Shadrick Creek Restoration Project

Annual Monitoring Report

Monitoring Year 2 of 5

FINAL

Shadrick Creek Stream Restoration Project
NCDMS Contract No. 7343
NCDMS Project No. 92916
DWR# 10-04065
USACE Action ID: 2010-00764
McDowell County, North Carolina
Data Collected: April 2019 – November 2019
Date Submitted: March 2020

Submitted to:

NCDEQ-Division of Mitigation Services
1652 Mail Service Center Raleigh NC 27699-1652

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EQUINOX
balance through proper planning

March 4, 2020

Matthew Reid
Western Project Manager
NCDENR – Division of Mitigation Services 5
Ravenscroft Dr., Suite 102
Asheville, NC 28801
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Re: DMS Draft MY2 Monitoring Report
Review for the Shadrick Creek Restoration Project
Catawba River Basin – CU# 03050101
McDowell County, North Carolina
NCEEP Project # 92916
Contract No. 7343

Dear Mr. Reid,

I have outlined our responses to the comments on the Draft Monitoring Year 2 report for the Shadrick Creek Stream Restoration Site in (Red).

General:

- Report needs considerable QA/QC. There are many errors and omissions that need attention before a draft should be submitted. Reviewed for errors, omissions and grammar.
- Please update footer to "Monitoring Year 2 of 5". Updated footer

1.5.1 Vegetation

- Text indicates vegetation monitoring for MY2 was completed in 2018, and mentions MY1 summaries are located in appendix. Please QA/QC and make sure dates and information is correct for Monitoring Year 2 in 2019. Reviewed for errors
- Sentence referencing volunteer stems indicates a range between 364–1,255. According to Table 7 this should be 364 – 1,862. Please verify and update. Corrected formula error and updated tables and text.
- Discussion regarding invasive species references methods and treatment logs in Appendix F. There is no Appendix F included in the hard copy or electronic copy of the draft report. Please update Table of Contents to include Appendix F and include all invasive treatment logs in the final document. Appendix F added and populated.

1.5.1 Stream Geomorphology

- Discussion regarding problem area near STA 11+00 reference MY1. Update to reflect MY2 conditions. Updated text as needed.
- In future monitoring reports, if problem areas do not become worse or heal over time, please remove them from the discussion and CCPV. Noted, updated as needed
- Text says "photos of these areas can be found below". There are no photos included. Please include in final report in Appendix or with other photos. Photos included
- Please add the following statement to the section: Several beaver dams were identified in July 2019 on UT9 and Shadrick Reach 1. DMS has contracted with APHIS to remove the dams and beaver from the site and will continue to monitor the site for beaver activity. Added text and updated Table 2

Table 2

- Please separate the vegetation monitoring and the geomorphology monitoring dates as it was done in MY1. Separated
- Add invasive treatment dates that occurred in MY2 2019. Added
- Please add Beaver and Dam removal that occurred in August 2019. Added updated Table 2

CCPV

- Turn off CTLPT, NL, TOP1, DISK, REBAR layers on all sheets and remove from legend. Revised CCPV
- Please remove treated invasive polygons and only show polygons with current invasive populations. There are 15 areas totaling 0.67 acres according to text and Table 6 that are not currently shown on CCPV. Updated Table 6 & revised CCPV
- Please add approximate locations of beaver dams that were removed to CCPV. Added

Table 5

- Shadrick Creek R1 shows 3 unstable segments. Four unstable segments are discussed in the text and shown on the CCPV. Please verify and update. Verified and updated
- Shadrick Creek R2 shows 0 unstable segments. 2 unstable segments are discussed in the text and shown on the CCPV. Please verify and update. Verified and updated

Appendix C: Vegetation Plot Data

- Table 8 indicates that Vegetation Plot 10 is not meeting success criteria. This does not appear to be the case based on presented data. Please update. Corrected formula error and updated tables.
- Table 9 is the table from MY1. Please update with the correct MY2 table. Updated

Appendix D: Stream Measurement and Geomorphology Data

- See comment under Digital File Review section regarding cross section calculations.

- Please add a note to XS8 indicating why it was not surveyed this year (beaver dam). Add same note to Table 11a. Noted and updated in appropriate table and figures
- Pebble count sheets refer to "Monitoring Year – 2020; MY2". Please update all sheets to 2019. Revised

Digital File Review

DMS is conducting digital file audits on all projects. Below are missing or incomplete digital deliverables for the project. If you have any questions or need clarification regarding these items, please contact Greg Melia.

Morphology - Please check BHR calculations for the following riffle XS:

- XS9 - Seems to have enlarged between MY0 and MY2 but BHR decreasing. Believe it is due the choice of LTOB which is skewed to an elevation that is low relative to the selection process for LTOB at MY0. Reviewed and Revised
- XS17 - Decrease in BHR seem exaggerated based on overlays. Believe it is due the choice of LTOB which is skewed to an elevation that is low relative to the selection process for LTOB at MY0. Reviewed and Revised
- Please evaluate elevation selections for XS13 as well. Reviewed and Revised

Calculation of XSA and Max Depth are to be completed using TOB in keeping with methods specified in the Industry Technical Work group memorandum. Holding the AB XSA static only applies for the calculation of the BHR. Tracking channel change in XSA and Max Depth are to vary based on the use of LTOB. For clarity make sure the reader is aware that these methods are being employed. For example, please include a footnote to that effect:

"*Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioners in NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.*" Footnote added to table 11a

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Prepared by:

37 Haywood Street, Suite 100
Asheville, NC 28801

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Table of Contents

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1.0 PROJECT SUMMARY

1.1. Project Setting and Background

The Shadrick Creek Restoration Project (Shadrick) is located in the Catawba River Basin (CU 03050101). The Shadrick Creek site is also located within the Muddy Creek (Upper Catawba) Local Watershed (LWP) area. The Shadrick Creek site watershed also includes the Hydrologic Code (HUC) 0305010103006, which is identified as a Targeted Local Watershed (TLW) in the Ecosystem Enhancement Program's (EEP) 2009 Upper Catawba River Basin Restoration Priority (RBRP) Plan. Project work at the Shadrick site was completed in April 2017, and included construction, planting, invasive treatment, and fence installation. Through the project work, a total of 1,353 linear feet were restored, 6,966 linear feet were enhanced through Enhancement I, 215 linear feet were enhanced through Enhancement II, 2,895 linear feet were preserved, and 0.53 acre of wetlands were enhanced. The site generated a total of 6,662 SMU's, 0.27 WMU, and 527,000 SF of Buffer. Refer to Table 1 for the project components and mitigation credit information and Figure 2 for the project asset map.

The Shadrick site has a history of unrestricted livestock access, leading to bank erosion, compaction, and discontinuity between the stream and its associated floodplain. Historic agricultural practices, including recent tree farming, and removal of the vegetative buffer have caused loss of plant diversity, stream incision, and failing banks. The completed project will reduce sediment inputs from the failing banks, reduce nutrients and bacteria entering the stream from livestock, and will enhance the forested corridor along the stream floodplain.

This project is protected by a 54.6 acre conservation easement and is located approximately 5.5 miles east of Nebo, NC in McDowell County at 35.720410° N, 81.901405° W. The Shadrick Creek site is bounded to the north by the Norfolk Southern Railroad. Agricultural and/or forested lands border the project to the south, east, and west.

1.2. Project Goals and Objectives

The project goals address stressors identified in the TLW and priority subwatershed, as outline in the Final Mitigation Plan, and include:

- Improve water quality by repairing eroding stream banks, establishing riparian buffers and implementing agricultural best management practices;
- Improve the community structure of the buffers;
- Improve stream function and habitat by re-establishing stream-to-floodplain connections;
- Restore long-term stability through the restoration of channel dimensions, pattern, and profile;
- Improve in-stream habitat using in-stream structures; and
- Remove exotic invasive plant species.

The following objectives are proposed for accomplishing the above listed goals as outlined in the Final Mitigation Plan:

- Restoration and enhancement of approximately 5,276 LF of Shadrick Creek;
- Restoration and enhancement of 3,179 LF of UT's 1, 5, 9, and 10;
- Preservation of 3,835 LF of UT's 2, 5, 6, 7, and 8;
- Enhancement of 0.53 acre of wetland by improving hydrologic connections and vegetation communities;
- Installing over 8,000 LF of livestock fence, three wells and six watering tanks; and

- Establishment of riparian buffers by removing exotic invasive plants and installing a variety of native vegetation.

1.3. Project Success Criteria

The stream restoration success criterial for the project will follow accepted and approved criteria based on the Mitigation Plan for Shadrick Creek Stream Restoration (2010). The Shadrick Creek Mitigation Plan references the Stream Mitigation Guidelines issued in April 2003 by the USACE and NCDWQ. Specific success criteria are presented below.

1.3.1. Streams

The stream geometry will be considered successful if the cross section geometry, profile, and sinuosity are stable or reach a dynamic equilibrium. It is expected that there will be changes in the designed cross sections, profile, and/or substrate composition. Any changes that occur during the monitoring period will be evaluated to determine whether they represent a trend toward a less stable condition (e.g., down cutting, erosion, etc.) or simply an increase in stability (e.g., settling, vegetative changes, coarsening of bed material, etc.) or move toward quasi-equilibrium.

An initial, though not exclusive, indicator of success will be the stream's adherence to design or reference ratios of stream geometry found in the morphological table in Appendix D or in a comparable, stable reference system. The channel may not adhere to design or reference ratios of stream geometry, but can be considered stable if the following key indicators are present:

- Stream Type: Maintenance of the design stream type or progression toward/conversion to a stable stream type such as C or E will indicate stability.
- Bank Height Ratio: Bank height ratio between 1.0 and 1.2 will indicate that flood flows have access to the active floodplain and that higher flows do not apply excessive stresses to stream banks.

Determination of true bankfull may be difficult to determine until the stream has experienced adequate flooding events to create strong bankfull indicators. Stream bank erosion upstream of the project site will persistently contribute sediment to the project reaches due to unstable upstream banks. Excess sediment will be routed through the project area or deposited in target areas such as point bars and the floodplain. Minor sedimentation of pools and glides may occur. The pools are designed to be over-dug to account for some sedimentation in pools and glides. If a large storm event occurs before the woody vegetation has established, isolated bank erosion may occur in sections where the flood-prone area has been restricted by topography or easements. Areas of bank erosion will be repaired as necessary.

1.3.2. Vegetation

The success of riparian vegetation planting will be gauged by stem counts of planted species. Stem counts of more than 320 trees per acre after three years, and 260 trees per acre after five years will be considered successful. Photos taken at established photo points should indicate maturation of riparian vegetation.

1.4. Mitigation Components

The Shadrick Creek Restoration Project generated 6,662 SMUs, 0.27 WMU, and 527,000 Square Feet of Buffer Credits. Refer to Figure 2 for the project component/ asset map for a visual description of the project assets and Table 1 for project components and mitigation credit information for the Shadrick Creek Restoration Project. These credits are based on stream lengths surveyed during the as-built baseline survey and account for the breaks in the easement.

The total number of SMUs generated from the Shadrick Creek Restoration Project are 164 SMUs lower than what was outlined in the Shadrick Creek Restoration Project Mitigation Plan Addendum (2015). This discrepancy is due mostly to the Mitigation Plan Addendum calculating the total linear feet of stream preservation as 3,835 while the as-built report total indicates that the total linear feet of preservation equals 2,895 (difference of 940 LF). It is believed that this discrepancy is attributed to UT3 and UT4 being determined as non-jurisdictional streams. Other deviations from the Mitigation Plan exist based on data taken from the centerline survey for the As-Built survey. Please refer to Table 1 for these numbers.

1.5. Project Performance

Monitoring Year 2 (MY2) data was collected from April to November 2019. Monitoring activities included visual assessment of all reaches and the surrounding easement, collection of images at 31 permanent photo stations, inventory of 16 permanent vegetation monitoring plots, surveying of 18 cross-sections, conducting 5 pebble counts, and collection of longitudinal profile survey data for approximately 1,354 linear feet of stream channel.

Summary information/data related to the occurrence of items such as beaver or encroachment 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 (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on the NCDMS website (http://portal.NCDEQ.org/web/eep). All raw data supporting the tables and figures in the appendices is available from DMS upon request.

1.5.1. Vegetation

Visual assessment of vegetation outside of the monitoring plots (Appendix B – Table 6) indicates that the herbaceous vegetation is becoming established throughout the project. Shadrick Creek has some areas of bare, rocky ground, located primarily along the bankfull bench. These areas are to be expected in the first few years following construction, but show signs of improvement in MY2 and will be monitored in future site visits.

Monitoring of the permanent vegetation plots (n = 16; VP) was completed in October 2019. Summary tables and photographs associated with MY2 vegetation monitoring are located in Appendix B and Appendix C. MY2 monitoring data indicates that all vegetation plots are on track to meet the MY3 interim success criteria of 320 planted stems per acre. Planted stem densities among plots ranged from 324 to 688 planted stems per acre with an annual mean of 588 planted stems per acre across all plots. A total of 7 species of planted trees and shrubs were documented within the plots. When volunteer stems are included, the mean annual total stems per acre rose to 1197 and ranged between 364 and 2,630 stems per acre.

With regard to invasive-exotic species, multiple areas (n=15) of invasive-exotic vegetation were noted in small densities (0.56 acre) throughout the easement (Table 6). The species documented at the Shadrick Creek Site include Japanese honeysuckle (*Lonicera japonica*), Privet spp. (*Ligustrum sinense*), and kudzu (*Pueraria montana*). All areas called out as "invasives present" in the MY1 report were treated during MY2; invasive polygons will be removed from the CCPV as they are assessed as fully controlled. The timeframe and method of treatment can be found in Appendix F. Herbicide treatments and mechanical control of the remaining invasive-exotic populations are also scheduled for MY3.

1.5.2. Stream Geomorphology

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. A few small areas of bank scour were noted on Shadrick Creek Reach 1, Shadrick Creek Reach 3 and UT-1 (Table 5, Figure 2 CCPV). The first area on Shadrick Creek Reach 1 is located at the top of the Project near STA 11+00. Here the left descending bank (LDB) has scoured out due to an uprooted tree. A large scour pocket has formed where the tree had previously been rooted. This area has been monitored since baseline conditions and had not worsened during MY2 monitoring period. Further downstream on Shadrick Reach 1 at STA 37+50, the right descending bank (RDB) is scouring just downstream of the log sill structure. At high flows the thalweg is directed directly at this portion of the bank and has scoured out approximately 20 feet of bank downstream from the structure. Just downstream of that from there, another area of instability was noted at STA 39+00 where the LDB has been scoured approximately 20 feet just downstream of the two log structure. While both of these areas of instability are associated with log structures, both structures are intact and the scour appears to be a result of high flows coupled with bare banks after construction. Three new areas of bank scour were noted along Shadrick Reach 1 and Shadrick Reach 2. The first area is located along the left descending bank (LDB) of Shadrick Reach 1 at STA 33+75 totaling approximately 30 feet. The other two are located along the right descending bank of (RDB) of Shadrick Reach 2 at STA 101+25 totaling approximately 20 feet and STA 105+50 totaling 30 feet. Two areas of bank scour were also noted on Shadrick Creek Reach 3. The first is located at STA 107+75, where again high flows with the lack of a vegetated buffer have scoured out the RDB of the inside bend approximately 20 feet. The other area of bank scour located on Shadrick Creek Reach 3 is located at the bottom of the reach at STA 116+00. This area also lacks vegetation and located along the LDB of a bend. High flows and increased velocity originating from a straight portion of the reach have scoured this area for approximately 15 feet. Lastly, a small area of scour was documented at the bottom end of UT-1 at STA 29+50. Increased velocity coming from a culvert has scoured out the RDB for approximately 20 feet. Photos of these areas can be found in Appendix B. These areas and the rest of the site will be monitored in future visits for any further signs of instability.

Geomorphic data for MY2 was collected during July 2019. Summary tables and cross-section data plots related to stream morphology are located in Appendix D. Cross-sectional dimensions have remained stable between baseline conditions and MY2 monitoring efforts. Slight adjustments have been observed in all cross-sections, none were indicative of a move toward instability (Appendix D, Table 11a). Riffle dimensions for each reach also remained relatively similar between baseline conditions and MY2 monitoring. (Appendix D, Table 11b).

Generally, longitudinal profile data (Appendix B, Table 11b) indicated relatively little change in riffle and pool dimensions between baseline conditions and MY2 monitoring. Profile data from Shadrick Creek Reach 3 indicates that the stream has remained stable since baseline conditions. Riffle slopes and water surface slopes have remained almost the same since baseline. Mean riffle lengths have increased and pool lengths have decreased slightly from MY1 to MY2. UT-9 Reach 2 dimensions have also

indicated that mean riffle lengths have increased slightly and mean pool length is decreasing. These changes are to be expected in the first couple years after baseline completion as the stream channel adjusts. Longitudinal profile data will continue to be collected and analyzed in future monitoring years for unhealthy trends.

Several beaver dams were identified in July 2019 on UT9 and Shadrick Reach 1. DMS has contracted with APHIS to remove the dams and beaver from the site and will continue to monitor the site for beaver activity.

Substrate monitoring was performed during MY2. Pebble count D_{50} fell into the coarse gravel range for Shadrick Creek Reach 1 and medium gravel for Shadrick Creek Reach 3. Pebble counts were not conducted at UT 9 in MY2 due to beaver activity. The channel substrate will continue to be monitored in future years for shifts in particle size distributions

1.5.3. Stream Hydrology

Since project completion in late 2017, four bankfull events have been documented at the Shadrick Creek Site. Based on precipitation data, the suspected dates are January 12nd 2018, May 18th 2018, October 18th 2018, and April, 17, 2019 (Table 12, Appendix E).

2.0 METHODS

The visual assessment of the project was performed at the beginning and end of each monitoring year. Permanent photo station photos were taken during the initial visual assessment when leaf-off conditions exist. Additional photos of vegetation or stream problem areas were taken as needed.

Geomorphic measurements were taken during low flow conditions using a Nikon® NPR 332 Total Station. Three-dimensional coordinates associated with cross-section and profile data were collected in the field and geo-referenced (NAD83 State Plane feet FIPS 3200). Morphological data were collected at 18 of 19 cross-sections. Survey data was imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. Channel substrate was characterized using a Wolman Pebble Count as outlined in Harrelson et al. (1994) and processed using Microsoft Excel.

Vegetation success is being monitored at 16 permanent monitoring plots. Vegetation monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data is processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with metal t-posts and photos of each plot were taken from the origin each monitoring year.

Precipitation data was reported from the NCCRONOS station in Rutherfordton, NC. Bankfull events were documented with two crest gauges, one located on Shadrick Creek Reach 1 and another on Shadrick Creek Reach 3. Crest gauges will be monitored semi-annually. The height of the corklines were recorded and cross-referenced with known bankfull elevations at each crest gauge.

3.0 REFERENCES

Ben Patton Land Surveying. 2017. As-Built Survey of Shadrick Creek Restoration Project. Prepared for N.C. Division of Mitigation Services.

Confluence Engineering. 2015. Mitigation Plan Addendum – Final, Shadrick Creek Restoration Project. . Prepared for North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Mitigation Plan Addendum – Final, Shadrick Creek Restoration Project. EEP Project No. 92916.

Kimley-Horn and Associates, Inc. 2010. Mitigation Plan for Shadrick Creek Stream Restoration. Prepared for North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Final Mitigation Plan, Shadrick Creek Stream Restoration, McDowell County. EEP Project No: 92916.

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm

Appendix A
Project Background Data and Maps

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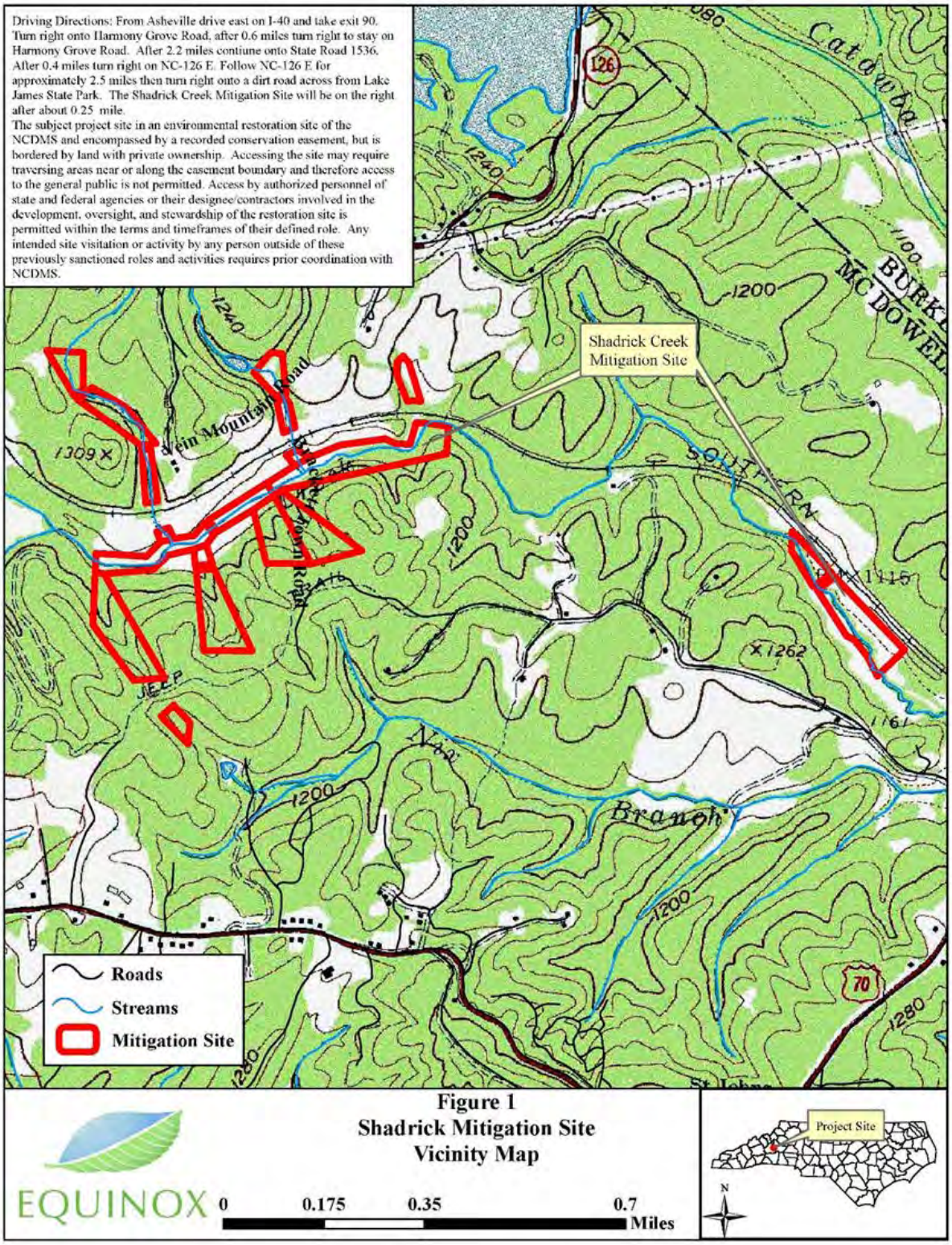
Driving Directions: From Asheville drive east on I-40 and take exit 90. Turn right onto Harmony Grove Road, after 0.6 miles turn right to stay on Harmony Grove Road. After 2.2 miles continue onto State Road 1536. After 0.4 miles turn right on NC-126 E. Follow NC-126 E for approximately 2.5 miles then turn right onto a dirt road across from Lake James State Park. The Shadrick Creek Mitigation Site will be on the right after about 0.25 mile.
The subject project site in an environmental restoration site of the NCDMS and encompassed by a recorded conservation easement, but is bordered by land with private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access to the general public is not permitted. Access by authorized personnel of state and federal agencies or their designee/contractors involved in the development, oversight, and stewardship of the restoration site is permitted within the terms and timeframes of their defined role. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with NCDMS.
Shadrick Creek Mitigation Site
Roads
Streams
Mitigation Site
Figure 1
Shadrick Mitigation Site
Vicinity Map
EQUINOX
0
0.175
0.35
0.7
Miles
Project Site
N

Table 1. Project Mitigation Components and Summation

Shadrick Creek Stream Restoration Project

Mitigation Credits*

	Stream SMUs				Wetland WMUs	Buffer SF
Type	R	EI	EII	**P**	**E**	**527,000**
Totals	**1,353**	**4,644**	**86**	**579**	**0.27**	

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Restoration Footage or Acreage*	Restoration Footage/Acreage Discrepancy from Mitigation Plan	Restoration -or- Restoration Equivalent	Approach (PI, PII etc.)	Mitigation Ratio	Mitigation Credits*	Buffer SF
Shadrick Reach 1	10+06 - 46+84	3,686	3,632	-6	EI	P3	1.5:1	2,421	199,000
Shadrick Reach 2	100+04 - 105+77	595	573	-2	EI	P3	1.5:1	382	226,000
Shadrick Reach 3	105+77 - 117+26	1,168	1,104	-4	R	P2	1:1	1,104	
UT-1	10+00 - 30+57	1,637	1,651	14	EI	P3	1.5:1	1,101	46,000
UT-5	6+64 - 8+79	228	215	-13	EII	Buffer	2.5:1	86	Incl. in Shadrick R1
UT's 2, 5, 6, 7 & 8	-	3,835	2,895	-940	P	Preservation	5:1	579	-
UT-9 Reach 1	9+90 - 17+42	678	706	28	EI	P3	1.5:1	471	34,000
UT-9 Reach 2	19+59 - 22+08	237	249	3	R	P2	1:1	249	
UT-10	9+92 - 13+96	391	404	13	EI	P3	1.5:1	269	24,000
Wetland A	UT1	0.44	0.44	0	E	Stab./Buffer	2:1	0.22	-
Wetland B	Shadrick Reach 1	0.09	0.09	0	E	Buffer	2:1	0.05	-

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine	-	-	-
Restoration	1,353	-	-	-	-	-
Enhancement	-	0.53	-	-	-	-
Enhancement I	6,966	-	-	-	-	-
Enhancement II	215	-	-	-	-	-
Preservation	2,895	-	-	-	527,000 SF	-
High Quality Preservation	-	-	-	-	-	-

BMP Elements

Element	Location	Purpose/Function	Notes
FB	Entire Site	Protect Stream Channel	

BMP Elements

BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

* Mitigation credits and stream lengths account for breaks in conservation easements

Table 2. Project Activity and Reporting History Shadrick Creek Restoration Project		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Mitigation Plan	-	May 2010
Mitigation Plan Addendum	-	Feb 2015
Final Design - Construction Plans	-	Feb 2015
Construction	Oct 2016 - Jun 2017	Jun 2017
Temporary S&E Mix Applied	Oct 2016 - Jun 2017	Jun 2017
Permanent Seed Mix Applied	Oct 2016 - Jun 2017	Jun 2017
Bare Root and Live Stake Plantings	Dec 2016 - Apr 2017	Apr 2017
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	Sep 2017 - Dec 2017	Feb 2018
Stream Assessment	Dec 2017	Feb 2018
Vegetation Assessment	Sep 2017	
Year 1 Monitoring	Oct 2018	Nov 2018
Invasive-Exotic Treatment	-	July 2018
Year 1 Vegetation Monitoring	Sept 2018	-
Year 1 Geomorphology Monitoring	Oct 2018	-
Year 2 Vegetation Monitoring	Oct 2019	-
Year 2 Geomorphology Monitoring	July 2019	-
Year 2 Beaver and Dam removal	-	August 2019
Year 2 Invasive vegetation management	-	March 2019
Year 2 Invasive vegetation management	-	June 2019
Year 2 Invasive vegetation management	-	July 2019
Year 2 Invasive vegetation management	-	October 2019
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts	
Shadrick Creek Restoration Project	
Prime Contractor	North Carolina Division of Mitigation Services 217 W Jones Street Suite 3000a Raleigh, North Carolina 27603 Matthew Reid (828) 231-7812
Designer	Wildlands Engineering 167B Haywood Road Asheville, North Carolina 28806 Andrew Bick (828) 774-5547
Construction Contractor	Baker Construction 1000 Bat Cave Road Old Fort, NC 28762 Charles Baker (828) 668-5060
Seeding Contractor	Baker Construction 1000 Bat Cave Road Old Fort, NC 28762 Charles Baker (828) 668-5060
Planting Contractor	Equinox 37 Haywood St. Asheville, North Carolina 28801 Owen Carson (828) 253-6856
As-built Surveys	Ben Patton Land Surveying 259 Daves Farm Dr. Marion, NC 28752 Ben Patton (828) 768-1625
Seeding Mix Source	Green Resource 5204 Highgreen Court Colfax, North Carolina 27235 (336) 855-6363
Live Stakes	Foggy Mountain Nursery 797 Helton Creek Road Lansing, North Carolina (336) 384-5323
Monitoring Performers (MY0-MY2) 2017 - 2019	Equinox Environmental 37 Haywood St. Asheville, North Carolina 28801 Danvey Walsh (828) 253-6856

Table 4. Project Baseline Information and Attributes							
Project Information							
Project Name	Shadrick Creek						
County	McDowell						
Project Area (acres)	54.6						
Project Coordinates (latitude and longitude)	35.720410° N, -81.901405° W						
Project Watershed Summary Information							
Physiographic Province	Blue Ridge						
River Basin	Catawba River						
USGS Hydrologic Unit 8-digit	3050101	USGS Hydrologic Unit 14-digit	0305010103006				
DWR Sub-basin	03-08-30						
Project Drainage Area (acres)	2,093						
Project Drainage Area Percentage of Impervious Area	> 1%						
CGIA Land Use Classification	Agricultural						
Reach Summary Information							
Parameters	**Shadrick Creek Reach 1**	**Shadrick Creek Reach 2**	**Shadrick Creek Reach 3**	**UT-1**	**UT-9 Reach 1**	**UT-9 Reach 2**	**UT-10**
Length of reach (linear feet)*	3,632	573	1,104	1,651	706	249	404
Valley Confinement (Rosgen)	VIII	VIII	VIII	II	II	VIII	II
Drainage area (miles^2)	2.80	3.30	3.30	0.10	0.10	0.10	0.05
Perrenial, Intermittent, Ephemeral	Perrenial	Perrenial	Perrenial	Perrenial	Perrenial	Perrenial	Perrenial
NCDWR Water Quality Classification	C	C	C	C	C	C	C
Stream Classification (existing)	E4	E4	E4	G4	B4, G4	B4, G4	F4
Stream Classification (proposed)	C4	C4	C4	B4	B4	E4	B4
Evolutionary Trend (Rosgen)	V	V	V	V	VI	VI	VI
FEMA classification	-	-	-	-	-	-	-
Wetland Summary Information							
Parameters	**Wetland A**			**Wetland B**			
Size of Wetland (acres)	0.44			0.09			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian			Riparian			
Mapped Soil Series	HeD			EwE			
Drainage class	well-drained			well-drained			
Soil Hydric Status	Hydric			Hydric			
Source of Hydrology	Spring			Spring			
Hydrologic Impairment	Logging			Stream Incision, Cattle Grazing			
Native vegetation community	Piedmont/ Low Mountain Alluvial Forest			Piedmont/ Low Mountain Alluvial Forest			
Percent composition of exotic invasive vegetation	0%			0%			
Regulatory Considerations							
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**				
Waters of the United States – Section 404	Yes	Yes	Jurisdictional Determination				
Waters of the United States – Section 401	Yes	Yes	Jurisdictional Determination				
Endangered Species Act	No	N/A	ERTR				
Historic Preservation Act	No	N/A	ERTR				
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A					
FEMA Floodplain Compliance	Yes	Yes	Yes				
Essential Fisheries Habitat	No	N/A	-				

*Accounts for breaks in conservation easements

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Appendix B
Visual Assessment Data

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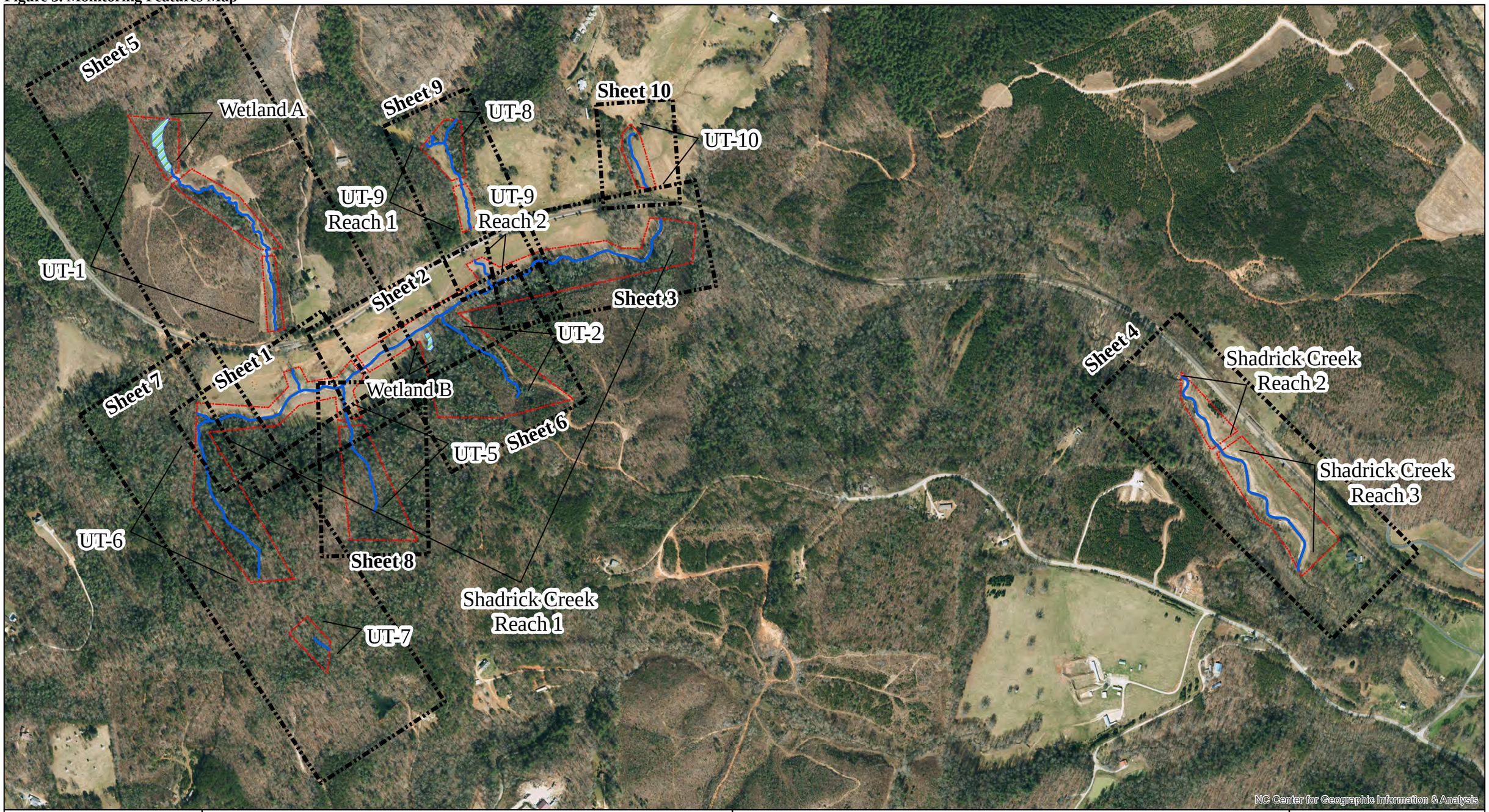
Figure 3. Monitoring Features Map



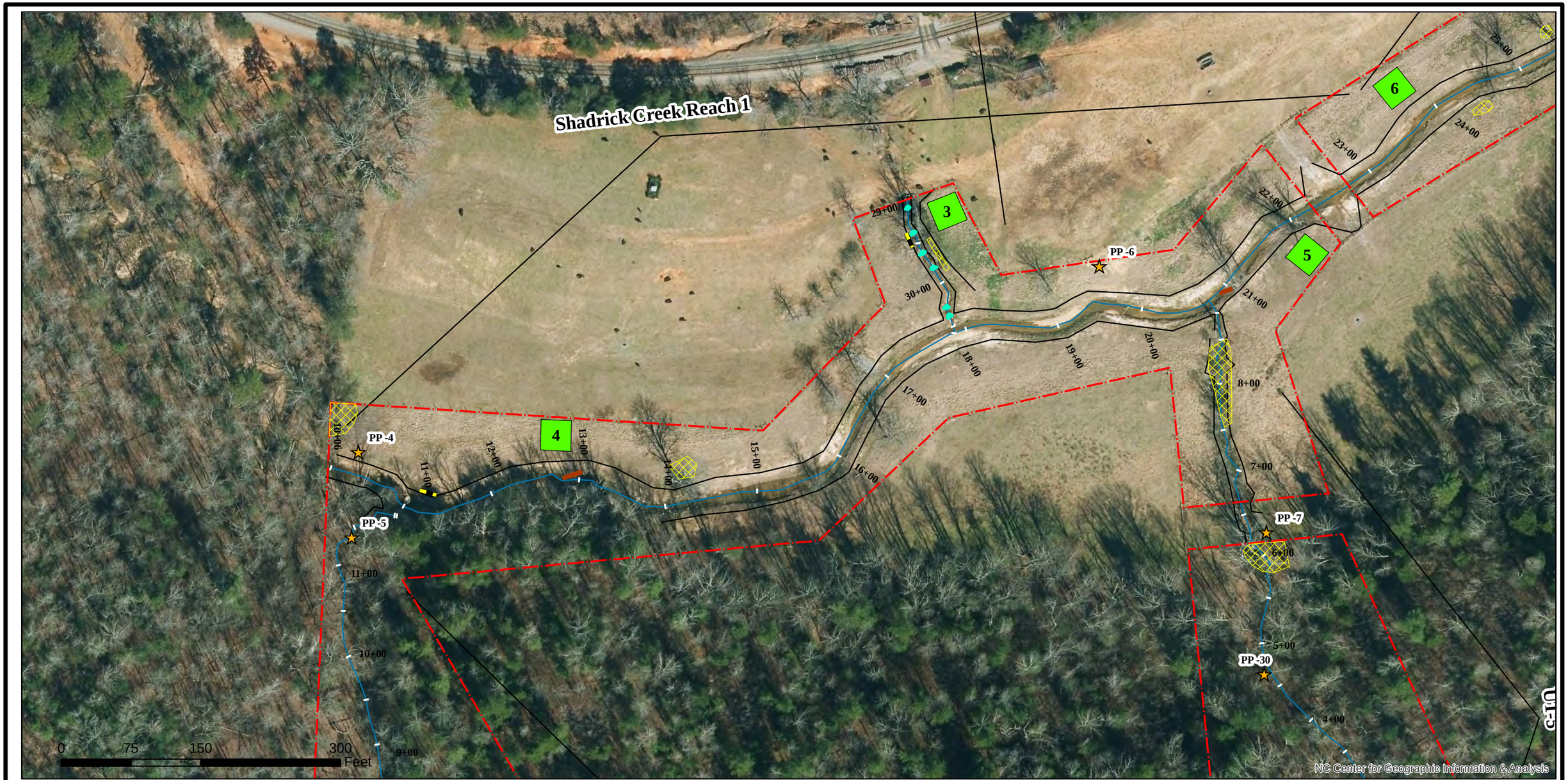
Nothing Compares
NORTH CAROLINA

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
April 2019
Overview Map

Thalweg
Wetland Enhancement
Easement
Sheet

EQUINOX

Figure 3. Monitoring Features Map



Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 1 of 10

- Photo Point
- Log Vane
- Boulder Structure
- Easement
- Top of Bank
- Thalweg

Vegetation Plot
- Success Criteria Met

Stream Problem Areas
- Bank Erosion

Invasive-Exotic Species
- Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 2 of 10

- Photo Point
- BeaverDam
- Log Vane
- Easement
- Top of Bank
- Cross-Section
- Crest Gauge
- Thalweg

Vegetation Plot
- Success Criteria Met
- Wetland Enhancement

Stream Problem Areas
- Bank Erosion

Invasive-Exotic Species
- Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 3 of 10

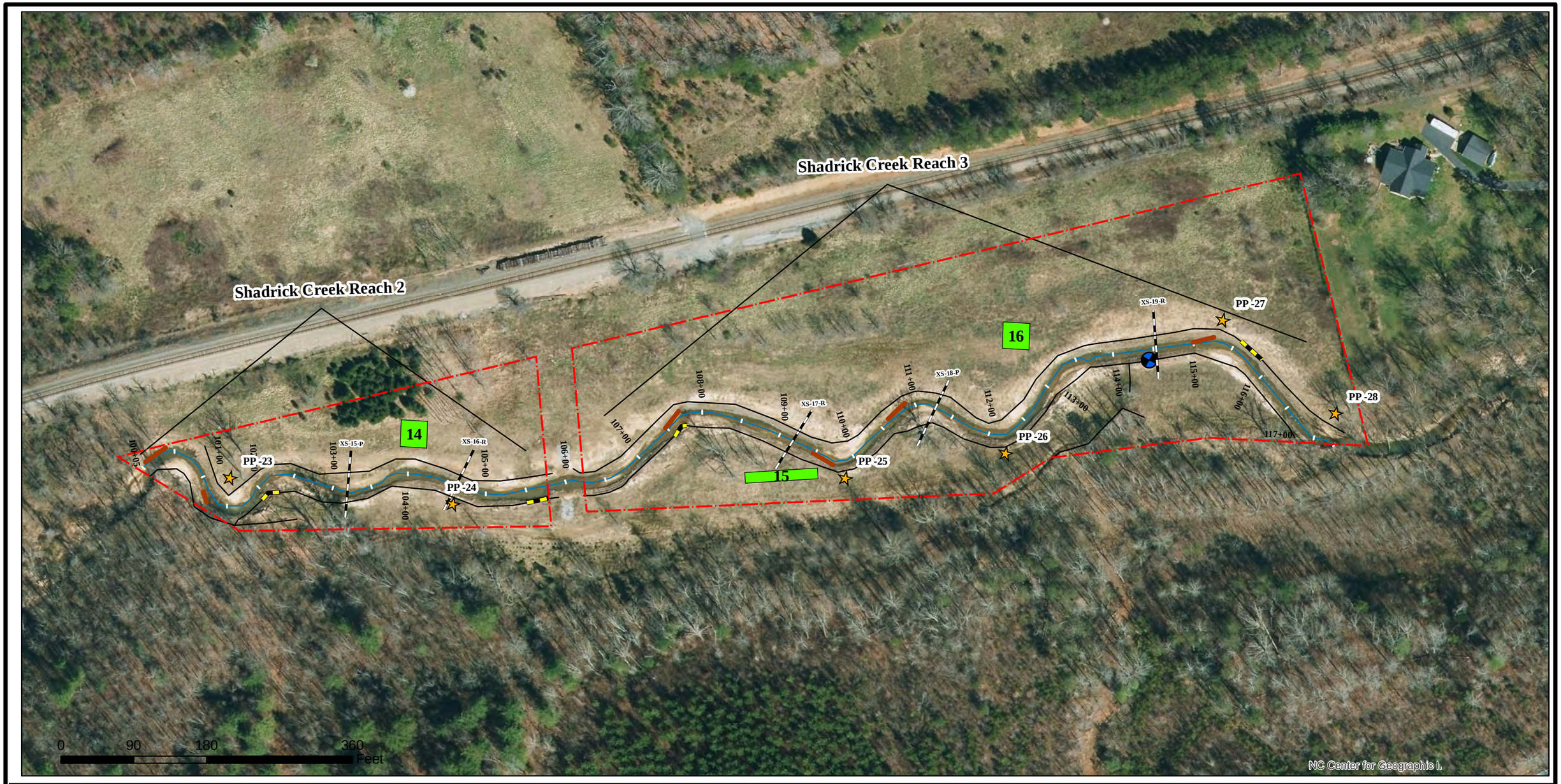
Photo Point
BeaverDam
Log Vane
Easement
Top of Bank
Cross-Section
Thalweg
Vegetation Plot
Success Criteria Met
Stream Problem Areas
Bank Erosion
Invasive-Exotic Species
Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map



Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 4 of 10

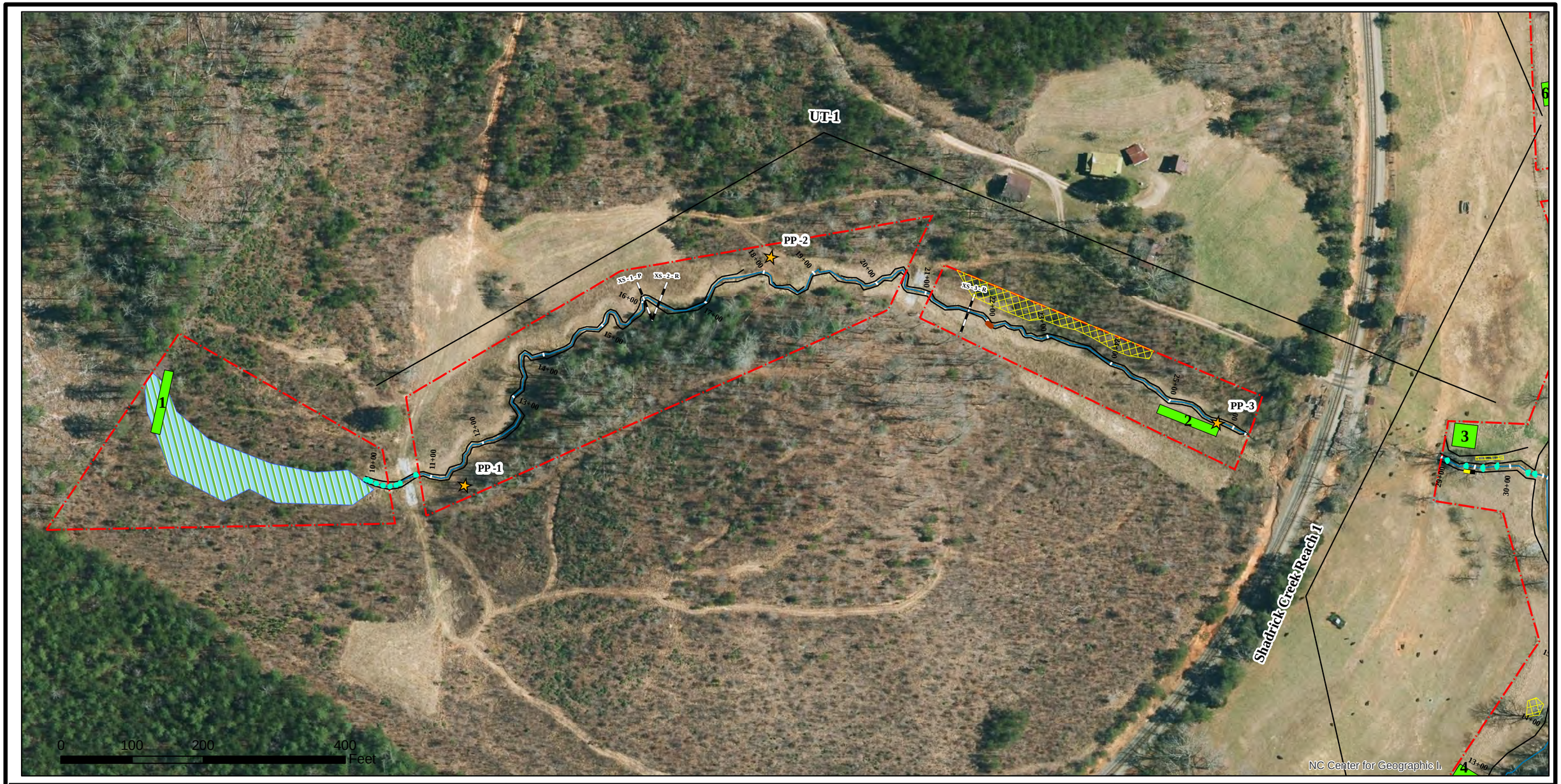
Photo Point
Log Vane
Easement
Top of Bank
Cross-Section
Crest Gauge
Thalweg
Vegetation Plot
Success Criteria Met
Stream Problem Areas
Bank Erosion

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map



Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 5 of 10

- Photo Point
- Log Vane
- Boulder Structure
- Easement
- Top of Bank
- Cross-Section
- Thalweg

Vegetation Plot
- Success Criteria Met
- Wetland Enhancement

Stream Problem Areas
- Bank Erosion

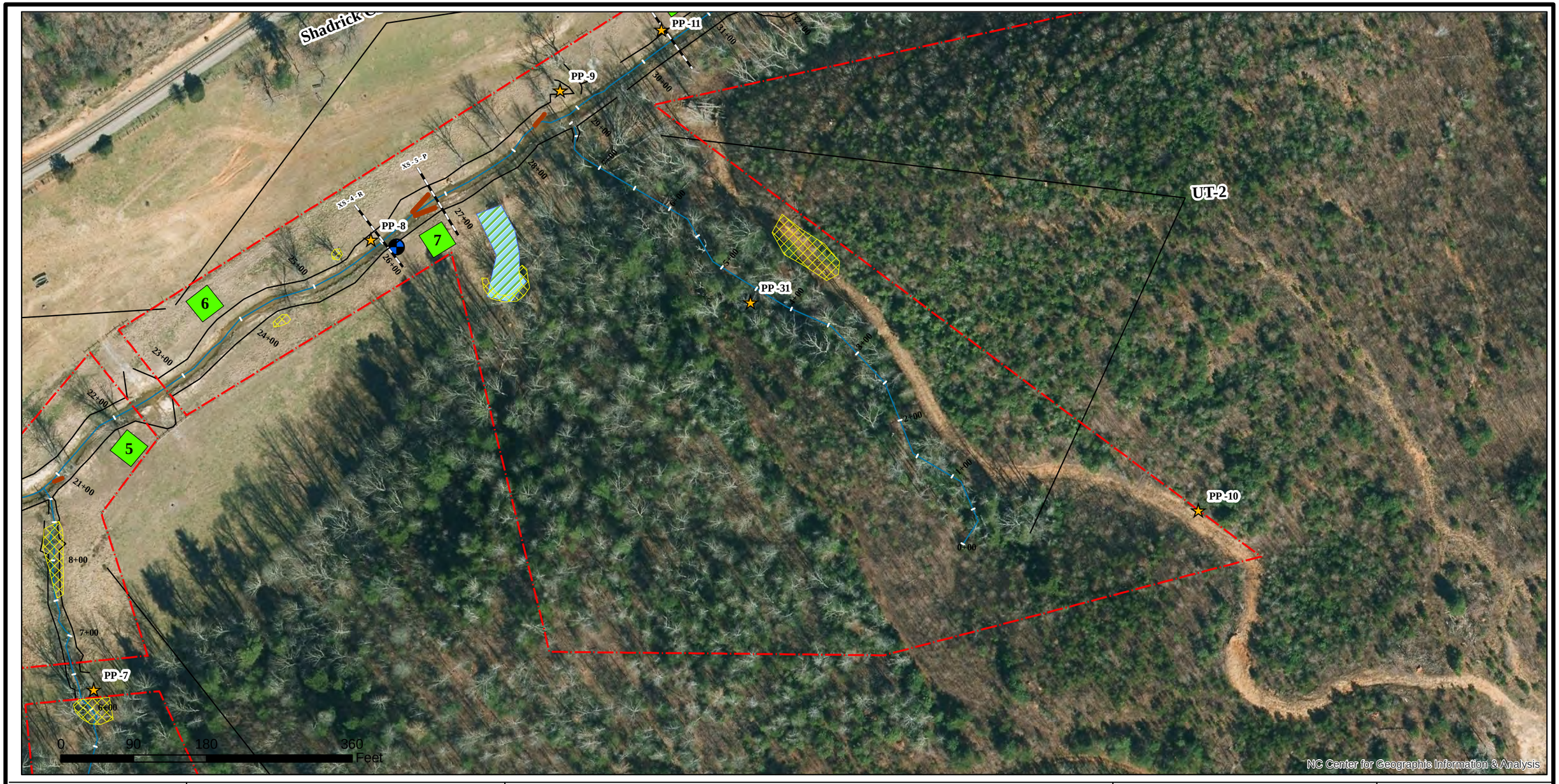
Invasive-Exotic Species
- Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map



Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 6 of 10

Photo Point
Log Vane
Easement
Top of Bank
Cross-Section
Crest Gauge
Thalweg
Vegetation Plot
Success Criteria Met
Wetland Enhancement
Invasive-Exotic Species
Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 7 of 10

- Photo Point
- Log Vane
- Easement
- Top of Bank
- Thalweg
- Vegetation Plot
  - Success Criteria Met
- Stream Problem Areas
  - Bank Erosion
- Invasive-Exotic Species
  - Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 8 of 10

Photo Point
Easement
Top of Bank
Thalweg
Invasive-Exotic Species
Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 9 of 10

Photo Point
BeaverDam
Log Vane
Easement
Top of Bank
Cross-Section
Thalweg
Vegetation Plot
Success Criteria Met
Stream Problem Areas
Bank Erosion
Invasive-Exotic Species
Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

Figure 3. Monitoring Features Map

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

Shadrick Creek Restoration Site
Monitoring Year 2
McDowell County, NC
NCDMS Contract No.: 00006783
NCDMS Project No.: 92916
December 2019
Sheet 10 of 10

Photo Point
Log Vane
Easement
Top of Bank
Cross-Section
Thalweg
Vegetation Plot
Success Criteria Met
Invasive-Exotic Species
Present

Notes:
1) Baseline Data Provided by Patton Land Surveying

Prepared by

EQUINOX

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Table 5. Visual Stream Morphology Stability Assessment Shadrick Creek Restoration Site - Shadrick Creek Reach 1 - Enhancement I Assessed Length 3,631 feet										
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjusted % for Stabilizing Woody Vegetation**
1. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			4	66	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	4	66	99%	N/A	N/A	N/A
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	15	15			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	15			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	15	15			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	15	15			100%			

Table 5 cont'd. Visual Stream Morphology Stability Assessment Shadrick Creek Restoration Site - Shadrick Creek Reach 2 - Enhancement I Assessed Length 573 feet										
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjusted % for Stabilizing Woody Vegetation**
1. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			2	52	95%	0	0	95%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	0	52	95%	N/A	N/A	N/A
2. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5 cont'd. Visual Stream Morphology Stability Assessment
Shadrick Creek Restoration Site - Shadrick Creek Reach 3 - Restoration
Assessed Length 1,104 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			2	41	98%	0	0	98%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	2	41	98%	N/A	N/A	N/A
2. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	3	3			100%			

N/A - Item does not apply.

Table 5 cont'd. Visual Stream Morphology Stability Assessment
Shadrick Creek Restoration Site - UT1 - Enhancement 1
Assessed Length 1,651 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured / Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			1	18	99%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	1	18	99%	N/A	N/A	N/A
2. Engineered 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 : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	14	14			100%			

N/A - Item does not apply.

Table 5 cont'd. Visual Stream Morphology Stability Assessment
Shadrick Creek Restoration Site - UT9 Reach 1 - Enhancement 1
Assessed Length 706 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. 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. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	0	0	100%	N/A	N/A	N/A
2. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	2	2			100%			

N/A - Item does not apply.

Table 5 cont'd. Visual Stream Morphology Stability Assessment
Shadrick Creek Restoration Site - UT9 Reach 2 - Restoration
Assessed Length 238 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. 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. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	0	0	100%	N/A	N/A	N/A
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	1	1			100%			

N/A - Item does not apply.

Table 5 cont'd. Visual Stream Morphology Stability Assessment
Shadrick Creek Restoration Site - UT10 - Enhancement I
Assessed Length 404 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. 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. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	N/A	N/A	N/A
				Totals	0	0	100%	N/A	N/A	N/A
2. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	1	1			100%			

N/A - Item does not apply.

Table 6. Vegetation Condition Assessment Shadrick Creek Restoration Site					
Planted Acreage : 8.68					
Vegetation Category	**Definitions**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of both woody and herbaceous material.	Brown Stipple	0	0.00	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	Red Stipple	0	0.00	0%
		Totals	0	0.00	0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	N/A	0	0.00	0%
		Cumulative Totals	0	0.00	0%
Easement Acreage : 54.59					
Vegetation Category	**Definitions**	**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).	Cross Hatch (Red - Dense/Yellow - Present)	15	0.56	1%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	N/A	0	0.00	0%

N/A - Item does not apply.

Permanent Photo Stations

UT-1 – Permanent Photo Station 1
Looking Upstream

UT-1 – Permanent Photo Station 1
Looking Downstream

UT-1 – Permanent Photo Station 2
Looking Upstream

UT-1 – Permanent Photo Station 2
Looking Downstream

UT-1 – Permanent Photo Station 3
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 4
Looking Downstream

UT-6 – Permanent Photo Station 5
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 6
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 6
Looking Downstream

UT-7 – Permanent Photo Station 7
Looking Upstream from Crossing

UT-7 – Permanent Photo Station 7
Looking Downstream from Crossing

Shadrick Creek Reach 1 – Permanent Photo Station 8
Looking Upstream from Cross-Section 4

Shadrick Creek Reach 1 – Permanent Photo Station 8
Looking Downstream from Cross-Section 4

Shadrick Creek Reach 1 – Permanent Photo Station 9
Looking Upstream at UT-2

UT-2 - Permanent Photo Station 10
Looking Downstream at Easement

Shadrick Creek Reach 1 – Permanent Photo Station 11
Looking Upstream from Cross-Section 6

Shadrick Creek Reach 1 – Permanent Photo Station 11
Looking Downstream from Cross-Section 6

Shadrick Creek Reach 1 – Permanent Photo Station 12
Looking Upstream Shadrick Creek from confluence of UT-9 Reach 2

Shadrick Creek Reach 1 – Permanent Photo Station 12
Looking Downstream Shadrick Creek from confluence of UT-9 Reach 2

Shadrick Creek Reach 1 – Permanent Photo Station 12
Looking Upstream UT-9 Reach 2 from the confluence with Shadrick Creek

Shadrick Creek Reach 1 – Permanent Photo Station 13
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 13
Looking Downstream

Shadrick Creek Reach 1 – Permanent Photo Station 14
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 14
Looking Downstream

Shadrick Creek Reach 1 – Permanent Photo Station 15
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 16
Looking Upstream

Shadrick Creek Reach 1 – Permanent Photo Station 16
Looking Downstream

UT-9 Reach 1 – Permanent Photo Station 17
Looking Upstream

UT-9 Reach 1 – Permanent Photo Station 17
Looking Downstream

UT-8– Permanent Photo Station 17
Looking Upstream

UT-9 Reach 1 – Permanent Photo Station 18
Looking Downstream

UT-9 Reach 1 – Permanent Photo Station 19
Looking Upstream

UT-9 Reach 2 – Permanent Photo Station 20
Looking Downstream

UT-10 – Permanent Photo Station 21
Looking Downstream

UT-10 – Permanent Photo Station 22
Looking Upstream

Shadrick Creek Reach 2 – Permanent Photo Station 23
Looking Upstream

Shadrick Creek Reach 2 – Permanent Photo Station 23
Looking Downstream

Shadrick Creek Reach 2 – Permanent Photo Station 24
Looking Upstream

Shadrick Creek Reach 2 – Permanent Photo Station 24
Looking Downstream

Shadrick Creek Reach 3 – Permanent Photo Station 25
Looking Upstream

Shadrick Creek Reach 3 – Permanent Photo Station 25
Looking Downstream

Shadrick Creek Reach 3 – Permanent Photo Station 26
Looking Upstream

Shadrick Creek Reach 3 – Permanent Photo Station 26
Looking Downstream

Shadrick Creek Reach 3 – Permanent Photo Station 27
Looking Upstream

Shadrick Creek Reach 3 – Permanent Photo Station 28
Looking Upstream

UT-7 – Permanent Photo Station 29
Looking Downstream

UT5 – Permanent Photo Station 30
Looking Upstream

UT-2 – Permanent Photo Station 31
Looking Downstream

Vegetation Plot Photos

Vegetation Monitoring Plot 1

Vegetation Monitoring Plot 2

Vegetation Monitoring Plot 3

Vegetation Monitoring Plot 4

Vegetation Monitoring Plot 5

Vegetation Monitoring Plot 6

Vegetation Monitoring Plot 7

Vegetation Monitoring Plot 8

Vegetation Monitoring Plot 9

Vegetation Monitoring Plot 10

Vegetation Monitoring Plot 11

Vegetation Monitoring Plot 12

Vegetation Monitoring Plot 13

Vegetation Monitoring Plot 14

Vegetation Monitoring Plot 15

Vegetation Monitoring Plot 16

Problem Area Photos

Shadrick Creek Reach 1 – Bank Erosion Station 11+00

Shadrick Creek Reach 1 – Bank Erosion Station 33+75

Shadrick Creek Reach 1 – Bank Erosion Station 37+50

Shadrick Creek Reach 1 – Bank Erosion Station 39+00

Shadrick Creek Reach 2 – Bank Erosion Station 101+25

Shadrick Creek Reach 2 – Bank Erosion Station 105+50

Shadrick Creek Reach 3 – Bank Erosion Station 107+50

UT1– Bank Erosion Station 29+50

.

UT 9 – Evidence of cattle bypass

UT 10 – Headcut

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Appendix C
Vegetation Plot Data

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Table 7. Current Plot Data (MY2) 2019
Shadrick Creek Restoration Project

			Current Plot Data (MY2 2019)																														
			Plot 1			Plot 2			Plot 3			Plot 4			Plot 5			Plot 6			Plot 7			Plot 8			Plot 9			Plot 10		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum		Tree	2	2	11	3	3	3	1	1	1	2	2	2				4	4	5	1	1	1				1	1	1			
Alnus serrulata	Tag Alder, Smooth Al	Shrub Tree						9									4						10									
Betula nigra	River Birch, Red Birch	Tree							1	1	1			3			52	3	3	3	2	2	6	2	2	17				7	7	7
Cercis canadensis		Shrub Tree							1	1	1							1	1	1				4	4	4	3	3	3			
Cornus amomum	Silky Dogwood	Shrub Tree												1																		
Corylus cornuta		Shrub Tree																														
Diospyros virginiana	American Persimmon	Tree												2									1						3			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	12	12	12	5	5	5	7	7	7	1	1	1	3	3	3	3	3	3	4	4	4	7	7	7	4	4	4			
Hamamelis virginiana		Shrub Tree																														
Ilex opaca	American Holly, Chris	Shrub Tree			1																											
Juglans nigra	Black Walnut	Tree									1									3												
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree			8																		1									
Liriodendron tulipifera		Tree			7																								2			
Nyssa sylvatica	Sour Gum, Black Gum	Tree			1																											
Platanus occidentalis	Sycamore, Plane-tree	Tree			1	3	3	3				5	5	6	1	1	1	2	2	2	3	3	10				9	9	18			
Populus deltoides		Tree				2	2	2				4	4	4	5	5	5	2	2	2										1	1	1
Quercus alba	White Oak	Tree			4																											
Quercus nigra	Water Oak, Paddle O	Tree																		1												
Quercus velutina	Black Oak	Tree			1																											
Rhus copallinum		Shrub Tree																														
Salix nigra	Black Willow	Tree																														1
		Stem count	14	14	46	13	13	22	10	10	11	12	12	19	9	9	65	15	15	20	10	10	33	13	13	28	17	17	31	8	8	9
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	2	2	9	4	4	5	4	4	5	4	4	7	3	3	5	6	6	8	4	4	7	3	3	3	4	4	6	2	2	3
		Stems per ACRE	567	567	1862	526	526	890	405	405	445	486	486	769	364	364	2630	607	607	809	405	405	1335	526	526	1133	688	688	1255	324	324	364

Table 7. Current Plot Data (MY2) 2019
Shadrick Creek Restoration Project

			Current Plot Data (MY2 2019)																		Annual Means								
			Plot 11			Plot 12			Plot 13			Plot 14			Plot 15			Plot 16			MY2 (2019)			MY1 (2018)			MY0 (2017)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum		Tree	2	2	2	2	2	2	3	3	9	1	1	1				2	2	2	24	24	40	24	24	26	25	25	25
Alnus serrulata	Tag Alder, Smooth Al	Shrub Tree															1						24			28			
Betula nigra	River Birch, Red Birch	Tree	1	1	1							2	2	2	1	1	4	3	3	3	20	20	97	21	21	30	24	24	24
Cercis canadensis		Shrub Tree	1	1	1	1	1	1													11	11	11	10	10	10	10	10	10
Cornus amomum	Silky Dogwood	Shrub Tree															3						4						
Corylus cornuta		Shrub Tree									1												1						
Diospyros virginiana	American Persimmon	Tree															2						8			3			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2	2	2	7	7	7	3	3	3	3	3	4	4	4	7	2	2	2	67	67	71	66	66	66	67	67	67
Hamamelis virginiana		Shrub Tree							1	1	1				2	2	2	1	1	1	4	4	4	6	6	6	8	8	8
Ilex opaca	American Holly, Chris	Shrub Tree																					1						
Juglans nigra	Black Walnut	Tree															2						6						
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree																					9						
Liriodendron tulipifera		Tree												2									11			8			
Nyssa sylvatica	Sour Gum, Black Gum	Tree																					1						
Platanus occidentalis	Sycamore, Plane-tree	Tree				2	2	2	3	3	3	4	4	8	1	1	5	2	2	2	35	35	61	33	33	46	36	36	36
Populus deltoides		Tree	4	4	4				1	1	1	3	3	3	3	3	3	2	2	2	27	27	27	27	27	27	28	28	28
Quercus alba	White Oak	Tree																					4						
Quercus nigra	Water Oak, Paddle O	Tree																					1						
Quercus velutina	Black Oak	Tree																					1						
Rhus copallinum		Shrub Tree																								4			
Salix nigra	Black Willow	Tree																					1			2			
	Stem count		10	10	10	12	12	12	11	11	18	13	13	20	11	11	29	12	12	12	188	188	383	187	187	256	198	198	198
	size (ares)		1			1			1						1			1			16			16			16		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.32			0.32			0.32		
	Species count		5	5	5	4	4	4	5	5	6	5	5	6	5	5	9	6	6	6	7	7	20	7	7	12	7	7	7
	Stems per ACRE		405	405	405	486	486	486	445	445	728	526	526	809	445	445	1174	486	486	486	588	588	1197	584	584	800	619	619	619

P-Planted, T Planted and Volunteer

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

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Table 8. Vegetation Plot Criteria Attainment Shadrick Creek Restoration Project		
Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	
14	Yes	
15	Yes	
16	Yes	

Table 9. CVS Vegetation Plot Metadata Shadrick Creek Restoration Site	
Report Prepared By	Drew Alderman
Date Prepared	2/28/2020 16:52
database name	DMS_ShadrickCreek_92916_MY2.mdb
database location	Z:\ES\NRI&M\EEP Monitoring\Shadrick Creek\MY2 - 2019\Data\Veg
computer name	FIELD-PC
file size	73588736
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	92916
project Name	Shadrick Creek
Description	Stream Restoration Project
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	16

Appendix D
Stream Measurement and Geomorphology Data

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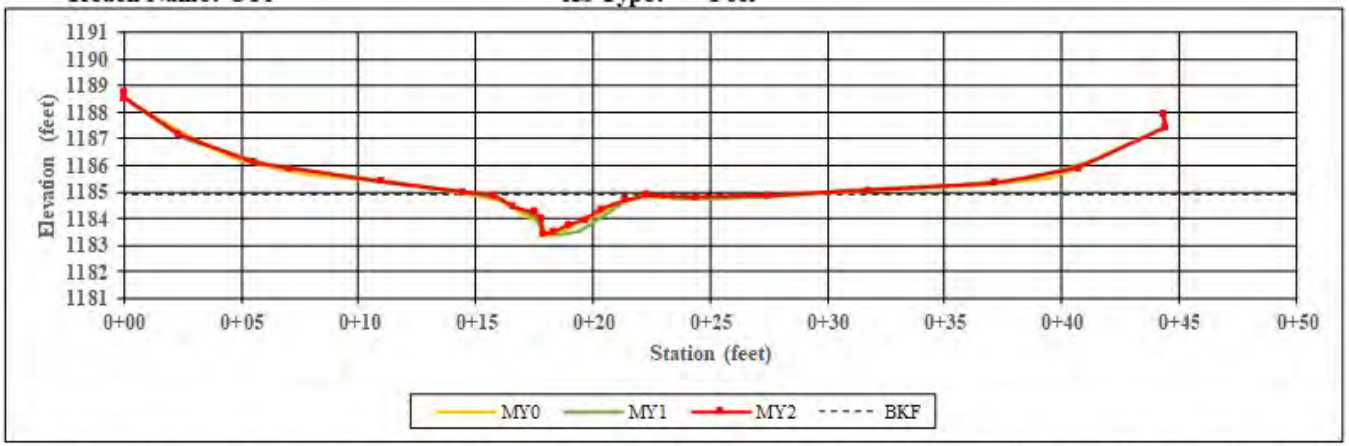
Project Name: Shadrick Creek **XS Number:** 1 **Station:** 16+05

Reach Name: UT1 **XS Type:** Pool



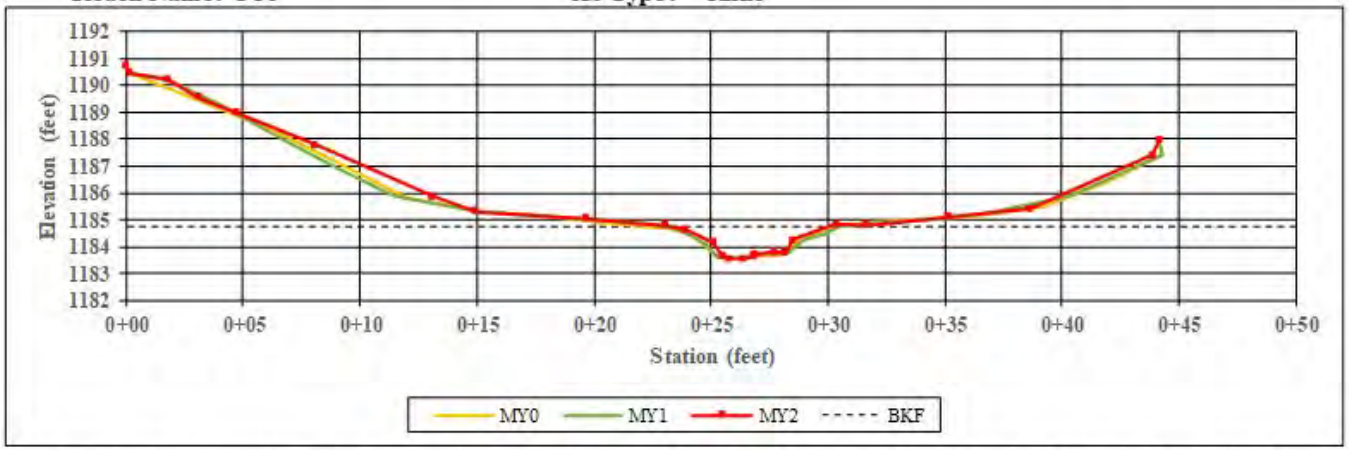
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	7.1	6.1	7.4	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.6	0.7	0.6	-	-	-	-	-
Bankfull Max Depth (ft)	1.5	1.4	1.5	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	4.5	4.5	4.5	-	-	-	-	-
Width/Depth Ratio	11.1	8.3	12.2	-	-	-	-	-
Entrenchment Ratio	3.4	3.9	3.3	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.4	1.5					

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 2 **Station:** 16+29

Reach Name: UT1 **XS Type:** Riffle



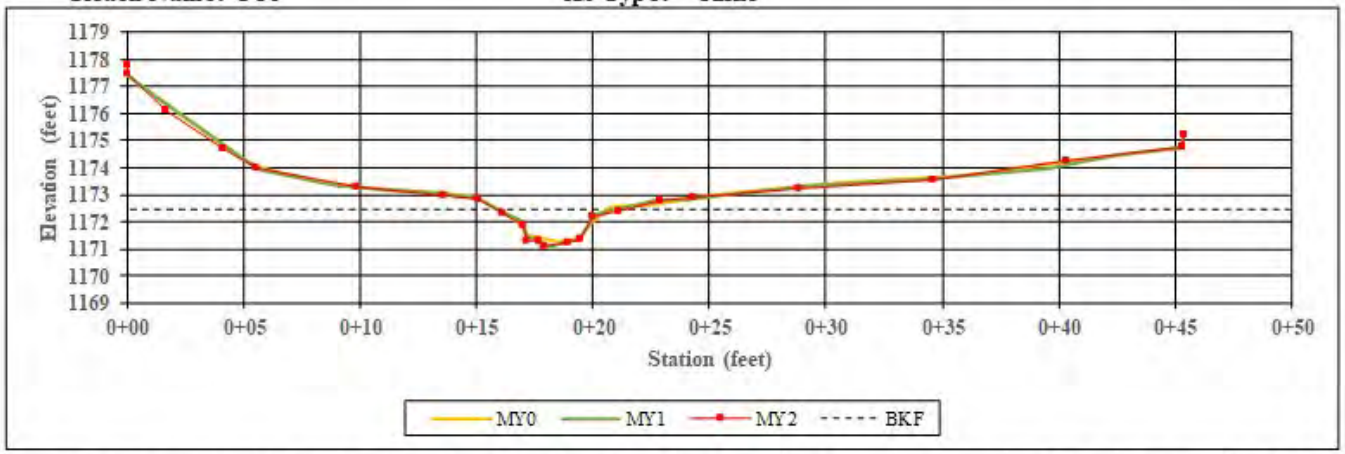
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.3	6.7	6.3	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.7	0.6	0.7	-	-	-	-	-
Bankfull Max Depth (ft)	1.1	1.1	1.2	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	4.3	4.3	4.3	-	-	-	-	-
Width/Depth Ratio	9.4	10.4	9.1	-	-	-	-	-
Entrenchment Ratio	3.8	3.6	3.8	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.1	1.1	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 3 **Station:** 21+68

Reach Name: UT1 **XS Type:** Riffle



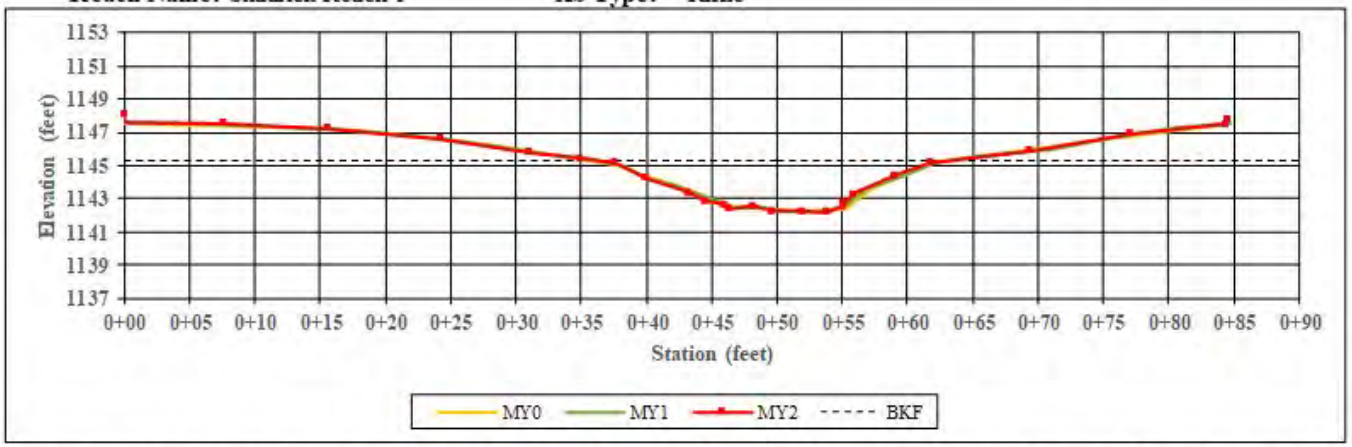
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	5.0	5.5	5.5	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.8	0.7	0.7	-	-	-	-	-
Bankfull Max Depth (ft)	1.3	1.4	1.3	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	3.9	3.9	3.9	-	-	-	-	-
Width/Depth Ratio	6.5	7.8	7.9	-	-	-	-	-
Entrenchment Ratio	4.8	4.4	4.3	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.4	1.3	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 4 **Station:** 26+02

Reach Name: Shadrick Reach 1 **XS Type:** Riffle



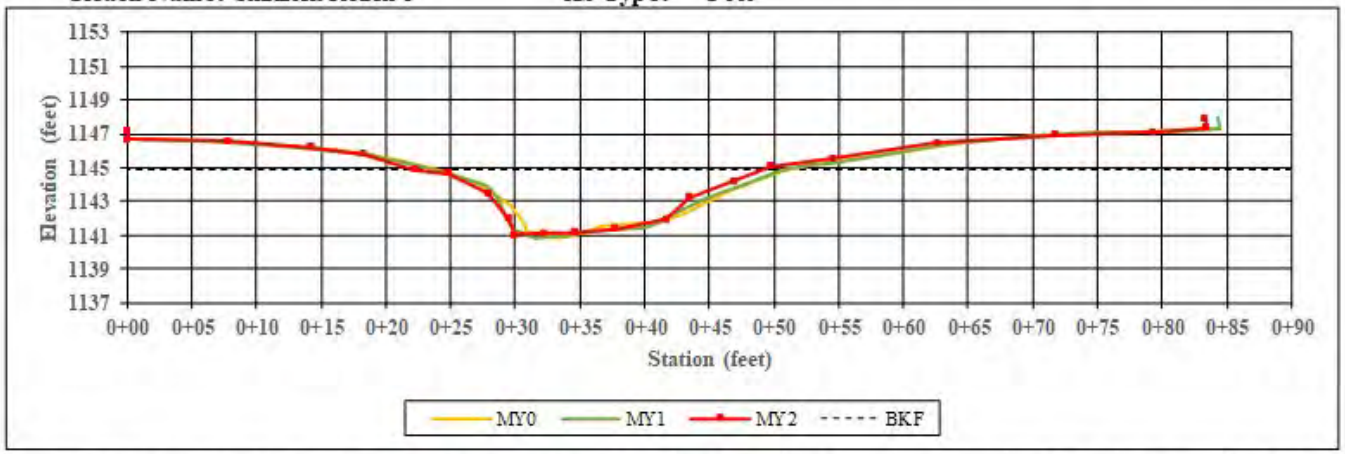
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	26.6	25.9	24.1	-	-	-	-	-
Floodprone Width (ft)	100.0	100.0	100.0	-	-	-	-	-
Bankfull Mean Depth (ft)	1.8	1.8	1.9	-	-	-	-	-
Bankfull Max Depth (ft)	3.0	3.1	3.1	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	47.0	47.0	47.0	-	-	-	-	-
Width/Depth Ratio	15.0	14.2	12.4	-	-	-	-	-
Entrenchment Ratio	3.8	3.9	4.1	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	3.0	2.9	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 5 **Station:** 26+87

Reach Name: Shadrick Reach 1 **XS Type:** Pool



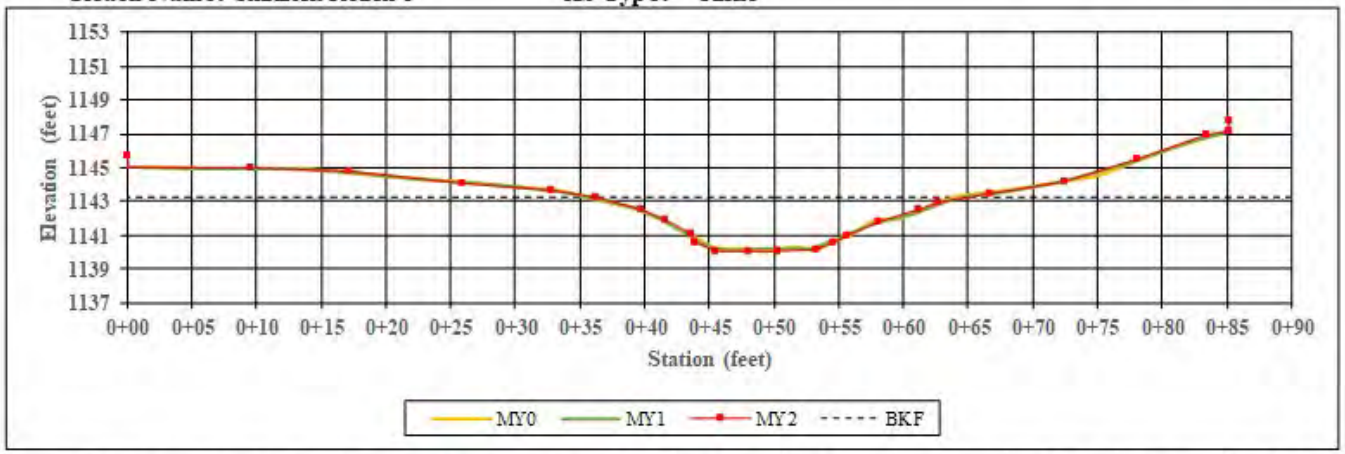
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	26.9	26.4	27.3	-	-	-	-	-
Floodprone Width (ft)	100.0	100.0	100.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.2	2.3	2.2	-	-	-	-	-
Bankfull Max Depth (ft)	4.0	4.0	3.9	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	59.5	59.5	59.5	-	-	-	-	-
Width/Depth Ratio	12.1	11.7	12.6	-	-	-	-	-
Entrenchment Ratio	3.7	3.8	3.7	-	-	-	-	-
Bank Height Ratio	1.0	1.1	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	4.3	4.1	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 6 **Station:** 30+44

Reach Name: Shadrick Reach 1 **XS Type:** Riffle



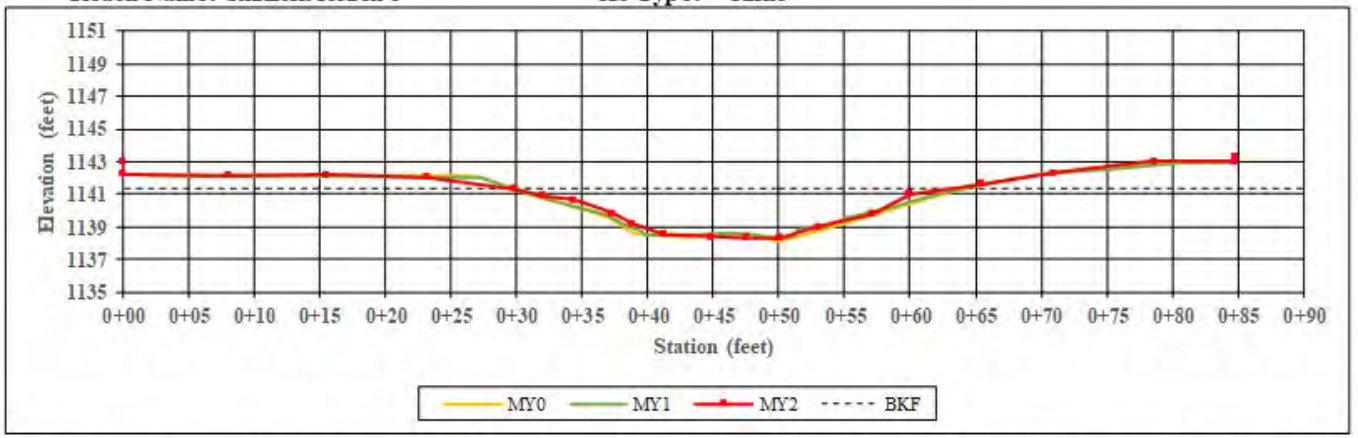
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	28.7	29.1	28.8	-	-	-	-	-
Floodprone Width (ft)	100.0	100.0	100.0	-	-	-	-	-
Bankfull Mean Depth (ft)	1.8	1.8	1.8	-	-	-	-	-
Bankfull Max Depth (ft)	3.2	3.1	3.2	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	52.0	52.0	52.0	-	-	-	-	-
Width/Depth Ratio	15.8	16.3	15.9	-	-	-	-	-
Entrenchment Ratio	3.5	3.4	3.5	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	3.1	3.2	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 7 **Station:** 34+64

Reach Name: Shadrick Reach 1 **XS Type:** Riffle



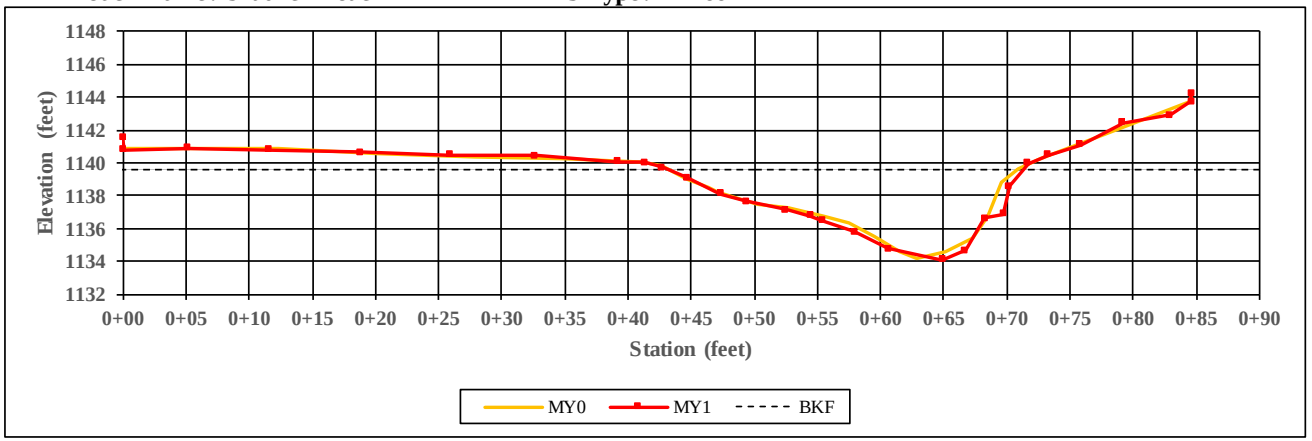
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	32.7	33.6	33.5	-	-	-	-	-
Floodprone Width (ft)	100.0	100.0	100.0	-	-	-	-	-
Bankfull Mean Depth (ft)	1.8	1.8	1.8	-	-	-	-	-
Bankfull Max Depth (ft)	3.0	3.0	3.0	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	59.3	59.3	59.3	-	-	-	-	-
Width/Depth Ratio	18.0	19.0	18.9	-	-	-	-	-
Entrenchment Ratio	3.1	3.0	3.0	-	-	-	-	-
Bank Height Ratio	1.0	0.8	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	2.4	2.7	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 8 **Station:** 37+68

Reach Name: Shadrick Reach 1 **XS Type:** Pool



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	*MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	28.8	28.2	-	-	-	-	-	-
Floodprone Width (ft)	100.0	100.0	-	-	-	-	-	-
Bankfull Mean Depth (ft)	2.9	3.0	-	-	-	-	-	-
Bankfull Max Depth (ft)	5.6	5.5	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	84.3	84.3	-	-	-	-	-	-
Width/Depth Ratio	9.8	9.4	-	-	-	-	-	-
Entrenchment Ratio	3.5	3.5	-	-	-	-	-	-
Bank Height Ratio	1.0	1.1	-	-	-	-	-	-
Low Top of Bank Depth (ft)	-	5.9	-	-	-	-	-	-

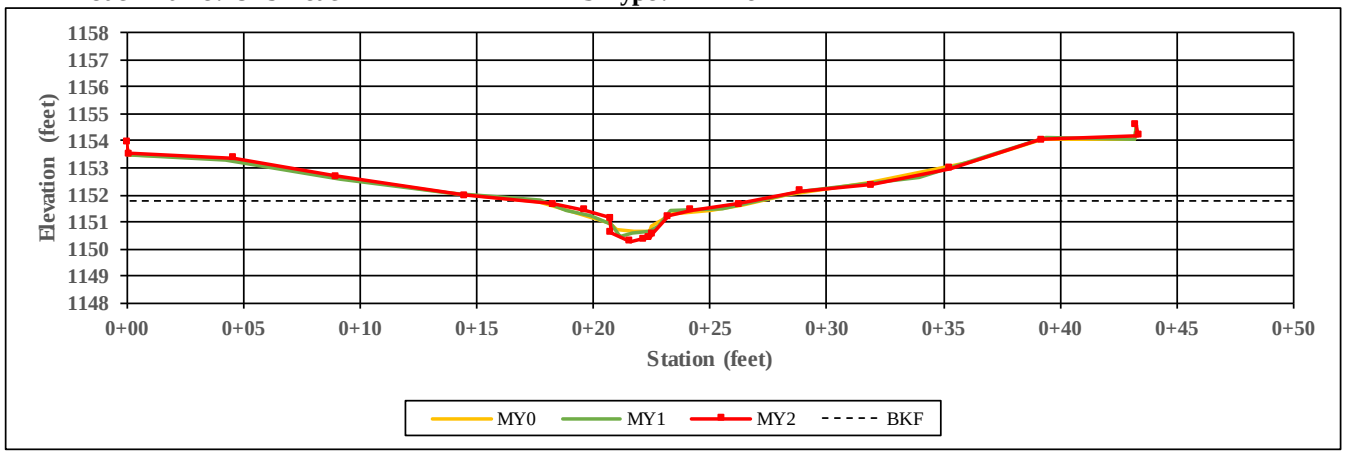
Left Descending Bank

Right Descending Bank

*** Cross section not surveyed due to beaver impoundment**

Project Name: Shadrick Creek **XS Number:** 9 **Station:** 16+53

Reach Name: UT9 Reach 1 **XS Type:** Riffle



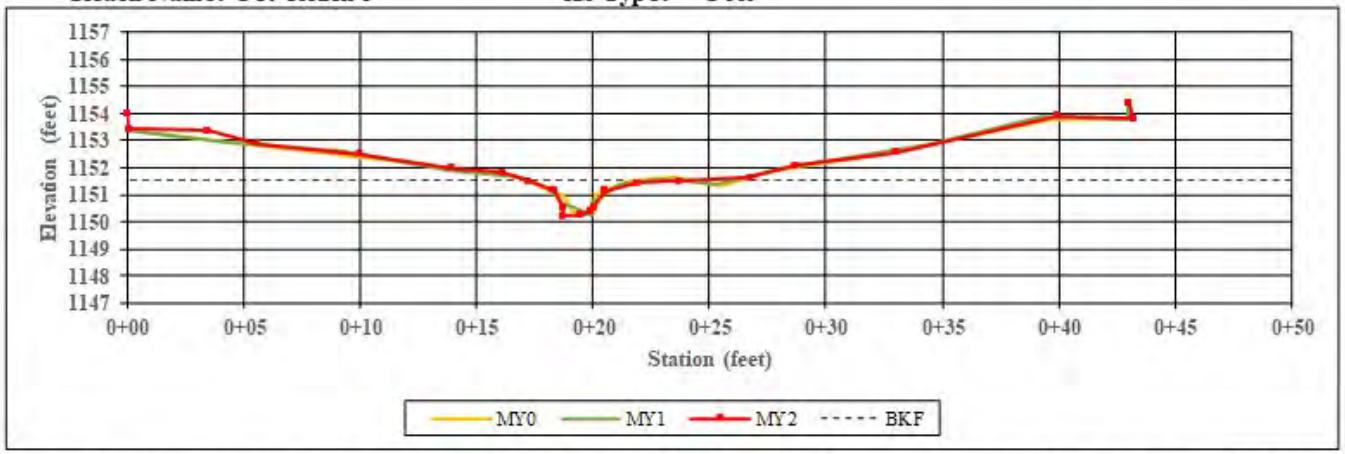
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	9.5	9.2	9.7	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.5	0.5	0.5	-	-	-	-	-
Bankfull Max Depth (ft)	1.1	1.3	1.5	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	4.8	4.8	4.8	-	-	-	-	-
Width/Depth Ratio	18.7	17.6	19.5	-	-	-	-	-
Entrenchment Ratio	2.5	2.6	2.5	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.3	1.5	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 10 **Station:** 16+68

Reach Name: UT9 Reach 1 **XS Type:** Pool



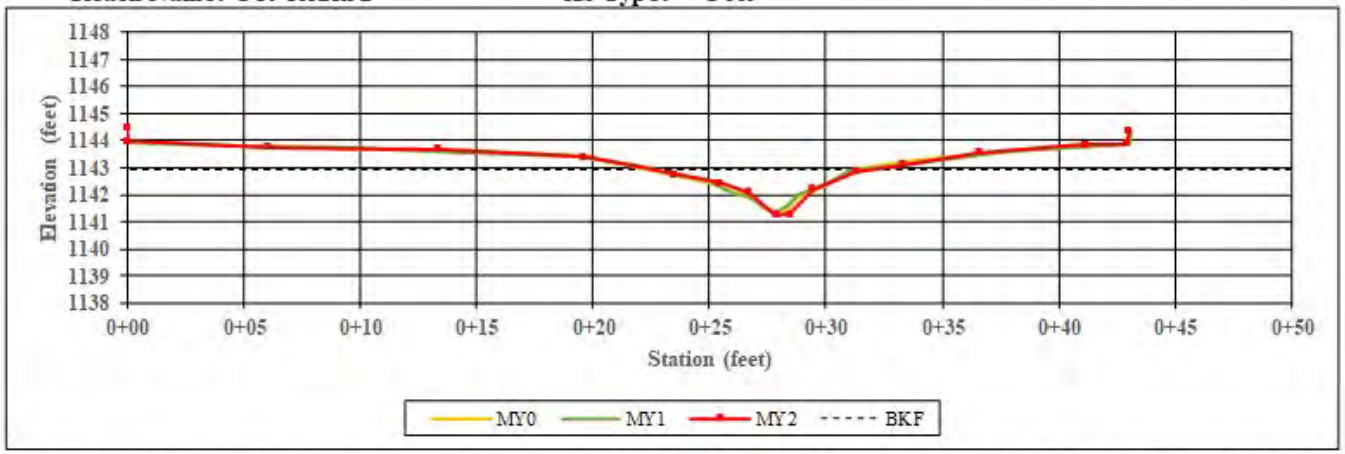
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.5	6.0	5.0	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.5	0.5	0.6	-	-	-	-	-
Bankfull Max Depth (ft)	1.3	1.4	1.3	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	3.0	3.0	3.0	-	-	-	-	-
Width/Depth Ratio	14.3	12.2	8.2	-	-	-	-	-
Entrenchment Ratio	3.7	4.0	4.8	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.3	1.2	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 11 **Station:** 21+34

Reach Name: UT9 Reach 2 **XS Type:** Pool



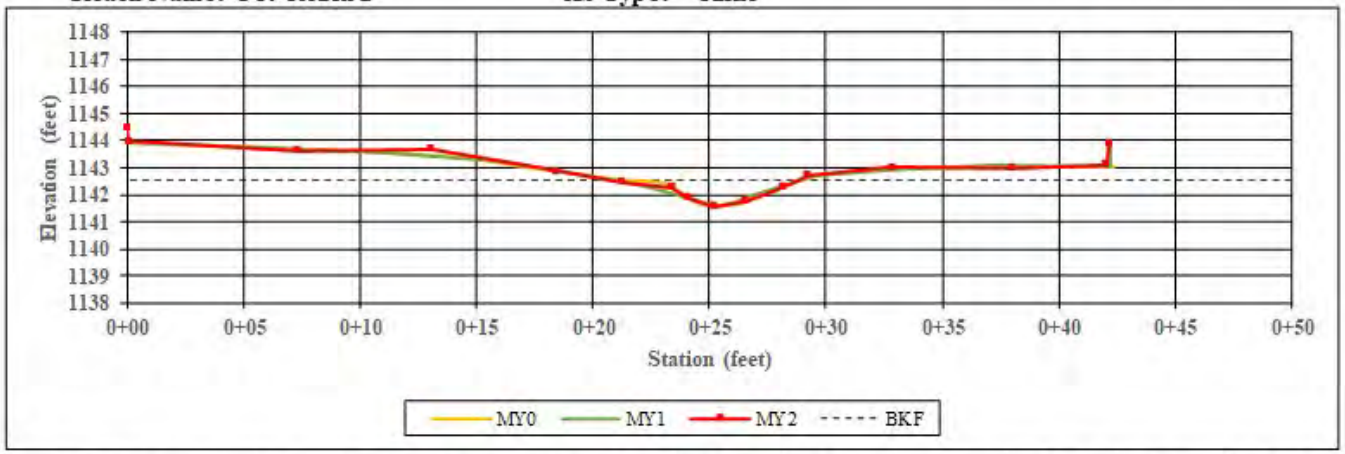
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	8.8	8.6	9.1	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.7	0.7	0.6	-	-	-	-	-
Bankfull Max Depth (ft)	1.6	1.6	1.7	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	5.8	5.8	5.8	-	-	-	-	-
Width/Depth Ratio	13.2	12.8	14.4	-	-	-	-	-
Entrenchment Ratio	2.7	2.8	2.6	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.6	1.5	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 12 **Station:** 21+49

Reach Name: UT9 Reach 2 **XS Type:** Riffle



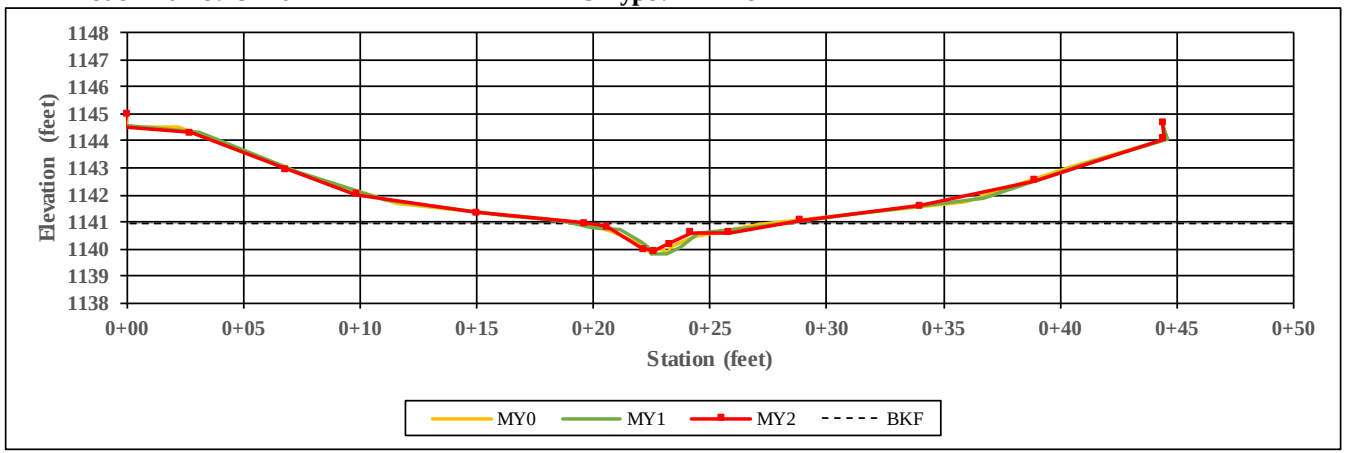
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	8.3	7.7	8.0	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.4	0.5	0.5	-	-	-	-	-
Bankfull Max Depth (ft)	1.0	1.0	1.0	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	3.6	3.6	3.6	-	-	-	-	-
Width/Depth Ratio	19.0	16.2	17.6	-	-	-	-	-
Entrenchment Ratio	2.9	3.1	3.0	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.0	0.9	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 13 **Station:** 13+00

Reach Name: UT10 **XS Type:** Riffle



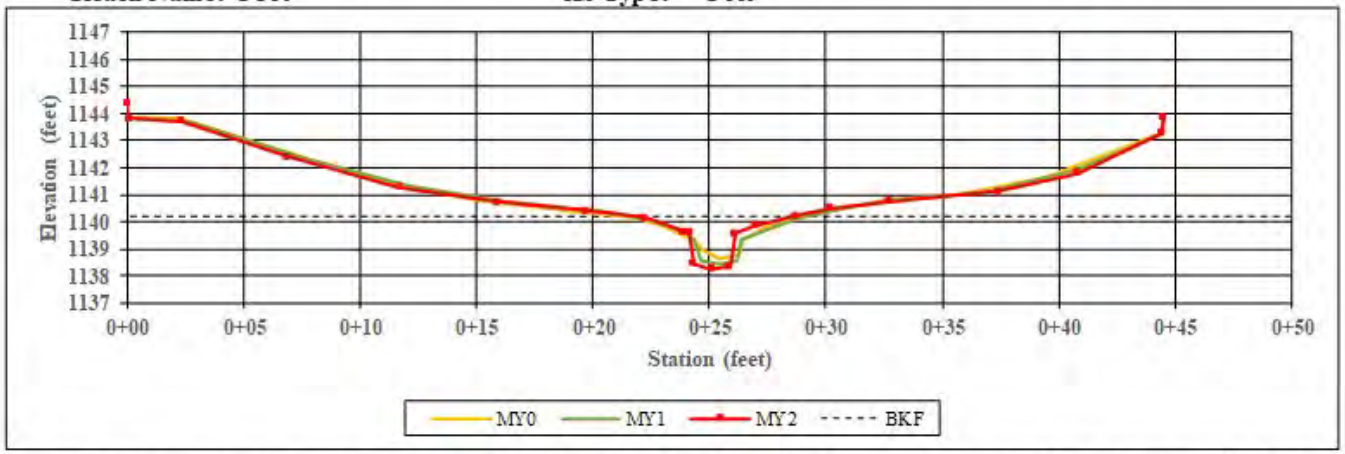
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	7.3	8.7	8.4	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.5	0.4	0.4	-	-	-	-	-
Bankfull Max Depth (ft)	1.1	1.1	1.0	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	3.4	3.4	3.4	-	-	-	-	-
Width/Depth Ratio	15.6	22.3	20.8	-	-	-	-	-
Entrenchment Ratio	3.3	2.8	2.9	-	-	-	-	-
Bank Height Ratio	1.0	0.9	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.0	1.0	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 14 **Station:** 13+13

Reach Name: UT10 **XS Type:** Pool



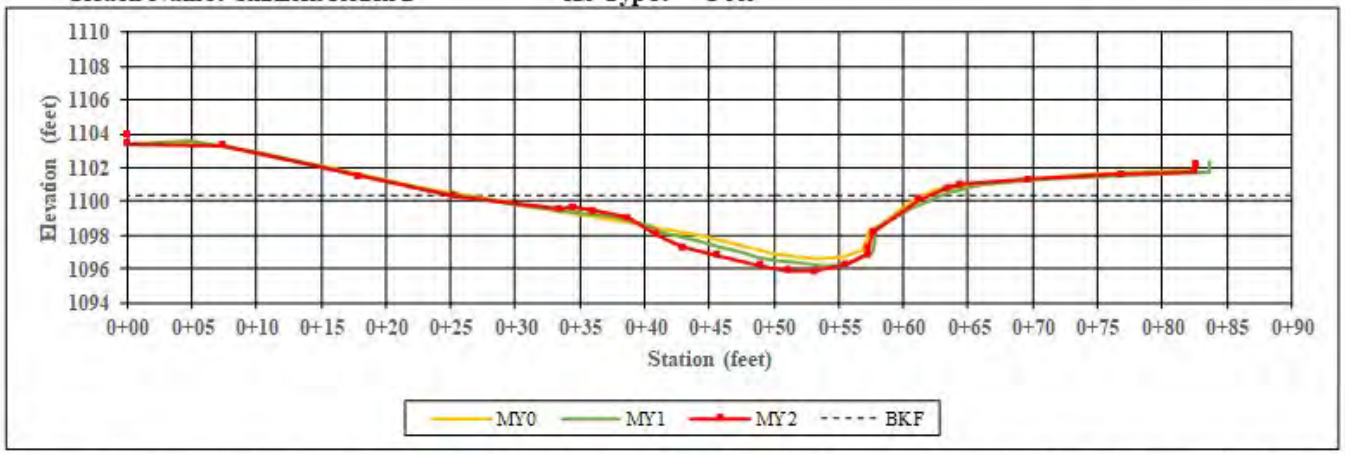
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	7.5	6.9	7.1	-	-	-	-	-
Floodprone Width (ft)	24.0	24.0	24.0	-	-	-	-	-
Bankfull Mean Depth (ft)	0.6	0.7	0.7	-	-	-	-	-
Bankfull Max Depth (ft)	1.6	1.7	1.9	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	4.8	4.8	4.8	-	-	-	-	-
Width/Depth Ratio	11.6	9.9	10.5	-	-	-	-	-
Entrenchment Ratio	3.2	3.5	3.4	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	1.6	1.9	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 15 **Station:** 103+19

Reach Name: Shadrick Reach 2 **XS Type:** Pool



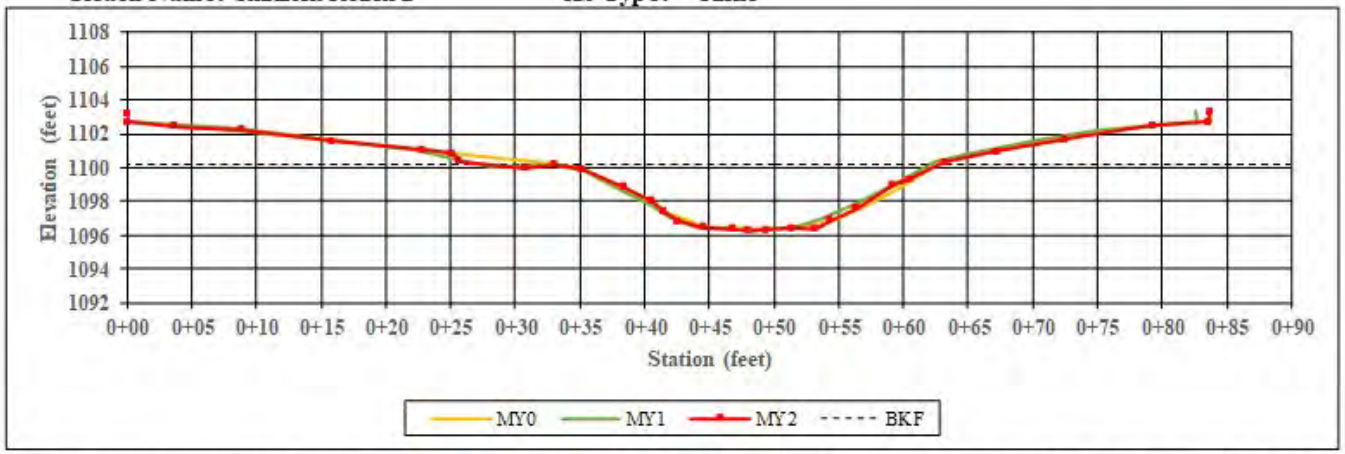
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	38.9	38.8	36.9	-	-	-	-	-
Floodprone Width (ft)	116.0	116.0	116.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.1	2.1	2.2	-	-	-	-	-
Bankfull Max Depth (ft)	4.1	4.3	4.5	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	80.4	80.4	80.4	-	-	-	-	-
Width/Depth Ratio	18.9	18.7	16.9	-	-	-	-	-
Entrenchment Ratio	3.0	3.0	3.1	-	-	-	-	-
Bank Height Ratio	1.0	1.0	0.8	-	-	-	-	-
Low Top of Bank Depth (ft)	-	4.4	3.8	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 16 **Station:** 104+67

Reach Name: Shadrick Reach 2 **XS Type:** Riffle



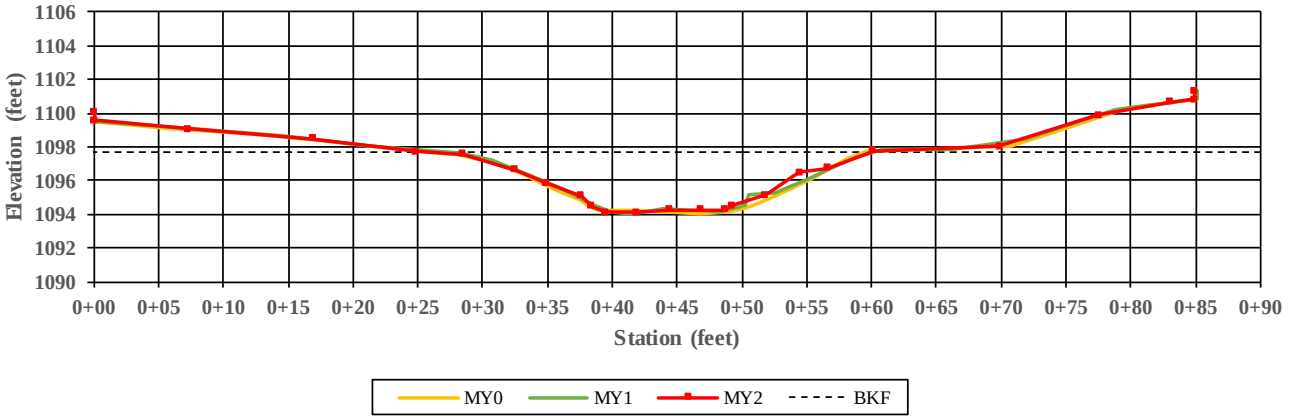
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	29.9	27.1	33.3	-	-	-	-	-
Floodprone Width (ft)	116.0	116.0	116.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.4	2.6	2.2	-	-	-	-	-
Bankfull Max Depth (ft)	3.9	4.0	4.0	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	71.7	71.7	71.7	-	-	-	-	-
Width/Depth Ratio	12.5	10.2	15.5	-	-	-	-	-
Entrenchment Ratio	3.9	4.3	3.5	-	-	-	-	-
Bank Height Ratio	1.0	0.9	0.8	-	-	-	-	-
Low Top of Bank Depth (ft)	-	3.8	3.0	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 17 **Station:** 109+18

Reach Name: Shadrick Reach 3 **XS Type:** Riffle



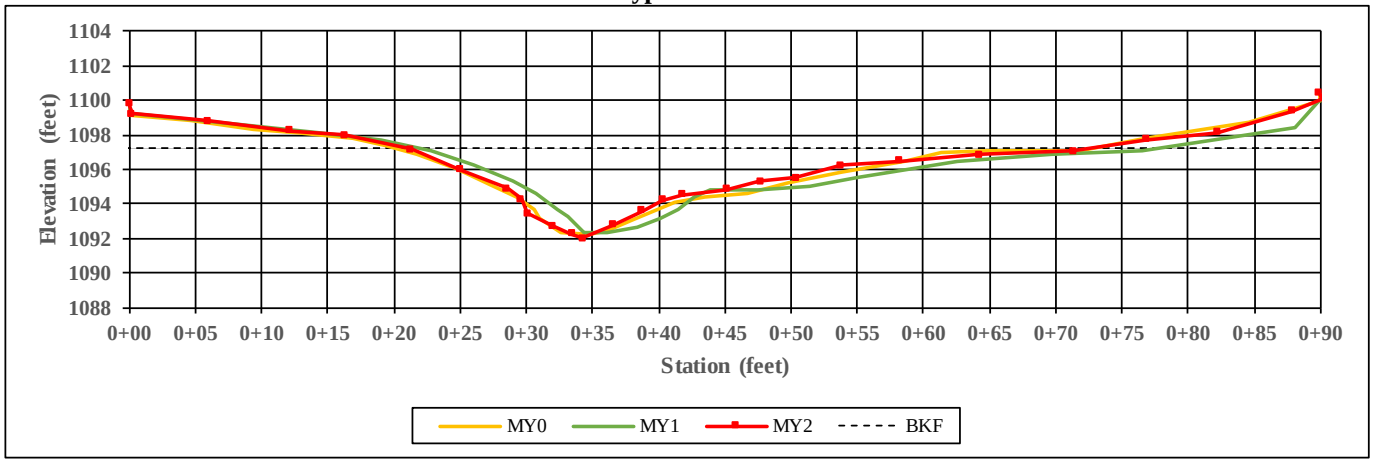
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	31.1	32.7	34.4	-	-	-	-	-
Floodprone Width (ft)	116.0	116.0	116.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.2	2.1	2.0	-	-	-	-	-
Bankfull Max Depth (ft)	3.5	3.6	3.6	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	68.6	68.6	68.6	-	-	-	-	-
Width/Depth Ratio	14.1	15.6	17.2	-	-	-	-	-
Entrenchment Ratio	3.7	3.5	3.4	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	3.5	3.6	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 18 **Station:** 111+27

Reach Name: Shadrick Reach 3 **XS Type:** Pool



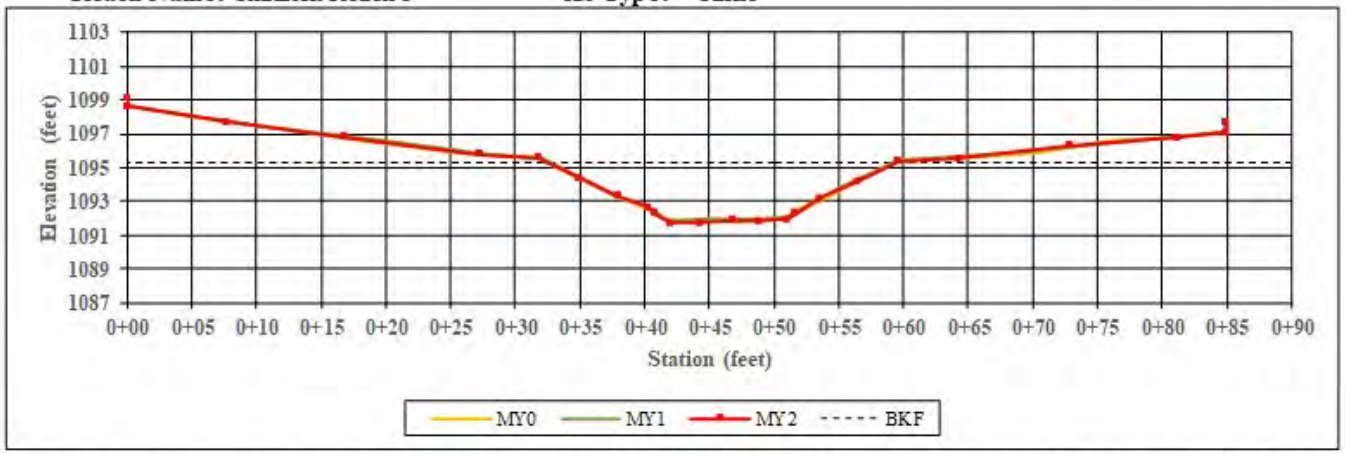
CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	40.0	43.7	36.9	-	-	-	-	-
Floodprone Width (ft)	116.0	116.0	116.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.2	2.0	2.4	-	-	-	-	-
Bankfull Max Depth (ft)	4.7	4.7	5.2	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	88.1	89.5	88.1	-	-	-	-	-
Width/Depth Ratio	18.2	21.3	15.5	-	-	-	-	-
Entrenchment Ratio	2.9	2.7	3.1	-	-	-	-	-
Bank Height Ratio	1.0	0.9	0.9	-	-	-	-	-
Low Top of Bank Depth (ft)	-	4.2	4.8	-	-	-	-	-

Left Descending Bank

Right Descending Bank

Project Name: Shadrick Creek **XS Number:** 19 **Station:** 114+53

Reach Name: Shadrick Reach 3 **XS Type:** Riffle



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	26.9	26.9	26.9	-	-	-	-	-
Floodprone Width (ft)	116.0	116.0	116.0	-	-	-	-	-
Bankfull Mean Depth (ft)	2.3	2.3	2.3	-	-	-	-	-
Bankfull Max Depth (ft)	3.5	3.5	3.6	-	-	-	-	-
Bankfull Cross-Sectional Area (ft^2)	61.0	61.0	61.0	-	-	-	-	-
Width/Depth Ratio	11.9	11.8	11.8	-	-	-	-	-
Entrenchment Ratio	4.3	4.3	4.3	-	-	-	-	-
Bank Height Ratio	1.0	1.0	1.0	-	-	-	-	-
Low Top of Bank Depth (ft)	-	3.6	3.7	-	-	-	-	-

Left Descending Bank

Right Descending Bank

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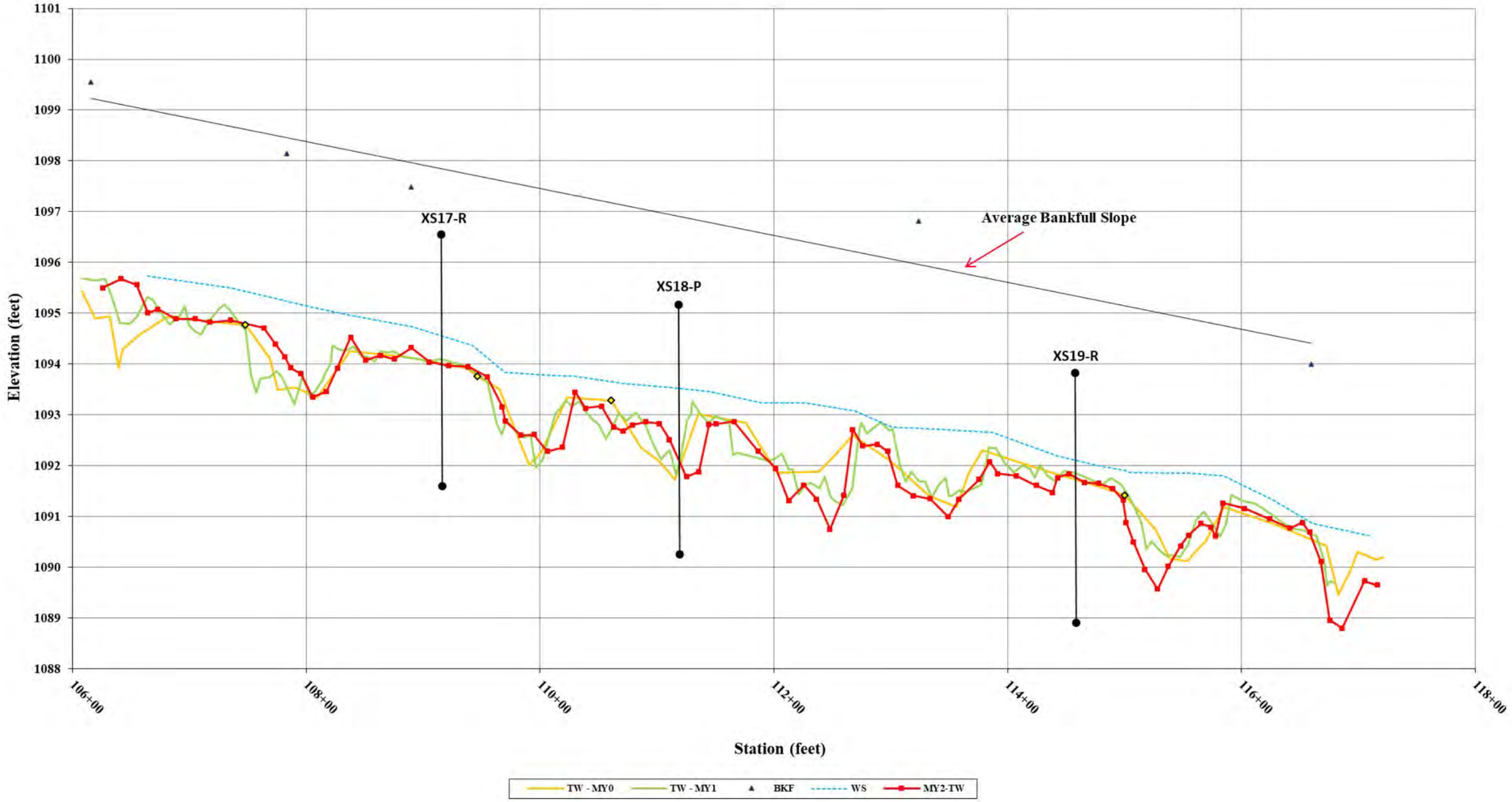
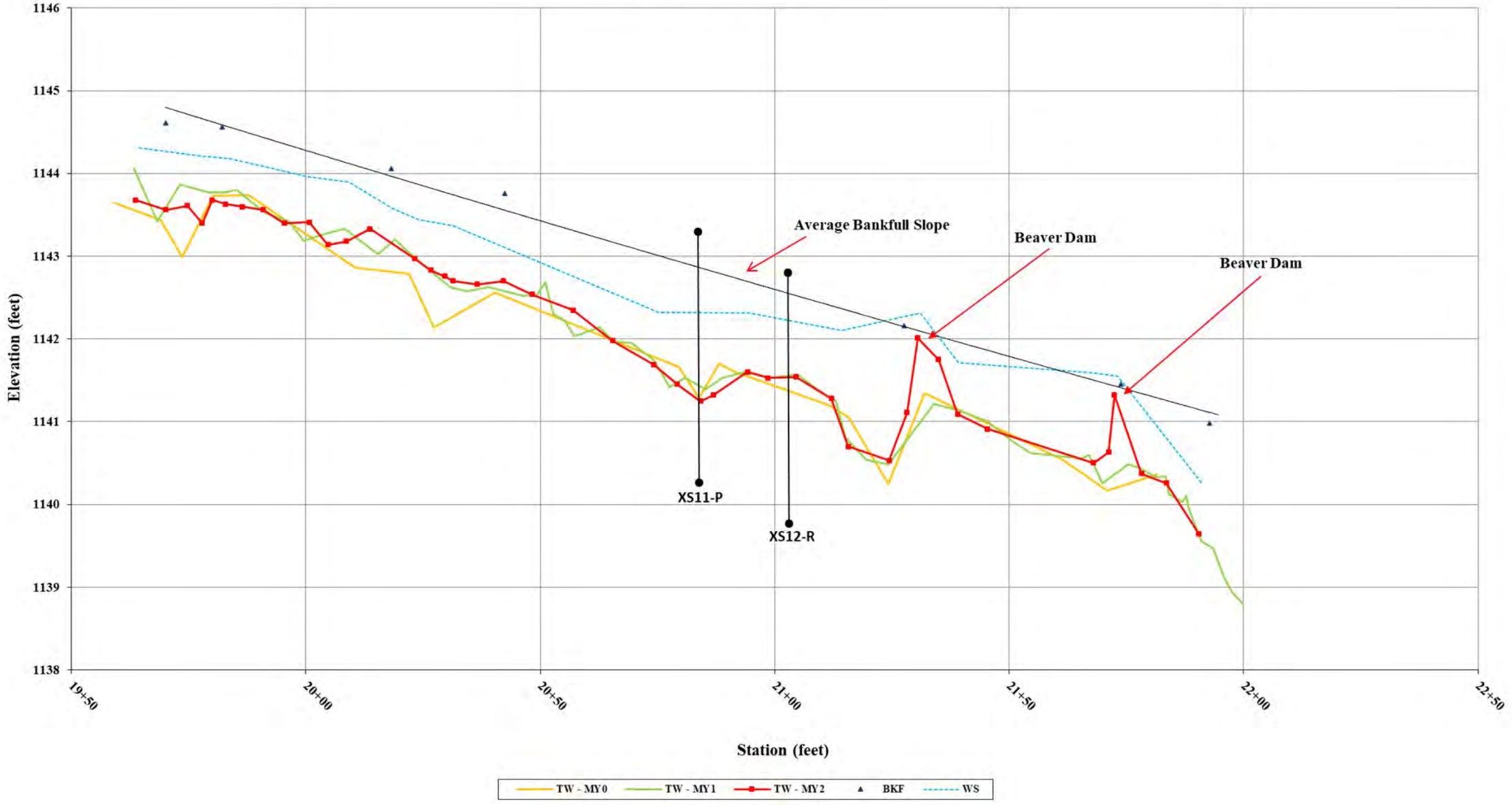
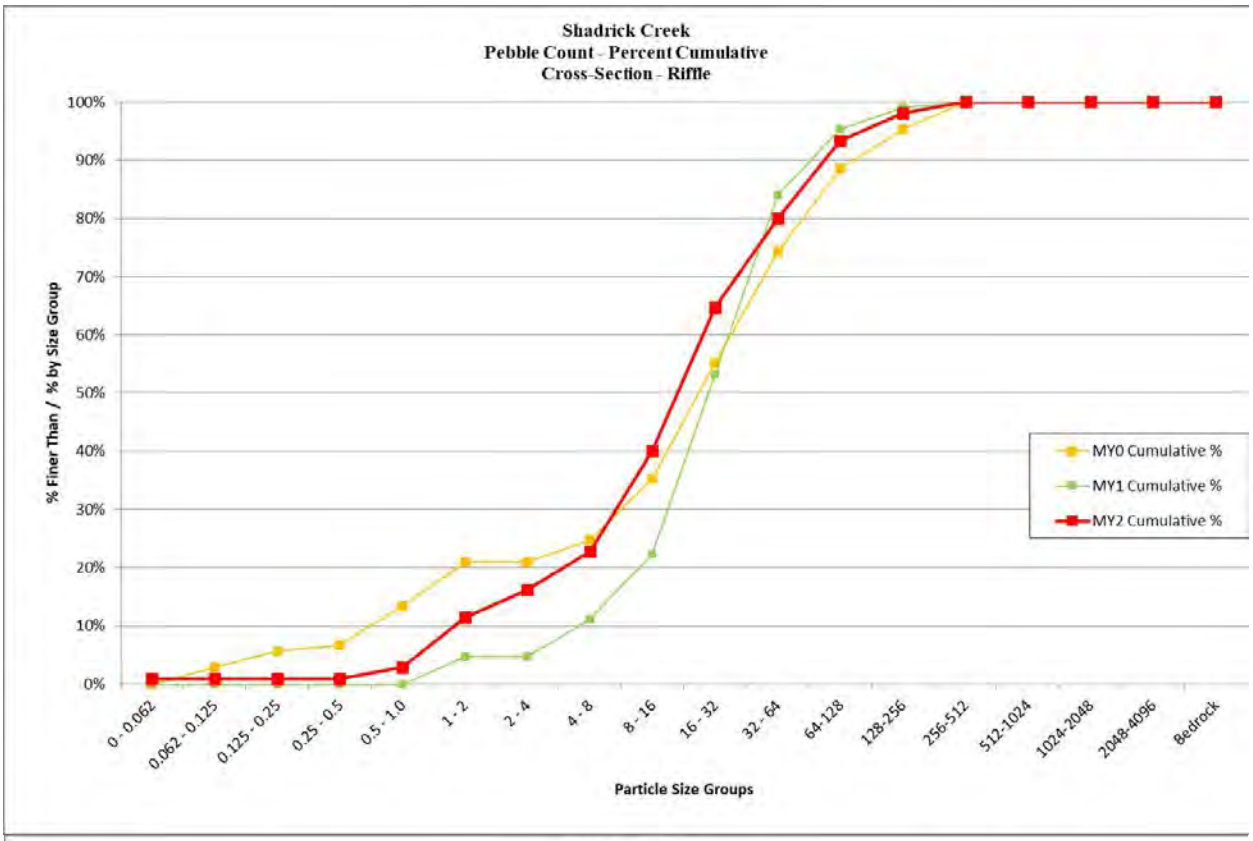
Shadrick Creek - Shadrick Reach 3
Longitudinal Profile
Staioning 106+23 to 117+27

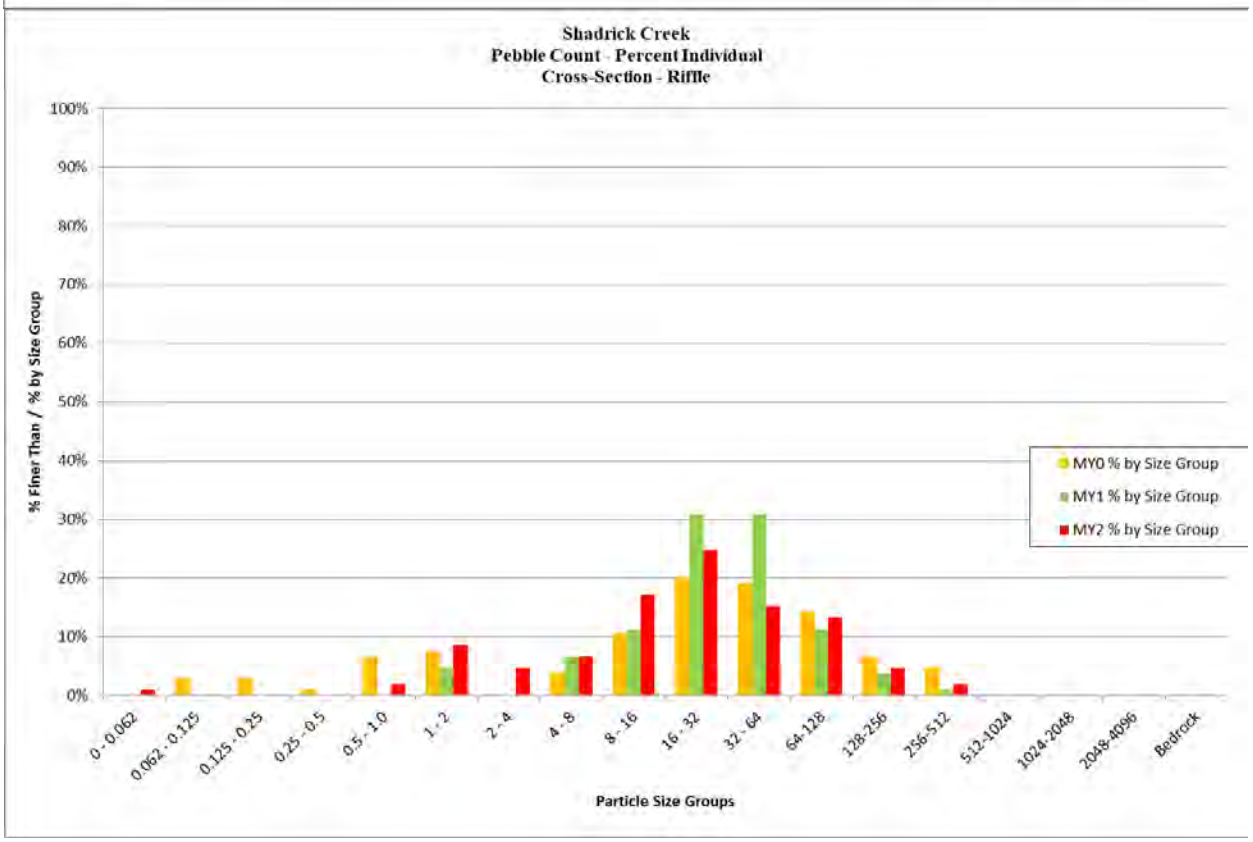


Shadrick Creek - UT9
Longitudinal Profile
Staioning 19+59 to 22+08

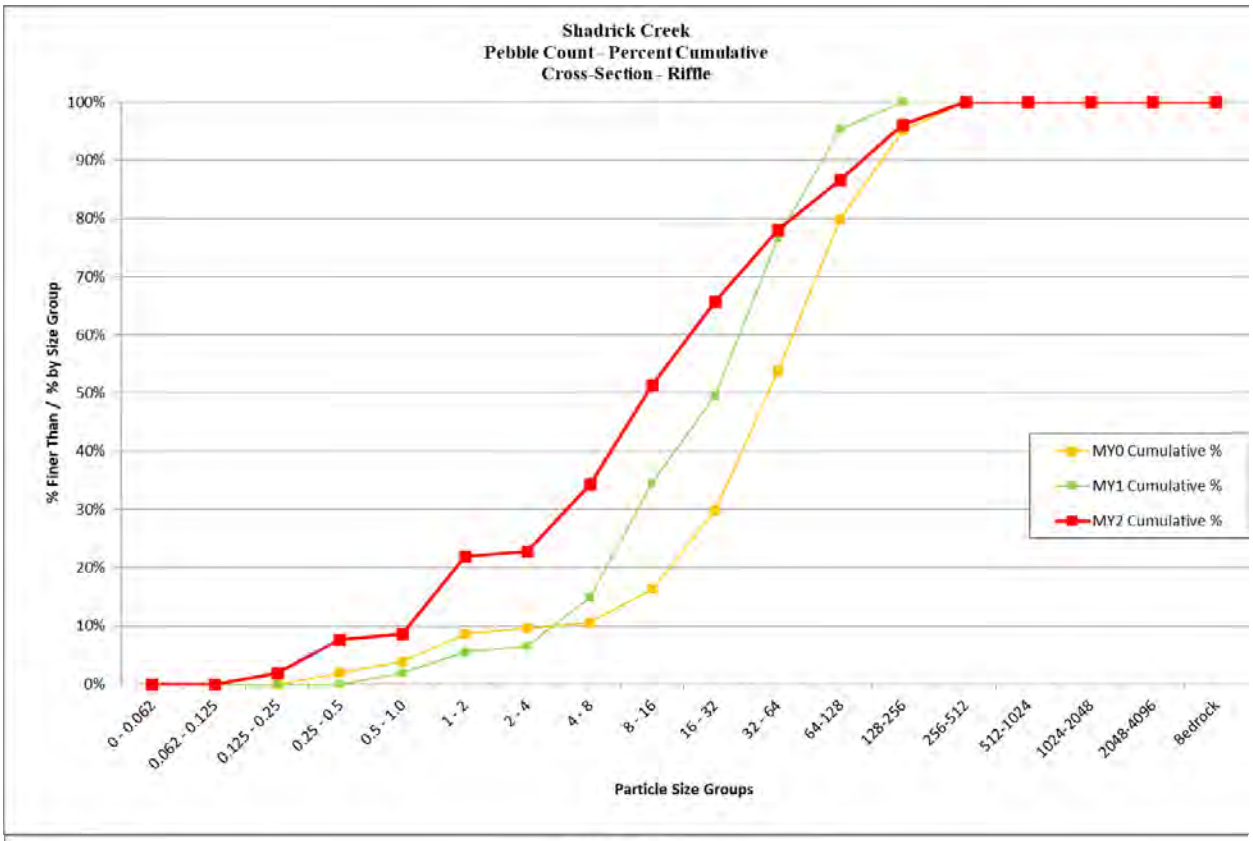


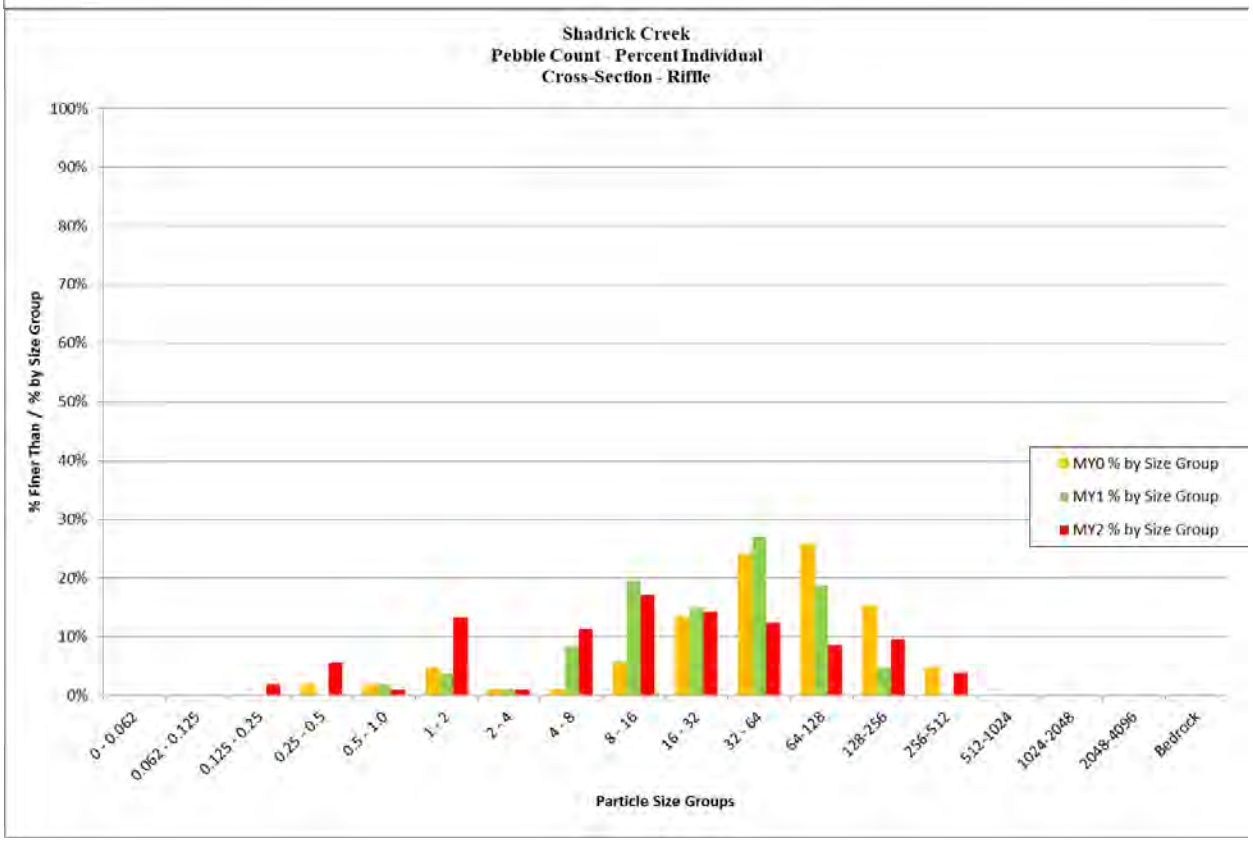
Shadrick Creek			
Cross Section 4 - Riffle			
Monitoring Year - 2020; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	1	1.0%	1%
0.062 - 0.125	0	0.0%	1%
0.125 - 0.25	0	0.0%	1%
0.25 - 0.5	0	0.0%	1%
0.5 - 1.0	2	1.9%	3%
1 - 2	9	8.6%	11%
2 - 4	5	4.8%	16%
4 - 8	7	6.7%	23%
8 - 16	18	17.1%	40%
16 - 32	26	24.8%	65%
32 - 64	16	15.2%	80%
64-128	14	13.3%	93%
128-256	5	4.8%	98%
256-512	2	1.9%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	**105**	**100%**	**100%**
		Summary Data	
		D50	**20**
		D84	**79**
		D95	**150**


Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 Cumulative %
MY1 Cumulative %
MY2 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

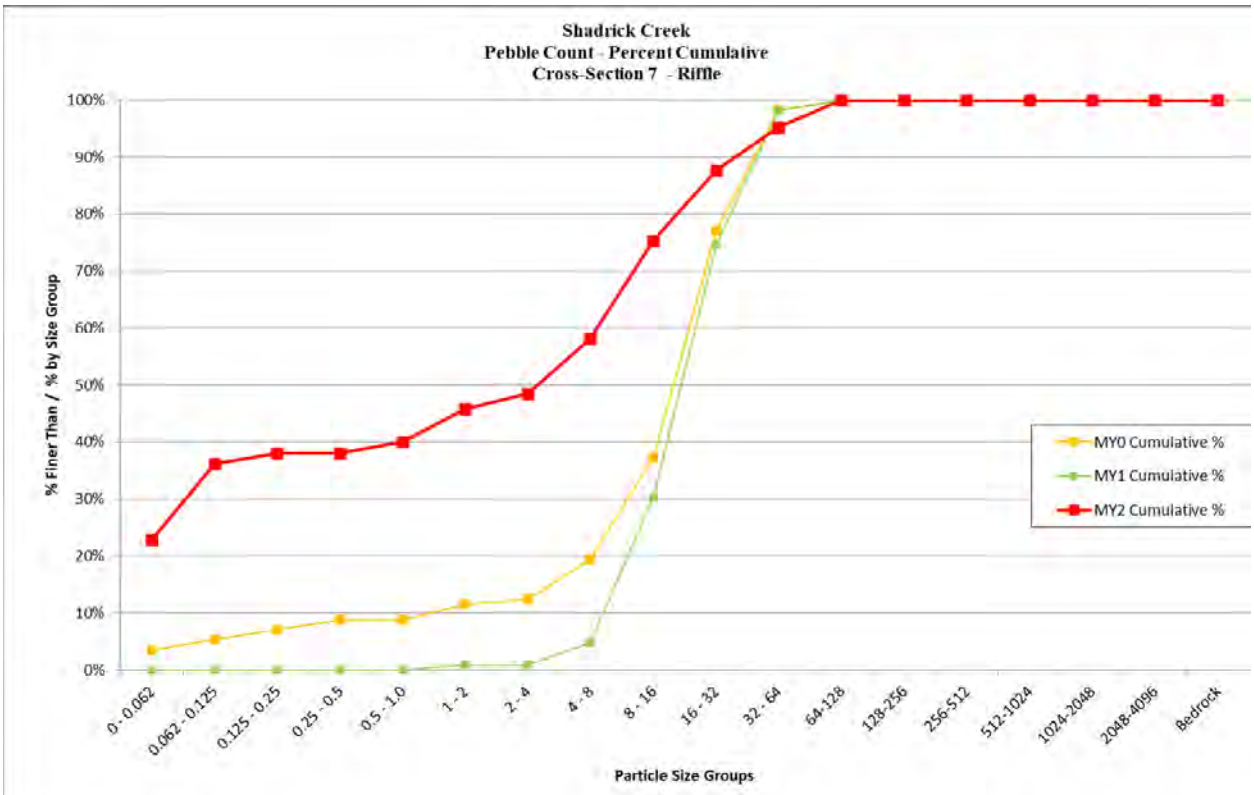

Shadrick Creek
Pebble Count - Percent Individual
Cross-Section - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 % by Size Group
MY1 % by Size Group
MY2 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

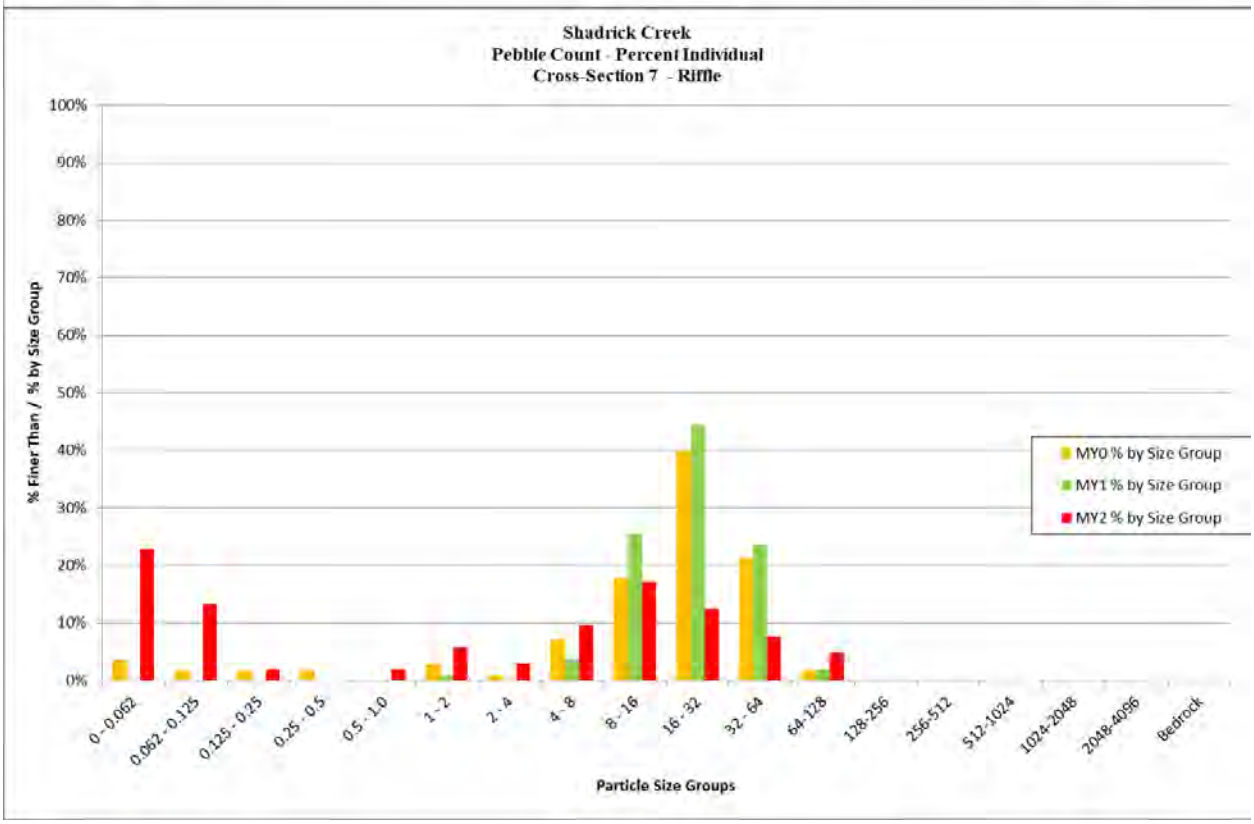
Shadrick Creek			
Cross Section 6 - Riffle			
Monitoring Year - 2020; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	0	0.0%	0%
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	2	1.9%	2%
0.25 - 0.5	6	5.7%	8%
0.5 - 1.0	1	1.0%	9%
1 - 2	14	13.3%	22%
2 - 4	1	1.0%	23%
4 - 8	12	11.4%	34%
8 - 16	18	17.1%	51%
16 - 32	15	14.3%	66%
32 - 64	13	12.4%	78%
64-128	9	8.6%	87%
128-256	10	9.5%	96%
256-512	4	3.8%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	**105**	**100%**	**100%**
		Summary Data	
		D50	**15**
		D84	**110**
		D95	**210**


Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 Cumulative %
MY1 Cumulative %
MY2 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups


Shadrick Creek
Pebble Count - Percent Individual
Cross-Section - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 % by Size Group
MY1 % by Size Group
MY2 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

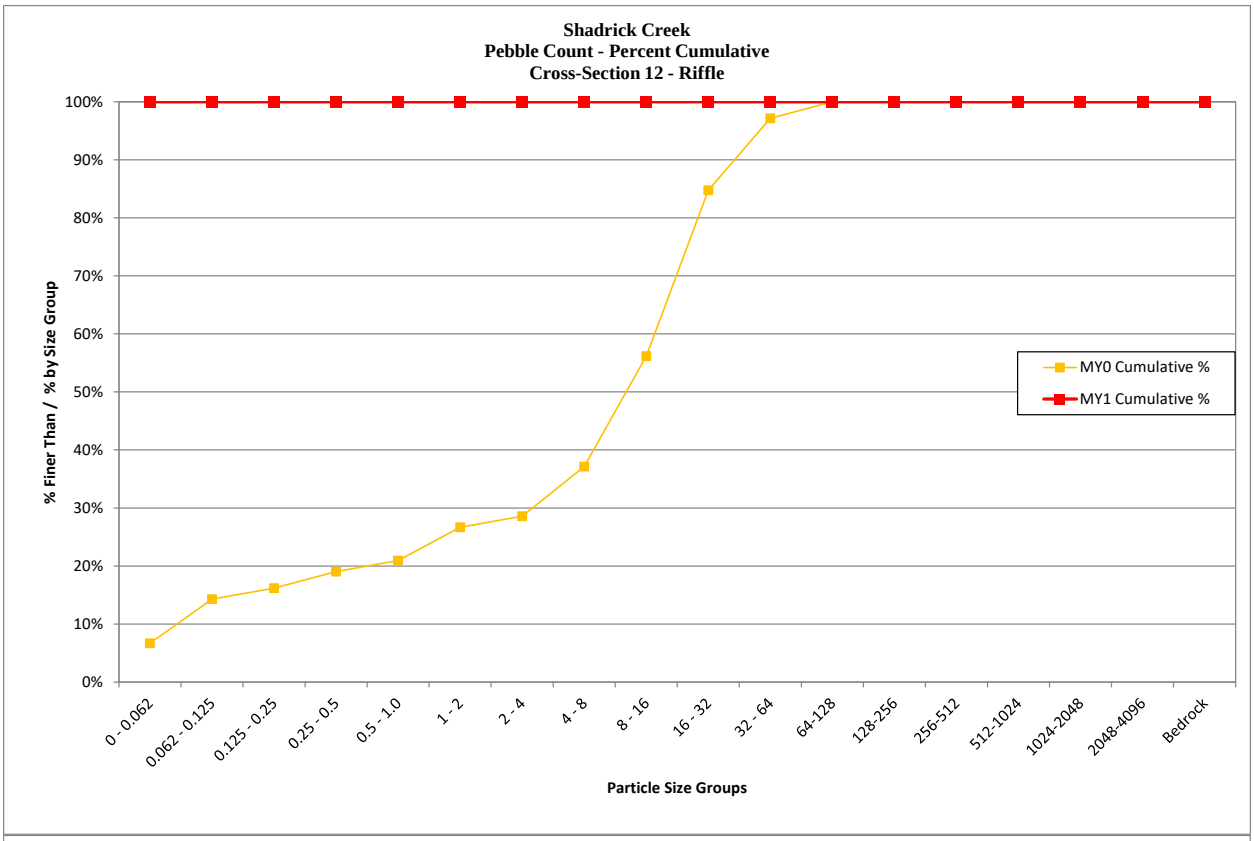
Shadrick Creek			
Cross Section 7 - Riffle			
Monitoring Year - 2020; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	24	22.9%	23%
0.062 - 0.125	14	13.3%	36%
0.125 - 0.25	2	1.9%	38%
0.25 - 0.5	0	0.0%	38%
0.5 - 1.0	2	1.9%	40%
1 - 2	6	5.7%	46%
2 - 4	3	2.9%	49%
4 - 8	10	9.5%	58%
8 - 16	18	17.1%	75%
16 - 32	13	12.4%	88%
32 - 64	8	7.6%	95%
64-128	5	4.8%	100%
128-256	0	0.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	**105**	**100%**	**100%**
		Summary Data	
		D50	**4.7**
		D84	**27**
		D95	**63**

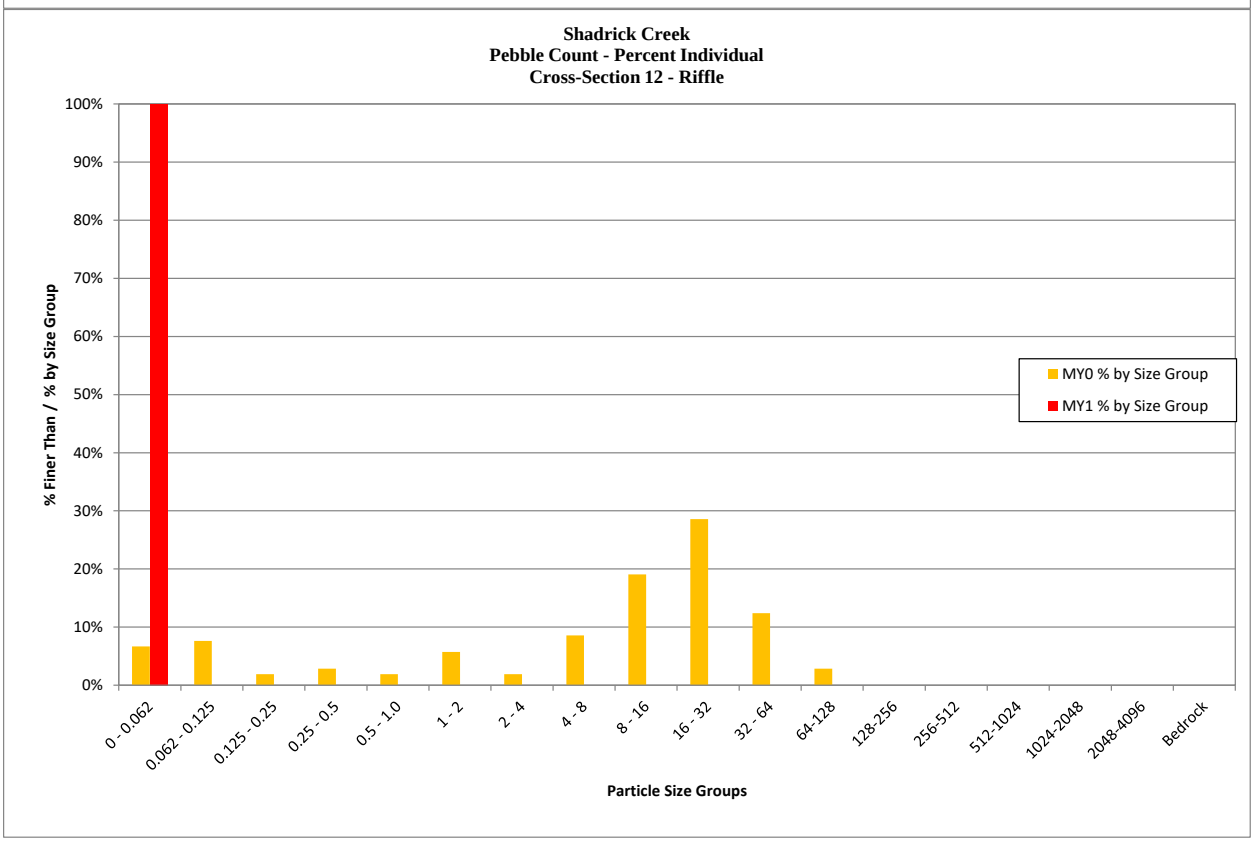

Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section 7 - Riffle
% Finer Than / % by Size Group
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
MY0 Cumulative %
MY1 Cumulative %
MY2 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups


Shadrick Creek
Pebble Count - Percent Individual
Cross-Section 7 - Riffle
% Finer Than / % by Size Group
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
MY0 % by Size Group
MY1 % by Size Group
MY2 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

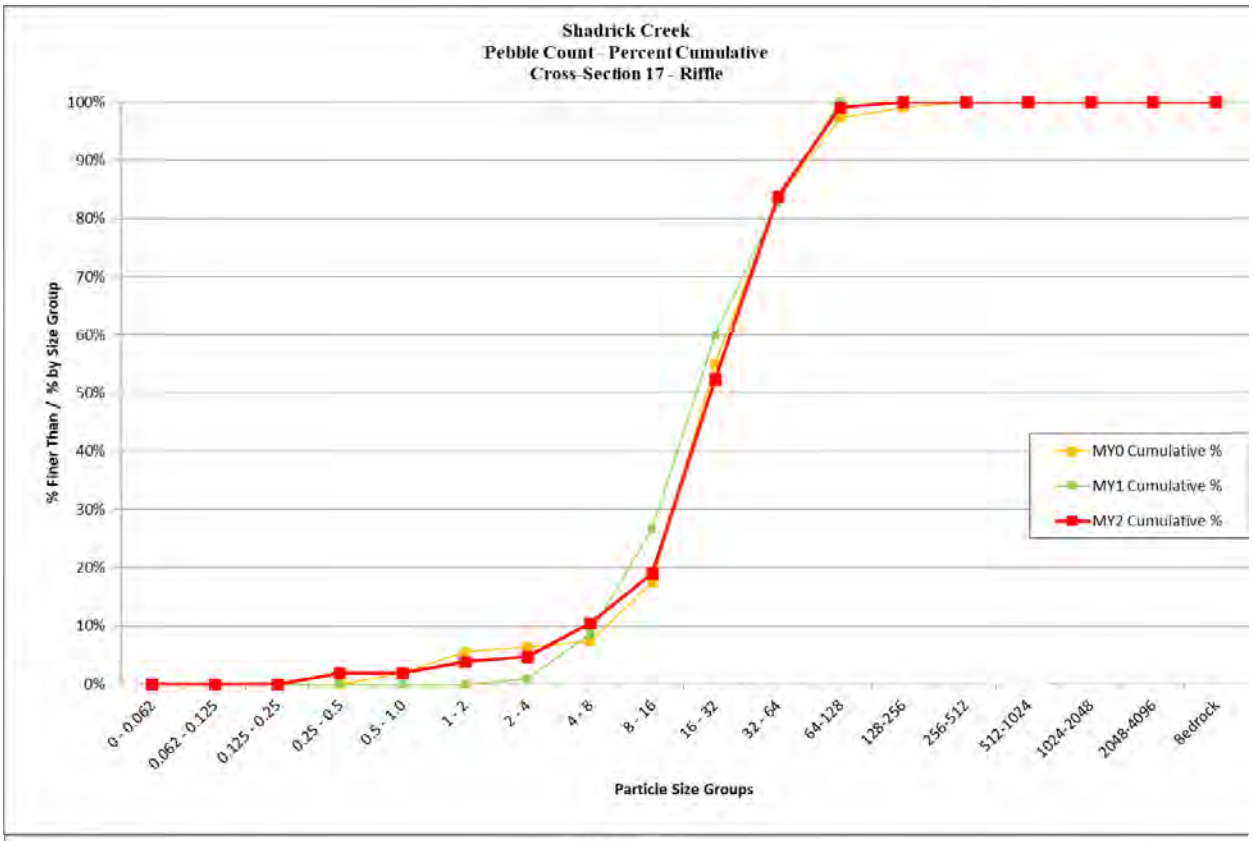
Shadrick Creek			
Cross Section 12 - Riffle			
Monitoring Year - 2019; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	0	N/A	N/A
0.062 - 0.125	0	N/A	N/A
0.125 - 0.25	0	N/A	N/A
0.25 - 0.5	0	N/A	N/A
0.5 - 1.0	0	N/A	N/A
1 - 2	0	N/A	N/A
2 - 4	0	N/A	N/A
4 - 8	0	N/A	N/A
8 - 16	0	N/A	N/A
16 - 32	0	N/A	N/A
32 - 64	0	N/A	N/A
64-128	0	N/A	N/A
128-256	0	N/A	N/A
256-512	0	N/A	N/A
512-1024	0	N/A	N/A
1024-2048	0	N/A	N/A
2048-4096	0	N/A	N/A
Bedrock	0	N/A	N/A
Total	**0**	N/A	N/A
		Summary Data	
		D50	**N/A**
		D84	**N/A**
		D95	**N/A**

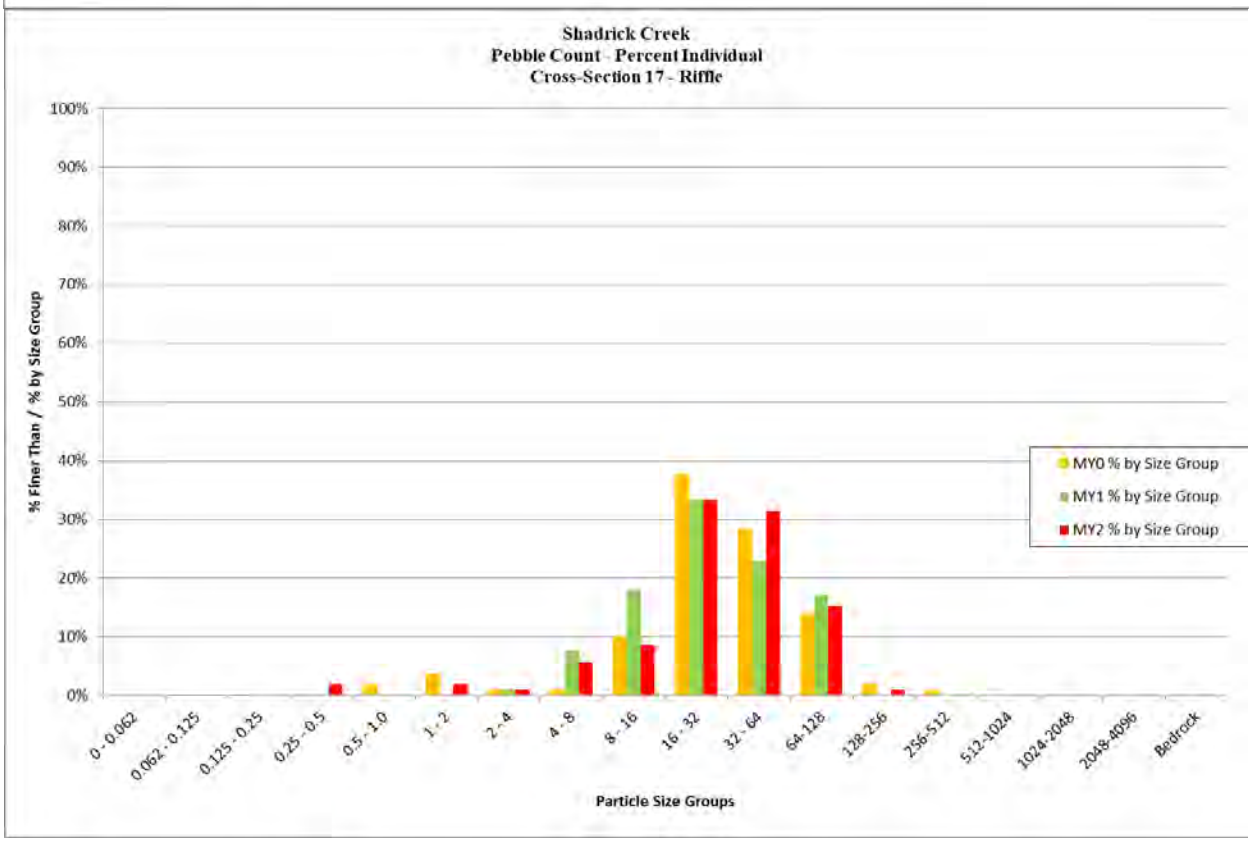
*No data collected due to presence of beaver dam.


Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section 12 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 Cumulative %
MY1 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

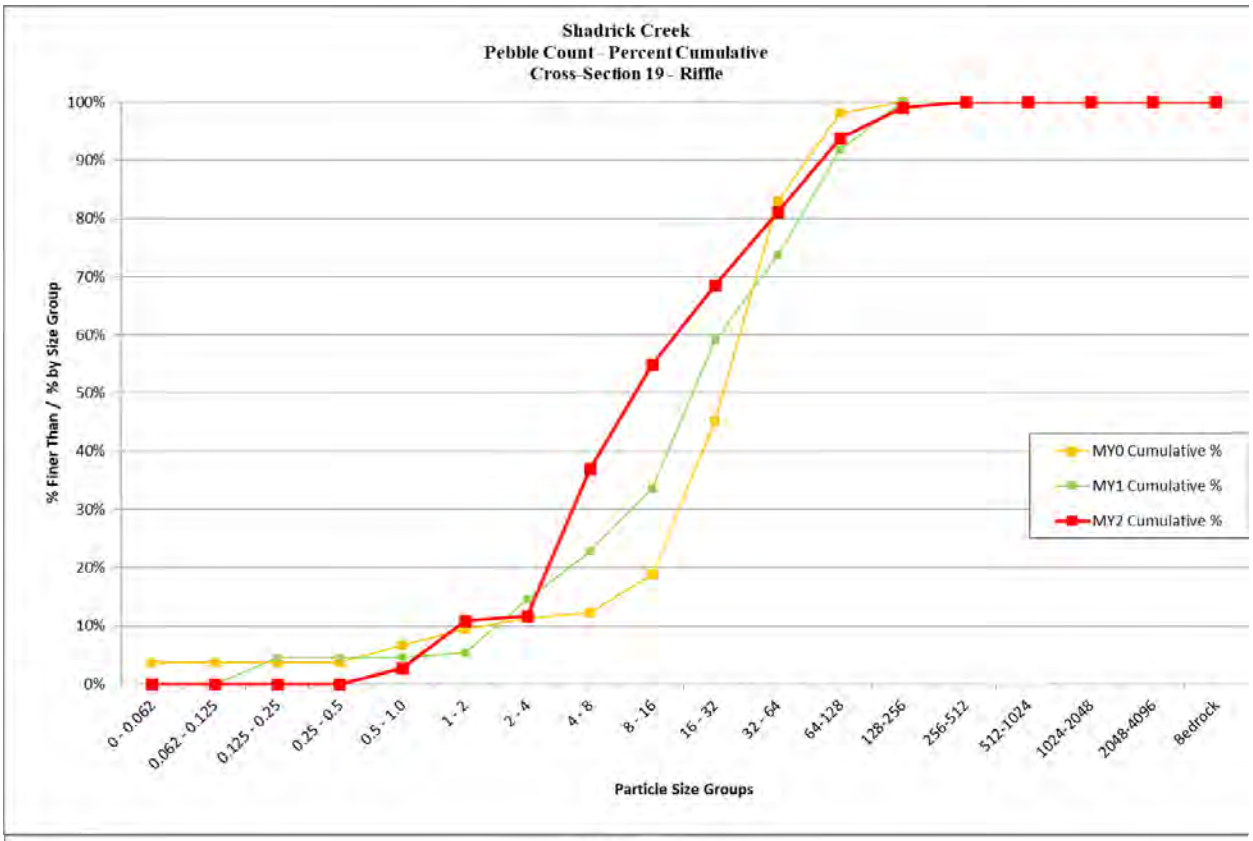

Shadrick Creek
Pebble Count - Percent Individual
Cross-Section 12 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 % by Size Group
MY1 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

Shadrick Creek			
Cross Section 17 - Riffle			
Monitoring Year - 2019; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	0	0.0%	0%
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	0	0.0%	0%
0.25 - 0.5	2	1.9%	2%
0.5 - 1.0	0	0.0%	2%
1 - 2	2	1.9%	4%
2 - 4	1	1.0%	5%
4 - 8	6	5.7%	10%
8 - 16	9	8.6%	19%
16 - 32	35	33.3%	52%
32 - 64	33	31.4%	84%
64-128	16	15.2%	99%
128-256	1	1.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	**105**	**100%**	**100%**
		Summary Data	
		D50	**31**
		D84	**64**
		D95	**100**


Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section 17 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 Cumulative %
MY1 Cumulative %
MY2 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups


Shadrick Creek
Pebble Count - Percent Individual
Cross-Section 17 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 % by Size Group
MY1 % by Size Group
MY2 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

Shadrick Creek			
Cross Section 19 - Riffle			
Monitoring Year - 2019; MY2			
Bed Surface Material Particle Size Class (mm)	**Number**	**% Individual**	**% Cumulative**
0 - 0.062	0	0.0%	0%
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	0	0.0%	0%
0.25 - 0.5	0	0.0%	0%
0.5 - 1.0	3	2.7%	3%
1 - 2	9	8.1%	11%
2 - 4	1	0.9%	12%
4 - 8	28	25.2%	37%
8 - 16	20	18.0%	55%
16 - 32	15	13.5%	68%
32 - 64	14	12.6%	81%
64-128	14	12.6%	94%
128-256	6	5.4%	99%
256-512	1	0.9%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	**111**	**100%**	**100%**
		Summary Data	
		D50	**13**
		D84	**77**
		D95	**140**


Shadrick Creek
Pebble Count - Percent Cumulative
Cross-Section 19 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 Cumulative %
MY1 Cumulative %
MY2 Cumulative %
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

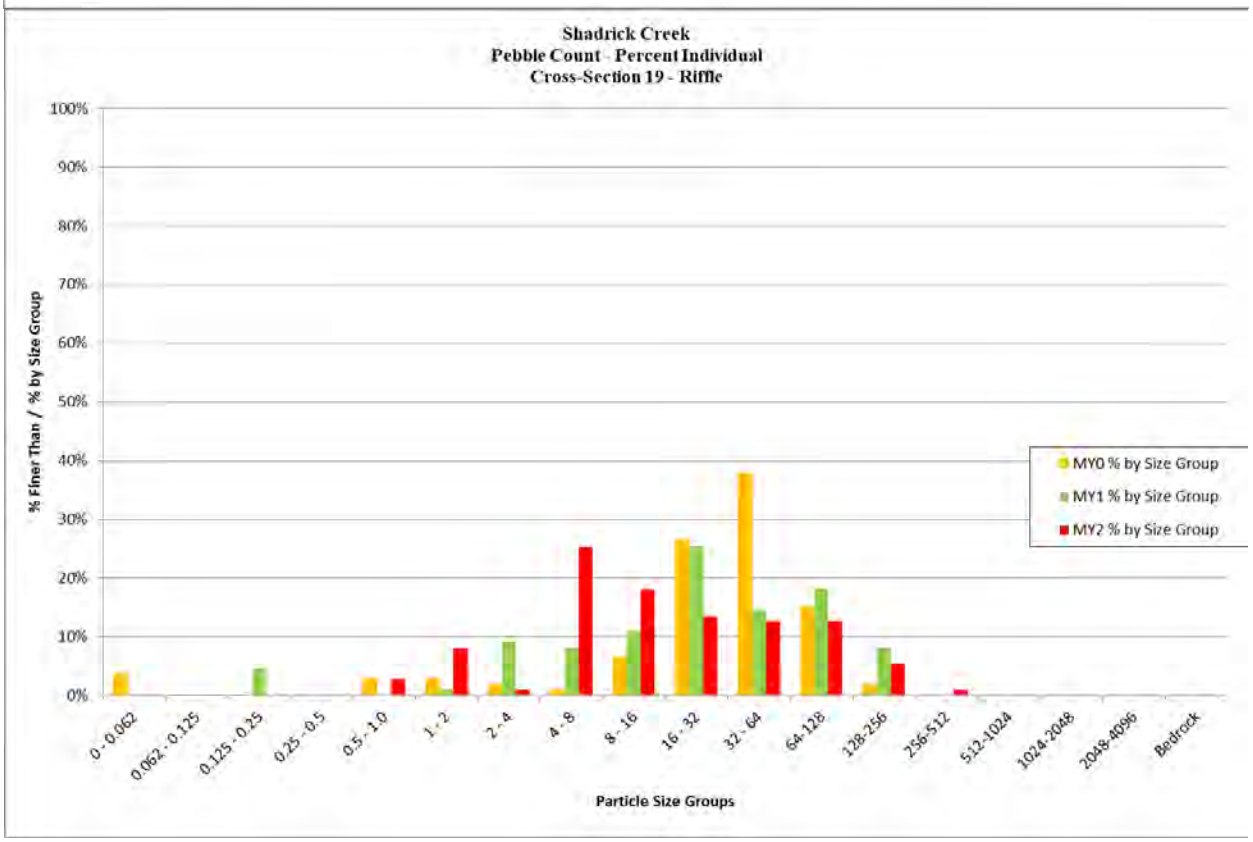

Shadrick Creek
Pebble Count - Percent Individual
Cross-Section 19 - Riffle
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Finer Than / % by Size Group
MY0 % by Size Group
MY1 % by Size Group
MY2 % by Size Group
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size Groups

Table 10. Baseline Stream Data Summary
Shadrick Creek - Shadrick Creek Reach 1 (3,631 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	21.0	-	22.0	23.0	-	-	-	-	19	-	-	-	-	27.0	-	26.6	29.3	28.7	32.7	3.1	3
Floodprone Width (ft)				68.0	-	74.0	80.0	-	-	-	-	32.0	-	-	-	-	100.0	-	100.0	100.0	100.0	100.0	0.0	3
Bankfull Mean Depth (ft)				2.4	-	2.6	2.8	-	-	-	-	1.8	-	-	-	-	2.2	-	1.8	1.8	1.8	1.8	0.0	3
Bankfull Max Depth (ft)				3.6	-	3.6	3.7	-	-	-	-	2.1	-	-	-	-	3.0	-	3.0	3.1	3.0	3.2	0.1	3
Bankfull Cross Sectional Area (ft^2)		-		51.4	-	57.5	63.5	-	-	-	-	34.5	-	-	-	-	58.4	-	47.0	52.8	52.0	59.3	6.2	3
Width/Depth Ratio				6.9	-	8.6	10.3	-	-	-	-	10.4	-	-	-	-	12.4	-	15.0	16.3	15.8	18.0	1.5	3
Entrenchment Ratio				3.0	-	3.4	3.8	-	-	-	-	1.7	-	-	-	-	3.7	-	3.1	3.4	3.5	3.8	0.4	3
Bank Height Ratio				1.3	-	1.3	1.4	-	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.0	1.0	0.0	3
d50 (mm)				23.0	-	25.0	40.0	-	-	-	-	40.0	-	-	-	23.0	25.0	40.0	21.0	35.0	28.0	56.0	18.5	3
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)				3.9	-	4.4	4.8	-	-	-	-	3.9	-	-	-	-	5.0	-	-	-	-	-	-	-
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				66.0	-	70.0	162.0	-	-	-	-	65.0	-	-	-	66.0	70.0	162.0	-	-	-	-	-	-
Radius of Curvature (ft)				34.0	-	61.0	149.0	-	-	-	-	60.0	-	-	-	34.0	61.0	149.0	-	-	-	-	-	-
Rc: Bankfull Width (ft/ft)				1.6	-	2.8	6.5	-	-	-	-	3.2	-	-	-	1.6	2.8	6.5	-	-	-	-	-	-
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio				3.1	-	3.2	7.0	-	-	-	-	3.4	-	-	-	3.1	3.2	7.0	-	-	-	-	-	-
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				0.75						-						-			-					
Max Part Size (mm) Mobilized at Bankfull				120.0						-						-			-					
Stream Power (Transport Capacity) W/m^2				-												-			-					
Additional Reach Parameters																								
Drainage Area (mi^2)				2.8						2.5						2.8								
Rosgen Classification				E4						E4						C4			C4					
Bankfull Velocity (fps)		-		4.8						3.7						3.9								
Bankfull Discharge (cfs)		-		273.0						127.0						230.0								
Valley Length (ft)				-						-						-			3,268					
Channel Thalweg Length (ft)				-						-						3,641			3,631					
Sinuosity				1.32						1.80						1.32			1.13					
Water Surface Slope (ft/ft)				0.0053						0.0089						0.0053								
Bankfull Slope (ft/ft)				-						-						-			-					
Bankfull Floodplain Area (acres)				-						-														
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - Shadrick Creek Reach 2 (573 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	19.9	-	20.6	21.3	-	-	-	-	19.7	-	-	-	-	29.0	-	-	29.9	-	-	-	1
Floodprone Width (ft)				68.0	-	74.0	80.0	-	-	-	-	32.0	-	-	-	-	100.0	-	-	116.0	-	-	-	1
Bankfull Mean Depth (ft)	-	-	-	2.3	-	2.4	2.5	-	-	-	-	2.1	-	-	-	-	2.4	-	-	2.4	-	-	-	1
Bankfull Max Depth (ft)				3.4	-	3.7	4.0	-	-	-	-	3.2	-	-	-	-	3.4	-	-	3.9	-	-	-	1
Bankfull Cross Sectional Area (ft^2)		-		46.4	-	49.4	52.3	-	-	-	-	41.0	-	-	-	-	69.7	-	-	71.7	-	-	-	1
Width/Depth Ratio				8.5	-	8.6	8.6	-	-	-	-	9.5	-	-	-	-	12.1	-	-	12.5	-	-	-	1
Entrenchment Ratio				2.2	-	2.8	3.3	-	-	3.0	-	4.0	5.0	-	-	-	1.7	-	-	3.9	-	-	-	1
Bank Height Ratio				1.6	-	1.7	1.7	-	-	-	-	1.9	-	-	-	-	1.0	-	-	1.0	-	-	-	1
d50 (mm)				10.0	-	12.0	32.0	-	-	10.0	-	12.0	32.0	-	-	10.0	12.0	32.0						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)				-	-	5.1	-	-	-	-	-	-	-	-	-	-	5.5	-	-	-	-	-	-	-
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				60.0	-	80.0	100.0	-	-	60.0	-	80.0	100.0	-	-	90.0	116.0	160.0	-	-	-	-	-	-
Radius of Curvature (ft)				20.0	-	43.0	118.0	-	-	30.0	-	40.0	50.0	-	-	30.0	60.0	75.0	-	-	-	-	-	-
Rc: Bankfull Width (ft/ft)				1.00	-	21.00	5.50	-	-	1.50		2.00	2.50	-	-	1.10	2.10	2.60	-	-	-	-	-	-
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio				3.0	-	3.9	4.7	-	-	3.1	-	4.1	5.1	-	-	3.1	4.0	5.5	-	-	-	-	-	-
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				0.84						-						-			-					
Max Part Size (mm) Mobilized at Bankfull				130.0						-						-			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				3.3						3.2						3.3								
Rosgen Classification				E4						E4						C4			C4					
Bankfull Velocity (fps)		-		4.5						5.3						4.0								
Bankfull Discharge (cfs)		-		225.0						217.0						280.0								
Valley Length (ft)				-						-						-			499					
Channel Thalweg Length (ft)				-						-						575			573					
Sinuosity				1.26						1.26						1.31			1.15					
Water Surface Slope (ft/ft)				0.0050						0.0050						0.0048			-					
Bankfull Slope (ft/ft)				-						-						-			-					
Bankfull Floodplain Area (acres)				-						-														
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - Shadrick Creek Reach 3 (1,104 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	19.9	-	20.6	21.3	-	-	-	-	19.7	-	-	-	-	29.0	-	26.9	29.0	29.0	31.1	2.9	2
Floodprone Width (ft)				68.0	-	74.0	80.0	-	-	-	-	32.0	-	-	-	-	100.0	-	116.0	116.0	116.0	116.0	0.0	2
Bankfull Mean Depth (ft)	-	-	-	2.3	-	2.4	2.5	-	-	-	-	2.1	-	-	-	-	2.4	-	2.2	2.2	2.2	2.3	0.0	2
Bankfull Max Depth (ft)				3.4	-	3.7	4.0	-	-	-	-	3.2	-	-	-	-	3.4	-	3.5	3.5	3.5	3.5	0.0	2
Bankfull Cross Sectional Area (ft^2)		-		46.4	-	49.4	52.3	-	-	-	-	41.0	-	-	-	-	69.7	-	61.0	64.8	64.8	68.6	5.4	2
Width/Depth Ratio				8.5	-	8.6	8.6	-	-	-	-	9.5	-	-	-	-	12.1	-	11.9	13.0	13.0	14.1	1.6	2
Entrenchment Ratio				2.2	-	2.8	3.3	-	-	3.0	-	4.0	5.0	-	-	-	1.7	-	3.7	4.0	4.0	4.3	0.4	2
Bank Height Ratio				1.6	-	1.7	1.7	-	-	-	-	1.9	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	0.0	2
d50 (mm)				10.0	-	12.0	32.0	-	-	10.0	-	12.0	32.0	-	-	10.0	12.0	32.0	29.0	32.0	32.0	35.0	4.2	2
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32.0	69.7	67.8	121.6	34.8	7
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.004	0.007	0.008	0.011	0.002	7
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.8	42.9	45.0	63.8	15.1	7
Pool Max Depth (ft)				-	-	5.1	-	-	-	-	-	-	-	-	-	-	5.5	-	4.3	4.8	4.5	5.5	0.5	7
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87.4	145.2	141.1	196.3	40.1	6
Pattern																								
Channel Belt Width (ft)				60.0	-	80.0	100.0	-	-	60.0	-	80.0	100.0	-	-	90.0	116.0	160.0	84.7	94.5	95.0	103.5	7.7	4
Radius of Curvature (ft)				20.0	-	43.0	118.0	-	-	30.0	-	40.0	50.0	-	-	30.0	60.0	75.0	61.6	67.0	66.8	72.9	4.8	4
Rc: Bankfull Width (ft/ft)				1.00	-	21.00	5.50	-	-	1.50	-	2.00	2.50	-	-	1.10	2.10	2.60	2.12	2.31	2.30	2.51	0.17	3
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	202.5	250.1	248.2	301.6	51.7	4
Meander Width Ratio				3.0	-	3.9	4.7	-	-	3.1	-	4.1	5.1	-	-	3.1	4.0	5.5	2.1	2.3	2.3	2.5	0.16	4
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2				0.84						-						-			-					
Max Part Size (mm) Mobilized at Bankfull				130.0						-						-			-					
Stream Power (Transport Capacity) W/m^2				-						-						-								
Additional Reach Parameters																								
Drainage Area (mi^2)				3.3						3.2						3.3								
Rosgen Classification				E4						E4						C4			C4					
Bankfull Velocity (fps)		-		4.5						5.3						4.0								
Bankfull Discharge (cfs)		-		225.0						217.0						280.0								
Valley Length (ft)				-						-						1,108			1,104					
Channel Thalweg Length (ft)				-						-						-			927					
Sinuosity				1.26						1.26						1.31			1.19					
Water Surface Slope (ft/ft)				0.0050						0.0050						0.0048			0.0043					
Bankfull Slope (ft/ft)				-						-						-			0.0055					
Bankfull Floodplain Area (acres)				-						-														
% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - UT1 (1,651 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	3.3	-	3.9	5.3	-	-	5.4	-	6.7	8.0	-	-	-	8.0	-	5.02	5.68	5.68	6.34	0.93	2
Floodprone Width (ft)				4.5	-	13.0	21.0	-	-	13.0	-	16.5	20.0	-	-	-	24.0	-	24	24	24	24	0	2
Bankfull Mean Depth (ft)	-	-	-	0.3	-	0.7	1.0	-	-	0.6	-	0.6	0.7	-	-	-	0.7	-	0.68	0.73	0.73	0.77	0.07	2
Bankfull Max Depth (ft)				0.5	-	0.9	1.2	-	-	1.1	-	1.1	1.2	-	-	-	1.0	-	1.1	1.19	1.19	1.28	0.12	2
Bankfull Cross Sectional Area (ft^2)		-		1.2	-	2.8	4.6	-	-	3.1	-	4.3	5.5	-	-	-	5.5	-	3.88	4.09	4.09	4.3	0.3	2
Width/Depth Ratio				4.2	-	6.1	12.6	-	-	9.4	-	10.5	11.6	-	-	-	11.6	-	6.5	7.93	7.93	9.35	2.02	2
Entrenchment Ratio				1.1	-	2.8	5.2	-	-	-	-	2.5	-	-	-	-	3.0	-	3.78	4.28	4.28	4.78	0.7	2
Bank Height Ratio				1.0	-	1.5	3.0	-	-	-	-	1.0	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	0.0	2
d50 (mm)				3.0	-	6.0	9.0	-	-	3.0	-	6.0	9.0	-	-	3.0	6.0	9.0						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)				0.9	-	1.3	1.9	-	-	-	-	1.2	-	-	-	-	1.6	-	-	-	-	-	-	-
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				16.0	-	35.0	50.0	-	-	-	-	40.0	-	-	-	16.0	35.0	50.0	-	-	-	-	-	-
Radius of Curvature (ft)				7.0	-	20.0	70.0	-	-	21.0	-	22.0	23.0	-	-	7.0	20.0	70.0	-	-	-	-	-	-
Rc: Bankfull Width (ft/ft)				2.1	-	5.1	13.2	-	-	3.1	-	3.3	3.4	-	-	2.1	5.1	13.2	-	-	-	-	-	-
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio				4.8	-	8.9	9.5	-	-	-	-	6.0	-	-	-	4.8	8.9	9.5	-	-	-	-	-	-
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2						0.95						-				-					-			
Max Part Size (mm) Mobilized at Bankfull						145.0						-				-					-			
Stream Power (Transport Capacity) W/m^2						-						-				-								
Additional Reach Parameters																								
Drainage Area (mi^2)						0.10						0.10				0.10								
Rosgen Classification						G4						B4				B4					C4			
Bankfull Velocity (fps)		-				5.5						7.0				4.5								
Bankfull Discharge (cfs)		-				24.0						30.0				25.0								
Valley Length (ft)						-						-				-								
Channel Thalweg Length (ft)						-						-				1,637					1,651			
Sinuosity						1.13						1.13				1.13					1.14			
Water Surface Slope (ft/ft)						0.0230						0.0230				0.0230					-			
Bankfull Slope (ft/ft)						-						-				-					-			
Bankfull Floodplain Area (acres)						-						-												
% of Reach with Eroding Banks						-						-												
Channel Stability or Habitat Metric						-						-												
Biological or Other						-						-												

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - UT9 Reach 1 (706 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	4.2	-	5.7	6.0	-	-	5.4	-	6.7	8.0	-	-	-	8.0	-	-	9.5	-	-	-	1
Floodprone Width (ft)				8.0	-	10.0	11.0	-	-	13.0	-	17.00	20.0	-	-	-	24.0	-	-	24.0	-	-	-	1
Bankfull Mean Depth (ft)	-	-	-	0.5	-	0.7	1.1	-	-	0.6	-	0.6	0.7	-	-	-	0.7	-	-	0.5	-	-	-	1
Bankfull Max Depth (ft)				0.6	-	0.9	1.5	-	-	1.1	-	1.1	1.2	-	-	-	1.0	-	-	1.1	-	-	-	1
Bankfull Cross Sectional Area (ft^2)		-		2.6	-	2.7	6.3	-	-	3.1	-	4.3	5.5	-	-	-	5.5	-	-	4.8	-	-	-	1
Width/Depth Ratio				5.7	-	6.3	12.7	-	-	9.4	-	10.5	11.6	-	-	-	11.6	-	-	18.7	-	-	-	1
Entrenchment Ratio				1.4	-	1.7	2.7	-	-	-	-	2.5	-	-	-	-	3.0	-	-	2.5	-	-	-	1
Bank Height Ratio				2.3	-	2.7	4.4	-	-	-	-	1.0	-	-	-	-	1.0	-	-	1.0	-	-	-	1
d50 (mm)				-	-	0.3	-	-	-	3.0	-	6.0	9.0	-	-	-	0.3	-						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)				1.0	-	1.2	1.4	-	-	-	-	1.2	-	-	-	-	1.6	-	-	-	-	-	-	-
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				20.0	-	26.0	31.0	-	-	-	-	40.0	-	-	-	20.0	26.0	31.0	-	-	-	-	-	-
Radius of Curvature (ft)				36.0	-	47.0	62.0	-	-	21.0	-	22.0	23.0	-	-	36.0	47.0	62.0	-	-	-	-	-	-
Rc: Bankfull Width (ft/ft)				6.0	-	8.2	14.9	-	-	3.1	-	3.3	3.4	-	-	6.0	8.2	14.9	-	-	-	-	-	-
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio				4.5	-	4.8	5.1	-	-	-	-	6.0	-	-	-	4.5	4.8	5.1	-	-	-	-	-	-
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2						1.44						-				-				-				
Max Part Size (mm) Mobilized at Bankfull						200.0						-				-				-				
Stream Power (Transport Capacity) W/m^2						-						-				-								
Additional Reach Parameters																								
Drainage Area (mi^2)						0.1						0.1				0.1								
Rosgen Classification						B4, G4						B4				B4				B4				
Bankfull Velocity (fps)		-				10.1						7.0				4.5								
Bankfull Discharge (cfs)		-				48.0						30.0				25.0								
Valley Length (ft)						-						-				-				696				
Channel Thalweg Length (ft)						-						-				678				706				
Sinuosity						1.03						1.13				1.03				1.08				
Water Surface Slope (ft/ft)						0.0350						0.0230				0.0350				-				
Bankfull Slope (ft/ft)						-						-				-				-				
Bankfull Floodplain Area (acres)						-						-												
% of Reach with Eroding Banks						-						-												
Channel Stability or Habitat Metric						-						-												
Biological or Other						-						-												

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - UT9 Reach 2 (238 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	4.2	-	5.7	6.0	-	-	5.4	-	6.7	8.0	-	-	-	8.0	-	-	8.3	-	-	-	1
Floodprone Width (ft)				8.0	-	10.0	11.0	-	-	13.0	-	17	20.0	-	-	-	24.0	-	-	24.0	-	-	-	1
Bankfull Mean Depth (ft)	-	-	-	0.5	-	0.7	1.1	-	-	0.6	-	0.6	0.7	-	-	-	0.7	-	-	0.4	-	-	-	1
Bankfull Max Depth (ft)				0.6	-	0.9	1.5	-	-	1.1	-	1.1	1.2	-	-	-	1.0	-	-	1.0	-	-	-	1
Bankfull Cross Sectional Area (ft^2)		-		2.6	-	2.7	6.3	-	-	3.1	-	4.3	5.5	-	-	-	5.5	-	-	3.6	-	-	-	1
Width/Depth Ratio				5.7	-	6.3	12.7	-	-	9.4	-	10.5	11.6	-	-	-	11.6	-	-	19.0	-	-	-	1
Entrenchment Ratio				1.4	-	1.7	2.7	-	-	-	-	2.5	-	-	-	-	3.0	-	-	2.9	-	-	-	1
Bank Height Ratio				2.3	-	2.7	4.4	-	-	-	-	1.0	-	-	-	-	1.0	-	-	1.0	-	-	-	1
d50 (mm)				-	-	0.3	-	-	-	3.0	-	6.0	9.0	-	-	-	0.3	-	-	13.0	-	-	-	1
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23.3	29.0	27.3	38.4	6.7	4
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.016	0.022	0.020	0.033	0.008	4
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	10.2	11.2	12.6	3.1	4
Pool Max Depth (ft)				1.0	-	1.2	1.4	-	-	-	-	1.2	-	-	-	-	1.8	-	1.0	1.5	1.5	1.7	0.3	4
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.4	47.7	46.4	56.4	8.1	3
Pattern																								
Channel Belt Width (ft)				20.0	-	26.0	31.0	-	-	-	-	40.0	-	-	-	-	42.0	-	24.5	30.0	29.0	36.6	6.1	3
Radius of Curvature (ft)				36.0	-	47.0	62.0	-	-	21.0	-	22	23.0	-	-	-	15.0	-	13.3	15.2	15.4	16.9	1.8	3
Rc: Bankfull Width (ft/ft)				6.0	-	8.2	14.9	-	-	3.1	-	3.3	3.4	-	-	-	1.9		2.12	2.31	2.30	2.51	0.17	3
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63.7	78.5	79.3	92.5	14.4	3
Meander Width Ratio				4.5	-	4.8	5.1	-	-	-	-	6.0	-	-	-	-	5.3	-	3.1	3.8	3.6	4.6	0.8	3
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2						0.58						-				-					-			
Max Part Size (mm) Mobilized at Bankfull						100.0						-				-					-			
Stream Power (Transport Capacity) W/m^2						-						-				-								
Additional Reach Parameters																								
Drainage Area (mi^2)						0.10						0.1				0.1								
Rosgen Classification						B4, G4						B4				E4					C5			
Bankfull Velocity (fps)		-				10.10						7.0				3.3								
Bankfull Discharge (cfs)		-				48.00						30.0				18.0								
Valley Length (ft)						-						-				-					198			
Channel Thalweg Length (ft)						-						-				245					238			
Sinuosity						1.03						1.13				1.71					1.20			
Water Surface Slope (ft/ft)						0.04						0.0230				0.0140					0.0168			
Bankfull Slope (ft/ft)						-						-				-					0.0182			
Bankfull Floodplain Area (acres)						-						-												
% of Reach with Eroding Banks						-						-												
Channel Stability or Habitat Metric						-						-												
Biological or Other						-						-												

- Information unavailable.

Non-Applicable.

Table 10 Cont'd. Baseline Stream Data Summary
Shadrick Creek - UT10 (404 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**N**
Bankfull Width (ft)	-	-	-	-	-	7.0	-	-	-	5.4	-	6.7	8.0	-	-	-	7.0	-	-	7.3	-	-	-	1
Floodprone Width (ft)				-	-	9.0	-	-	-	13.0	-	17	20.0	-	-	-	24.0	-	-	24.0	-	-	-	1
Bankfull Mean Depth (ft)	-	-	-	-	-	0.5	-	-	-	0.6	-	0.6	0.7	-	-	-	0.6	-	-	0.5	-	-	-	1
Bankfull Max Depth (ft)				-	-	0.8	-	-	-	1.1	-	1.1	1.2	-	-	-	0.8	-	-	1.1	-	-	-	1
Bankfull Cross Sectional Area (ft^2)		-		-	-	3.8	-	-	-	3.1	-	4.3	5.5	-	-	-	4.0	-	-	3.4	-	-	-	1
Width/Depth Ratio				-	-	13.0	-	-	-	9.4	-	10.5	11.6	-	-	-	12.3	-	-	15.6	-	-	-	1
Entrenchment Ratio				-	-	1.3	-	-	-	-	-	2.5	-	-	-	-	3.4	-	-	3.3	-	-	-	1
Bank Height Ratio				-	-	2.5	-	-	-	-	-	1.0	-	-	-	-	1.0	-	-	1.0	-	-	-	1
d50 (mm)				-	-	0.3	-	-	-	3.0	-	6.0	9.0	-	-	-	0.3	-						
Profile																								
Riffle Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Max Depth (ft)				-	-	-	-	-	-	-	-	1.2	-	-	-	-	1.3	-	-	-	-	-	-	-
Pool Spacing (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																								
Channel Belt Width (ft)				-	-	30.0	-	-	-	-	-	40	-	-	-	-	30.0	-	-	-	-	-	-	-
Radius of Curvature (ft)				36.0	-	66.0	67.0	-	-	21.0	-	22	23.0	-	-	-	66.0	-	-	-	-	-	-	-
Rc: Bankfull Width (ft/ft)				5.1	-	9.4	9.6	-	-	3.1	-	3.3	3.4	-	-	-	3.3	-	-	-	-	-	-	-
Meander Wavelength (ft)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio				-	-	4.3	-	-	-	-	-	6.0	-	-	-	-	4.3	-	-	-	-	-	-	-
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft^2						0.86						-				-				-				
Max Part Size (mm) Mobilized at Bankfull						135.0						-				-				-				
Stream Power (Transport Capacity) W/m^2						-						-				-								
Additional Reach Parameters																								
Drainage Area (mi^2)						0.03						0.1				0.03								
Rosgen Classification						F4						B4				B4				B4				
Bankfull Velocity (fps)		-				1.9						7				7.0								
Bankfull Discharge (cfs)		-				7.0						30.0				30.0								
Valley Length (ft)						-						-				-				390				
Channel Thalweg Length (ft)						-						-				391				404				
Sinuosity						1.04						1.13				1.04				1.03				
Water Surface Slope (ft/ft)						0.0249						0.0230				0.0249				0.0168				
Bankfull Slope (ft/ft)						-						-				-				0.0182				
Bankfull Floodplain Area (acres)						-						-												
% of Reach with Eroding Banks						-						-												
Channel Stability or Habitat Metric						-						-												
Biological or Other						-						-												

- Information unavailable.

Non-Applicable.

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Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Shadrick Creek Restoration Project

	Cross Section 1 (Pool) UT-1						Cross Section 2 (Riffle) UT-1						Cross Section 3 (Riffle) UT-1						Cross Section 4 (Riffle) Shadrick Reach 1						Cross Section 5 (Pool) Shadrick Reach 1					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	1184.8	1184.8	1184.9				1184.6	1184.6	1184.7				1172.5	1172.5	1172.5				1145.2	1145.26	1145.3				1144.9	1144.8	1144.9			
Low Bank Height Elevation (datum) Used	1184.8	1184.8	1184.9				1184.6	1184.6	1184.6				1172.5	1172.5	1172.4				1145.2	1145.15	1145.2				1144.9	1145.1	1145.1			
Bankfull Width (ft)	7.1	6.1	7.4				6.3	6.7	6.3				5.0	5.6	5.5				26.6	25.9	24.1				26.9	26.4	27.3			
Floodprone Width (ft)	24.0	24.0	24.0				24.0	24.0	24.0				24.0	24.0	24.0				100.0	100.0	100.0				100.0	100.0	100.0			
Bankfull Mean Depth (ft)	0.6	0.7	0.6				0.7	0.6	0.7				0.8	0.7	0.7				1.8	1.8	1.9				2.2	2.3	2.2			
Bankfull Max Depth (ft)	1.5	1.4	1.5				1.1	1.1	1.2				1.3	1.4	1.3				3.0	3.1	3.1				4.0	4.0	3.9			
Bankfull Cross Sectional Area (ft^2)	4.5	4.5	4.5				4.3	4.3	4.3				3.9	3.9	3.9				47.0	47.0	47.0				59.5	59.5	59.5			
Bankfull Width/Depth Ratio	11.1	8.3	12.2				9.4	10.4	9.1				6.5	7.9	7.9				15.0	14.2	12.4				12.1	11.7	12.6			
Bankfull Entrenchment Ratio	3.4	3.9	3.3				3.8	3.6	3.8				4.8	4.3	4.3				3.8	3.9	4.1				3.7	3.8	3.7			
Bankfull Bank Height Ratio	1.0	1.0	0.9				1.0	1.0	0.9				1.0	1.0	1.0				1.0	1.0	1.0				1.0	1.1	1.0			
Low Top of Bank Depth (ft)	-	1.4	1.5				-	1.1	1.1				-	1.4	1.3				-	3.0	2.9				-	4.3	4.1			

	Cross Section 6 (Riffle) Shadrick Reach 1						Cross Section 7 (Riffle) Shadrick Reach 1						Cross Section 8 (Pool) Shadrick Reach 1						Cross Section 9 (Riffle) UT-9 Reach 1						Cross Section 10 (Pool) UT-9 Reach 1					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**+MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	1143.3	1143.2	1143.2				1141.2	1141.3	114.2				1139.8	1139.6	-				1151.8	1151.8	1151.8				1151.6	1151.6	1151.6			
Low Bank Height Elevation (datum) Used	1143.3	1143.2	1143.2				1141.2	1141.1	1141.2				1139.8	1140.0	-				1151.8	1151.8	1151.4				1151.6	1151.6	1151.5			
Bankfull Width (ft)	28.7	29.1	28.8				32.7	33.6	33.5				28.8	28.2	-				9.5	9.2	9.7				6.5	6.1	5.0			
Floodprone Width (ft)	100.0	100.0	100.0				100.0	100.0	100.0				100.0	100.0	-				24.0	24.0	24.0				24.0	24.0	24.0			
Bankfull Mean Depth (ft)	1.8	1.8	1.8				1.8	1.8	1.8				2.9	3.0	-				0.5	0.5	0.5				0.5	0.5	0.6			
Bankfull Max Depth (ft)	3.2	3.1	3.2				3.0	3.0	3.0				5.6	5.5	-				1.1	1.3	1.5				1.3	1.4	1.3			
Bankfull Cross Sectional Area (ft^2)	52.0	52.0	52.0				59.3	59.3	59.3				84.3	84.3	-				4.8	4.8	4.8				3.0	3.0	3.0			
Bankfull Width/Depth Ratio	15.8	16.3	15.9				18.0	19.0	18.9				9.8	9.4	-				18.7	17.6	19.5				14.3	12.1	8.2			
Bankfull Entrenchment Ratio	3.5	3.4	3.5				3.1	3.0	3.0				3.5	3.5	-				2.5	2.6	2.5				3.7	4.0	4.8			
Bankfull Bank Height Ratio	1.0	1.0	1.0				1.0	0.9	0.9				1.0	1.1	-				1.0	1.0	1.0				1.0	1.0	0.9			
Low Top of Bank Depth (ft)	-	3.1	3.2				-	2.8	2.7				-	5.9	-				-	1.3	1.2				-	1.3	1.2			

	Cross Section 11 (Pool) UT-9 Reach 2						Cross Section 12 (Riffle) UT-9 Reach 2						Cross Section 13 (Riffle) UT-10						Cross Section 14 (Pool) UT-10						Cross Section 15 (Pool) Shadrick Reach 2					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	1142.9	1142.9	1142.9				1142.5	1142.5	1142.5				1140.9	1140.9	1140.9				1140.2	1140.1	1140.2				1100.7	1100.5	110.4			
Low Bank Height Elevation (datum) Used	1142.9	1142.9	1142.8				1142.5	1142.5	1142.5				1140.9	1140.8	1140.6				1140.2	1140.1	1140.1				1100.7	1100.5	1099.6			
Bankfull Width (ft)	8.8	8.6	9.1				8.3	7.7	8.0				7.3	8.7	8.4				7.5	6.9	7.1				38.9	38.8	36.9			
Floodprone Width (ft)	24.0	24.0	24.0				24.0	24.0	24.0				24.0	24.0	24.0				24.0	24.0	24.0				116.0	116.0	116.0			
Bankfull Mean Depth (ft)	0.7	0.7	0.6				0.4	0.5	0.5				0.5	0.4	0.4				0.6	0.7	0.7				2.1	2.1	2.2			
Bankfull Max Depth (ft)	1.6	1.6	1.7				1.0	1.0	1.0				1.1	1.1	1.0				1.6	1.7	1.9				4.1	4.3	4.5			
Bankfull Cross Sectional Area (ft^2)	5.8	5.8	5.8				3.6	3.6	3.6				3.4	3.4	3.4				4.8	4.8	4.8				80.4	80.4	80.4			
Bankfull Width/Depth Ratio	13.2	12.8	14.4				19.0	16.2	17.6				15.6	22.3	20.8				11.6	9.9	10.5				18.9	18.7	16.9			
Bankfull Entrenchment Ratio	2.7	2.8	2.6				2.9	3.1	3.0				3.3	2.8	2.9				3.2	3.5	3.4				3.0	3.0	3.1			
Bankfull Bank Height Ratio	1.0	1.0	0.9				1.0	1.0	0.9				1.0	0.9	1.0				1.0	1.0	1.0				1.0	1.0	0.8			
Low Top of Bank Depth (ft)	-	1.6	1.5				-	1.0	0.9				-	1.0	0.7				-	1.6	1.9				-	4.4	3.8			

	Cross Section 16 (Riffle) Shadrick Reach 2						Cross Section 17 (Riffle) Shadrick Reach 3						Cross Section 18 (Pool) Shadrick Reach 3						Cross Section 19 (Riffle) Shadrick Reach 3					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Record Elevation (datum) Used	1100.2	1100.3	1100.3				1097.6	1097.7	1097.7				1097.0	1097.0	1097.0				1095.3	1095.4	1095.3			
Low Bank Height Elevation (datum) Used	1100.2	1100.2	1099.3				1097.6	1097.6	1096.5				1097.0	1096.5	1097.0				1095.3	1095.4	1095.3			
Bankfull Width (ft)	29.9	29.5	33.3				31.1	32.7	34.4				40.0	43.7	32.5				26.9	26.9	26.9			
Floodprone Width (ft)	116.0	116.0	116.0				116.0	116.0	116.0				116.0	116.0	116.0				116.0	116.0	116.0			
Bankfull Mean Depth (ft)	2.4	2.4	2.2				2.2	2.1	2.0				2.2	2.0	2.7				2.3	2.3	2.3			
Bankfull Max Depth (ft)	3.9	4.0	4.0				3.5	3.6	3.6				4.7	4.7	5.3				3.5	3.5	3.6			
Bankfull Cross Sectional Area (ft^2)	71.7	71.7	71.7				68.6	68.6	68.6				88.1	88.1	88.2				61.0	61.0	61.0			
Bankfull Width/Depth Ratio	12.5	12.1	15.5				14.1	15.6	17.2				18.2	21.6	12.0				11.9	11.8	11.8			
Bankfull Entrenchment Ratio	3.9	3.9	3.5				3.7	3.5	3.4				2.9	2.7	3.6				4.3	4.3	4.3			
Bankfull Bank Height Ratio*	1.0	1.0	0.9				1.0	1.0	1.0				1.0	0.9	0.8				1.0	1.0	1.0			
Low Top of Bank Depth (ft)	-	3.8	3.6				-	3.5	2.4				-	4.2	4.2				-	3.6	3.7			

* Beginning in MY1 (2018), the bankfull elevation and channel cross-section dimensions have been calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018)

+ Cross section not surveyed due to beaver impoundment

Table 11b. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - Shadrick Creek Reach 1 (3,631 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	26.6	29.3	28.7	32.7	3.1	3	25.9	29.5	29.1	33.6	3.9	3	24.1	28.8	28.8	33.5	4.7	3																		
Floodprone Width (ft)	100.0	100.0	100.0	100.0	0.0	3	100.0	100.0	100.0	100.0	0.0	3	100.0	100.0	100.0	100.0	0.0	3																		
Bankfull Mean Depth (ft)	1.8	1.8	1.8	1.8	0.0	3	1.8	1.8	1.8	1.8	0.0	3	1.8	1.8	1.8	1.9	0.1	3																		
Bankfull Max Depth (ft)	3.0	3.1	3.0	3.2	0.1	3	3.0	3.1	3.1	3.1	0.1	3	3.0	3.1	3.1	3.2	0.1	3																		
Bankfull Cross-Sectional Area (ft^2)	47.0	52.8	52.0	59.3	6.2	3	47.0	52.8	52.0	59.3	6.2	3	47.0	52.8	52.0	59.3	6.2	3																		
Width/Depth Ratio	15.0	16.3	15.8	18.0	1.5	3	14.2	16.5	16.3	19.0	2.4	3	12.4	15.7	15.9	18.9	3.3	3																		
Entrenchment Ratio	3.1	3.4	3.5	3.8	0.4	3	3.0	3.4	3.4	3.9	0.4	3	3.0	3.5	3.5	4.1	0.6	3																		
Bank Height Ratio	1.0	1.0	1.0	1.0	0.0	3	0.9	1.0	1.0	1.0	0.0	3	0.9	0.9	1.0	1.0	0.0	3																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Belt Width (ft)																																				
Radius of Curvature (ft)																																				
Rc: Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg Length (ft)	3,631																																			
Sinuosity (ft)	1.13																																			
Water Surface Slope (Channel) (ft/ft)	.																																			
Bankfull Slope (ft/ft)																																				
Ri% / Ru% / P% / G% / S%																																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - Shadrick Creek Reach 2 (573 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	-	29.9	-	-	-	1	-	29.5	-	-	-	1	-	33.3	-	-	-	1																		
Floodprone Width (ft)	-	116.0	-	-	-	1	-	116.0	-	-	-	1	-	116	-	-	-	1																		
Bankfull Mean Depth (ft)	-	2.4	-	-	-	1	-	2.4	-	-	-	1	-	2.2	-	-	-	1																		
Bankfull Max Depth (ft)	-	3.9	-	-	-	1	-	4.0	-	-	-	1	-	4.0	-	-	-	1																		
Bankfull Cross-Sectional Area (ft^2)	-	71.7	-	-	-	1	-	71.7	-	-	-	1	-	71.7	-	-	-	1																		
Width/Depth Ratio	-	12.5	-	-	-	1	-	12.1	-	-	-	1	-	15.5	-	-	-	1																		
Entrenchment Ratio	-	3.9	-	-	-	1	-	3.9	-	-	-	1	-	3.5	-	-	-	1																		
Bank Height Ratio	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	0.9	-	-	-	1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Belt Width (ft)																																				
Radius of Curvature (ft)																																				
Rc: Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg Length (ft)	573																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)																																				
Bankfull Slope (ft/ft)																																				
Ri% / Ru% / P% / G% / S%																																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - Shadrick Creek Reach 3 (1,104 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	26.9	29.0	29.0	31.1	2.9	2	26.9	29.8	29.8	32.7	4.2	2	26.9	30.6	30.6	34.4	5.3	2																		
Floodprone Width (ft)	116.0	116.0	116.0	116.0	0.0	2	116.0	116.0	116.0	116.0	0.0	2	116.0	116.0	116.0	116.0	0.0	2																		
Bankfull Mean Depth (ft)	2.2	2.2	2.2	2.3	0.0	2	2.1	2.2	2.2	2.3	0.1	2	2.0	2.1	2.1	2.3	0.2	2																		
Bankfull Max Depth (ft)	3.5	3.5	3.5	3.5	0.0	2	3.5	3.6	3.6	3.6	0.1	2	3.6	3.6	3.6	3.6	0.0	2																		
Bankfull Cross-Sectional Area (ft^2)	61.0	64.8	64.8	68.6	5.4	2	61.0	64.8	64.8	68.6	5.4	2	61.0	64.8	64.8	68.6	5.4	2																		
Width/Depth Ratio	11.9	13.0	13.0	14.1	1.6	2	11.8	13.7	13.7	15.6	2.7	2	11.8	14.5	14.5	17.2	3.8	2																		
Entrenchment Ratio	3.7	4.0	4.0	4.3	0.4	2	3.5	3.9	3.9	4.3	0.5	2	3.4	3.8	3.8	4.3	0.7	2																		
Bank Height Ratio	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2																		
Profile																																				
Riffle Length (ft)	32.0	69.7	67.8	121.6	34.8	7	22.7	62.4	62.7	113.2	36.5	7	28.4	73.4	72.3	105.2	29.3	7																		
Riffle Slope (ft/ft)	0.004	0.007	0.008	0.011	0.002	7	0.004	0.008	0.007	0.013	0.004	7	0.003	0.007	0.006	0.012	0.003	7																		
Pool Length (ft)	13.8	42.9	45.0	63.8	15.1	7	26.4	53.8	53.1	82.5	20.3	7	28.3	50.7	40.9	76.7	21.1	7																		
Pool Max Depth (ft)	4.3	4.8	4.5	5.5	0.5	7	4.5	4.9	5.0	5.4	0.3	7	4.8	5.1	5.1	5.5	0.3	7																		
Pool Spacing (ft)	87.4	145.2	141.1	196.3	40.1	6	76.2	147.5	134.5	212.3	53.0	6	101.3	147.3	141.0	202.0	39.1	6																		
Pattern																																				
Channel Belt Width (ft)	84.7	94.5	95.0	103.5	7.7	4																														
Radius of Curvature (ft)	61.6	67.0	66.8	72.9	4.8	4																														
Rc: Bankfull Width (ft/ft)	2.1	2.3	2.3	2.5	0.2	3																														
Meander Wavelength (ft)	202.5	250.1	248.2	301.6	51.7	4																														
Meander Width Ratio	2.1	2.3	2.3	2.5	0.2	4																														
Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4																							
Channel Thalweg Length (ft)	1,104						1,093																													
Sinuosity (ft)	1.19						1.18																													
Water Surface Slope (Channel) (ft/ft)	0.0043						0.0045						0.0042																							
Bankfull Slope (ft/ft)	0.0055						0.0043						0.0046																							
Ri% / Ru% / P% / G% / S%	48%	12%	30%	11%	0%		42%	12%	37%	8%	0%		50%	12%	34%	4%	0%																			

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - UT1 (1,651 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	5.0	5.7	5.7	6.3	0.9	2	5.6	6.1	6.1	6.7	0.8	2	5.5	5.9	5.9	6.3	0.5	2																		
Floodprone Width (ft)	24.0	24.0	24.0	24.0	0.0	2	24.0	24.0	24.0	24.0	0.0	2	24.0	24.0	24.0	24.0	0.0	2																		
Bankfull Mean Depth (ft)	0.7	0.7	0.7	0.8	0.1	2	0.6	0.7	0.7	0.7	0.0	2	0.7	0.7	0.7	0.7	0.0	2																		
Bankfull Max Depth (ft)	1.1	1.2	1.2	1.3	0.1	2	1.1	1.3	1.3	1.4	0.3	2	1.2	1.3	1.3	1.3	0.1	2																		
Bankfull Cross-Sectional Area (ft^2)	3.9	4.1	4.1	4.3	0.3	2	3.9	4.1	4.1	4.3	0.3	2	3.9	4.1	4.1	4.3	0.3	2																		
Width/Depth Ratio	6.5	7.9	7.9	9.4	2.0	2	7.9	9.1	9.1	10.4	1.8	2	7.9	8.5	8.5	9.1	0.8	2																		
Entrenchment Ratio	3.8	4.3	4.3	4.8	0.7	2	3.6	3.9	3.9	4.3	0.5	2	3.8	4.1	4.1	4.3	0.4	2																		
Bank Height Ratio	1.0	1.0	1.0	1.0	0.0	2	1.0	1.0	1.0	1.0	0.0	2	0.9	0.9	0.9	1.0	0.0	2																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Belt Width (ft)																																				
Radius of Curvature (ft)																																				
Rc: Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg Length (ft)	1,651																																			
Sinuosity (ft)	1.14																																			
Water Surface Slope (Channel) (ft/ft)																																				
Bankfull Slope (ft/ft)																																				
Ri% / Ru% / P% / G% / S%																																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - UT9 Reach 1 (706 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	-	9.5	-	-	-	1	-	9.2	-	-	-	1	-	9.7	-	-	-	1																		
Floodprone Width (ft)	-	24.0	-	-	-	1	-	24.0	-	-	-	1	-	24	-	-	-	1																		
Bankfull Mean Depth (ft)	-	0.5	-	-	-	1	-	0.5	-	-	-	1	-	0.5	-	-	-	1																		
Bankfull Max Depth (ft)	-	1.1	-	-	-	1	-	1.3	-	-	-	1	-	1.5	-	-	-	1																		
Bankfull Cross-Sectional Area (ft^2)	-	4.8	-	-	-	1	-	4.8	-	-	-	1	-	4.8	-	-	-	1																		
Width/Depth Ratio	-	18.7	-	-	-	1	-	17.6	-	-	-	1	-	19.5	-	-	-	1																		
Entrenchment Ratio	-	2.5	-	-	-	1	-	2.6	-	-	-	1	-	2.5	-	-	-	1																		
Bank Height Ratio	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	0.8	-	-	-	1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Belt Width (ft)																																				
Radius of Curvature (ft)																																				
Rc: Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg Length (ft)	706																																			
Sinuosity (ft)	1.08																																			
Water Surface Slope (Channel) (ft/ft)																																				
Bankfull Slope (ft/ft)																																				
Ri% / Ru% / P% / G% / S%																																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - UT9 Reach 2 (238 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	-	8.3	-	-	-	1	-	7.7	-	-	-	1	-	8.0	-	-	-	1																		
Floodprone Width (ft)	-	24.0	-	-	-	1	-	24.0	-	-	-	1	-	24.0	-	-	-	1																		
Bankfull Mean Depth (ft)	-	0.4	-	-	-	1	-	0.5	-	-	-	1	-	0.5	-	-	-	1																		
Bankfull Max Depth (ft)	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	1.0	-	-	-	1																		
Bankfull Cross-Sectional Area (ft^2)	-	3.6	-	-	-	1	-	3.6	-	-	-	1	-	3.6	-	-	-	1																		
Width/Depth Ratio	-	19.0	-	-	-	1	-	16.2	-	-	-	1	-	17.6	-	-	-	1																		
Entrenchment Ratio	-	2.9	-	-	-	1	-	3.1	-	-	-	1	-	3.0	-	-	-	1																		
Bank Height Ratio	-	1.0	-	-	-	1	-	1.0	-	-	-	1	-	0.9	-	-	-	1																		
Profile																																				
Riffle Length (ft)	23.3	29.0	27.3	38.4	6.7	4	18.8	24.6	24.3	31.0	5.0	4	21.1	25.6	26.7	33.4	5.7	4																		
Riffle Slope (ft/ft)	0.016	0.022	0.020	0.033	0.008	4	0.014	0.022	0.021	0.030	0.007	4	0.015	0.022	0.020	0.032	0.007	4																		
Pool Length (ft)	5.6	10.2	11.2	12.6	3.1	4	7.1	12.2	11.1	19.3	5.3	4	6.4	11.2	11.2	16.0	4.2	4																		
Pool Max Depth (ft)	1.0	1.5	1.5	1.7	0.3	4	1.1	1.4	1.4	1.8	0.3	4	1.1	1.4	1.5	1.8	0.3	4																		
Pool Spacing (ft)	40.4	47.7	46.4	56.4	8.1	3	38.7	44.9	45.3	50.6	6.0	3	39.5	46.3	45.8	53.5	7.0	3																		
Pattern																																				
Channel Belt Width (ft)	24.5	30.0	29.0	36.6	6.1	3																														
Radius of Curvature (ft)	13.3	15.2	15.4	16.9	1.8	3																														
Rc: Bankfull Width (ft/ft)	2.1	2.3	2.3	2.5	0.2	3																														
Meander Wavelength (ft)	63.7	78.5	79.3	92.5	14.4	3																														
Meander Width Ratio	3.1	3.8	3.6	4.6	0.8	3																														
Additional Reach Parameters																																				
Rosgen Classification	C5						C5						C5																							
Channel Thalweg Length (ft)	238						240						239																							
Sinuosity (ft)	1.20						1.20						1.20																							
Water Surface Slope (Channel) (ft/ft)	0.0168						0.0171						0.0159																							
Bankfull Slope (ft/ft)	0.0182						0.0166						0.0173																							
Ri% / Ru% / P% / G% / S%	60%	13%	21%	6%	0%		51%	15%	25%	9%	0%		55%	14%	8%	0%																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Table 11b Cont'd. Monitoring Data - Stream Reach Data Summary
Shadrick Creek - UT10 (404 feet)

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 4						MY - 5					
Dimension & Substrate - Riffle	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	-	7.3	-	-	-	1	-	8.7	-	-	-	1	-	8.4	-	-	-	1																		
Floodprone Width (ft)	-	24.0	-	-	-	1	-	24.0	-	-	-	1	-	24	-	-	-	1																		
Bankfull Mean Depth (ft)	-	0.5	-	-	-	1	-	0.4	-	-	-	1	-	0.4	-	-	-	1																		
Bankfull Max Depth (ft)	-	1.1	-	-	-	1	-	1.1	-	-	-	1	-	1.0	-	-	-	1																		
Bankfull Cross-Sectional Area (ft^2)	-	3.4	-	-	-	1	-	3.4	-	-	-	1	-	3.4	-	-	-	1																		
Width/Depth Ratio	-	15.6	-	-	-	1	-	22.3	-	-	-	1	-	20.8	-	-	-	1																		
Entrenchment Ratio	-	3.3	-	-	-	1	-	2.8	-	-	-	1	-	2.9	-	-	-	1																		
Bank Height Ratio	-	1.0	-	-	-	1	-	0.9	-	-	-	1	-	0.7	-	-	-	1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max Depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Belt Width (ft)																																				
Radius of Curvature (ft)																																				
Rc: Bankfull Width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg Length (ft)	404																																			
Sinuosity (ft)	1.03																																			
Water Surface Slope (Channel) (ft/ft)																																				
Bankfull Slope (ft/ft)																																				
Ri% / Ru% / P% / G% / S%																																				

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

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Appendix E
Hydrologic Data

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Table 12. Verification of Bankfull Events Shadrick Creek Restoration Project				
Shadrick Reach 1				
Date of Data Collection	**Date of Occurrence**	**Method**	**Feet Above Bankfull Elevation**	**Photo # (if available)**
6/5/2018	Unknown[2]	Crest Gauge	0.05	n/a
11/8/2018	Unknown[3]	Wrack Lines	Unknown	n/a
4/24/2019	Unknown[1]	Crest Gauge	0.4	1
4/24/2019	Unknown[1]	Wrack Lines	Unknown	2
Shadrick Reach 3				
Date of Data Collection	**Date of Occurrence**	**Method**	**Feet Above Bankfull Elevation**	**Photo # (if available)**
2/5/2018	Unknown[4]	Wrack Lines	Unknown	n/a
11/8/2018	Unknown[3]	Crest Gauge	0.6	n/a
4/24/2019	Unknown[1]	Wrack Lines	Unknown	3
4/24/2019	Unknown[1]	Crest Gauge	0.4	4

[1] Suspected date is 4/17/2019

[2] Suspected date is 5/18/2018

[3] Suspected date is 10/18/2018

[4] Suspected date is 1/12/2018

Photo Verification of Bankfull Events

Photo #1 – Shadrick Creek Reach 1 Crest Gauge at 1.2 feet (Recorded bankfull 1.2 feet)

Photo #2 – Shadrick Creek Reach 1 STA 116+00 Wrack Lines

Photo #3 – Shadrick Creek Reach 3 STA 115+50 Wrack Lines

Photo #4 – Shadrick Creek Reach 3 Crest Gauge at 2.05 feet (Recorded bankfull 1.6 feet)

Figure 3. Daily Precipitation Totals for the Shadrick Creek Restoration Site

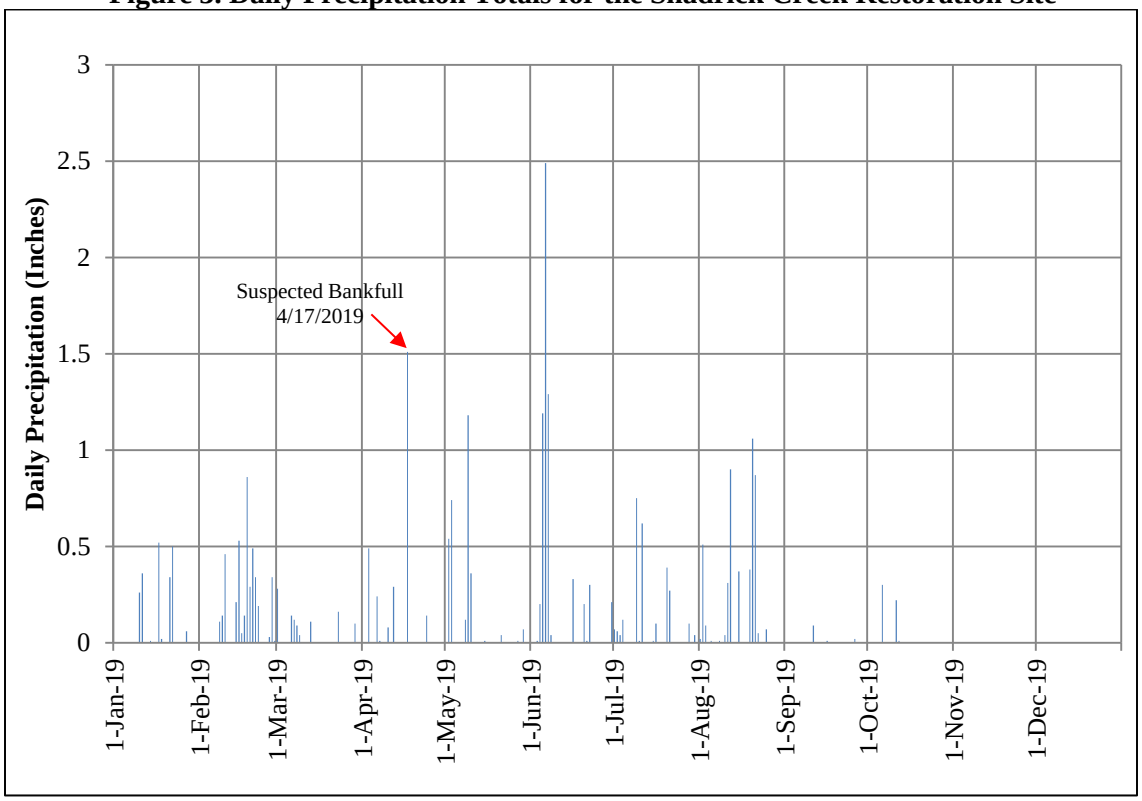
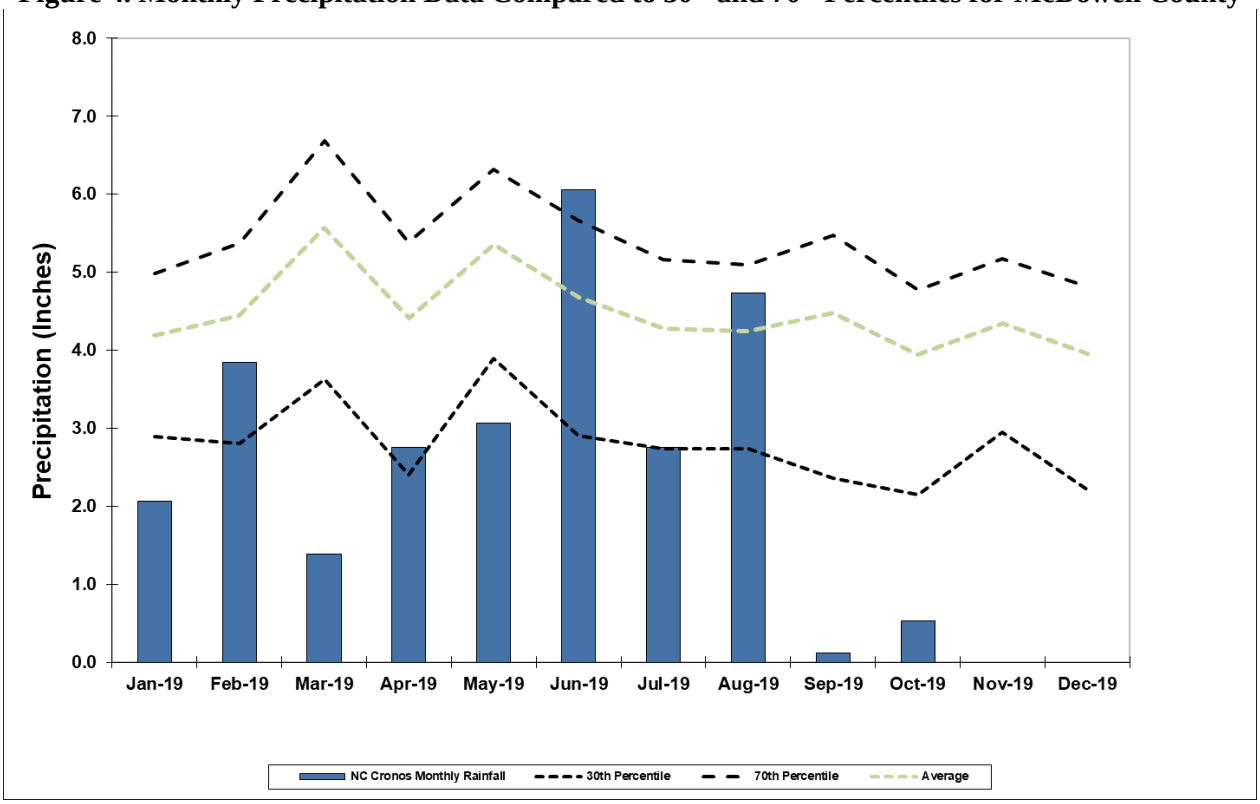


Figure 4. Monthly Precipitation Data Compared to 30th and 70th Percentiles for McDowell County



Appendix F
Invasive vegetation management

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SHADRICK CREEK MITIGATION PROJECT - #D16020i - HERBICIDE LOG, INVOICE #2016-2021 #4

Date	Start / End Time	Certified Applicator	Areas	Target Species	Type	Herbicide	Solution (%)	Volume Herbicide Concentrate Used* (oz)	Volume Mixture Used (gal)	Weather	Temp (°F)	Wind Speed (mph)	Notes
3/4/2019	12:00-3:00pm	026-29539	UT1, UT-2, Mainstem Reach1, UT-9, UT-10 (partial)	ROMU, LISI, LOJA	Foliar	Triclopyr 3 (amine) in water + CideKick adjuvant	25	16	0.5	sunny, warm	86	0	Cut stump treatment of ROMU, LISI, PUMO, LOJA;
6/5/2019	10:00 - 4:00	026-29539	UT1, UT-2, Mainstem Reach1, UT-9, UT-10 (partial)	ROMU, LISI, LOJA	Foliar	Triclopyr 3 (amine) in water + CideKick adjuvant	5	67	10.5	sunny, warm	86	0	Cut stem application to climbing honeysuckle, kudzu vines and pop-ups of privet and rose (not much rose); privet localized around mature trees left during construction.
7/9/2019	10:00 - 4:00	026-29539	UT-10, UT-4, UT-5	PUMO	Foliar	Clopyralid 3 in water plus CideKick adjuvant	0.07	15	15	sunny, mild	82	1-2	Cut/paint vines, spray ground infestations
7/9/2019	10:00 - 4:00	026-29539	UT-1, Mainstem Reach 1, UT-9/10	ROMU, LISI, LOJA	Foliar	Triclopyr 3 (amine) in water + CideKick adjuvant	5	35	6	sunny, hot, exposed	86	0	Foliar treatment of LOJA, LISI, ROMU incidental to walk through;
10/4/2019	10:00-2:00	026-29539	UT-9, UT-10, UT-4; approach area (barn)	PUMO	Foliar	Clopyralid 3 in water plus CideKick adjuvant	0.07	7	7	overcast	80	0	Treat remnant kudzu;
10/16/2019	10:00-2:00	026-29539	UT-1, UT-9, UT-10, UT-4	ROMU, LISI, LOJA	Foliar	Triclopyr 3 (amine) in water + CideKick adjuvant	5	55	9.5	sunny	75	0	Treatment of resproiuts; nominal amount of cut stem used to treat several large olive missed in year 1;