FINAL

ANNUAL MONITORING REPORT
YEAR 5 (2016)
UT TO BALD STREAM/WETLAND RESTORATION SITE
YANCEY COUNTY, NORTH CAROLINA
(DMS Project No. 92596, Contract No. 4997)
Construction Completed December 2011

Submitted to:
North Carolina Department of Environmental Quality
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Axiom Environmental, Inc.
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Raleigh, North Carolina 27603

Axiom Environmental, Inc.

December 2016

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Appendices

1.0 EXECUTIVE SUMMARY

The UT to Bald Creek Stream and Wetland Restoration Site (hereafter referred to as the "Site") is situated within the US Geological Survey (USGS) hydrologic unit 06010108 of the French Broad River Basin and NC Division of Water Resources (NCDWR) Priority Sub-basin 04-03-07. The Site is located in Yancey County, approximately eight miles west of the City of Burnsville, North Carolina. The Site is encompassed within a 12.74-acre easement located on two tracts of property. Tract one is owned by Henry and Elizabeth Turner and tract two is owned by Charles Young Jr. and Deana Blanchard. The Site is comprised of five headwater tributaries originating from Mountain seeps and springs, and five adjacent streamside wetlands (Figure 2, Appendix B). Prior to construction, upper reaches of the Site were forested and relatively stable. Downstream reaches were impacted by agricultural activities with minimal riparian buffer. This report (compiled based on the North Carolina Ecosystem Enhancement Program (NCEEP) *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for Year 5 (2016) monitoring.

The project goals (from the approved *Unnamed Tributaries to Bald Creek Stream Restoration Project, Final Restoration Plan* [NCEEP 2009]) include the following.

- Reduce erosion within the Site
- Restore a channel capable of transporting watershed flows and sediment loads efficiently
- Improve wetland and stream aquatic habitat
- Enhance wildlife habitat
- Improve overall water quality

These goals will be accomplished through the implementation of the following objectives.

- Exclude livestock from the stream in order to
    - Reduce direct inputs of nutrients and fecal coliform bacteria into the stream
    - Eliminate stress on streambanks caused by hoof shear
- Plant a native riparian buffer in order to
    - Provide woody root mass to stabilize the streambanks
    - Filter sediment and nutrient pollutants from agricultural fields and prevent them from entering the stream
    - Provide shade to the stream channel as a means of reducing water temperatures
    - Provide a source for woody debris and leaf litter that will enhance aquatic habitat
- Enhance existing wetlands by excluding livestock, managing invasive species, and planting native wetland vegetation
- Restore Site streams to a proper bankfull dimension and stabilize steep and eroding streambanks
- Provide Site streams with adequate flood-prone area
- Repair headcuts and establish a more diverse bed morphology with riffle-pool sequences supported by in-stream structures
- Restore an impounded reach of stream by removing a small dam and culvert
- Create protected riparian corridors for wildlife passage
- Preserve high-quality forested headwater streams in the steeper reaches of the Site

Vegetation success criteria (from the approved *Unnamed Tributaries to Bald Creek Stream Restoration Project, Final Restoration Plan* [NCEEP 2009]) is as follows.

> "Success criteria for the preferred species in restoration areas will be based on annual and cumulative survival and growth over five years. Survival of preferred species must be at a minimum of 320 stems-per-acre at the end of three years of monitoring and 260 stems-per-acre after five years."

Six vegetation monitoring plots were monitored on September 2016 for monitoring Year 5 (2016). Overall, Site vegetation averaged 384 planted stems-per-acre (excluding livestakes) in Year 5 (2016), which exceeds the minimum stem count for success criteria of 260 stems-per-acre. Four of the six plots met or exceeded success criteria. Vegetation plots 4 and 5 were below success criteria with 243 planted stems-per-acre each, just one stem shy of success criteria. Low planted stem survival in vegetation plots 4 and 5 may be attributed to competition from herbaceous vegetation (primarily fescue [*Festuca* spp.] and tearthumb [*Polygonum sagitatum*]).

Thirteen vegetation areas of concern were identified on the site. Planted stem densities were moderate throughout the Site and are low in certain areas (VAC-1 to -4). Planted stems were generally hard to locate due to the thick fescue (*Festuca* spp.) in drier areas and had poor stem growth due to saturation and competition with sedges (*Carex* spp.), soft rush (*Juncus effusus*), and tearthumb (*Polygonum sagitatum)* in wetter areas. Multiflora rose (*Rosa multiflora*) was observed scattered throughout the site, however seven small patches of very dense multiflora rose (*Rosa multiflora*) were identified during Year 5 (2016). A treatment was performed in October 2016 which greatly reduced the density of these populations, however, these patches still appear to be negatively affecting planted stem survivability. Additionally, two patches of dense white poplar (*Populus alba*) were identified on the Site. These areas of concern are summarized below and depicted on the attached Figure 2 (Appendix B).

Vegetation Areas of Concern

Map Identifier	Feature/Issue
VAC-1	Low stem density around Tributary 3
VAC-2	Low stem density on the right bank of the Mainstem in and around Veg Plot 5
VAC-3	Low stem density in and around Veg Plot 4
VAC-4	Low stem density on the right bank of Tributary 2 near an adjacent driveway
VAC-5 to -11	Multiflora rose
VAC-12 to -13	Dense white poplar

Stream success criteria (from the approved *Unnamed Tributaries to Bald Creek Stream Restoration Project, Final Restoration Plan* [NCEEP 2009]) is as follows.

> "Monitoring shall consist of the collection and analysis of stream stability and riparian vegetation survivability data to support the evaluation of the project in meeting established restoration objectives."

A visual assessment and geomorphic survey were completed for the Site. Site reaches are conforming to design criteria established in the *Unnamed Tributaries to Bald Creek Stream Restoration Project, Final Restoration Plan* (NCEEP 2009). No significant bank erosion was recorded and geomorphic measurements are within the range of proposed design parameters. Stream areas of concern include five areas of aggradation (SAC-1 to -5) were observed along the Mainstem, Tributary 2, Tributary 3, and Tributary 4. Several of these areas were documented previously and conditions continue to improve. During Year 3 (2014) monitoring, it was noted that the upper reaches of Tributary 3 and Tributary 4 have indiscernible bed and bank for varying lengths. These tributaries exhibit intermittent flow regimes, and low flow may be responsible for the lack of bed and bank characteristics in these reaches. These areas remained unchanged during Year 4 (2015) and Year 5 (2016) monitoring. The middle reach of the Mainstem, just below the pond, and the lower reach of Tributary 2 appear to be exhibiting aggradation of fine materials, possibly due to surface flows across the adjacent floodplain and extensive herbaceous vegetation growth within the channel bed combined with low energy flow in the channel. Additionally, a failed structure was observed in the downstream reach of Tributary 3, just before its confluence with the Mainstem. Several boulders from the bank of this long step-pool, fallout structure have fallen into the streambed. The structure appears relatively stable with herbaceous vegetation establishing on the dislodged boulders, however it is not yet completely stabilized. Stream areas of concern are summarized in the following table and are depicted on Figure 2 (Appendix B).

Stream Areas of Concern

Map Identifier	Feature/Issue
SAC-1 and -2	Aggradation on Mainstem
SAC-3	Aggradation on the lower portion of Tributary 2
SAC-4 and -5	Indiscernible bed and bank on the upper reaches of Tributaries 3 and 4
SAC-6	Failed rock structure on Tributary 3

The stream reach adjacent to cross-section 2 exhibited significant down cutting during years 3 (2014) and 4 (2015). During early summer 2016, a headcut was observed rapidly migrating upstream through this area creating significant incision below it, damaging a log structure. In October 2016, NCDMS performed stream repairs in order to repair the structure and return the streambed to its design elevation. This repair is depicted in the Cross Section 2 plot (Appendix D). A previously observed headcut and resulting incision in the lower portion of Tributary 2 was also repaired at that time. Some down cutting was also observed at cross-section 3 during year 5 (2016); however, this was the result of an isolated high-energy flow, and it does not pose any threat to stream stability or Site success.

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 tables and figures within this report's 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 the Restoration Plan) documents available on NCDMS's website. All raw data supporting the tables and figures in the appendices is available from NCDMS upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Six vegetation plots were established and marked during the Year 1 (2012) monitoring period. Plots were established by installing 4-foot, metal U-bar posts at the corners and a 10-foot, 0.75 inch PVC at the origin. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed in September 2016 for the Year 5 (2016) monitoring season using methods outlined in *CVS-EEP Protocol for Recording Vegetation, Levels 1-2 Plot Sampling Only,* Version 4.2 (Lee et al. 2008) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Southern and Mid-Atlantic States* (Weakley 2012).

2.2 Stream Assessment

Annual stream monitoring was conducted in April 2016. Measurements were taken using a Topcon GTS 303 total station and Recon data collector. The raw total station file was processed using Carlson Survey Software into a Computer Aided Design (CAD) file. Coordinates were exported as a text/ASCII file to Microsoft Excel for processing and presentation of data. Pebble counts were completed using the modified Wolman method (Rosgen 1993). One crest gauge (PVC with wooden staff gauge and cork filings) was installed in the lower, downstream third of the Site.

Six permanent cross-sections, three riffle and three pool, were established and will be used to evaluate stream dimension annually; locations are depicted on Figure 2 (Appendix B). Cross-sections are permanently monumented with 5-foot metal t-posts at each end point. Cross-sections will be surveyed to provide a detailed measurement of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, a pebble count was completed at cross-section 2 and photographs will be taken at each permanent cross-section location annually.

Six stream monitoring reaches were established and will be used to evaluate stream pattern and longitudinal profile; locations are depicted on Figure 2 (Appendix B). Measurement of channel pattern will include belt-width, meander length, and radius of curvature (only in year one). Subsequently, data will be used to calculate meander-width ratios. Longitudinal profile measurements will include average water surface slopes and facet slopes and pool-to-pool spacing. Twenty-two permanent photo points were established throughout the restoration reach (12 fixed photo points, 4 cross-section photo points, and 6 vegetation plot photo points); locations are depicted on Figure 2 (Appendix B) and are included in Appendix B. In addition, visual stream morphology stability assessments will be completed in four monitoring reaches annually to assess the channel bed, banks, and in-stream structures.

3.0 REFERENCES

Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS). 2015. Station NC-YN-7. Bald Creek 1.2 Mi NW (online). Available: http://www.cocorahs.org/ViewData/StationPrecipSummary.aspx [October 19, 2015]. CoCoRaHS.

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Rosgen. 1993. Applied Fluvial Geomorphology, Training Manual. River Short Course, Wildland Hydrology, Pagosa Springs, CO.

Weakley, Alan S. 2012. Flora of the Southern and Mid-Atlantic States. Available online at: http://www.herbarium.unc.edu/WeakleysFlora.pdf [September 28, 2012]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weather Underground. 2015. Station at Asheville Airport, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KAVL/2014/1/1/CustomHistory.html?dayend=31&monthend=12&yearend=2014&req_city=NA&req_state=NA&req_statename=NA [February 18, 2015]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

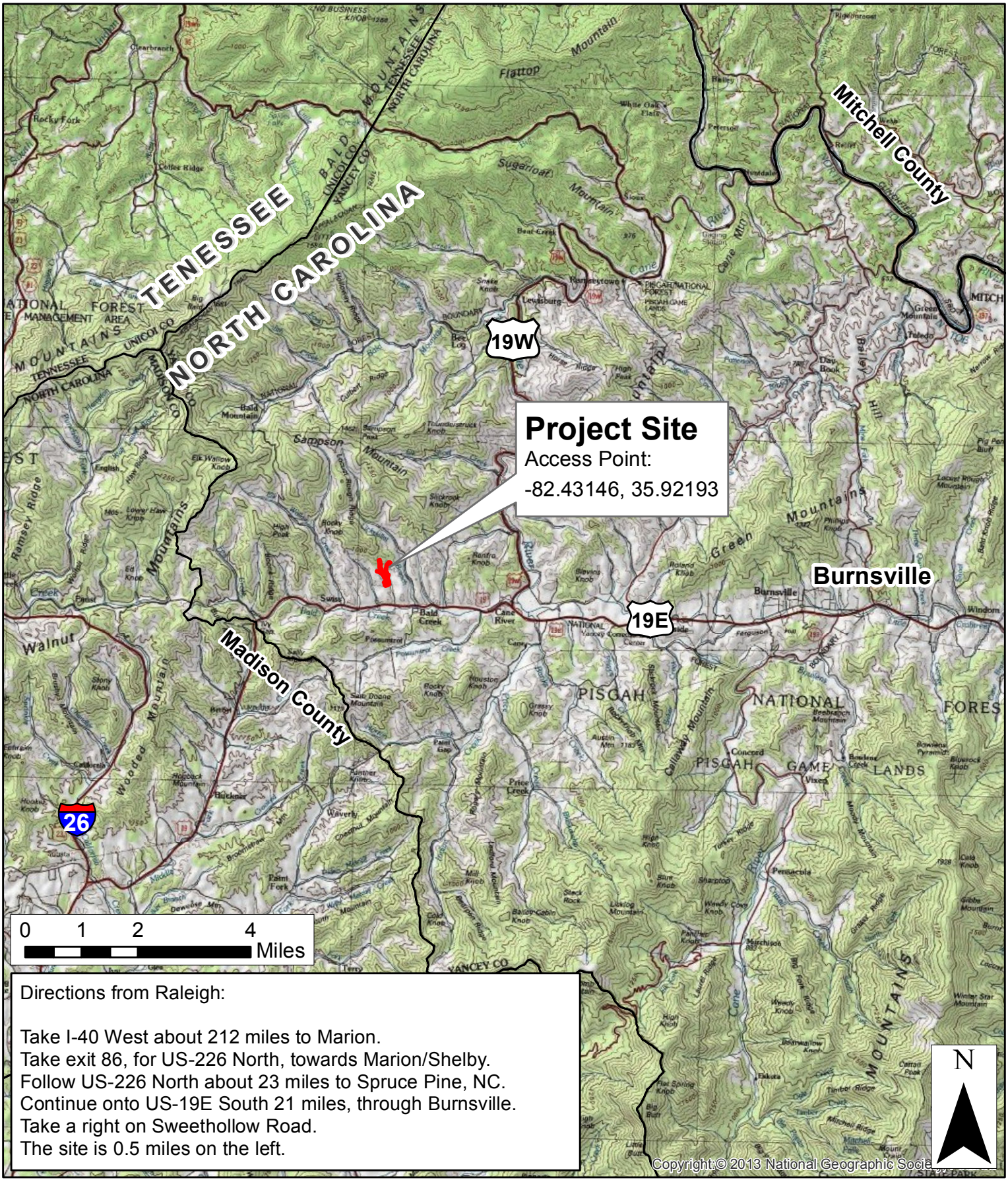
Figure 1. Site Location Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Directions from Raleigh:

Take I-40 West about 212 miles to Marion.
Take exit 86, for US-226 North, towards Marion/Shelby.
Follow US-226 North about 23 miles to Spruce Pine, NC.
Continue onto US-19E South 21 miles, through Burnsville.
Take a right on Sweethollow Road.
The site is 0.5 miles on the left.

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SITE LOCATION MAP
UT TO BALD STREAM RESTORATION
DMS PROJECT NUMBER 92596
Yancey County, North Carolina

Dwn. by. KRJ	FIGURE
Date: October 2015	1
Project: 12-004.15	

Table 1. Project Components and Mitigation Credits
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Mitigation Credits							
	Stream		Riparian Wetland		Buffer		
Type	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent			
Totals	2770	168	0	0.62	0		
Projects Components							
Project Component/ Reach ID	Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
Mainstem	10+00 – 18+39	800	P	Preservation	839	1:5	Headwater channels in mature hardwood forest.
Mainstem	18+39 – 20+50	250	R (P2)	Restoration	211	1:1	Removed earthen dam and small pond. Daylighted culverted stream segment, tied in stable upstream and downstream segments, and added grade control. Pulled channel off the left bank and graded bench, sloped back right bank, and enhanced profile with additional pool habitat.
Mainstem	20+50 – 22+15 (CMP 22+15 – 22+60) 22+60-24+81	378	EII	Enhancement Level II	386	1:2.5	Riparian plantings to culver under driveway and wetland plantings around pond.
Mainstem	24+81 – 25+00	71	NA	NA	19	NA	Sweet Hallow Road
Mainstem	25+00 – 26+00	NA	R (P1)	Restoration	100	1:1	New alignment on back side of dam/Sweet Hallow Road
Mainstem	26+00 – 30+72	522	EI (P1)	Enhancement Level I	472	1:1.5	Enhanced existing vegetated swale from base of dam to confluence with riparian plantings and livestock exclusion. Short reach of incised channel below headcut was graded back and stabilized. Log silles were placed at the top and bottom of incised reach and bottom of reach above confluence. Reach has one permanent vehicular ford crossing.

Table 1 (continued). Project Components and Mitigation Credits
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Mainstem	30+72 – 36+63	587	R (P1/P2)	Restoration	591	1:1	Constructed new B-type channel primarily on existing alignment. Raised channel invert to reconnect with historical floodplain from confluence to the stable cottonwood section, stabilized with rock cross vanes, and added forded stream crossing below cottonwoods. Transitioned to Priority 2 restoration below the crossing with a step-pool and constructed riffle. Restored dimension by excavating a bankfull bench on the right bank, restored profile with step-pool structures. This reach was limited to small meanders due to a naturally confined valley type.
Tributary 1	10+00 – 13+21	321	EII	Enhancement Level II	321	1:2.5	Invasive species removal and planting.
Tributary 1	13+21 – 14+60	220	R (P1)	Restoration	139	1:1	Installed step-pool structure to stabilized headcut and meet pond elevation. Multi-thread channel was graded and replaced with a single-thread channel. Log sills were added for grade control at the top.
Tributary 2	10+00 – 18+26	826	EII	Enhancement Level II	826	1:2.5	Invasive species treatment and planting
Tributary 2	18+26 – 19+49	123	R (P2)	Restoration	123	1:1	Installed step-pool system to stabilize a series of severe head-cuts. Pulled channel off of the steep left bank and tied in to culvert under Sweet Hallow Road.
Tributary 2	19+49 – 19+93	51	NA	NA	44	NA	Sweet Hollow Road
Tributary 2	19+93 – 24+43	450	EII	Enhancement Level II	450	1:2.5	Planted and installed grade control structures near the confluence with the Mainstem.
Tributary 3	10+00 – 12+17	217	EII	Enhancement Level II	217	1:2.5	Enhanced spring-fed swale for potential amphibian and reptile habitat. Removed invasive species, preserved existing trees on slope, and planted.
Tributary 3	12+17 -14+54	NA	R (P1)	Restoration	237	1:1	Constructed a new channel through pasture to reconnect Tributary 3 to the Mainstem and provide a stable conveyance for higher flows.
Tributary 4	10+00 – 14+35	428	EII	Enhancement Level II	435	1:2.5	Planted and excluded livestock. Installed grade control to stabilize tie-in at the confluence with the Mainstem. In addition, several log sills were installed for grade control and habitat enhancement.

Table 1 (continued). Project Components and Mitigation Credits
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Wetland 1		0.18		Enhancement	0.18	1:2	Planted wetland plants around pond fringe and littoral shelf, and riparian plants on left embankment of pond.
Wetland 1A		0.48		Enhancement	0.48	1:2	Removed invasive species and supplementally planted.
Wetland 3		0.2		Enhancement	0.2	1:2	Removed invasive species, excluded livestock, and supplementally planted.
Wetland 4		0.11		Enhancement	0.11	1:2	Removed invasive species, excluded livestock, and supplementally planted.
Wetland 5		0.26		Enhancement	0.26	1:2	Removed invasive species, excluded livestock, and supplementally planted.

Component Summation

Restoration Level	Stream (linear footage)	Riparian Wetland (acres)	Buffer (square footage)
Restoration	1401		
Enhancement (Level I)	472		
Enhancement (Level II)	2635		
Preservation	839		
Creation			
Wetland Enhancement		1.23	
Totals	**5347**	**1.23**	
Mitigation Units	**2938 SMUs**	**0.62 WMUs**	

Table 2. Project Activity and Reporting History
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Elapsed Time Since Grading Complete: 5 years 2 month
Elapsed Time Since Planting Complete: 4 years 11 months
Number of Reporting Year: 5

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan		June 2009
Final Design – Construction Plans		November 2010
Construction		September 2011
Temporary S&E mix applied to entire project area		December 2011
Permanent seed mix applied to entire project area		December 2011
Containerized and B&B plantings for entire reach		December 2011
As-built Construction Drawings		March 2012
Restoration Plan		June 2009
Final Design – Construction Plans		November 2010
Construction		September 2011
Year 1 Monitoring (2012)	December 2012	February 2013
Year 2 Monitoring (2013)	August 2013	November 2013
Year 3 Monitoring (2014)	February 2015*	March 2015
Year 4 Monitoring (2015)	October 2015	December 2015
Year 5 Monitoring (2016)	November 2016	December 2016

*Year 3 (2014) monitoring was performed in February 2015 due to site access restrictions during a landowner dispute.

Table 3. Project Contacts Table
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Designer	URS Corporation – North Carolina Morrisville, NC 919-461-1597
Construction, Planting, and Seeding Contractor	River Works, Inc. Cary, NC 919-459-9001-692-4633
Surveyor	Turner Land Surveying, PLLC 3201 Glenridge Drive Raleigh, NC 27604 David Turner 919-875-1378
Seed Mix Source	Unknown
Years 1-5 Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Baseline Information and Attributes
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Project Information					
Project Name	UT to Bald Creek Restoration Site				
Project County	Yancey				
Project Area (Acres)	12.74				
Project Coordinates (NAD83 2007)	807,670.33, 984,247.33				
Project Watershed Summary Information					
Physiographic Region	Blue Ridge				
Ecoregion	Southern Crystalline Ridges and Mountains				
Project River Basin	French Broad				
USGS 8-digit HUC	06010108				
USGS 14-digit HUC	06010108080020				
NCDWQ Subbasin	04-03-07				
Project Drainage Area (Sq. Mi.)	0.19				
Project Drainage Area Impervious Surface	<5%				
Watershed Type	85% wooded, 12% agriculture, 3% rural				
Reach Summary Information					
Parameters	**Mainstem**	**UT 1**	**UT 2**	**UT 3**	**UT 4**
Restored/Enhanced Length (Linear Feet)	2590	460	1392	454	435
Drainage Area (Square Miles)	0.19	0.03	0.06	0.01	0.01
NCDWQ Index Number	7-3-22				
NCDWQ Classification	C				
Valley Type/Morphological Description	II/B- and C-type				
Dominant Soil Series	Saunook and Thunder-Saunook Complex				
Drainage Class	Well drained				
Soil Hydric Status	Nonhydric				
Slope	0.050 – 0.160				
FEMA Classification	Not in a detailed FEMA flood zone				
Native Vegetation Community	100%				
Percent Composition of Exotic Invasives	< 5%				
Regulatory Considerations					
Regulation	**Applicable**				
Waters of the U.S. –Sections 404 and 401	Yes-Received Appropriate Permits				
Endangered Species Act	No effect				
Historic Preservation Act	No effect				
CZMA/CAMA	No				
FEMA Floodplain Compliance	Not in a detailed FEMA flood zone				
Essential Fisheries Habitat	No				

APPENDIX B

VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View

Tables 5.1-5.4. Visual Stream Morphology Stability Assessment Tables

Table 6. Vegetation Condition Assessment Table

Site Fixed-Station Photos

Vegetation Monitoring Photographs

N

Imagery Source: 2014 CGIA Orthoimagery

Mainstem
Tributary 1
Tributary 2
Tributary 3
Tributary 4
Wetland 1
Wetland 1A
Wetland 2
Wetland 3
Wetland 4
Wetland 5
XS-1
XS-2
XS-3
XS-4
XS-5
XS-6
SAC-1
SAC-2
SAC-3
SAC-4
SAC-5
SAC-6
VAC-1
VAC-2
VAC-3
VAC-4
VAC-5
VAC-6
VAC-7
VAC-8
VAC-9
VAC-10
VAC-11
VAC-12
VAC-13
10+00
15+00
20+00
25+00
30+00
14+00
24+00
11+00
35+00

Legend

- Easement Boundary
- Stream Restoration
- Stream Enhancement (level I)
- Stream Enhancement (level II)
- Stream Preservation
- Non-Credit Generating Stream
- In-Stream Structures
- Stream Stationing
- Crossings
- Stream Monitoring Reach
- Monitoring Cross Sections
- CVS Monitoring Plots
- Wetland Area
- Stream Area of Concern - Aggradation
- Vegetation Area of Concern - Multiflora Rose
- Vegetation Area of Concern - White Poplar
- Vegetation Area of Concern - Low Stem Density
- Crest Gauge
- Photo Points

0 125 250 500 750 Feet

NC OneMap, NC Center for Geographic Information and Analysis, NC 911 Board

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CURRENT CONDITIONS PLAN VIEW
UT TO BALD STREAM RESTORATION
DMS PROJECT NUMBER 92596
Yancey County, North Carolina

Dwn. by.	KRJ
Date:	Dec. 2016
Project:	12-004.15
FIGURE	2

Table 5.1 **Visual Stream Morphology Stability Assessment**
Reach ID **Main Tributary**
Assessed Length **1487**

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. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			2	375	75%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	10	14			71%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	10	18			56%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	14			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%			
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	10	10			100%			

Table 5.2 **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 2**
Assessed Length **460**

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. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	125	73%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	7	11			64%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	6	10			60%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	11	11			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. 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%. (See guidance for this table in EEP monitoring guidance document)	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 5.3 **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 3**
Assessed Length **317**

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. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	160	50%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	4	4			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	5	7			71%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	7	7			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		2. Thalweg centering at downstream of meander (Glide)	11	11			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	3			67%			
	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.	2	3			67%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	3			67%			
	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%			

Table 5.4 **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary 4**
Assessed Length **224**

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. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			1	50	78%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	2	5			40%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	2	5			40%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	5	5			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	5	5			100%			
		2. Thalweg centering at downstream of meander (Glide)	5	5			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. 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%. (See guidance for this table in EEP monitoring guidance document)	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%			

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **6.4**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	0.1 acres	NA	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY5 stem count criteria.	0.1 acres	Purple	5	0.47	7.3%
			Total	5	0.47	7.3%
3. Areas of Poor Growth Rates or Vigor	NA	0.25 acres	NA	0	0.00	0.0%
			Cumulative Total	5	0.47	7.3%

Easement Acreage[2] **14**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Dense multiflora rose and white poplar	1000 SF	Pink spotted and yellow polygons	9	0.16	1.1%
5. Easement Encroachment Areas[3]	NA	none	NA	0*	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particularly for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

*Two areas of prior encroachment are identified on Figure 2 (Appendix B), however these areas appear to have recovered and are no longer considered areas of concern.

UT to Bald Creek
Site Fixed-Station Photographs
Taken September 2016

UT to Bald Creek
Site Fixed-Station Photographs (continued)
Taken September 2016

UT To Bald
Vegetation Monitoring Photographs
Taken September 2016

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

Table 7. Vegetation Plot Criteria Attainment
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	67%
2	Yes	
3	Yes	
4	No	
5	No	
6	Yes	

Table 8. CVS Vegetation Plot Metadata
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Report Prepared By	Corri Faquin
Date Prepared	9/14/2016 15:25
database name	Axiom-UTBald-2016-A-v2.3.1.mdb
database location	S:\Business\Projects\12\12-004 EEP Monitoring\12-004.15 UT to Bald\2016\CVS
computer name	PHILLIP-PC
file size	47017984
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	92596
project Name	UT to Bald
River Basin	French Broad
length(ft)	
stream-to-edge width (ft)	
Required Plots (calculated)	
Sampled Plots	6

Table 9. Total and Planted Stems by Plot and Species
DMS Project Code 92596. Project Name: UT to Bald

			Current Plot Data (MY5 2016)																Annual Means											
			92596-01-0001			92596-01-0002			92596-01-0003			92596-01-0004			92596-01-0005			92596-01-0006			MY5 (2016)			MY4 (2015)			MY3 (2015)			MY2 (2013)			MY1 (2012)		
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	PnoLS	P-all	T
Acer saccharum	sugar maple	Tree																6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7
Alnus serrulata	hazel alder	Shrub									2	2	2	2				1	1	2	3	3	6	3	3	7	1	1	1	1	1	3			
Betula nigra	river birch	Tree																1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	10	10	10
Carpinus caroliniana	American hornbeam	Tree	3	3	3	2	2	2													5	5	5	5	5	5	6	6	6	7	7	7	7	7	7
Celtis laevigata	sugarberry	Tree	1	1	1																1	1	1	1	1	1	1	1	1	1	1	1			
Cornus amomum	silky dogwood	Shrub				1	4	4										4	4	4	5	8	8	5	8	10	5	8	8	5	8	8	4	7	7
Fraxinus pennsylvanica	green ash	Tree	1	1	1	3	3	3	2	2	2				1	1	1				7	7	7	7	7	7	7	7	7	6	6	6	3	3	3
Lindera benzoin	northern spicebush	Shrub													2	2	2	1	1	1	3	3	3	3	3	3	3	3	3	5	5	5	2	2	2
Liriodendron tulipifera	tuliptree	Tree						3												2			5			1									
Platanus occidentalis	American sycamore	Tree																3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	2	2	2
Quercus	oak	Tree																															1	1	1
Quercus michauxii	swamp chestnut oak	Tree				4	4	4	4	4	4	2	2	2							10	10	10	10	10	10	10	10	10	10	10	10	8	8	8
Quercus pagoda	cherrybark oak	Tree													1	1	1				1	1	1												
Quercus rubra	northern red oak	Tree													1	1	1				1	1	1	2	2	2	3	3	3	3	3	3	3	3	3
Robinia pseudoacacia	black locust	Tree																								3			2			1			1
Salix	willow	Shrub or Tree			11			10			1												22			13									2
Salix nigra	black willow	Tree																								6						9			6
Salix sericea	silky willow	Shrub																											26						
Ulmus	elm	Tree							2	2	2	1	1	1							3	3	3	3	3	3	4	4	4	4	4	4	6	6	6
Ulmus americana	American elm	Tree	4	4	4	1	1	1				1	1	1	1	1	1	1	1	1	8	8	8	9	9	9	9	9	9	8	8	8			
	Stem count		9	9	20	11	14	27	8	8	11	6	6	6	6	6	6	17	17	20	57	60	90	58	61	91	59	62	90	63	66	78	53	56	65
	size (ares)		1			1			1			1			1			1			6			6			6			6			6		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.15			0.15			0.15			0.15			0.15		
	Species count		4	4	5	5	5	7	3	3	5	4	4	4	5	5	5	7	7	8	14	14	16	13	13	17	13	13	15	13	13	15	11	11	14
	Stems per ACRE		364.2	364.2	809.4	445.2	566.6	1093	323.7	323.7	445.2	242.8	242.8	242.8	242.8	242.8	242.8	688	688	809.4	384.5	404.7	607	391.2	411.4	613.8	397.9	418.2	607	424.9	445.2	526.1	357.5	377.7	438.4

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

APPENDIX D

STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-b. Baseline Stream Data Summary

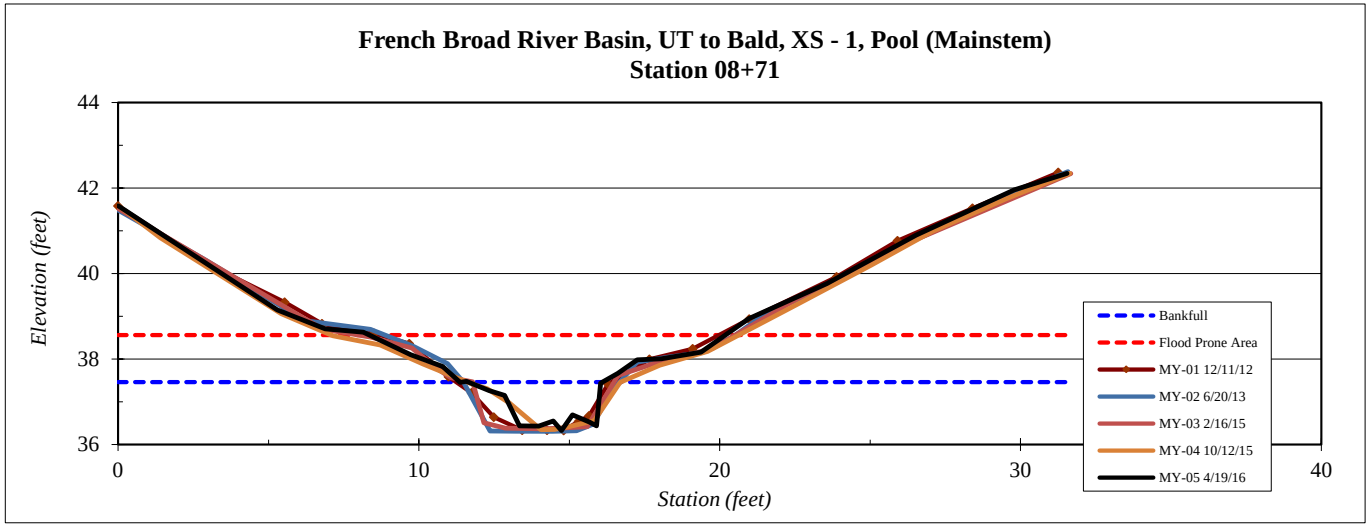
Tables 11a-b. Monitoring Data

River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 1, Pool (Mainstem)
Drainage Area (sq mi):	0.19
Date:	4/19/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	41.6
5.3	39.1
6.9	38.7
8.2	38.6
9.7	38.1
10.8	37.8
11.4	37.5
11.6	37.5
12.3	37.3
12.9	37.1
13.3	36.4
14.0	36.4
14.5	36.6
14.7	36.33
15.1	36.70
15.7	36.53
15.9	36.43
16.0	37.43
16.6	37.67
17.3	37.98
18.1	38.01
19.4	38.16
21.0	38.95
23.6	39.77
26.5	40.90
29.8	41.96
31.5	42.34

SUMMARY DATA	
Bankfull Elevation:	37.5
Bankfull Cross-Sectional Area:	3.1
Bankfull Width:	4.5
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	1.0

Stream Type	B/C

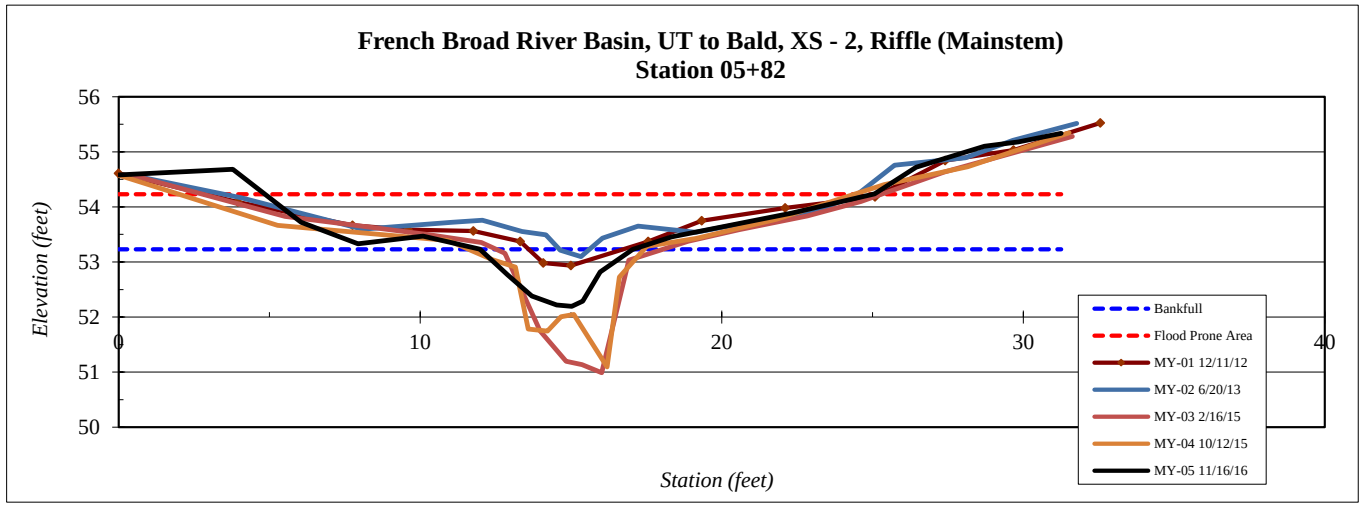


River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 2, Riffle (Mainstem)
Drainage Area (sq mi):	0.19
Date:	11/16/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	54.58
3.78	54.68
6.05	53.72
7.94	53.33
10.09	53.47
11.98	53.23
12.89	52.77
13.70	52.38
14.52	52.22
15.03	52.19
15.39	52.29
15.97	52.82
17.04	53.23
18.33	53.46
22.32	53.89
25.07	54.24
26.45	54.72
28.71	55.10
29.84	55.18
31.26	55.34

SUMMARY DATA	
Bankfull Elevation:	53.2
Bankfull Cross-Sectional Area:	3.0
Bankfull Width:	5.1
Flood Prone Area Elevation:	54.2
Flood Prone Width:	33.0
Max Depth at Bankfull:	1.0
Mean Depth at Bankfull:	0.6
W / D Ratio:	8.7
Entrenchment Ratio:	6.5
Bank Height Ratio:	1.0

Stream Type	B/C

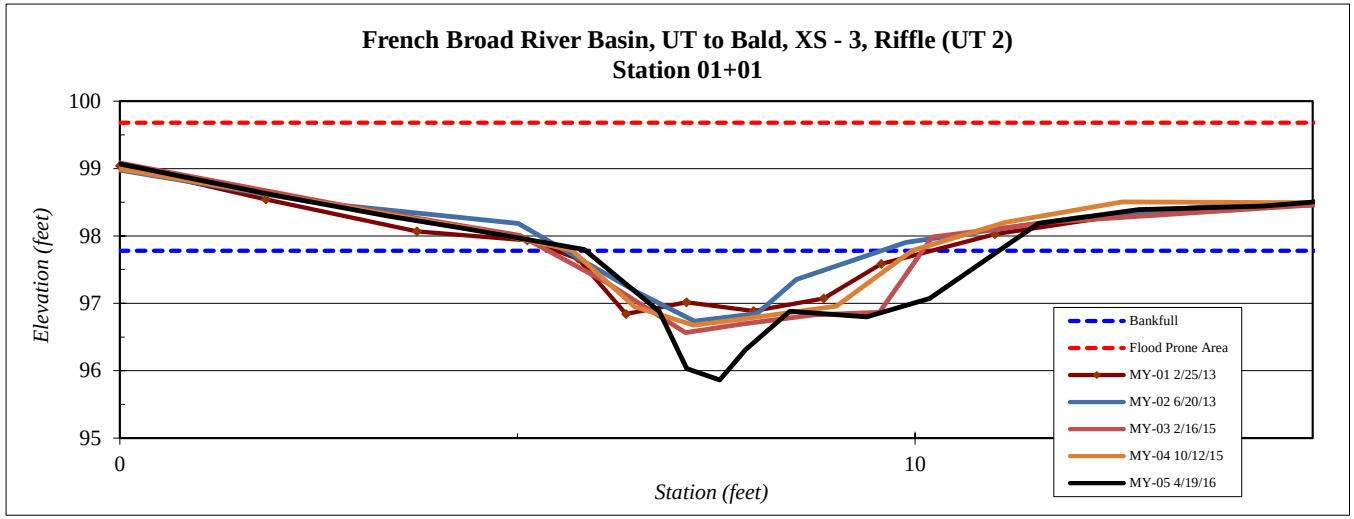


River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 3, Riffle (UT 2)
Drainage Area (sq mi):	0.06
Date:	4/19/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.00	99.07
1.80	98.64
3.35	98.30
4.36	98.10
5.84	97.80
6.78	96.88
7.13	96.03
7.55	95.86
7.87	96.31
8.43	96.88
9.39	96.80
10.18	97.07
11.55	98.19
12.81	98.39
14.38	98.44
15.4	98.54

SUMMARY DATA	
Bankfull Elevation:	97.8
Bankfull Cross-Sectional Area:	4.7
Bankfull Width:	5.2
Flood Prone Area Elevation:	99.7
Flood Prone Width:	16.0
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	0.9
W / D Ratio:	5.8
Entrenchment Ratio:	3.1
Bank Height Ratio:	1.0

Stream Type	B/C

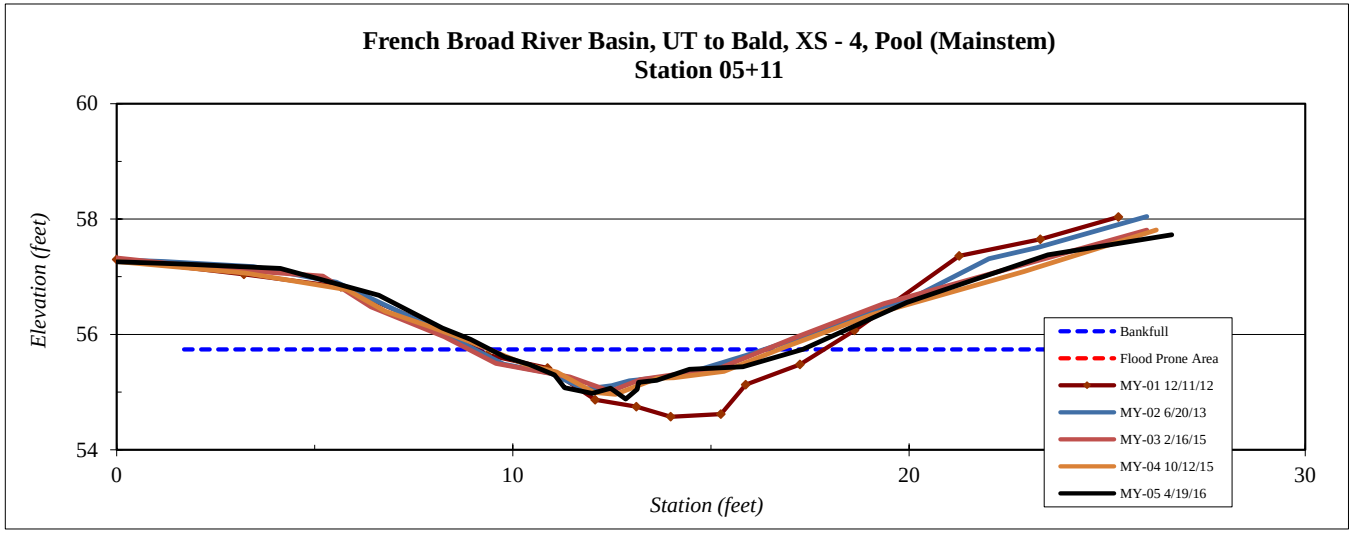


River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 4, Pool (Mainstem)
Drainage Area (sq mi):	0.04
Date:	4/19/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
26.6	57.7
23.5	57.4
19.9	56.6
17.3	55.7
15.8	55.4
14.5	55.4
13.6	55.2
13.2	55.2
13.1	55.1
12.8	54.9
12.5	55.1
12.0	55.0
11.3	55.1
11.1	55.30
10.4	55.48
9.8	55.61
8.9	55.92
8.2	56.11
6.6	56.68
4.1	57.14
1.7	57.22
0.0	57.26

SUMMARY DATA	
Bankfull Elevation:	55.7
Bankfull Cross-Sectional Area:	3.2
Bankfull Width:	7.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	1.0

Stream Type	B/C

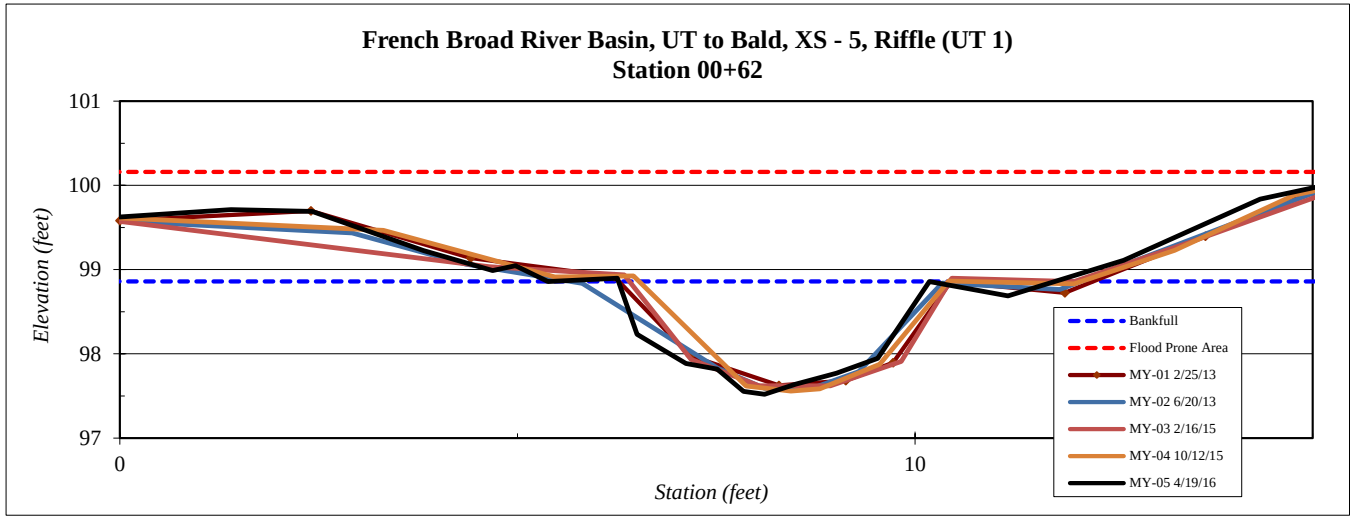


River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 5, Riffle (UT 1)
Drainage Area (sq mi):	0.025
Date:	4/19/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
-0.11	99.62
1.40	99.71
2.42	99.69
3.82	99.23
4.69	98.99
4.98	99.05
5.38	98.86
6.26	98.90
6.50	98.23
7.12	97.89
7.51	97.82
7.84	97.55
8.11	97.52
8.50	97.64
9.01	97.77
9.5	97.95
10.2	98.86
11.2	98.69
12.62	99.11
14.34	99.84
16.22	100.22
17.00	100.40

SUMMARY DATA	
Bankfull Elevation:	98.9
Bankfull Cross-Sectional Area:	3.6
Bankfull Width:	3.9
Flood Prone Area Elevation:	100.2
Flood Prone Width:	16.0
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	4.2
Entrenchment Ratio:	4.1
Bank Height Ratio:	1.0

Stream Type	B/C

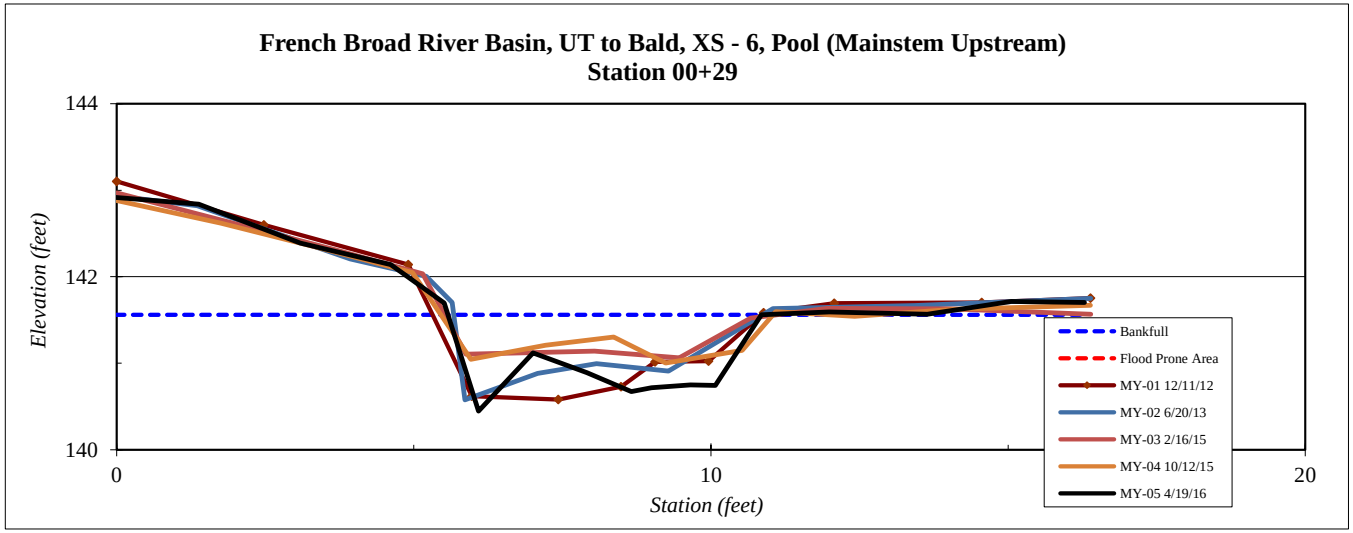


River Basin:	French Broad
Site Name	UT to Bald
XS ID	XS - 6, Pool (Mainstem Upstream)
Drainage Area (sq mi):	0.04
Date:	4/19/2016
Field Crew:	Perkinson, Jernigan

Station	Elevation
-0.3	142.9
1.4	142.8
3.1	142.4
4.6	142.1
5.5	141.7
6.1	140.4
7.0	141.1
7.9	140.9
8.7	140.7
9.0	140.7
9.7	140.8
10.1	140.7
10.8	141.6
12.0	141.59
13.6	141.57
15.1	141.71
16.3	141.70

SUMMARY DATA	
Bankfull Elevation:	141.6
Bankfull Cross-Sectional Area:	3.6
Bankfull Width:	5.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	1.0

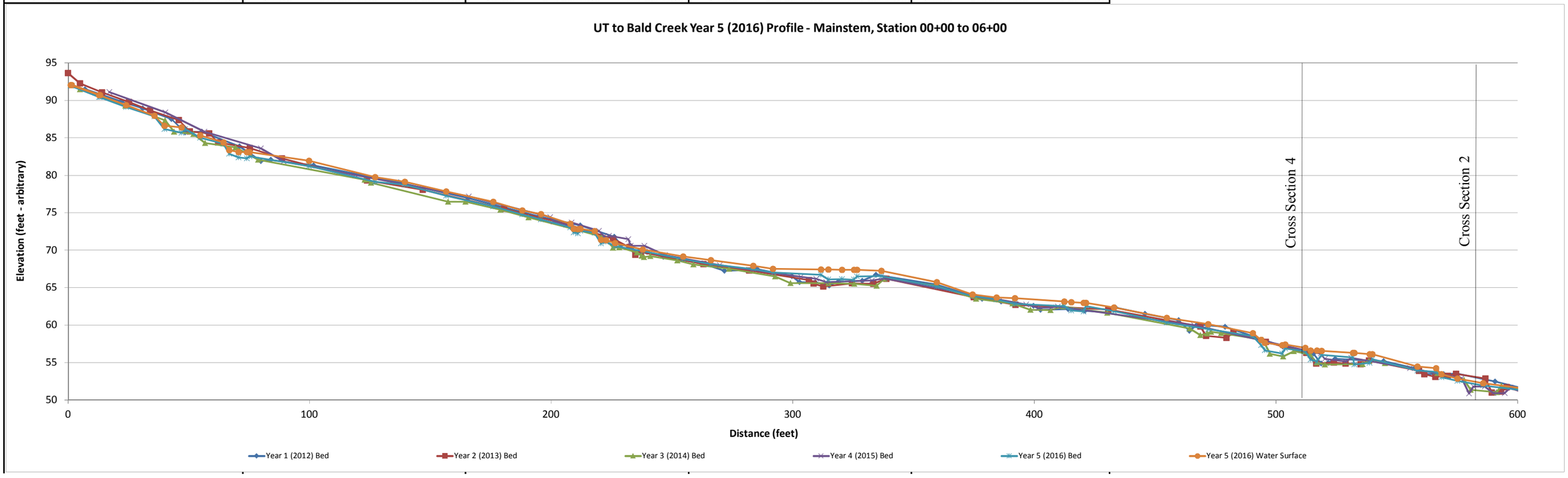
Stream Type	B/C



Project Name	UT to Bald Creek - Profile
Reach	Mainstem Station 00+00 - 06+00
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**

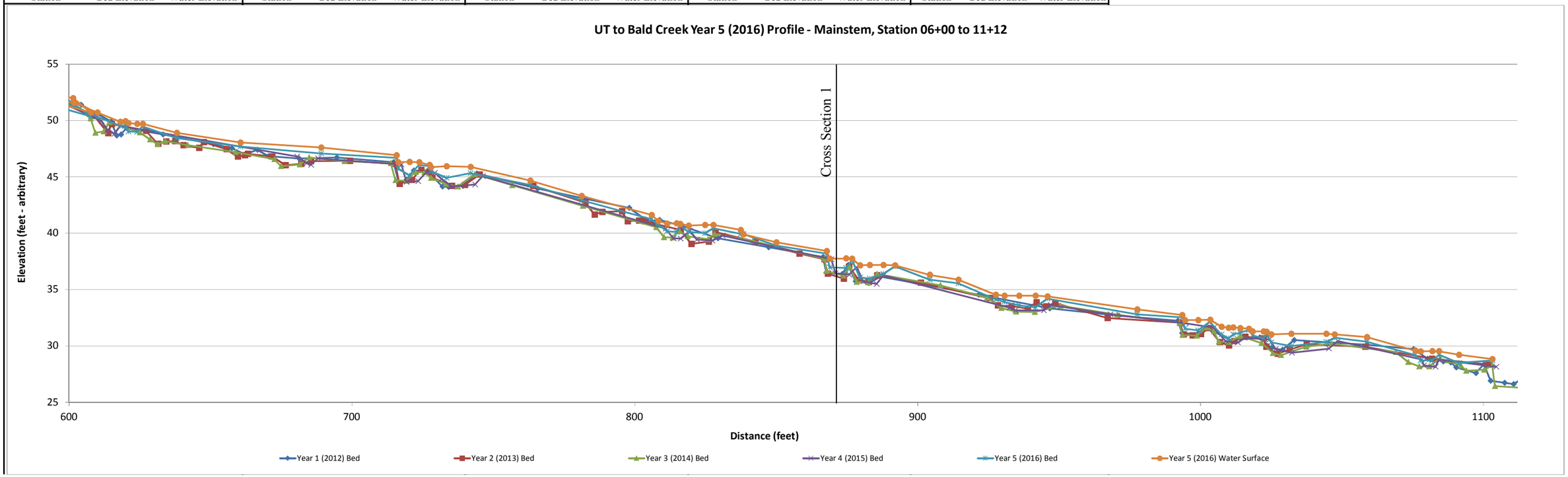
	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0558	0.0540	0.0556	0.0542	0.0554
Riffle Length	37	35	27	34	38
Avg. Riffle Slope	0.0509	0.0609	0.0715	0.0630	0.0574
Pool Length	13	12	17	11	10
Pool to Pool Spacing	40	38	38	44	45



Project Name	UT to Bald Creek - Profile
Reach	Mainstem Station 06+00 - 11+12
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0558	0.0540	0.0556	0.0542	0.0554
Riffle Length	37	35	27	34	38
Avg. Riffle Slope	0.0509	0.0609	0.0715	0.0630	0.0574
Pool Length	13	12	17	11	10
Pool to Pool Spacing	40	38	38	44	45

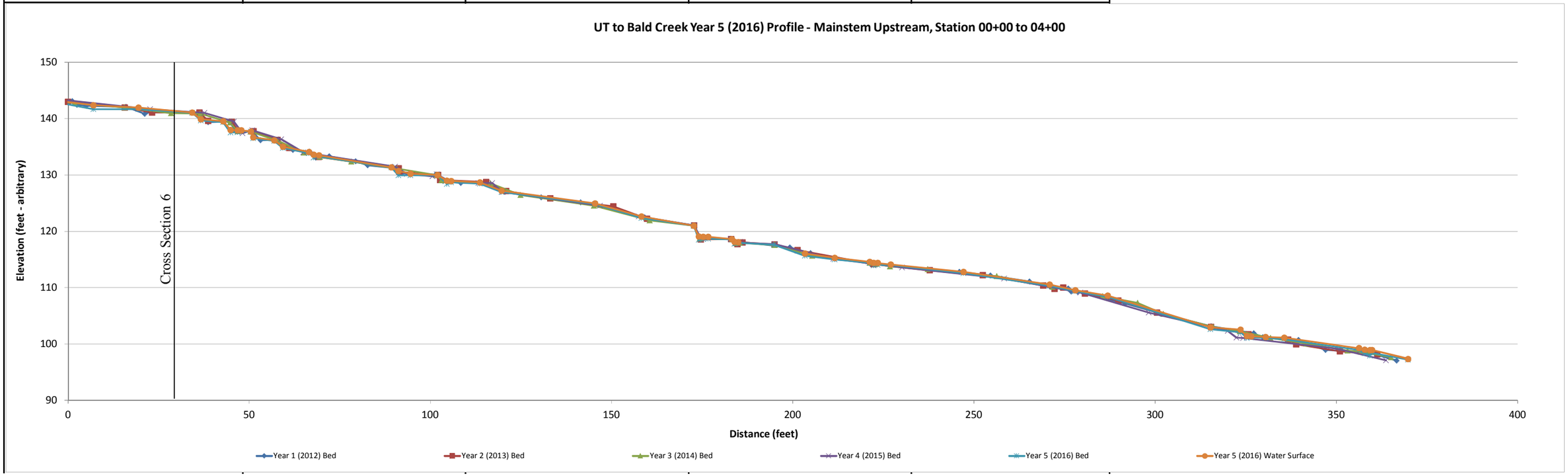
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**



Project Name	UT to Bald Creek - Profile
Reach	Mainstem Upstream Station 00+00 - 04+00
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.1301	0.1313	0.1315	0.1324	0.1290
Riffle Length	16	43	75	42	34
Avg. Riffle Slope	0.0750	0.0846	0.0953	0.0927	0.1050
Pool Length	5	2	6	4	4
Pool to Pool Spacing	14	46	102	59	36

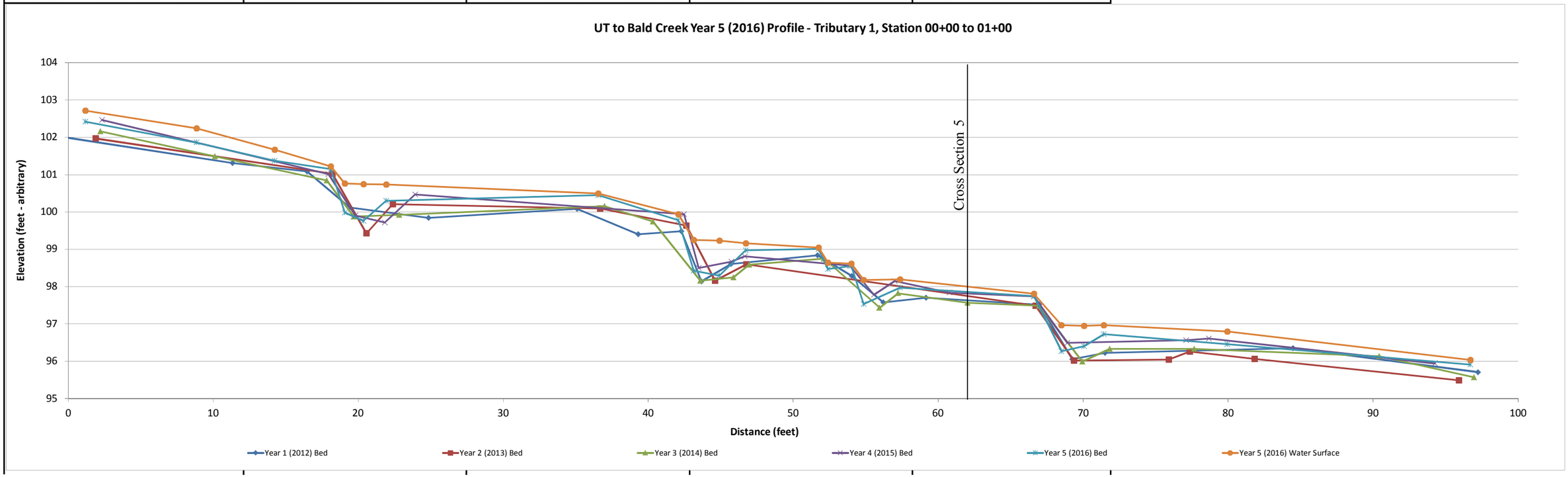
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**



Project Name	UT to Bald Creek - Profile
Reach	Tributary 1 Station 00+00 - 01+00
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0674	0.0782	0.0679	0.0766	0.0660
Riffle Length	7	19	14	13	15
Avg. Riffle Slope	0.0418	0.0777	0.0391	0.0631	0.0460
Pool Length	6	6	6	6	4
Pool to Pool Spacing	13	24	19	19	16

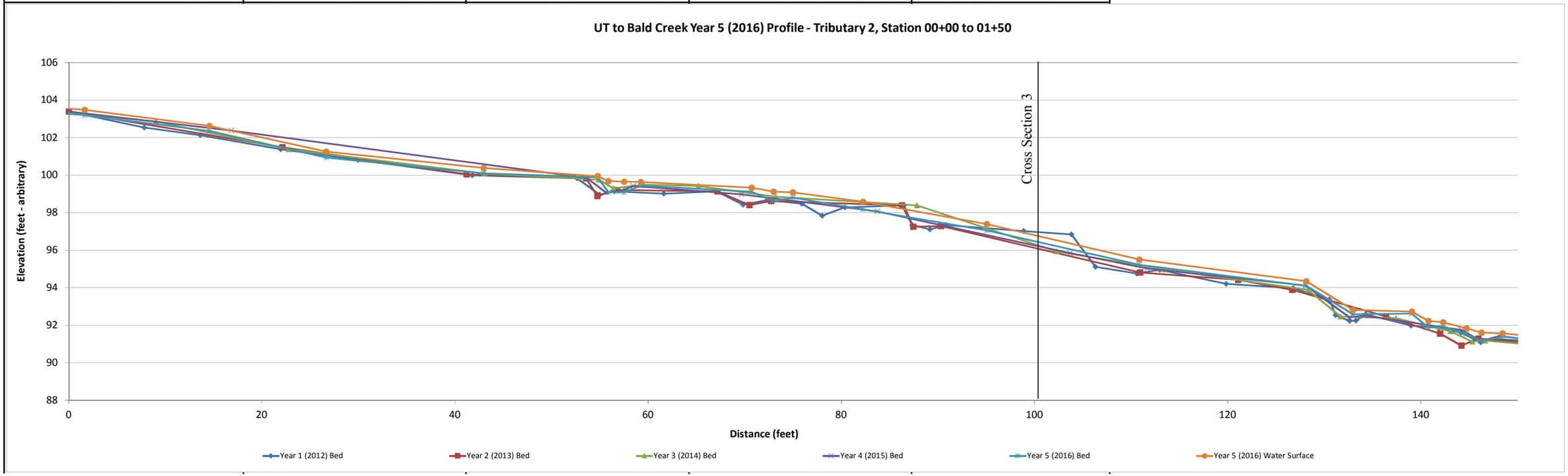
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**



Project Name	UT to Bald Creek - Profile
Reach	Tributary 2 Station 00+00 - 01+50
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0814	0.0844	0.0823	0.0881	0.0865
Riffle Length	10	32	49	39	26
Avg. Riffle Slope	0.0542	0.0611	0.0693	0.0751	0.0745
Pool Length	4	4	4	5	4
Pool to Pool Spacing	15	29	51	39	24

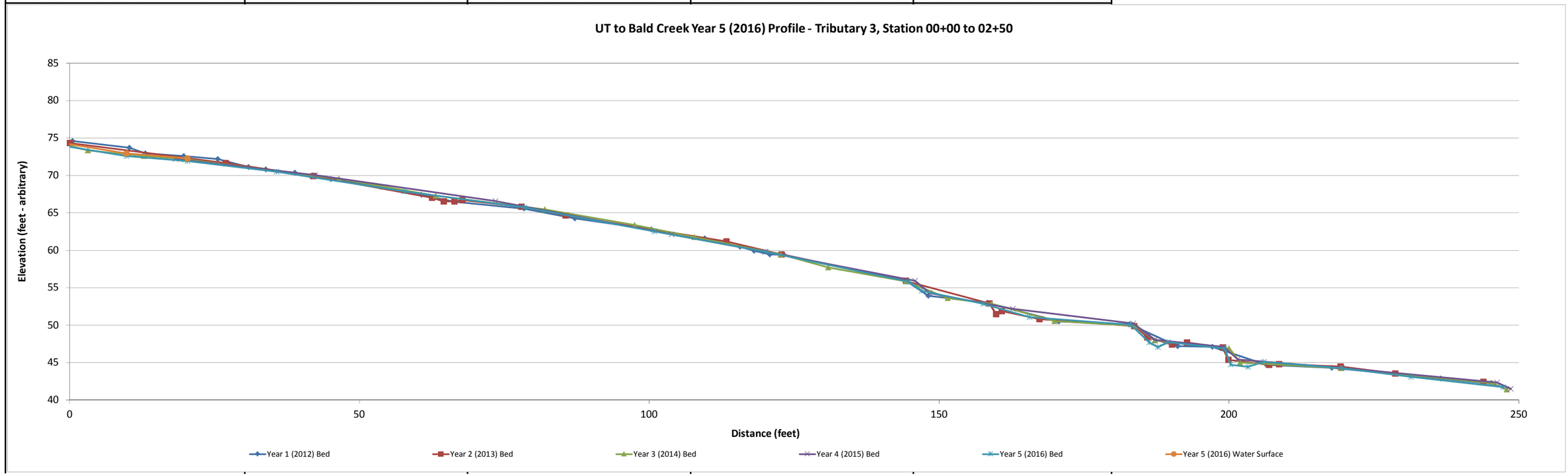
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation



Project Name	UT to Bald Creek - Profile
Reach	Tributary 3 Station 00+00 - 02+50
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	NA*	NA*	NA*	NA*	NA*
Riffle Length	25	44	33	19	30
Avg. Riffle Slope	NA*	NA*	NA*	NA*	NA*
Pool Length	18	7	10	16	7
Pool to Pool Spacing	28	45	25	25	32

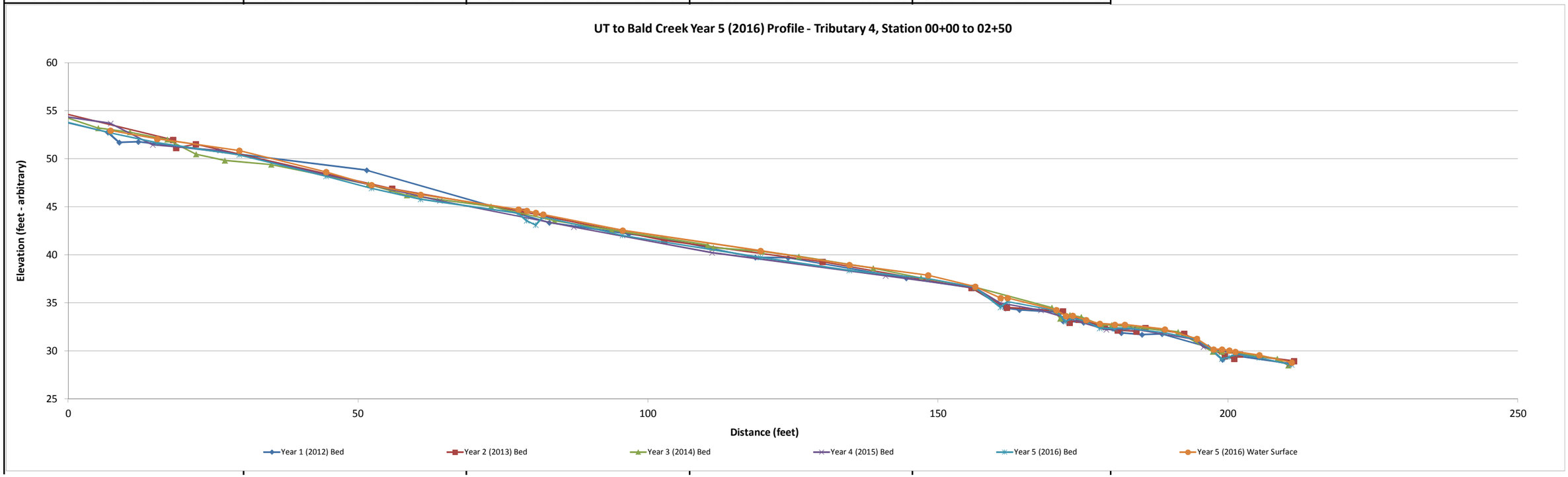
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**



Project Name	UT to Bald Creek - Profile
Reach	Tributary 4 Station 00+00 - 02+50
Feature	Profile
Date	4/19/16
Crew	Perkinson, Jernigan

	2012	2013	2014	2015	2016
Avg. Water Surface Slope	0.0074	0.1228	0.1147	0.1229	0.0120
Riffle Length	23	22	11	24	32
Avg. Riffle Slope	0.0118	0.1118	0.0814	0.1008	0.0132
Pool Length	34	6	5	7	5
Pool to Pool Spacing	57	13	13	21	37

2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey			2016 Year 5 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**



Weighted Pebble Count

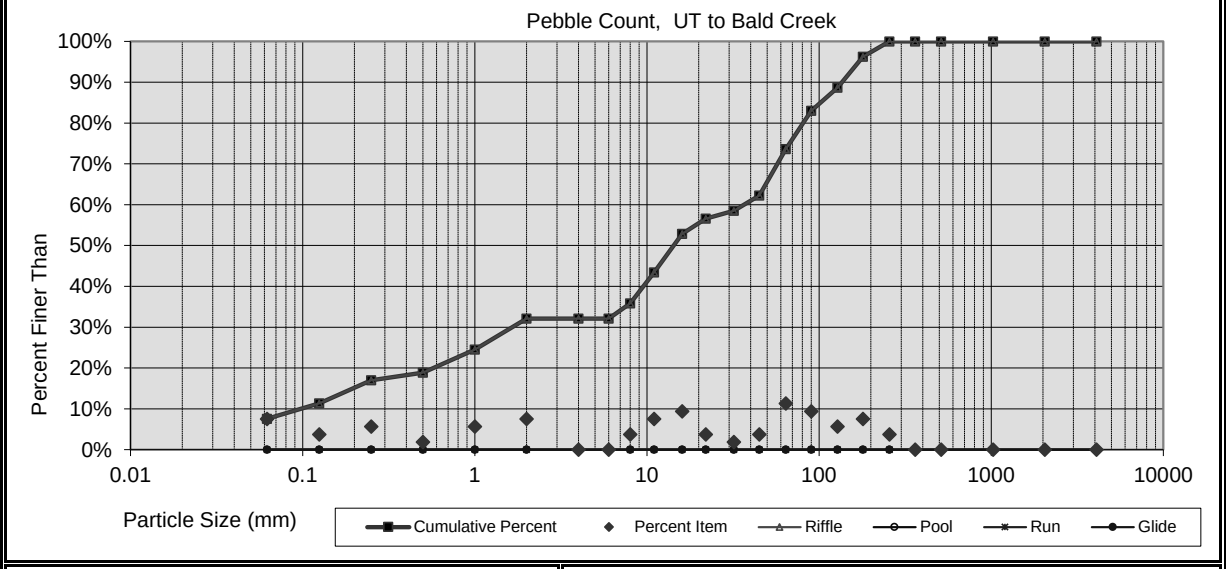
Percent Riffle:	**100**	Percent Run:	
Percent Pool:		Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	7.5	# #
very fine sand	0.062	0.13	3.8	# #
fine sand	0.13	0.25	5.7	# #
medium sand	0.25	0.5	1.9	# #
coarse sand	0.5	1	5.7	# #
very coarse sand	1	2	7.5	# #
very fine gravel	2	4	0.0	# #
fine gravel	4	6	0.0	# #
fine gravel	6	8	3.8	# #
medium gravel	8	11	7.5	# #
medium gravel	11	16	9.4	# #
coarse gravel	16	22	3.8	# #
coarse gravel	22	32	1.9	# #
very coarse gravel	32	45	3.8	# #
very coarse gravel	45	64	11.3	# #
small cobble	64	90	9.4	# #
medium cobble	90	128	5.7	# #
large cobble	128	180	7.5	# #
very large cobble	180	256	3.8	# #
small boulder	256	362	0.0	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			0.0	#
		Weighted Count:	100	
		True Total Particle Count:	53	

	UT to Bald Creek
	French Broad

Note:	**Cross Section 2 - Mainstem**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.222	7.50	14.3	96	170	8%	25%	42%	26%	0%	0%

Table 10a.1 Baseline Stream Data Summary
UT to Bald Stream Restoration Site/92596 - Mainstem (1,112 feet)

Parameter	e[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data			Design Mainstem			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Mainstem Upstream	Mainstem Downstream	Tributary 2	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5.5			7.1			5.8	5.1	2.7		5.5							
Floodprone Width (ft)					7			9			10	9	7		2.0							
Bankfull Mean Depth (ft)					0.4			0.8			0.5	0.5	0.1		0.5							
[1]Bankfull Max Depth (ft)					0.7			1.1			0.6	0.8	0.2		0.6							
Bankfull Cross Sectional Area (ft[2])					2.7			3.9			2.9	2.6	0.4	2.5		2.6						
Width/Depth Ratio					6.9			17.8			11.6	10.2	27		12							
Entrenchment Ratio					1.2			1.2			1.8	1.8	2.5		2.0							
[1]Bank Height Ratio					1.0			2.4			1.0	1.0	1.0		1.0							
Profile																						
Riffle Length (ft)																						
Riffle Slope (ft/ft)					0.048			0.144			0.0014	0.041	0.0508	0.0003		0.0012						
Pool Length (ft)					None Distinct						Not Available											
Pool Max depth (ft)														1.15		1.38						
Pool Spacing (ft)														15		100						
Pattern																						
Channel Beltwidth (ft)					12			32			12.0 - 25.0	25.0 - 32.0	10.0 - 25.0	12		32						
Radius of Curvature (ft)					36			134			36.0 - 60.0	97.0 - 134.0	21.0 - 31.0	36		134						
Rc:Bankfull width (ft/ft)					5.1			24.4			6.2 - 10.3	19.0 - 26.3	7.8 - 11.5	6.5		24.4						
Meander Wavelength (ft)					60			245			200.0 - 245.0	60.0 - 220.0	35.0 - 47.0	60		220						
Meander Width Ratio					10.9			40			2.1 - 4.3	4.9 - 6.3	3.7 - 9.3	10.9		44.5						
Transport parameters																						
Reach Shear Stress (competency) lb/f[2]																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m[2]					69 - 217									46 - 183								
Additional Reach Parameters																						
Rosgen Classification					B/G5						B5			B5								
Bankfull Velocity (fps)					5.9 - 8.9									8.9 - 9.7								
Bankfull Discharge (cfs)					23 - 24																	
Valley length (ft)																						
Channel Thalweg length (ft)																						
Sinuosity (ft)					1.05 - 1.11						1.11	1.05	1.3	1.03 - 1.09								
Water Surface Slope (Channel) (ft/ft)					0.0476 - 0.1441						0.1441	0.0476	0.0508	0.0321 - 0.1213								
BF slope (ft/ft)																						
[3]Bankfull Floodplain Area (acres)																						
[4]% of Reach with Eroding Banks																						
Channel Stability or Habitat Metric																						
Biological or Other																						

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a.2 Baseline Stream Data Summary
UT to Bald Stream Restoration Site/92596 - Tributary 2 (459 feet)

Parameter	e[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data			Design Tributary 2			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Mainstem Upstream	Mainstem Downstream	Tributary 2	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5.5			7.1			5.8	5.1	2.7		3							
Floodprone Width (ft)					7			9			10	9	7		6.0							
Bankfull Mean Depth (ft)					0.4			0.8			0.5	0.5	0.1		0.2							
[1]Bankfull Max Depth (ft)					0.7			1.1			0.6	0.8	0.2		0.3							
Bankfull Cross Sectional Area (ft[2])					2.7			3.9			2.9	2.6	0.4		0.5							
Width/Depth Ratio					6.9			17.8			11.6	10.2	27		14							
Entrenchment Ratio					1.2			1.2			1.8	1.8	2.5		2.0							
[1]Bank Height Ratio					1.0			2.4			1.0	1.0	1.0		1.0							
Profile																						
Riffle Length (ft)																						
Riffle Slope (ft/ft)					0.048			0.144			0.0014	0.041	0.0508		0.128							
Pool Length (ft)					None Distinct						Not Available											
Pool Max depth (ft)															0.43							
Pool Spacing (ft)															10-60							
Pattern																						
Channel Beltwidth (ft)					12			32			12.0 - 25.0	25.0 - 32.0	10.0 - 25.0		10-25							
Radius of Curvature (ft)					36			134			36.0 - 60.0	97.0 - 134.0	21.0 - 31.0		21-31							
Rc:Bankfull width (ft/ft)					5.1			24.4			6.2 - 10.3	19.0 - 26.3	7.8 - 11.5		7-10.3							
Meander Wavelength (ft)					60			245			200.0 - 245.0	60.0 - 220.0	35.0 - 47.0		35-50							
Meander Width Ratio					10.9			40			2.1 - 4.3	4.9 - 6.3	3.7 - 9.3		3.3-8.3							
Transport parameters																						
Reach Shear Stress (competency) lb/f[2]																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m[2]					69 - 217									3								
Additional Reach Parameters																						
Rosgen Classification					B/G5						B5			B5								
Bankfull Velocity (fps)					5.9 - 8.9									1.5								
Bankfull Discharge (cfs)					23 - 24																	
Valley length (ft)																						
Channel Thalweg length (ft)																						
Sinuosity (ft)					1.05 - 1.11						1.11	1.05	1.3	1.04								
Water Surface Slope (Channel) (ft/ft)					0.0476 - 0.1441						0.1441	0.0476	0.0508	0.0641								
BF slope (ft/ft)																						
[3]Bankfull Floodplain Area (acres)																						
[4]% of Reach with Eroding Banks																						
Channel Stability or Habitat Metric																						
Biological or Other																						

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a.3 Baseline Stream Data Summary
UT to Bald Stream Restoration Site/92596 - Tributary 3 (318 feet)

Parameter	e[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data			Design Tributary 3			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Mainstem Upstream	Mainstem Downstream	Tributary 2	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5.5			7.1			5.8	5.1	2.7		1.8							
Floodprone Width (ft)					7			9			10	9	7		10.0							
Bankfull Mean Depth (ft)					0.4			0.8			0.5	0.5	0.1		0.3							
[1]Bankfull Max Depth (ft)					0.7			1.1			0.6	0.8	0.2		0.3							
Bankfull Cross Sectional Area (ft[2])					2.7			3.9			2.9	2.6	0.4		0.54							
Width/Depth Ratio					6.9			17.8			11.6	10.2	27		6							
Entrenchment Ratio					1.2			1.2			1.8	1.8	2.5		5.6							
[1]Bank Height Ratio					1.0			2.4			1.0	1.0	1.0		1.0							
Profile																						
Riffle Length (ft)																						
Riffle Slope (ft/ft)					0.048			0.144			0.0014	0.041	0.0508		0.155							
Pool Length (ft)					None Distinct						Not Available											
Pool Max depth (ft)															0.9							
Pool Spacing (ft)															10-100							
Pattern																						
Channel Beltwidth (ft)					12			32			12.0 - 25.0	25.0 - 32.0	10.0 - 25.0		10-20							
Radius of Curvature (ft)					36			134			36.0 - 60.0	97.0 - 134.0	21.0 - 31.0									
Rc:Bankfull width (ft/ft)					5.1			24.4			6.2 - 10.3	19.0 - 26.3	7.8 - 11.5									
Meander Wavelength (ft)					60			245			200.0 - 245.0	60.0 - 220.0	35.0 - 47.0									
Meander Width Ratio					10.9			40			2.1 - 4.3	4.9 - 6.3	3.7 - 9.3		5.6-11							
Transport parameters																						
Reach Shear Stress (competency) lb/f[2]																						
Max part size (mm) mobilized at bankfull																						
Stream Power (transport capacity) W/m[2]					69 - 217									8								
Additional Reach Parameters																						
Rosgen Classification					B/G5						B5			B5								
Bankfull Velocity (fps)					5.9 - 8.9																	
Bankfull Discharge (cfs)					23 - 24																	
Valley length (ft)																						
Channel Thalweg length (ft)															318							
Sinuosity (ft)					1.05 - 1.11						1.11	1.05	1.3		1.03							
Water Surface Slope (Channel) (ft/ft)					0.0476 - 0.1441						0.1441	0.0476	0.0508		0.1548							
BF slope (ft/ft)																						
[3]Bankfull Floodplain Area (acres)																						
[4]% of Reach with Eroding Banks																						
Channel Stability or Habitat Metric																						
Biological or Other																						

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b.1 Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Bald Stream Restoration Site/92596

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																													
[1]SC% / Sa% / G% / C% / B% / Be%																													
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																													
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																													
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																													

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

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

UT to Bald Stream Restoration Site/92596

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used		37.4	37.4	37.5	37.5	37.5			53.4	53.7	53.0	53.0	53.2			97.7	97.7	97.7	97.8	97.8			55.4	55.6	55.7	55.7	55.7	
Bankfull Width (ft)		4.9	5.1	4.7	5.1	4.5			4.2	4.5	4.0	4.6	5.1			4.1	3.5	4.5	4.3	5.2			6.1	6.6	7.5	7.3	7.9	
Floodprone Width (ft)		NA	NA	NA	NA	NA			13.0	20.0	33.0	33.0	33.0			14.0	14.0	16.0	16.0	16.0			NA	NA	NA	NA	NA	
Bankfull Mean Depth (ft)		0.8	0.9	0.9	0.7	0.7			0.3	0.2	1.3	0.9	0.6			0.6	0.5	0.7	0.7	0.9			0.5	0.5	0.4	0.4	0.4	
Bankfull Max Depth (ft)		1.1	1.1	1.1	1.1	1.1			0.4	0.6	2.0	1.9	1.0			0.8	0.9	1.1	1.1	1.9			0.8	0.6	0.7	0.8	0.9	
Bankfull Cross Sectional Area (ft^2)		3.8	4.5	4.3	3.4	3.1			1.1	1.0	5.2	4.2	3.0			2.3	1.8	3.3	3.2	4.7			3.2	3.2	2.9	3.0	3.2	
Bankfull Width/Depth Ratio		NA	NA	NA	NA	NA			16.0	20.3	3.1	5.0	8.7			7.3	6.8	6.1	5.8	5.8			NA	NA	NA	NA	NA	
Bankfull Entrenchment Ratio		NA	NA	NA	NA	NA			3.1	4.4	8.3	7.2	6.5			3.4	4.0	3.6	3.7	3.1			NA	NA	NA	NA	NA	
Bankfull Bank Height Ratio		NA	NA	NA	NA	NA			1.0	1.0	1.0	1.0	1.0			1.0	1.0	1.0	1.0	1.0			NA	NA	NA	NA	NA	
Cross Sectional Area between end pins (ft^2)		----	----	----	----	----			----	----	----	----	----			----	----	----	----	----			----	----	----	----	----	
d50 (mm)		----	----	----	----	----			NA*	0.2	1.0	0.3	14.3			----	----	----	----	----			----	----	----	----	----	

	Cross Section 5 (Riffle)							Cross Section 6 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used		98.7	98.7	98.7	98.9	98.9			141.6	141.6	141.6	141.6	141.6	
Bankfull Width (ft)		4.0	4.2	3.8	3.9	3.9			5.6	5.4	6.4	5.7	5.3	
Floodprone Width (ft)		16.0	16.0	16.0	16.0	16.0			NA	NA	NA	NA	NA	
Bankfull Mean Depth (ft)		0.8	0.7	0.8	0.8	0.9			0.7	0.6	0.4	0.4	0.7	
Bankfull Max Depth (ft)		1.1	1.1	1.1	1.3	1.3			1.0	1.1	0.6	0.6	1.1	
Bankfull Cross Sectional Area (ft^2)		3.0	3.0	3.1	3.3	3.6			3.9	3.3	2.4	2.3	3.6	
Bankfull Width/Depth Ratio		5.3	5.9	4.7	4.6	4.2			NA	NA	NA	NA	NA	
Bankfull Entrenchment Ratio		4.0	3.8	4.2	4.1	4.1			NA	NA	NA	NA	NA	
Bankfull Bank Height Ratio		1.0	1.0	1.0	1.0	1.0			NA	NA	NA	NA	NA	
Cross Sectional Area between end pins (ft^2)		----	----	----	----	----			----	----	----	----	----	
d50 (mm)		----	----	----	----	----			----	----	----	----	----	

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established.used
If the performer has inherited the project and cannot acquire the datum for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values.
Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

* Greater than 50% of the material identified in the pebble count was characterized as silt/clay particle size.

Exhibit Table 11b.1 Monitoring Data - Stream Reach Data Summary
UT to Bald Stream Restoration Site/92596 - Mainstem Downstream (1,112 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)								4.2						4.5						4.0						4.6						5.1				
Floodprone Width (ft)								13						20						33.0						33						33				
Bankfull Mean Depth (ft)								0.3						0.2						1.3						0.9						0.6				
[1]Bankfull Max Depth (ft)								0.4						0.6						2.0						1.9						1.0				
Bankfull Cross Sectional Area (ft^2)								1.1						1						5.2						4.2						3.0				
Width/Depth Ratio								14						19.6						3.1						5.1						8.6				
Entrenchment Ratio								3.1						4.5						8.2						7.1						6.5				
[1]Bank Height Ratio								1.0						1.0						1.0						1.0						1.0				
Profile																																				
Riffle Length (ft)							4.6	37.3	33	105.1	28	14	2.9	34.8	25.3	130	34.7	20	2.5	27.2	25.9	64.2	19.1	22	1.9	33.5	29.5	108.9	28.4	18	3	37.8	28.2	132.8	34.4	21
Riffle Slope (ft/ft)							0.0170	0.0508	0.0509	0.1221	0.03	14	0.018	0.061	0.051	0.116	0.028	20	0.0265	0.0715	0.0651	0.1397	0.0321	22	0.0225	0.0630	0.0607	0.1146	0.0283	18	0.0206	0.0574	0.0551	0.1193	0.0232	20
Pool Length (ft)							5.5	12.9	12	33.8	6.2	18	4.8	12.2	10.2	32	6.4	23	5.6	16.5	12.6	45.3	10.6	24	4.1	11	9.6	24.2	5.6	17	4.2	10.4	9.5	24.1	4.6	24
Pool Max depth (ft)							1.1			1.1			0.6			1.1			0.7			2.0			0.6			1.1			0.9			1.1		
Pool Spacing (ft)							8.9	40	39	116.5	29.2	18	8.7	37.8	22.2	162	34.2	23	8.3	37.6	30	98.2	25.7	24	8.6	43.9	37	122	32.1	19	6.3	44.5	31.6	143.5	37.8	24
Pattern																																				
Channel Beltwidth (ft)							25			32																										
Radius of Curvature (ft)							97			134																										
Rc:Bankfull width (ft/ft)							17.6			24.4																										
Meander Wavelength (ft)							60			220																										
Meander Width Ratio							4.5			5.8																										

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification							BC						Cb						Cb						Cb						Cb					
Channel Thalweg length (ft)							1112						1102						1102						1102						1102					
Sinuosity (ft)							1.03						1.03						1.03						1.03						1.3					
Water Surface Slope (Channel) (ft/ft)							0.0558						0.054						0.0556						0.0542						0.0554					
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%													38	28	20	14	0	0	30	22	30	16	0	0	63	26	30	8	0	0	8	25	42	26	0	0
[3]d16 / d35 / d50 / d84 / d95 /													NA	NA	0.2	57	98		NA	0.1	1	64	122		NA	NA	0.3	40	98		0.222	7.5	14.3	96	170	
[2]% of Reach with Eroding Banks							**0**						**0**						**0**						**0**						**0**					
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b.2 Monitoring Data - Stream Reach Data Summary
UT to Bald Stream Restoration Site/92596 - Mainstem Upstream (375 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
[1]Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Width/Depth Ratio																																				
Entrenchment Ratio																																				
[1]Bank Height Ratio																																				
Profile																																				
Riffle Length (ft)							4.6	17	13	66	17	11	6.6	43.3	40.3	86.7	33.5	8	47.7	82.5	74.6	133.0	41.6	4	8.3	42	39.4	134.2	44.4	7	6.5	34.3	24.8	100.1	30.1	10
Riffle Slope (ft/ft)							0.0102	0.0750	0.0845	0.1515	0.047	11	0.0295	0.085	0.076	0.154	0.047	8	0.0827	0.1045	0.0953	0.145	0.0276	4	0.0633	0.0927	0.9920	0.1157	0.0267	3	0.0327	0.1050	0.1030	0.2077	0.0504	10
Pool Length (ft)							1.6	5.5	5.3	10.2	2.5	16	0.1	2.2	1.9	5.5	1.8	7	2.1	12.7	5.6	30.5	15.5	3	2.9	4.1	4.3	5.1	1.1	3	1.7	3.5	3.7	5.3	1.2	9
Pool Max depth (ft)							1			1			1.1			1.1			0.6			0.6			0.6			0.6			1.1			1.1		
Pool Spacing (ft)							12.4	14.3	12.4	42.2	9	16	8.9	46.4	46.1	92.2	37	7	79.6	106.8	102.1	138.6	29.7	3	10.1	58.9	44.1	137.1	54.6	4	10.5	36.3	23.7	102.3	30.9	9
Pattern																																				
Channel Beltwidth (ft)							12			25																										
Radius of Curvature (ft)							36			60																										
Rc:Bankfull width (ft/ft)							6.5			10.9																										
Meander Wavelength (ft)							200			245																										
Meander Width Ratio							2.2			4.5																										
Additional Reach Parameters																																				
Rosgen Classification							B						B						B						B						B					
Channel Thalweg length (ft)							375						361						368.1						368.1						374					
Sinuosity (ft)							1.09						1.09						1.09						1.09						1.09					
Water Surface Slope (Channel) (ft/ft)							0.1301						0.1313						0.1315						0.1324						0.129					
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks							0						0						0						0						0					
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b.3 Monitoring Data - Stream Reach Data Summary
UT to Bald Stream Restoration Site/92596 - Tributaries (562 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)							4	4.1	4.1	4.1			3.5	3.9	3.9	4.2			3.8	4.2	4.2	4.5			3.9	4.1	4.1	4.3			3.9	4.6	4.6	5.2		
Floodprone Width (ft)							14	15	15	16			14	15	15	16			16.0	16.0	16	6.0			16	16	16	16			16	16	16	16		
Bankfull Mean Depth (ft)							0.6	0.7	0.7	0.8			0.5	0.6	0.6	0.7			0.7	0.8	0.8	0.8			0.7	0.8	0.8	0.8			0.9	0.9	0.9	0.9		
[1]Bankfull Max Depth (ft)							0.8	1	1	1.1			0.9	1	1	1.1			1.1	1.1	1.1	1.1			1.1	1.2	1.2	1.3			1.3	1.6	1.6	1.9		
Bankfull Cross Sectional Area (ft^2)							2.3	2.7	2.7	3			1.8	2.4	2.4	3			3.1	3.2	3.2	3.3			3.2	3.3	3.3	3.3			3.6	4.2	4.2	4.7		
Width/Depth Ratio							5	5.9	5.9	6.8			6	6.5	6.5	7			4.8	5.6	5.6	6.4			4.9	5.5	5.5	6.1			4.3	5.1	5.1	5.8		
Entrenchment Ratio							3.4	3.7	3.7	4			3.8	3.9	3.9	4			3.6	3.9	3.9	4.2			3.7	3.9	3.9	4.1			3.1	3.6	3.6	4.1		
[1]Bank Height Ratio							1.0			1.0			1.0			1.0			1.0			1.0			1.0			1.0			1.0			1.0		
Profile - Tributary 1																																				
Riffle Length (ft)							5.1	7.3	6.9	10.3	2.3	4	16.3	18.8	19.9	20.2	2.2	3	5.2	14.4	13.6	25.1	7.6	5	7.3	13.3	15.6	18.5	4.7	5	5	15.3	16.9	25.3	8.2	5
Riffle Slope (ft/ft)							0.0050	0.0418	0.0362	0.0896	0.0368	4	0.0712	0.0777	0.0721	0.0897	0.0104	3	0.0308	0.0391	0.0393	0.0843	0.0211	5	0.0423	0.0631	0.0518	0.0988	0.0253	5	0.0237	0.0460	0.0396	0.0880	0.0245	5
Pool Length (ft)							3.4	6.2	7.2	8.4	2.1	5	4.2	6.3	4.2	10.6	3.7	3	4.9	5.5	5.1	6.6	0.8	4	3.1	6.3	5.1	12.1	4	4	2.3	3.8	3.8	4.8	1	5
Pool Max depth (ft)																																				
Pool Spacing (ft)							7.2	12.6	12.3	18.6	5.3	4	24.1	24.3	24.3	24.4	0.2	2	11.8	18.9	14.8	30.0	8.2	4	11.5	19.1	18.6	27.7	8.2	4	2.3	15.7	12.6	30.1	11.2	5
Profile - Tributary 2																																				
Riffle Length (ft)							3.6	10	9.9	17.5	4.5	7	10.5	32.3	32.6	53.5	23.5	4	9.9	49.4	54.9	83.5	37.1	3	10	39.2	38.6	69.6	27.2	4	2.4	26.4	11.6	64	27.7	6
Riffle Slope (ft/ft)							0.0117	0.0542	0.0433	0.0987	0.0352	7	0.0233	0.0611	0.0549	0.1114	0.0399	4	0.0465	0.0693	0.0657	0.0955	0.0247	3	0.0634	0.0751	0.0750	0.0870	0.0111	4	0.0271	0.0745	0.0680	0.1287	0.0355	6
Pool Length (ft)							2.1	4.1	3.9	6.8	1.6	7	3.1	4.2	4	5.5	1	4	3.6	4.1	4.1	4.7	0.7	2	3.9	4.9	4.8	6.1	1.1	3	3.2	3.8	3.7	4.5	0.6	**5**
Pool Max depth (ft)																																				
Pool Spacing (ft)							8.8	15	13.7	26.7	5.9	7	13.6	29.5	19.1	55.7	22.9	3	13.5	50.8	50.8	88.1	52.8	2	16.1	39.4	27.6	74.4	30.9	3	5.7	23.6	14.9	68.3	25.3	5
Profile - Tributary 3																																				
Riffle Length (ft)							21.1	25.4	24.6	31.1	4.8	4	6.2	43.5	35.2	90.9	33.5	5	7.5	32.9	13.7	123.6	44.9	6	17.9	19.4	19.4	20.8	2	2	9.7	29.8	38.2	41.3	17.4	3
Riffle Slope (ft/ft)							No water in channel during field visit.						No water in channel during field visit.						No water in channel during field visit.						No water in channel during field visit.						No water in channel during field visit.			
Pool Length (ft)							12.9	17.6	14.3	24.5	5.1	7	2.2	6.6	7.2	9.8	3.5	4	3.3	10.2	9	19.3	6.8	4	15.5	16.2	16.2	16.9	1	2	6.4	6.6	6.6	6.8	0.3	**2**
Pool Max depth (ft)																																				
Pool Spacing (ft)							14	28.4	29.6	48.1	13.3	6	15.2	45.3	35	96.1	36	4	14.7	25.3	20.5	45.4	14.1	4	15.5	24.5	20.4	37.7	11.6	3	16.1	32.1	32.1	48.1	22.6	2
Profile - Tributary 4																																				
Riffle Length (ft)							6.4	15.1	9.6	31.6	10.7	5	4.5	22.3	8	68.8	31	4	1.9	9.0	10.5	13.2	4.9	4	10.9	23.7	14.8	45.4	18.9	3	2.3	32.1	11.1	85.4	37.3	6
Riffle Slope (ft/ft)							No water in channel during field visit.						0.0743	0.1118	0.1097	0.1538	0.0329	4	0.0276	0.0637	0.0814	0.0821	0.0312	3	0.1008			0.1008			0.1008	0.1318	0.1165	0.1925	0.0337	6
Pool Length (ft)							4.6	7.3	8.1	10.1	2.3	5	2.7	5.8	5.5	9.6	3.1	4	3.1	5.3	5.2	7.5	2.2	3	1.3	7.1	4.3	15.9	7.7	3	2.6	4.8	4.9	6.7	1.8	6
Pool Max depth (ft)																																				
Pool Spacing (ft)							8.1	13.7	14.4	18	4.1	4	7.2	13.3	13.7	18.9	5.9	3	5.1	13.0	16.7	17.1	6.8	3	16	21.4	21.4	26.8	7.6	2	5.1	36.9	17.7	88	36.4	6
Pattern																																				
Channel Beltwidth (ft)							10			88																										
Radius of Curvature (ft)							6			31																										
Rc:Bankfull width (ft/ft)							2.5			10.3																										
Meander Wavelength (ft)							25			50																										
Meander Width Ratio							4			35																										
Additional Reach Parameters																																				
Rosgen Classification							B						B						B						B						B					
Channel Thalweg length (ft)							562						562						562						562						562					
Sinuosity (ft)							1.03 - 1.05						1.03 - 1.05						1.03 - 1.05						1.03 - 1.05						1.03 - 1.05					
Water Surface Slope (Channel) (ft/ft)							0.0674 - 0.1301						0.0782 - .1228						0.0679 - .1147						0.0766 - .1229						0.0660 - 0.1196					
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks							**0**						**0**						**0**						**0**						**0**					
Channel Stability or Habitat Metric																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

APPENDIX E

HYDROLOGY DATA

Table 12. Verification of Bankfull Events

Table 12. Verification of Bankfull Events
UT to Bald Stream and Wetland Restoration Site (DMS Project Number 92596)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
June 7, 2013	May 5, 2013	Crest gauge observations indicated a bankfull event after approximately 3.4 inches of rain was documented* at a nearby rain station on May 5, 2013.	--
February 10, 2015	September 7, 2014	Crest gauge observations indicated a bankfull event after approximately 2.04 inches of rain was documented* at a nearby rain station on September 7, 2014 and 1.97 inches was documented in the previous 4 days.	--
February 10, 2015	October 14, 2014	Crest gauge observations indicated a bankfull event after approximately 2.41 inches of rain was documented* at a nearby rain station on October 14, 2014.	--
October 12, 2015	July 15, 2015	Crest gauge observations indicated a bankfull event after approximately 5.01 inches of rain was documented** at a nearby rain station on July 13-15, 2015.	--
October 12, 2015	September 30, 2015	Crest gauge observations indicated a bankfull event after approximately 2.51 inches of rain was documented** at a nearby rain station on September 29-30, 2015.	--
September 14, 2016	May 4, 2016	Crest gauge observations indicated a bankfull event after approximately 2.73 inches of rain was documented** at a nearby rain station on May 4, 2016.	--

*Asheville Airport (Weatherunderground 2015)
**Bald Creek (CoCoRaHS 2016)

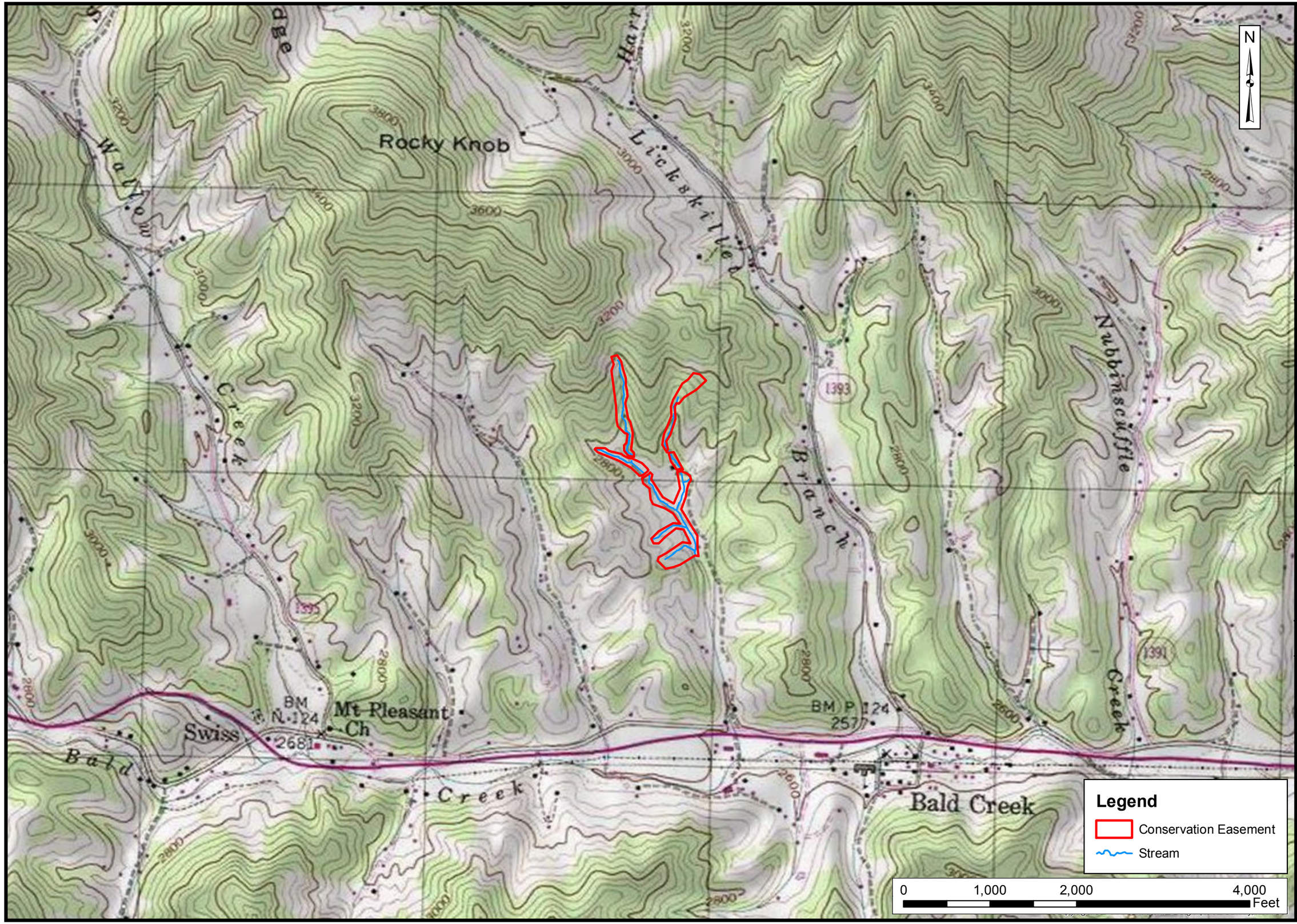
APPENDIX F

ADDITIONAL DATA

Figure 3. USGS Topographic Map

Figure 4. NRCS Soils Map

Preconstruction Photographs



Axiom Environmental, Inc.

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

Project:

UT to BALD STREAM/WETLAND RESTORATION SITE

DMS Project Number 92596
Yancey County, NC

Title:

USGS TOPOGRAPHIC MAP

Bald Creek, NC 7.5 Minute Quads

Drawn by: KRJ

Date: Nov 2016

Scale: 1 in = 1,000 ft

Project No.: 12-004.15

FIGURE

3

Map Symbol	Soil Description
BtF	Buladean-chestnut complex, 50 to 95 percent slopes, stony
CnD2	Clifton clay loam, 15 to 30 percent slopes, eroded
CnE2	Clifton clay loam, 30 to 50 percent slopes, eroded
EcE	Evard-Cowee complex, 30 to 50 percent slopes, stony
ScC	Saunook sandy loam, 8 to 15 percent slopes, stony
TsC	Thunder-Saunook complex, 8 to 15 percent slopes, very bouldery

Legend

- Easement Boundary
- Stream
- NRCS Soil Boundaries

0 700 1,400 Feet

Axiom Environmental, Inc.

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

Project:

UT TO BALD STREAM/WETLAND RESTORATION SITE

DMS Project Number 92596
Yancey County, NC

Title:

NRCS SOILS MAP

Drawn by: KRJ

Date: Nov 2016

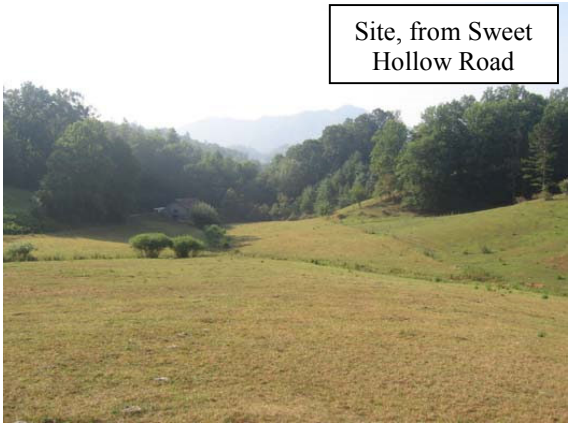
Scale: 1 in = 290 ft

Project No.: 12-004.15

FIGURE

4

UT To Bald
Preconstruction Photographs
Taken from Restoration Plan (dated June 2009)



UT To Bald
Preconstruction Photographs (continued)
Taken from Restoration Plan (dated June 2009)