Year 1 Monitoring Report for Stream Restoration of Bailey Fork

Burke County, NC
SCO # D04006-02

Prepared for:
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Ecosystem Enhancement PROGRAM

Submitted: January 2008

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Table of Contents

List of Tables

List of Appendices

I. EXECUTIVE SUMMARY

The Bailey Fork stream restoration project is located near Morganton in Burke County, North Carolina. Prior to restoration, the stream banks were denuded, actively eroding, and had a nearly vertical profile, and vegetative cover was minimal along the stream. The project goal for the restoration, completed during early 2006, was to modify the dimension, pattern, and profile of the existing stream channels to be stable and self-maintaining by utilizing natural channel design techniques and procedures. Elements of the restoration design included improved bed form and aquatic habitat diversity, integrating riffle-pool sequences, in-channel grade control structures, and root wads into the proposed restoration design, and the establishment of a native forested riparian plant community. The following report documents the Year 1 Annual Monitoring for this project.

Monitoring of the vegetation was completed in September 2006 using the methodology of the Carolina Vegetation Survey. Stem counts completed in 10 vegetation plots showed an average density of 429 stems per acre for the site. This density exceeds the success criteria of 320 stems/acre after three years of monitoring. One vegetation problem area occurred near one of these vegetation plots, where pasture mowing had infringed upon the riparian buffer and decreased the woody stem density of this plot below the minimum criteria.

Monitoring of stream geomorphology, completed in April 2007 with the stream survey and visual stability assessment, identified a number of emerging problem areas associated with the channel. Several areas of erosion, typically associated with meander bends, have resulted in bank scour and/or bank failure. The problem areas associated with aggradation in the mid-channel and the sedimentation of some in-channel structures is likely exacerbated by deposition of the eroded material. Despite the erosion and sedimentation problems, the constructed riffles remain stable, with a median particle size ranging from very coarse gravel to small cobble. The substrate of the pools also remained stable, with median particle sizes remaining fine to medium sand as was reported in the as-built plan.

In future monitoring years, stream geomorphology and vegetation data will be taken simultaneously in the fall of 2007 (Year 2) through the fall of 2010 (Year 5).

II. PROJECT BACKGROUND

A. Location and Setting

The project site is located approximately 2 miles southwest of Morganton, Burke County, North Carolina. The site is specifically located 1.7 miles southwest of the I-40/US 64 interchange, as shown in Figure 1. The stream channels included in this project are the mainstem of Bailey Fork, and two unnamed tributaries to Bailey Fork, designated as UT1 and UT2. The project reach along the mainstem includes a portion upstream of Probst Road (hereafter referred to as Upper) and a portion downstream of that road (hereafter referred to as Lower).

The directions to the project site are as follows:

> From I-40, take US 64 south to Propst Road (SR 1112) and turn right. The project site is located on the north and south sides of Propst Road approximately 1,800 feet from the Propst Road and US 64 intersection.

B. Project Structure, Mitigation Type, Approach and Objectives

The primary land use within the immediate project site was agricultural. Based on photographic interpretation, the site had been historically utilized for agricultural production of row crops and hay. It was very likely that the project site has been farmed since the Civil War era. The site had been degraded by past land management practices including mechanical land clearing, straightening and dredging of stream channels and continual hay production. The project site was most recently utilized to produce hay for livestock feed. The stream banks were denuded, actively eroding, and had a nearly vertical profile. Vegetative cover was minimal along the embankment, resulting in eroding banks and promoting lateral channel migration. The channels were in a highly incised state resulting in confined flood flows. Prior to restoration, the floodplain was functioning more as a terrace not accessible at the bankfull elevation.

The project goal for the restoration was to modify the dimension, pattern, and profile of the existing stream channels to be stable and self-maintaining by utilizing natural channel design techniques and procedures. Physical restoration and water quality improvements were accomplished by fulfilling the restoration objectives below:

- Design a channel with the appropriate cross-sectional dimension, pattern, and longitudinal profile while utilizing the existing channel condition survey, and collected reference reach data as a guide.
- Improve upon and create bed form and aquatic habitat diversity (riffles, runs, pools, and glides)
- Integrate, in conjunction with the stream restoration, a nested floodplain (bankfull bench) that will be accessible at the proposed bankfull channel elevation (Priority II restoration) or raise the bed elevation of the current stream so the bankfull elevation matches the current floodplain elevation (Priority I).
- Ensure channel and stream bank stabilization by integrating in-channel grade control structures, root wads, and native vegetation into the proposed restoration design while also creating a stable and functional aquatic and terrestrial habitat.
- Establish a native forested riparian plant community within a minimum of 30 feet from the proposed top of the bankfull channel. Remove exotic vegetation during construction implementation and the elimination of current embankment maintenance practices.
- Provide aesthetic and educational opportunities.

Information on the project structure and objectives is included in Tables I and II.

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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 1: SITE VICINITY MAP

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	Job No.	Scale:
December, 2006	2006-1626	1" = 3000'

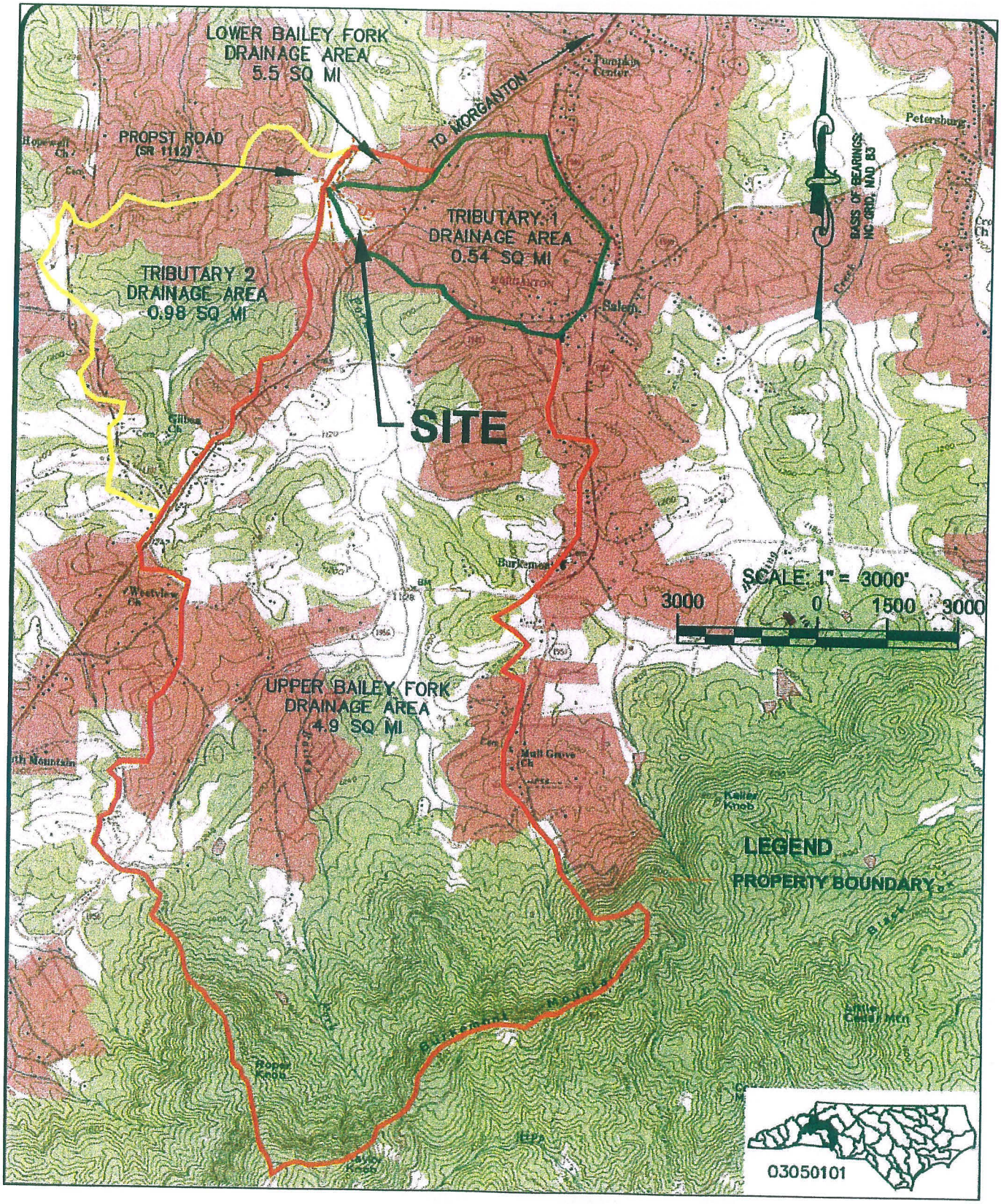

Table I. Project Structure Table Bailey Fork Stream Restoration / EEP Project No. D04006-02	
Project Segment/Reach ID	**Linear Footage or Acreage**
Upper	1,543.0 lf
Lower	1,170.4 lf
UT1	1,758.1 lf
UT2	1,271.0 lf
TOTAL	**5,742.5 lf**

Table II. Project Mitigation Objectives Table Bailey Fork Stream Restoration / EEP Project No. D04006-02				
Project Segment/ Reach ID	**Mitigation Type**	**Approach**	**Linear Footage or Acreage**	**Comment**
Upper	Restoration	Priority 2	1,543.0 lf	Restore dimension, pattern, and profile
Lower	Restoration	Priority 2	1,170.4 lf	Restore dimension, pattern, and profile
UT1	Restoration	Priority 1	1,758.1 lf	Restore dimension, pattern, and profile
UT2	Restoration	Priority 1	1,271.0 lf	Restore dimension, pattern, and profile
TOTAL			**5,742.5 lf**	

C. Project History and Background

Project activity and reporting history are provided in Table III. The project contact information is provided in Table IV. The project background history is provided in Table V.

Table III. Project Activity and Reporting History Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Jan 2005	Oct 2004	Mar 2005
Final Design - 90%	Jan 2005	N/A	Mar 2005
Construction	Aug 2005	N/A	Sep 2005
Temporary S&E applied to entire project area	Feb 2005	N/A	Feb 2005
Permanent plantings	Mar 2006	N/A	Mar 2006
Mitigation plan/As-built	Dec 2005	May 2006	Aug 2006
Year 1 monitoring	2006	Sep 2006 (vegetation) Apr 2007 (geomorphology)	May 2007
Year 2 monitoring	2007		
Year 3 monitoring	2008		
Year 4 monitoring	2009		
Year 5 monitoring	2010		

N/A: Data collection is not an applicable task to these project activities.

Table IV. Project Contact Table Bailey Fork Stream Restoration / EEP Project No. D04006-02	
Designer	Natural Systems Engineering* 3719 Benson Drive , Raleigh, NC 27609
Construction Contractor	Natural Systems Engineering* 3719 Benson Drive , Raleigh, NC 27609
Monitoring Performers	EMH&T, Inc. 5500 New Albany Road, Columbus, OH 43054
Stream Monitoring POC	Warren Knotts, EMH&T
Vegetation Monitoring POC	Holly Blunck, EMH&T
*Contact:	Jim Halley at The John R. McAdams Company, Inc 2905 Meridian Parkway, Durham, NC 27713

Table V. Project Background Table Bailey Fork Stream Restoration / EEP Project No. D04006-02	
Project County	Burke
Drainage Area-Upper	4.9 sq mi
Drainage Area-Lower	5.5 sq mi
Drainage Area-UT1	0.55 sq mi
Drainage Area-UT2	0.98 sq mi
Drainage Impervious Cover Estimate	10%
Stream Order	2nd
Physiographic Region	Piedmont
Ecoregion	Northern Inner Piedmont
Rosgen Classification of As-built	E/C type
Dominant Soil Types	Colvard sandy loam
Reference Site ID	Sal's Branch, Whites Creek, S. Muddy Birchfield, S. Muddy Tributary 4
USGS HUC for Project and Reference	03050101
NCDWQ Sub-basin for Project and Reference	03-08-31
NCDWQ Classification for Project and Reference	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reason for 303d listing or stressor	N/A
% of project easement fenced	20%

Data for Table V was derived from information from reports produced by Natural Systems Engineering.

D. Monitoring Plan View

The monitoring plan view is included as Figure 2. The information shown in Figure 2 is derived entirely from the As-Built stream plan provided with the approved Mitigation Plan report and recently revised by the original stream restoration designer/contractor. All structures shown have been confirmed by the stream restoration designer/contractor based on field reconnaissance. The monitoring plan view also depicts the locations of all monumented cross-sections, vegetation plots, crest gauges and photo points that are part of the five year monitoring effort for this project.

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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 2A - INDEX MAP

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: December, 2007

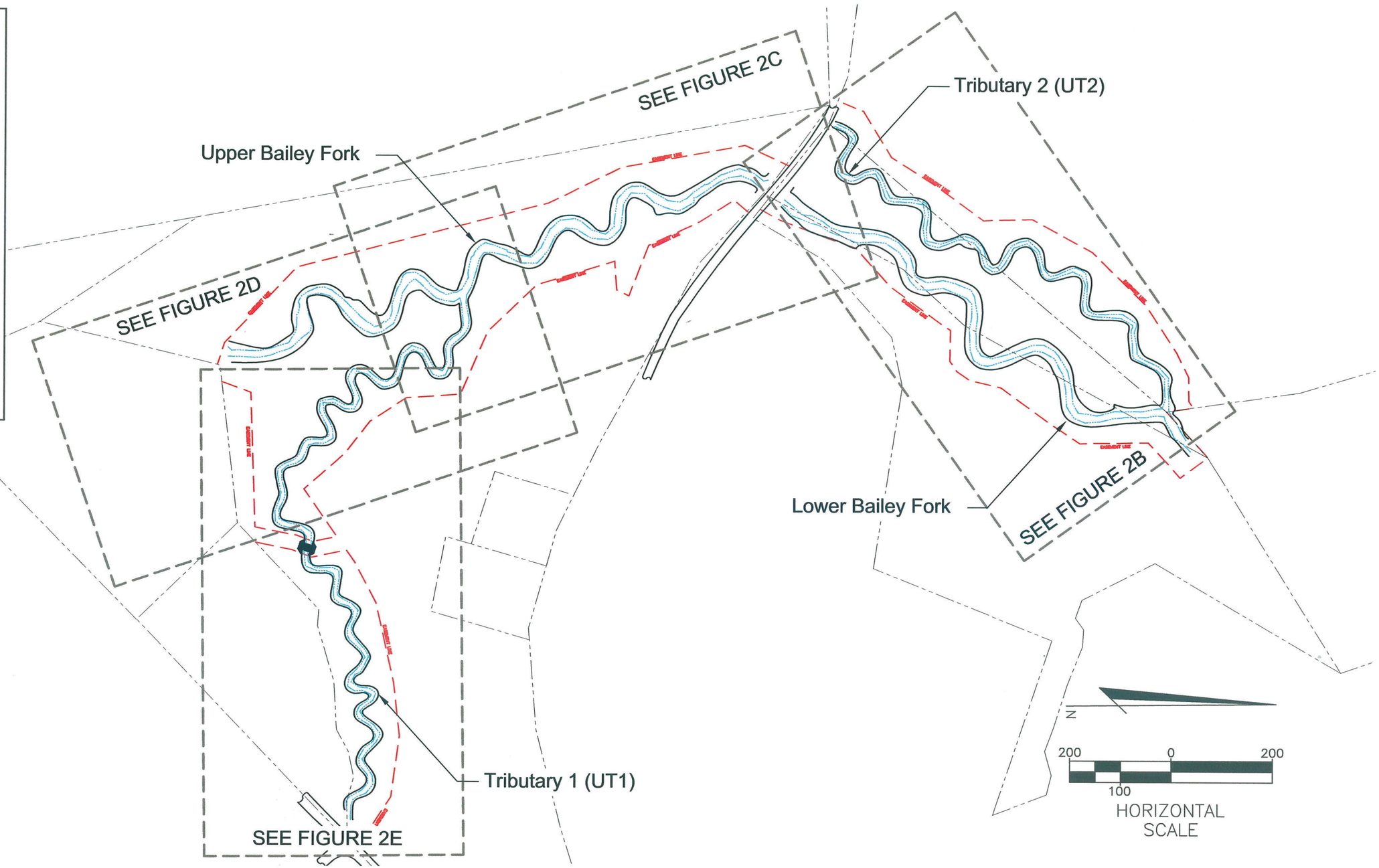
Scale: 1" = 60'

Job No: 2006-1626

LEGEND

- Root Wad
- Step–Cross Vane
- "J" Hook
- Rock Channel Sill
- Log Channel Sill
- Riffle

Base map and structure locations are shown per the as–built plan completed by Natural Systems Engineering in Nov. 2007.



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BAILEY FORK STREAM RESTORATION

FIGURE 2B

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	December, 2007
Scale:	1" = 60'
Job No:	2006-1626

LEGEND

- Vegetation Plot
- Photo Point
- Cross Section
- Crest Gauge

N/F
DAVID STROUP & WF
DB. 225 PG. 58

N/F
CHARLES TALBERT
DB. 1322 PG. 157
PB. 4 PG. 29

EASEMENT LINE
NEW FENCE LINE
VP-7
VP-8
VP-9
VP-10
XSEC 9
XSEC 10
XSEC 11
XSEC 12
PHOTO POINT 9 (PHOTO #9)
PHOTO POINT 10 (PHOTO #10)
PHOTO POINT 11 (PHOTO #11)
PHOTO POINT 12 (PHOTO #12)
PHOTO POINT 13 (PHOTO #13)
CG3
CG4
PERSON VANE
5" RCP
INV= 1031.39
7.5' GVAN
10.8 CMP
INV= 1031.27
INV= 1030.91
INV= 1030.80
INV= 1030.68

60 0 60
30
HORIZONTAL SCALE

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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 2C

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	December, 2007
Scale:	1" = 60'
Job No:	2006-1626

LEGEND

- Vegetation Plot
- Photo Point
- Cross Section
- Crest Gauge

N/F
JAYNES GLADYS
PROPST
DB. 225 PG. 59

N

60 0 60
30
HORIZONTAL
SCALE

EASEMENT LINE

XSEC 5
XSEC 6
XSEC 7
XSEC 8

PHOTO POINT 14 (PHOTO #14)
PHOTO POINT 6 (PHOTO #6)
PHOTO POINT 5 (PHOTO #5)
PHOTO POINT 8 (PHOTO #8)
PHOTO POINT 7 (PHOTO #7)

VP-5
VP-6
VP-7

CG2

PROPST ROAD
(ASPHALT ROAD)

NEW FENCE LINE

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BAILEY FORK STREAM RESTORATION

FIGURE 2D

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	December, 2007
Scale:	1" = 60'
Job No:	2006-1623

LEGEND

- Vegetation Plot
- Photo Point
- Cross Section
- Crest Gauge

N/F
CHARLIE DUVAL
DB. 841 PG. 1650

EASEMENT LINE

VP-2
VP-3
VP-4
VP-5

XSEC 3
XSEC 4
XSEC 5
XSEC 6

PHOTO POINT 3 (PHOTO #3)
PHOTO POINT 4 (PHOTO #4)
PHOTO POINT 5 (PHOTO #5)
PHOTO POINT 6 (PHOTO #6)
PHOTO POINT 14 (PHOTO #14)

CG2

N

60 0 60
30
HORIZONTAL SCALE

PERMANENT BENCHMARK
ELEVATION 1045.53 FT.

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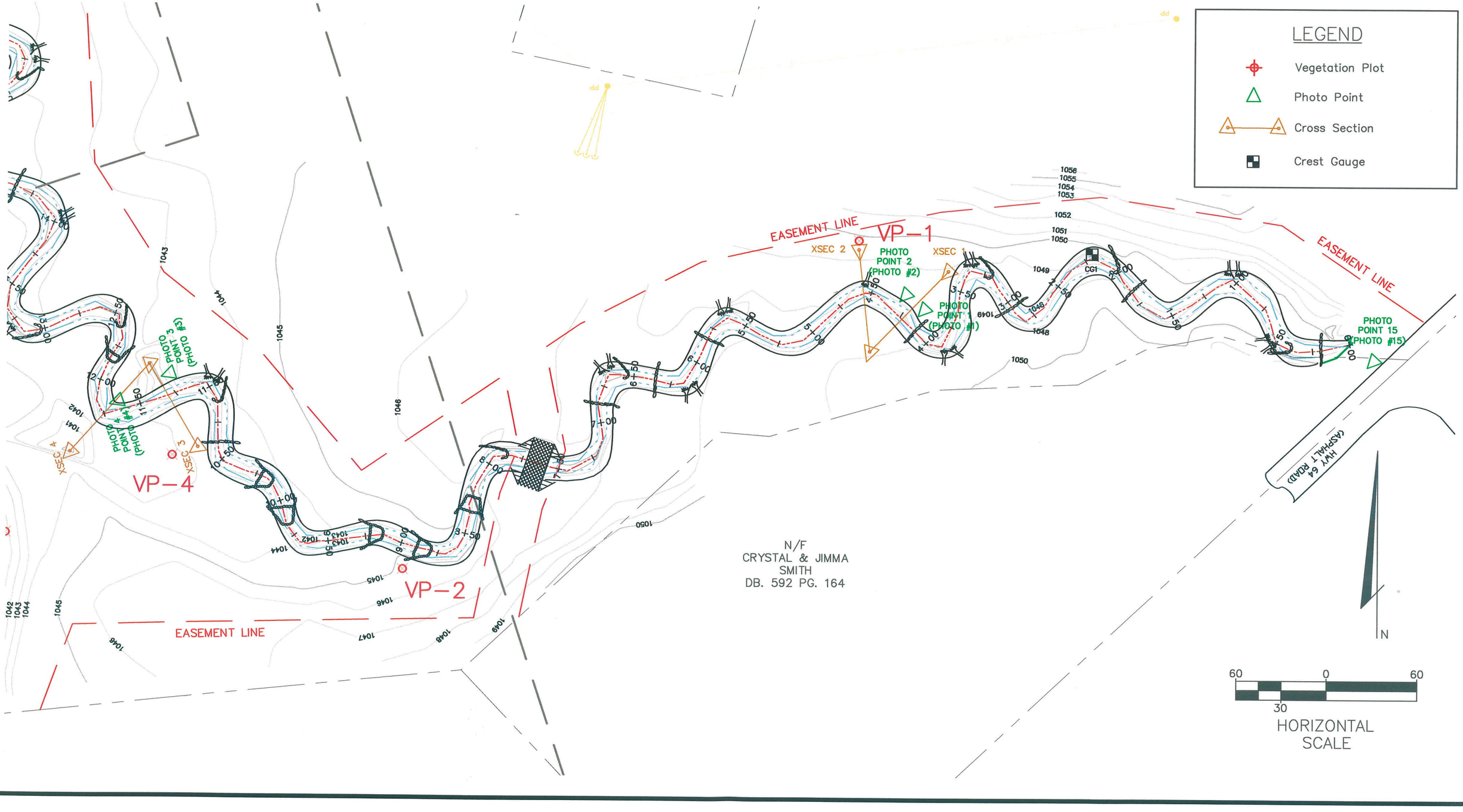
BAILEY FORK STREAM RESTORATION

FIGURE 2E

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	December, 2007
Scale:	1" = 60'
Job No:	2006-1626



III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

Soils present in the riparian area adjacent to Bailey Fork are characteristic of those found in alluvial landforms within the Northern Inner Piedmont ecoregion of North Carolina. Colvard sandy loam soils are the only mapped unit located within the floodplain and immediately adjacent to the stream channels on the project site. Colvard soils are formed in loamy alluvial deposits, and are nearly level, very deep, and well-drained or moderately well-drained.

Other soils within the project's vicinity include Fairview sandy clay loam and Unison fine sandy loam, which are mapped on adjacent slopes and terraces. No hydric soils were mapped within the project corridor.

Data on the soils series found within and near the project site is summarized in Table VI.

Table VI. Preliminary Soil Data
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Series	Max. Depth (in.)	% Clay on Surface	K	T	OM %
Colvard sandy loam	60+	8-18	0.24	5	1-2
Fairview sandy clay loam	60+	20-35	0.24	5	0.5-1
Unison fine sandy loam	60+	12-20	0.24	5	0.5-1

Data for Table VI was derived from information from reports produced by Natural Systems Engineering.

2. Vegetative Problem Areas

Vegetative Problem Areas are defined as areas either lacking vegetation or containing populations of exotic vegetation. All problem areas identified during Monitoring Year 1 are summarized in Table VII. Photographs of the vegetative problem areas are shown in Appendix A.

Table VII. Vegetative Problem Areas
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Feature/Issue	Station # / Range	Probable Cause	Photo #
Other	Vegetation Plot 5	Pasture mowing infringed upon riparian buffer	VPA 1

The only vegetation problem area was a section near Vegetation Plot #5 where mowing of the adjacent pasture land for hay had infringed upon the riparian buffer. This mowing appeared to have damaged and killed some of the woody vegetation planted in this area.

3. Vegetation Problem Area Plan View

The location of each vegetation problem area is shown on the vegetative problem area plan view included in Appendix A.

4. Stem Counts

A summary of the stem count data for each species arranged by plot is shown in Table 8. This data was compiled from the information collected on each plot using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0.* Additional data tables generated using the CVS-EEP format are included in Appendix A.

Table VIII. Stem counts for each species arranged by plot.
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Species	Plots										Year 1 Totals
	1	2	3	4	5	6	7	8	9	10	
Shrubs											
Alnus serrulata	1										1
Cephalanthus occidentalis	1		1				1				3
Cornus amomum				1		1		3	2	2	9
Rosa palustris	2										2
Trees											0
Liriodendron tulipifera		1		1		10	3				15
Platanus occidentalis	1	1	12	4	1	1	6			9	35
Quercus pagoda		10				1	4	9	7		31
Quercus phellos	1		1	1			1	2	1	2	9
Salix nigra		1									1
Year 1 Totals	6	13	14	7	1	13	15	14	10	13	106
Live Stem Density	243	527	567	284	41	527	608	567	405	527	
Average Live Stem Density	429										

The average stem density for the entire site exceeds the minimum criteria of 320 stems per acre after three years. Three individual plots had stem densities below the minimum; however, green ash seedlings have recruited in two of these plots, which would increase the stem counts. The third plot, Plot #5, was discussed in the Vegetation Problem Areas section of this report.

5. Vegetation Plot Photos

Vegetation plot photos are provided in Appendix A.

B. Stream Assessment

1. Hydrologic Criteria

One bankfull event was has been documented for the site, as reported in the Mitigation As-Built Report. No further bankfull events have been recorded during the monitoring period.

2. Stream Problem Areas

A summary of the areas of concern identified during the visual assessment of the stream is included in Table IX.

Table IX. Stream Problem Areas Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	4+00 - 4+25 Upper	Lateral bar; bank material moving	SPA 1
	1+50 - 2+00 Upper	Lateral bar; bank material moving	
Bank failure	9+00 Lower	Location of rootwad contributing to downstream bank failure	SPA 2
	8+00 Lower	Large boulder fell out of bank; bank cutting back	
	11+50 Upper	Bank armor has fallen, washed-out behind	
Bank scour	11+80 - 12+50 Upper	Coir matting has fallen, channel bank washed-out behind; deposition downstream	SPA 3
	10+25 Upper	Location of rootwad contributing to downstream bank slough	
	3+50 Upper	Channel is overwide, bank is slumping	
Stressed/failing structure	5+60 UT2	Embedded rock sill; channel is stable	SPA 4
	2+50 UT2	Embedded cross-vane; channel is stable	
	1+25 UT2	Embedded J-hook; channel is stable	
	14+75 Upper	Half buried J-hook; channel is stable	
	13+00 Upper	Embedded J-hook; channel is stable	
	10+60 UT1	Embedded rock sill ; channel is stable	
	3+25 UT1	Half buried J-hook; channel is stable	
	0+50 UT1	Embedded J-hook; channel is stable	
	0+25 UT1	Embedded rock sill ; channel is stable	
Other	7+00 UT1	Sinkhole adjacent to channel; water flowing through	SPA 5

A number of unstable areas were found along the upper and lower reaches of the Bailey Fork mainstem, including areas of aggradation, bank scour, and bank failure. Several structures along Upper Bailey Fork and Tributaries UT1 and UT2 have become impacted by channel aggradation at these structures. As sand is dominant in the watershed, the sediment over the embedded structures may partially result from the natural sand supply in the watershed. However, in each area where a structure is embedded, the channel is stable, with no bank failure or bar formation.

3. Stream Problem Areas Plan View

The location of each structural problem area is shown on the stream problem area plan view included in Appendix B.

4. Stream Problem Areas Photos

Photographs of the stream problem areas are included in Appendix B.

5. Fixed Station Photos

The fixed photograph stations correspond to the monumented cross-sections of the same number. These photographs are provided on the cross-section data sheets located in Appendix B.

6. Stability Assessment Table

The visual stream assessment was performed to determine the percentage of stream features that remain in a state of stability after the first year of monitoring. A summary of the visual

assessment for each reach is included in Table Xa through Table Xd. This summary was compiled from the more comprehensive Table B1, included in Appendix B. Each of the structures shown on the as-built plans were assessed during monitoring and reported in the tables.

Table Xa. Categorical Stream Feature Visual Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Upper

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	87%				
B. Pools[2]	100%	88%				
C. Thalweg	100%	100%				
D. Meanders	100%	91%				
E. Bed General	100%	98%				
F. Vanes / J Hooks etc.[3]	100%	97%				
G. Wads and Boulders[4]	N/A	N/A				

Table Xb. Categorical Stream Feature Visual Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Lower

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	100%				
B. Pools[2]	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	91%				
E. Bed General	100%	100%				
F. Vanes / J Hooks etc. [3]	100%	100%				
G. Wads and Boulders[4]	N/A	N/A				

Table Xc. Categorical Stream Feature Visual Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: UT1

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	93%				
B. Pools[2]	100%	89%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes / J Hooks etc. [3]	100%	97%				
G. Wads and Boulders[3]	100%	100%				

Table Xd. Categorical Stream Feature Visual Stability Assessment Bailey Fork Stream Restoration / EEP Project No. D04006-02 Segment/Reach: UT2						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%				
B. Pools[2]	100%	96%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes / J Hooks etc. [3]	100%	95%				
G. Wads and Boulders[4]	N/A	N/A				

[1]Riffles are assessed using the longitudinal profile. A riffle is determined to be stable based on a comparison of location and elevation with respect to the as-built profile.
[2]Pools are assessed using the longitudinal profile. A pool is determined to be stable based on a comparison of location and elevation with respect to the as-built profile and a consideration of appropriate depth.
[3]Physical structures such as vanes, J-hooks, and root wads are assessed using the as-built plan sheets to define the location of such features. A structure is considered stable if the feature remains functional in the same location as shown in the as-built plan.
[4]Those features not included in the stream restoration were labeled N/A. This includes structures such as rootwads and boulders.

All of the meanders in an unstable state had pronounced erosion along the outer bends. Streambank maintenance has already occurred to reestablish stability; this will be documented in the Year 2 results. Identified problematic structures on Upper Bailey and on Tributaries UT1 and UT2 were vanes/J-hooks. Each of the affected structures has become embedded in fine sediment. However, the channel is stable at each location where aggradation has covered a structure. Deposition was also deemed the likely cause for those pools and riffles that differed in profile from the as-built. Some of the pools have become quite shallow, a few to the point of losing pool functions. The unstable riffles were typically areas where a structure had become covered by sediment. Despite the deposition, the channel appears to be stable, and no maintenance is planned for these features.

7. Quantitative Measures

Graphic interpretations of cross-sections, profiles and pebble counts are provided in Appendix B. A summary of the baseline morphology for the site is included in Table XI for comparison with the monitoring data shown in the tables in the appendix. All geomorphic data in Table XI, except for the Year 1 monitoring data, was derived from information provided by Natural Systems Engineering. All Year 0 data represented in the cross-sections and profiles contained in Appendix B was also derived from information provided by Natural Systems Engineering.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: Upper {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XSs 5 & 8			Year 1 Sta. 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			4.90	0.14	1.70	0.92			4.90			4.90			4.90			4.90
BF Width (ft)			25.10	7.35	10.80	9.08	19.90	26.47	23.19			28.00	28.20	37.70	32.95	29.07	30.94	30.01
Floodprone Width (ft)				43.00	150.00	96.50	180.00	180.00	180.00			280.00	100.00	109.00	104.50	99.20	109.50	104.35
BF Cross Sectional Area (ft^2)			63.62	9.10	20.70	14.90	67.37	71.69	69.53			65.00	71.70	81.80	76.75	77.68	102.22	89.95
BF Mean Depth (ft)			2.53	1.30	2.10	1.70	2.71	3.38	3.05			2.30	2.30	2.30	2.30	2.67	3.30	2.99
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			4.20	4.10	5.20	4.65	4.14	5.39	4.77
Width/Depth (ft)			9.92	5.65	5.14	5.40	7.34	7.83	7.59			12.20	12.26	16.39	14.33	9.38	10.89	10.14
Entrenchment Ratio				5.85	13.89	9.87	9.05	9.04	9.04			10.00	3.55	2.89	3.22	3.41	3.54	3.48
Bank Height Ratio				0.70	1.00	0.85	1.80	2.10	1.95			1.00	1.00	1.10	1.05	1.00	1.10	1.05
Wetted Perimeter (ft)			30.16	9.95	15.00	12.48	25.32	33.23	29.28			32.60	32.80	42.30	37.55	30.60	34.41	32.51
Hydraulic Radius (ft)			2.11	0.91	1.38	1.15	2.66	2.16	2.41			1.99	1.93	2.19	2.06	2.54	2.97	2.76
Pattern																		
*Channel Beltwidth (ft)				20.00	50.00	35.00	75.00	105.00	90.00	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50
*Radius of Curvature (ft)				10.00	21.00	15.50	18.00	30.00	24.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00
*Meander Wavelength (ft)				35.00	50.00	42.50	60.00	96.00	78.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00
*Meander Width Ratio				2.00	21.80	11.90	3.20	3.60	3.40	2.50	5.50	4.00	2.50	5.50	4.00	2.26	5.10	3.68
Profile																		
Riffle Length (ft)				3.00	26.40	14.70	15.00	67.80	41.40	23.80	68.00	45.90	23.80	68.00	45.90	5.60	24.00	12.70
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0086	0.0860	0.0473	0.0020	0.0035	0.0028	0.0020	0.0035	0.0028	0.0120	0.0456	0.0238
Pool Length (ft)				5.50	41.30	23.40	80.00	100.00	90.00	45.00	96.00	70.50	45.00	96.00	70.50	27.90	72.20	51.20
Pool Spacing (ft)				16.00	70.00	43.00	81.00	211.00	146.00	95.00	224.00	159.50	95.00	224.00	159.50	56.00	167.00	98.20
Substrate																		
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				6.9	19.6	13.3			113.4
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			55.0	121.0	154.0	137.5			178.3
Additional Reach Parameters																		
Valley Length (ft)				209	295	252.00			1108			1108			1108			550
Channel Length (ft)				406	479	442.50			1383.0			1410.4			1543.0			800
Sinuosity				1.9	1.6	1.8			1.1			1.3			1.3			1.5
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0027			0.0053
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0020			0.0032
Rosgen Classification			E	E4	E4	E4			E-F-G			E4/C4			C4			E4
*Habitat Index																		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Year 1 data was derived using only the three riffle cross-sections out of the six total cross-sections from which pebble count data was collected. For this segment, XS 5 was the only riffle cross-section for which data was collected.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: Lower {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XS 12			Year 1 Sta 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			5.50	0.14	1.70	0.92			5.50			5.50			5.50			5.50
BF Width (ft)			26.02	7.35	10.80	9.08	19.90	37.42	28.66			30.00			31.50			32.36
Floodprone Width (ft)				43.00	150.00	96.50	70.00	143.33	70.00			250.00			106.00			104.21
BF Cross Sectional Area (ft^2)			67.85	9.10	20.70	14.90	78.11	95.26	86.69			75.00			81.40			81.42
BF Mean Depth (ft)			2.61	1.30	2.10	1.70	1.60	3.00	2.30			2.50			2.60			2.52
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			4.50			4.30			4.35
Width/Depth (ft)			9.97	5.65	5.14	5.40	5.88	9.77	7.83			12.00			12.12			12.84
Entrenchment Ratio				5.85	13.89	9.87	6.80	9.04	7.92			8.33			3.37			3.22
Bank Height Ratio				0.70	1.00	0.85	1.80	2.10	1.95			1.00			1.05			1.05
Wetted Perimeter (ft)			31.24	9.95	15.00	12.48	23.10	43.42	33.26			35.00			36.70			34.27
Hydraulic Radius (ft)			2.17	0.91	1.38	1.15	3.38	2.19	2.79			2.14			2.22			2.38
Pattern																		
*Channel Beltwidth (ft)				20.00	50.00	35.00	75.00	105.00	90.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00
*Radius of Curvature (ft)				10.00	21.00	15.50	18.00	30.00	24.00	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50
*Meander Wavelength (ft)				35.00	50.00	42.50	60.00	96.00	78.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00
*Meander Width Ratio				2.00	21.80	11.90	3.20	3.60	3.40	3.27	4.00	3.63	3.11	3.81	3.46	3.03	3.71	3.37
Profile																		
Riffle Length (ft)				3.00	26.40	14.70	34.80	69.50	52.15	14.00	40.00	27.00	30.00	55.00	42.50	6.90	15.80	11.35
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0070	0.0235	0.0153	0.0025	0.0070	0.0048	0.0013	0.0029	0.0021	0.0095	0.0447	0.0271
Pool Length (ft)				5.50	41.30	23.40	27.20	60.00	43.60	20.00	45.00	32.50	50.00	100.00	75.00	27.70	54.10	40.90
Pool Spacing (ft)				16.00	70.00	43.00	110.00	110.00	110.00	50.00	85.00	67.50	110.00	140.00	125.00	50.60	141.60	113.28
Substrate																		
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				6.9	19.6	13.3			46.1
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			80.0	121.0	154.0	137.5			96.7
Additional Reach Parameters																		
Valley Length (ft)				209	295	252.00			920			920			920			635
Channel Length (ft)				406	479	442.50			1125.3			1174.1			1170.4			800
Sinuosity				1.9	1.6	1.8			1.2			1.3			1.3			1.3
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0049			0.0025			0.0028			0.00178
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0075			0.0033			0.0030			0.00182
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4
*Habitat Index																		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria.

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Year 1 data was derived using only the three riffle cross-sections out of the six total cross-sections from which pebble count data was collected. For this segment, XS 12 was the only riffle cross-section for which data was collected.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: UT1 {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XSs 1 & 3			Year 1 Sta. 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			0.54	0.14	1.70	0.92			0.54			0.54			0.54			0.54
BF Width (ft)			10.93	7.35	10.80	9.08	19.90	26.47	23.19			14.00	16.60	27.40	22.00	14.43	17.76	16.10
Floodprone Width (ft)				43.00	150.00	96.50	180.00	180.00	180.00	65.00	120.00	92.50	64.40	74.00	69.20	63.78	72.92	68.35
BF Cross Sectional Area (ft^2)			14.30	9.10	20.70	14.90	67.37	71.69	69.53			17.50	15.40	27.40	21.40	12.60	15.45	14.03
BF Mean Depth (ft)			1.30	1.30	2.10	1.70	2.71	3.38	3.05			1.30	0.56	1.73	1.15	0.87	0.87	0.87
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			1.80	1.80	3.00	2.40	1.66	1.98	1.82
Width/Depth (ft)			8.41	5.65	5.14	5.40	5.88	9.77	7.83			10.77	15.84	29.64	22.74	16.59	20.41	18.50
Entrenchment Ratio				5.85	13.89	9.87	6.80	9.04	7.92			6.61	2.70	3.88	3.29	3.59	5.05	4.32
Bank Height Ratio				0.70	1.00	0.85	2.05	2.15	2.10			1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)			13.53	9.95	15.00	12.48	25.32	33.23	29.28			16.60	17.72	30.86	24.29	15.20	19.06	17.13
Hydraulic Radius (ft)			1.06	0.91	1.38	1.15	2.66	2.16	2.41			1.05	0.87	0.89	0.88	0.81	0.83	0.82
Pattern																		
*Channel Beltwidth (ft)				20.00	50.00	35.00	30.00	40.00	35.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00
*Radius of Curvature (ft)				10.00	21.00	15.50	9.00	18.00	13.50	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00
*Meander Wavelength (ft)				35.00	50.00	42.50	48.00	60.00	54.00	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50
*Meander Width Ratio				2.00	21.80	11.90	2.80	3.70	3.25	2.10	5.70	3.90	2.10	5.70	3.90	2.08	4.50	3.29
Profile																		
Riffle Length (ft)				3.00	26.40	14.70	34.80	69.50	52.15	14.00	40.00	27.00	4.00	37.00	14.22	4.70	28.60	15.70
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0070	0.0235	0.0153	0.0025	0.0070	0.0048	0.0010	0.1830	0.0020	0.0046	0.0645	0.0254
Pool Length (ft)				5.50	41.30	23.40	27.20	60.00	43.60	20.00	45.00	32.50	3.00	37.00	20.00	8.40	56.90	30.80
Pool Spacing (ft)				16.00	70.00	43.00	110.00	110.00	110.00	50.00	85.00	67.50	22.00	88.00	50.00	39.77	120.50	64.00
Substrate																		
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				16.7	22.4	19.6			
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			65.0	31.0	50.0	40.5			
Additional Reach Parameters																		
Valley Length (ft)				209	295	252.00			1225			1225			1225			575
Channel Length (ft)				406	479	442.50			1648.1			1707.3			1758.1			800
Sinuosity				1.9	1.6	1.8			1.3			1.4			1.4			1.4
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0071			0.0047
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0064			0.0046
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4
*Habitat Index																		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Year 1 data was derived using only the three riffle cross-sections out of the six total cross-sections from which pebble count data was collected. No data is reported for this segment, as only pool cross-sections were used for data collection.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: UT2 {Long-Term Monitoring Profile Station 0+00 to 6+00 (600 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XS 10			Year 1 Sta. 0+00 - 6+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			0.98	0.14	1.70	0.92			0.98			0.98			0.98			0.98
BF Width (ft)			13.59	7.35	10.80	9.08			8.20			16.00			18.60			16.97
Floodprone Width (ft)				43.00	150.00	96.50	12.00	150.00	81.00	60.00	180.00	120.00			67.00			67.00
BF Cross Sectional Area (ft^2)			21.14	9.10	20.70	14.90			20.10			23.00			18.70			15.43
BF Mean Depth (ft)			1.55	1.30	2.10	1.70			2.40			1.40			1.00			0.91
BF Max Depth (ft)				1.80	2.80	2.30			3.50			2.00			1.90			1.55
Width/Depth (ft)			8.77	5.65	5.14	5.40			3.42			8.00			18.60			18.65
Entrenchment Ratio				5.85	13.89	9.87			0.00			7.50			3.60			3.95
Bank Height Ratio				0.70	1.00	0.85			0.00			1.00			1.00			1.00
Wetted Perimeter (ft)			16.69	9.95	15.00	12.48			0.00			18.80			20.60			17.41
Hydraulic Radius (ft)			1.27	0.91	1.38	1.15			0.00			1.22			0.91			0.89
Pattern																		
*Channel Beltwidth (ft)				20.00	50.00	35.00	30.00	33.00	31.50	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60
*Radius of Curvature (ft)				10.00	21.00	15.50	15.00	18.00	16.50	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00
*Meander Wavelength (ft)				35.00	50.00	42.50	66.00	78.00	72.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00
*Meander Width Ratio				2.00	21.80	11.90	3.70	4.00	3.85	2.10	5.70	3.90	2.10	5.70	3.90	2.10	5.70	3.90
Profile																		
Riffle Length (ft)				3.00	26.40	14.70	16.00	24.00	20.00	16.00	44.80	30.40	16.00	44.80	30.40	3.60	13.10	8.90
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0072	0.0650	0.0361	0.0020	0.0045	0.0033	0.0020	0.0045	0.0033	0.0080	0.0616	0.0259
Pool Length (ft)				5.50	41.30	23.40				22.40	48.00	35.20	22.40	48.00	35.20	12.50	53.10	29.00
Pool Spacing (ft)				16.00	70.00	43.00				55.00	85.00	70.00	55.00	85.00	70.00	37.20	80.10	63.70
Substrate																		
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0						2.0			45.0
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			48.0			62.0			173.5
Additional Reach Parameters																		
Valley Length (ft)				209	295	252.00			860			860			860			425
Channel Length (ft)				406	479	442.50			898.9			1181.6			1271.0			600
Sinuosity				1.9	1.6	1.8			1.1			1.4			1.5			1.4
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0051			0.0024
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0047			0.0026
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4
*Habitat Index																		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Year 1 data was derived using only the three riffle cross-sections out of the six total cross-sections from which pebble count data was collected. For this segment, XS 10 was the only riffle cross-section for which data was collected.

IV. METHODOLOGY

Vegetation monitoring was conducted in September 2006 using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee, M.T., Peet, RK., Roberts, S.R., Wentworth, T.R. 2006). Stream monitoring (geomorphic survey) was conducted in April 2007 to provide adequate time between the as-built survey (completed in August 2006) and the Year 1 monitoring survey. Stream monitoring for Year 2 will occur in the fall of 2007, to provide six months between the Year 1 and Year 2 surveys. Subsequent stream monitoring will occur in the fall of Years 3, 4 and 5 to provide a full year between surveys. Vegetation monitoring will continue to be conducted in the fall of each subsequent year of monitoring, providing a full year between vegetative surveys.

APPENDIX A

Vegetation Raw Data

1. Vegetation Problem Area Photos
2. Vegetation Problem Area Plan View
3. Vegetation Monitoring Plot Photos
4. Vegetation Data Tables

VPA 1
View of mowed pasture infringing upon the riparian area near Vegetation Plot 5.
(EMH&T, Inc. 9/20/06)

EMH&T
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M C M X X V I

COUNTY, NORTH CAROLINA

BAILEY FORK

MONITORING

APPENDIX A

VEGETATION PROBLEM AREA PLAN VIEW

Date:	September, 2006
Scale:	1" = 200'
Job No:	2006-1626

Vegetation Plot 1
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 2
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 3
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 4
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 5
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 6
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 7
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 8
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 9
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Vegetation Plot 10
Monitoring Year 1
(EMH&T, Inc. 9/20/06)

Table 1. Vegetation Metadata	
Report Prepared By	Holly Blunck
Date Prepared	12/11/2006 16:14
database name	CVS_EEP_DataEntry_v202.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	This worksheet, which is a summary of the project and the project data.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
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.
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	D040062
project Name	Bailey Fork
Description	Restoration of Bailey Fork and unnamed tributaries
length (ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

Table 2. Vegetation Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Alnus serrulata	1					
	Cephalanthus occidentalis	3					
	Cornus amomum	8		1			
	Quercus pagoda	21	10				
	Quercus phellos	7	2				
	Rosa palustris	2					
	Salix nigra	1					
	Liriodendron tulipifera	11	4				
	Platanus occidentalis	19	15	1			
TOT:	**9**	**73**	**31**	**2**			

Table 3. Vegetation Damage by Species							
	Species	All Damage Categories	(no damage)	Die-back	Deer	Insects	Other/Unknown Animal
	Alnus serrulata	1	1				
	Cephalanthus occidentalis	3	3				
	Cornus amomum	9	8	1			
	Liriodendron tulipifera	15	15				
	Platanus occidentalis	35	32	2			1
	Quercus pagoda	31	26	2	2	1	
	Quercus phellos	9	9				
	Rosa palustris	2	2				
	Salix nigra	1	1				
TOT:	**9**	**106**	**97**	**5**	**2**	**1**	**1**

Table 4. Vegetation Damage by Plot							
	plot	All Damage Categories	(no damage)	_Enter other damage_	Deer	Insects	Other/Unknown Animal
	D040062-01-0001	6	6				
	D040062-01-0002	13	13				
	D040062-01-0003	14	11	2			1
	D040062-01-0004	7	7				
	D040062-01-0005	1	1				
	D040062-01-0006	13	13				
	D040062-01-0007	15	15				
	D040062-01-0008	14	11	2		1	
	D040062-01-0009	10	7	1	2		
	D040062-01-0010	13	13				
TOT:	**10**	**106**	**97**	**5**	**2**	**1**	**1**

Table 5. Stem Count by Plot and Species															
	Species	Total Stems	# plots	avg# stems	plot D040062-01-0001	plot D040062-01-0002	plot D040062-01-0003	plot D040062-01-0004	plot D040062-01-0005	plot D040062-01-0006	plot D040062-01-0007	plot D040062-01-0008	plot D040062-01-0009	plot D040062-01-0010
	Alnus serrulata	1	1	1	1									
	Cephalanthus occidentalis	3	3	1	1		1				1			
	Cornus amomum	9	5	1.8				1		1		3	2	2
	Liriodendron tulipifera	15	4	3.75		1		1		10	3			
	Platanus occidentalis	35	8	4.38	1	1	12	4	1	1	6			9
	Quercus pagoda	31	5	6.2		10				1	4	9	7	
	Quercus phellos	9	7	1.29	1		1	1			1	2	1	2
	Rosa palustris	2	1	2	2									
	Salix nigra	1	1	1		1								
TOT:	**9**	**106**	**9**		**6**	**13**	**14**	**7**	**1**	**13**	**15**	**14**	**10**	**13**

APPENDIX B

Geomorphologic Raw Data

1. Stream Problem Areas Plan View
2. Stream Problem Area Photos
3. Table B1. Qualitative Visual Stability Assessment
4. Cross Section Plots
5. Longitudinal Plots
6. Pebble Count Plots

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COUNTY, NORTH CAROLINA

BAILEY FORK

MONITORING

APPENDIX B

STREAM PROBLEM AREA PLAN VIEW

Date:	November, 2007
Scale:	1" = 200'
Job No:	2006-1626

SPA 1
Area of aggradation along Upper Bailey Fork between stations 1+50 and 2+00.
(EMH&T, Inc. 4/13/07)

SPA 2
Bank failure along Upper Bailey Fork between stations 11+25 and 11+75.
(EMH&T, Inc. 4/13/07)

SPA 3
Bank scour along Upper Bailey Fork at station 3+50.
(EMH&T, Inc. 4/13/07)

SPA 4
Stressed or failing structure along Upper Bailey Fork at station 1+25.
Buried J-hook.
(EMH&T, Inc. 4/13/07)

SPA 5
Sinkhole along right bank of UT1 near station 7+00.
(EMH&T, Inc. 9/21/06)

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Upper

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built*	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	13	15	2	87	
	2. Armor stable (e.g. no displacement)?	13	15	2	87	
	3. Facet grade appears stable?	13	15	2	87	
	4. Minimal evidence of embedding/fining?	13	15	2	87	
	5. Length appropriate?	13	15	2	87	**87%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	14	16	2	88	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	14	16	2	88	
	3. Length appropriate?	14	16	2	88	**88%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	11	11	0	100	
	2. Downstream of meander (glide/inflection) centering?	11	11	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	7	11	4	64	
	2. Of those eroding, # w/concomitant point bar formation?	11	11	0	100	
	3. Apparent Rc within spec?	11	11	0	100	
	4. Sufficient floodplain access and relief?	11	11	0	100	**91%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	2/ 75 feet	97	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**98%**
F. Vanes/ Sills	1. Free of back or arm scour?	16	16	0	100	
	2. Height appropriate?	16	16	0	100	
	3. Angle and geometry appear appropriate?	16	16	0	100	
	4. Free of piping or other structural failures?	16	16	0	100	
	5. Structure buried under aggraded material	14	16	2	87	**97%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Lower

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built*	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	9	9	0	100	
	2. Armor stable (e.g. no displacement)?	9	9	0	100	
	3. Facet grade appears stable?	9	9	0	100	
	4. Minimal evidence of embedding/fining?	9	9	0	100	
	5. Length appropriate?	9	9	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	10	10	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	10	10	0	100	
	3. Length appropriate?	10	10	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	6	6	0	100	
	2. Downstream of meander (glide/inflection) centering?	6	6	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	6	2	66	
	2. Of those eroding, # w/concomitant point bar formation?	6	6	0	100	
	3. Apparent Rc within spec?	6	6	0	100	
	4. Sufficient floodplain access and relief?	6	6	0	100	**91%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes/ Sills	1. Free of back or arm scour?	9	9	0	100	
	2. Height appropriate?	9	9	0	100	
	3. Angle and geometry appear appropriate?	9	9	0	100	
	4. Free of piping or other structural failures?	9	9	0	100	
	5. Structure buried under aggraded material	9	9	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: UT1

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built*	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	33	35	2	94	
	2. Armor stable (e.g. no displacement)?	33	35	2	94	
	3. Facet grade appears stable?	33	35	2	94	
	4. Minimal evidence of embedding/fining?	31	35	4	89	
	5. Length appropriate?	33	35	2	94	**93%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	33	35	2	94	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	28	35	7	80	
	3. Length appropriate?	33	35	2	94	**89%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	28	28	0	100	
	2. Downstream of meander (glide/inflection) centering?	28	28	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	28	28	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	28	28	0	100	
	3. Apparent Rc within spec?	28	28	0	100	
	4. Sufficient floodplain access and relief?	28	28	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes/ Sills	1. Free of back or arm scour?	31	31	0	100	
	2. Height appropriate?	31	31	0	100	
	3. Angle and geometry appear appropriate?	31	31	0	100	
	4. Free of piping or other structural failures?	31	31	0	100	
	5. Structure buried under aggraded material	27	31	4	87	**97%**
G. Wads/ Boulders	1. Free of scour?	12	12	0	100	
	2. Footing stable?	12	12	0	100	**100%**

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: UT2

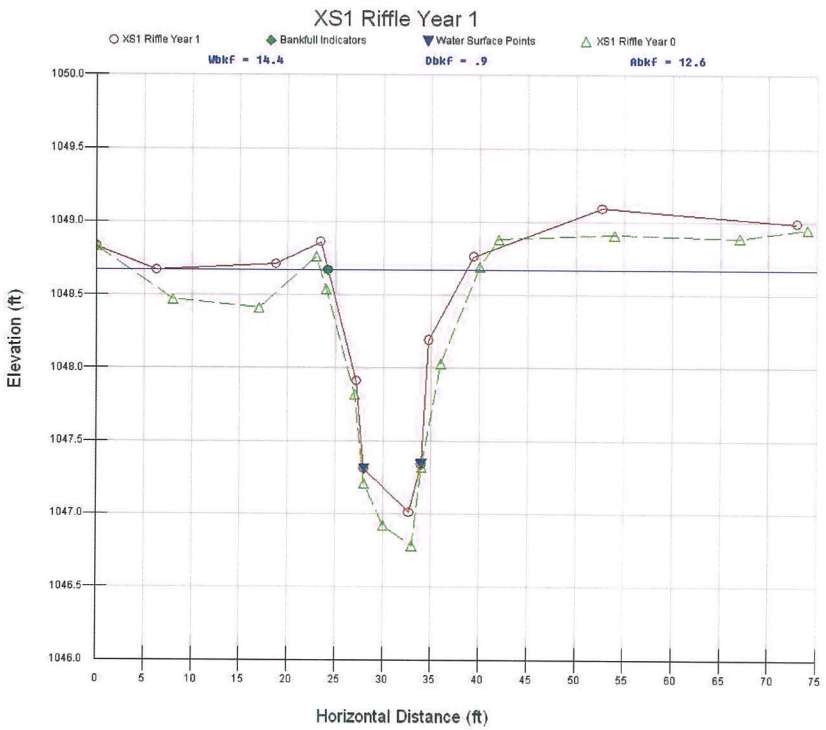
Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built*	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	19	19	0	100	
	2. Armor stable (e.g. no displacement)?	19	19	0	100	
	3. Facet grade appears stable?	19	19	0	100	
	4. Minimal evidence of embedding/fining?	19	19	0	100	
	5. Length appropriate?	19	19	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	19	19	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	19	19	0	100	
	3. Length appropriate?	17	19	2	89	**96%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	15	15	0	100	
	2. Downstream of meander (glide/inflection) centering?	15	15	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	15	15	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	15	15	0	100	
	3. Apparent Rc within spec?	15	15	0	100	
	4. Sufficient floodplain access and relief?	15	15	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes/ Sills	1. Free of back or arm scour?	11	11	0	100	
	2. Height appropriate?	11	11	0	100	
	3. Angle and geometry appear appropriate?	11	11	0	100	
	4. Free of piping or other structural failures?	11	11	0	100	
	5. Structure buried under aggraded material	8	11	3	73	**95%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Summary Data

Bankfull Area	12.6 ft^2
Bankfull Width	14.43 ft
Mean Depth	0.87 ft
Maximum Depth	1.66 ft
Width/Depth Ratio	16.59
Entrenchment Ratio	5.05
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT1
DATE	4/14/07
CROSS SECTION:	1
FEATURE:	Riffle

Cross-section photo – looking upstream



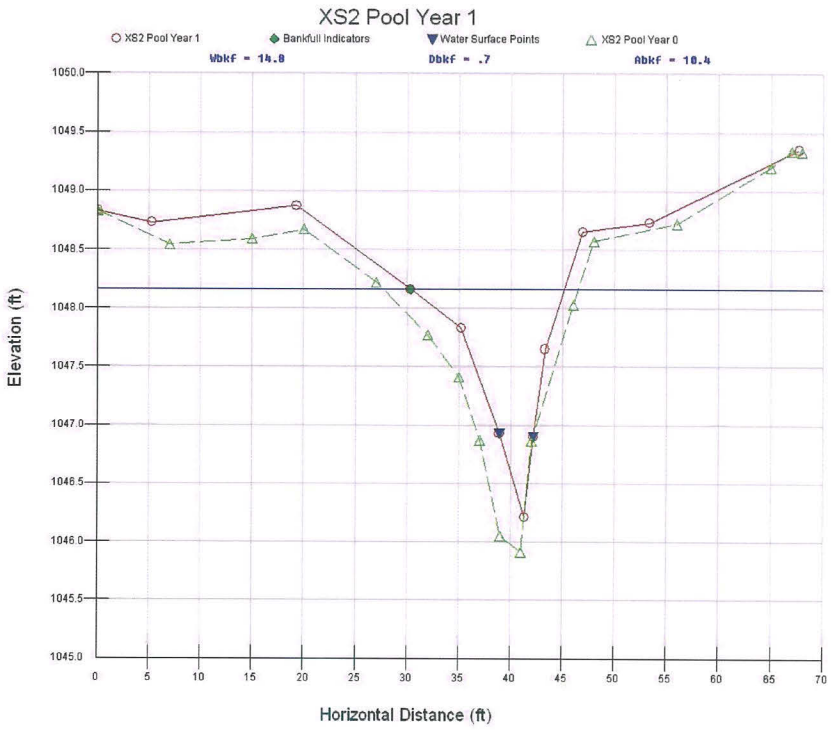
EMH&T

Summary Data

Bankfull Area	10.35 ft^2
Bankfull Width	14.81 ft
Mean Depth	0.7 ft
Maximum Depth	1.95 ft
Width/Depth Ratio	21.16
Entrenchment Ratio	4.57
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT1
DATE	4/14/07
CROSS SECTION:	2
FEATURE:	Pool

Cross-section photo – looking downstream



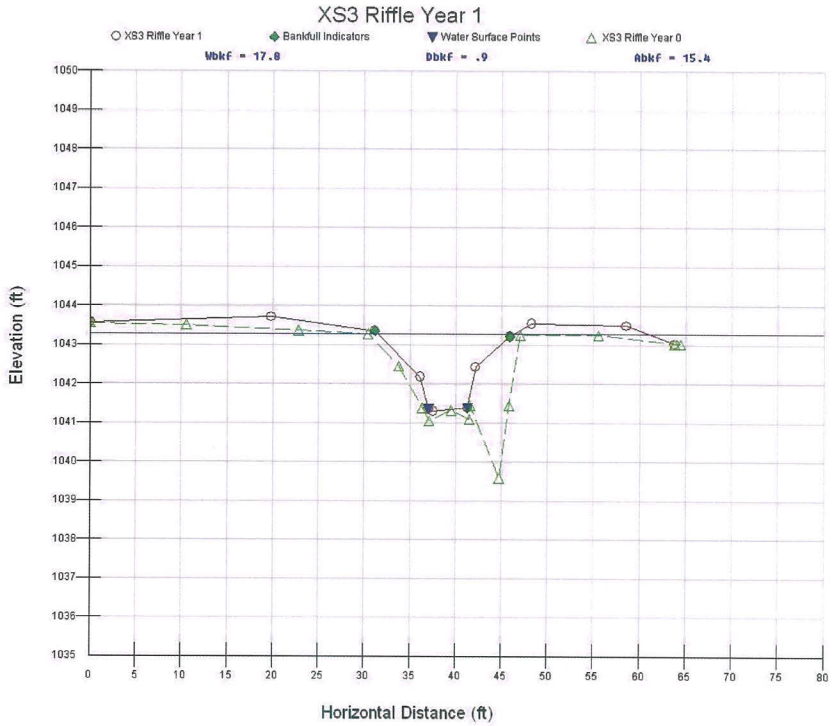
EMH&T

Summary Data

Bankfull Area	15.45 ft^2
Bankfull Width	17.76 ft
Mean Depth	0.87 ft
Maximum Depth	1.98 ft
Width/Depth Ratio	20.41
Entrenchment Ratio	3.59
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT1
DATE	4/14/07
CROSS SECTION:	3
FEATURE:	Riffle

Cross-section photo – looking downstream

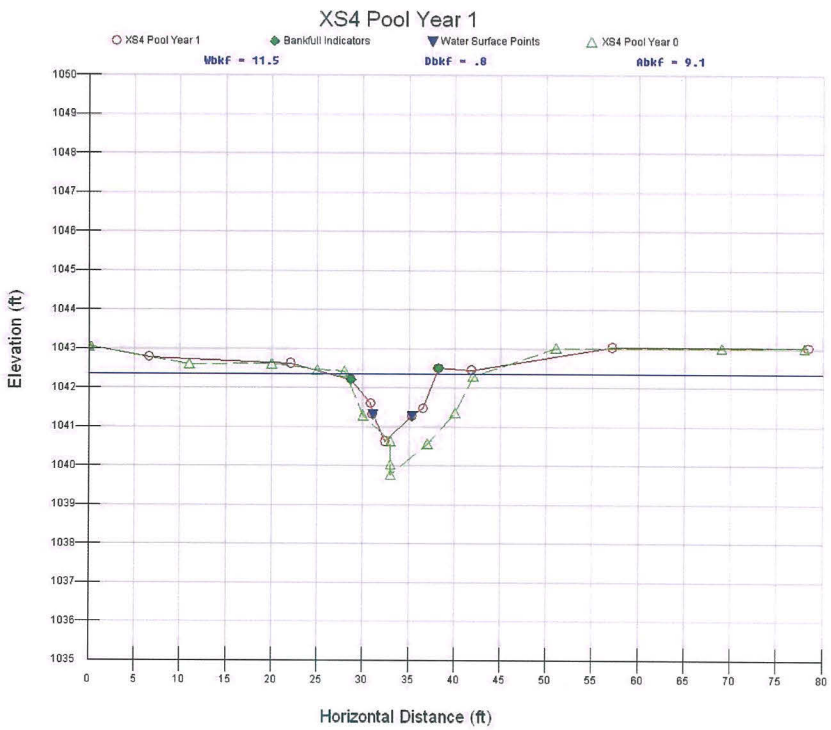


Summary Data

Bankfull Area	9.13 ft^2
Bankfull Width	11.54 ft
Mean Depth	0.79 ft
Maximum Depth	1.73 ft
Width/Depth Ratio	14.61
Entrenchment Ratio	6.8
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT1
DATE	4/14/07
CROSS SECTION:	4
FEATURE:	Pool

Cross-section photo – looking upstream

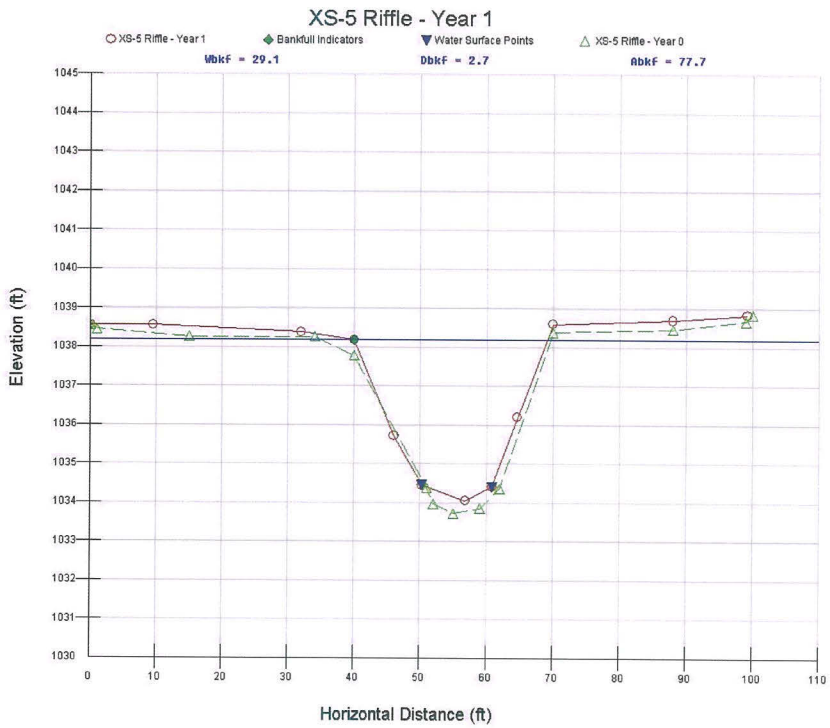


Summary Data

Bankfull Area	77.68 ft^2
Bankfull Width	29.07 ft
Mean Depth	2.67 ft
Maximum Depth	4.14 ft
Width/Depth Ratio	10.89
Entrenchment Ratio	3.41
Classification	E

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Upper
DATE	4/14/07
CROSS SECTION:	5
FEATURE:	Riffle

Cross-section photo – looking downstream

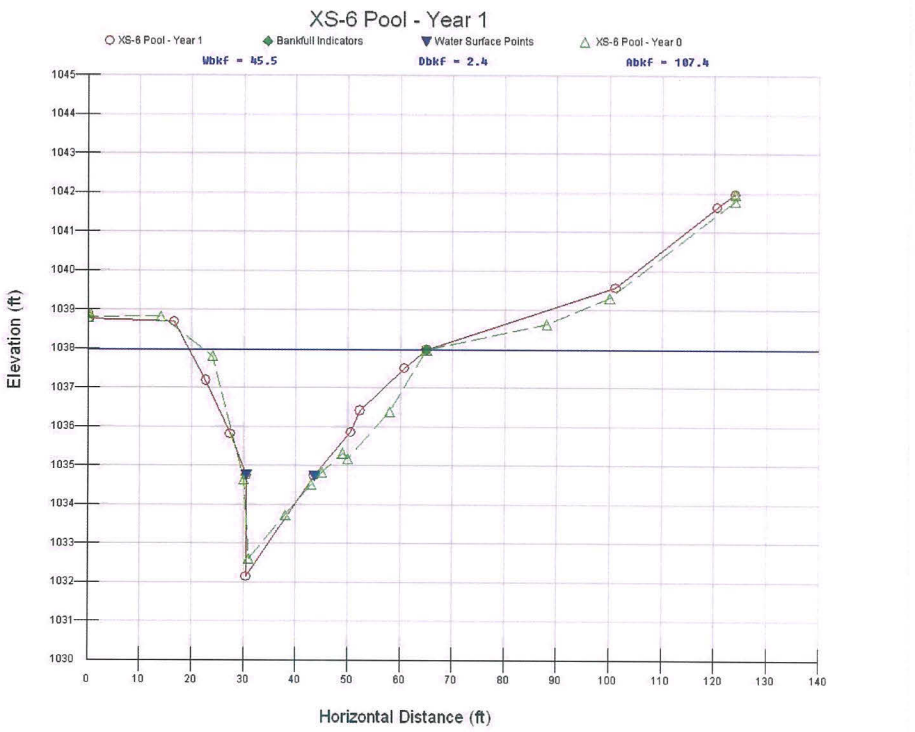


Summary Data

Bankfull Area	107.45 ft^2
Bankfull Width	45.53 ft
Mean Depth	2.36 ft
Maximum Depth	5.83 ft
Width/Depth Ratio	19.29
Entrenchment Ratio	2.72
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Upper
DATE	4/14/07
CROSS SECTION:	6
FEATURE:	Pool

Cross-section photo – looking downstream

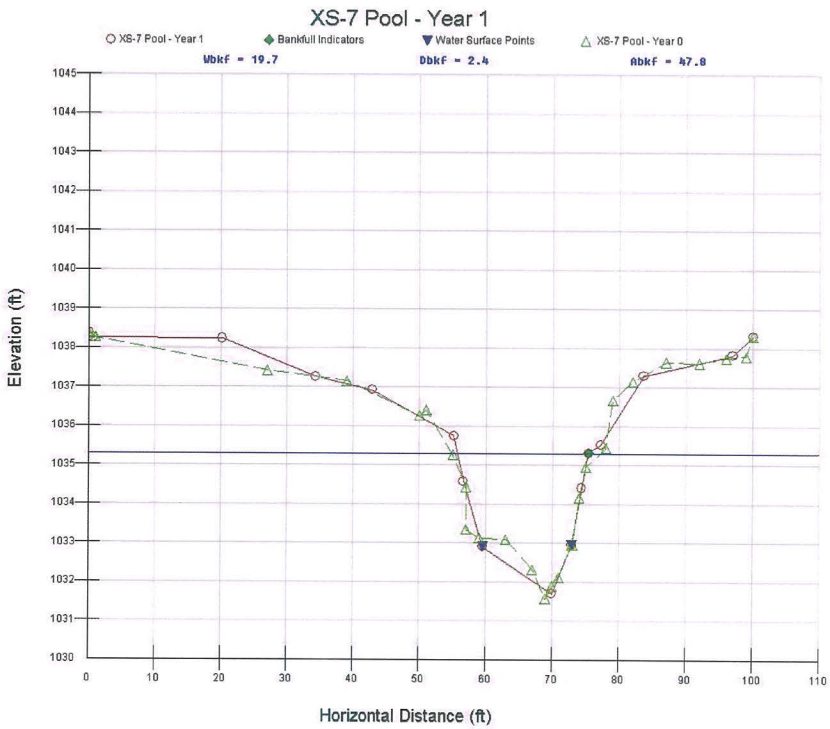


Summary Data

Bankfull Area	47.85 ft^2
Bankfull Width	19.67 ft
Mean Depth	2.43 ft
Maximum Depth	3.61 ft
Width/Depth Ratio	8.09
Entrenchment Ratio	5.09
Classification	E

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Upper
DATE	4/14/07
CROSS SECTION:	7
FEATURE:	Pool

Cross-section photo – looking downstream

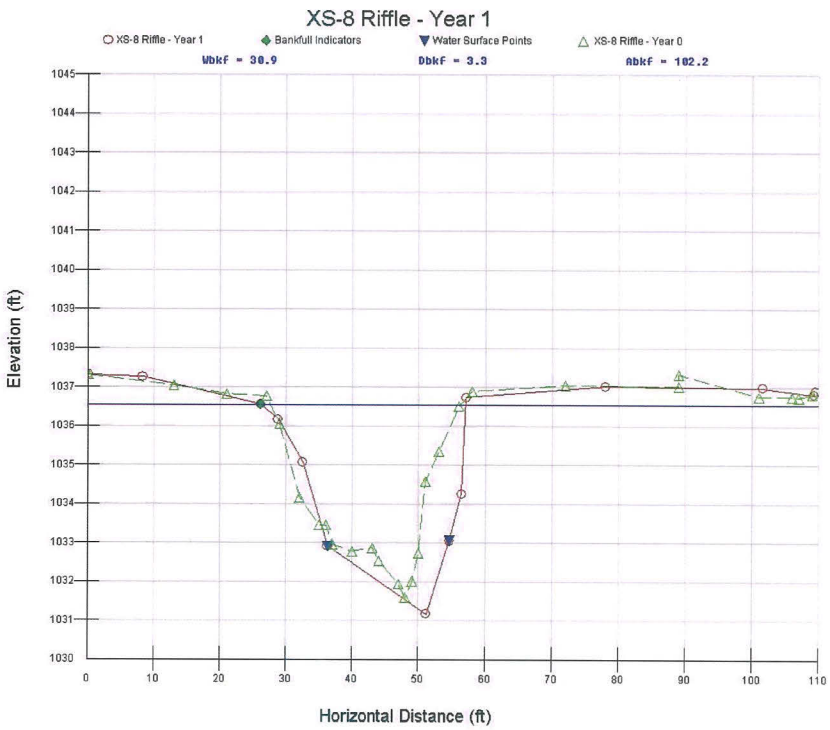


Summary Data

Bankfull Area	102.22 ft^2
Bankfull Width	30.94 ft
Mean Depth	3.3 ft
Maximum Depth	5.39 ft
Width/Depth Ratio	9.38
Entrenchment Ratio	3.54
Classification	E

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Upper
DATE	4/14/07
CROSS SECTION:	8
FEATURE:	Riffle

Cross-section photo – looking upstream

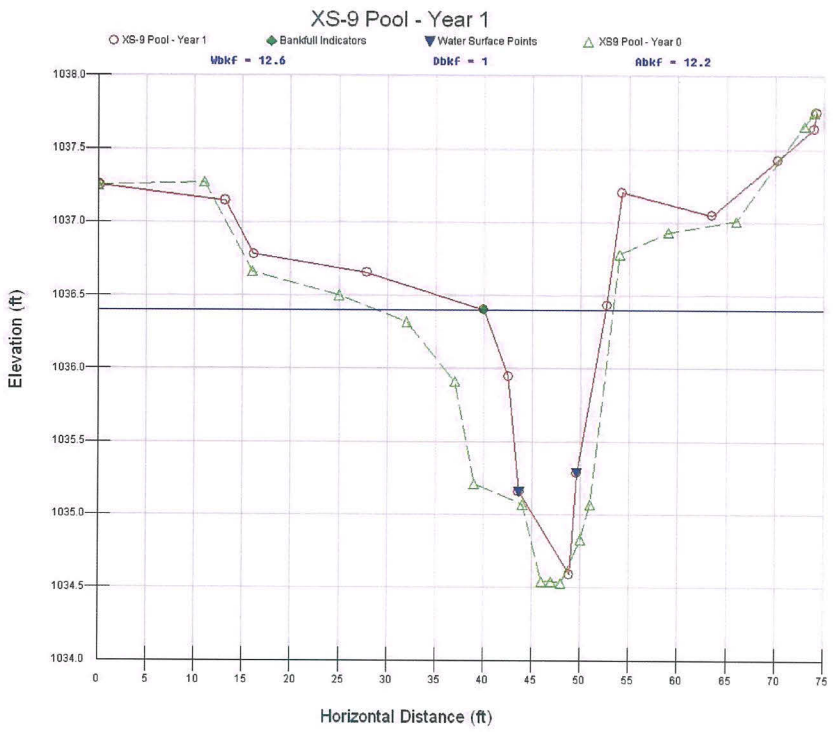


Summary Data

Bankfull Area	12.23 ft^2
Bankfull Width	12.6 ft
Mean Depth	0.97 ft
Maximum Depth	1.81 ft
Width/Depth Ratio	12.99
Entrenchment Ratio	5.89
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT2
DATE	4/14/07
CROSS SECTION:	9
FEATURE:	Pool

Cross-section photo – looking downstream

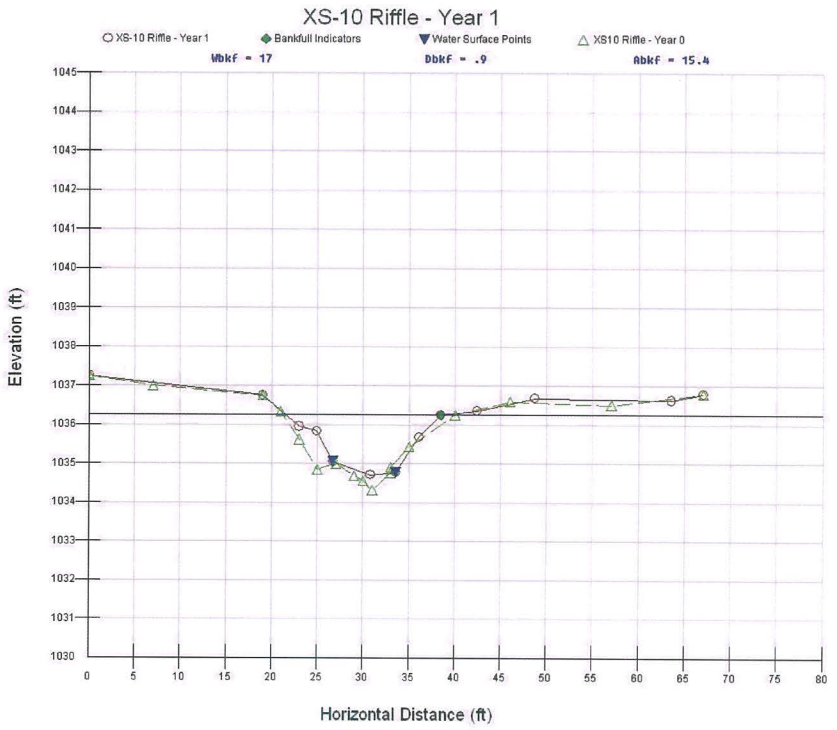


Summary Data

Bankfull Area	15.43 ft^2
Bankfull Width	16.97 ft
Mean Depth	0.91 ft
Maximum Depth	1.55 ft
Width/Depth Ratio	18.65
Entrenchment Ratio	3.95
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	UT2
DATE	4/14/07
CROSS SECTION:	10
FEATURE:	Riffle

Cross-section photo – looking downstream



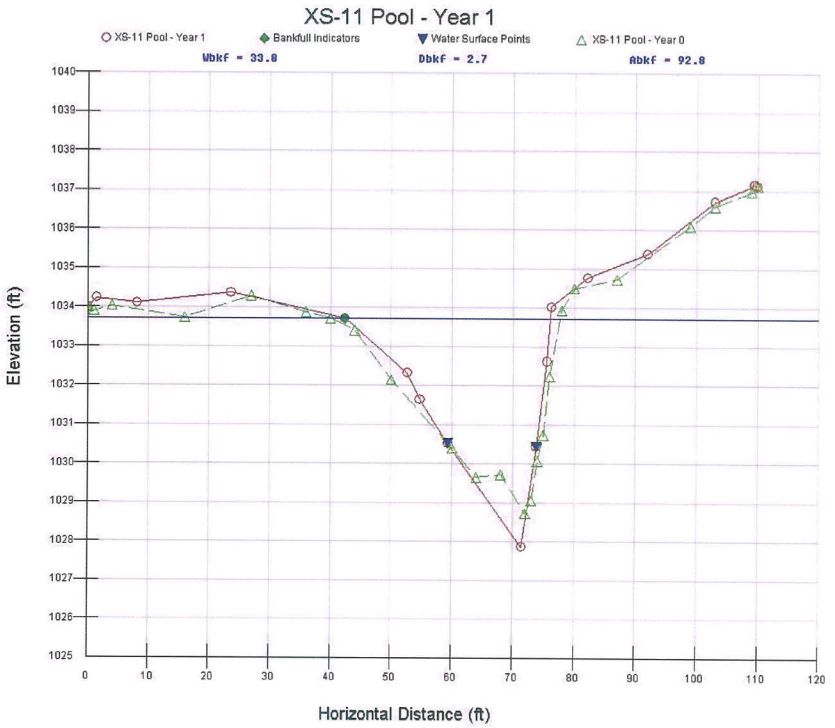
EMH&T

Summary Data

Bankfull Area	92.8 ft^2
Bankfull Width	33.76 ft
Mean Depth	2.75 ft
Maximum Depth	5.86 ft
Width/Depth Ratio	12.28
Entrenchment Ratio	3.26
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Lower
DATE	4/14/07
CROSS SECTION:	11
FEATURE:	Pool

Cross-section photo – looking upstream

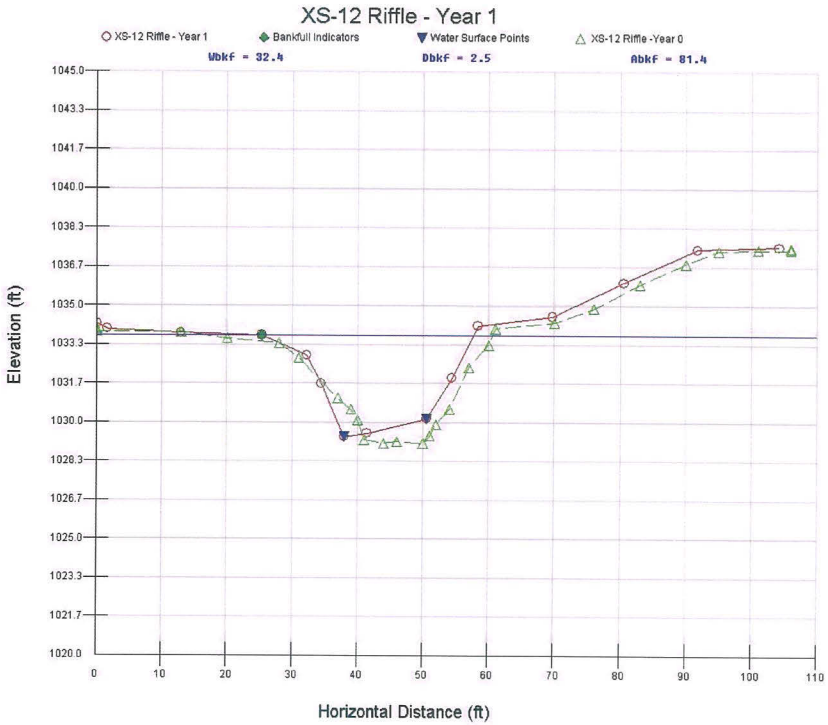


Summary Data

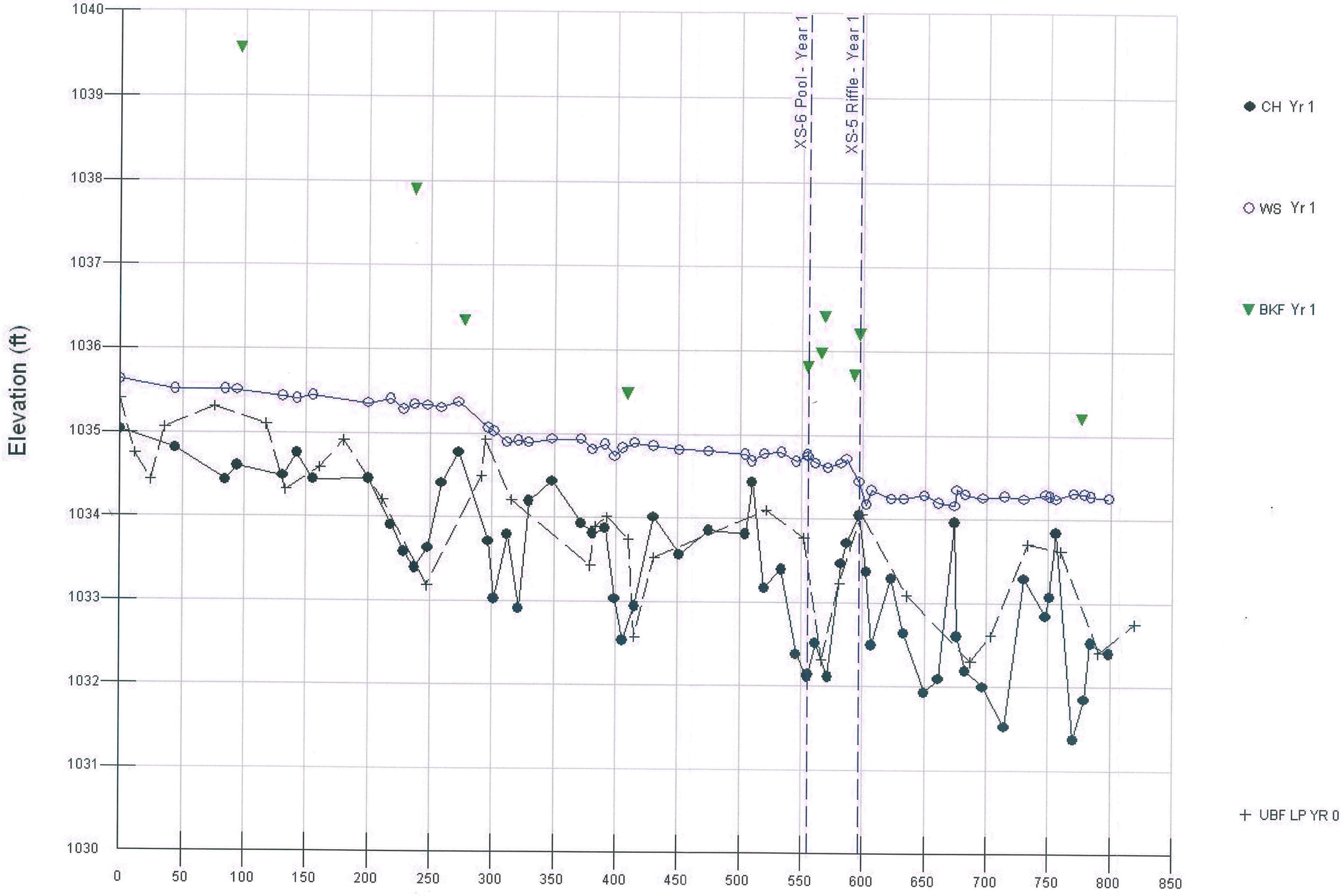
Bankfull Area	81.42 ft^2
Bankfull Width	32.36 ft
Mean Depth	2.52 ft
Maximum Depth	4.35 ft
Width/Depth Ratio	12.84
Entrenchment Ratio	3.22
Classification	C

PROJECT	Bailey Fork
	D04006-2
	1-YEAR
TASK	Cross-Section
REACH	Lower
DATE	4/14/07
CROSS SECTION:	12
FEATURE:	Riffle

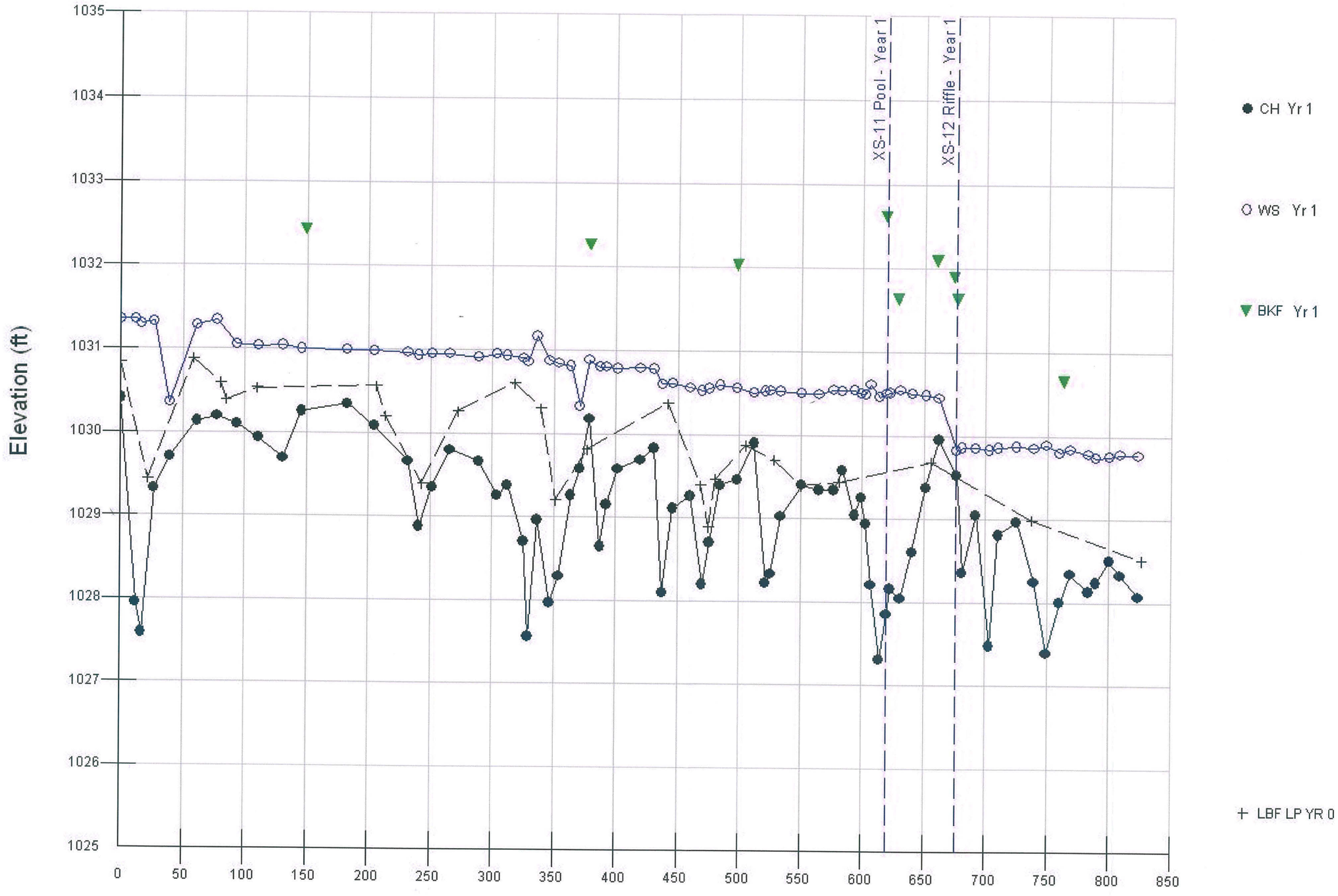
Cross-section photo – looking downstream



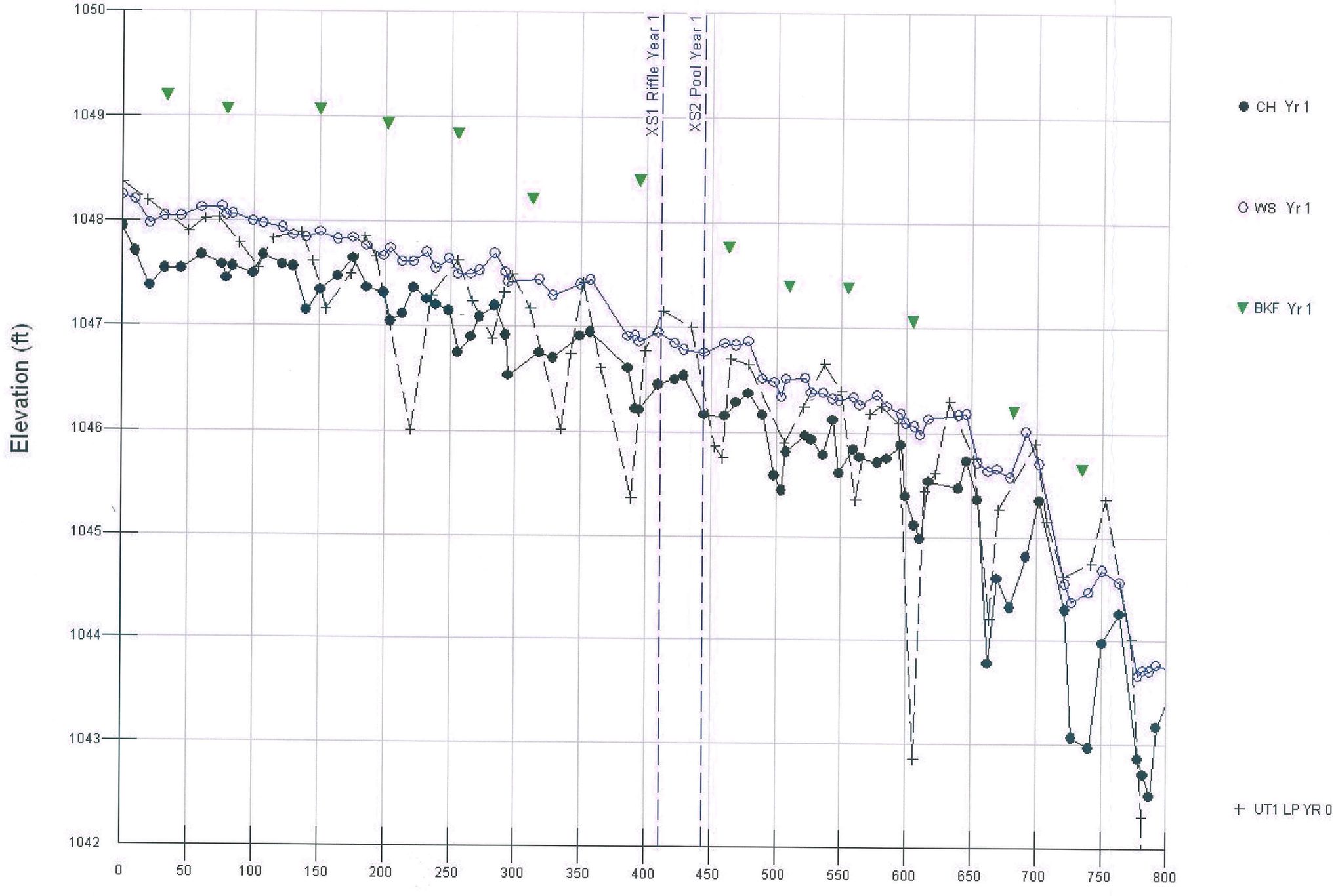
Upper Bailey Fork Longitudinal Profile - Year 1



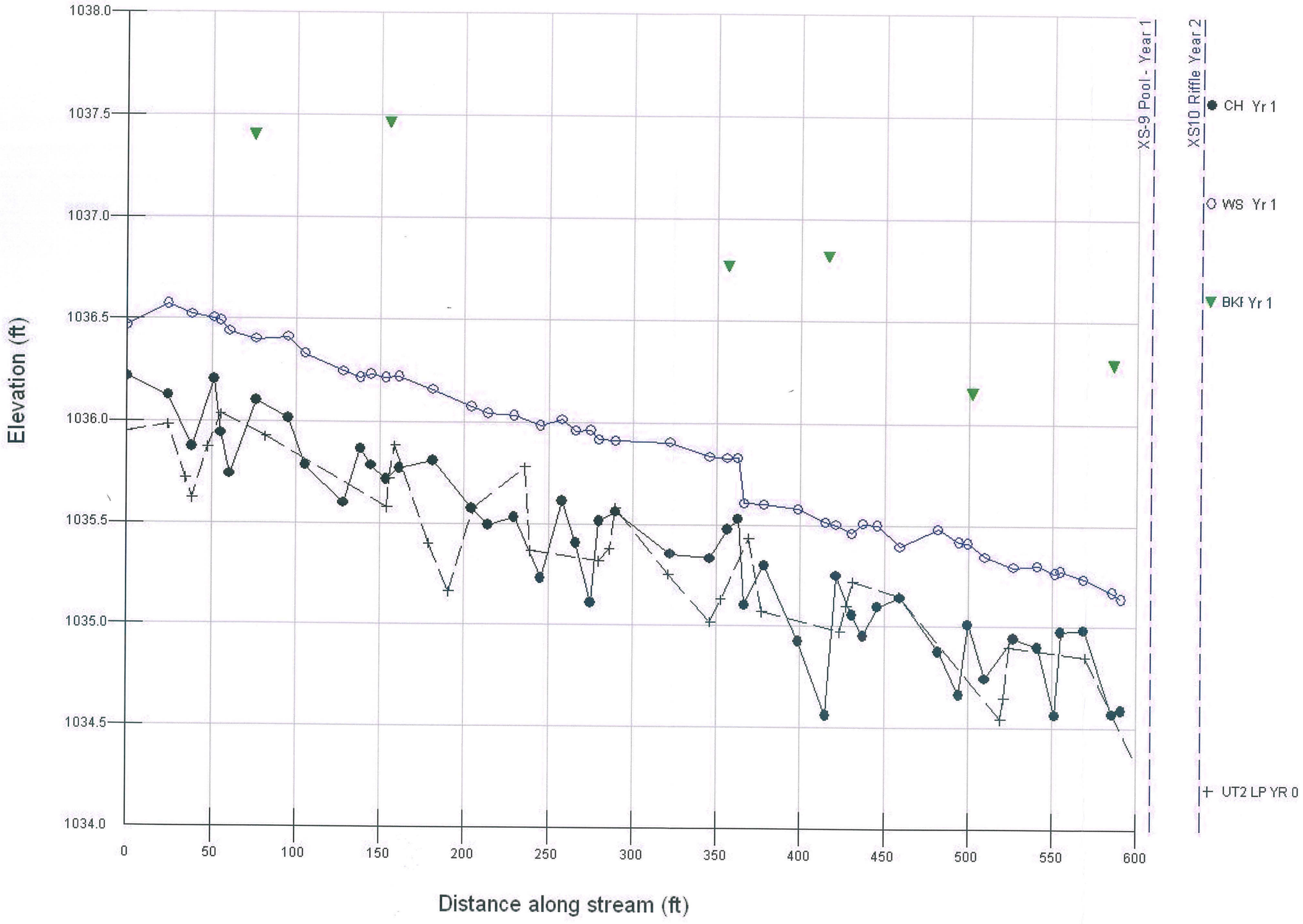
Lower Bailey Fork Longitudinal Profile - Year 1



UT1 Longitudinal Profile - Year 1

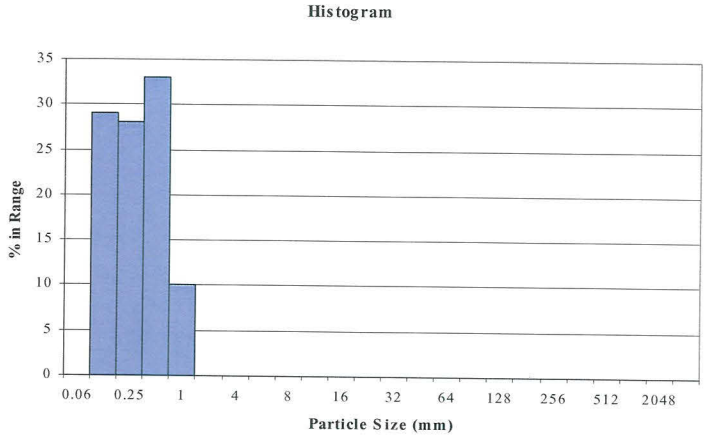


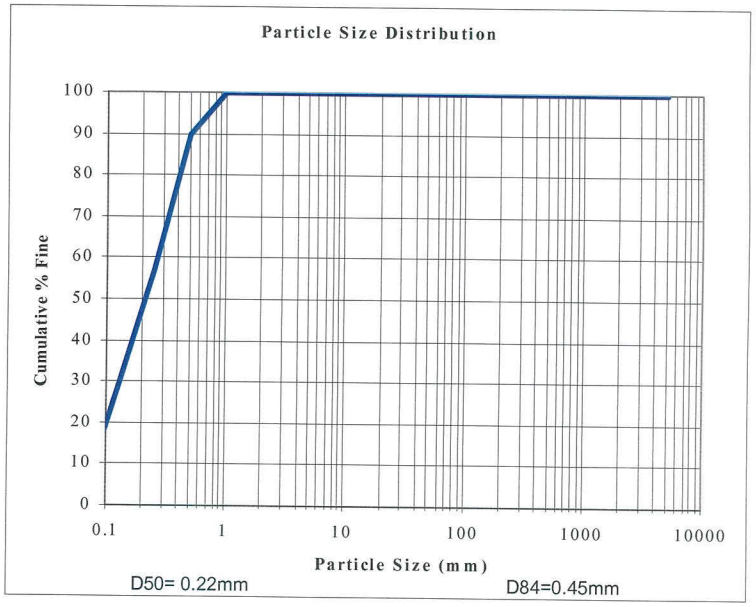
UT2 Longitudinal Profile - Year 1



Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	29	29	29
Fine Sand	0.125-0.25	28	28	57
Medium Sand	0.25-0.5	33	33	90
Coarse Sand	0.5-1.0	10	10	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

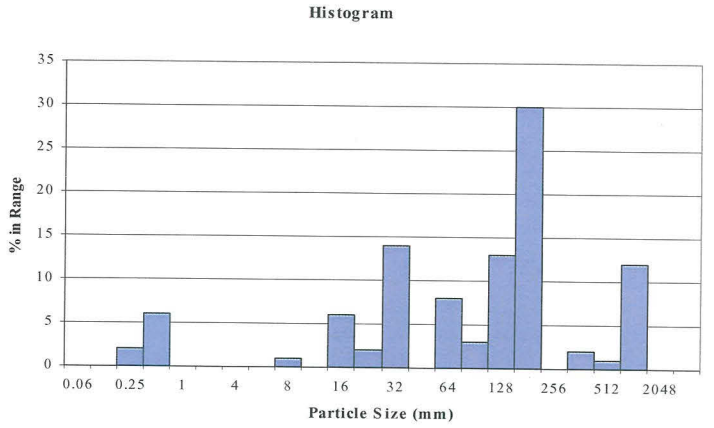
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	UT1	**X Sec**	2
Date	9/20/2006	**Sta No.**	4+50

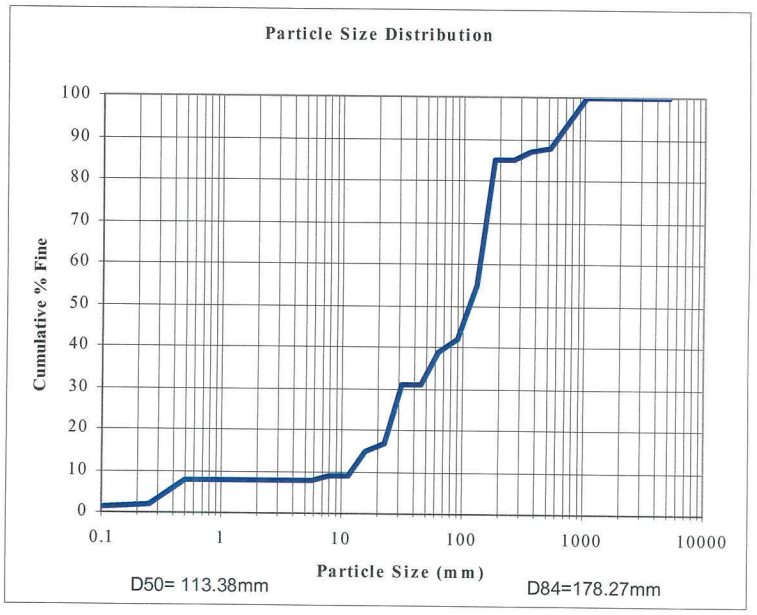




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	2	2	2
Medium Sand	0.25-0.5	6	6	8
Coarse Sand	0.5-1.0	0	0	8
Very Coarse Sand	1.0-2.0	0	0	8
Very Fine Gravel	2.0-4.0	0	0	8
Fine Gravel	4.0-5.7	0	0	8
Fine Gravel	5.7-8.0	1	1	9
Medium Gravel	8.0-11.3	0	0	9
Medium Gravel	11.3-16.0	6	6	15
Coarse Gravel	16.0-22.6	2	2	17
Coarse Gravel	22.6-32	14	14	31
Very Coarse Gravel	32-45	0	0	31
Very Coarse Gravel	45-64	8	8	39
Small Cobble	64-90	3	3	42
Small Cobble	90-128	13	13	55
Large Cobble	128-180	30	30	85
Large Cobble	180-256	0	0	85
Small Boulder	256-362	2	2	87
Small Boulder	362-512	1	1	88
Medium Boulder	512-1024	12	12	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

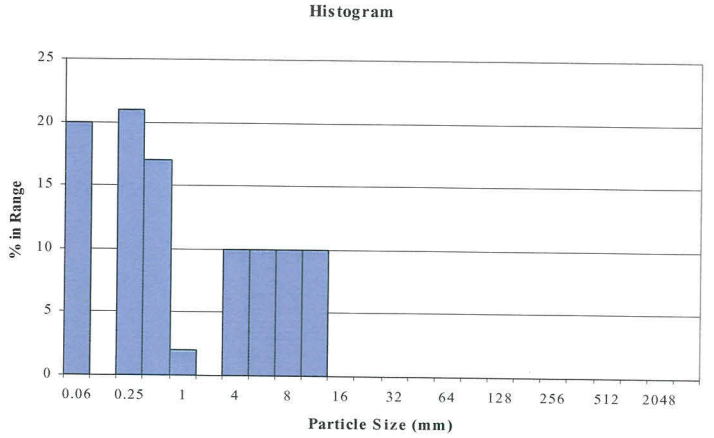
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Upper	**X Sec**	5
Date	9/20/2006	**Sta No.**	6+00

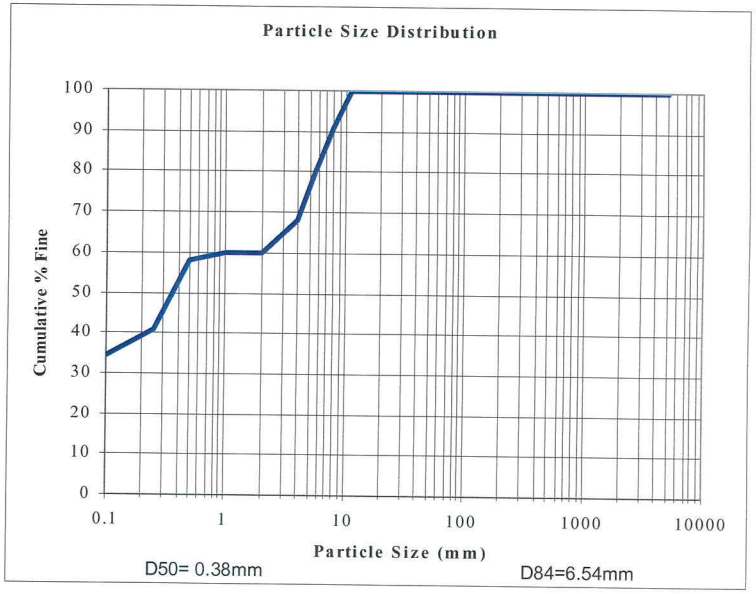




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	20	20	20
Very Fine Sand	0.062-0.125	0	0	20
Fine Sand	0.125-0.25	21	21	41
Medium Sand	0.25-0.5	17	17	58
Coarse Sand	0.5-1.0	2	2	60
Very Coarse Sand	1.0-2.0	0	0	60
Very Fine Gravel	2.0-4.0	8	10	68
Fine Gravel	4.0-5.7	12	10	80
Fine Gravel	5.7-8.0	11	10	91
Medium Gravel	8.0-11.3	9	10	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

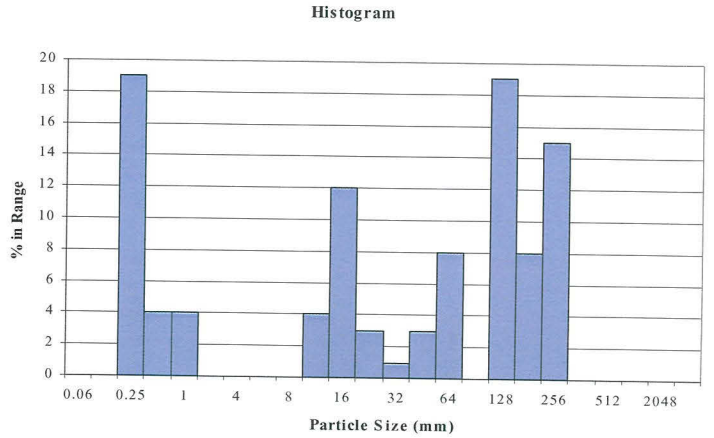
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Upper	**X Sec**	7
Date	9/20/2006	**Sta No.**	11+00

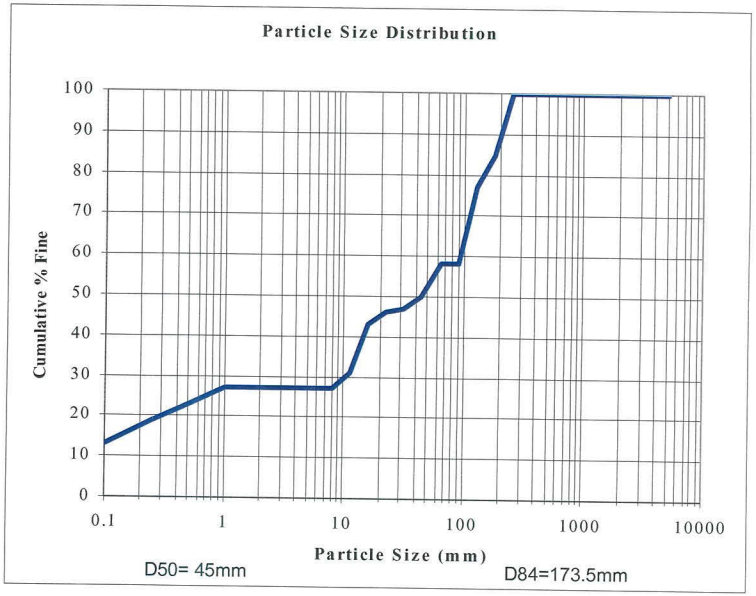




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	19	19	19
Medium Sand	0.25-0.5	4	4	23
Coarse Sand	0.5-1.0	4	4	27
Very Coarse Sand	1.0-2.0	0	0	27
Very Fine Gravel	2.0-4.0	0	0	27
Fine Gravel	4.0-5.7	0	0	27
Fine Gravel	5.7-8.0	0	0	27
Medium Gravel	8.0-11.3	4	4	31
Medium Gravel	11.3-16.0	12	12	43
Coarse Gravel	16.0-22.6	3	3	46
Coarse Gravel	22.6-32	1	1	47
Very Coarse Gravel	32-45	3	3	50
Very Coarse Gravel	45-64	8	8	58
Small Cobble	64-90	0		58
Small Cobble	90-128	19	19	77
Large Cobble	128-180	8	8	85
Large Cobble	180-256	15	15	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

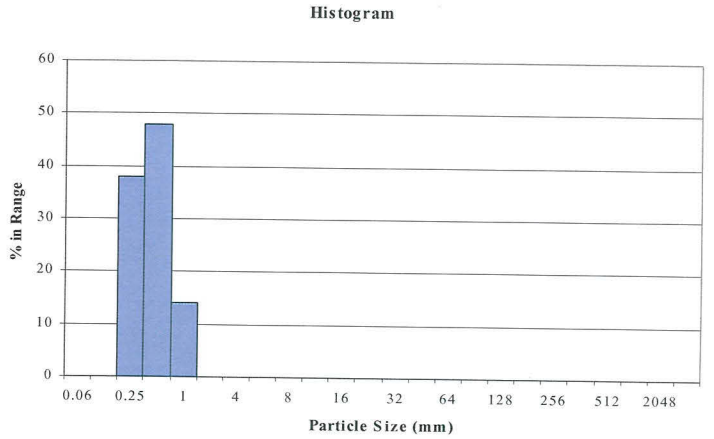
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	UT2	**X Sec**	10
Date	9/20/2006	**Sta No.**	6+50

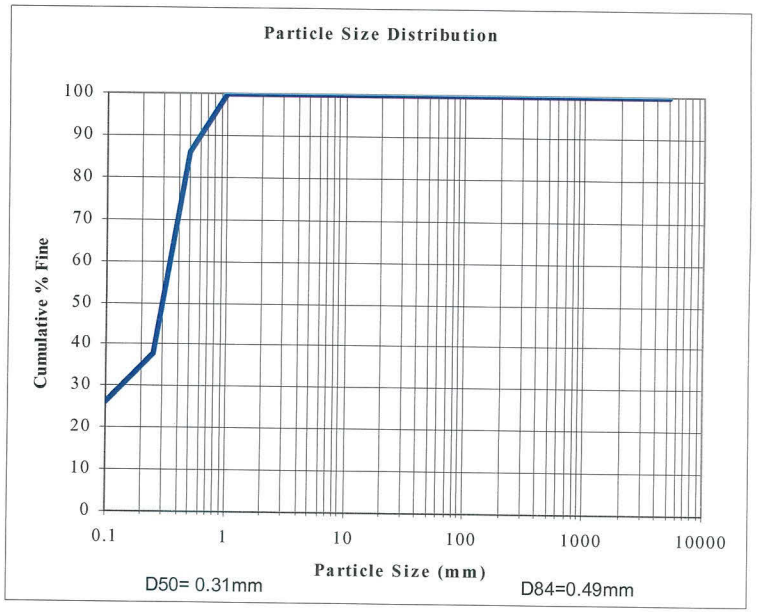




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	38	38	38
Medium Sand	0.25-0.5	48	48	86
Coarse Sand	0.5-1.0	14	14	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Lower	**X Sec**	11
Date	9/20/2006	**Sta No.**	6+00





Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	6	6	6
Coarse Sand	0.5-1.0	0	0	6
Very Coarse Sand	1.0-2.0	0	0	6
Very Fine Gravel	2.0-4.0	0	0	6
Fine Gravel	4.0-5.7	0	0	6
Fine Gravel	5.7-8.0	0	0	6
Medium Gravel	8.0-11.3	0	0	6
Medium Gravel	11.3-16.0	2	2	8
Coarse Gravel	16.0-22.6	10	10	18
Coarse Gravel	22.6-32	12	12	30
Very Coarse Gravel	32-45	18	18	48
Very Coarse Gravel	45-64	35	35	83
Small Cobble	64-90	0	0	83
Small Cobble	90-128	5	5	88
Large Cobble	128-180	1	1	89
Large Cobble	180-256	6	6	95
Small Boulder	256-362	0	0	95
Small Boulder	362-512	1	1	96
Medium Boulder	512-1024	4	4	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Lower	**X Sec**	12
Date	9/20/2006	**Sta No.**	6+50