UT Bear Creek (Phillips)
Stream Restoration Monitoring Report
EEP Project # 92719
Monitoring Year – 01
2009

Submitted to:

Ecosystem Enhancement PROGRAM

NCDENR-EEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

December 2009

Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Contact: Adam Spiller
Email: adam.spiller@kci.com
KCI Project No: 12071067_BC

Design Firm

Environmental Services, Inc.
524 South New Hope Road
Raleigh, NC 27610
Phone (919) 212-1760

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

In 2002, the North Carolina Department of Transportation identified the unnamed tributary to (UT) Bear Creek Site (Phillips) in Chatham County, North Carolina as a potential stream restoration project. The 1.7 mi^2 watershed is located within the USGS 8-digit HUC 03030003 and the NCDWQ Sub-basin 03-06-12 of the Cape Fear River Basin. The project restored approximately 2,378 linear feet of channel - 1,921 feet on UT Bear Creek and 457 feet on unnamed tributary (UT) 2 - and enhanced an additional 935 feet of channel on UT2. Project construction occurred in 2006, after which the project was transferred to the North Carolina Ecosystem Enhancement Program (EEP). Project objectives are listed below:

- Excluding cattle from the stream channels.
- Increasing channel stability.
- Restoring dimension, pattern, and profile to UT Bear Creek and UT 2.

The riparian buffer was planted with five different species of bare root trees and two different species of live stakes. Seven vegetation monitoring plots were established in 2009, during the first year of monitoring. These plots were set up following the Carolina Vegetation Survey (CVS) vegetation monitoring protocol. Based on the seven monitoring plots, the first-year monitoring counted an average of 410 planted stems/acre across the site. One of the seven vegetation monitoring plots had planted stem densities less than the success criteria of 260 stems/acre. Level 2 monitoring found that there are many volunteers in the plot as well. The site's average stem density including volunteers is 1,705 stems/acre with all of the vegetation plots having densities above 260 stems/acre. The three most prominent exotic invasive species found within the project buffer are Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and microstegium (*Microstegium vimineum*), with the privet being especially thick in certain areas. The first year of monitoring found the vegetation component of the project to be on track to meeting the success criteria.

There are two hydrologic features on the site. The first, UT Bear Creek, has been restored by altering the dimension, pattern, and profile and is controlled vertically by numerous bedrock outcrops and cross vanes. The second feature is UT 2 and it has been divided into two reaches, UT 2A, which was enhanced, and UT 2B, which was restored. UT 2A is a straight channel, that begins at Station 30+00 and whose banks are stabilized by the mature trees that line both sides of the channel for the length of the reach. This reach was enhanced by planting native vegetation in the riparian buffer beyond the top of bank. UT 2B begins where UT 2A ends at the ford crossing at Station 39+75. This reach was restored by changing the dimension, pattern and profile of the channel from the ford to the confluence with UT Bear Creek. During first-year monitoring, a visual inspection of the site found the streams to be stable and functioning as designed. This visual assessment also evaluated the accuracy of the red line as-built drawings. Four discrepancies were found. These include planform changes from Station 16+85 to 17+70, 21+90 to 22+85, and 42+50 to 43+05, and a structure change at Station 24+50 from root wads to stone stabilization. Changes to the As-Built Plan data were made to reflect these discrepancies and are found in the Current Condition Plan View (CCPV) and Table 1 of this report.

In addition to the as-built data assessment, the visual inspection also examined the site for stream stability and potential problem areas. UT Bear Creek appeared stable throughout the project. There is one area of floodplain erosion that occurred during greater than bankfull events. Also, there is a beaver dam downstream of the site that is creating backwater conditions in the bottom quarter of UT Bear Creek and high water at the ford crossing at Station 25+30. UT 2 is also stable, with the only potential problem area being erosion at the cross vane at Station 39+75 and two areas of bed degradation.

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 mitigation and restoration plan documents available on the EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

The Level 2 CVS-EEP protocol (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from UT Bear Creek.

3.0 REFERENCES

Lee, Michael 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)

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

Appendix A

General Figures and Plan Views

DIRECTIONS TO BEAR CREEK SITE:
From Raleigh, take US 440 West towards US 1 South. Take the exit for 64 East, then take 15/501 South towards Pittsboro. At the circle take a right onto West St. Then, take left onto NC 902. Take a right onto Edwards Hill Church Rd. after going through Bear Creek. The site is on the East side of the road. Enter site through gate.

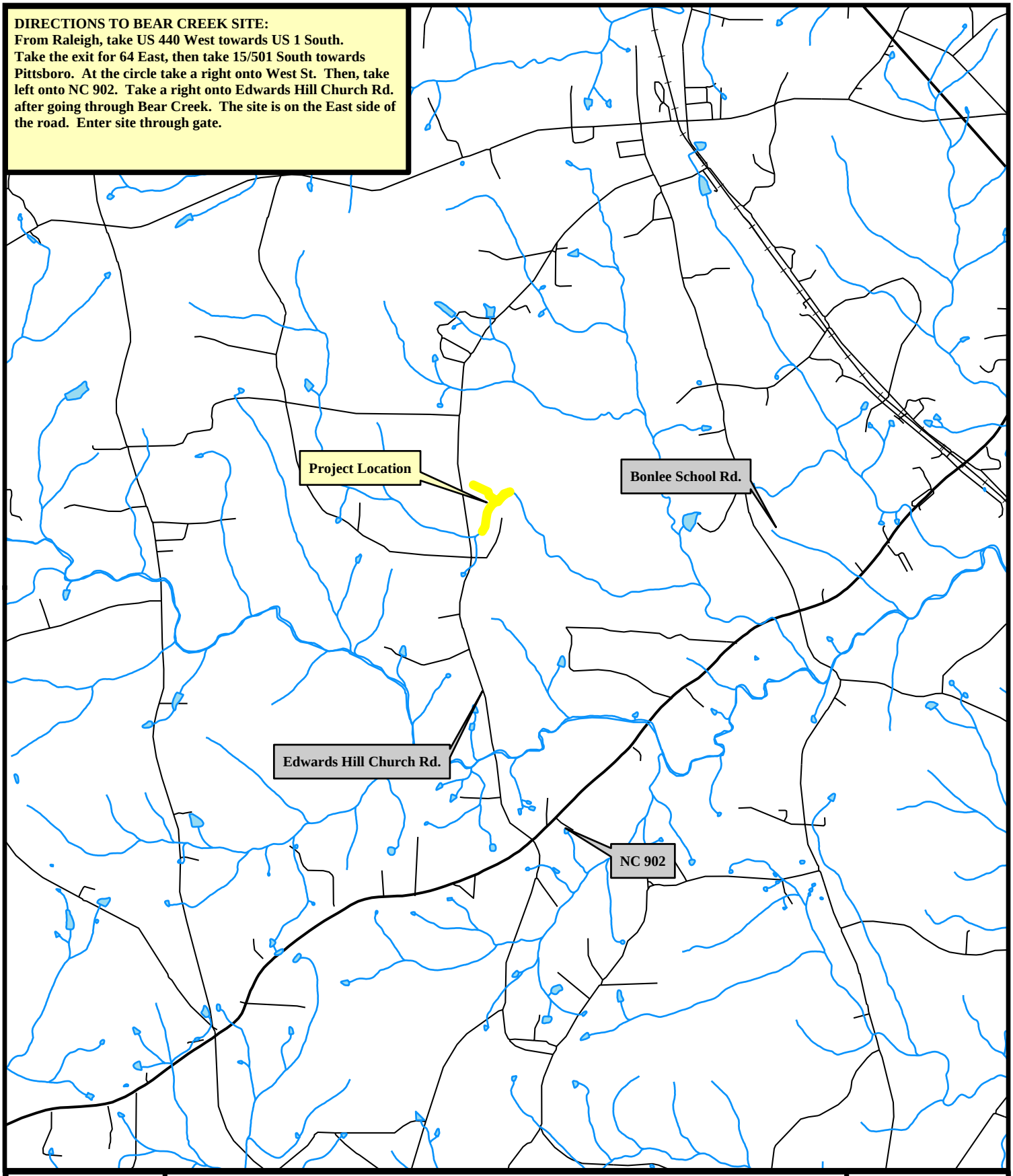

Figure 1. Site Vicinity Map
UT Bear Creek, Chatham County, EEP Project # 92719

0.5 0.25 0 0.5 1 Miles

N

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC

VEG PLOT ORIGIN	NORTHING	EASTING
VEG PLOT #1	678009.150	1870616.996
VEG PLOT #2	678141.298	1870637.817
VEG PLOT #3	678511.536	1871025.627
VEG PLOT #4	678625.673	1871457.478
VEG PLOT #5	679280.172	1871026.350
VEG PLOT #6	679303.124	1870894.117
VEG PLOT #7	679729.012	1870585.995

EDWARDS HILL CHURCH ROAD
NC 1141
VEGETATED DEPOSITION
FLOODPLAIN EROSION
CROSS VANE
PP#1
PP#2
PP#3
PP#4
VEG PLOT #1
VEG PLOT #2
J-HOOK
ROOT WADS
THICK PRIVET
SPARSE VEGETATION
FORD CROSSING
CONSERVATION EASEMENT
CONSERVATION EASEMENT
BEGIN REACH UT BEAR CREEK STA 10+00 RESTORATION
PROPOSED CENTERLINE, TOP OF BANK, AND BANKFULL BENCH LIMIT
FARM ROAD AND BUILDINGS
MATCHLINE – SEE SHEET 2
10+00
11+00
12+00
13+00
14+00
15+00
16+00
17+00
18+00
NC GRID NAD '83
–40 0 40 80
GRAPHIC SCALE

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement

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ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

UT BEAR CREEK (PHILLIPS)
CHATHAM COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 92719 - MY01

REACH: UT BEAR CREEK

DATE: DEC 2009
SCALE: 1" = 80'

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 3

MATCHLINE – SEE SHEET 3

MATCHLINE – SEE SHEET 1

CONSERVATION EASEMENT

CONSERVATION EASEMENT

FORD CROSSING

BEGIN REACH UT–2B BEAR CREEK STATION 39+75 RESTORATION

40+00

PP#8

41+00

BED DEGRADATION AND BANK EROSION

BED DEGRADATION

42+00

CROSS VANE

BACKWATER BEGINS FROM DOWNSTREAM BEAVER DAM

43+00

END REACH UT–2B BEAR CREEK

FORD CROSSING

BACKWATER BEGINS FROM DOWNSTREAM BEAVER DAM

CONSTRUCTED RIFFLE

25+00

PP#6

26+00

27+00

44+00

28+00

PP#7

29+00

END REACH UT BEAR CREEK

BOULDER STABILIZATION

PP#5

VEG PLOT #4

VEG PLOT #3

24+00

23+00

J-HOOK

22+00

PROPOSED CENTERLINE, TOP OF BANK, AND BANKFULL BENCH LIMIT

THICK PRIVET

THICK PRIVET

FORD CROSSING

NC GRID NAD '83

–40 0 40 80

GRAPHIC SCALE

REVISIONS

SYM	DESCRIPTION	DATE	APPROVED

Ecosystem Enhancement

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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

UT BEAR CREEK (PHILLIPS)
CHATHAM COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 92719 - MY01

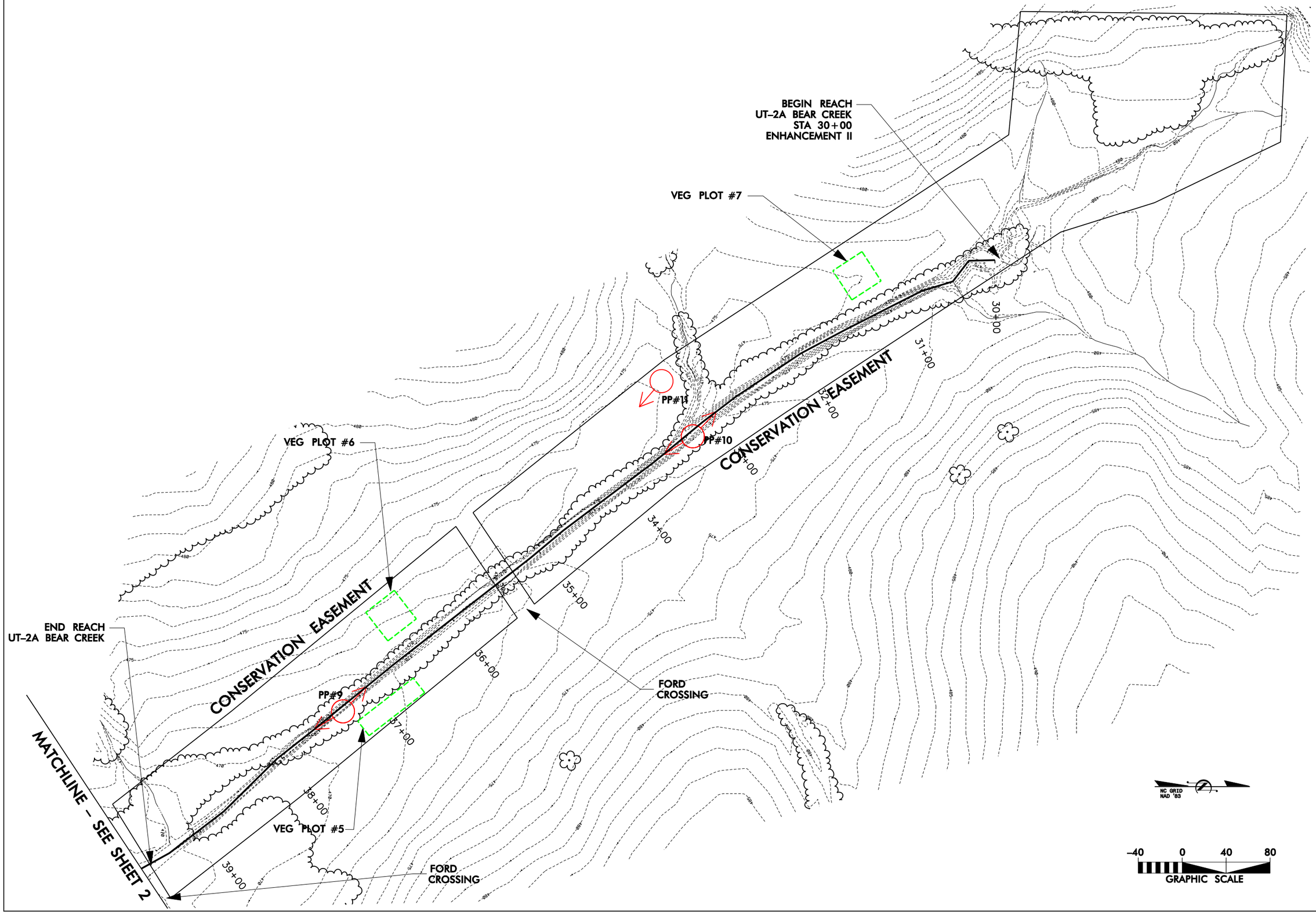
REACHES: UT BEAR CREEK AND UT-2B BEAR CREEK

DATE: DEC 2009

SCALE: 1" = 80'

CURRENT CONDITION PLAN VIEW

SHEET 2 OF 3



SYM	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

UT BEAR CREEK (PHILLIPS)

CHATHAM COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 92719 - MY01

REACH: UT-2A BEAR CREEK

DATE: DEC 2009
SCALE: 1" = 80'

CURRENT CONDITION PLAN VIEW

SHEET 3 OF 3

Appendix B

General Project Tables

Table 1a. Project Components
Project Number and Name: 92719 - UT Bear Creek (Phillips)

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Buffer Acres	BMP Elements	Comment
UT Bear Creek	1,926	R	P2	1,921	10+00 - 29+77			Linear Footage does not include stream length in easement exceptions
UT2A	935	EII	-	935	30+00 - 39+75			Linear Footage does not include stream length in easement exceptions
UT2B	420	R	P2	457	39+75 - 44+32			

Table 1b. Component Summations
Project Number and Name: 92719 - UT Bear Creek (Phillips)

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	2,378						
Enhancement							
Enhancement I							
Enhancement II	935						
Creation							
Preservation							
HQ Preservation							
Totals	**3,313**						
MU Totals	**2,752**						

Table 2. Project Activity and Reporting History Project Number and Name: 92719 - UT Bear Creek (Phillips)		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Feasibility Study	N/A	2002
Conceptual Plan	N/A	N/A
Mitigation Plan	N/A	Jun 03
Construction	N/A	2006
As-Built Plans	N/A	Mar 06
Year 1 Monitoring	Oct 09	Dec 09

Table 3. Project Contacts Table Project Number and Name: 92719- UT Bear Creek (Phillips)	
Design Firm	Environmental Services, Inc. 524 South New Hope Road Raleigh, North Carolina 27610 Contact: Mr. Ron Spears Phone: (919) 212-1760
Construction Contractor	unknown
Monitoring Performers	
MY-01	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table Project Number and Name: 92719 – UT Bear Creek (Phillips)	
Project County	Chatham County
Drainage Area	1.7 mi^2
Drainage Impervious Cover Estimate (%)	< 10%
Stream Order	Second Order (UT Bear Creek)
	First Order (UT2)
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-built	C4/5 (UT Bear Creek)
	C4/5 (UT2)
Dominant Soil Types	Cid-Lignum Complex
Reference Site ID	Richland Creek
	UT South Fork Cane Creek
	UT Bear Creek
USGS HUC for Project and Reference	03030003 (UT Bear Creek Site and References)
NCDWQ Sub-basin for Project and Reference	03-06-12 (UT Bear Creek)
NCDWQ Classification for Project and Reference	C (UT Bear Creek)
Any portion of the project segment 303d listed?	No
Any portion of the project segment upstream of a 303d listed segment?	No
% of Project Easement Fenced	100%

Appendix C

Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table Project Number and Name: 92719 - UT Bear Creek (Phillips)		
Vegetation Plot ID	**Monitoring Year 01 Planted Stem Density (stems/acre)**	**Vegetation Survival Threshold Met?**
1	364	Yes
2	405	Yes
3	324	Yes
4	445	Yes
5	526	Yes
6	607	Yes
7	202	No

Table 6. Vegetation Metadata Table
Project Number and Name: 92719 – UT Bear Creek (Phillips)

Report Prepared By	Brian Roberts
Date Prepared	11/11/2009 14:29
Database Name	KCI-2008-cvs-eep-entrytool-v2.2.7-MTL.mdb
Database Location	C:\Users\broberts\Desktop\KCI_2008-entrytool-v2.2.7

PROJECT SUMMARY----------

Project Code	Project Name	Description	Length (ft)	Stream-to-Edge Width (ft)	Area (sq m)	Required Plots (calculated)	Sampled Plots
92719	UT Bear Creek (Phillips)	Stream restoration site in Chatham County, NC.	3,500	40	22,294	7	7

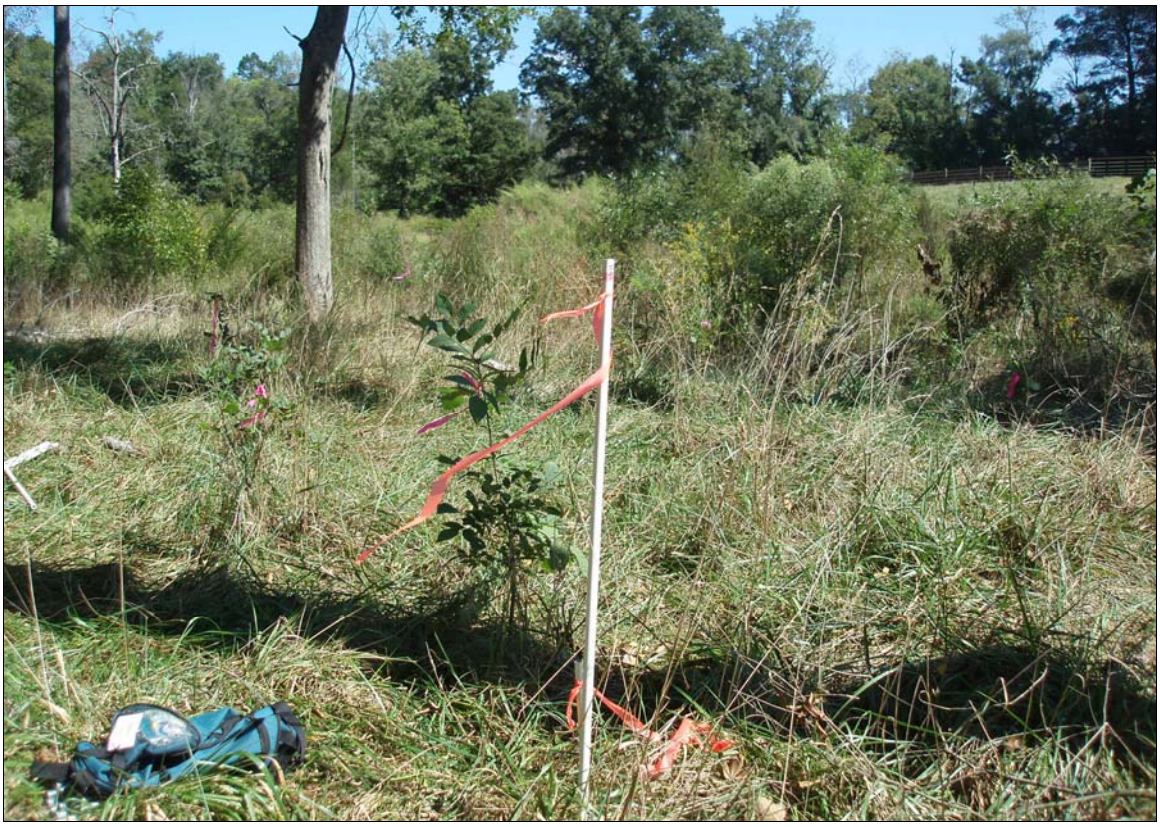
Table 7. Stem Count Total and Planted by Plot and Species
Project Number and Name: 92719 – UT Bear Creek (Phillips)

			Current Plot Data (MY01 2009)																					Annual Means		
			92719-A-0001			92719-A-0002			92719-A-0003			92719-A-0004			92719-A-0005			92719-A-0006			92719-A-0007			MY01 (2009)		
Scientific Name	Common Name	Species Type	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Acer rubrum	red maple	Tree			2																					2
Baccharis	baccharis	Shrub Tree			1			1			2															4
Diospyros virginiana	common persimmon	Tree					1	1			1												15		1	17
Fraxinus pennsylvanica	green ash	Tree		2	97		5	6		1	1		4	4		13	14		7	8		4	5		36	135
Juglans nigra	black walnut	Tree									8			1												9
Juniperus virginiana	eastern redcedar	Tree									3															3
Liquidambar styraciflua	sweetgum	Tree			10			1						2			2									15
Morus	mulberry	Shrub Tree												2												2
Platanus occidentalis	American sycamore	Tree		6	6								1	1											7	7
Prunus serotina	black cherry	Shrub Tree						1			1															2
Quercus lyrata	overcup oak	Tree		1	1																				1	1
Quercus michauxii	swamp chestnut oak	Tree					3	3					3	3					6	6					12	12
Quercus phellos	willow oak	Tree					1	1		7	14		3	5					2	2		1	1		14	23
Rhus glabra	smooth sumac	Shrub Tree						1																		1
Salix nigra	black willow	Tree			1																					1
Ulmus alata	winged elm	Tree						1			1									1						3
Ulmus americana	American elm	Tree									4															4
Ulmus rubra	slippery elm	Tree			8			6			22			1			2									39
	Stem count		0	9	126	0	10	22	0	8	57	0	11	19	0	13	18	0	15	17	0	5	21	0	71	280
	size (ares)		1			1			1			1			1			1			1			7		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.17		
	Species count		0	3	8	0	4	10	0	2	10	0	4	8	0	1	3	0	3	4	0	2	3	0	6	18
	Stems per ACRE		0	364.22	5099	0	404.69	890.31	0	323.75	2306.7	0	445.15	768.9	0	526.09	728.43	0	607.03	687.97	0	202.34	849.84	0	410.47	1618.7

P-LS – Planted Live Stakes P-all – Planted Stems Total (with Live Stakes) T – Total (Planted Including Live Stakes and Volunteers)

Vegetation Monitoring Plot Photos

Vegetation Plot 1: 9/30/09 – MY-01



Vegetation Plot 2: 9/30/09 – MY-01

Vegetation Plot 3: 9/30/09 – MY-01

Vegetation Plot 4: 9/30/09 – MY-01

Vegetation Plot 5: 9/30/09 – MY-01

Vegetation Plot 6: 9/30/09 – MY-01

Vegetation Plot 7: 9/30/09 – MY-01

Appendix D

Stream Assessment Data

Stream Station Photos

PP#1 – MY01 – 11/17/09

PP#2u – MY01 – 11/17/09

PP#2d – MY01 – 11/17/09

PP#3u – MY01 – 11/17/09

PP#3d – MY01 – 11/17/09

PP#4u – MY01 – 11/17/09

PP#4d – MY01 – 11/17/09

PP#5u – MY01 – 11/17/09

PP#5d – MY01 – 11/17/09

PP#6 – MY01 – 11/17/09

PP#7u – MY01 – 11/17/09

PP#7d – MY01 – 11/17/09

PP#8u – MY01 – 11/17/09

PP#8d– MY01 – 11/17/09

PP#9u – MY01 – 11/17/09

PP#9d – MY01 – 11/17/09

PP#10u – MY01 – 11/17/09

PP#10d – MY01 – 11/17/09

PP#11 – MY01 – 11/17/09

PP#Where's Adam– MY01 – 11/17/09

Table 8a. Visual Morphological Stability Assessment
Project Number and Name: 92719 – UT Bear Creek
Segment/Reach: UT Bear Creek, 1,926 Linear Feet

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?					
	2. Armor stable (e.g. no displacement)?					
	3. Facet grade appears stable?					
	4. Minimal evidence of embedding/fining?					
	5. Length appropriate?					
B. Pools	1. Present? (e.g. no severe aggradation)					
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)					
	3. Length appropriate?					
C. Thalweg	1. Upstream of meander bend centering?					
	2. Downstream of meander centering?					
D. Meanders	1. Outer bend in state of limited/controlled erosion?	22	22	N/A	100%	
	formation?	0	0	N/A		
	3. Apparent Rc within spec?	22	22	N/A	100%	
	4. Sufficient floodplain access and relief?	22	22	N/A	100%	**100%**
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	1/10	99%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0/0	100%	**99%**
F. Bank	1.Actively eroding, wasting, or slumping bank	N/A	N/A	0/0	100%	**100%**
G. Vanes	1. Free of back or arm scour?	10	10	N/A	100%	
	2. Height appropriate?	10	10	N/A	100%	
	3. Angle and geometry appear appropriate?	10	10	N/A	100%	
	4. Free of piping or other structural failures?	10	10	N/A	100%	**100%**
H. Wads / Boulders	1. Free of scour?	3	3	N/A	100%	
	2. Footing stable?	3	3	N/A	100%	100%

*Total number of features per as-built estimated from red line as-built planview sheets.

Table 8b. Qualitative Visual Stability Assessment
Project Number and Name: 92719 – Bear Creek
Segment/Reach: UT-2B, 452 Linear Feet

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?					
	2. Armor stable (e.g. no displacement)?					
	3. Facet grade appears stable?					
	4. Minimal evidence of embedding/fining?					
	5. Length appropriate?					
B. Pools	1. Present? (e.g. no severe aggradation)					
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)					
	3. Length appropriate?					
C. Thalweg	1. Upstream of meander bend centering?					
	2. Downstream of meander centering?					
D. Meanders	1. Outer bend in state of limited/controlled erosion?	5	6	N/A	83%	
	2. Of those eroding, # w/ concomitant point bar formation?	0	1	N/A	0%	
	3. Apparent Rc within spec?[#]	6	6	N/A	N/A	
	4. Sufficient floodplain access and relief?	4	6	N/A	67%	**50%**
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0/0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	2/30	93%	**97%**
F. Bank	1.Actively eroding, wasting, or slumping bank	N/A	N/A	1/20	98%	**98%**
G. Vanes	1. Free of back or arm scour?	4	5	N/A	80%	
	2. Height appropriate?	5	5	N/A	100%	
	3. Angle and geometry appear appropriate?	5	5	N/A	100%	
	4. Free of piping or other structural failures?	4	5	N/A	80%	**90%**

*Total number of features per as-built estimated from red line as-built planview sheets.

No design data is available to compare to current values.

Table 9. Verification of Bankfull Events
Project Number and Name: 92719 - UT Bear Creek (Phillips)

Date of Data Collection	Date of Occurence	Method	Photo Number
11/17/2009	11/13/2009	Site visit to evaluate indicators of stage after storm events	N/A