Beaver Creek
Stream Restoration Monitoring Report

DMS Project # 028 Contract#: 6410
County: Surry
Monitoring Year: 2015
Years of Measurement/Monitoring: 4

Submitted to:

NCDEQ-DMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Data Collection: 2015
Construction Completed: February 2003
Submitted: December 2015

Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 278-2514
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Project Contact: Adam Spiller
Email: adam.spiller@kci.com
KCI Project No: 16157992

Design Firm

Earth Tech of North Carolina
701 Corporate Center Drive, Suite 475
Raleigh, NC 27607

Table of Contents

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

In 2002, the North Carolina Ecosystem Enhancement Program (EEP) restored a 4,670 linear feet of Beaver Creek, a Tributary to Fisher River in Surry County, NC. The 5.9-mi^2 project watershed is located in US Geological Survey Hydrologic Unit 03040101 (NC Division of Water Quality Sub-basin 12-63-12) of the Yadkin River Basin. The site was first identified by the Surry County Soil and Water Conservation District as a potential restoration site after landowners complained about active erosion and flooding adjacent to the stream. The project is located entirely within undeveloped land consisting of agricultural land predominantly being used for hay production. The project objectives are listed below.

Project Objectives

- Restore 4,670 linear feet of Beaver Creek (as measured along the thalweg).
- Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
- Improve water quality and reduce further property loss by stabilizing eroding stream banks.
- Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation.
- Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris, and establish a riparian buffer.
- Provide aesthetic value, wildlife habitat, and bank stability through the creation or enhancement of a riparian zone.

Construction was completed at the site in summer 2002. Repair work was conducted at the site in the spring of 2004. The site was then monitored in 2004, Monitoring Year 1 by NC State University and in 2005 (MY2) by EcoLogic Associates. A second round of repair work was scheduled for 2005. The site was not monitored in 2006 or 2007, pending additional repairs and maintenance. Repairs were completed at the site in the summer of 2008. Additional planting and transplants took place in December 2008. URS performed the third year of monitoring in 2008. Another round of repairs was completed in December 2014, and fourth year monitoring was conducted in 2015 by KCI.

During the first year of monitoring (2004) four circular vegetation plots were established onsite. The following year (2005) fourteen new vegetation plots were established and permanently marked in the field. After repairs occurred in summer 2008, during which many of the plots were affected by construction, five plots were inventoried (VP11, VP10, VP12, VP4, and VP15) for the third year of monitoring in 2008. These five plots were monitored again in 2015, the fourth year of monitoring. The vegetation monitoring success criterion for the planted stream riparian zone is a density of 320 stems/acre after the third year of monitoring and 260 stems/acre at the end of five years of monitoring. The fourth-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. As a result of the repair work performed in 2014, plots 10 and 15 were reinstalled during the fourth year monitoring in the approximate location that they had been in for previous monitoring years. The site's average density for this monitoring period was 332 planted stems/acre. Two of the five plots had less than 260 planted stems/acre, with plots 4 and 15 being the only ones to not meet the success criteria. Despite this lack of planted woody vegetation, volunteer species are robust throughout the site and including volunteers, the site averaged 1,570 total stems/acre, with only plot 15 not meeting the stem density criteria. Invasive species are present throughout the site, but are only scattered in isolated patches throughout the easement.

The project was originally surveyed in 2005 by EcoLogic. No longitudinal profile was surveyed at this time but seven cross-sections were installed on the site. Because of the repair work that occurred in 2014, the right bank pins of cross-sections 3, and 4 were reinstalled in July 2015 during the fourth year monitoring. An effort was made to install these as close to the original cross-sections as possible, but there are alignment differences between the MY03 and MY04 cross-section data for these cross-sections. Cross-sections 1, 5, 6, and 7 show little change from the most recent monitoring year. Cross-sections 2, 3, and 4 were all located within the 2014 repair areas and therefore show significant change from the previous monitoring year.

These repaired cross-sections are stable with the installed bioengineering creating well vegetated banks since planting in December 2014. As a part of the stream success criterion, the stream must experience at least two bankfull events, each in separate monitoring years. The site has experienced multiple bankfull events since construction.

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 and in the Mitigation Plan documents available on the DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 METHODOLOGY

The survey data were collected with a total station instrument, using control coordinates supplied by URS. The MY04 stream survey was completed on July 23, 2015

The CVS-EEP protocol, Level 2 (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the site. The MY04 vegetation survey was conducted on July 2, 2015.

3.0 REFERENCES

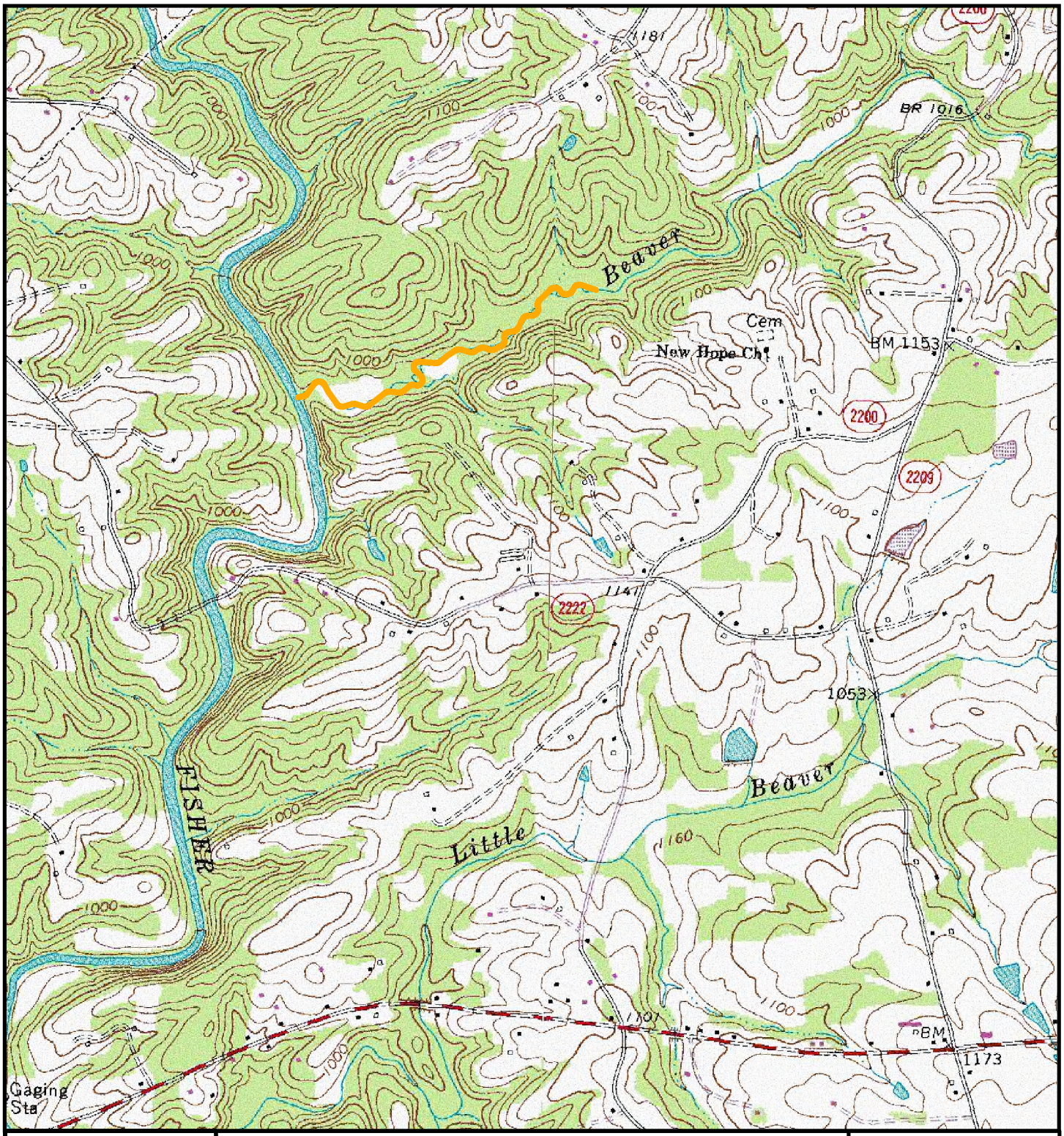
Lee, M. T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

USACE. 2003. Stream Mitigation Guidelines. (http://www.saw.usace.army.mil/wetlands/Mitigation/Documents/Stream/).

Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf).

Appendix A

Project Vicinity Map and Background Tables



KCI ASSOCIATES OF NC

Figure 1. Vicinity Map
Beaver Creek Stream Restoration Site
DMS Project #028

N
W E
S

Project Reach

1:63,360
1 inch equals 1 miles
1 0.5 0 1
Miles

Table 1. Project Components and Mitigation Credits
Beaver Creek, DMS Project #028

Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Overall Credits	4,266								

Project Components						
Project Component -or- Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage/Acreage	Mitigation Ratio
Beaver Creek	10+00 – 52+13	4,213*	PI	Restoration	4,266	1:1

Length and Area Summations						
Restoration Level	Stream (linear feet)	Riparian Wetlands (Acres)		Non-Riparian Wetlands (Acres)	Buffer (square feet)	Upland (Acres)
Restoration	4,266					
Enhancement I						
Enhancement II						

*discrepancy between stationing and creditable footage is due to the as-built thalweg measurement's use for credit calculation

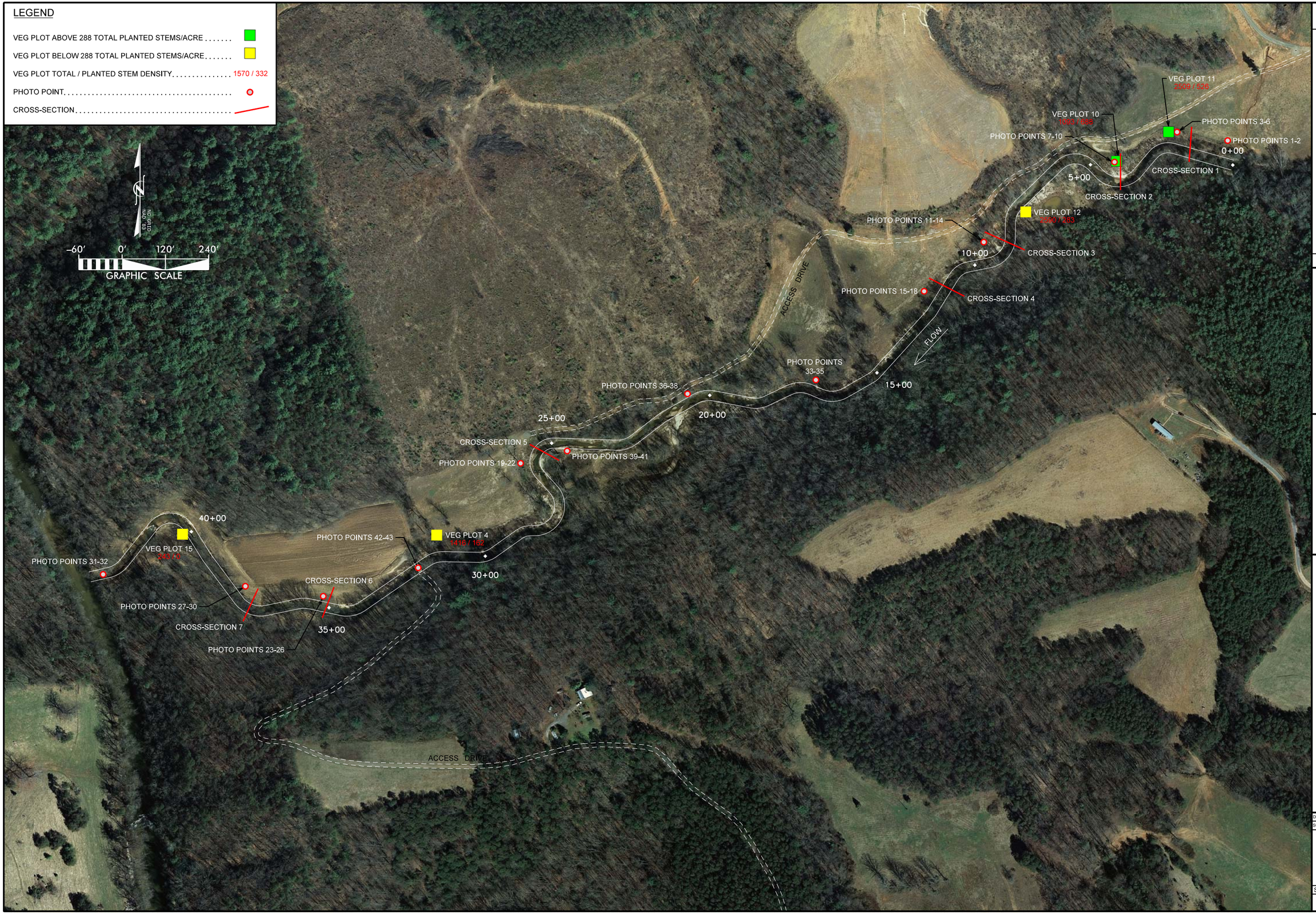
Table 2. Project Activity and Reporting History		
Project Number and Name: 028 – Beaver Creek		
Elapsed Time Since Grading Complete: 13 years		
Elapsed Time Since Planting Complete: 13 years		
Number of Reporting Years: 4		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan		2001
Mitigation Plan		2001
Construction		Fall 2002
Temporary S&E mix applied to project area		Fall 2002
As-built Report	Fall 2002	Feb. 2003
Permanent seed mix applied to reach		Fall 2002
Structural maintenance (bank and structure)		Spring 2004
Supplemental planting of bare root and containers		Spring 2004
Year 1 Monitoring	Fall 2004	Sep. 2004
Year 2 Monitoring	Fall 2005	Sep. 2005
Structural maintenance (bank and structure)		Summer 2008
Year 3 Monitoring	Sep. 2008	Oct. 2008
Supplemental planting of bare root and containers		Dec. 2008
Structural maintenance (bank and structure)		Dec. 2014
Year 4 Monitoring	July 2015	Dec. 2015

Table 3. Project Contacts Table	
Project Number and Name: DMS #028, Beaveer Creek	
Design Firm	Earth Tech of North Carolina
	701 Corporate Center Drive, Suite 475
	Raleigh, NC 27607
	Contact: Bill Jenkins
	Phone: (919) 854-6200
Construction Contractor	West Contracting
	PO Box 310
	Marble, NC 28905
	Contact: Maurice West Jr.
	Phone: (828)837-2280
Planting Contractor	Carolina Environmental
	PO Box 1905
	Mount Airy, NC 27030
	Contact: Joanne Cheatham
	Phone: (336)320-3849
2014 Repair Design Firm	KCI Associates of NC
	Landmark Center II, Suite 220
	4601 Six Forks Rd.
	Raleigh, NC 27609
	Contact: Mr. Adam Spiller
	Phone: (919) 278-2514
2014 Repair Construction Contractor	Carolina Environmental Contracting, Inc.
	PO Box 1905
	Mount Airy, NC 27030-6905
	Contact: Ms. Joanne Cheatham
	Phone: (336) 320-3849
Monitoring Performers	
MY-01	Biological & Agricultural Engineering
	North Carolina State University
	Campus Box 7625
	Raleigh, NC 27695
	Contact: Dan Clinton
	Phone: (919)515-6771
MY-02	EcoLogic Associates, P.C.
	4321-A South Elm-Eugene Street
	Greensboro, NC 27406
	Contact: Kyle Hoover
	Phone: (336)355-1108
MY-03	URS Corporation – North Carolina
	1600 Perimeter Park Drive, Suite 400
	Morrisville, NC 27560
	Contact: Kathleen McKeithan
	Phone: (919) 461-1597
MY-04	KCI Associates of NC
	Landmark Center II, Suite 220
	4601 Six Forks Rd.
	Raleigh, NC 27609
	Contact: Mr. Adam Spiller
	Phone: (919) 278-2514

Table 4. Project Attribute Table	
Project Number and Name: 028 - Beaver Creek	
Project County	Surry County
Physiographic Region	Piedmont/Foothills
Ecoregion	Northern Inner Piedmont (45e)
Project River Basin	Yadkin
USGS HUC for Project (8 digit)	03040101
NCDWQ Sub-basin for Project	12-63-12
Within extent of EEP Watershed Plan?	No
WRC Class (Warm, Cool, Cold)	Cool
% of project easement demarcated	-
Beaver activity observed during design phase?	No
Restoration Component Attribute Table	
	Beaver Creek
Drainage Area	5.9 sq.mi.
Stream Order	Third
Restored length (feet)	4,266
Perennial or Intermittent	Perennial
Watershed Type (Rural, Urban, Developing, etc.)	Rural
Watershed LULC Distribution	
Urban	5%
Ag-Row Crop	0%
Ag-Livestock	50%
Forested	45%
Water/Wetlands	0%
Watershed impervious cover (%)	< 5%
NCDWQ AU/Index Number	27-5-(0.7)
NCDWQ Classification	C
303d listed?	No
Upstream of a 303d listed segment?	No
Reasons for 303d Listing or Stressor	N/A
Total acreage of easement	-
Total vegetated acreage within the easement	-
Total planted acreage as part of the restoration	9.4
Rosgen Classification of pre-existing	C4, G4, and F4
Rosgen Classification of As-built	E4
Valley Type	-
Valley Slope	0.006
Valley side slope range (e.g. 2-3%)	-
Valley toe slope range (e.g. 2-3%)	-
Trout waters designation	No
Species of concern, endangered etc.? (Y/N)	No
Dominant soil series and characteristics	
Series	Colvard and Suches
Drainage class	Well drained
Hydric status	Non-hydric
Slope	0-3%

Appendix B

Visual Assessment Data



REVISIONS

DATE	DESCRIPTION	STM.

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BEAVER CREEK STREAM RESTORATION
PROJECT #28 - MONITORING YEAR 04

SURRY COUNTY, NORTH CAROLINA

DATE: DEC 2015
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1

Table 5. Visual Stream Morphology Stability Assessment
Project Number and Name: 028 -Beaver Creek
Assessed Length 4,266

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)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	20	20			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	40	40			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	40	40			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%			
		2. Thalweg centering at downstream of meander (Glide)	22	22			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.	36	36			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	36	36			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	36	36			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)	36	36			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	36	36			100%			

Table 6. Vegetation Condition Assessment

Project Number and Name: 028 - Beaver Creek

Planted Acreage N/A **Easement Acreage N/A**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	N/A
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	N/A
			Total	0	0.00	N/A
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	N/A
			Cumulative Total	0	0.00	N/A
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	N/A
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	N/A

Stream Station Photos

P1 facing upstream

P2 facing downstream

P3 facing upstream

P4 facing left bank

P5 facing downstream

P6 facing right bank floodplain

P7 facing upstream

P8 facing left bank

P9 facing downstream

P10 facing right bank floodplain

P11 facing upstream

P12 facing left bank

P13 facing downstream

P14 facing right bank floodplain

P15 facing upstream

P16 facing left bank

P17 facing downstream

P18 facing right bank floodplain

P19 facing upstream

P20 facing left bank

P21 facing downstream

P22 facing right bank floodplain

P23 facing upstream

P24 facing left bank

P25 facing downstream

P26 facing right bank floodplain

P27 facing upstream

P28 facing left bank

P29 facing downstream

P30 facing right bank floodplain

P31 facing upstream

P32 facing downstream at Fisher River

P33 facing upstream

P34 facing left bank

P35 facing downstream

P36 facing upstream

P37 facing left bank

P38 facing downstream

P39 facing upstream

P40 facing right bank

P41 facing downstream

P42 facing upstream

P43 facing downstream

Vegetation Monitoring Plot Photos

Plot 3 Photo. MY04 – 7/23/15

Plot 11 Photo. MY04 – 7/23/15

Plot 4 Photo. MY04 – 7/23/15

Plot 12 Photo. MY04 – 7/23/15

Plot 10 Photo. MY04 – 7/23/15

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment Project Number and Name: 028 - Beaver Creek	
Vegetation Plot ID	**Vegetation Survival Threshold Met?**
4	No
10	Yes
11	Yes
12	Yes
15	No

Table 8. CVS Vegetation Plot Metadata	
Report Prepared By	Bethany Williams
Date Prepared	7/29/2015 14:46
database name	Beaver Creek 2008 cvs-eep-entrytool-v2.3.1.mdb
database location	M:\2015\16157992 Beaver Crk Monitoring\CVS Data Entry Tool
computer name	12-3ZV4FP1
file size	59375616
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	28
project Name	Beaver Creek
Description	Stream Restoration
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	5

Table 9. CVS Stem Count Total and Planted by Plot and Species																							
DMS Project Code 28. Project Name: Beaver Creek																							
			Current Plot Data (MY4 2015)																Annual Means				
			E28-01-0004			E28-01-0010			E28-01-0011			E28-01-0012			E28-01-0015			MY4 (2015)			MY3 (2008)		
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
Acer rubrum	red maple	Tree									6			4						10			
Alnus serrulata	hazel alder	Shrub								6	8			1					6	9		6	6
Betula nigra	river birch	Tree			10	4	4	6	1	1	1	1	1	17			1	6	6	35	14	14	14
Carpinus caroliniana	American hornbeam	Tree	2	2	14													2	2	14	2	2	2
Cercis canadensis	eastern redbud	Tree	1	1	1			1	1	1	1							2	2	3	4	4	4
Cornus amomum	silky dogwood	Shrub				1	1	1			2							1	1	3			
Cornus florida	flowering dogwood	Tree												1						1			
Diospyros virginiana	common persimmon	Tree				2	2	4										2	2	4			
Fraxinus pennsylvanica	green ash	Tree				5	5	5	4	4	5	1	1	4				10	10	14	8	8	8
Juglans nigra	black walnut	Tree			1			3			1						1			6	1	1	1
Juniperus virginiana	eastern redcedar	Tree												1						1			
Lindera benzoin	northern spicebush	Shrub									3									3			
Liriodendron tulipifera	tuliptree	Tree									1			3			1			5			
Nyssa sylvatica	blackgum	Tree							1	1	3							1	1	3	1	1	1
Oxydendrum arboreum	sourwood	Tree												10						10			
Pinus strobus	eastern white pine	Tree												1						1			
Platanus occidentalis	American sycamore	Tree			2	5	5	5										5	5	7			
Prunus serotina	black cherry	Tree															1			1	2	2	2
Quercus falcata	southern red oak	Tree							2	2	2							2	2	2	2	2	2
Quercus michauxii	swamp chestnut oak	Tree	1	1	1				2	2	2	4	4	5				7	7	8	10	10	10
Quercus phellos	willow oak	Tree							1	1	1	1	1	2				2	2	3	3	3	3
Quercus velutina	black oak	Tree																			2	2	2
Rhus glabra	smooth sumac	shrub							1	1	1							1	1	1	7	7	7
Salix nigra	black willow	Tree		5	5									3					5	8		10	10
Sambucus canadensis	Common Elderberry	Shrub									7						2			9			
Ulmus americana	American elm	Tree			1															1			
Ulmus rubra	slippery elm	Tree						2			18			12						32			
Stem count			4	9	35	17	17	27	13	19	62	7	7	64	0	0	6	41	52	194	56	72	72
size (ares)			1			1			1			1			1			5			5		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.12			0.12		
Species count			3	4	8	5	5	8	8	9	16	4	4	13	0	0	5	12	14	26	12	14	14
Stems per ACRE			161.9	364.2	1416	688	688	1093	526.1	768.9	2509	283.3	283.3	2590	0	0	242.8	331.8	420.9	1570	453.2	582.7	582.7

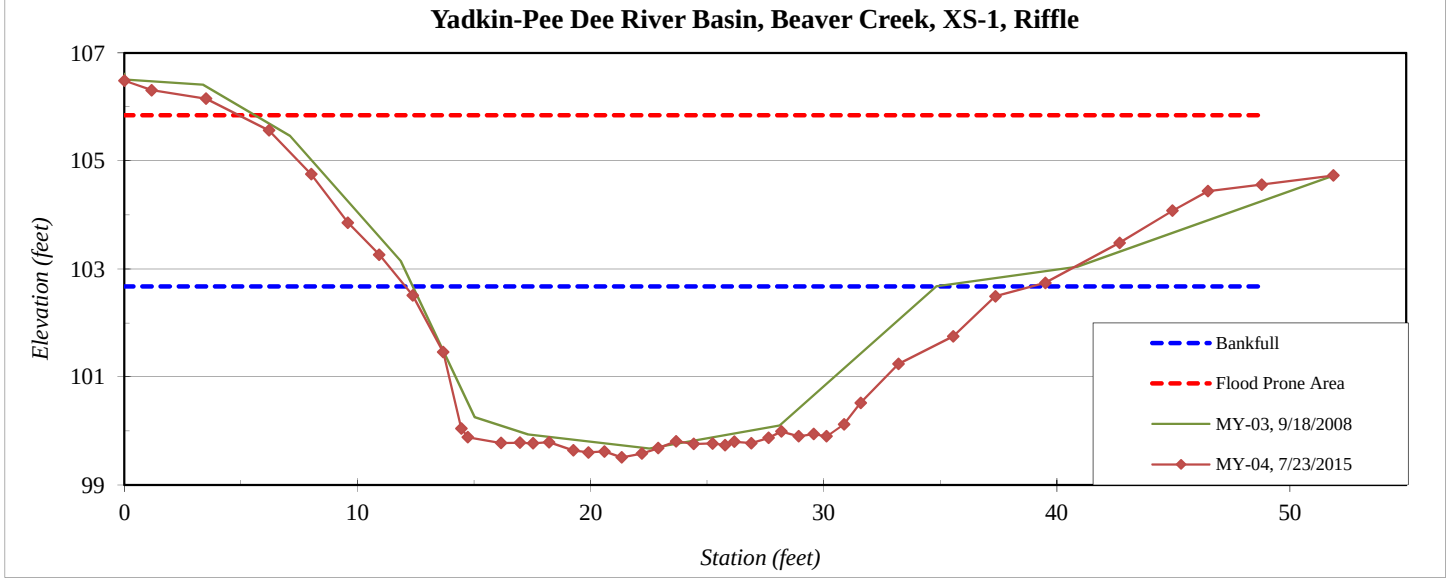
Appendix D

Stream Survey Data

River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-1, Riffle
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	106.49
1.2	106.31
3.5	106.15
6.2	105.57
8.0	104.76
9.6	103.86
10.9	103.26
12.4	102.51
13.7	101.46
14.5	100.05
14.7	99.88
16.2	99.78
17.0	99.78
17.5	99.77
18.2	99.79
19.3	99.64
19.9	99.60
20.6	99.62
21.3	99.51
22.2	99.58
22.9	99.68
23.7	99.81
24.4	99.76
25.2	99.77
25.8	99.74
26.2	99.80
26.9	99.77
27.6	99.87
28.2	99.99
28.9	99.90
29.6	99.94
30.1	99.90
30.9	100.13
31.6	100.52
33.2	101.24

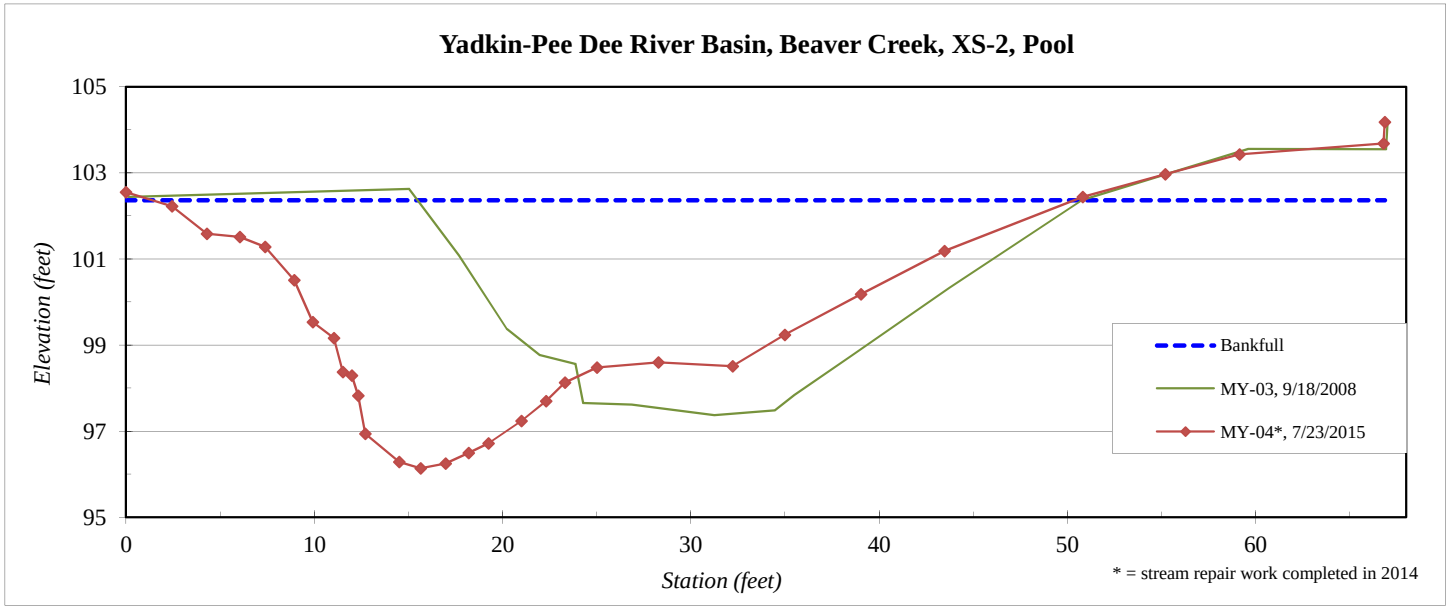
SUMMARY DATA	
Bankfull Elevation:	102.7
Bankfull Cross-Sectional Area:	58.6
Bankfull Width:	26.9
Flood Prone Area Elevation:	105.8
Flood Prone Width:	>50
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	2.2
W / D Ratio:	12.4
Entrenchment Ratio:	1.9
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-2, Pool
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	102.55
2.4	102.22
4.3	101.58
6.0	101.51
7.4	101.28
8.9	100.51
9.9	99.53
11.0	99.16
11.5	98.37
12.0	98.29
12.3	97.82
12.7	96.94
14.5	96.29
15.6	96.13
17.0	96.25
18.2	96.49
19.3	96.71
21.0	97.24
22.3	97.70
23.3	98.13
25.0	98.48
28.3	98.60
32.2	98.51
35.0	99.24
39.0	100.18
43.5	101.18
50.8	102.44
55.2	102.97
59.1	103.43
66.8	103.68
66.9	104.18

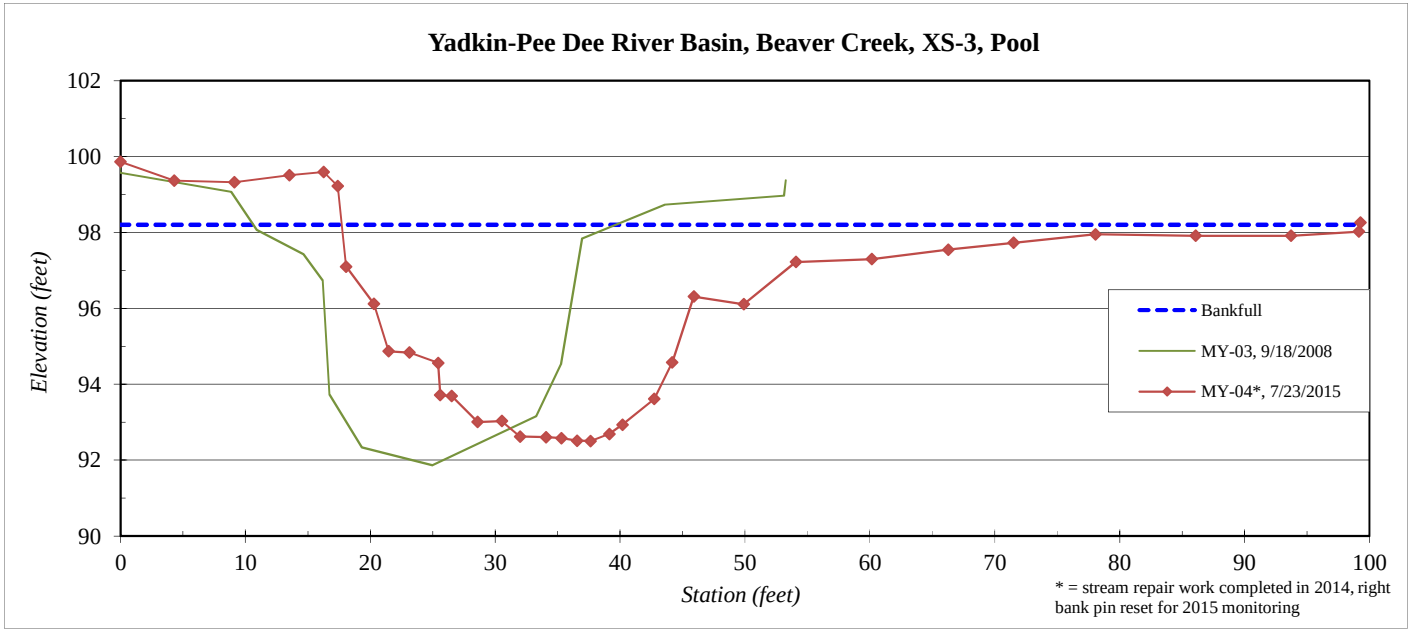
SUMMARY DATA	
Bankfull Elevation:	102.4
Bankfull Cross-Sectional Area:	144.5
Bankfull Width:	49.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	6.2
Mean Depth at Bankfull:	2.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-3, Pool
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	101.07
4.3	100.57
9.1	100.53
13.5	100.71
16.3	100.80
17.4	100.43
18.1	98.30
20.3	97.32
21.5	96.08
23.1	96.04
25.4	95.77
25.6	94.92
26.5	94.90
28.6	94.21
30.5	94.24
32.0	93.83
34.1	93.81
35.3	93.78
36.5	93.72
37.6	93.71
39.1	93.89
40.2	94.14
42.7	94.82
44.2	95.78
45.9	97.52
49.9	97.32
54.1	98.43
60.2	98.50
66.3	98.75
71.5	98.93
78.1	99.16
86.1	99.12
93.7	99.12
99.2	99.23
99.3	99.47

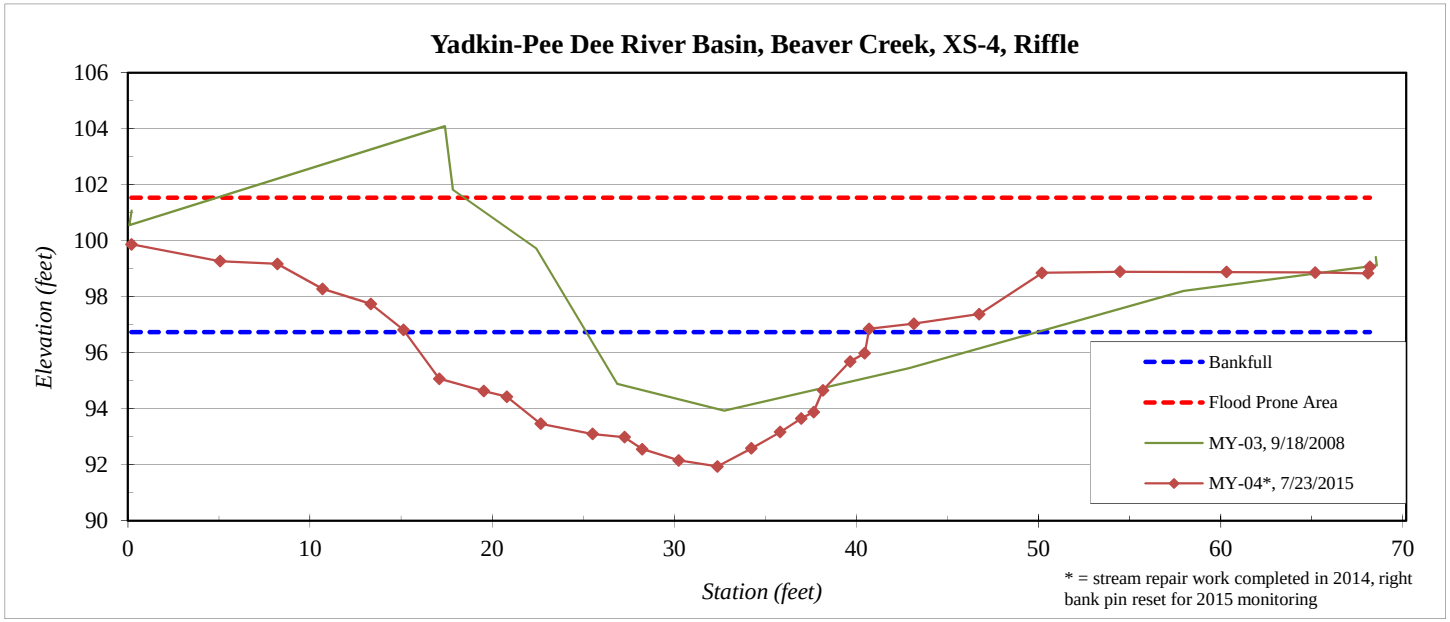
SUMMARY DATA	
Bankfull Elevation:	98.2
Bankfull Cross-Sectional Area:	93.2
Bankfull Width:	34.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.5
Mean Depth at Bankfull:	2.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-4, Riffle
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	99.87
4.9	99.27
8.0	99.17
10.5	98.28
13.1	97.74
14.9	96.81
16.9	95.07
19.3	94.63
20.6	94.43
22.5	93.46
25.3	93.10
27.1	92.98
28.0	92.56
30.0	92.16
32.2	91.94
34.0	92.58
35.6	93.17
36.8	93.65
37.5	93.88
38.0	94.66
39.5	95.69
40.3	95.98
40.5	96.85
43.0	97.03
46.5	97.37
50.0	98.85
54.3	98.89
60.1	98.88
65.0	98.86
67.9	98.83
68.0	99.07

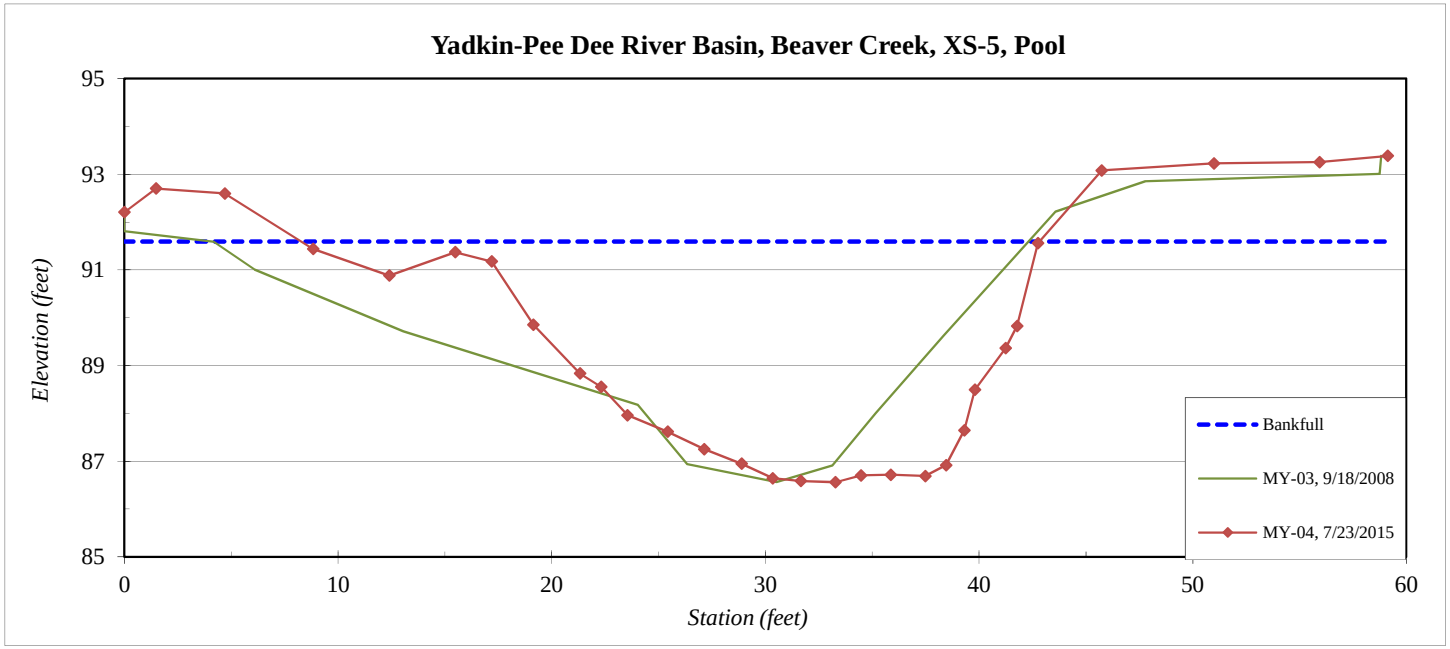
SUMMARY DATA	
Bankfull Elevation:	96.7
Bankfull Cross-Sectional Area:	77.8
Bankfull Width:	25.5
Flood Prone Area Elevation:	101.5
Flood Prone Width:	>60
Max Depth at Bankfull:	4.8
Mean Depth at Bankfull:	3.1
W / D Ratio:	8.3
Entrenchment Ratio:	1.8
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-5, Pool
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	92.21
1.5	92.70
4.7	92.60
8.8	91.44
12.4	90.88
15.5	91.37
17.2	91.18
19.1	89.85
21.3	88.83
22.3	88.56
23.6	87.96
25.4	87.62
27.1	87.25
28.9	86.95
30.4	86.64
31.7	86.59
33.3	86.56
34.5	86.70
35.9	86.72
37.5	86.69
38.5	86.92
39.3	87.65
39.8	88.49
41.2	89.36
41.8	89.83
42.8	91.56
45.7	93.08
51.0	93.23
55.9	93.26
59.1	93.4

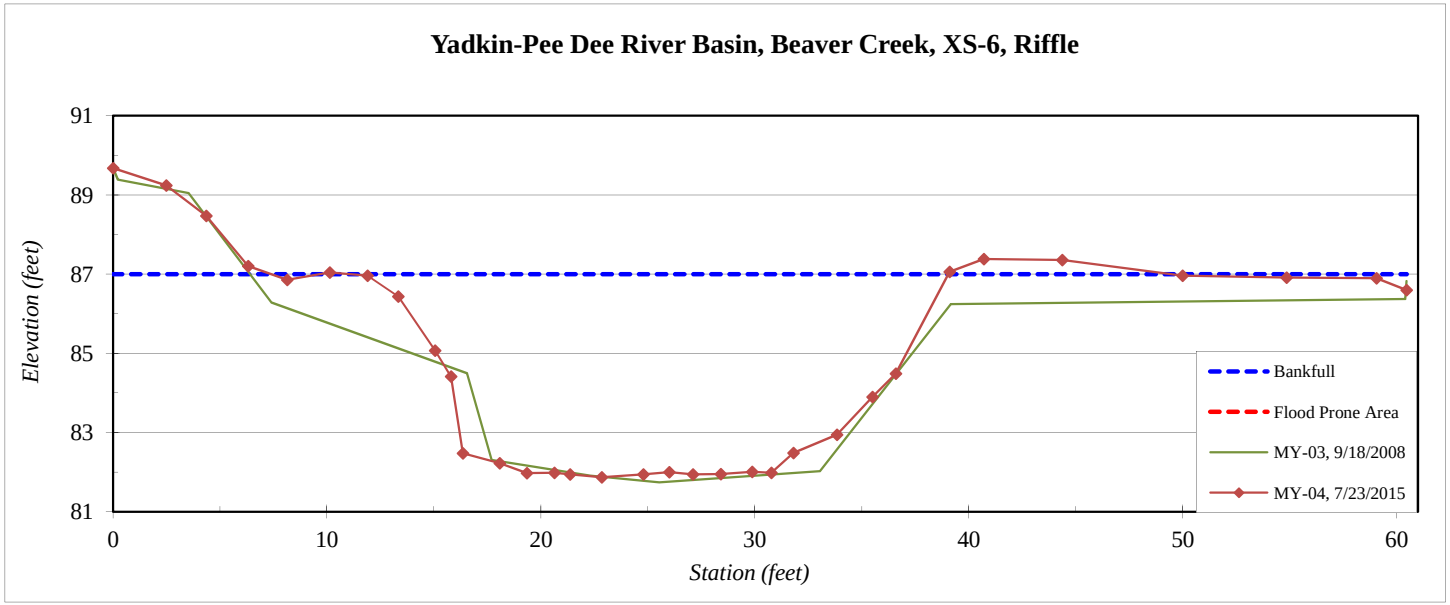
SUMMARY DATA	
Bankfull Elevation:	91.6
Bankfull Cross-Sectional Area:	135.7
Bankfull Width:	41.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	5.0
Mean Depth at Bankfull:	3.3
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-6, Riffle
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	89.67
2.5	89.24
4.4	88.47
6.3	87.20
8.1	86.86
10.1	87.05
11.9	86.96
13.3	86.44
15.1	85.07
15.8	84.42
16.4	82.47
18.1	82.23
19.3	81.98
20.6	81.99
21.4	81.94
22.8	81.87
24.8	81.94
26.0	82.00
27.1	81.94
28.4	81.95
29.9	82.01
30.8	81.98
31.8	82.48
33.8	82.94
35.5	83.90
36.6	84.49
39.1	87.05
40.7	87.38
44.4	87.36
50.0	86.96
54.9	86.91
59.1	86.90
60.5	86.60

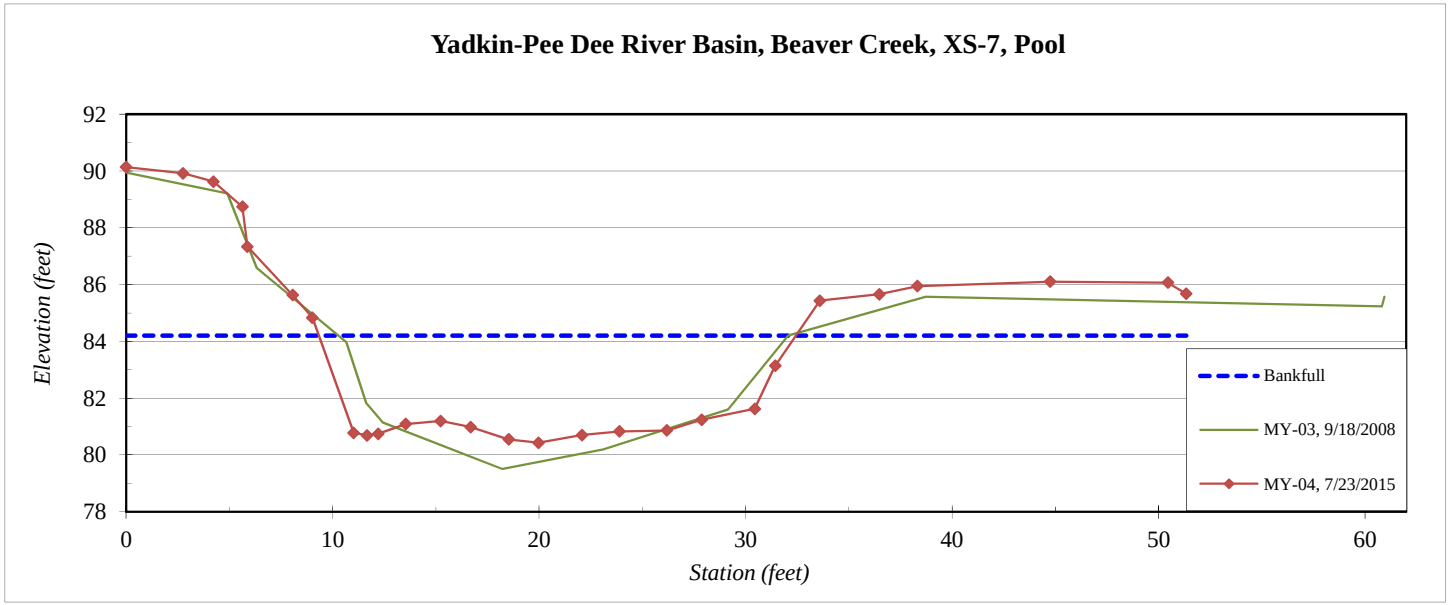
SUMMARY DATA	
Bankfull Elevation:	87.0
Bankfull Cross-Sectional Area:	104.9
Bankfull Width:	38.2
Flood Prone Area Elevation:	92.1
Flood Prone Width:	>60
Max Depth at Bankfull:	5.1
Mean Depth at Bankfull:	2.7
W / D Ratio:	13.9
Entrenchment Ratio:	1.6
Bank Height Ratio:	1.0



River Basin:	Yadkin-Pee Dee
Watershed:	Beaver Creek
XS ID	XS-7, Pool
Drainage Area (sq mi):	5.90
Date:	7/23/2015
Field Crew:	T. Seelinger and B. Williams

Station	Elevation
0.0	90.14
2.8	89.92
4.2	89.63
5.6	88.74
5.9	87.34
8.1	85.63
9.0	84.83
11.0	80.78
11.7	80.69
12.2	80.74
13.5	81.09
15.2	81.20
16.7	80.99
18.5	80.55
20.0	80.43
22.1	80.70
23.9	80.83
26.2	80.86
27.9	81.24
30.4	81.62
31.4	83.15
33.6	85.44
36.5	85.66
38.3	85.95
44.8	86.11
50.5	86.07
51.3	85.68

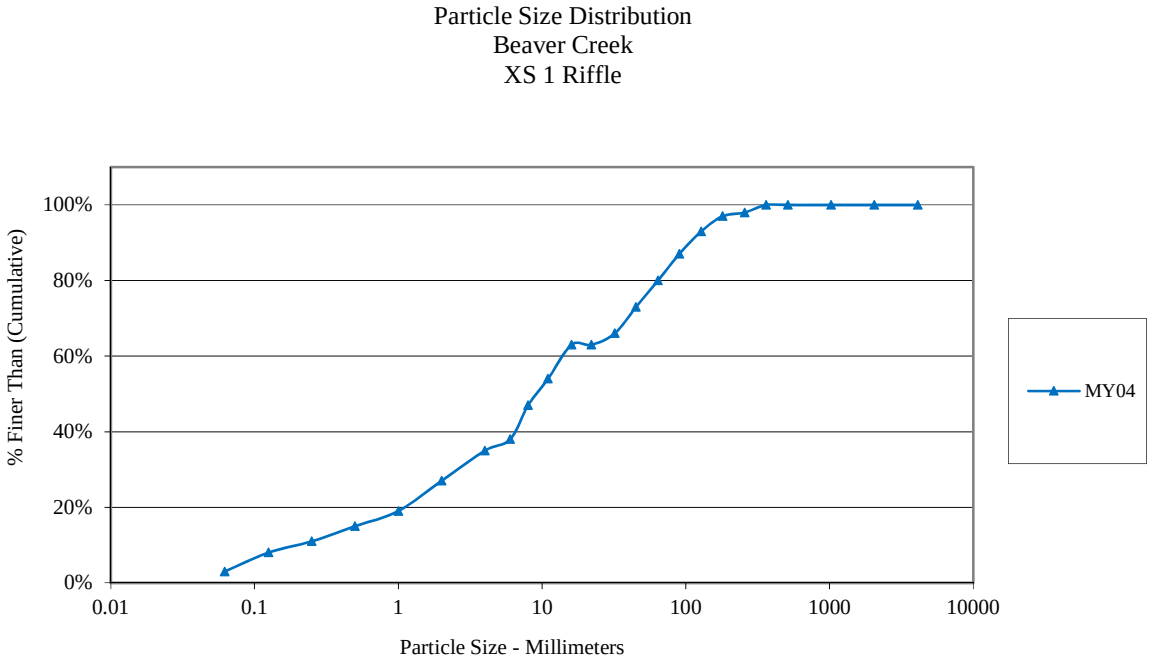
SUMMARY DATA	
Bankfull Elevation:	84.2
Bankfull Cross-Sectional Area:	69.1
Bankfull Width:	23.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.8
Mean Depth at Bankfull:	3.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



Pebble Count Plots

Cross-Section 1 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	3
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	8
Very Fine	2 - 4		8
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	9
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		7
Small	64 - 90	C	7
Small	90 - 128	O	6
Large	128 - 180	B	4
Large	180 - 256	L	1
Small	256 - 362	B	2
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



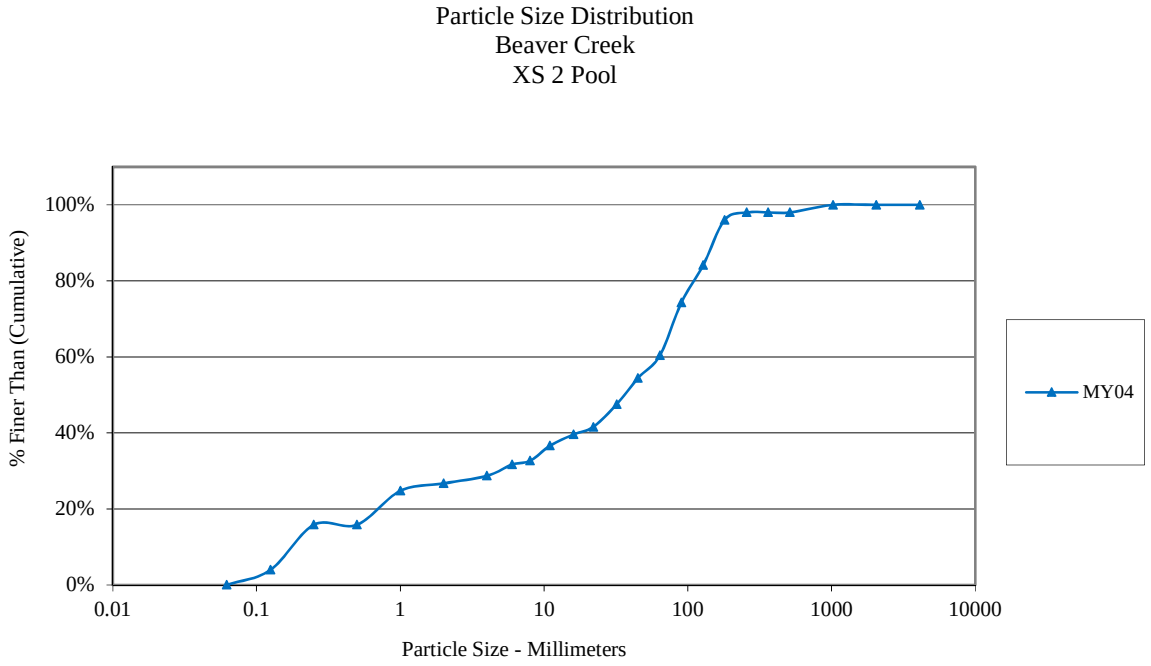
Size (mm)	
D16	0.59
D35	4
D50	9.2
D65	28
D84	78
D95	150

Size Distribution	
mean	6.8
dispersion	12.0
skewness	-0.09

Type	
silt/clay	3%
sand	24%
gravel	53%
cobble	18%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	4
Fine	.125 - .25	A	12
Medium	.25 - .50	N	
Coarse	.50 - 1	D	9
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		2
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		6
Small	64 - 90	C	14
Small	90 - 128	O	10
Large	128 - 180	B	12
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	2
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



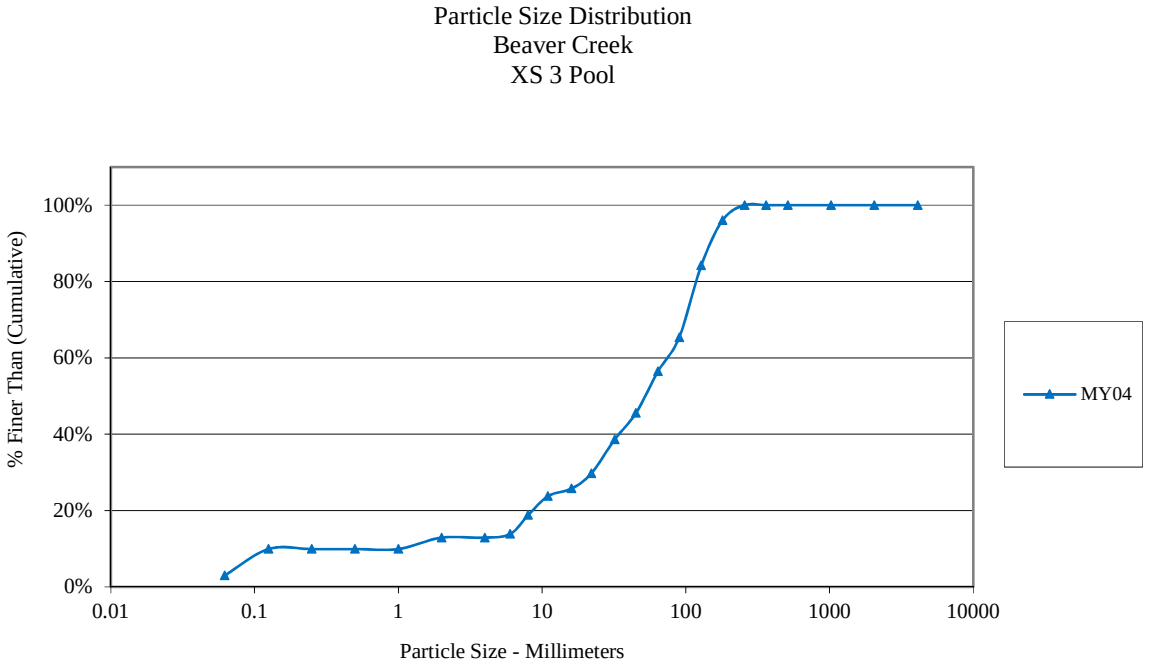
Size (mm)	
D16	0.51
D35	9.6
D50	36
D65	72
D84	130
D95	170

Size Distribution	
mean	8.1
dispersion	37.1
skewness	-0.42

Type	
silt/clay	0%
sand	27%
gravel	34%
cobble	38%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	7
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	9
Very Coarse	32 - 45	S	7
Very Coarse	45 - 64		11
Small	64 - 90	C	9
Small	90 - 128	O	19
Large	128 - 180	B	12
Large	180 - 256	L	4
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



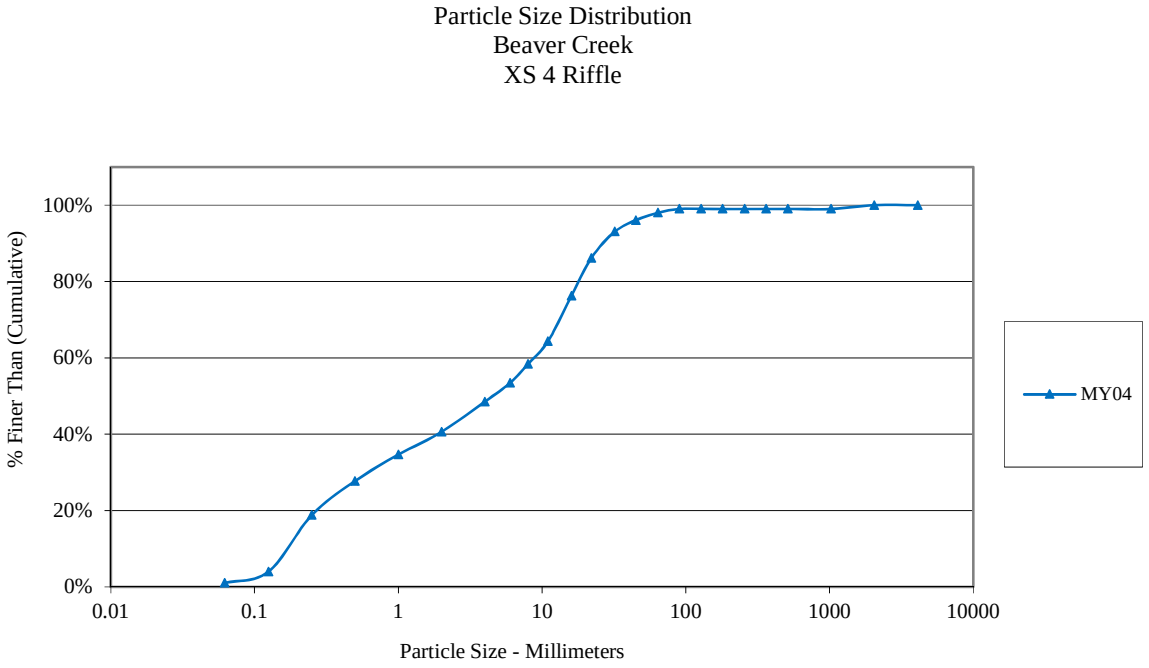
Size (mm)	
D16	6.8
D35	27
D50	52
D65	89
D84	130
D95	170

Size Distribution	
mean	29.7
dispersion	5.1
skewness	-0.21

Type	
silt/clay	3%
sand	10%
gravel	44%
cobble	44%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	15
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	6
Very Fine	2 - 4		8
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	12
Coarse	16 - 22.6	E	10
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		2
Small	64 - 90	C	1
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	1
Bedrock	>2048	BDRK	
		Total	101

Note:



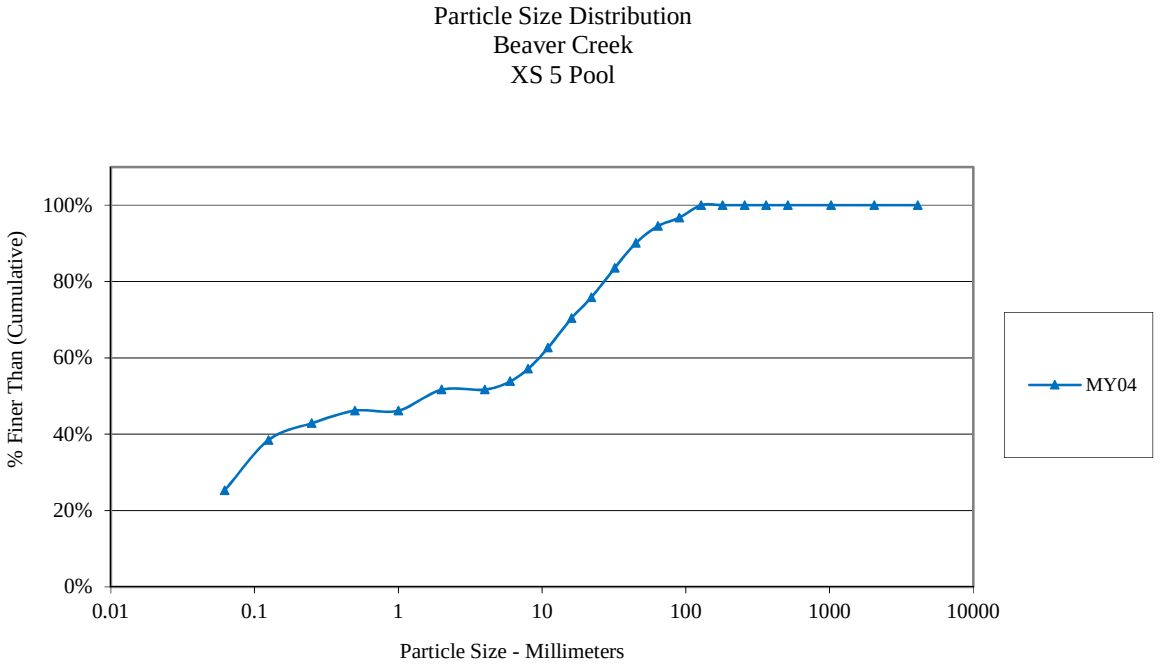
Size (mm)	
D16	0.22
D35	1
D50	4.5
D65	11
D84	21
D95	40

Size Distribution	
mean	2.1
dispersion	12.6
skewness	-0.23

Type	
silt/clay	1%
sand	40%
gravel	57%
cobble	1%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	23
Very Fine	.062 - .125	S	12
Fine	.125 - .25	A	4
Medium	.25 - .50	N	3
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	5
Very Fine	2 - 4		
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	5
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		4
Small	64 - 90	C	2
Small	90 - 128	O	3
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	91

Note:



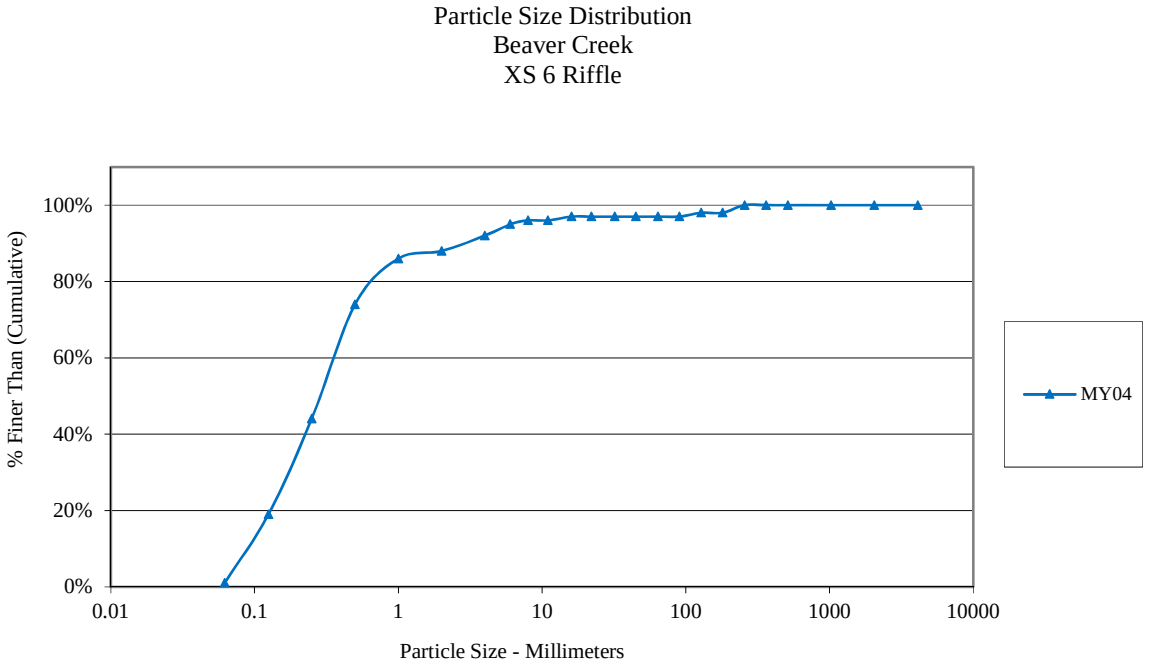
Size (mm)	
D16	0.062
D35	0.1
D50	1.6
D65	12
D84	33
D95	69

Size Distribution	
mean	1.4
dispersion	23.2
skewness	-0.03

Type	
silt/clay	25%
sand	26%
gravel	43%
cobble	5%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 Riffle - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	18
Fine	.125 - .25	A	25
Medium	.25 - .50	N	30
Coarse	.50 - 1	D	12
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		4
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	1
Large	128 - 180	B	
Large	180 - 256	L	2
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



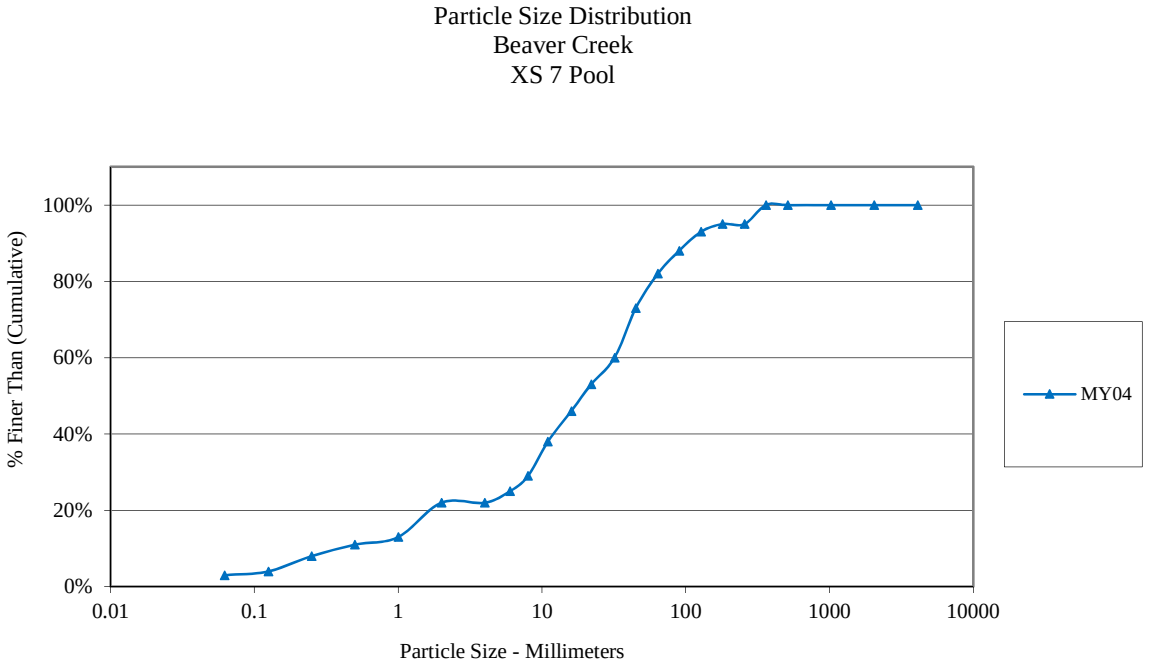
Size (mm)	
D16	0.11
D35	0.19
D50	0.29
D65	0.41
D84	0.89
D95	6

Size Distribution	
mean	0.3
dispersion	2.9
skewness	0.03

Type	
silt/clay	1%
sand	87%
gravel	9%
cobble	3%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 7 Pool - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	4
Medium	.25 - .50	N	3
Coarse	.50 - 1	D	2
Very Coarse	1 - 2	S	9
Very Fine	2 - 4		
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	7
Coarse	22.6 - 32	L	7
Very Coarse	32 - 45	S	13
Very Coarse	45 - 64		9
Small	64 - 90	C	6
Small	90 - 128	O	5
Large	128 - 180	B	2
Large	180 - 256	L	
Small	256 - 362	B	5
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



Size (mm)	
D16	1.3
D35	9.90
D50	19
D65	36
D84	72
D95	260

Size Distribution	
mean	9.7
dispersion	9.2
skewness	-0.22

Type	
silt/clay	3%
sand	19%
gravel	60%
cobble	13%
boulder	5%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Table 10. Baseline Morphology and Hydraulic Summary																		
Beaver Creek - DMS Project Number 028																		
Parameter*	**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream (Big Branch)**			**Project Reference Stream (Basin Creek)**			**Design**			**As-built**		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)	15	50	28	27	37.5	30.6	20	21.5	20.8	29.5	36.9	33.2	--	--	28	21.9	33.6	--
Floodprone Width (ft)	--	--	--	--	--	230	--	--	130	--	--	329	--	--	230	--	--	313
BF Cross Sectional Area (ft^2)	40	150	75	53.3	89.7	70.6	40.9	42.8	41.9	64.9	71.9	68.4	--	--	70	55.1	104.6	--
BF Mean Depth (ft)	1.7	4	2.8	1.8	2.8	2.3	--	--	2	1.9	2.2	2.1	--	--	2.5	2.6	3.1	--
BF Max Depth (ft)	--	--	--	2.5	3.3	3.1	2.5	2.7	2.6	3	3.2	3.1	--	--	4.2	4.3	5.2	--
Width/Depth Ratio	--	--	--	9.5	16	13.6	9.8	10.8	10.3	13.4	19.4	16.4	--	--	11.2	9.8	10.8	--
Entrenchment Ratio	--	--	--	--	--	7.5	--	--	65	--	--	8.9	--	--	7.5	9.4	12	--
Bank Height Ratio	--	--	--	1.6	2.5	2	--	--	--	--	--	--	--	--	--	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern																		
Channel Beltwidth (ft)	--	--	--	34	256	107	31	44	37	59	75	64.7	43	208	99	43	208	87
Radius of Curvature (ft)	--	--	--	16	285	99	42	63	55	40.1	69.3	51.2	45	76	65.5	45	76	65
Meander Wavelength (ft)	--	--	--	116	802	338	185	260	222			350	192	485	305	192	485	275
Meander Width Ratio	--	--	--	1.1	8.4	3.5	1.5	2.1	1.8	1.7	2.3	1.9	1.5	7.4	3.5	--	--	--
* USGS gage data are unavailable for this project and are not included in the table.																		

Table 10. Baseline Morphology and Hydraulic Summary																		
Beaver Creek - DMS Project Number 028																		
Parameter*	**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream (Big Branch)**			**Project Reference Stream (Basin Creek)**			**Design**			**As-built**		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Profile																		
Riffle Length (ft)	--	--	--	--	--	--	23.4	78	58.5	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.015	0.019	0.017	0.018	0.02	0.021	0.004	0.032	0.01	--	--	--
Pool Length (ft)	--	--	--	--	--	--	23.6	32	26.9	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	80	440	215	98	180	139	271	334	305	94	321	159	--	--	--
Substrate																		
d50 (mm)	--	--	--	--	--	4.7	--	--	--	--	--	58	--	--	--	--	--	--
d84 (mm)	--	--	--	--	--	90	--	--	--	--	--	180	--	--	--	--	--	--
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3314
Channel Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4220
Sinuosity	--	--	--	--	--	1.35	--	--	1.1	--	--		--	--	1.22	--	--	1.3
Water Surface Slope (ft/ft)	--	--	--	--	--	0.005	--	--	0.009	--	--	0.014	--	--	0.005	--	--	0.50%
BF Slope (ft/ft)	--	--	--	--	--	0.006	--	--	0.009	--	--		--	--	0.006	--	--	
Rosgen Classification	--	--	--	--	--	C4, G4, F4	--	--	E4	--	--	C4	--	--	E4	--	--	E5
* USGS gage data are unavailable for this project and are not included in the table.																		

Table 11a. Monitoring - Cross-Section Morphology Data Tables
Beaver Creek
DMS Project Number 028

Parameter	Cross Section 1 Riffle					Cross Section 2 Pool					Cross Section 3 Pool					Cross Section 4 Riffle				
Dimension	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY1**	**MY2**	**MY3**	**MY4***	**MY5**	**MY1**	**MY2**	**MY3**	**MY4***	**MY5**	**MY1**	**MY2**	**MY3**	**MY4***	**MY5**
BF Width (ft)	29.1	19.3	22.5	26.9		29.1	25.6	35.3	49.0		24.6	21.2	34.1	34.9		32.9	19.1	20.2	25.5	
Floodprone Width (ft)	>50	>50	>50	>50		--	--	--	--		--	--	--	--		>60	>60	>60	>60	
BF Cross Sectional Area (ft^2)	86.8	32.1	48.4	58.6		110.6	71.7	110.0	144.5		78.2	48.8	83.7	93.2		108.0	38.9	78.6	77.8	
BF Mean Depth	2.7	1.67	2.2	2.2		3.8	2.8	3.1	2.9		3.2	2.3	2.5	2.7		3.3	2.0	3.9	3.1	
BF Max Depth	4.5	2.2	3.0	3.2		5.8	4.8	5.0	6.2		5.2	3.3	4.3	4.5		6.7	2.8	4.9	4.8	
Width/Depth Ratio	11.8	11.6	10.4	12.4		--	9.2	11.3	--		--	9.2	13.9	--		10.0	9.3	5.2	8.3	
Entrenchment Ratio	10.8	1.7	>2.2	>1.9		--	2.4	>2.0	--		--	1.9	>2.1	--		9.6	1.6	>3.0	>3.0	
Bank Height Ratio	--	--	1.0	1.0		--	--	1.0	--		--	--	1.0	--		--	--	1.0	1	
Wetted Perimeter (ft)	--	20.6	23.9	--		--	28.9	37.6	--		--	23.2	36.0	--		--	20.8	25.0	--	
Hydraulic radius (ft)	--	1.6	2	--		--	2.5	2.9	--		--	2.1	2.3	--		--	1.9	3.1	--	
Substrate																				
d50 (mm)	1.13	3.2	40	9.2		0.4	0.7	6.4	36.0		0.4	1.6	1.5	52.0		0.6	2.0	0.1	4.5	
d84 (mm)	45.3	32.0	120.0	78		27.9	1.0	39.0	130.0		21.7	16.0	6.0	130.0		22.0	52.6	9.1	21.0	

Parameter	Cross Section 5 Pool					Cross Section 6 Riffle					Cross Section 7 Pool				
Dimension	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	48.0	34.0	38.1	41.3		34.6	33.2	31.6	38.2		38.2	20.8	21.8	23.1	
Floodprone Width (ft)	--	--	--	--		>60	>60	>60	>60		--	--	--	--	
BF Cross Sectional Area (ft^2)	125.8	88.8	101.6	135.7		93.6	78.2	90.2	104.9		95.2	47.0	71.1	84.2	
BF Mean Depth	2.6	2.6	2.7	3.3		2.7	2.4	2.9	2.7		2.5	2.3	3.3	3.0	
BF Max Depth	5.7	4.5	5.0	5.0		4.8	4.3	4.5	5.1		5.8	3.9	4.7	3.8	
Width/Depth Ratio	--	13.1	14.3	--		12.8	14.1	11.1	13.9		--	9.1	6.7	--	
Entrenchment Ratio	--	1.5	>1.6	--		9.1	1.3	>1.9	>1.6		--	2.2	>2.8	--	
Bank Height Ratio	--	--	1.0	--		--	--	1.0	1.0		--	--	1.0	--	
Wetted Perimeter (ft)	--	35.7	39.9	--		--	36.0	34.4	--		--	22.6	24.9	--	
Hydraulic radius (ft)	--	2.5	2.5	--		--	2.2	2.6	--		--	2.1	2.8	--	
Substrate															
d50 (mm)	5.3	1.4	0.1	1.6		0.4	11.0	1.1	0.3		0.4	0.6	0.9	19.0	

*=Cross-sections 2, 3, and 4 reset in June 2015, before MY4 survey

Table 11b. Monitoring - Stream Reach Morphology Data Table
Beaver Creek
DMS Project Number 028

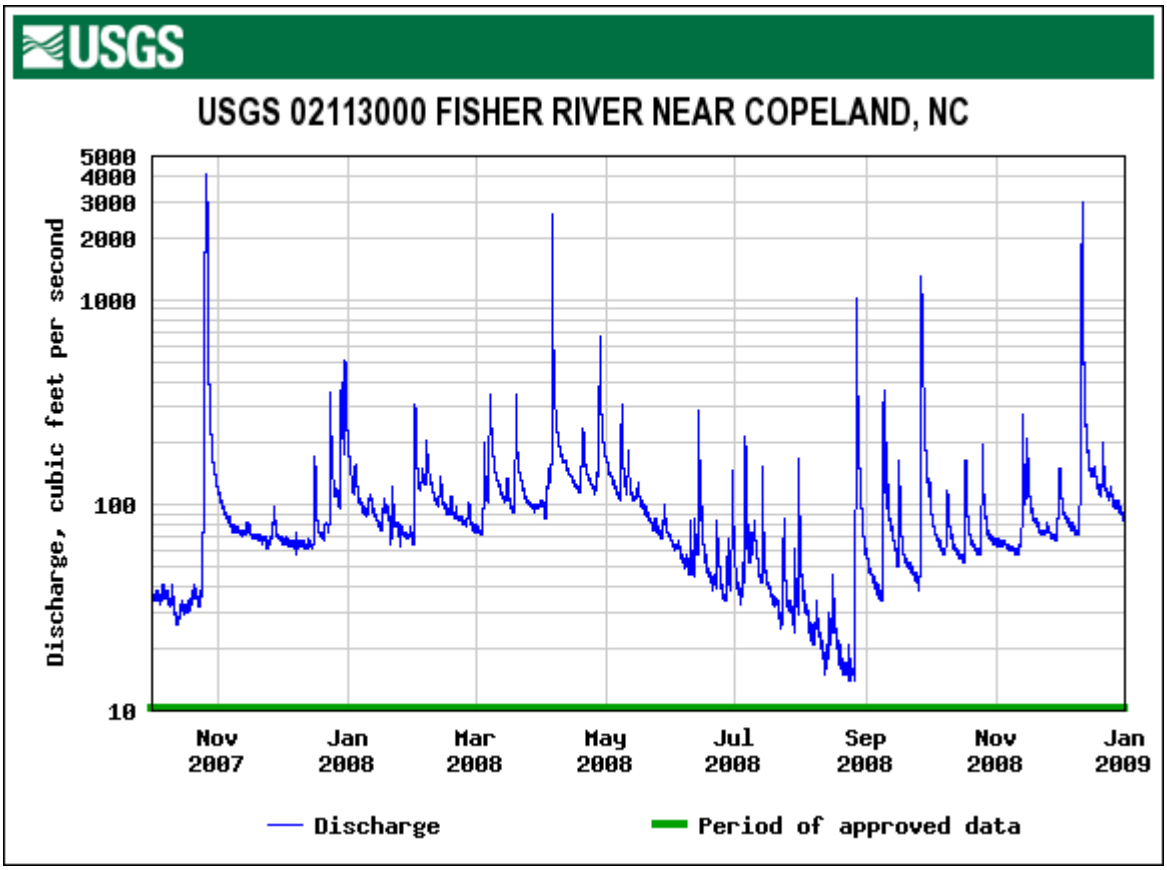
Parameter	MY1			MY2			MY3			MY4*			MY5		
Pattern	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
Channel Beltwidth (ft)	39	192	80	40	240	90	20	200	80						
Radius of Curvature (ft)	42	170	90	50	100	70	42	100	60						
Meander Wavelength (ft)	182	481	267	225	435	262	230	570	380						
Meander Width Ratio	--	--	--	11.6	22.5	13.5	9.8	29.7	17.8						
Profile															
Riffle Length (ft)	--	--	--	5.2	53.3	21.1	25	50.8	35.7						
Riffle Slope (ft/ft)	--	--	--	0.0053	0.069	0.029	0.0083	0.026	0.016						
Pool Length (ft)	--	--	--	33.9	195	89	57.8	187.8	95.1						
Pool Spacing (ft)	--	--	--	17.5	219	84	16.3	384.8	127.7						
Additional Reach Parameters															
Valley Length (ft)	--	3314	--	--	3314	--	--	3314	--						
Channel Length (ft)	--	4198	--	--	4360	--	--	4210	--						
Sinuosity	--	1.3	--	--	1.3	--	--	1.3	--						
Water Surface Slope (ft/ft)	--	0.55	--	--	0.005	--	--	0.005	--						
BF Slope (ft/ft)	--	0.54	--	--	0.005	--	--	0.005	--						
Rosgen Classification	--	E5	--	--	B5	--	--	B5	--						

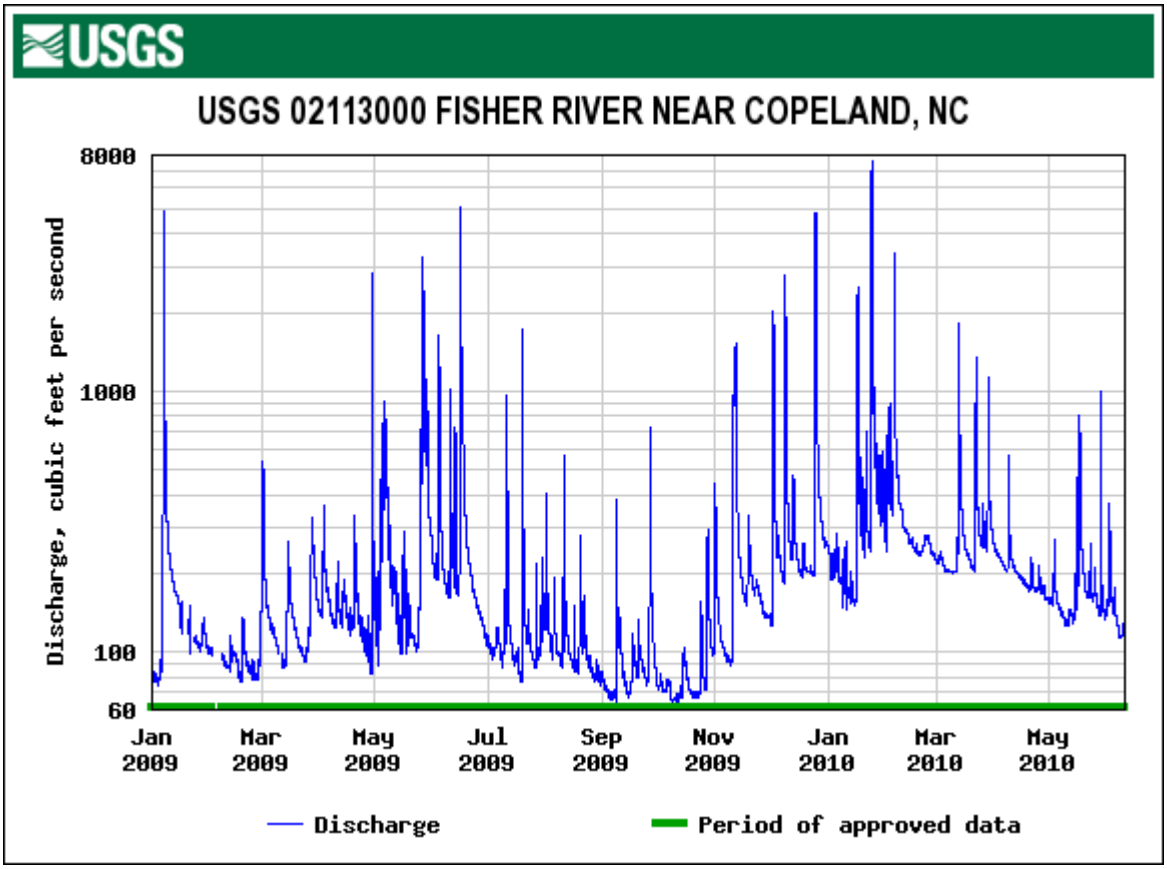
*= profile date not collected in MY4

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events Project Number and Name: 028 - Beaver Creek			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
9/19/2008	Oct. 2007	Proximal USGS Gage Resource	N/A
9/19/2008	March 2008	Proximal USGS Gage Resource	N/A
2/2/2016	Dec. 2008	Proximal USGS Gage Resource	N/A
2/2/2016	Jan. 2009	Proximal USGS Gage Resource	N/A
2/2/2016	June 2009	Proximal USGS Gage Resource	N/A
2/2/2016	Dec. 2009	Proximal USGS Gage Resource	N/A
2/2/2016	Jan. 2010	Proximal USGS Gage Resource	N/A




USGS
USGS 02113000 FISHER RIVER NEAR COPELAND, NC
Discharge, cubic feet per second
8000
1000
100
60
Jan 2009
Mar 2009
May 2009
Jul 2009
Sep 2009
Nov 2009
Jan 2010
Mar 2010
May 2010
Discharge
Period of approved data