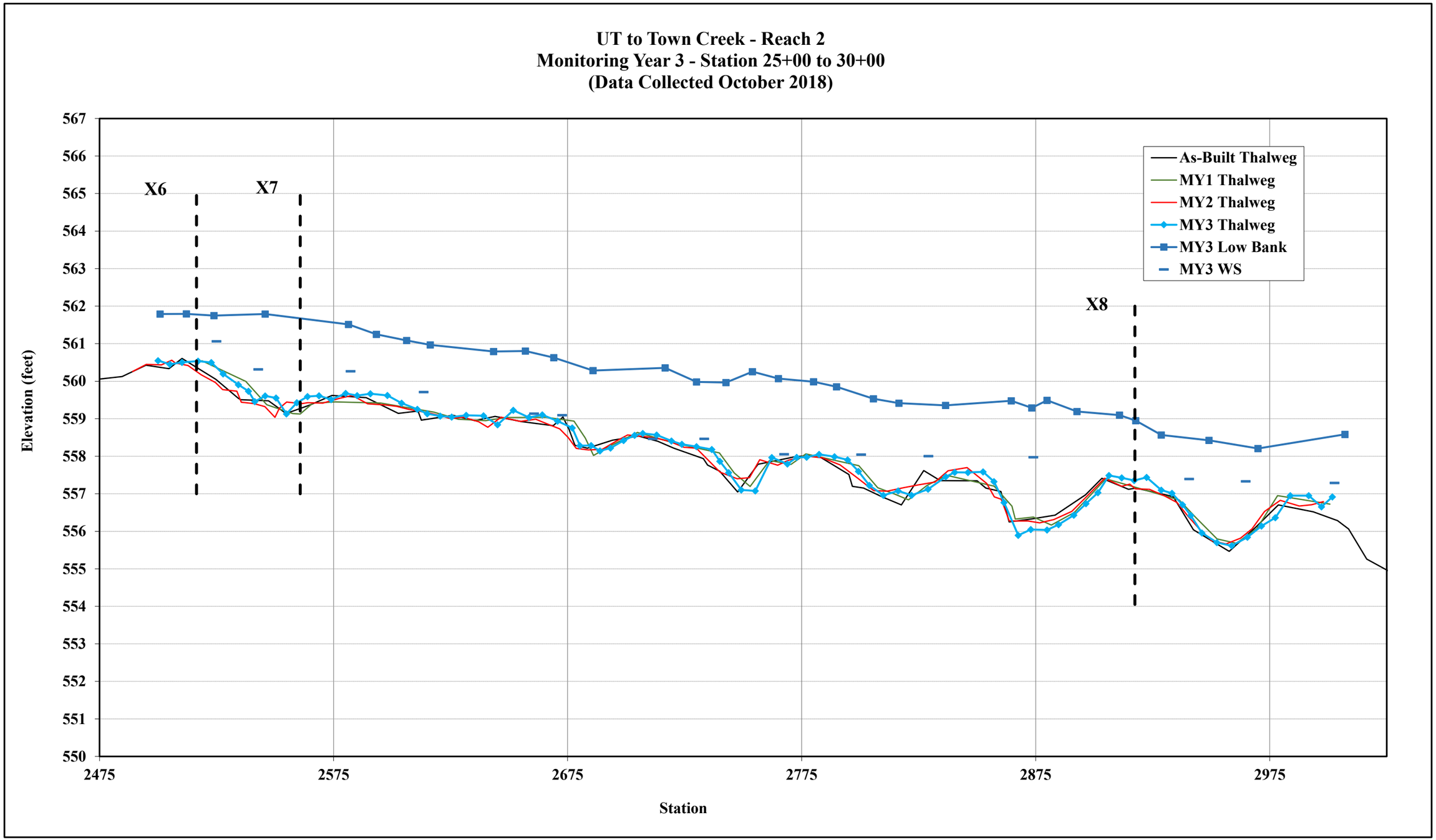


**Figure 4 Cont. Year 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

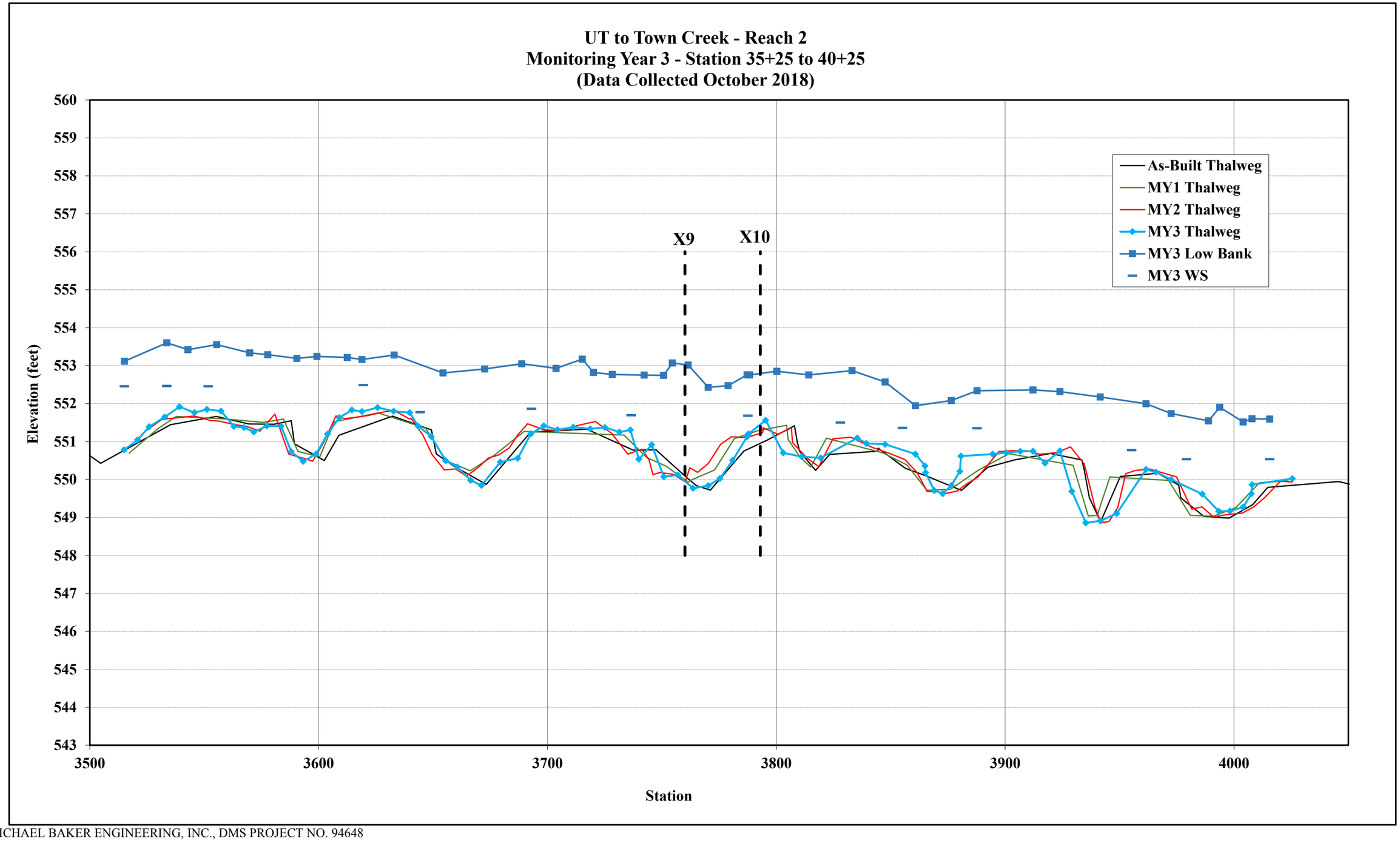


**Figure 4 Cont. Year 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

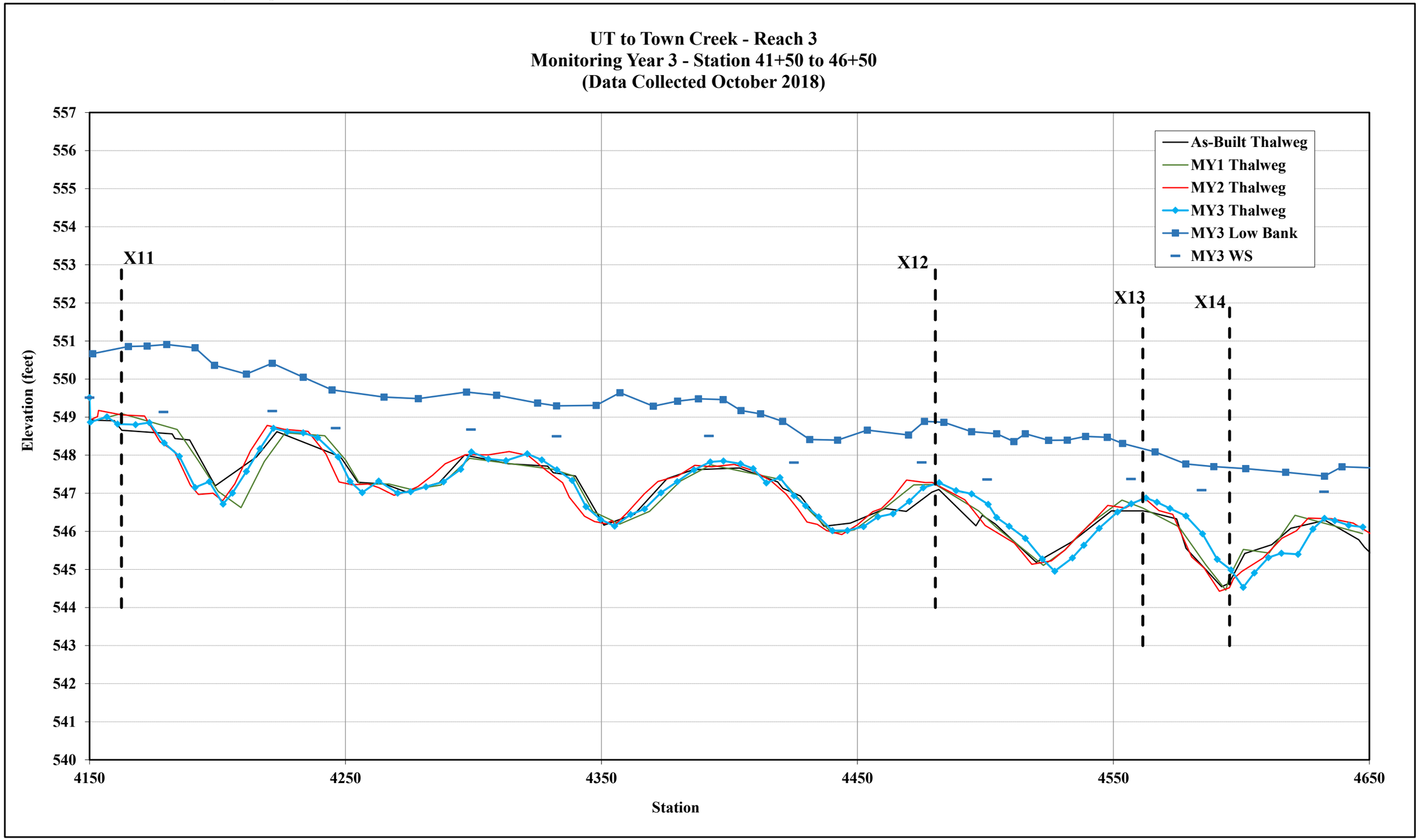


**Figure 4 Cont. Year 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

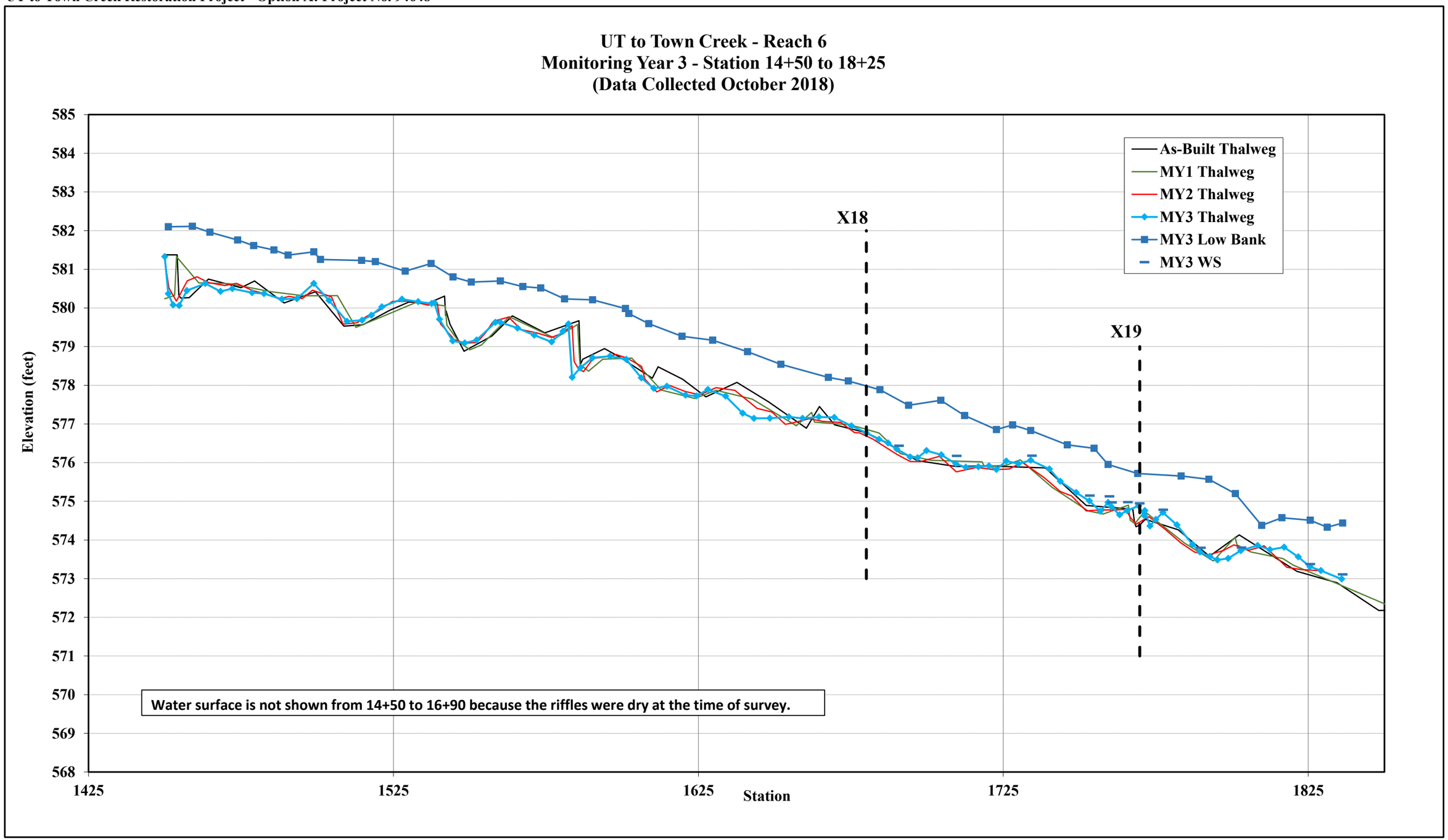


**Figure 4 Cont. Year 3 Profile**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

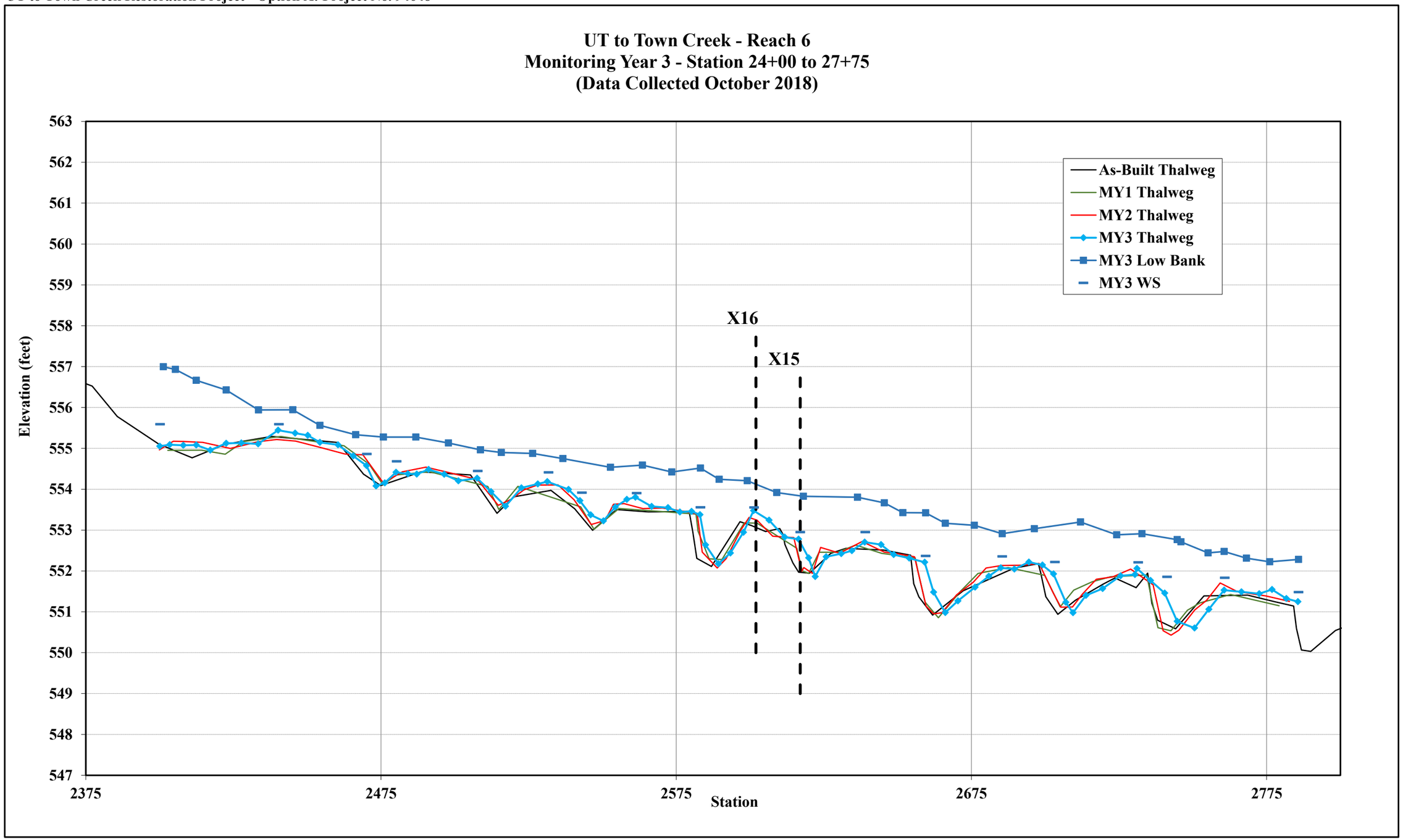


**Figure 5a. Reachwide Pebble Count Distribution with Annual Overlays**
**UT to Town Creek Restoration Project: Project No. 94648**

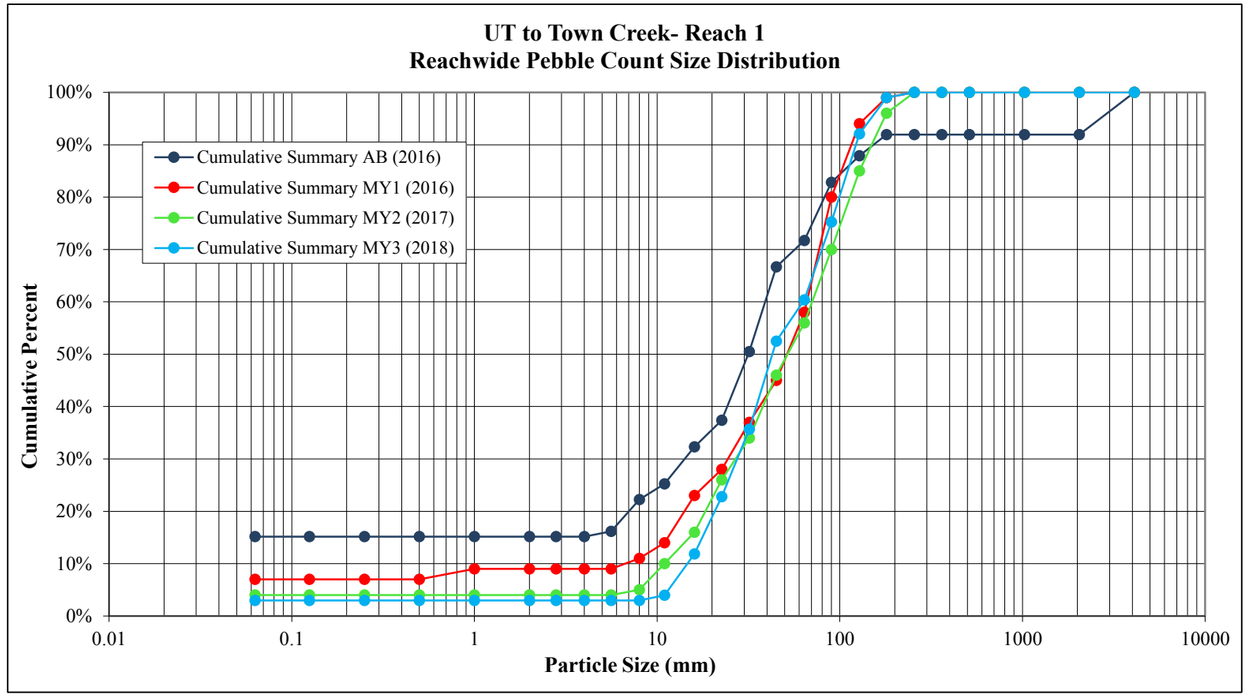
| | |
|---|---|
| SITE OR PROJECT: | UT To Town Creek - Year 3 |
| REACH/LOCATION: | Reach 1 (5 Riffles & 5 Pools) |
| DATE COLLECTED: | 9/26/2018 |
| FIELD COLLECTION BY: | RM and DP |
| DATA ENTERED BY: | DP |

| | | | 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 | 2 | 3 | 3% | 3% | 2% | 2% | 4% | 4% |
| Sand | Very Fine | .063 - .125 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Sand | Fine | .125 - .25 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Sand | Medium | .25 - .50 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Sand | Coarse | .50 - 1.0 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Sand | Very Coarse | 1.0 - 2.0 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Gravel | Very Fine | 2.0 - 2.8 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Gravel | Very Fine | 2.8 - 4.0 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Gravel | Fine | 4.0 - 5.6 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Gravel | Fine | 5.6 - 8.0 | 0 | 0 | | | 3% | 0% | 2% | 0% | 4% |
| Gravel | Medium | 8.0 - 11.0 | 0 | 1 | 1 | 1% | 4% | 0% | 2% | 2% | 6% |
| Gravel | Medium | 11.0 - 16.0 | 4 | 4 | 8 | 8% | 12% | 8% | 10% | 8% | 14% |
| Gravel | Coarse | 16.0 - 22.6 | 4 | 7 | 11 | 11% | 23% | 8% | 18% | 14% | 27% |
| Gravel | Coarse | 22.6 - 32 | 6 | 7 | 13 | 13% | 36% | 12% | 30% | 14% | 41% |
| Gravel | Very Coarse | 32 - 45 | 8 | 9 | 17 | 17% | 52% | 16% | 46% | 18% | 59% |
| Gravel | Very Coarse | 45 - 64 | 6 | 2 | 8 | 8% | 60% | 12% | 58% | 4% | 63% |
| Cobble | Small | 64 - 90 | 9 | 6 | 15 | 15% | 75% | 18% | 76% | 12% | 75% |
| Cobble | Small | 90 - 128 | 8 | 9 | 17 | 17% | 92% | 16% | 92% | 18% | 92% |
| Cobble | Large | 128 - 180 | 4 | 3 | 7 | 7% | 99% | 8% | 100% | 6% | 98% |
| Cobble | Large | 180 - 256 | 0 | 1 | 1 | 1% | 100% | 0% | 100% | 2% | 100% |
| Boulder | Small | 256 - 362 | 0 | 0 | | | 100% | 0% | 100% | 0% | 100% |
| Boulder | Small | 362 - 512 | 0 | 0 | | | 100% | 0% | 100% | 0% | 100% |
| Boulder | Medium | 512 - 1024 | 0 | 0 | | | 100% | 0% | 100% | 0% | 100% |
| Boulder | Large-Very Large | 1024 - 2048 | 0 | 0 | | | 100% | 0% | 100% | 0% | 100% |
| | Bedrock | > 2048 | 0 | 0 | | | 100% | 0% | 100% | 0% | 100% |
| | | Total | 50 | 51 | 101 | 100% | 100% | 100% | 100% | 100% | 100% |

| Cummulative Channel materials | |
|---|---|
| D16 = | 18.23 |
| D35 = | 31.45 |
| D50 = | 42.80 |
| D84 = | 108.09 |
| D95 = | 147.78 |
| D100 = | 180 - 256 |

| Riffle Channel materials | |
|---|---|
| D16 = | 20.73 |
| D35 = | 35.60 |
| D50 = | 50.61 |
| D84 = | 107.33 |
| D95 = | 145.46 |
| D100 = | 128 - 180 |

| Pool Channel materials | |
|---|---|
| D16 = | 16.94 |
| D35 = | 27.36 |
| D50 = | 37.95 |
| D84 = | 108.77 |
| D95 = | 150.93 |
| D100 = | 180 - 256 |



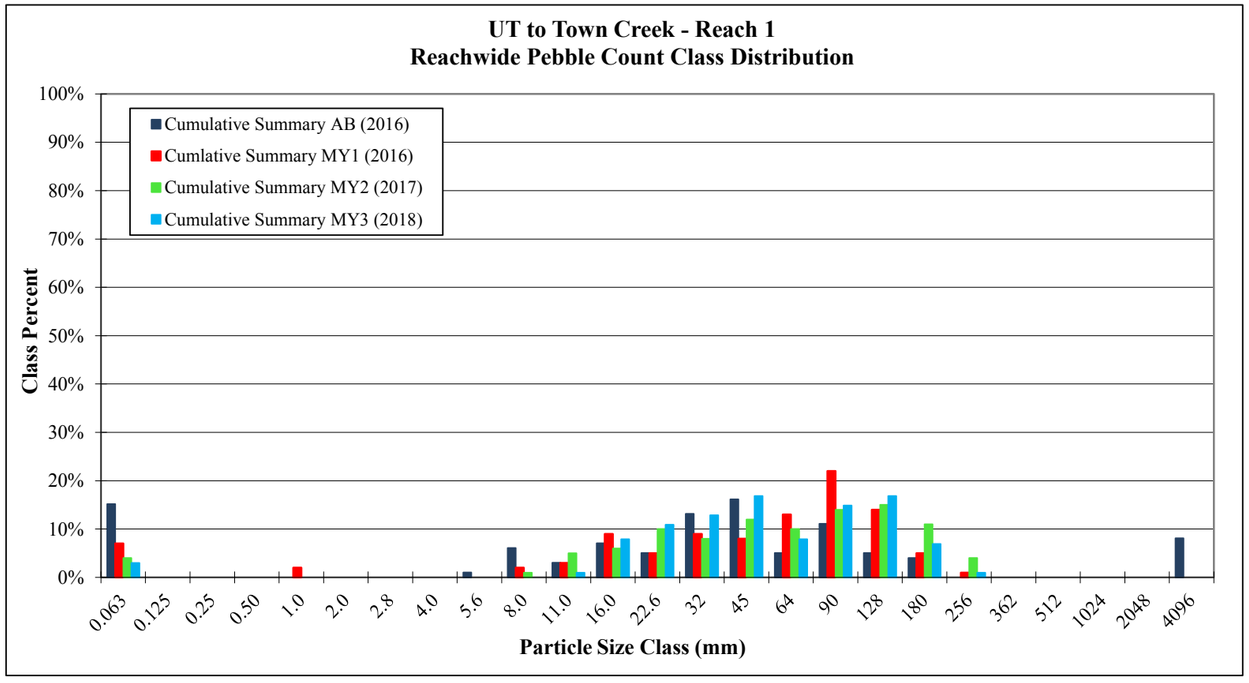



**Figure 5b. Reachwide Pebble Count Distribution with Annual Overlays**
**UT to Town Creek Restoration Project: Project No. 94648**

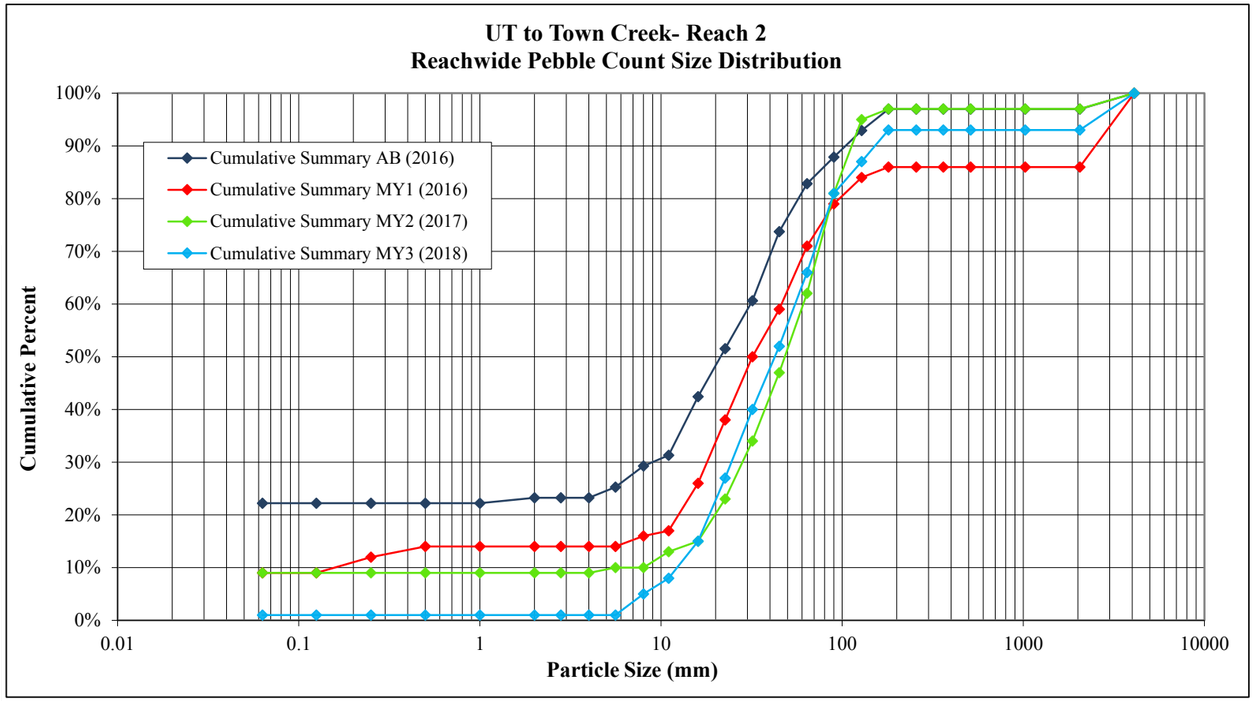
| | |
|---|---|
| SITE OR PROJECT: | UT To Town Creek - Year 3 |
| REACH/LOCATION: | Reach 2 (5 Riffles & 5 Pools) |
| DATE COLLECTED: | 9/26/2018 |
| FIELD COLLECTION BY: | DP and RM |
| DATA ENTERED BY: | DP |

| | | | PARTICLE CLASS | | | Reach Summary | | Riffle Summary | | Pool Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | PARTICLE | SIZE (mm) | Riffle | Pool | Total | Class % | % Cum | Class % | % Cum | Class % | % Cum |
| | Silt / Clay | < .063 | 0 | 1 | 1 | 1% | 1% | 0 | 0 | 2 | 2 |
| Sand | Very Fine | .063 - .125 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Fine | .125 - .25 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Medium | .25 - .50 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Coarse | .50 - 1.0 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Very Coarse | 1.0 - 2.0 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| Gravel | Very Fine | 2.0 - 2.8 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Very Fine | 2.8 - 4.0 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Fine | 4.0 - 5.6 | 0 | 0 | | | 1% | 0 | 0 | 0 | 2 |
| | Fine | 5.6 - 8.0 | 2 | 2 | 4 | 4% | 5% | 4 | 4 | 4 | 6 |
| | Medium | 8.0 - 11.0 | 2 | 1 | 3 | 3% | 8% | 4 | 8 | 2 | 8 |
| | Medium | 11.0 - 16.0 | 4 | 3 | 7 | 7% | 15% | 8 | 16 | 6 | 14 |
| | Coarse | 16 - 22.6 | 6 | 6 | 12 | 12% | 27% | 12 | 28 | 12 | 26 |
| | Coarse | 22.6 - 32 | 9 | 4 | 13 | 13% | 40% | 18 | 46 | 8 | 34 |
| | Very Coarse | 32 - 45 | 8 | 4 | 12 | 12% | 52% | 16 | 62 | 8 | 42 |
| | Very Coarse | 45 - 64 | 7 | 7 | 14 | 14% | 66% | 14 | 76 | 14 | 56 |
| Cobble | Small | 64 - 90 | 3 | 12 | 15 | 15% | 81% | 6 | 82 | 24 | 80 |
| | Small | 90 - 128 | 4 | 2 | 6 | 6% | 87% | 8 | 90 | 4 | 84 |
| | Large | 128 - 180 | 4 | 2 | 6 | 6% | 93% | 8 | 98 | 4 | 88 |
| | Large | 180 - 256 | 0 | 0 | | | 93% | 0 | 98 | 0 | 88 |
| Boulder | Small | 256 - 362 | 0 | 0 | | | 93% | 0 | 98 | 0 | 88 |
| | Small | 362 - 512 | 0 | 0 | | | 93% | 0 | 98 | 0 | 88 |
| | Medium | 512 - 1024 | 0 | 0 | | | 93% | 0 | 98 | 0 | 88 |
| | Large-Very Large | 1024 - 2048 | 0 | 0 | | | 93% | 0 | 98 | 0 | 88 |
| | Bedrock | > 2048 | 1 | 6 | 7 | 7% | 100% | 2 | 100 | 12 | 100 |
| | | **Total** | **50** | **50** | **100** | **100%** | **100%** | **100** | **100** | **100** | **100** |

| Cummulative | |
|---|---|
| **Channel materials** | |
| D16 = | 16.47 |
| D35 = | 27.99 |
| D50 = | 42.51 |
| D84 = | 107.33 |
| D95 = | 2496.54 |
| D100 = | > 2048 |

| Riffle | |
|---|---|
| **Channel materials** | |
| D16 = | 16.00 |
| D35 = | 25.87 |
| D50 = | 34.85 |
| D84 = | 98.28 |
| D95 = | 158.40 |
| D100 = | > 2048 |

| Pool | |
|---|---|
| **Channel materials** | |
| D16 = | 16.95 |
| D35 = | 33.39 |
| D50 = | 55.03 |
| D84 = | 128.00 |
| D95 = | 3068.53 |
| D100 = | > 2048 |



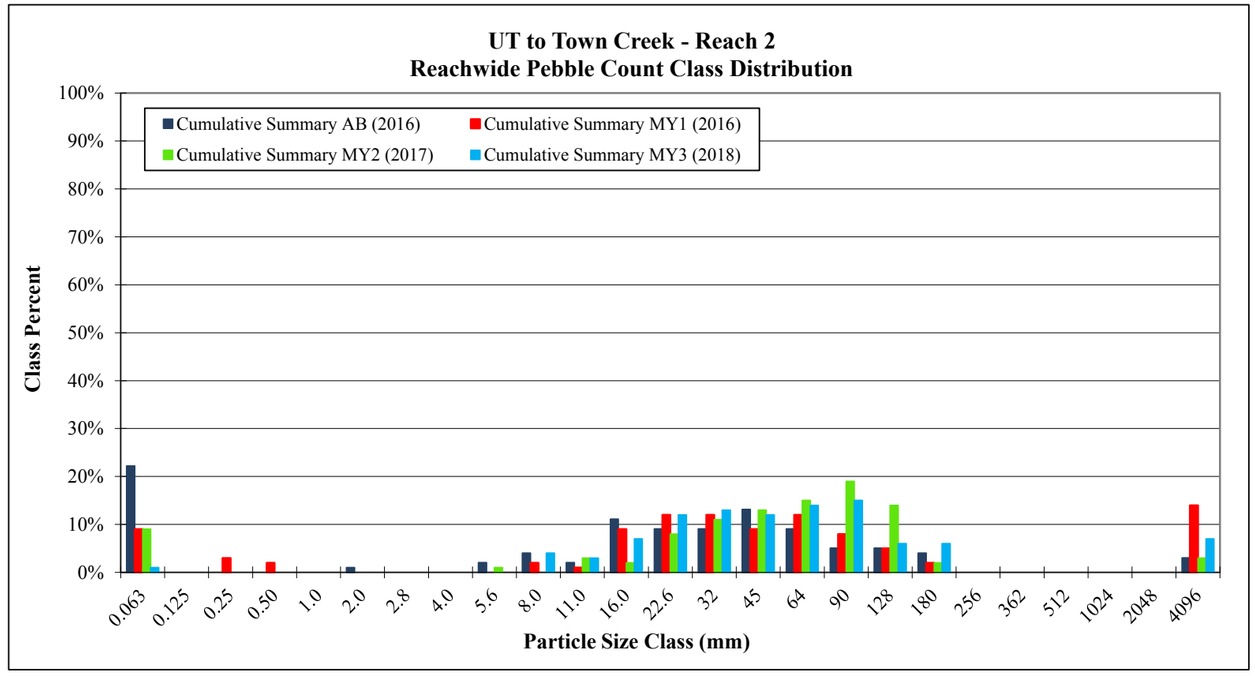



**Figure 5c. Reachwide Pebble Count Distribution with Annual Overlays**
**UT to Town Creek Restoration Project: Project No. 94648**

**PEBBLE COUNT DATA SHEET**

| | |
|---|---|
| SITE OR PROJECT: | UT To Town Creek - Year 3 |
| REACH/LOCATION: | Reach 3 (5 Riffles & 5 Pools) |
| DATE COLLECTED: | 9/26/2018 |
| FIELD COLLECTION BY: | DP RM |
| DATA ENTERED BY: | DP RM |

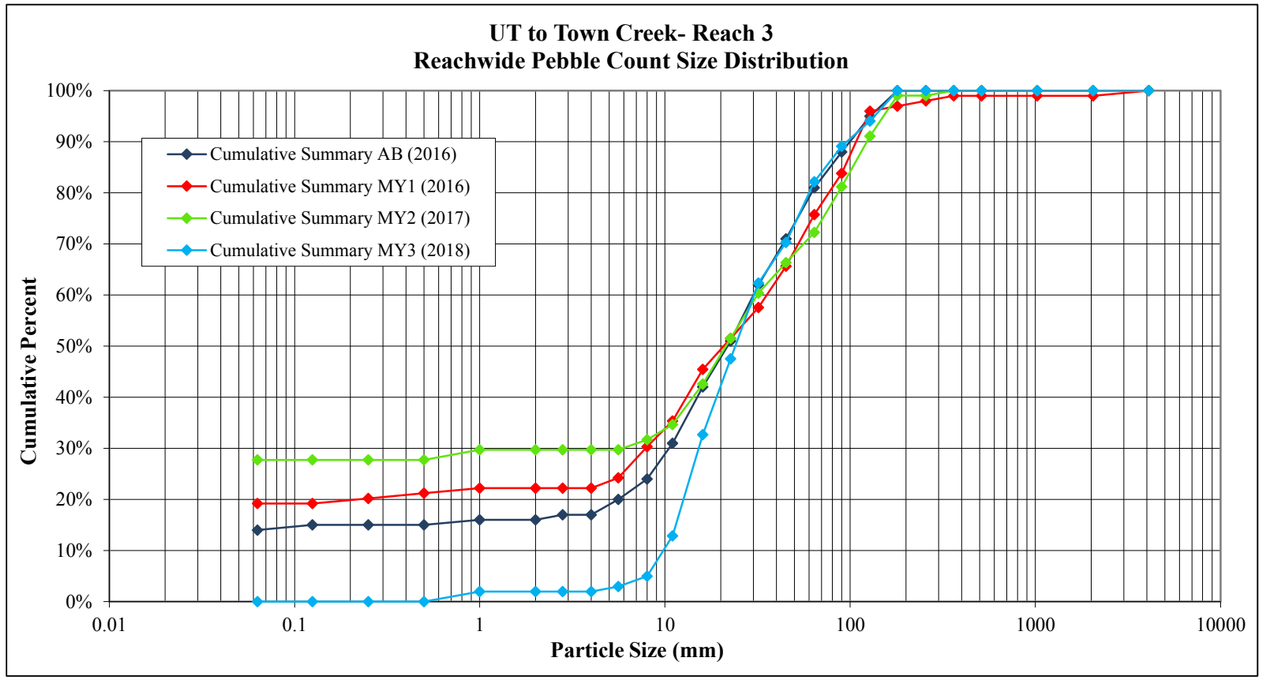
**SEDIMENT ANALYSIS DATA SHEET**

| | | | PARTICLE CLASS | | | Reach Summary | | Riffle Summary | | Pool Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | PARTICLE | SIZE (mm) | Riffle | Pool | Total | Class % | % Cum | Class % | % Cum | Class % | % Cum |
| | Silt / Clay | < .063 | 0 | 0 | | | 0% | 0 | 0 | 0 | 0 |
| Sand | Very Fine | .063 - .125 | 0 | 0 | | | 0% | 0 | 0 | 0 | 0 |
| | Fine | .125 - .25 | 0 | 0 | | | 0% | 0 | 0 | 0 | 0 |
| | Medium | .25 - .50 | 0 | 0 | | | 0% | 0 | 0 | 0 | 0 |
| | Coarse | .50 - 1.0 | 1 | 1 | 2 | 2% | 2% | 2 | 2 | 2 | 2 |
| | Very Coarse | 1.0 - 2.0 | 0 | 0 | | | 2% | 0 | 2 | 0 | 2 |
| Gravel | Very Fine | 2.0 - 2.8 | 0 | 0 | | | 2% | 0 | 2 | 0 | 2 |
| | Very Fine | 2.8 - 4.0 | 0 | 0 | | | 2% | 0 | 2 | 0 | 2 |
| | Fine | 4.0 - 5.6 | 1 | 0 | 1 | 1% | 3% | 2 | 4 | 0 | 2 |
| | Fine | 5.6 - 8.0 | 2 | 0 | 2 | 2% | 5% | 4 | 8 | 0 | 2 |
| | Medium | 8.0 - 11.0 | 3 | 5 | 8 | 8% | 13% | 6 | 14 | 10 | 12 |
| | Medium | 11.0 - 16.0 | 11 | 9 | 20 | 20% | 33% | 22 | 35 | 18 | 30 |
| | Coarse | 16 - 22.6 | 7 | 8 | 15 | 15% | 48% | 14 | 49 | 16 | 46 |
| | Coarse | 22.6 - 32 | 6 | 9 | 15 | 15% | 62% | 12 | 61 | 18 | 64 |
| | Very Coarse | 32 - 45 | 3 | 5 | 8 | 8% | 70% | 6 | 67 | 10 | 74 |
| | Very Coarse | 45 - 64 | 4 | 8 | 12 | 12% | 82% | 8 | 75 | 16 | 90 |
| Cobble | Small | 64 - 90 | 5 | 2 | 7 | 7% | 89% | 10 | 84 | 4 | 94 |
| | Small | 90 - 128 | 3 | 2 | 5 | 5% | 94% | 6 | 90 | 4 | 98 |
| | Large | 128 - 180 | 5 | 1 | 6 | 6% | 100% | 10 | 100 | 2 | 100 |
| | Large | 180 - 256 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| Boulder | Small | 256 - 362 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| | Small | 362 - 512 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| | Medium | 512 - 1024 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| | Large-Very Large | 1024 - 2048 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| | Bedrock | > 2048 | 0 | 0 | | | 100% | 0 | 100 | 0 | 100 |
| | | | 51 | 50 | 101 | 100% | 100% | 100 | 100 | 100 | 100 |

| Cummulative | |
|---|---|
| Channel materials | |
| $D_{16}$ = | 11.67 |
| $D_{35}$ = | 16.89 |
| $D_{50}$ = | 23.95 |
| $D_{84}$ = | 70.00 |
| $D_{95}$ = | 135.10 |
| $D_{100}$ = | 128 - 180 |

| Riffle | |
|---|---|
| Channel materials | |
| $D_{16}$ = | 11.44 |
| $D_{35}$ = | 15.92 |
| $D_{50}$ = | 23.26 |
| $D_{84}$ = | 89.02 |
| $D_{95}$ = | 151.27 |
| $D_{100}$ = | 128 - 180 |

| Pool | |
|---|---|
| Channel materials | |
| $D_{16}$ = | 11.96 |
| $D_{35}$ = | 17.82 |
| $D_{50}$ = | 24.42 |
| $D_{84}$ = | 56.08 |
| $D_{95}$ = | 98.28 |
| $D_{100}$ = | 128 - 180 |



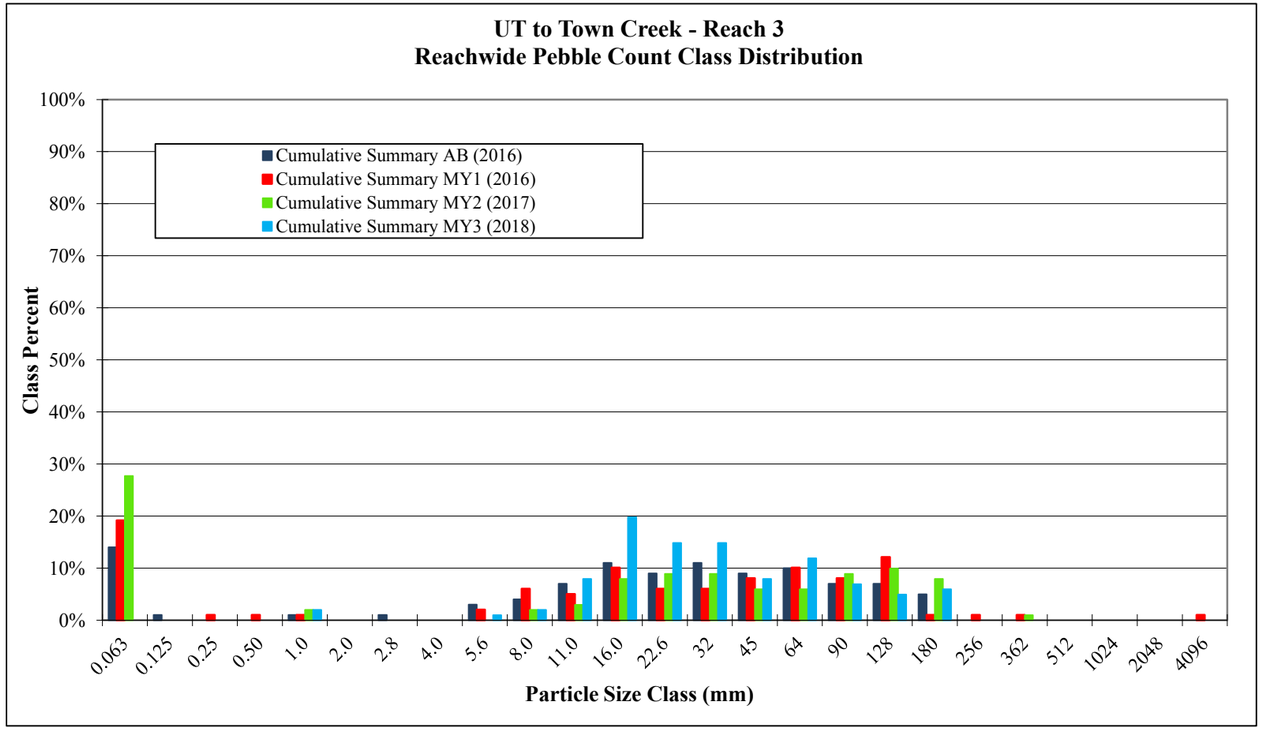



**Figure 5d. Reachwide Pebble Count Distribution with Annual Overlays**
**UT to Town Creek Restoration Project: Project No. 94648**

| | |
|---|---|
| SITE OR PROJECT: | UT To Town Creek - Year 3 |
| REACH/LOCATION: | Reach 6 (6 Riffles & 4 Pools) |
| DATE COLLECTED: | 9/26/2018 |
| FIELD COLLECTION BY: | DP and RM |
| DATA ENTERED BY: | DP |

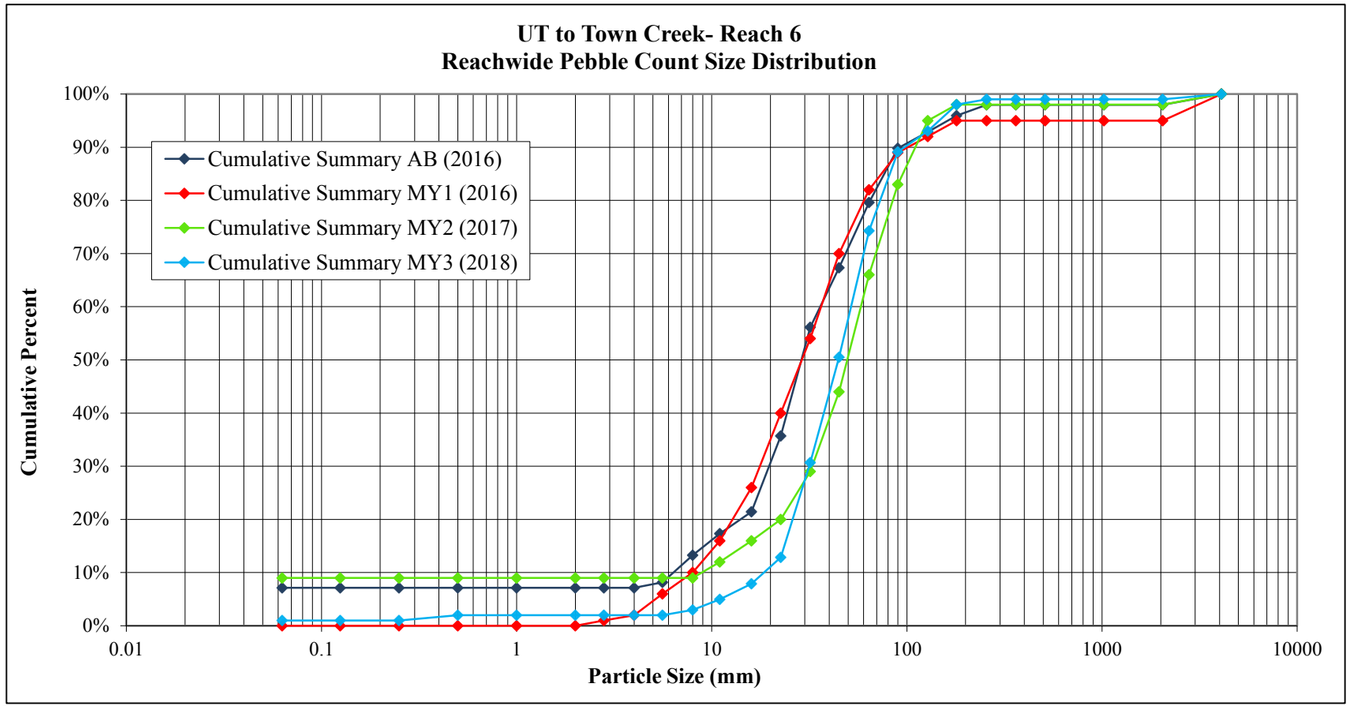
**SEDIMENT ANALYSIS DATA SHEET**

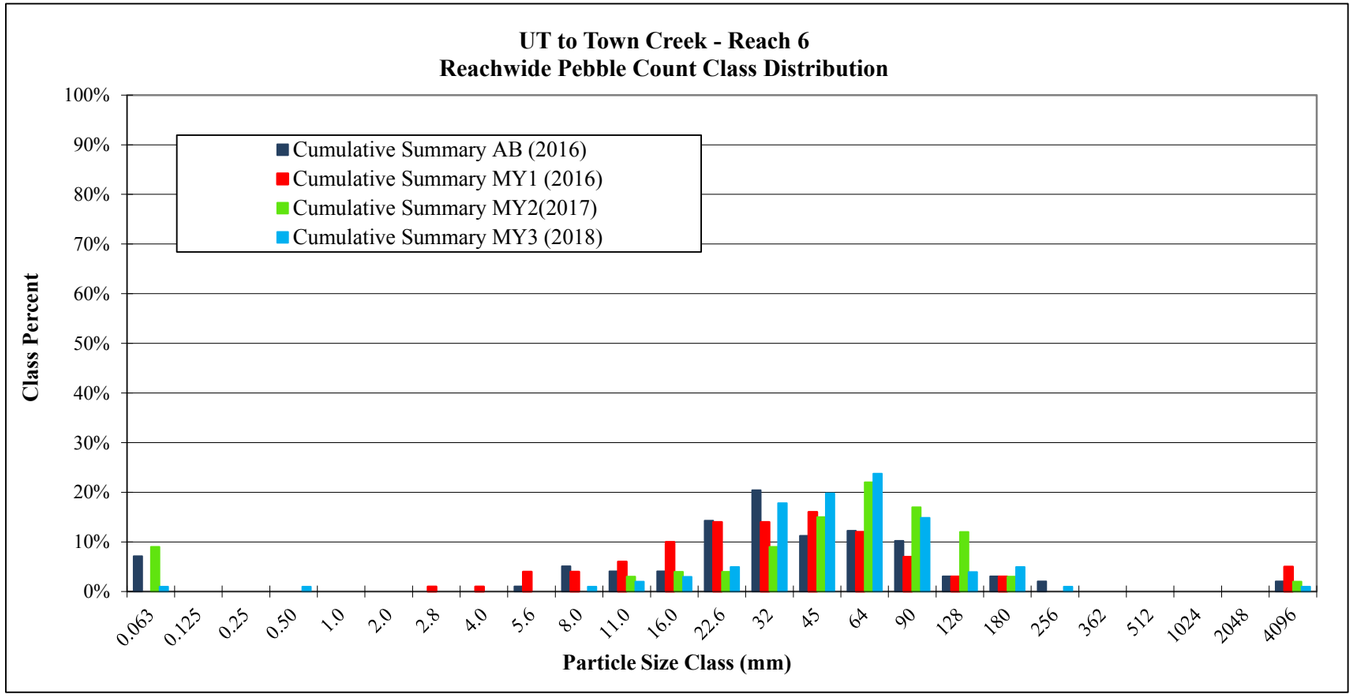
| | | | PARTICLE CLASS | | | Reach Summary | | Riffle Summary | | Pool Summary | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | PARTICLE | SIZE (mm) | Riffle | Pool | Total | Class % | % Cum | Class % | % Cum | Class % | % Cum |
| | Silt / Clay | < .063 | 1 | 0 | 1 | 1% | 1% | 2 | 2 | 0 | 0 |
| Sand | Very Fine | .063 - .125 | 0 | 0 | | | 1% | 0 | 2 | 0 | 0 |
| | Fine | .125 - .25 | 0 | 0 | | | 1% | 0 | 2 | 0 | 0 |
| | Medium | .25 - .50 | 1 | 0 | 1 | 1% | 2% | 2 | 3 | 0 | 0 |
| | Coarse | .50 - 1.0 | 0 | 0 | | | 2% | 0 | 3 | 0 | 0 |
| | Very Coarse | 1.0 - 2.0 | 0 | 0 | | | 2% | 0 | 3 | 0 | 0 |
| Gravel | Very Fine | 2.0 - 2.8 | 0 | 0 | | | 2% | 0 | 3 | 0 | 0 |
| | Very Fine | 2.8 - 4.0 | 0 | 0 | | | 2% | 0 | 3 | 0 | 0 |
| | Fine | 4.0 - 5.6 | 0 | 0 | | | 2% | 0 | 3 | 0 | 0 |
| | Fine | 5.6 - 8.0 | 0 | 1 | 1 | 1% | 3% | 0 | 3 | 2 | 2 |
| | Medium | 8.0 - 11.0 | 2 | 0 | 2 | 2% | 5% | 3 | 7 | 0 | 2 |
| | Medium | 11.0 - 16.0 | 2 | 1 | 3 | 3% | 8% | 3 | 10 | 2 | 5 |
| | Coarse | 16 - 22.6 | 3 | 2 | 5 | 5% | 13% | 5 | 15 | 5 | 10 |
| | Coarse | 22.6 - 32 | 9 | 9 | 18 | 18% | 31% | 15 | 30 | 22 | 32 |
| | Very Coarse | 32 - 45 | 13 | 7 | 20 | 20% | 50% | 22 | 52 | 17 | 49 |
| | Very Coarse | 45 - 64 | 18 | 6 | 24 | 24% | 74% | 30 | 82 | 15 | 63 |
| Cobble | Small | 64 - 90 | 6 | 9 | 15 | 15% | 89% | 10 | 92 | 22 | 85 |
| | Small | 90 - 128 | 1 | 3 | 4 | 4% | 93% | 2 | 93 | 7 | 93 |
| | Large | 128 - 180 | 3 | 2 | 5 | 5% | 98% | 5 | 98 | 5 | 98 |
| | Large | 180 - 256 | 0 | 1 | 1 | 1% | 99% | 0 | 98 | 2 | 100 |
| Boulder | Small | 256 - 362 | 0 | 0 | | | 99% | 0 | 98 | 0 | 100 |
| | Small | 362 - 512 | 0 | 0 | | | 99% | 0 | 98 | 0 | 100 |
| | Medium | 512 - 1024 | 0 | 0 | | | 99% | 0 | 98 | 0 | 100 |
| | Large-Very Large | 1024 - 2048 | 0 | 0 | | | 99% | 0 | 98 | 0 | 100 |
| | Bedrock | > 2048 | 1 | 0 | 1 | 1% | 100% | 2 | 100 | 0 | 100 |
| | | | 60 | 41 | 101 | | | 100 | 100 | 100 | 100 |

| Cummulative | |
|---|---|
| Channel materials | |
| D16 = | 24.02 |
| D35 = | 34.46 |
| D50 = | 44.62 |
| D84 = | 80.04 |
| D95 = | 146.20 |
| D100 = | > 2048 |

| Riffle | |
|---|---|
| Channel materials | |
| D16 = | 23.13 |
| D35 = | 34.62 |
| D50 = | 43.84 |
| D84 = | 69.30 |
| D95 = | 143.40 |
| D100 = | > 2048 |

| Pool | |
|---|---|
| Channel materials | |
| D16 = | 24.95 |
| D35 = | 34.17 |
| D50 = | 46.34 |
| D84 = | 88.11 |
| D95 = | 150.50 |
| D100 = | 180 - 256 |



# Appendix E

## Hydrologic Data

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

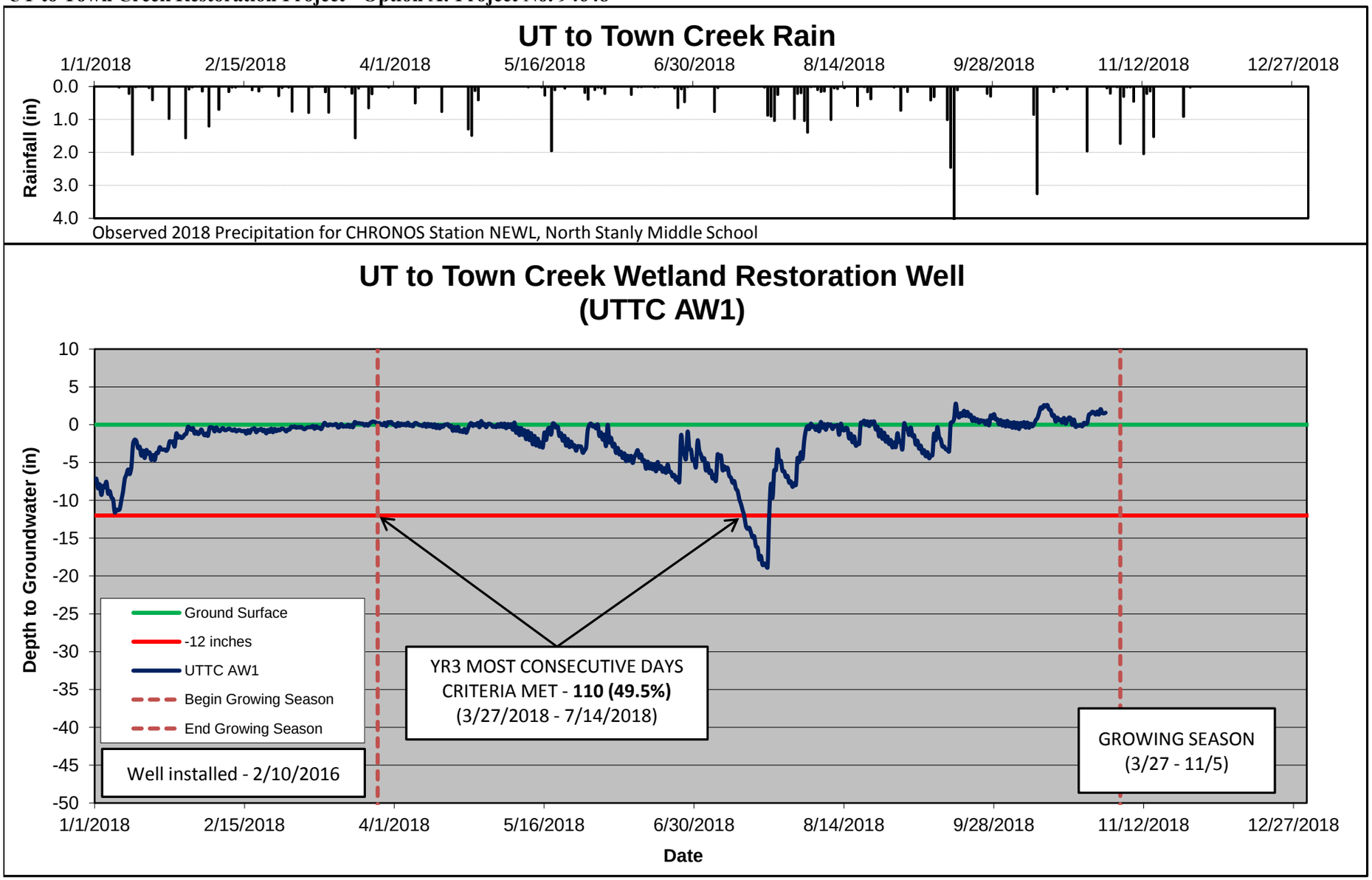


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

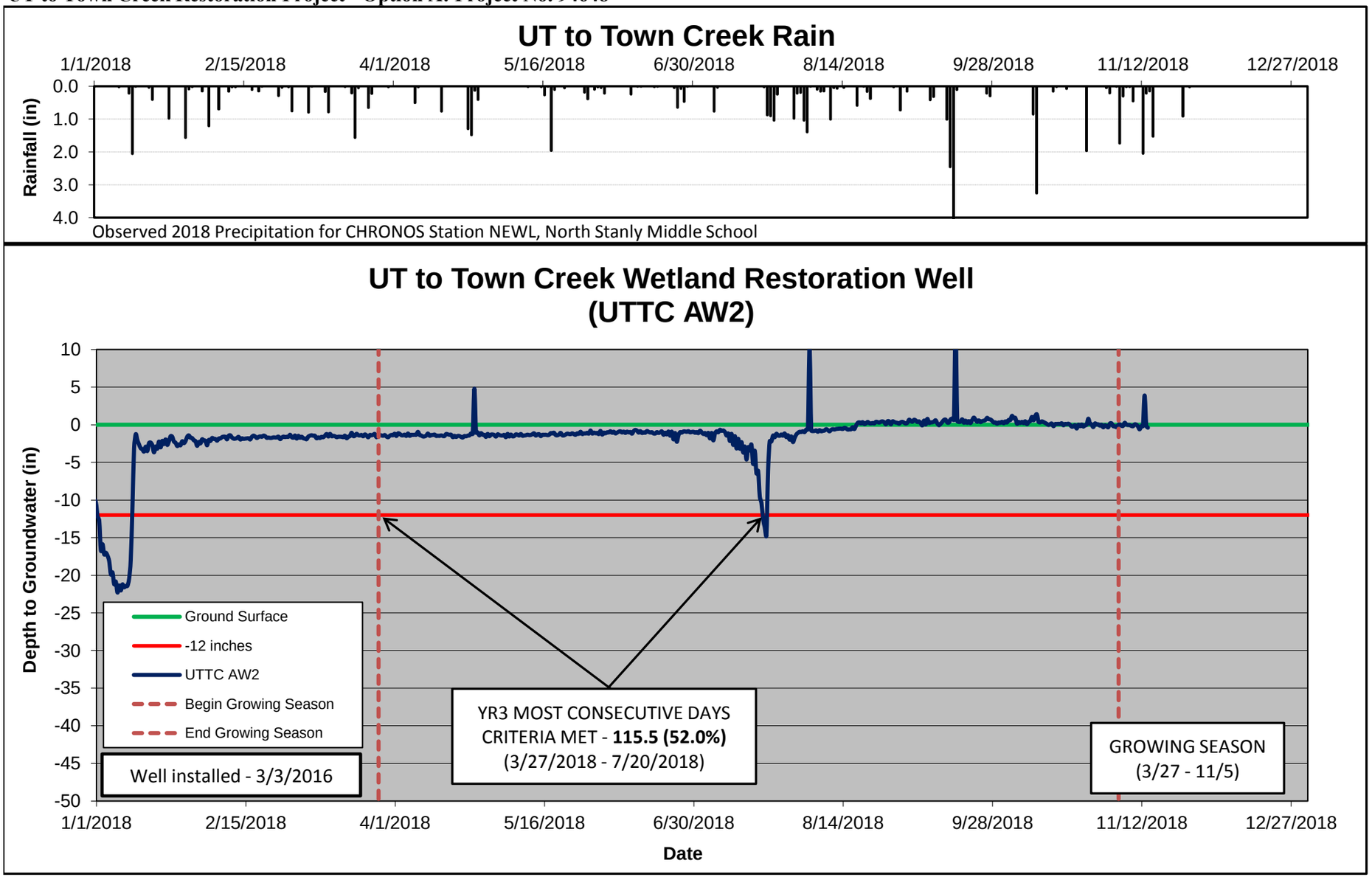


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

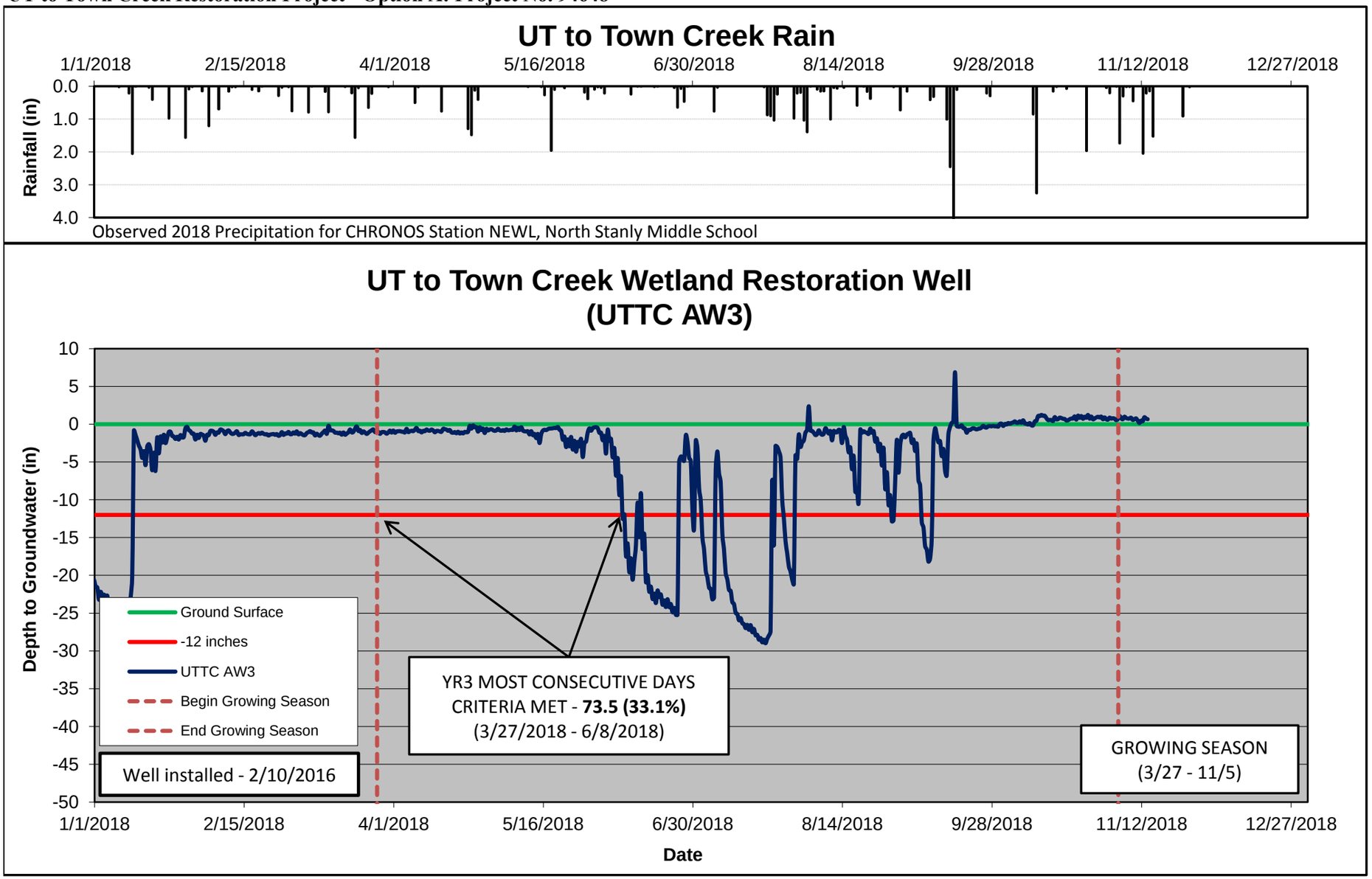


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

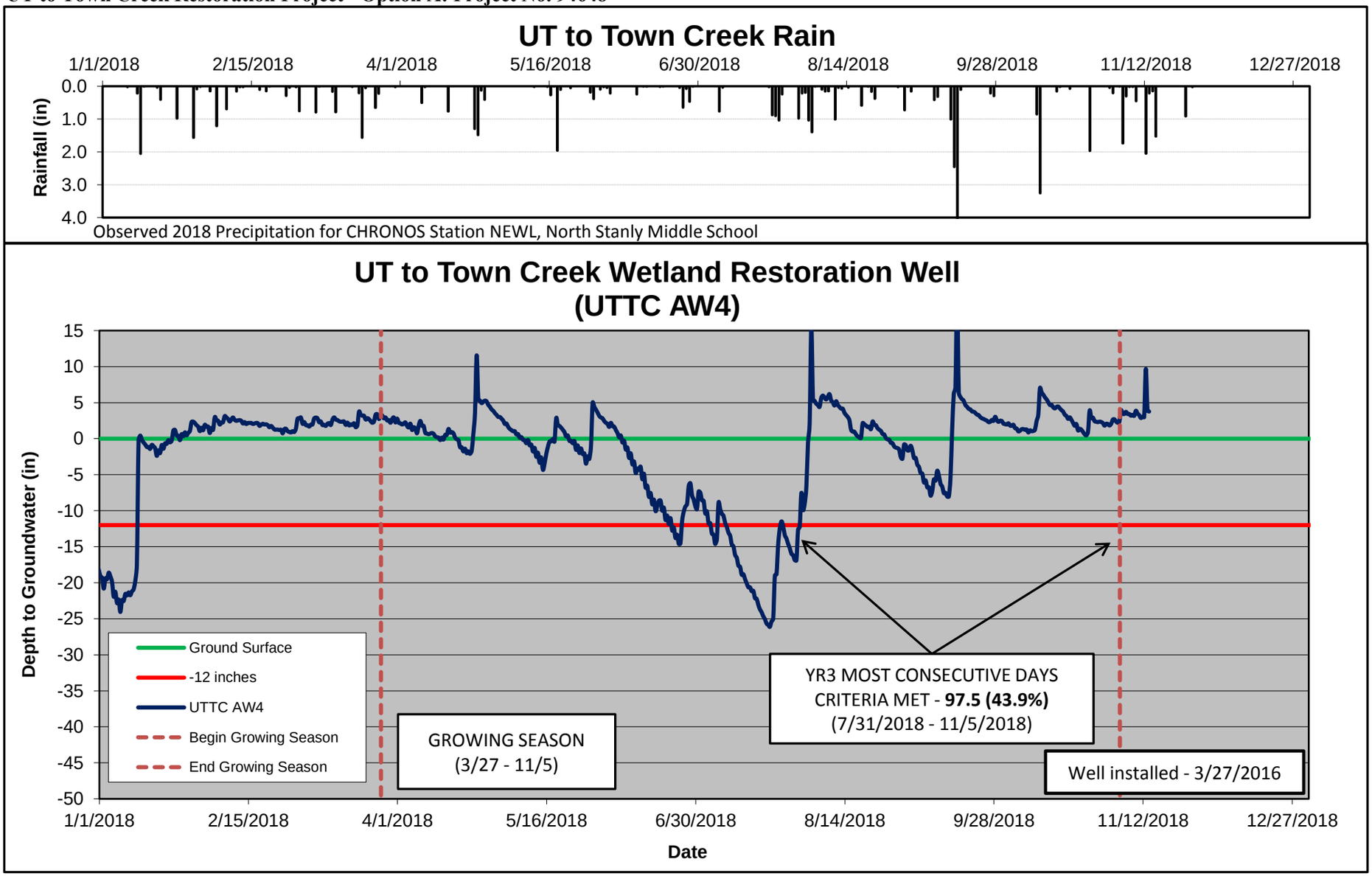


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

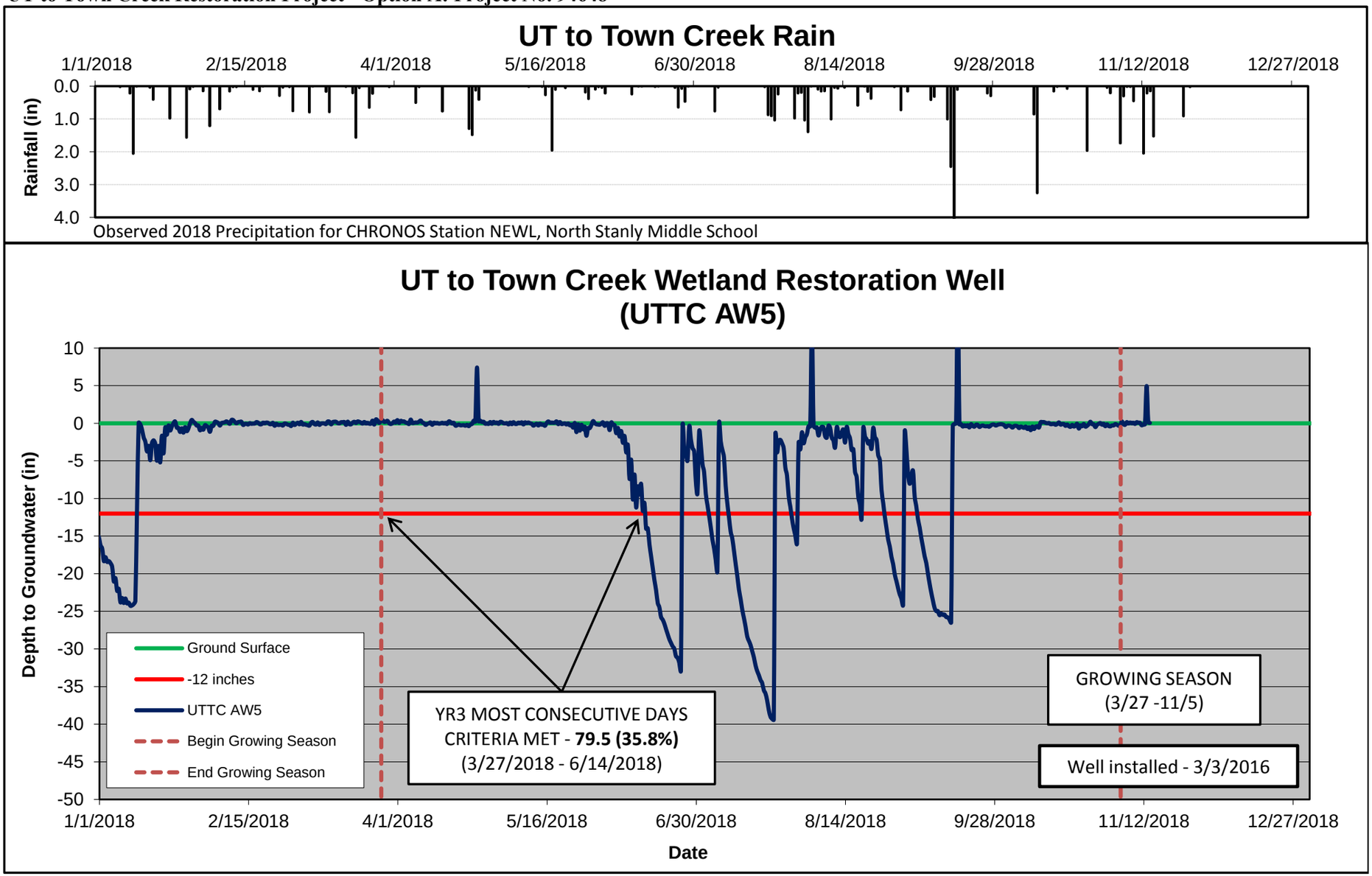


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

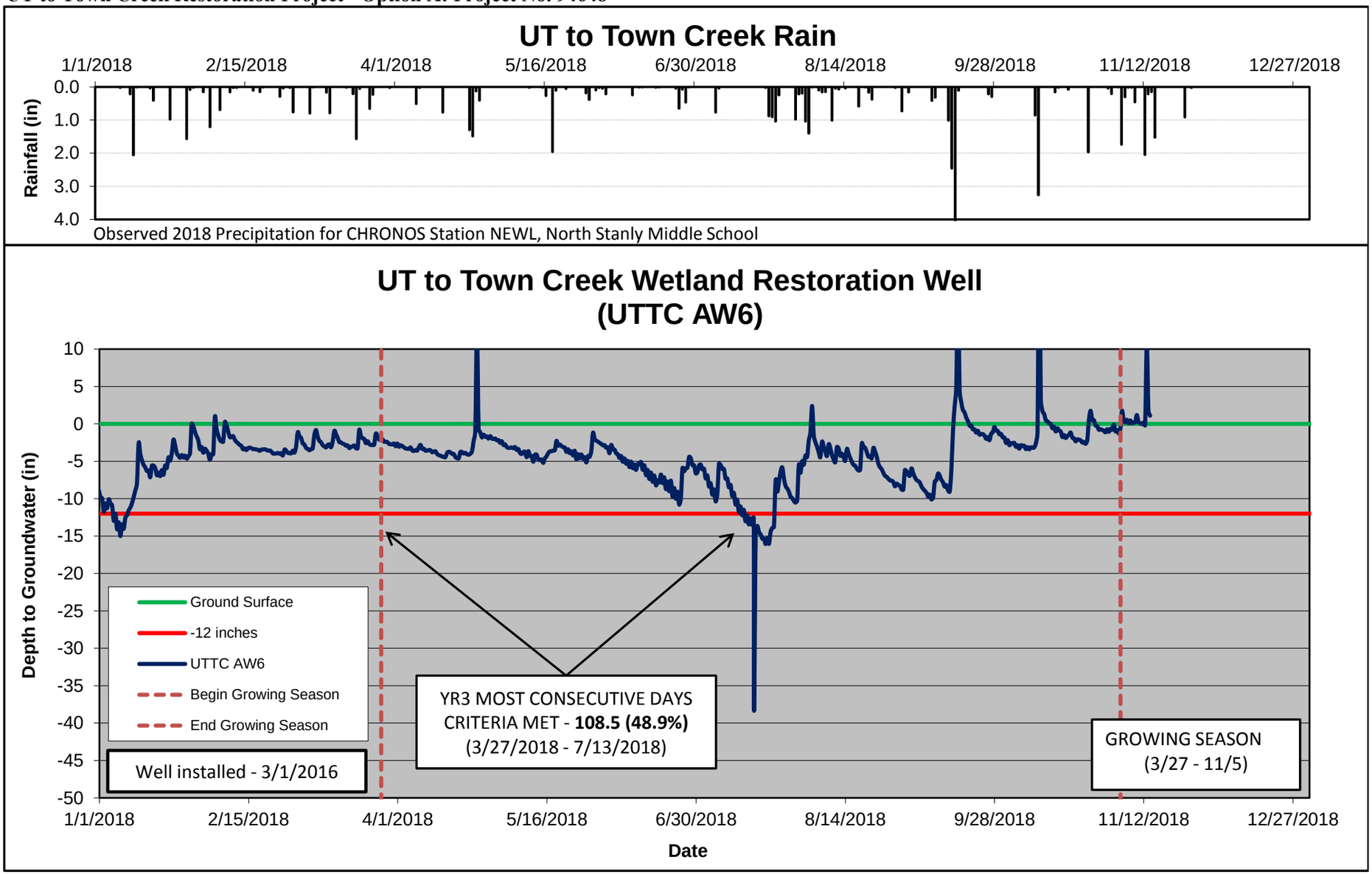


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

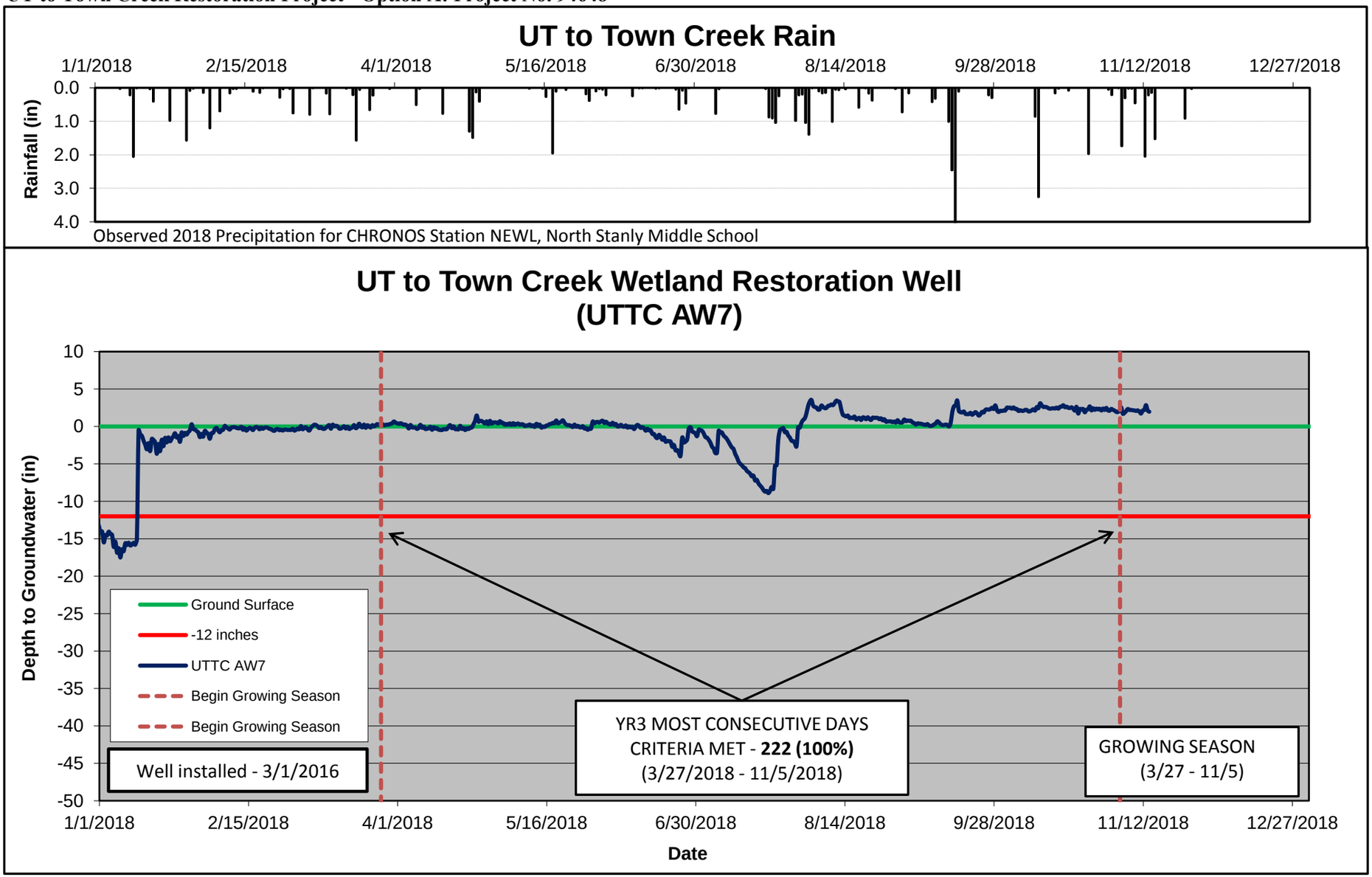


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

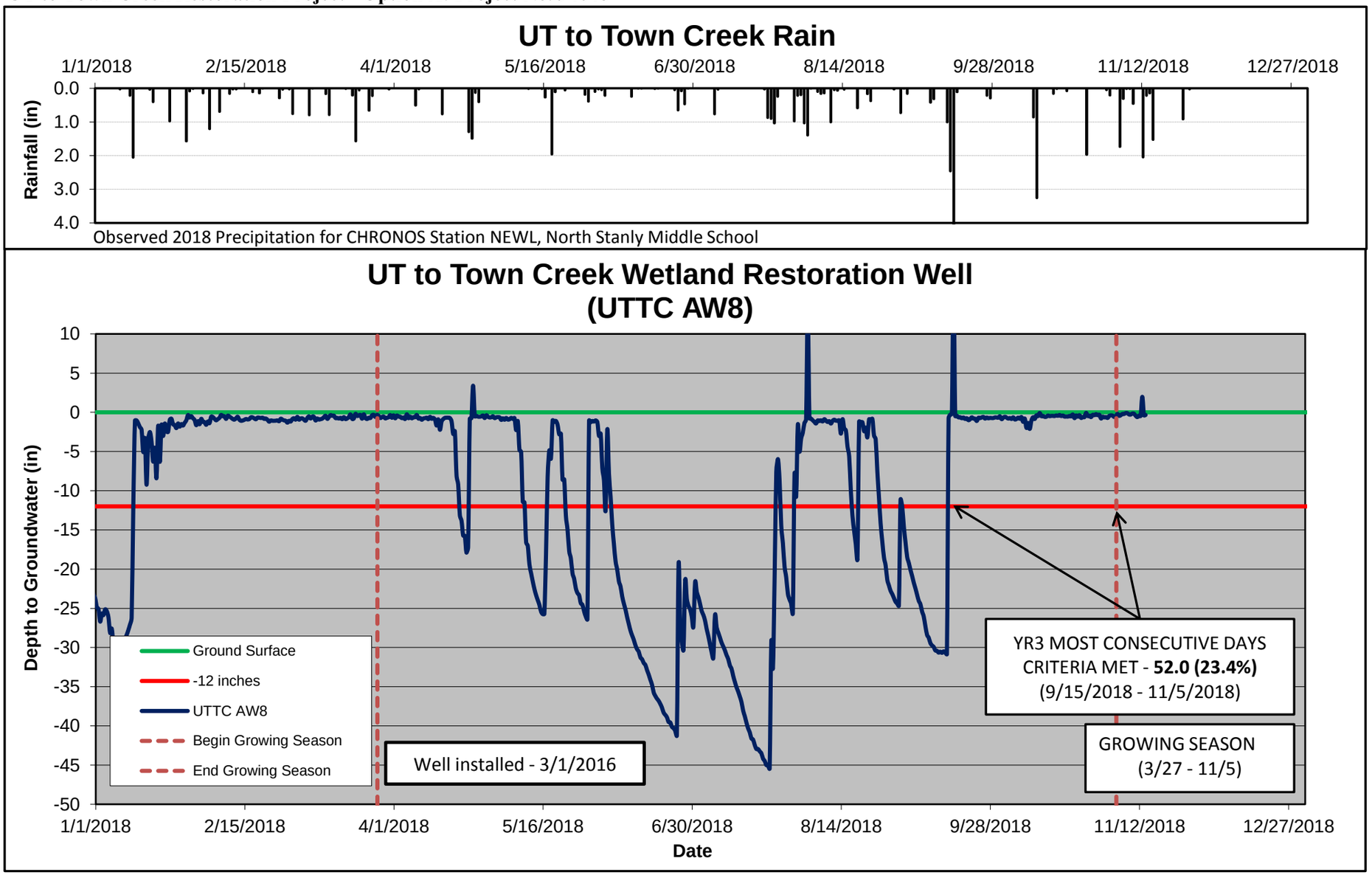


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

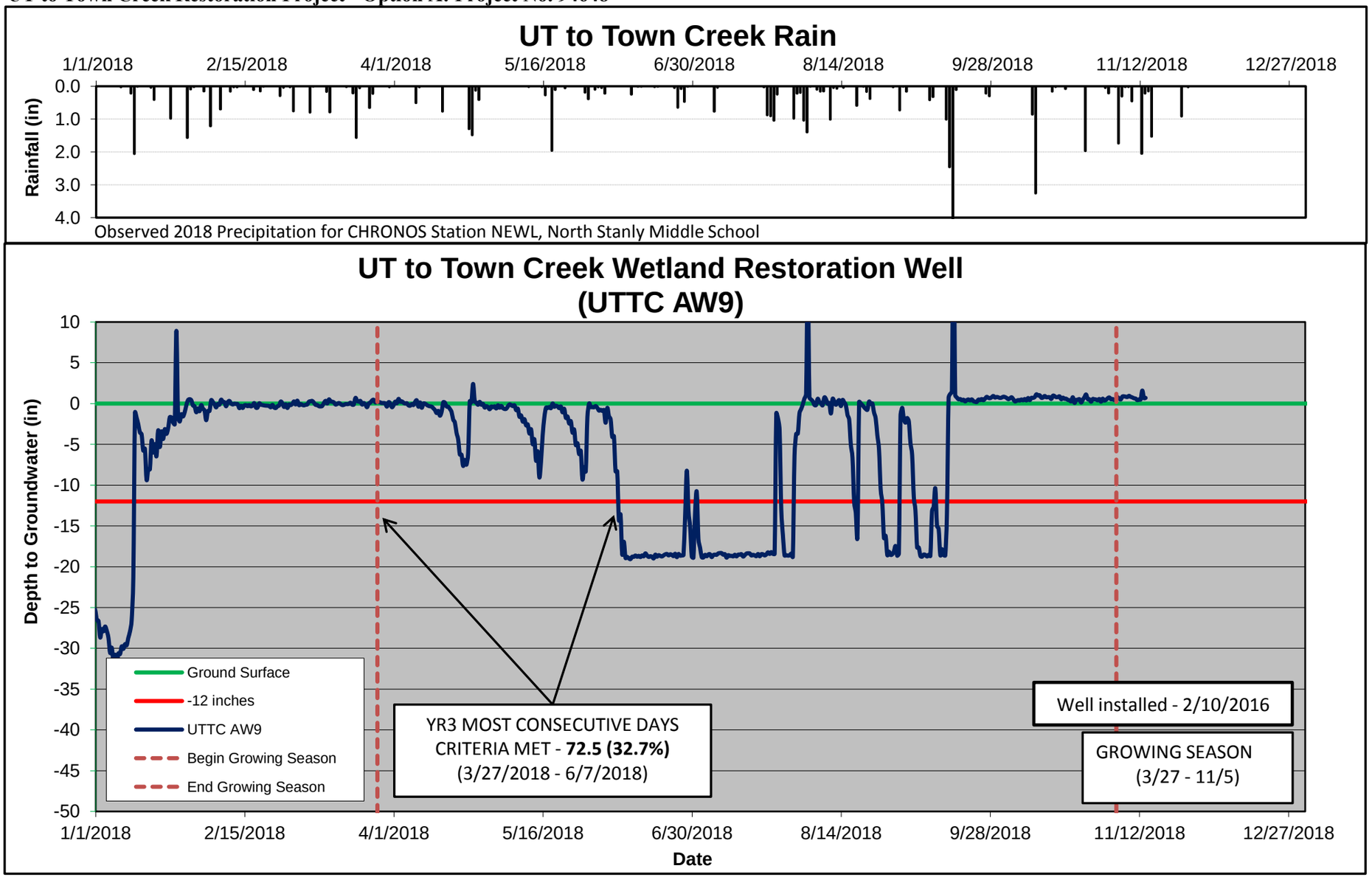


**Figure 6 Cont. Wetland Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**

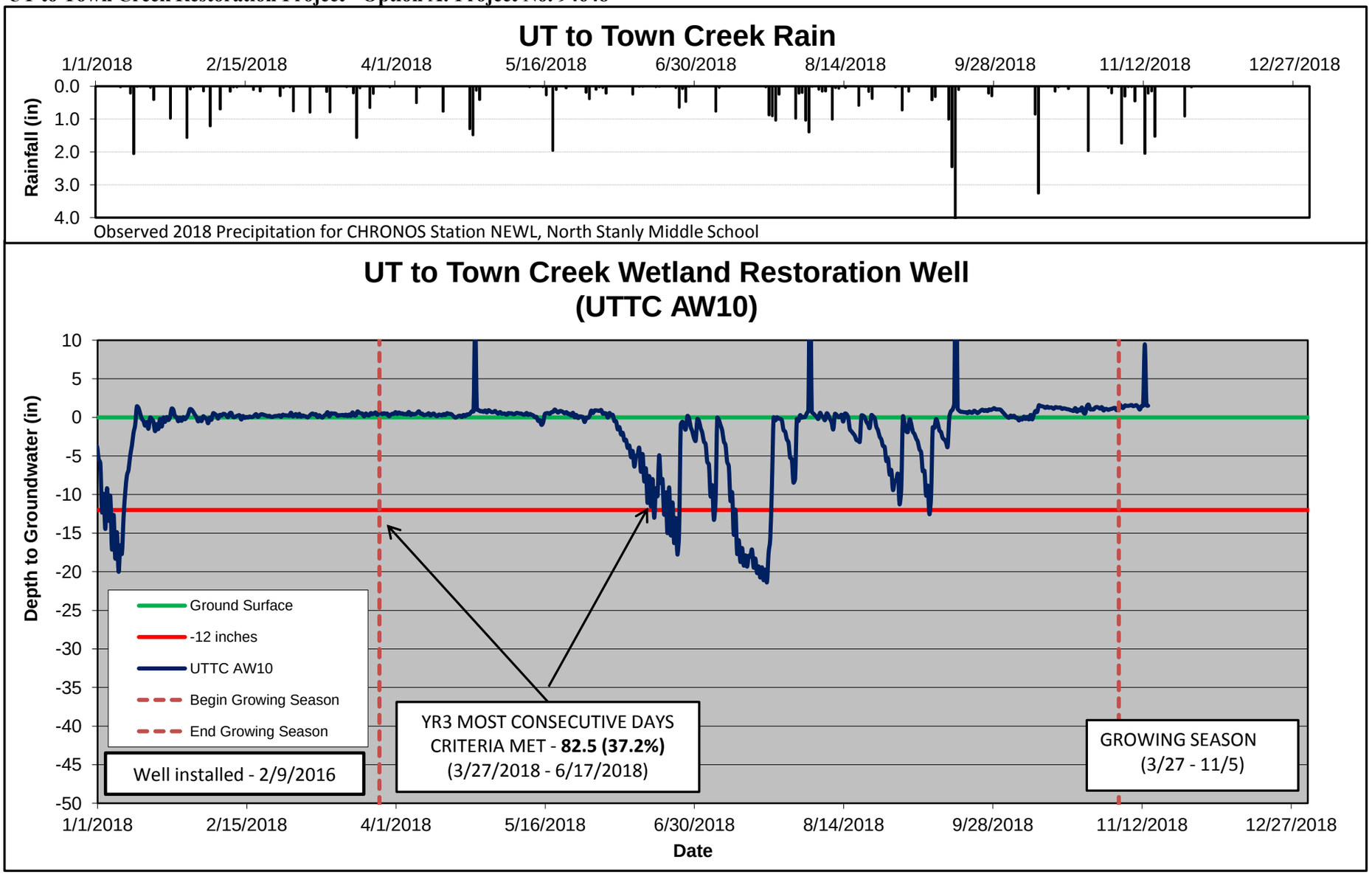
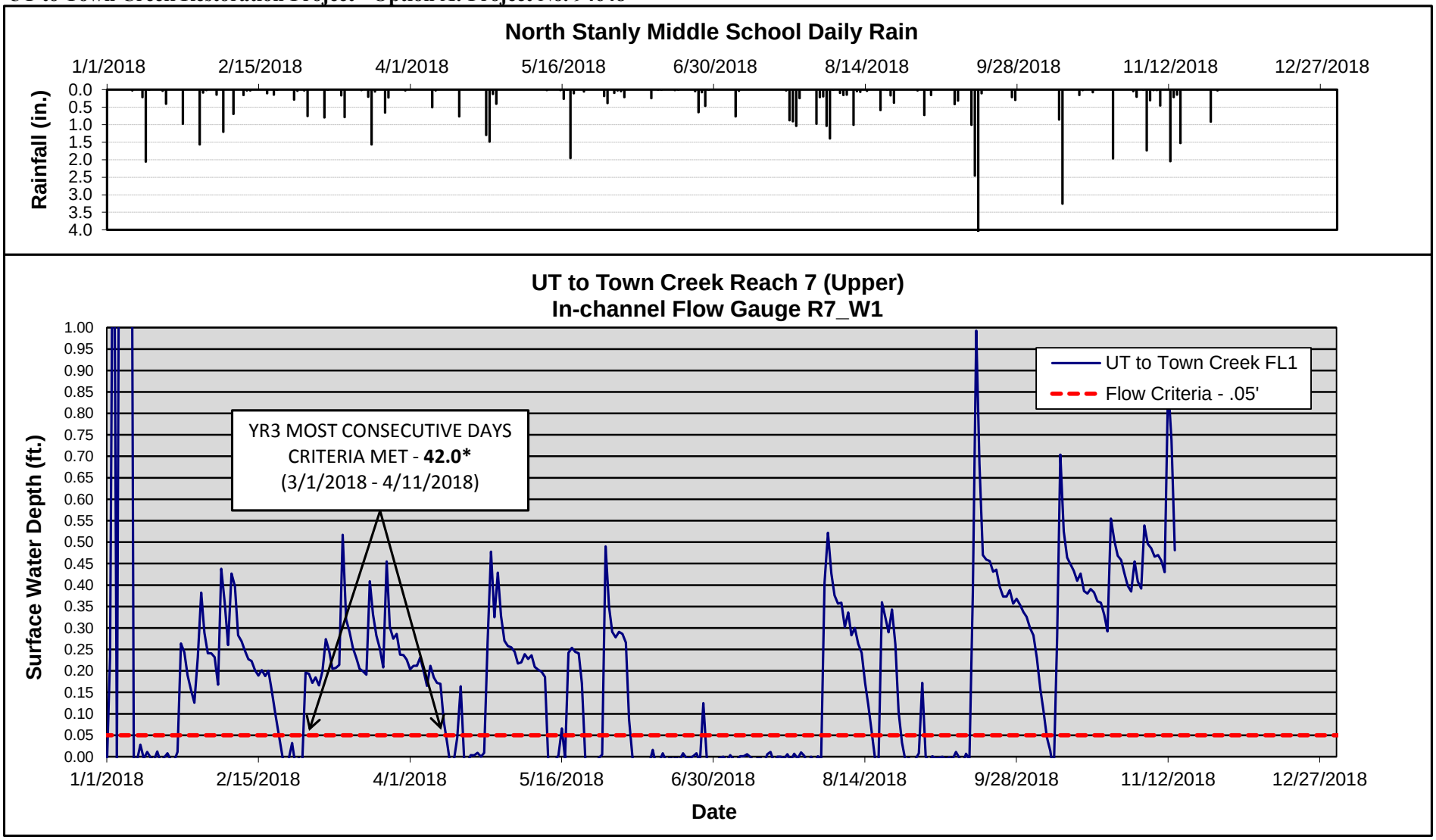
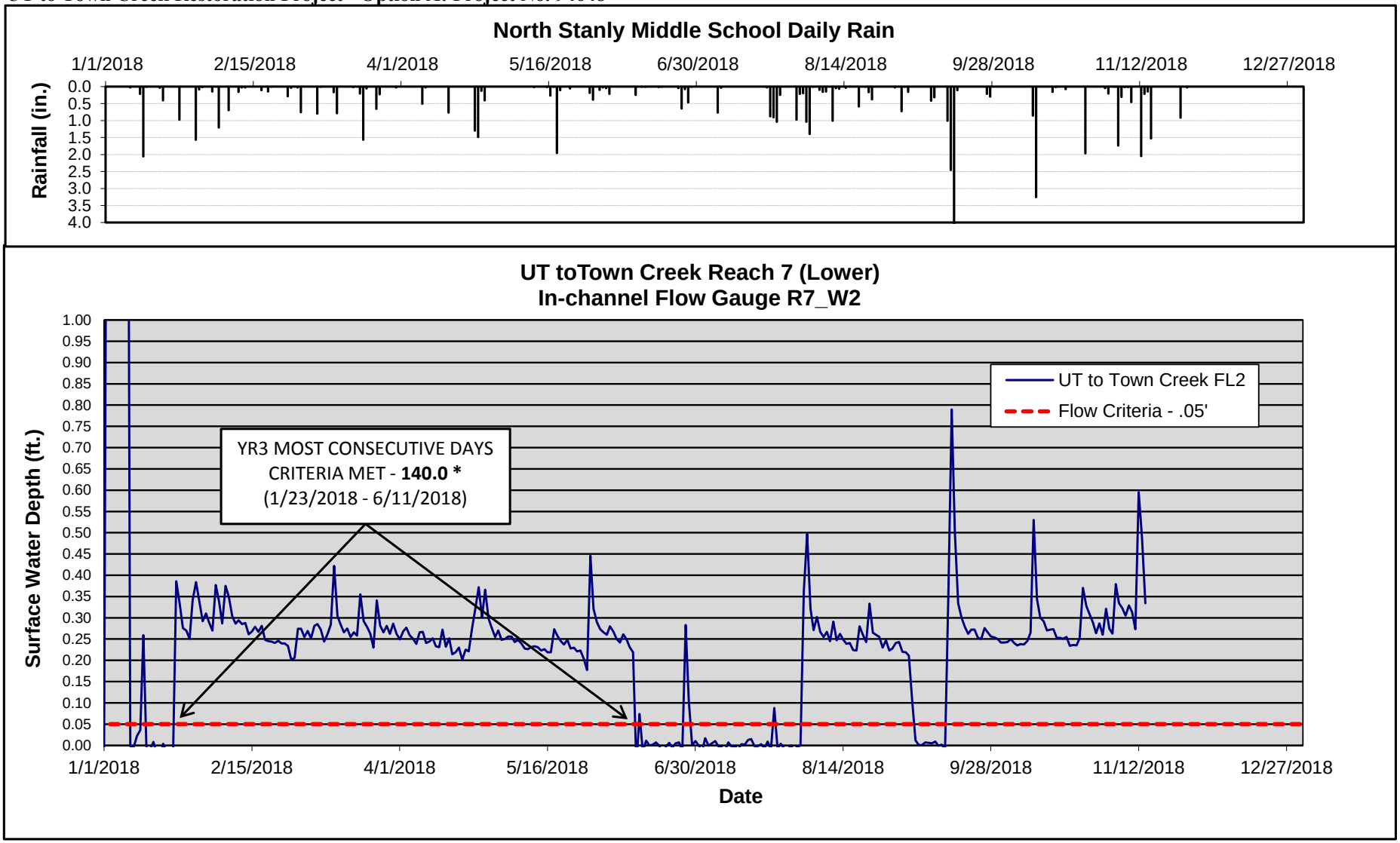


**Figure 7. In-stream Flow Gauge Graphs**
**UT to Town Creek Restoration Project - Option A: Project No. 94648**



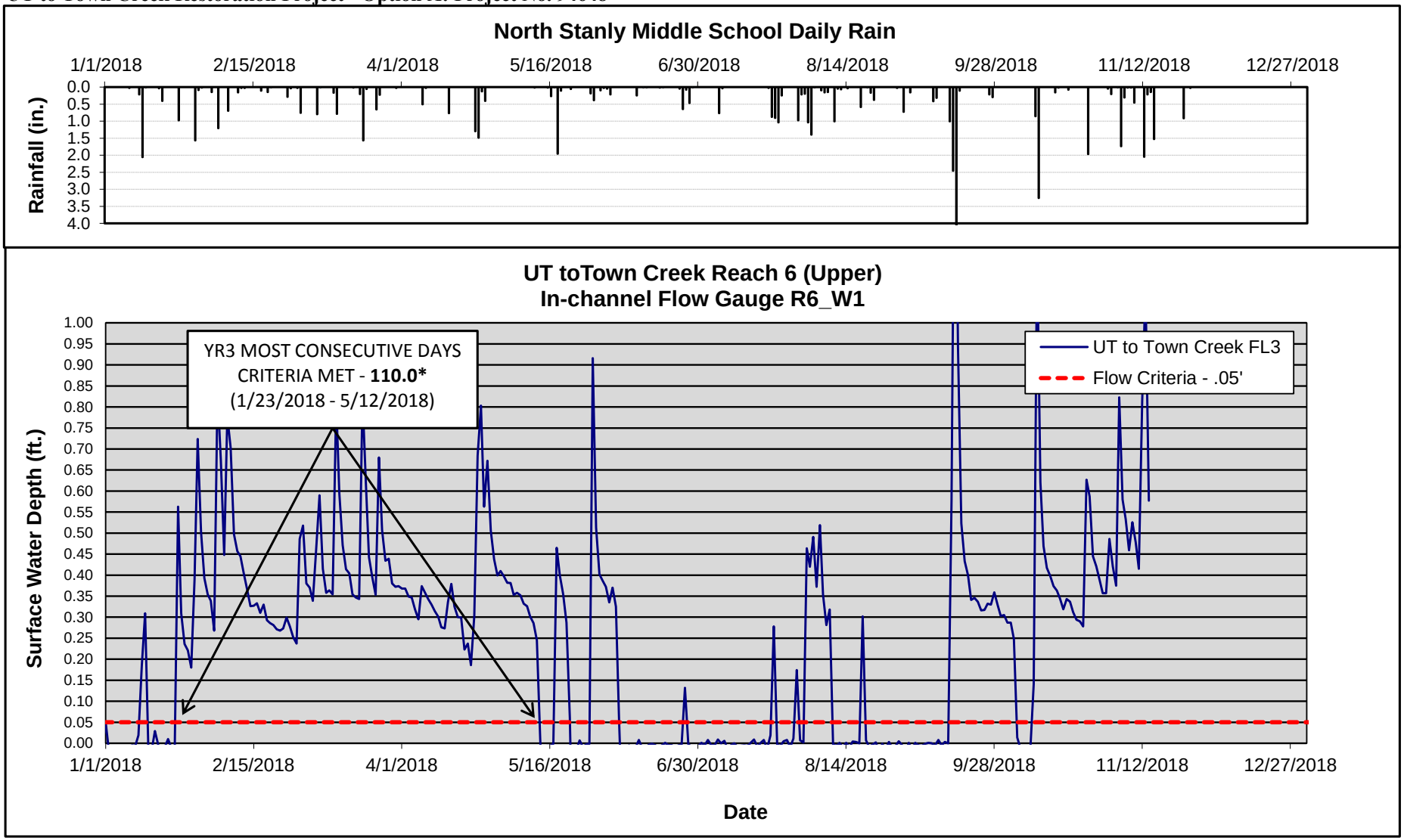

* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

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



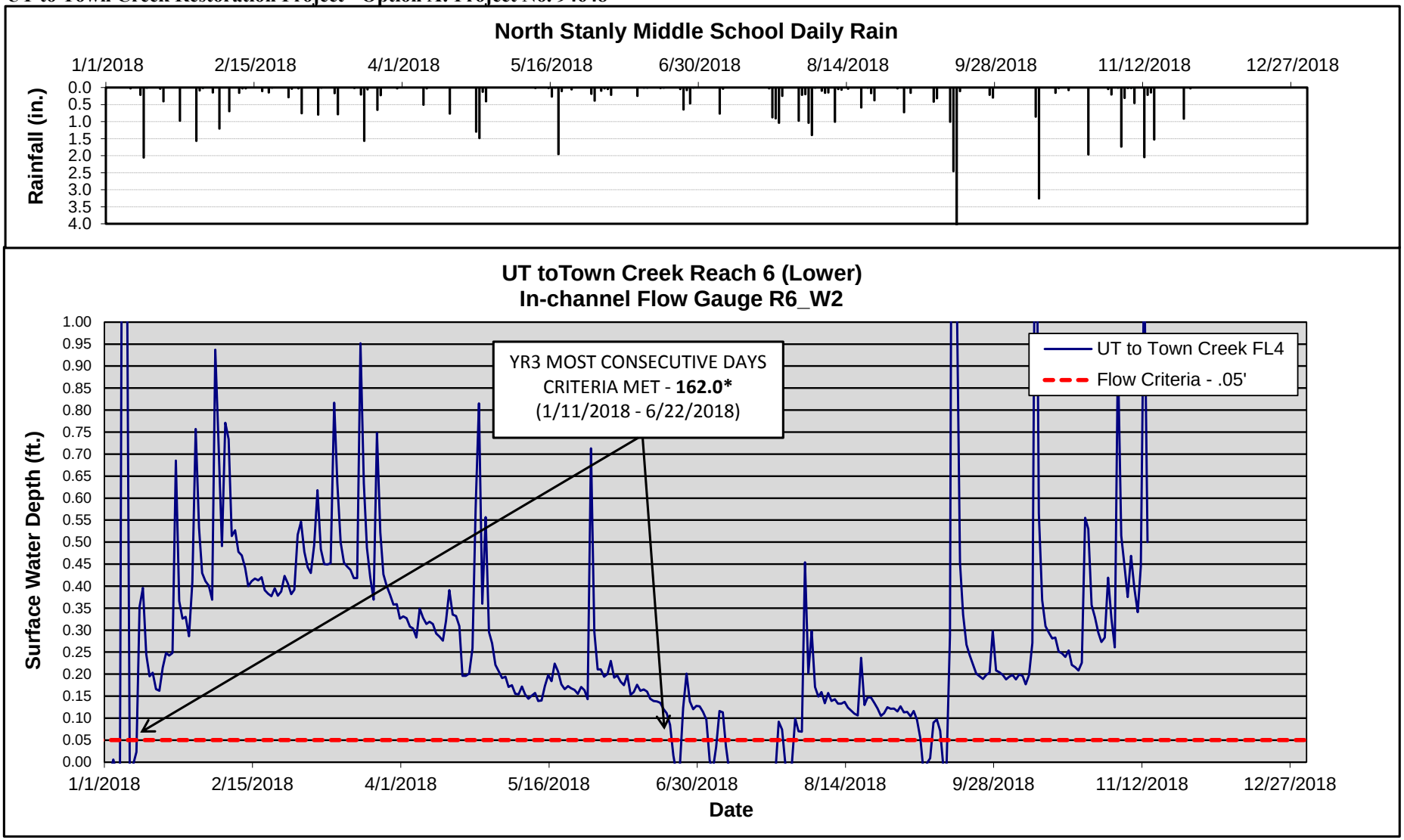

* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

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



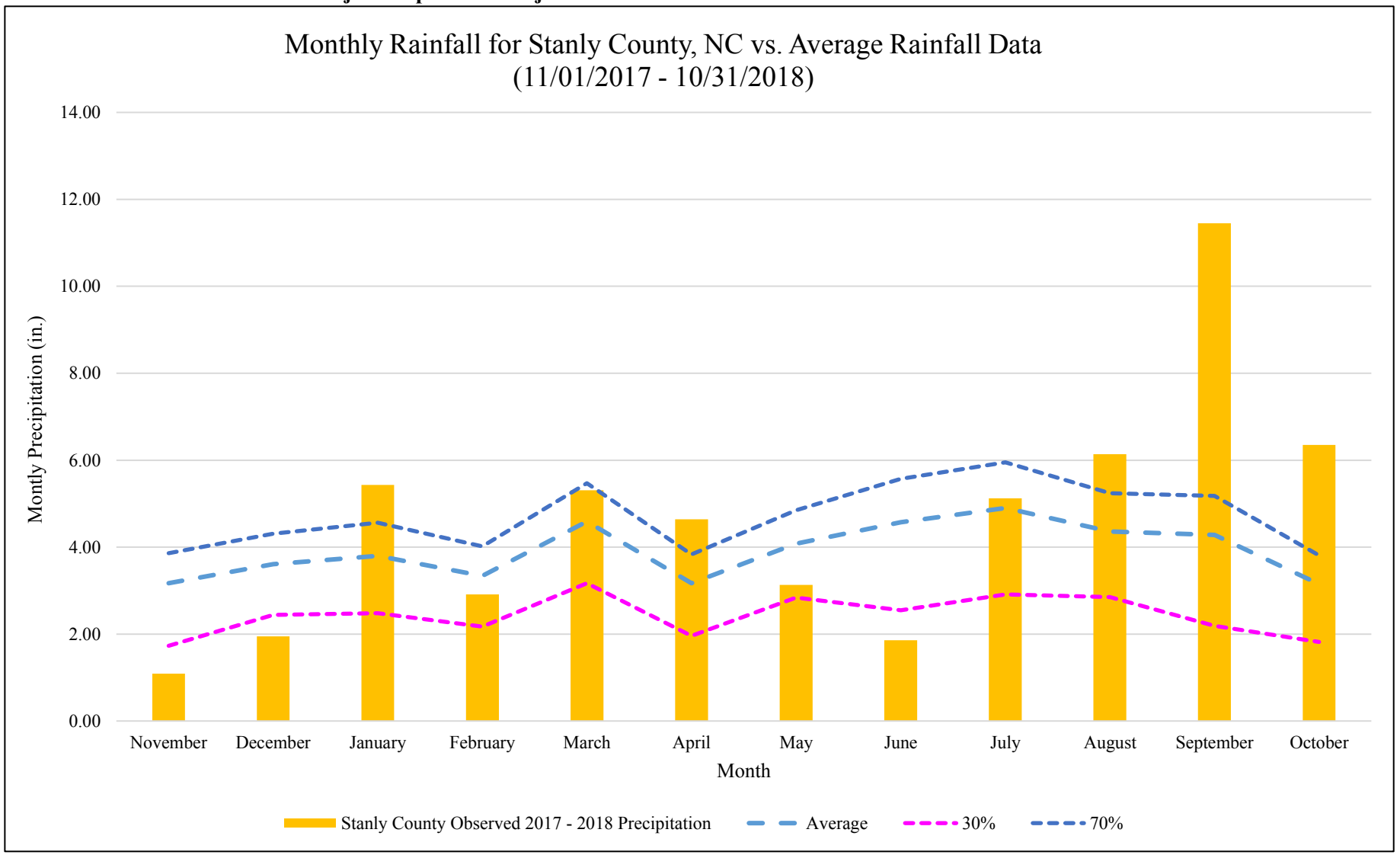

* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

**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.

**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 2017 - 2018 Precipitaion from CHRONOS Station NEWL, North Stanly Middle School

**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 | 49.5 | 110.0 | 97.5 | 216.5 | 2 |
| UTTC AW2 | Groundwater | Restoration | 52.0 | 115.5 | 100.2 | 222.5 | 2 |
| UTTC AW3 | Groundwater | Restoration | 33.1 | 73.5 | 81.3 | 180.5 | 8 |
| UTTC AW4 | Groundwater | Restoration | 43.9 | 97.5 | 88.7 | 197.0 | 4 |
| UTTC AW5 | Groundwater | Creation | 35.8 | 79.5 | 79.7 | 177.0 | 8 |
| UTTC AW6 | Reference | Jurisdictional | 48.9 | 108.5 | 96.6 | 214.5 | 2 |
| UTTC AW7 | Groundwater | Restoration | 100.0 | 222.0 | 100.0 | 222.0 | 1 |
| UTTC AW8 | Groundwater | Restoration | 23.4 | 52.0 | 59.2 | 131.5 | 9 |
| UTTC AW9 | Groundwater | Creation | 32.7 | 72.5 | 70.7 | 157.0 | 6 |
| UTTC AW10 | Groundwater | Creation | 37.2 | 82.5 | 93.7 | 208.0 | 6 |

**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.

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

| Summary of Groundwater Gauge Results for MY1-MY7 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gauge** | **Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)** | | | | | | |
| | **MY 1 (2016)** | **MY2 (2017)** | **MY3 (2018)** | **MY4 (2019)** | **MY5 (2020)** | **MY6 (2021)** | **MY7 (2022)** |
| UTTC AW1* | Yes/ 124 days (56%) | Yes/ 128 days (57%) | Yes/ 110 days (50%) | | | | |
| UTTC AW2 | Yes/ 93 days (42%) | Yes/ 154 days (69%) | Yes/ 116 days (52%) | | | | |
| UTTC AW3 | Yes/ 34 days (15%) | Yes/109 days (49%) | Yes/ 74 days (33%) | | | | |
| UTTC AW4 | Yes/ 90 days (41%) | Yes/120 days (54%) | Yes/ 98 days (44%) | | | | |
| UTTC AW5 | Yes/ 69 days (31%) | Yes/113 days (51%) | Yes/ 80 days (36%) | | | | |
| UTTC AW6* | Yes/ 125 days (56%) | Yes/130 days (58%) | Yes/ 109 days (49%) | | | | |
| UTTC AW7 | Yes/ 173 days (78%) | Yes/131 days (59%) | Yes/ 222 days (100%) | | | | |
| UTTC AW8 | No/ 16 days (7%) | Yes/ 26 days (12%) | Yes/ 52 days (23%) | | | | |
| UTTC AW9 | Yes/31 days (14%) | Yes/ 95 days (43%) | Yes/ 73 days (33%) | | | | |
| UTTC AW10 | Yes/ 77 days (35%) | Yes/ 113 days (51%) | Yes/ 83 days (37%) | | | | |

* Reference Well

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.

| Table 13. Verification of In-stream Flow Conditions<br>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]** |
| **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 |

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<br>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, MY3-2 |
| 8/23/2018 | Between 6/6/2018 and 8/23/2018 | Crest Gauge | 0.99 | Crest Gauge Photos MY3-3, MY3-4 |
| 9/26/2018 | Between 8/23/2018 and 9/26/2018 | Crest Gauge | 1.68 | Crest Gauge Photos MY3-5, MY3-6 |
| 11/14/2018 | Between 9/26/2018 and 11/14/2018 | Crest Gauge | 1.24 | Crest Gauge Photos MY3-7, MY3-8 |

## *UT to Town Creek – Bankfull Photos*


**Crest Gauge Photo MY3-1 (6/6/2018)**


**Wrack Line Photo MY3-2 (6/6/2018)**


**Crest Gauge Photo MY3-3 (8/23/2018)**


**Wrack Line Photo on Reach 2 - MY3-4 (8/23/2018)**


**Crest Gauge Photo MY3-5 (9/26/2018)**


**Wrack Line Photo MY3-6 (9/26/2018)**

**Crest Gauge Photo MY3-7 (11/14/2018)**

**Wrack Line Photo on Reach 1 - MY3-8 (11/14/2018)**

## *UT to Town Creek – Wetland Photos*

**UTTC AW1 – 11/14/2018**

**UTTC AW2 – 11/14/2018**

**UTTC AW3 – 11/14/2018**

**UTTC AW4 – 11/14/2018**

**UTTC AW5 – 11/14/2018**

**UTTC AW6 – 11/14/2018**

**UTTC AW7 – 11/14/2018**

**UTTC AW8 – 11/14/2018**

**UTTC AW9 – 11/14/2018**

**UTTC AW10 – 11/14/18**

## *UT to Town Creek Reach 6 – Flow Documentation Photos*


**Flow Documentation Photo – R6 (1/14/2018)**


**Flow Documentation Photo – R6 (1/20/2018)**

**Flow Documentation Photo – R6 (01/20/2018)**

**Flow Documentation Photo – R6 (11/14/2018)**


**Flow Documentation Photo – R7 (02/12/2018)**


**Flow Documentation Photo – R7 (03/20/2018)**


**Flow Documentation Photo – R7 (4/16/2018)**

**Flow Documentation Photo – R7 (11/14/2018)**

**Flow Documentation Photo – R7 (11/14/2018)**