ANNUAL MONITORING REPORT
UT to CANE CREEK RESTORATION SITE

ALAMANCE COUNTY, NORTH CAROLINA
(EEP Project No. 395)

Monitoring Year 1 of 5 (2009)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

November 2009

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Ecosystem Enhancement PROGRAM

November 2009

1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The UT to Cane Creek Restoration Site (Site) is located in southwest Alamance County approximately 5 miles east of Liberty, North Carolina in United States Geological Survey Hydrologic Unit 03030002050050 (North Carolina Division of Water Quality Subbasin 03-06-04) of the Cape Fear River Basin. This Hydrologic Unit has been identified as a Targeted Local Watershed in NCEEP's *Cape Fear River Basin Restoration Priorities 2009*. The Site was identified to assist the North Carolina Ecosystem Enhancement Program in meeting stream and wetland restoration goals. Primary activities at the Site included stream restoration and wetland enhancement/preservation by excluding livestock from the Site, stabilizing stream banks, installing in-stream structures, adjusting stream plan form, removing invasive species, and replanting riparian areas with native vegetation. Project restoration efforts provided 6783 Stream Mitigation Units and 1.1 riparian riverine Wetland Mitigation Units. This report summarizes data for year 1 (2009) monitoring.

The goals and objectives of this project focused on improving local water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat. These goals were accomplished by the following.

1. Reestablished stream stability and the capacity to transport watershed flows and sediment load by restoring stable channel morphology supported by natural instream habitat and grade/bank stabilization structures.
2. Reduced nonpoint source sedimentation and nutrient inputs into the Site by eliminating the acceleration of bank erosion as a result of land use activities, excluding livestock, and reestablishing a native riparian buffer greater than 50 feet in width.
3. Enhanced the capacity of the Site to mitigate flood flows by reconnecting the stream to the historic floodplain.

Success criteria dictate an average density of 320 stems per acre must be surviving after three monitoring years, 290 stems per acre after four monitoring years, and 260 stems per acre after five monitoring years. Based on the number of stems counted, average densities were measured at 451 planted stems per acre surviving in year 1 (2009). The dominant species identified at the Site were planted stems of river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), and swamp chestnut oak (*Quercus michauxii*). Ten of the individual plots met success criteria with planted stems alone, four additional plots (Plots 4, 6, 11, and 12) met success criteria when including appropriate natural recruit species, and one plot (Plot 1) was one stem shy of success criteria based on planted stems with no natural recruit development having occurred yet. Several areas within the Site, noted on Figure 3 (Appendix A), had poor herbaceous vegetation development, most likely due to soil infertility following construction.

Success criteria for stream restoration reaches should show little to no change from the as-built channel over the five-year monitoring period. Year 1 (2009) monitoring measurements indicate that there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. In addition, one bankfull event was documented to occur on November 11, 2009 during the year 1 (2009) monitoring period during Tropical Storm Ida. A few areas of minor bank erosion and channel aggradation were documented within the Site and are depicted on Figure 3 (Appendix A). These are not considered to be a problem at this time but should continue to be monitored closely in subsequent monitoring years.

In summary, the Site achieved success criteria for vegetation and stream attributes in the First Monitoring Year (2009). Summary information and 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 table and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

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2.0 METHODOLOGY

2.1 Vegetation Assessment

Following Site construction, fifteen plots (10-meters square) were established and monumented with metal fence posts at all plot corners and PVC at each plot origin. Plots were surveyed in September 2009 for the year 1 (2009) monitoring season. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). The locations of vegetation monitoring plots are depicted on Figure 2 in Appendix A.

2.2 Stream Assessment

Twelve permanent cross-sections and five approximately 600 linear foot long monitoring reaches were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Applied Fluvial Morphology (Rosgen 1996) stream classification system. Longitudinal profile measurements include thalweg and water surface; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth. Visual assessment of in-stream structures was conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure. Stream assessment data are included in Appendix D with the locations of cross-sections and monitoring reaches depicted on Figure 2 in Appendix A.

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. (online). Available: http://cvs.bio.unc.edu/methods.htm

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: http://www.herbarium.unc.edu/WeakleysFlora.pdf [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

United States Army Corps of Engineers, United States Environmental Protection Agency, North Carolina Wildlife Resources Commission, North Carolina Division of Water Quality (USACE et al.). 2003. Stream Mitigation Guidelines.

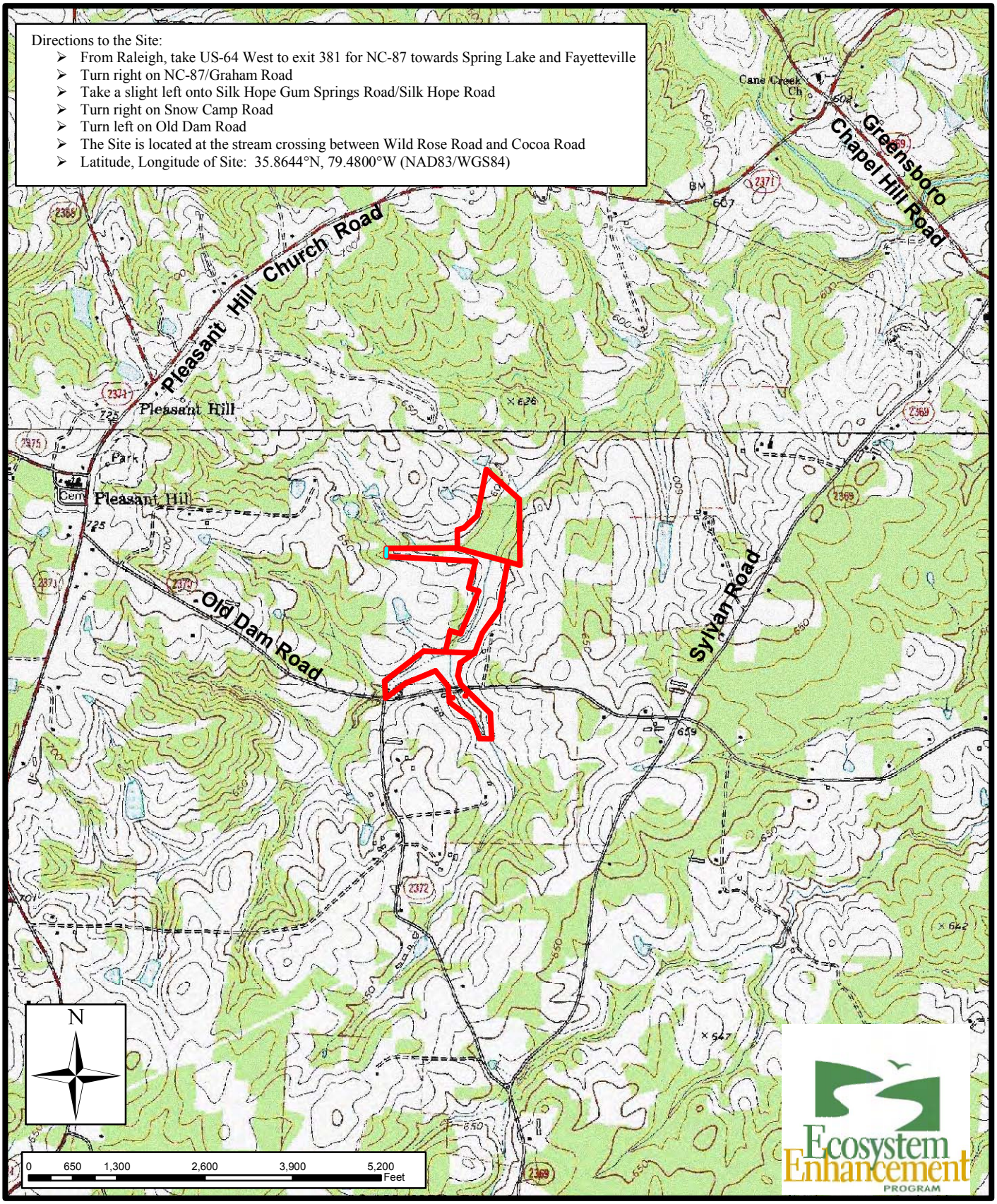
APPENDIX A

FIGURES AND PLAN VIEWS

Figure 1. Site Location

Figure 2. Monitoring Plan View

Figure 3. Problem Area Plan View



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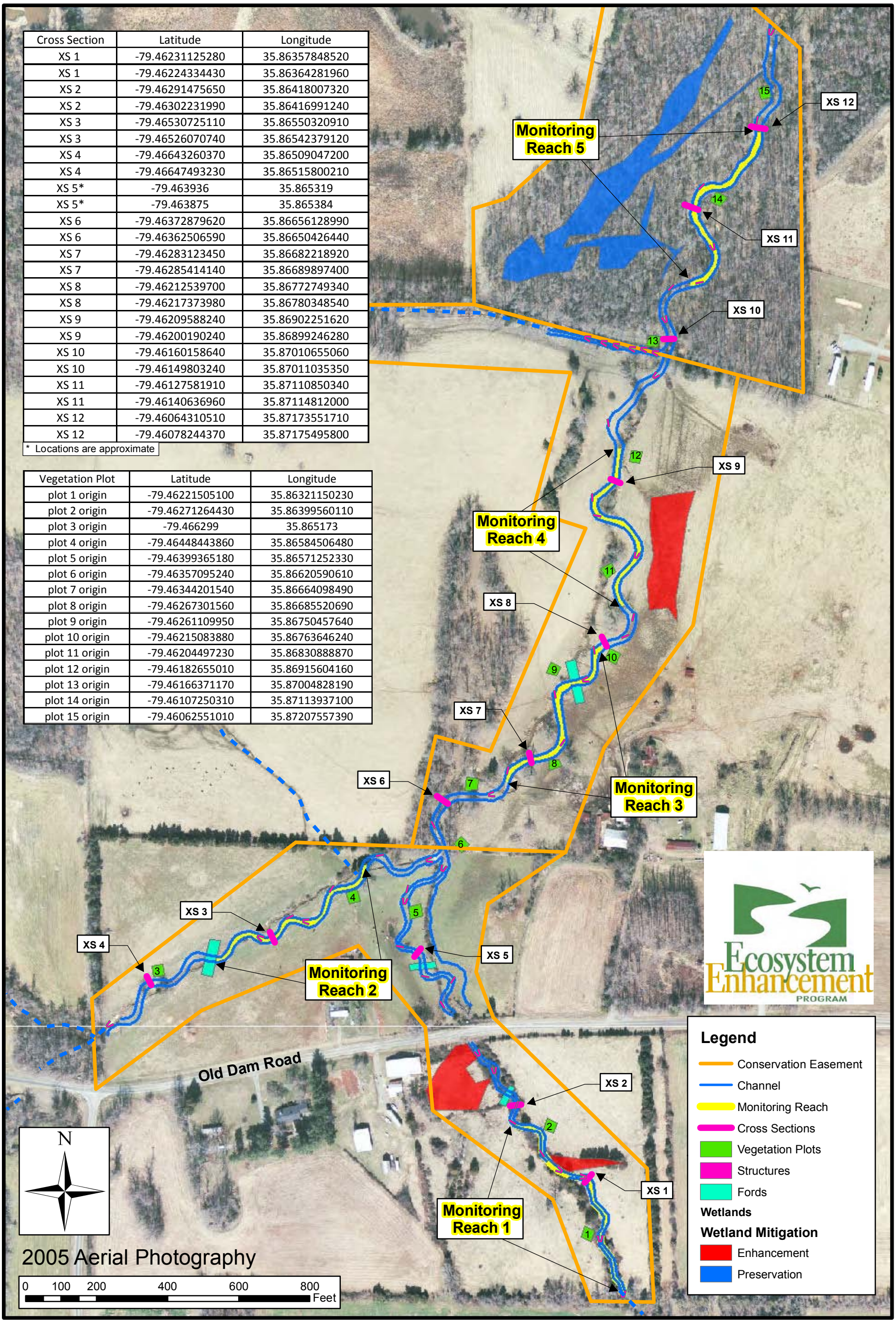
SITE LOCATION
UT to CANE CREEK RESTORATION SITE
EEP Project # 395
Alamance County, North Carolina

Dwn. By: WGL	FIGURE
Date: Nov 2009	1
Project: 08-001	

Cross Section	Latitude	Longitude
XS 1	-79.46231125280	35.86357848520
XS 1	-79.46224334430	35.86364281960
XS 2	-79.46291475650	35.86418007320
XS 2	-79.46302231990	35.86416991240
XS 3	-79.46530725110	35.86550320910
XS 3	-79.46526070740	35.86542379120
XS 4	-79.46643260370	35.86509047200
XS 4	-79.46647493230	35.86515800210
XS 5*	-79.463936	35.865319
XS 5*	-79.463875	35.865384
XS 6	-79.46372879620	35.86656128990
XS 6	-79.46362506590	35.86650426440
XS 7	-79.46283123450	35.86682218920
XS 7	-79.46285414140	35.86689897400
XS 8	-79.46212539700	35.86772749340
XS 8	-79.46217373980	35.86780348540
XS 9	-79.46209588240	35.86902251620
XS 9	-79.46200190240	35.86899246280
XS 10	-79.46160158640	35.87010655060
XS 10	-79.46149803240	35.87011035350
XS 11	-79.46127581910	35.87110850340
XS 11	-79.46140636960	35.87114812000
XS 12	-79.46064310510	35.87173551710
XS 12	-79.46078244370	35.87175495800

* Locations are approximate

Vegetation Plot	Latitude	Longitude
plot 1 origin	-79.46221505100	35.86321150230
plot 2 origin	-79.46271264430	35.86399560110
plot 3 origin	-79.466299	35.865173
plot 4 origin	-79.46448443860	35.86584506480
plot 5 origin	-79.46399365180	35.86571252330
plot 6 origin	-79.46357095240	35.86620590610
plot 7 origin	-79.46344201540	35.86664098490
plot 8 origin	-79.46267301560	35.86685520690
plot 9 origin	-79.46261109950	35.86750457640
plot 10 origin	-79.46215083880	35.86763646240
plot 11 origin	-79.46204497230	35.86830888870
plot 12 origin	-79.46182655010	35.86915604160
plot 13 origin	-79.46166371170	35.87004828190
plot 14 origin	-79.46107250310	35.87113937100
plot 15 origin	-79.46062551010	35.87207557390



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MONITORING PLANVIEW
UT to CANE CREEK RESTORATION SITE
EEP Project # 395
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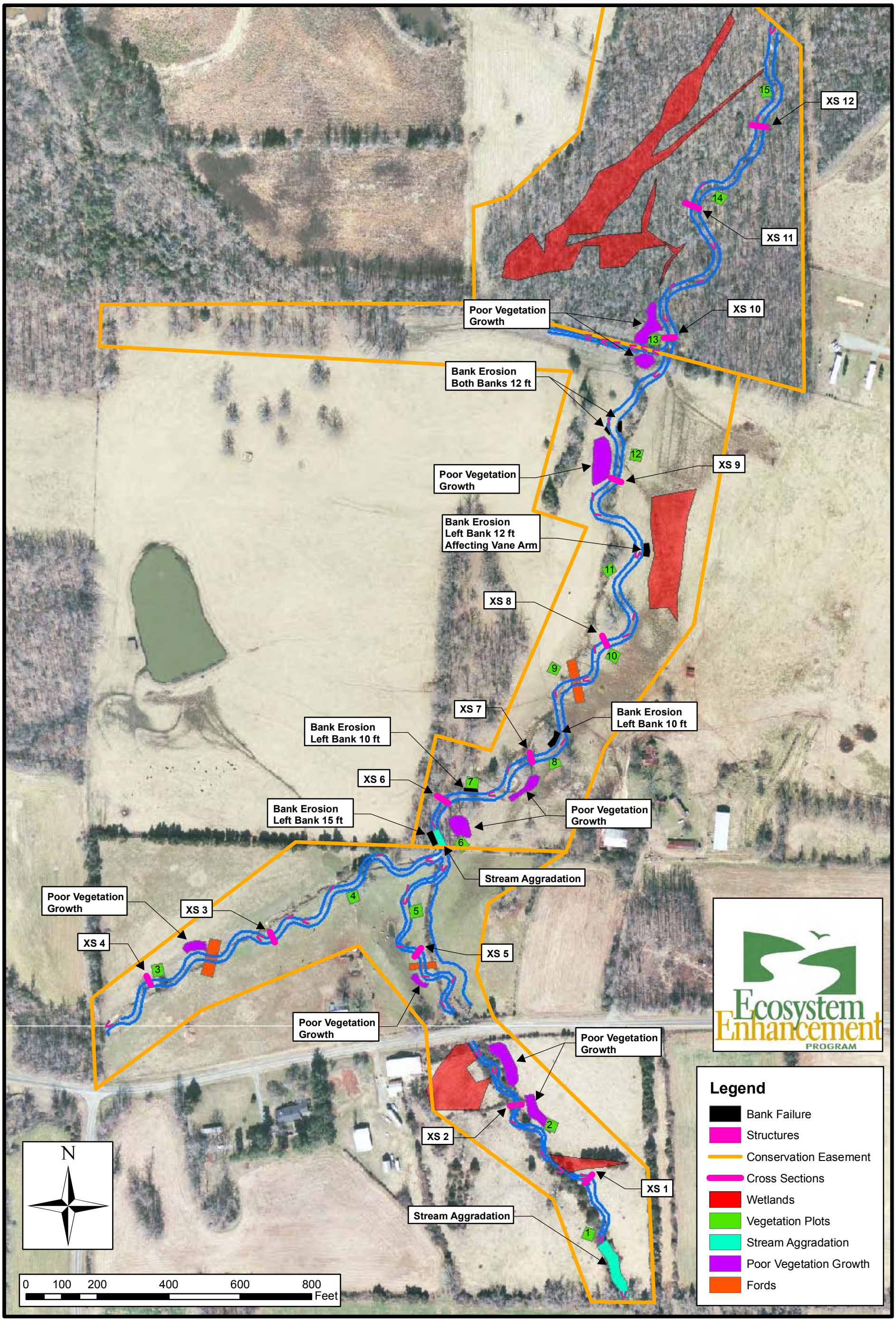
Dwn. By: WGL	FIGURE
Date: Nov 2009	2
Project: 08-001	



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PROBLEM AREA PLANVIEW
UT to CANE CREEK RESTORATION SITE
EEP Project # 395
Alamance County, North Carolina

Dwn. By: WGL	FIGURE
Date: Nov 2009	3
Project: 08-001	

APPENDIX B

GENERAL PROJECT TABLES

Table 1. Site Restoration Structures and Objectives

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Attributes Table

Table 1. Site Restoration Structures and Objectives
UT to Cane Creek (EEP Project Number 395)

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Linear Footage/ Acreage	Comment
Reach A	10+00-28+10.76	Restoration	Priority 1	1738.76**	Restoration of dimension and profile through a combination of on new location and in place restoration.
Reach B	28+10.76-49+29.45	Restoration	Priority 1	2118.69	
Reach C	49+29.45-61+24.03	Restoration	Priority 2	1194.58	
Reach D	100+00-113.57.31	Restoration	Priority 1	1357.31	
Reach E	200+00-203+73.25	Restoration	Priority 1	373.25	
Wetlands	--	Enhancement	--	1.3	Invasive species removal and planting.
Wetlands	--	Preservation	--	2.0	Invasive species removal.

Component Summation			
Restoration Level	**Stream (linear footage)**	**Riverine Riparian Wetland (acreage)**	**Planted Riparian Buffer (acreage)**
Restoration	6782.59	--	--
Enhancement	--	1.3	--
Preservation		2.0	--
Totals	**6782.59 linear feet**	**3.3 acres**	**41 acres**
Mitigation Units	**6783 SMUs**	**1.1 WMUs**	**--**

* Locations of each reach are depicted on the As-built Drawings in Appendix A

** Constructed linear footage excludes the 72-foot corrugated metal pipe at Old Dam Road; therefore, the linear footage is shorter than stationing depicts.

Table 2. Project Activity and Reporting History
UT to Cane Creek (EEP Project Number 395)

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	--	February 2006
Construction Completion	--	March 2009
Site Planting	--	March 2009
As-built Drawings	July-October 2008	July 2009
Mitigation Plan	--	October 2009

Table 3. Project Contacts Table
UT to Cane Creek (EEP Project Number 395)

Designer	URS Corporation 1600 Perimeter Park Drive, Suite 400 Morrisville, North Carolina 27560 Kathleen McKeithan (919) 461-1597
Construction Contractor	River Works, Inc. 8000 Regency Parkway, Suite 200 Cary, North Carolina 27511 Will Pederson (919) 459-9001
Conservation Easement Contractor	Landmark Surveying, Inc. 109 E. Harden Street Graham, North Carolina 27253 (336) 229-6275
As-built Surveying Contractor	Level Cross Surveying, PLLC 668 Marsh County Lane Randleman, North Carolina 23717 Sherri Willard (336) 495-1713

Table 4. Project Attribute Table
UT to Cane Creek (EEP Project Number 395)

Project County	Alamance County, North Carolina				
Physiographic Region	Piedmont				
Ecoregion	Carolina Slate Belt				
Project River Basin	Cape Fear				
USGS 14-digit HUC	03030002050050				
NCDWQ Subbasin	03-06-04				
Within EEP Watershed Plan Extent?	Yes-Targeted Local Watershed				
WRC Class	Warm				
% of project easement fenced	100 %				
Beaver activity observed during design phase	No				
Restoration Component Attribute Table					
	Reach A	**Reach B**	**Reach C**	**Reach D**	**Reach E**
Drainage area (acres)	390	1333	1640	892	282
Stream order	first	third	third	third	second
Restored length (linear feet)	1738.76	2118.69	1194.58	1357.31	373.25
Perennial or Intermittent	perennial	perennial	perennial	perennial	perennial
NCDWQ Index Number	16-28	16-28	16-28	16-28	16-28
NCDWQ Classification	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW
303d list?	No	No	No	No	No
Upstream of a 303d listed segment?	No	No	No	No	No
Total acreage of easement	50.75	50.75	50.75	50.75	50.75
Total planted acreage of easement	41	41	41	41	41
Rosgen classification of preexisting	Degraded E4	Degraded E4	Degraded E4	Degraded E4	Degraded E4
Rosgen classification of asbuilt	E4	E4	E4	E4	E4
Valley type	VIII	VIII	VIII	VIII	VIII
Valley slope	0.0083	0.0041	0.0045	0.0046	0.0156
Cowardin classification	R3UB1	R3UB1	R3UB1	R3UB1	R3UB1
Trout waters designation?	No	No	No	No	No
Species of concern, T&E, etc?	No	No	No	No	No
Dominant Soil Series and Characteristics	Tirzah silt loam, Georgeville silt loam, Starr loam, Colfax silt loam, Herndon silt loam, and mixed alluvial land				
Watershed Land Use (%)					
Managed Herbaceous Coverage	49.8				
Mixed Upland Hardwoods	31.4				
Cultivated	9.9				
Southern Yellow Pine	4.6				
Deciduous Shrubland	2.0				
Mixed Hardwoods/Conifers	0.9				
Unmanaged Herbaceous Upland	0.6				
Evergreen Shrubland	0.4				
Water Bodies	0.4				
Impervious Surfaces	<0.1				

APPENDIX C

VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary

Vegetation Monitoring Plot Photos

CVS Summary Data Tables

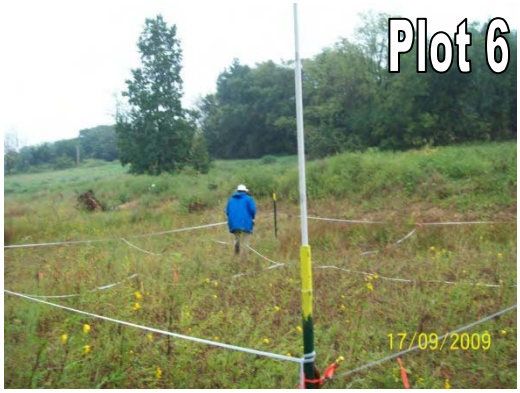
Table 6. Vegetation Metadata Table

Table 7. Total and Planted Stems by Plot and Species

Table 5. Vegetation Plot Mitigation Success Summary Table
UT to Cane Creek (EEP Project Number 395)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	No	93%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	
14	Yes	
15	Yes	

UT to Cane Creek Restoration Site
Year 1 (2009) Annual Monitoring
Vegetation Plot Photos (taken September 2009)



UT to Cane Creek Restoration Site
Year 1 (2009) Annual Monitoring
Vegetation Plot Photos (taken September 2009), continued

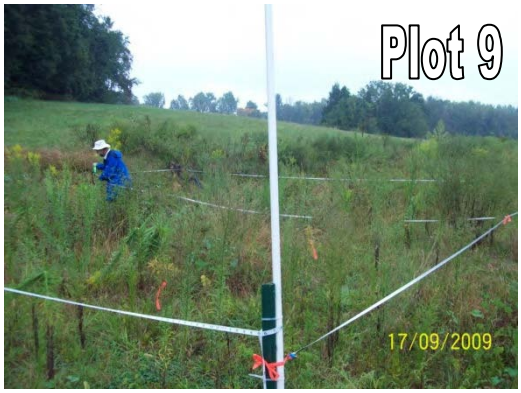


Table 6. Vegetation Metadata Table
UT to Cane Creek Restoration Site (EEP Project Number 395)

Report Prepared By	Corri Faquin
Date Prepared	11/5/2009 10:41
database name	Axiom-2009-A-v2.2.7.mdb
database location	C:\Axiom\Business\CVS database
computer name	CORRILAPTOP
file size	85573632
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	395
project Name	UT to Cane Creek
Description	UT to Cane Creek Stream and Wetland Restoration
River Basin	Cape Fear
Sampled Plots	15

Table 7. Total and Planted Stems by Plot and Species
UT to Cane Creek Restoration Site (EEP Project Number 395)

		Current Data (MY1 2009)																														Current Mean MY1 (2009)	
		Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12		Plot 13		Plot 14		Plot 15			
Species	CommonName	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total stems	Planted stems
Acer rubrum	red maple																													1		1	
Alnus serrulata	hazel alder													1	1																	1	1
Betula nigra	river birch			5	5	3	3			2	2			3	3	3	3	3	3	2	2					7	6	1	1	2	2	31	30
Carya	hickory	1	1	1	1									3	3																	5	5
Celtis laevigata	sugarberry					1	1							2	2			2	2							1	1					6	6
Cephalanthus occidentalis	common buttonbush	2	2							1	1	1	1	1	1			1	1							2	2	1	1			9	9
Cornus amomum	silky dogwood	1	1	1	1			3	3					1	1									1	1							7	7
Corylus americana	American hazelnut													2	2											1	1					3	3
Diospyros virginiana	common persimmon							1		2	2															1						4	2
Fraxinus pennsylvanica	green ash			1	1	6	6	4	4			6	3	1	1	1		7	4	5	2	3	3	5	3	40		192	2	122	2	393	31
Liquidambar styraciflua	sweetgum											1				4		22		7								5		14		53	
Liriodendron tulipifera	tuliptree																			1	1	1	1					1	1			3	3
Nyssa	tupelo									1	1																					1	1
Platanus occidentalis	American sycamore	1	1			2	2			1	1					7	6	2	2					1	1					8	5	22	18
Pyrus calleryana	Callery pear																					1										1	
Quercus michauxii	swamp chestnut oak									4	4	2	2							5	5			1	1			2	2	7	7	21	21
Quercus pagoda	cherrybark oak													2	2													3	3			5	5
Quercus phellos	willow oak	1	1	4	4	1	1			4	4					1	1	2	2					1	1	3	3	2	2			19	19
Rhus glabra	smooth sumac							1																								1	
Salix nigra	black willow	1	1			3	3			1	1					10				60		5										80	5
Sassafras albidum	sassafras													1																		1	
Unknown						1	1																									1	1
Plot area (acres)		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247			
Species Count		**6**	**6**	**5**	**5**	**7**	**7**	**4**	**2**	**8**	**8**	**4**	**3**	**10**	**9**	**6**	**3**	**7**	**6**	**6**	**4**	**4**	**2**	**5**	**5**	**7**	**5**	**8**	**7**	**6**	**4**	**22**	**17**
Stem Count		**28**	**7**	**12**	**12**	**17**	**17**	**9**	**7**	**16**	**16**	**10**	**6**	**17**	**16**	**26**	**10**	**39**	**14**	**80**	**10**	**10**	**4**	**9**	**7**	**55**	**13**	**207**	**12**	**154**	**16**	**668**	**167**
Stems per acre		**1134**	**283**	**486**	**486**	**688**	**688**	**364**	**283**	**648**	**648**	**405**	**243**	**688**	**648**	**1053**	**405**	**1579**	**567**	**3239**	**405**	**405**	**162**	**364**	**283**	**2227**	**526**	**8381**	**486**	**6235**	**648**	**1803**	**451**

APPENDIX D

STREAM ASSESSMENT DATA

Tables 8A-8E. Qualitative Visual Stability Assessment

Table 9. Verification of Bankfull Events

Cross-section Plots and Tables

Longitudinal Profile Plots

Pebble Count Plots

Table 8A. Qualitative Visual Stability Assessment

Reach 1
UT to Cane Creek Restoration Site (EEP Project Number 395)

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?	11	11	N/A	100	96.4
	2. Armor stable (e.g. no displacement)?	11	11	N/A	100	
	3. Facet grade appears stable?	11	11	N/A	100	
	4. Minimal evidence of embedding/fining?	9	11	N/A	82	
	5. Length appropriate?	11	11	N/A	100	
B. Pools	1. Present? (e.g. no severe aggradation)	8	11	N/A	73	82
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	8	11	N/A	73	
	3. Length appropriate?	11	11	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	11	11	N/A	100	100
	2. Downstream of meander centering?	11	11	N/A	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	11	11	N/A	100	100
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A	100	
	3. Apparent Rc within spec?	11	11	N/A	100	
	4. Sufficient floodplain access and relief?	11	11	N/A	100	
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	113	83	91.5
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	100
G. Vanes	1. Free of back or arm scour?	6	6	N/A	100	100
	2. Height appropriate?	6	6	N/A	100	
	3. Angle and geometry appear appropriate?	6	6	N/A	100	
	4. Free of piping or other structural failures?	6	6	N/A	100	
H. Wads / Boulders	1. Free of scour?	2	2	N/A	100	100
	2. Footing stable?	2	2	N/A	100	

Table 8B. Qualitative Visual Stability Assessment

Reach 2
UT to Cane Creek Restoration Site (EEP Project Number 395)

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?	7	7	N/A	100	100
	2. Armor stable (e.g. no displacement)?	7	7	N/A	100	
	3. Facet grade appears stable?	7	7	N/A	100	
	4. Minimal evidence of embedding/fining?	7	7	N/A	100	
	5. Length appropriate?	7	7	N/A	100	
B. Pools	1. Present? (e.g. no severe aggradation)	7	7	N/A	100	**100**
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	7	7	N/A	100	
	3. Length appropriate?	7	7	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	7	7	N/A	100	**100**
	2. Downstream of meander centering?	7	7	N/A	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	7	7	N/A	100	**100**
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A	100	
	3. Apparent Rc within spec?	7	7	N/A	100	
	4. Sufficient floodplain access and relief?	7	7	N/A	100	
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	**100**
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	**100**
G. Vanes	1. Free of back or arm scour?	4	4	N/A	100	**100**
	2. Height appropriate?	4	4	N/A	100	
	3. Angle and geometry appear appropriate?	4	4	N/A	100	
	4. Free of piping or other structural failures?	4	4	N/A	100	
H. Wads / Boulders	1. Free of scour?	2	2	N/A	100	**100**
	2. Footing stable?	2	2	N/A	100	

Table 8C. Qualitative Visual Stability Assessment

Reach 3
UT to Cane Creek Restoration Site (EEP Project Number 395)

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?	5	5	N/A	100	96
	2. Armor stable (e.g. no displacement)?	5	5	N/A	100	
	3. Facet grade appears stable?	5	5	N/A	100	
	4. Minimal evidence of embedding/fining?	5	5	N/A	100	
	5. Length appropriate?	4	5	N/A	80	
B. Pools	1. Present? (e.g. no severe aggradation)	4	4	N/A	100	**100**
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	4	4	N/A	100	
	3. Length appropriate?	4	4	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	5	5	N/A	100	**100**
	2. Downstream of meander centering?	5	5	N/A	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	4	N/A	100	**100**
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A		
	3. Apparent Rc within spec?	4	4	N/A	1100	
	4. Sufficient floodplain access and relief?	4	4	N/A	100	
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	**100**
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	10	98	**98**
G. Vanes	1. Free of back or arm scour?	5	5	N/A	100	**100**
	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?	5	5	N/A	100	
H. Wads / Boulders	1. Free of scour?	0	0	N/A	100	**100**
	2. Footing stable?	0	0	N/A	100	

Table 8D. Qualitative Visual Stability Assessment

Reach 4
UT to Cane Creek Restoration Site (EEP Project Number 395)

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?	5	5	N/A	100	100
	2. Armor stable (e.g. no displacement)?	5	5	N/A	100	
	3. Facet grade appears stable?	5	5	N/A	100	
	4. Minimal evidence of embedding/fining?	5	5	N/A	100	
	5. Length appropriate?	5	5	N/A	100	
B. Pools	1. Present? (e.g. no severe aggradation)	4	4	N/A	100	100
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	4	4	N/A	100	
	3. Length appropriate?	4	4	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	5	5	N/A	100	100
	2. Downstream of meander centering?	5	5	N/A	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	3	4	N/A	75	91
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A	0	
	3. Apparent Rc within spec?	4	4	N/A	100	
	4. Sufficient floodplain access and relief?	4	4	N/A	100	
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	100
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	12	97	97
G. Vanes	1. Free of back or arm scour?	2	3	N/A	66	91.5
	2. Height appropriate?	3	3	N/A	100	
	3. Angle and geometry appear appropriate?	3	3	N/A	100	
	4. Free of piping or other structural failures?	3	3	N/A	100	
H. Wads / Boulders	1. Free of scour?	3	3	N/A	100	100
	2. Footing stable?	3	3	N/A	100	

Table 8E. Qualitative Visual Stability Assessment

Reach 5
UT to Cane Creek Restoration Site (EEP Project Number 395)

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?	5	5	N/A	100	96
	2. Armor stable (e.g. no displacement)?	5	5	N/A	100	
	3. Facet grade appears stable?	5	5	N/A	100	
	4. Minimal evidence of embedding/fining?	5	5	N/A	100	
	5. Length appropriate?	4	5	N/A	80	
B. Pools	1. Present? (e.g. no severe aggradation)	5	5	N/A	100	100
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	5	5	N/A	100	
	3. Length appropriate?	5	5	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	5	5	N/A	100	100
	2. Downstream of meander centering?	5	5	N/A	100	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	5	5	N/A	100	100
	2. Of those eroding, # w/ concomitant point bar formation?	0	0	N/A	100	
	3. Apparent Rc within spec?	5	5	N/A	100	
	4. Sufficient floodplain access and relief?	5	5	N/A	100	
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	100
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	100
G. Vanes	1. Free of back or arm scour?	3	3	N/A	100	100
	2. Height appropriate?	3	3	N/A	100	
	3. Angle and geometry appear appropriate?	3	3	N/A	100	
	4. Free of piping or other structural failures?	3	3	N/A	100	
H. Wads / Boulders	1. Free of scour?	1	1	N/A	100	100
	2. Footing stable?	1	1	N/A	100	

Table 9. Verification of Bankfull Events

UT to Cane Creek Restoration Site (EEP Project Number 395)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
November 16, 2009	November 11, 2009	Visual observation of wrack adjacent to the stream channel and within the floodplain as the result of Tropical Storm Ida	1-2

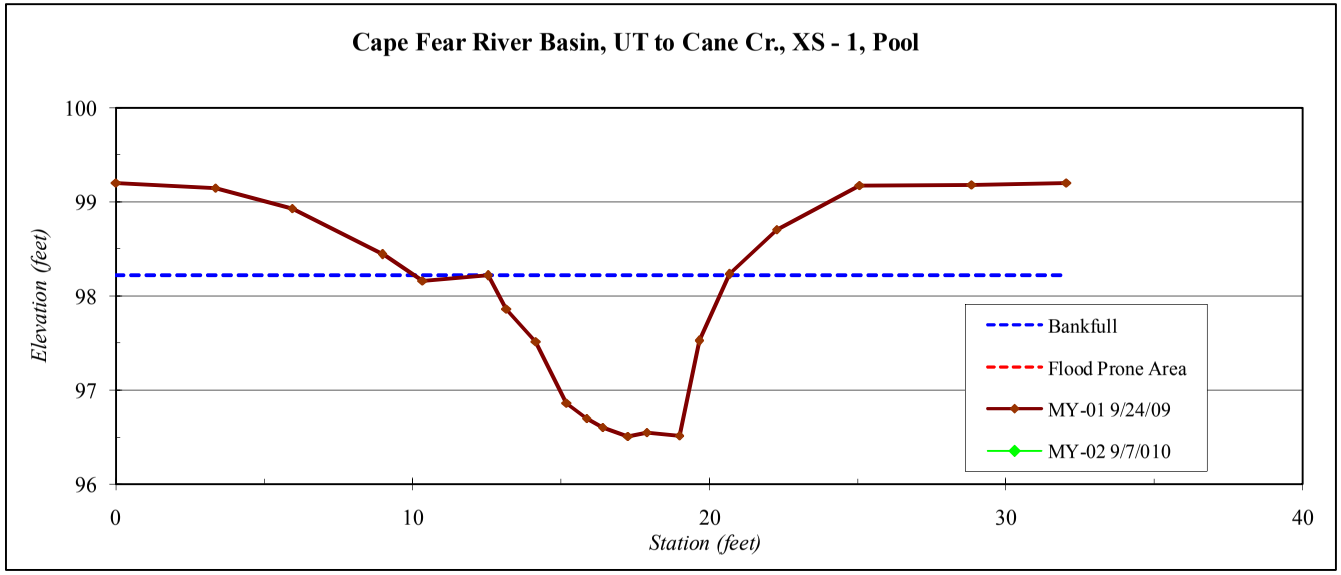
Bankfull Event Photos 1-2 showing evidence of overbank through wrack lines on banks and debris deposition from overland flow within the floodplain.

River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 1, Pool
Feature	Pool
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	99.20
3.4	99.15
5.9	98.93
9.0	98.45
10.3	98.16
12.5	98.22
13.2	97.87
14.2	97.52
15.2	96.86
15.9	96.70
16.4	96.61
17.3	96.51
17.9	96.55
19.0	96.52
19.7	97.53
20.7	98.24
22.3	98.7
25.1	99.2
28.8	99.2
32.0	99.2

SUMMARY DATA	
Bankfull Elevation:	98.2
Bankfull Cross-Sectional Area:	9.0
Bankfull Width:	8.1
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	1.1
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA

Stream Type	E

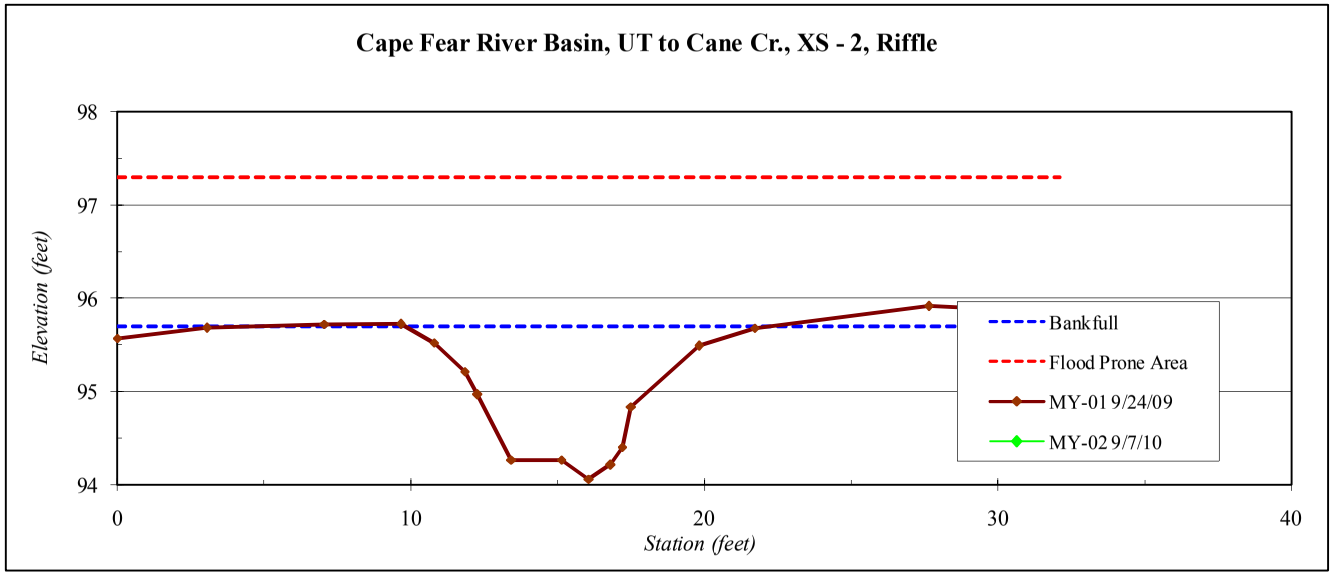


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 2, Riffle
Feature	Riffle
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.00	95.57
3.05	95.68
7.05	95.72
9.65	95.72
10.79	95.52
11.84	95.21
12.26	94.97
13.42	94.27
15.13	94.27
16.05	94.06
16.80	94.22
17.20	94.40
17.50	94.83
19.82	95.49
21.72	95.68
27.6	95.9
32.1	95.9

SUMMARY DATA	
Bankfull Elevation:	95.7
Bankfull Cross-Sectional Area:	9.3
Bankfull Width:	12.4
Flood Prone Area Elevation:	97.3
Flood Prone Width:	150.0
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	0.8
W / D Ratio:	16.5
Entrenchment Ratio:	12.1
Bank Height Ratio:	1.0

Stream Type	C

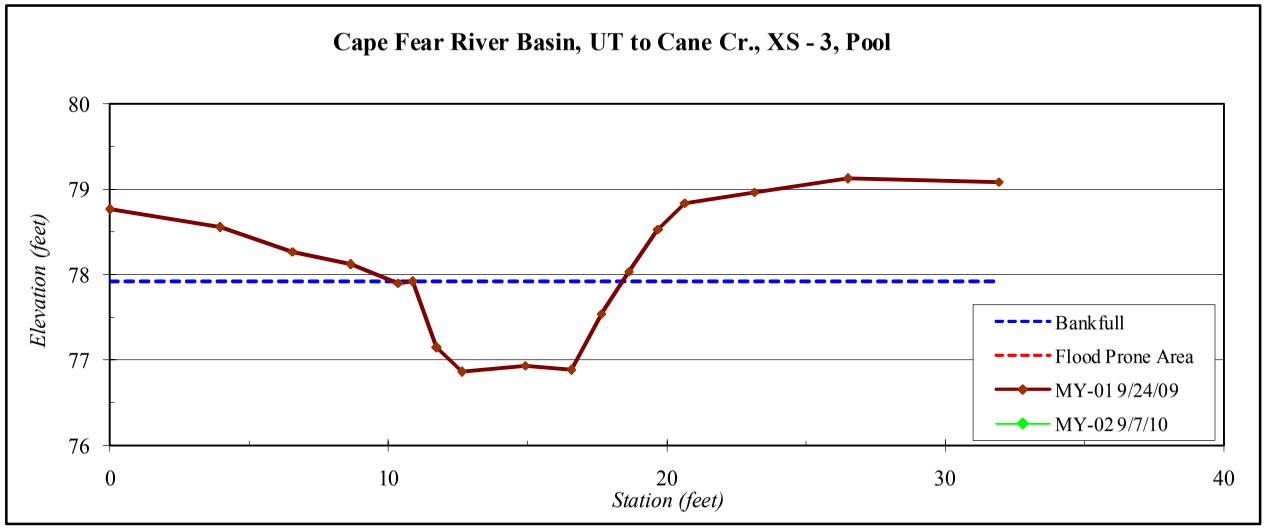


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 3, Pool
Feature	Pool
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.00	78.76
3.95	78.55
6.55	78.27
8.64	78.12
10.35	77.90
10.87	77.92
11.73	77.15
12.64	76.86
14.91	76.93
16.56	76.88
17.64	77.54
18.63	78.03
19.68	78.53
20.64	78.83
23.1	79.0
26.5	79.1
31.9	79.1

SUMMARY DATA	
Bankfull Elevation:	77.9
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	8.2
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA

Stream Type	E/C

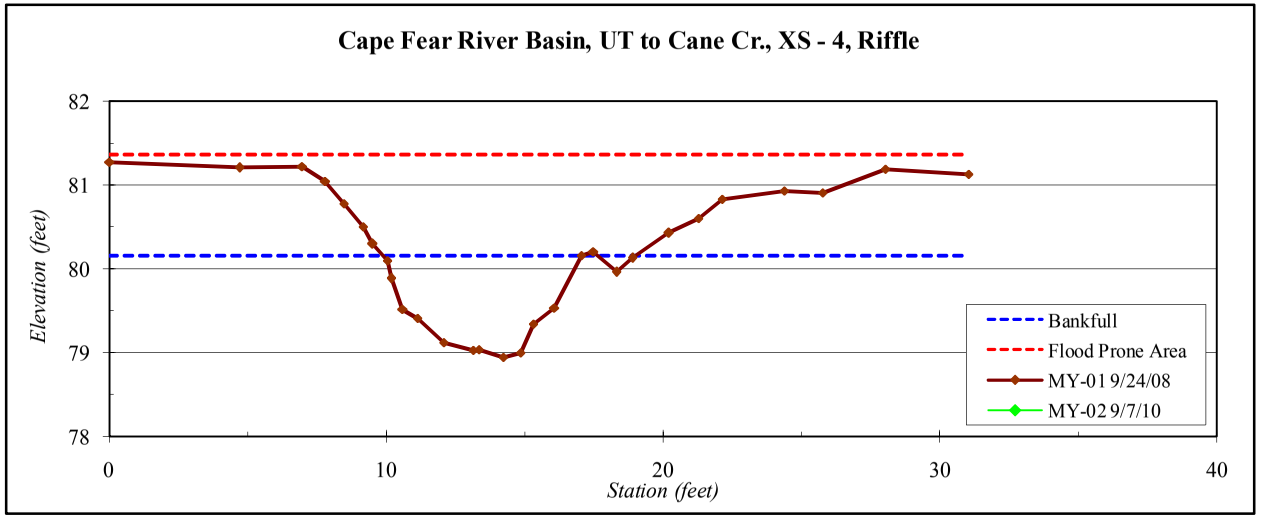


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 4, Riffle
Feature	Riffle
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	81.3
4.7	81.2
7.0	81.2
7.8	81.0
8.5	80.8
9.2	80.5
9.5	80.3
10.0	80.1
10.2	79.9
10.6	79.5
11.1	79.4
12.1	79.1
13.1	79.0
13.3	79.0
14.2	78.95
14.8	79.00
15.3	79.34
16.1	79.53
17.1	80.16
17.5	80.20
18.3	79.96
18.9	80.13
20.2	80.43
21.3	80.60
22.1	80.83
24.4	80.93
25.8	80.91
28.0	81.19
31.0	81.13

SUMMARY DATA	
Bankfull Elevation:	80.2
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	8.6
Flood Prone Area Elevation:	81.4
Flood Prone Width:	150.0
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.7
W / D Ratio:	12.1
Entrenchment Ratio:	17.4
Bank Height Ratio:	1.0

Stream Type	C/E

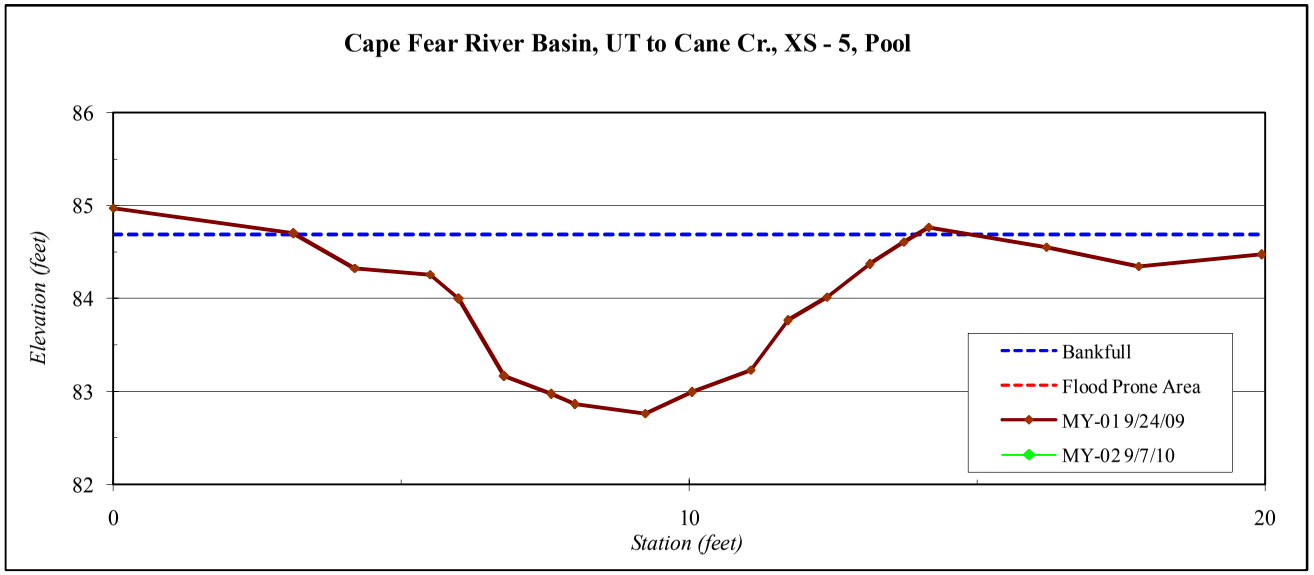


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 5, Pool
Feature	Pool
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	85.0
3.1	84.7
4.2	84.3
5.5	84.3
6.0	84.0
6.8	83.2
7.6	83.0
8.0	82.9
9.2	82.8
10.0	83.0
11.1	83.2
11.7	83.8
12.4	84.0
13.1	84.4
13.7	84.6
14.2	84.8
16.2	84.6
17.8	84.3
19.9	84.5

SUMMARY DATA	
Bankfull Elevation:	84.7
Bankfull Cross-Sectional Area:	11.1
Bankfull Width:	10.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.0
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA

Stream Type	E/C

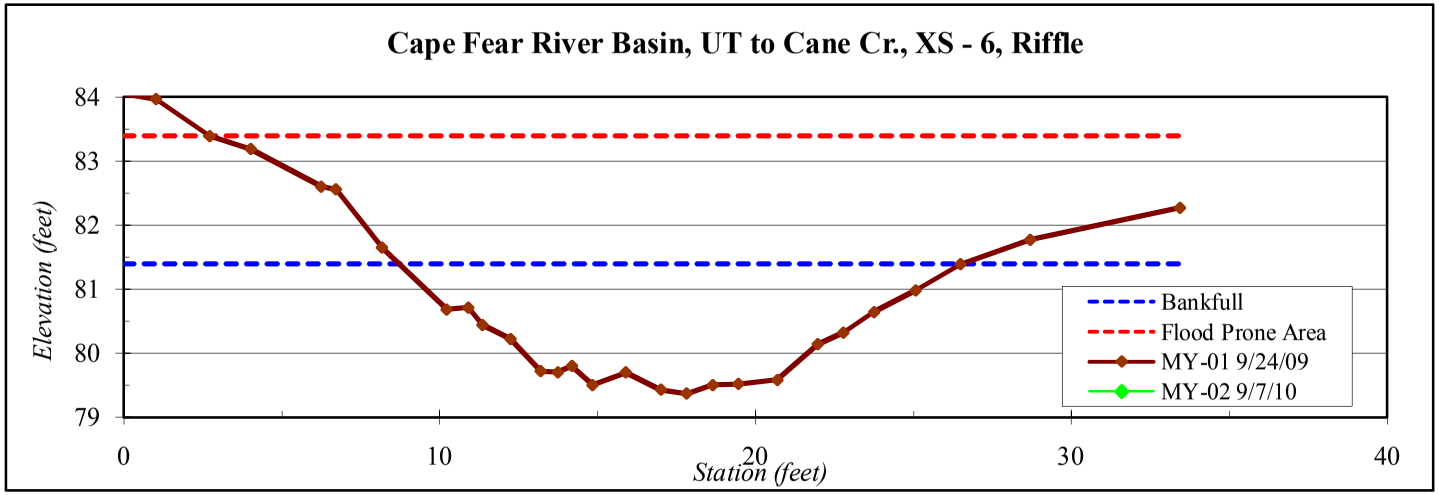


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 6, Riffle
Feature	Riffle
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	84.0
1.0	84.0
2.7	83.4
4.0	83.2
6.3	82.6
6.7	82.6
8.2	81.6
10.2	80.7
10.9	80.7
11.3	80.4
12.2	80.2
13.2	79.7
13.7	79.7
14.2	79.8
14.8	79.5
15.9	79.7
17.0	79.4
17.8	79.4
18.6	79.5
19.5	79.5
20.7	79.6
22.0	80.1
22.8	80.3
23.7	80.6
25.1	81.0
26.5	81.4
28.7	81.8
33.4	82.3

SUMMARY DATA	
Bankfull Elevation:	81.4
Bankfull Cross-Sectional Area:	22.2
Bankfull Width:	17.8
Flood Prone Area Elevation:	83.4
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.2
W / D Ratio:	14.3
Entrenchment Ratio:	8.4
Bank Height Ratio:	1.0

Stream Type	E/C

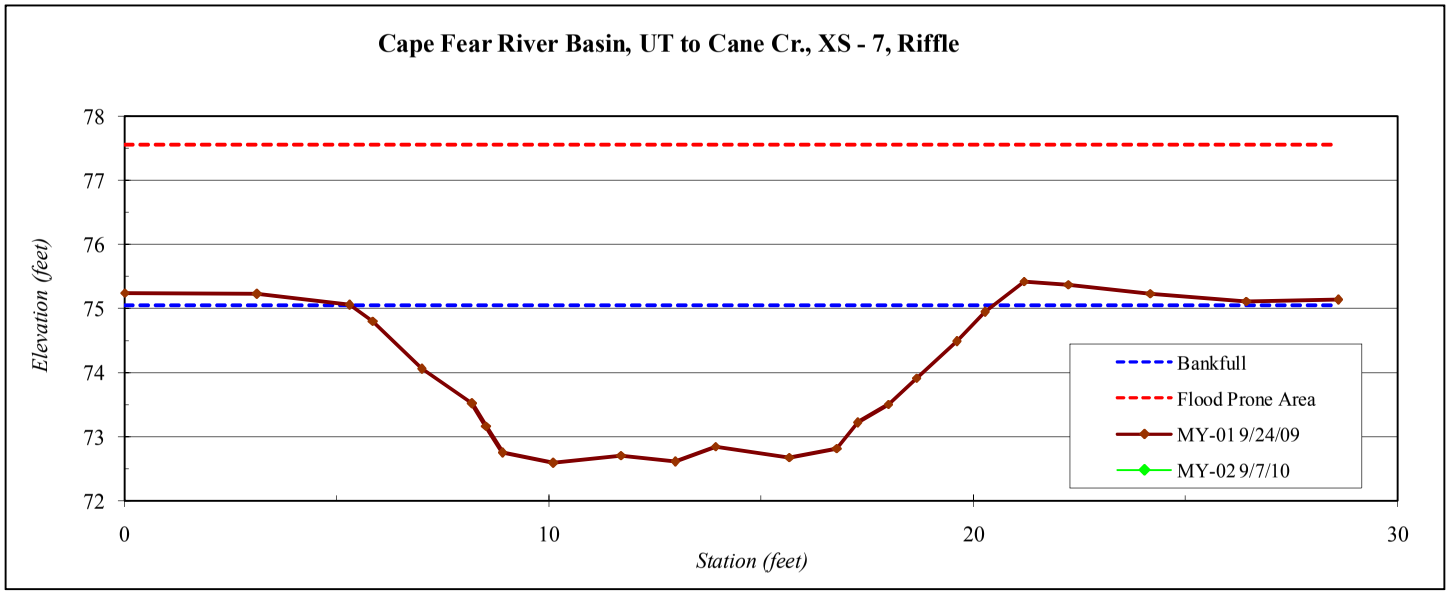


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 7, Riffle
Feature	Riffle
Date:	9/24/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	75.2
3.1	75.2
5.3	75.1
5.8	74.8
7.0	74.1
8.2	73.5
8.5	73.2
8.9	72.7
10.1	72.6
11.7	72.7
13.0	72.6
13.9	72.8
15.7	72.7
16.8	72.8
17.3	73.2
18.0	73.5
18.7	73.9
19.6	74.5
20.3	74.9
21.2	75.4
22.2	75.4
24.2	75.2
26.4	75.1
28.6	75.1

SUMMARY DATA	
Bankfull Elevation:	75.1
Bankfull Cross-Sectional Area:	26.3
Bankfull Width:	15.2
Flood Prone Area Elevation:	77.6
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.7
W / D Ratio:	8.8
Entrenchment Ratio:	9.9
Bank Height Ratio:	1.0

Stream Type	E

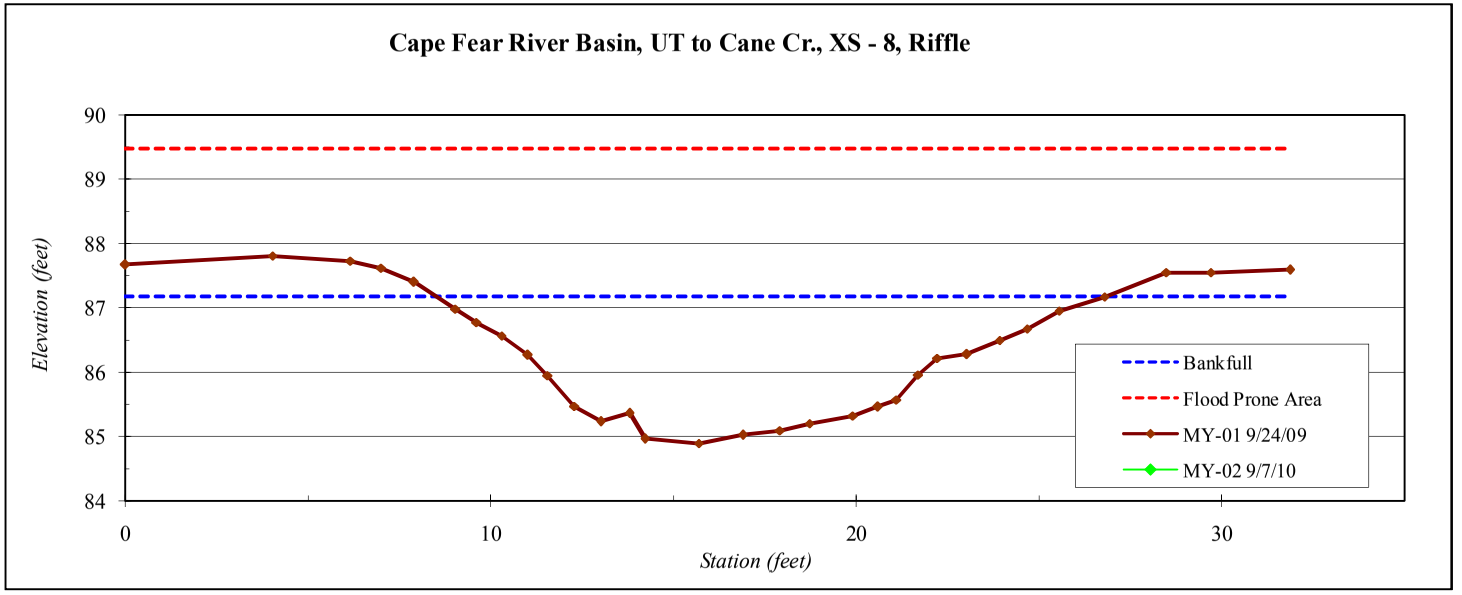


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 8, Riffle
Feature	Riffle
Date:	10/8/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	87.7
4.0	87.8
6.2	87.7
7.0	87.6
7.9	87.4
9.0	87.0
9.6	86.8
10.3	86.6
11.0	86.3
11.6	85.9
12.3	85.5
13.0	85.2
13.8	85.4
14.2	85.0
15.7	84.9
16.9	85.0
17.9	85.1
18.7	85.2
19.9	85.3
20.6	85.5
21.1	85.6
21.7	86.0
22.2	86.2
23.0	86.3
23.9	86.5
24.7	86.7
25.6	87.0
26.8	87.2
28.5	87.6
29.7	87.5
31.9	87.6

SUMMARY DATA	
Bankfull Elevation:	87.2
Bankfull Cross-Sectional Area:	24.4
Bankfull Width:	18.3
Flood Prone Area Elevation:	89.5
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.3
W / D Ratio:	13.7
Entrenchment Ratio:	8.2
Bank Height Ratio:	1.0

Stream Type	E/C

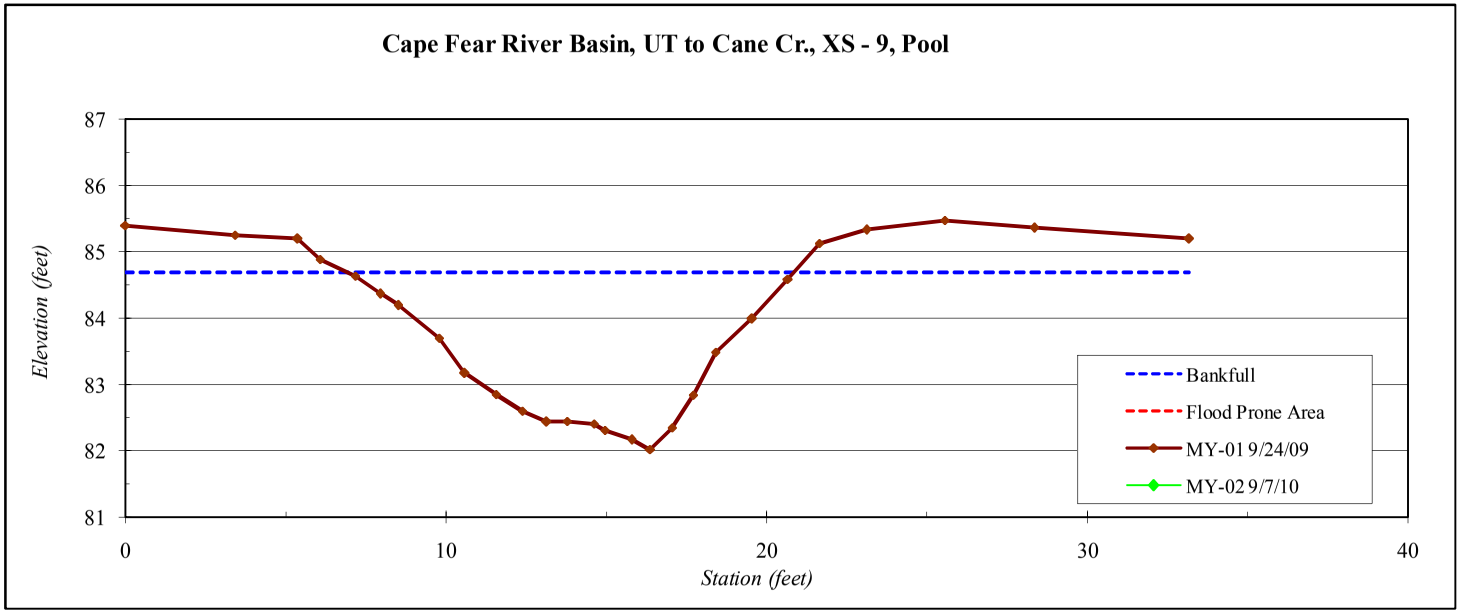


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 9, Pool
Feature	Pool
Date:	10/8/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	85.4
3.4	85.3
5.4	85.2
6.1	84.9
7.2	84.6
8.0	84.4
8.5	84.2
9.8	83.7
10.6	83.2
11.6	82.9
12.4	82.6
13.1	82.4
13.8	82.4
14.6	82.4
15.0	82.3
15.8	82.2
16.4	82.0
17.0	82.4
17.7	82.8
18.4	83.5
19.5	84.0
20.7	84.6
21.6	85.1
23.1	85.3
25.6	85.5
28.4	85.4
33.2	85.2

SUMMARY DATA	
Bankfull Elevation:	84.7
Bankfull Cross-Sectional Area:	28.4
Bankfull Width:	16.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.7
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	NA

Stream Type	E/C

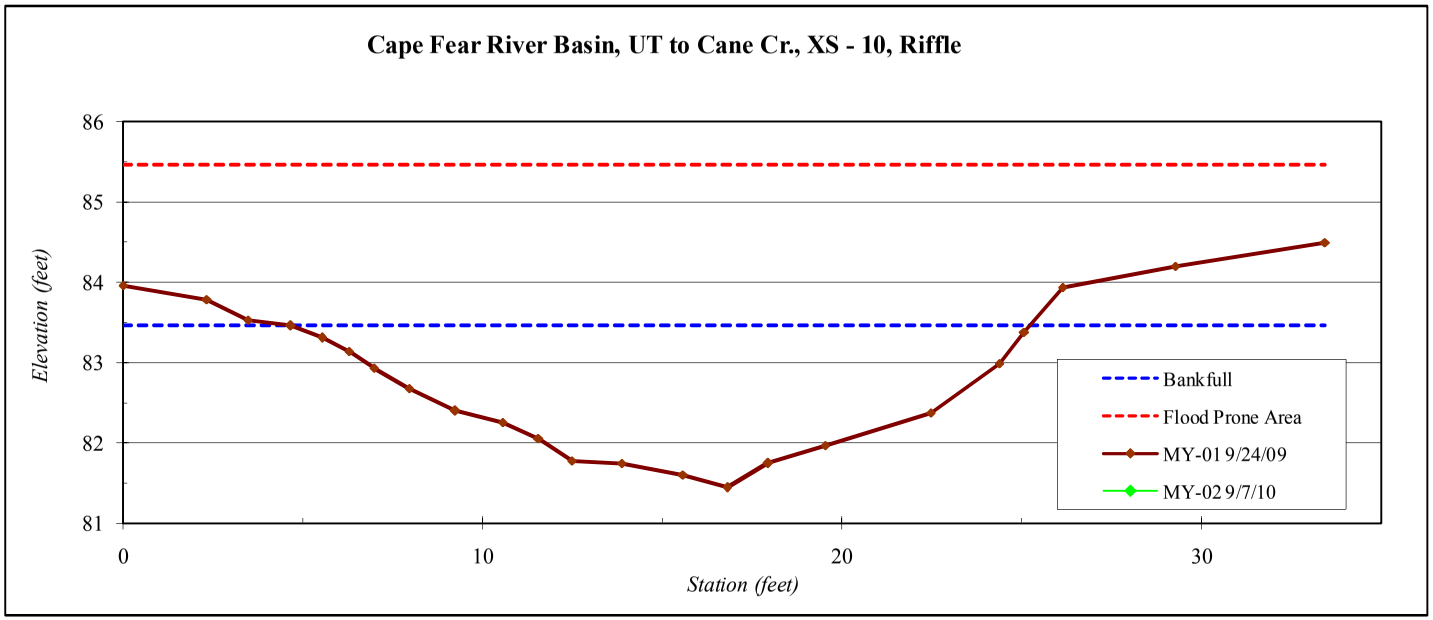


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 10, Riffle
Feature	Riffle
Date:	10/8/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	84.0
2.3	83.8
3.5	83.5
4.7	83.5
5.5	83.3
6.3	83.1
7.0	82.9
8.0	82.7
9.2	82.4
10.6	82.3
11.5	82.1
12.5	81.8
13.9	81.7
15.6	81.6
16.8	81.4
17.9	81.7
19.5	82.0
22.5	82.4
24.4	83.0
25.1	83.4
26.1	83.9
29.3	84.2
33.4	84.5

SUMMARY DATA	
Bankfull Elevation:	83.5
Bankfull Cross-Sectional Area:	24.5
Bankfull Width:	20.6
Flood Prone Area Elevation:	85.5
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.2
W / D Ratio:	17.3
Entrenchment Ratio:	7.3
Bank Height Ratio:	1.0

Stream Type	C

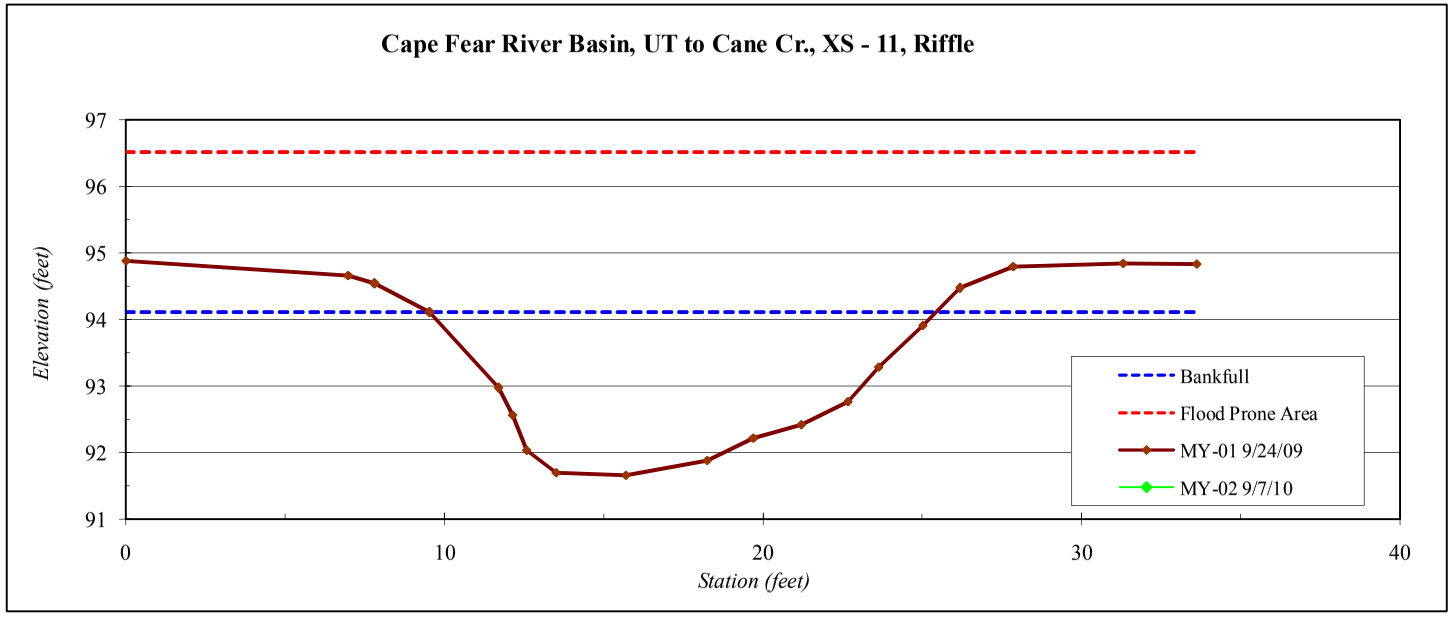


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 11, Riffle
Feature	Riffle
Date:	10/8/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	94.88
7.0	94.66
7.8	94.54
9.5	94.11
11.7	92.97
12.1	92.57
12.6	92.04
13.5	91.70
15.7	91.66
18.3	91.88
19.7	92.22
21.2	92.42
22.7	92.76
23.6	93.29
25.0	93.91
26.2	94.47
27.9	94.80
31.3	94.84
33.6	94.83

SUMMARY DATA	
Bankfull Elevation:	94.1
Bankfull Cross-Sectional Area:	25.7
Bankfull Width:	15.9
Flood Prone Area Elevation:	96.5
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.6
W / D Ratio:	9.8
Entrenchment Ratio:	9.4
Bank Height Ratio:	1.0

Stream Type	E/C

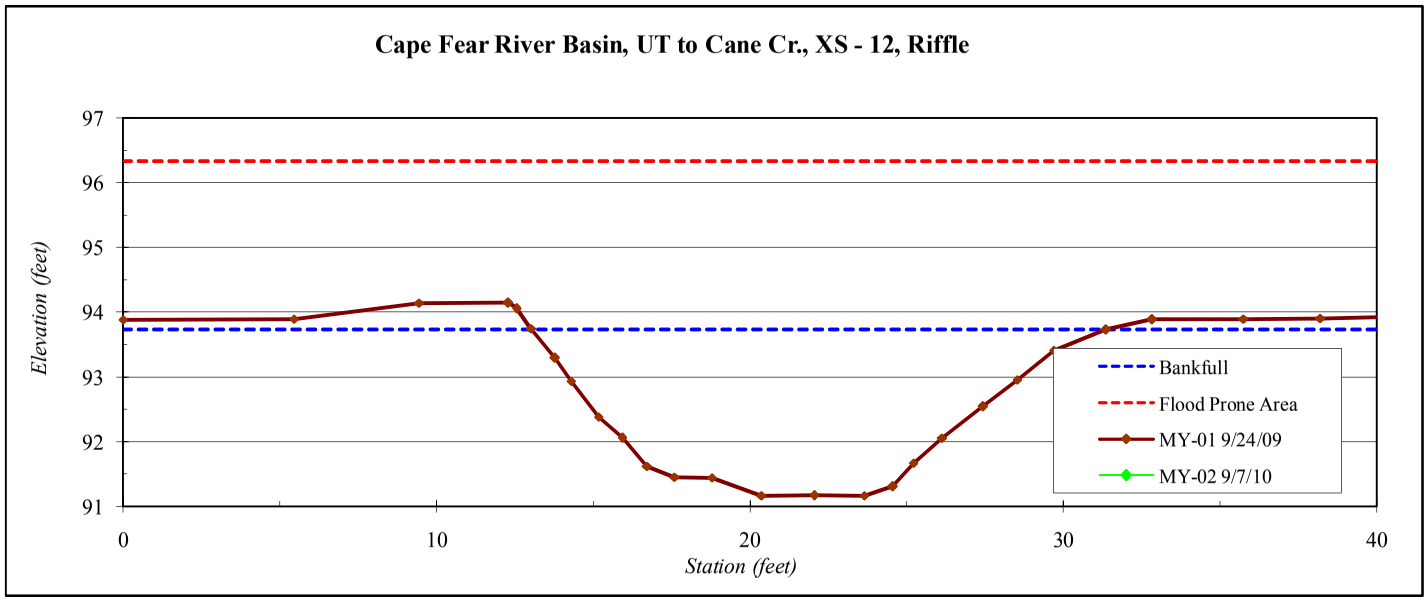


River Basin:	Cape Fear
Watershed:	UT to Cane Cr.
XS ID	XS - 12, Riffle
Feature	Riffle
Date:	10/8/2009
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	93.88
5.5	93.89
9.4	94.14
12.3	94.15
12.6	94.05
13.0	93.74
13.8	93.29
14.3	92.94
15.2	92.38
15.9	92.06
16.7	91.62
17.6	91.45
18.8	91.44
20.4	91.17
22.1	91.17
23.7	91.17
24.6	91.31
25.2	91.67
26.1	92.06
27.4	92.5
28.5	93.0
29.7	93.4
31.4	93.7
32.8	93.9
35.8	93.9
38.2	93.9
40.8	93.9

SUMMARY DATA	
Bankfull Elevation:	93.7
Bankfull Cross-Sectional Area:	22.9
Bankfull Width:	14.5
Flood Prone Area Elevation:	96.3
Flood Prone Width:	150.0
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.6
W / D Ratio:	9.2
Entrenchment Ratio:	10.3
Bank Height Ratio:	1.0

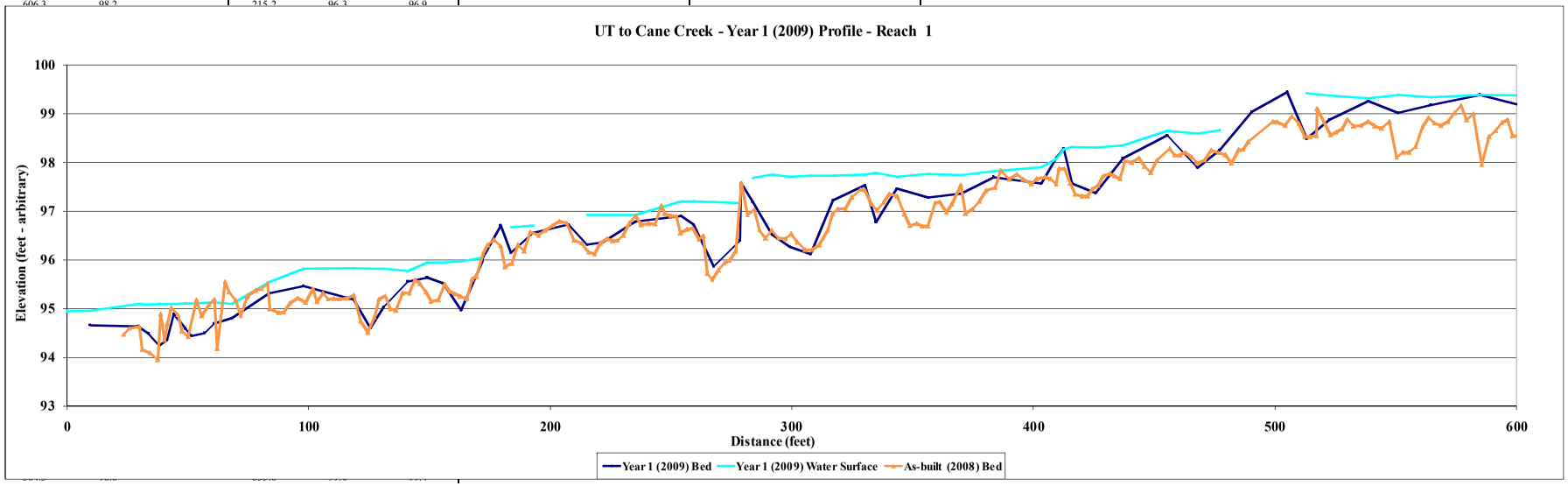
Stream Type	E/C



Project Name	UT to Cane Creek - Year 1 (2009) Profile
Reach	1
Feature	Profile
Date	9/24/09
Crew	Dean, Perkinson

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
677.8			0.0		94.9						
673.5	99.2		9.6	94.7	95.0						
668.5	99.6		29.4	94.6	95.1						
666.7	99.2		33.8	94.5	95.1						
665.3	99.0		38.2	94.2	95.1						
663.3	98.3		41.3	94.4	95.1						
661.8	97.9		44.3	94.9	95.1						
658.1	98.0		49.0	94.6	95.1						
655.1	98.1		51.5	94.4	95.1						
653.4	98.2		56.9	94.5	95.1						
651.2	99.1		60.9	94.7	95.1						
649.4	99.0		68.3	94.8	95.1						
647.0	98.9		83.6	95.3	95.5						
644.8	98.9		97.9	95.5	95.8						
641.1	98.6		118.7	95.2	95.8						
638.5	98.5		125.6	94.6	95.8						
636.4	98.5		131.0	95.0	95.8						
633.4	98.7		141.0	95.6	95.8						
631.1	98.9		149.2	95.6	96.0						
628.1	99.2		155.6	95.5	95.9						
626.0	99.1		163.2	95.0	96.0						
622.7	99.0		171.8	96.0	96.0						
620.6	98.9		172.0	96.0							
618.1	99.0		179.5	96.7							
614.2	98.8		183.8	96.1	96.7						
611.2	98.7		193.0	96.6	96.7						
608.9	98.1		207.5	96.7							
606.3	98.2		215.2	96.3	96.9						

	2009	2010	2011	2012
Avg. Water Surface Slope	0.0068			
Riffle Length	17			
Avg. Riffle Slope	0.0066			
Pool Length	20			
Avg. Pool Slope	0.0015			

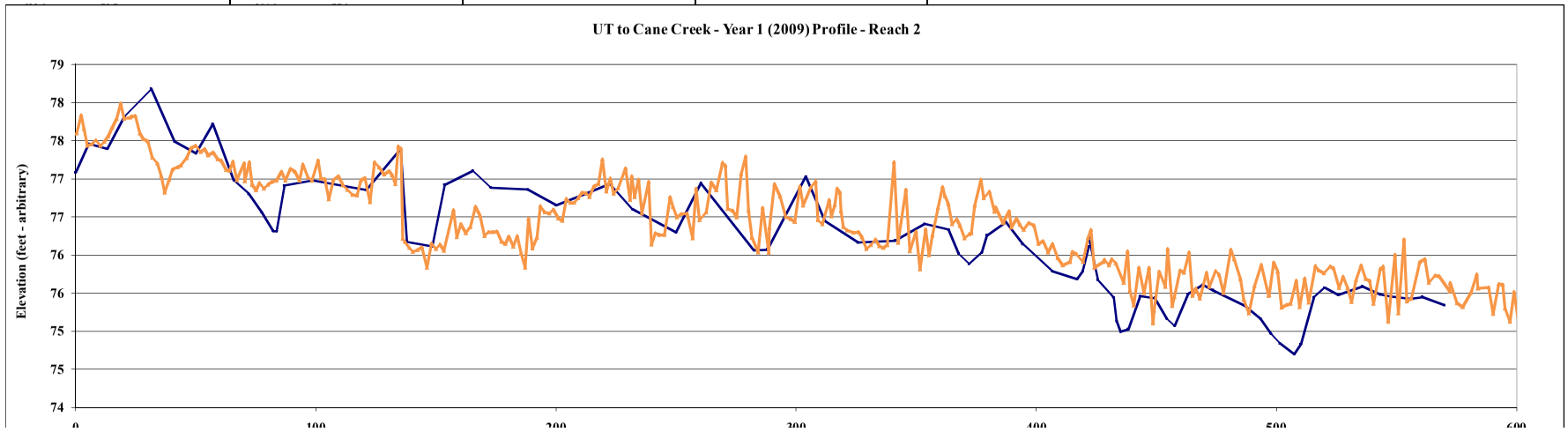


Project Name	UT to Cane Creek - Year 1 (2009) Profile
Reach	2
Feature	Profile
Date	9/24/09
Crew	Dean, Perkinson

2008 As-built			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
601.5	75.0		0.0	77.1							
598.9	75.5		5.4	77.5							
597.3	75.1		13.3	77.4							
595.1	75.3		20.3	77.8							
594.3	75.6		31.5	78.2							
592.4	75.6		41.3	77.5							
590.1	75.2		50.2	77.3							
588.2	75.6		57.1	77.7							
583.9	75.6		65.9	77.0							
583.4	75.7		72.1	76.8							
581.0	75.5		77.5	76.6							
577.4	75.3		82.2	76.3							
575.2	75.4		83.8	76.3							
572.2	75.6		86.9	76.9							
572.1	75.5		98.7	77.0							
567.7	75.7		121.1	76.9							
565.9	75.7		135.4	77.4							
563.4	75.6		137.8	76.2							
561.7	75.9		148.4	76.1							
559.6	75.9		153.7	76.9							
556.2	75.4		165.5	77.1							
554.3	75.4		172.9	76.9							
553.1	76.2		188.3	76.9							
550.7	75.2		200.1	76.6							
549.3	76.0		212.1	76.8							
546.5	75.1		222.5	76.9							
544.3	75.8		232.0	76.6							
543.3	75.8		250.0	76.3							
540.5	75.4		260.4	76.9							
538.7	75.7		282.5	76.1							
537.1	75.7		288.1	76.1							
535.1	75.9		295.9	76.5							

	2009	2010	2011	2012
Avg. Water Surface Slope	------			
Riffle Length	13.0			
Avg. Riffle Slope	------			
Pool Length	22.0			
Avg. Pool Slope	------			

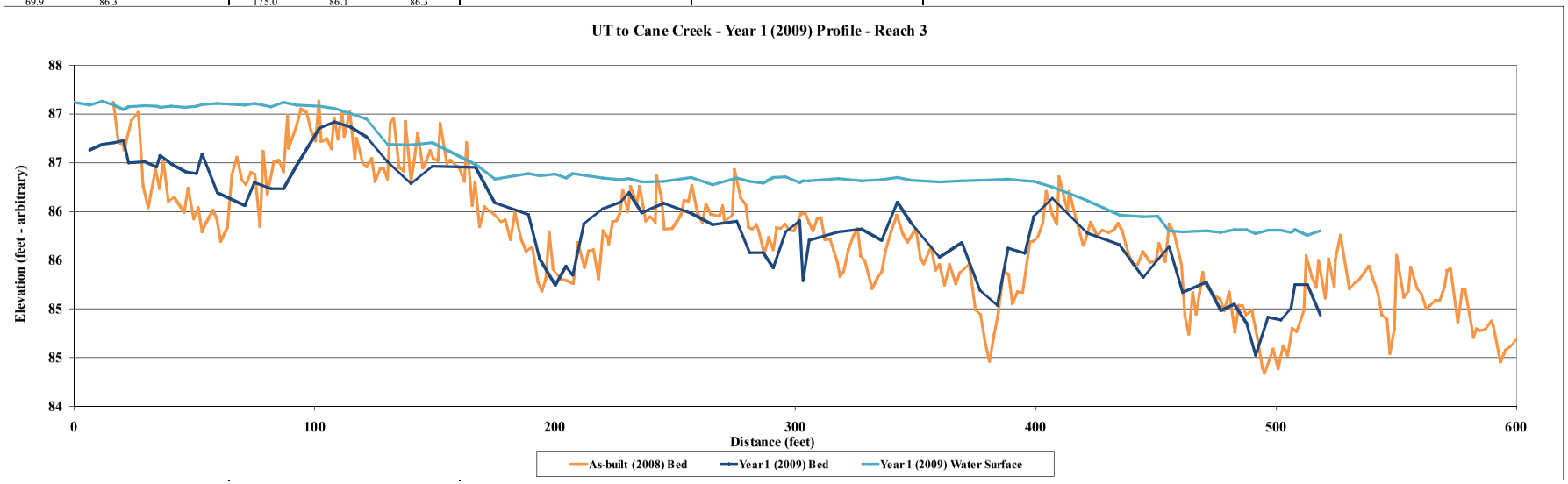
No Water In Channel



Project Name	UT to Cane Creek - Year 1 (2009) Profile
Reach	3
Feature	Profile
Date	9/24/09
Crew	Dean, Perkinson

2008 As-built			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
15.2			0.0		87.1						
16.3	87.1		6.5	86.6	87.1						
18.5	86.7		11.8	86.7	87.1						
20.7	86.7		16.6	86.7	87.1						
20.9	86.6		20.6	86.7	87.0						
23.8	86.9		22.7	86.5	87.1						
26.6	87.0		29.5	86.5	87.1						
27.0	86.9		34.5	86.5	87.1						
28.8	86.3		35.9	86.6	87.1						
30.9	86.0		40.6	86.5	87.1						
33.8	86.4		46.4	86.4	87.1						
35.6	86.2		50.8	86.4	87.1						
37.2	86.5		53.3	86.6	87.1						
39.4	86.1		59.6	86.2	87.1						
41.6	86.1		71.1	86.1	87.1						
45.9	86.0		75.0	86.3	87.1						
47.5	86.2		82.1	86.2	87.1						
49.9	85.9		87.2	86.2	87.1						
51.7	86.0		92.4	86.5	87.1						
53.4	85.8		102.0	86.9	87.1						
55.0	85.9		108.5	86.9	87.1						
57.8	86.0		115.0	86.9	87.0						
59.3	85.9		121.7	86.8	86.9						
61.0	85.7		130.4	86.5	86.7						
63.8	85.8		140.2	86.3	86.7						
65.6	86.4		149.0	86.5	86.7						
67.8	86.6		167.0	86.5	86.5						
69.9	86.3		175.0	86.1	86.3						

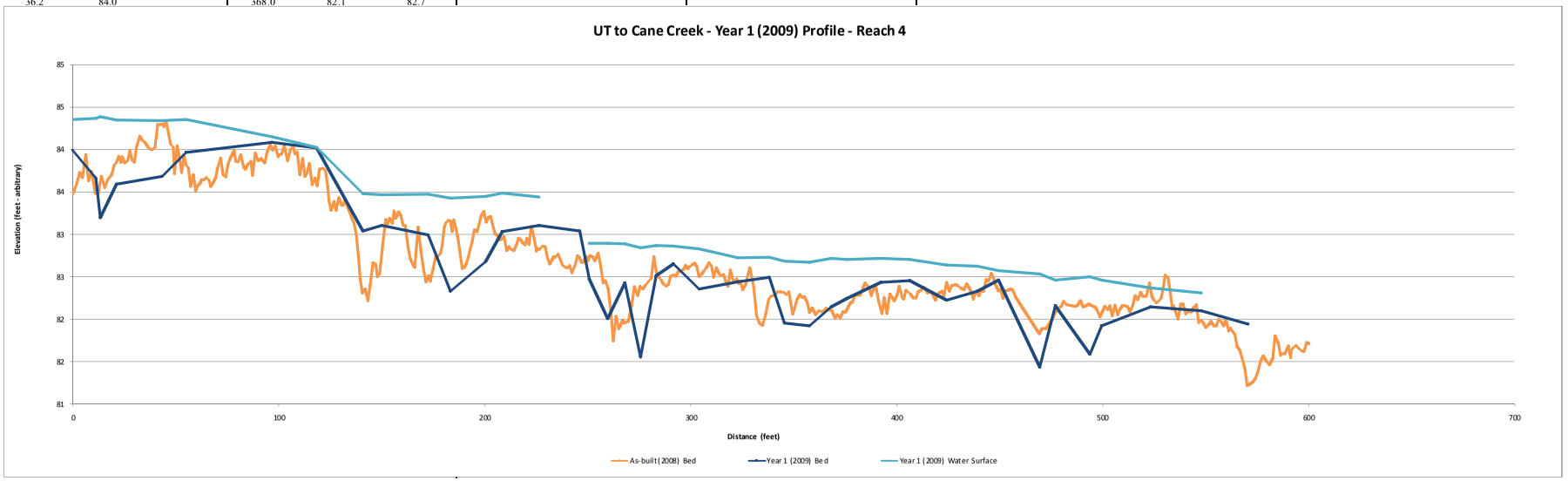
	2009	2010	2011	2012
Avg. Water Surface Slope	0.0025			
Riffle Length	96			
Avg. Riffle Slope	0.0036			
Pool Length	37			
Avg. Pool Slope	0.0001			



Project Name	UT to Cane Creek - Year 1 (2009) Profile
Reach	4
Feature	Profile
Date	9/24/09
Crew	Dean, Perkinson

2008 As-built			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.1	83.5		0.0	84.0	84.4						
1.8	83.6		11.2	83.7	84.4						
3.2	83.7		13.2	83.2	84.4						
4.7	83.7		21.1	83.6	84.4						
6.3	83.9		43.4	83.7	84.3						
7.6	83.6		55.1	84.0	84.4						
9.0	83.7		96.7	84.1	84.1						
10.8	83.5		118.3	84.0	84.0						
12.2	83.5		140.7	83.0	83.5						
13.8	83.7		149.9	83.1	83.5						
15.5	83.6		172.5	83.0	83.5						
16.8	83.6		183.2	82.3	83.4						
18.7	83.7		200.3	82.7	83.5						
20.1	83.8		208.3	83.0	83.5						
21.2	83.8		226.4	83.1	83.4						
22.3	83.9		246.1	83.0							
23.2	83.9		250.6	82.5	82.9						
24.0	83.9		259.7	82.0	82.9						
25.2	83.8		267.9	82.4	82.9						
26.4	83.9		275.6	81.6	82.8						
27.7	84.0		283.1	82.5	82.9						
28.7	83.9		291.4	82.7	82.9						
29.8	83.9		304.0	82.4	82.8						
30.9	84.0		322.8	82.4	82.7						
32.4	84.2		338.0	82.5	82.7						
33.6	84.1		345.5	82.0	82.7						
35.1	84.1		357.5	81.9	82.7						
36.2	84.0		368.0	82.1	82.7						

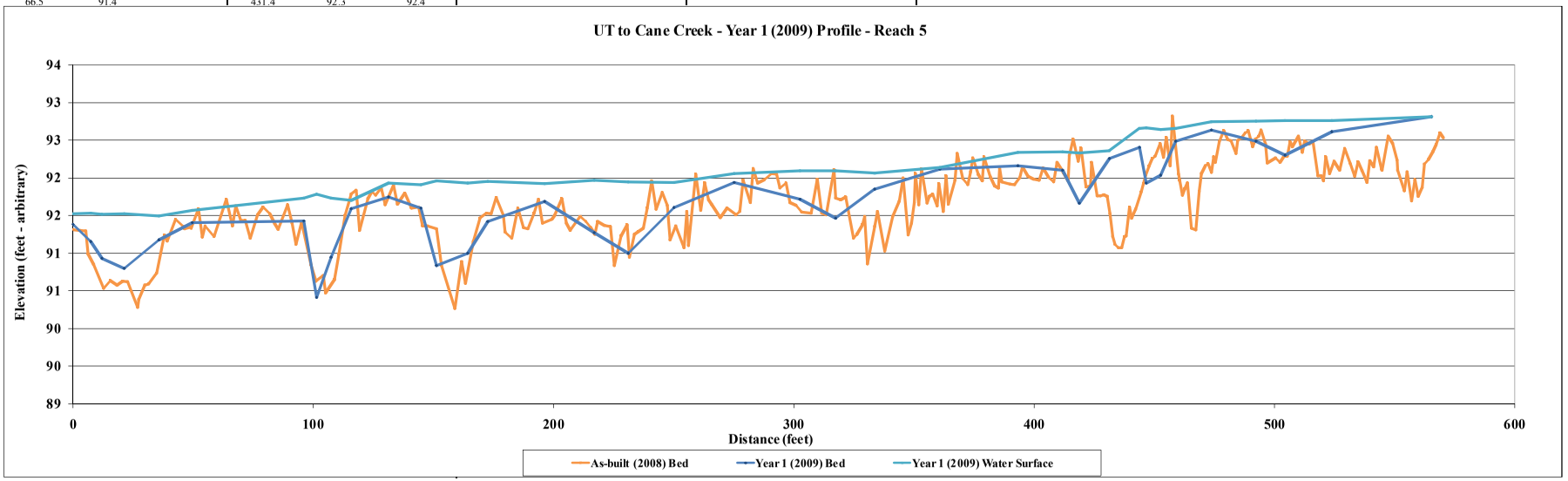
	2009	2010	2011	2012
Avg. Water Surface Slope	0.0037			
Riffle Length	23			
Avg. Riffle Slope	0.0029			
Pool Length	31			
Avg. Pool Slope	0.0018			



Project Name	UT to Cane Creek - Year 1 (2009) Profile
Reach	5
Feature	Profile
Date	9/24/09
Crew	Dean, Perkinson

2008 As-built			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.5	91.3		0.0	91.4	91.5						
3.0	91.3		7.4	91.2	91.5						
5.3	91.3		12.0	90.9	91.5						
6.3	91.0		21.5	90.8	91.5						
8.7	90.9		35.7	91.2	91.5						
12.7	90.5		49.6	91.4	91.6						
15.5	90.6		96.1	91.4	91.7						
18.3	90.6		101.4	90.4	91.8						
20.8	90.6		107.4	91.0	91.7						
22.8	90.6		115.7	91.6	91.7						
26.9	90.3		131.4	91.7	91.9						
27.5	90.4		144.7	91.6	91.9						
29.8	90.6		151.4	90.8	92.0						
31.7	90.6		164.3	91.0	91.9						
34.8	90.7		172.7	91.4	92.0						
38.1	91.2		196.3	91.7	91.9						
39.3	91.2		217.0	91.3	92.0						
42.7	91.4		231.0	91.0	92.0						
45.9	91.4		250.1	91.6	91.9						
46.5	91.3		275.2	91.9	92.1						
48.9	91.4		302.6	91.7	92.1						
49.1	91.3		317.5	91.5	92.1						
52.2	91.6		333.8	91.8	92.1						
53.9	91.2		360.8	92.1	92.1						
55.1	91.4		393.2	92.2	92.3						
58.8	91.2		411.8	92.1	92.3						
63.8	91.7		418.8	91.7	92.3						
66.5	91.4		431.4	92.3	92.4						

	2009	2010	2011	2012
Avg. Water Surface Slope	0.0023			
Riffle Length	33			
Avg. Riffle Slope	0.0036			
Pool Length	28			
Avg. Pool Slope	0.0001			



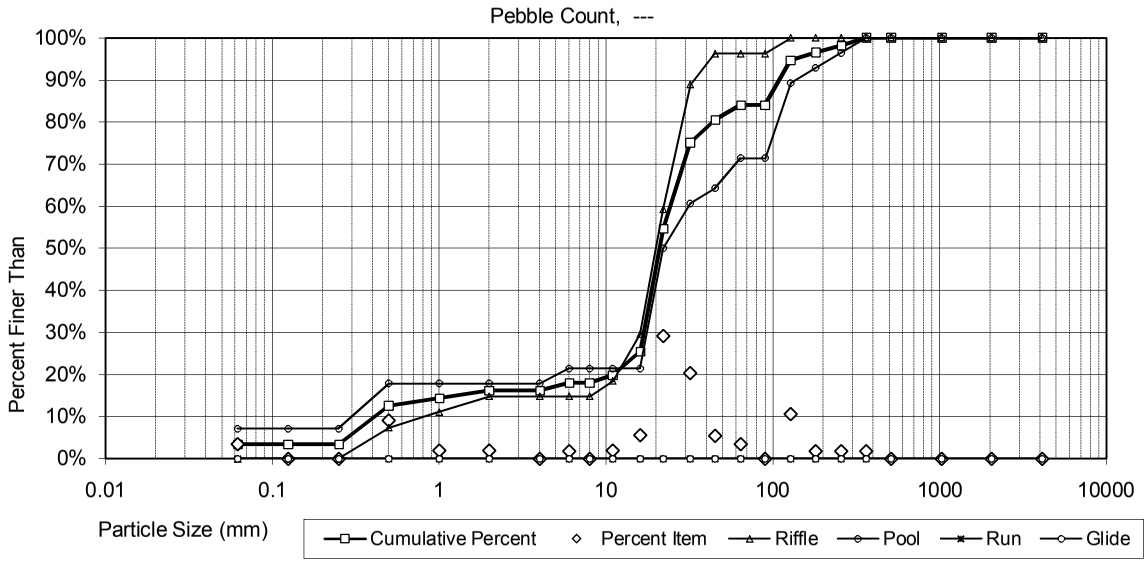
Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:	
Percent Pool	**50**	Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	3.4	# #
very fine sand	0.062	0.13	0.0	# #
fine sand	0.13	0.25	0.0	# #
medium sand	0.25	0.5	8.9	# #
coarse sand	0.5	1	1.9	# #
very coarse sand	1	2	1.9	# #
very fine gravel	2	4	0.0	# #
fine gravel	4	6	1.7	# #
fine gravel	6	8	0.0	# #
medium gravel	8	11	1.9	# #
medium gravel	11	16	5.6	# #
coarse gravel	16	22	28.6	# #
coarse gravel	22	32	20.0	# #
very coarse gravel	32	45	5.4	# #
very coarse gravel	45	64	3.4	# #
small cobble	64	90	0.0	# #
medium cobble	90	128	10.5	# #
large cobble	128	180	1.7	# #
very large cobble	180	256	1.7	# #
small boulder	256	362	1.7	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			1.7	#
		Weighted Count:	100	
		True Total Particle Count	56	

Note: **Ut to Cane Creek - Reach 1**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.785	17.73	20.9	63	135	3%	13%	67%	14%	2%	2%

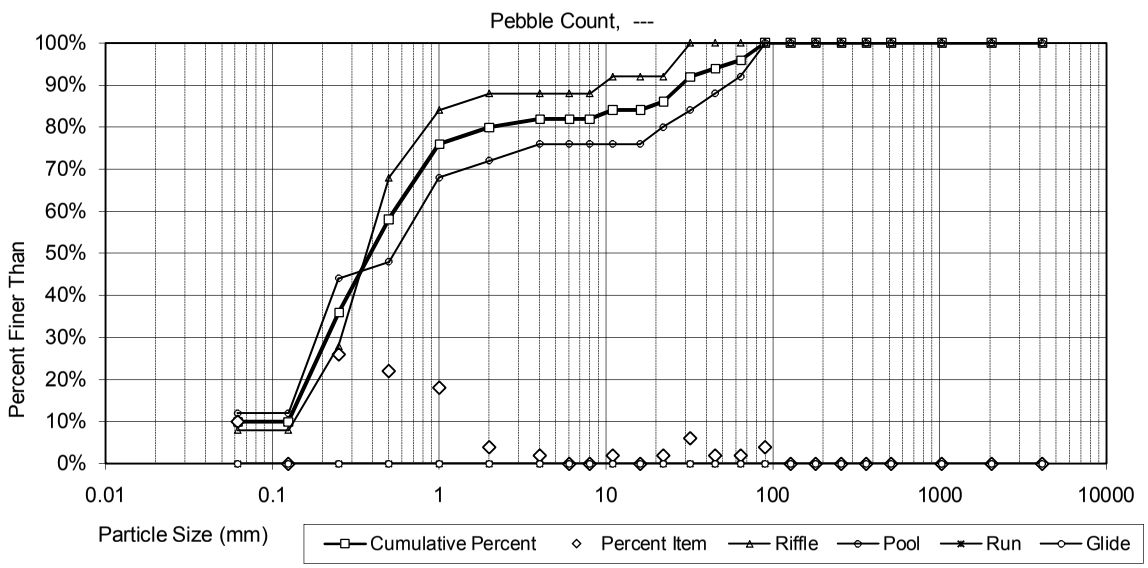
Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:	
Percent Pool	**50**	Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	10.0	# #
very fine sand	0.062	0.13	0.0	# #
fine sand	0.13	0.25	26.0	# #
medium sand	0.25	0.5	22.0	# #
coarse sand	0.5	1	18.0	# #
very coarse sand	1	2	4.0	# #
very fine gravel	2	4	2.0	# #
fine gravel	4	6	0.0	# #
fine gravel	6	8	0.0	# #
medium gravel	8	11	2.0	# #
medium gravel	11	16	0.0	# #
coarse gravel	16	22	2.0	# #
coarse gravel	22	32	6.0	# #
very coarse gravel	32	45	2.0	# #
very coarse gravel	45	64	2.0	# #
small cobble	64	90	4.0	# #
medium cobble	90	128	0.0	# #
large cobble	128	180	0.0	# #
very large cobble	180	256	0.0	# #
small boulder	256	362	0.0	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			0.0	#
		Weighted Count:	100	
		True Total Particle Count	50	

Note: **Ut to Cane Creek - Reach 2**



Size percent less than (mm)				
D16	D35	D50	D84	D95
0.147	0.24	0.4	11	54

Percent by substrate type					
silt/clay	sand	gravel	cobble	boulder	bedrock
10%	70%	16%	4%	0%	0%

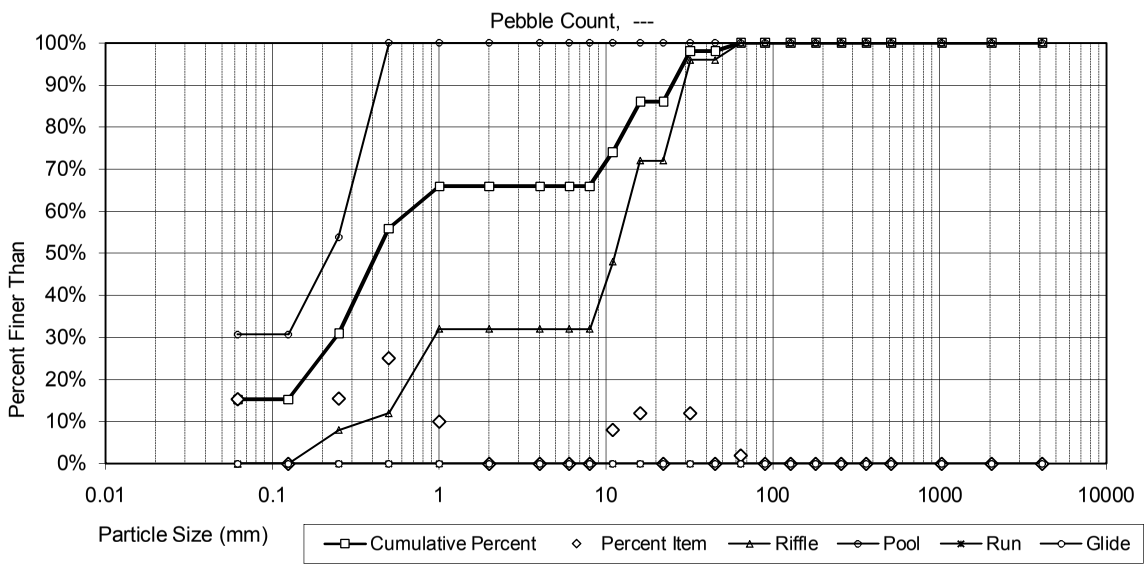
Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:	
Percent Pool	**50**	Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	15.4	# #
very fine sand	0.062	0.13	0.0	# #
fine sand	0.13	0.25	15.5	# #
medium sand	0.25	0.5	25.1	# #
coarse sand	0.5	1	10.0	# #
very coarse sand	1	2	0.0	# #
very fine gravel	2	4	0.0	# #
fine gravel	4	6	0.0	# #
fine gravel	6	8	0.0	# #
medium gravel	8	11	8.0	# #
medium gravel	11	16	12.0	# #
coarse gravel	16	22	0.0	# #
coarse gravel	22	32	12.0	# #
very coarse gravel	32	45	0.0	# #
very coarse gravel	45	64	2.0	# #
small cobble	64	90	0.0	# #
medium cobble	90	128	0.0	# #
large cobble	128	180	0.0	# #
very large cobble	180	256	0.0	# #
small boulder	256	362	0.0	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			0.0	#
		Weighted Count:	100	
		True Total Particle Count	51	

Note: **Ut to Cane Creek - Reach 3**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.128	0.28	0.4	15	29	15%	51%	34%	0%	0%	0%

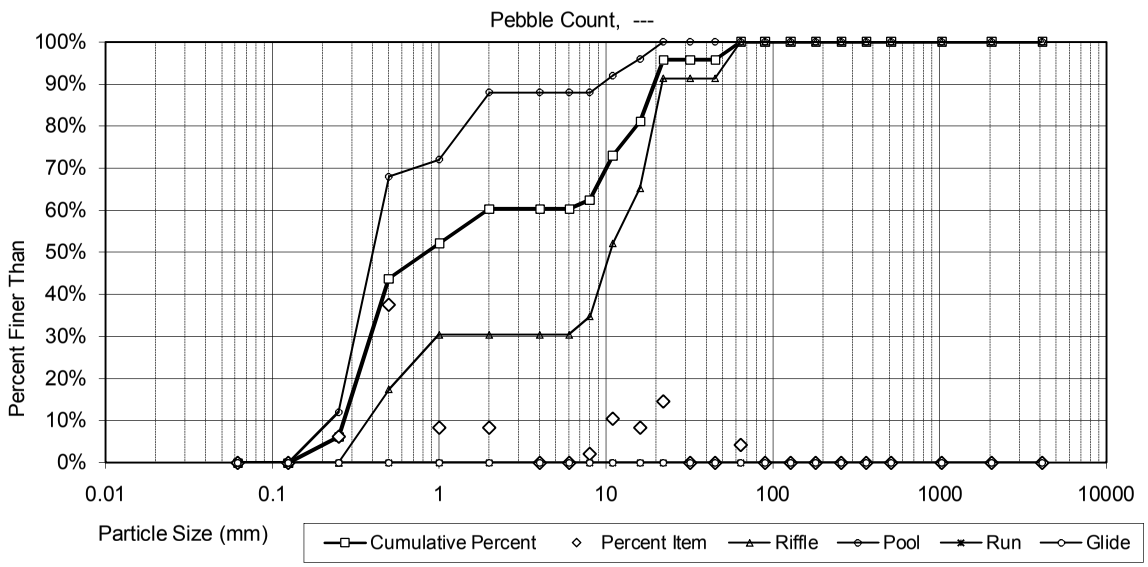
Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:	
Percent Pool	**50**	Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	0.0	# #
very fine sand	0.062	0.13	0.0	# #
fine sand	0.13	0.25	6.0	# #
medium sand	0.25	0.5	36.0	# #
coarse sand	0.5	1	8.0	# #
very coarse sand	1	2	8.0	# #
very fine gravel	2	4	0.0	# #
fine gravel	4	6	0.0	# #
fine gravel	6	8	2.0	# #
medium gravel	8	11	10.0	# #
medium gravel	11	16	8.0	# #
coarse gravel	16	22	14.0	# #
coarse gravel	22	32	0.0	# #
very coarse gravel	32	45	0.0	# #
very coarse gravel	45	64	4.0	# #
small cobble	64	90	0.0	# #
medium cobble	90	128	0.0	# #
large cobble	128	180	0.0	# #
very large cobble	180	256	0.0	# #
small boulder	256	362	0.0	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			4.0	#
		Weighted Count:	100	
		True Total Particle Count	50	

Note:	**Ut to Cane Creek - Reach 4**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.299	0.43	0.8	17	22	0%	58%	38%	0%	0%	4%

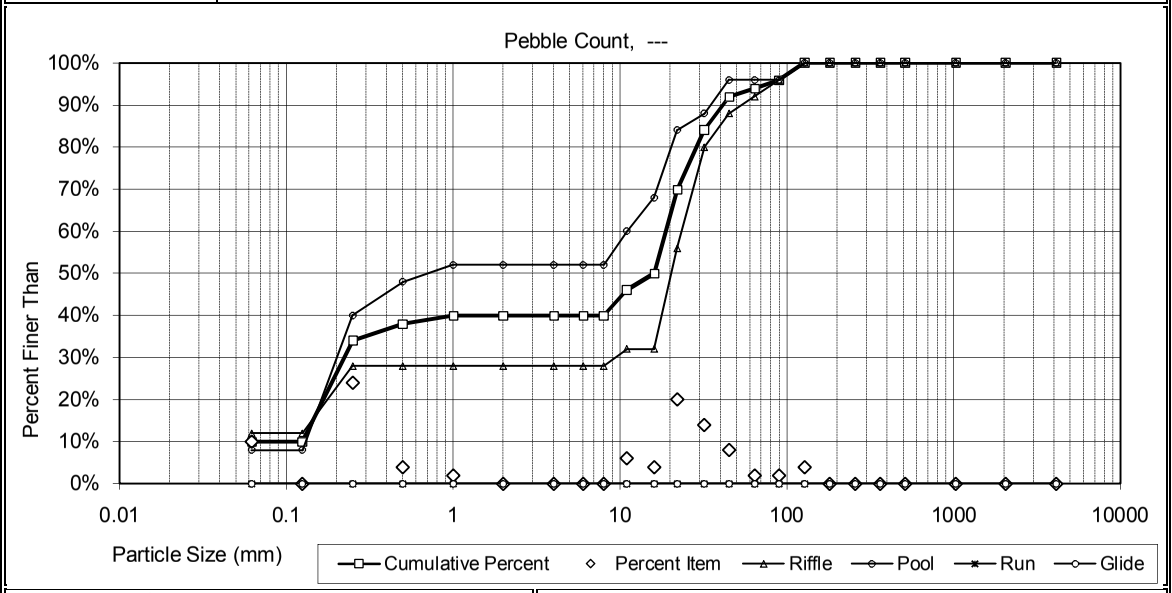
Weighted Pebble Count

Percent Riffle:	**50**	Percent Run:	
Percent Pool	**50**	Percent Glide:	

Pebble Count,

Material	Size Range (mm)		Total #	
silt/clay	0	0.062	10.0	# #
very fine sand	0.062	0.13	0.0	# #
fine sand	0.13	0.25	24.0	# #
medium sand	0.25	0.5	4.0	# #
coarse sand	0.5	1	2.0	# #
very coarse sand	1	2	0.0	# #
very fine gravel	2	4	0.0	# #
fine gravel	4	6	0.0	# #
fine gravel	6	8	0.0	# #
medium gravel	8	11	6.0	# #
medium gravel	11	16	4.0	# #
coarse gravel	16	22	20.0	# #
coarse gravel	22	32	14.0	# #
very coarse gravel	32	45	8.0	# #
very coarse gravel	45	64	2.0	# #
small cobble	64	90	2.0	# #
medium cobble	90	128	4.0	# #
large cobble	128	180	0.0	# #
very large cobble	180	256	0.0	# #
small boulder	256	362	0.0	# #
small boulder	362	512	0.0	# #
medium boulder	512	1024	0.0	# #
large boulder	1024	2048	0.0	# #
very large boulder	2048	4096	0.0	# #
bedrock			0.0	#
		Weighted Count:	100	
		True Total Particle Count	50	

Note: **Ut to Cane Creek - Reach 5**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.149	0.30	16.0	32	76	10%	30%	54%	6%	0%	0%