Baseline Monitoring Report
Little Troublesome Stream Restoration Site
Project # 749
Rockingham County

Submitted to:

Ecosystem Enhancement PROGRAM

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

Construction Completed: December 2009
Data Collection: February 2010
Submitted: May 2010

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 783-9214
Fax: (919) 783-9266

Project Manager: Adam Spiller
Email: adam.spiller@kci.com
Project No: 12053743G

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EXECUTIVE SUMMARY

The Little Troublesome Stream and Wetland Restoration Site, completed in December 2009, restored a total of 2,188 linear feet of stream in the Upper Cape Fear River Basin. In addition, there are approximately 4.5 acres of wetland preservation, 1.9 acres of wetland enhancement, and 2,754 linear feet of stream preservation within the site. The project is located in the USGS Hydrologic Unit 03030002-01-0030 of the Cape Fear River Basin. This HU is within the EEP's Upper Cape Fear Basin Local Watershed Plan and is also listed as a Targeted Local Watershed (TLW) in EEP's *Cape Fear River Basin Priorities Plan 2009*. The project goals and objectives are listed below.

Project Goals

- Restore a stable channel morphology to the project stream that is capable of moving the flows and sediment provided by its watershed.
- Improve water quality for an NCDWQ stream, classified as a Class C and Nutrient Sensitive Waters by reducing bank erosion and bed degradation.
- Enhance aquatic and terrestrial habitat.
- Enhance and preserve existing wetlands and forested buffers.

Project Objectives

- Restore 2,188 linear feet of stable stream channel with the appropriate pattern, profile, and dimension that can support a gravel transport system
- Restore a natural riparian buffer.
- Restore the hyporheic zone in the project streams and re-establish the natural stream features.
- Plug ditches to increase groundwater input to existing wetlands.
- Plant native trees and shrubs throughout the site.

The project site, which is protected by a 30-acre permanent conservation easement held by the State of North Carolina, is situated in Rockingham County in the Northern Inner Piedmont ecoregion of the Piedmont physiographic province. The site is located on two private properties along Little Troublesome Creek (LTC) immediately upstream of Mizpah Church Road, approximately five miles southeast of the Town of Reidsville. The site's 12 square mile watershed is 30% urban and drains half of the Town of Reidsville. Historically, the channel was straightened and at times cattle have had unrestricted access to the channel. Immediately before restoration, cows were fenced out of the stream, but the banks were continuing to erode as the channel was widening. There are also two unnamed tributaries to LTC on the site. Prior to the restoration the first tributary (UT1) was deeply incised with eroding banks. The second tributary (UT2) is a stable intermittent channel and was preserved as a part of this project. Existing wetlands are located to the east and west of LTC. The two areas of wetlands east of LTC each had shallow ditches that reduced the length of the wetland hydroperiod.

Two reference reaches were used in the design process, a section of Collins Creek in Orange County and a section of UT to Wilkinson Creek in Chatham County. Based on the reference and existing site conditions, LTC was restored according to a Priority Level II approach and UT1 utilized a Priority Level III approach. LTC was remeandered and a floodplain was constructed along both sides of the restored channel, creating an E4/C4 channel type. UT1 was remeandered to create a B4c channel type. UT2 was preserved, as were its adjacent wetlands on the west side of the stream. The wetlands on the east side of the stream were enhanced by filling drainage features and by planting additional stems to increase the diversity in the already vegetated wetlands. The site's unvegetated areas were planted with native trees and shrubs consistent with Piedmont Levee Forest and Piedmont Alluvial Forest communities. The site was built as designed with the addition of a riffle grade control before the cross vane at Station 22+00 on

LTC and a log sill and rock stabilization at Station 54+00 on UT1. The site was also planted as designed with a few species substitutions.

The baseline monitoring in February 2010 established the stream and vegetation monitoring components. The stream monitoring consists of a full longitudinal profile of LTC and UT1, and seven cross-sections, three riffles and one pool on LTC and two riffles and one pool on UT1. Eight vegetation monitoring plots were established throughout the planted riparian buffer. These plots will be monitored every year according to the latest CVS-EEP vegetation monitoring protocol. The site will be monitored for at least five years or until the success criteria are met. The first year of monitoring will be in 2010.

1.0 Project Goals, Background and Attributes

1.1 Location and Setting

The project site is located on two parcels, the first owned by Neal Hall with approximately 20 acres on the west side of LTC and the second owned by Jimmie Mitchell with approximately 10.2 acres on the east side of LTC. The project is protected in perpetuity by a conservation easement held by the State of North Carolina. The project site is located along LTC immediately upstream of Mizpah Church Road, and is approximately 5 miles southeast of the Town of Reidsville. See Figure 1 in Appendix A.

The project is located in the USGS Hydrologic Unit 03030002-01-0030 of the Cape Fear River Basin and drains approximately 7,740 acres, including the southern portion of the Town of Reidsville. This HU is within the EEP's Upper Cape Fear Basin Local Watershed Plan and is also listed as a Targeted Local Watershed (TLW) in EEP's *Cape Fear River Basin Priorities Plan 2009*.

1.2 Project Goals and Objectives

Project Goals

- Restore a stable channel morphology to the project stream that is capable of moving the flows and sediment provided by its watershed.
- Improve water quality for an NCDWQ stream, classified as a Class C and Nutrient Sensitive Waters by reducing bank erosion and bed degradation.
- Enhance aquatic and terrestrial habitat.
- Enhance and preserve existing wetlands and forested buffers.

Project Objectives

- Restore 2,188 linear feet of stable stream channel with the appropriate pattern, profile, and dimension that can support a gravel transport system.
- Restore a natural riparian buffer.
- Restore the hyporheic zone in the project streams and re-establish the natural stream features.
- Plug ditches to increase groundwater input to existing wetlands.
- Plant native trees and shrubs throughout the site.

1.3 Project Structure, Restoration Type and Approach

This project restored 1,401 linear feet of LTC and 812 linear feet of UT1, preserved 2,754 linear feet of UT2, enhanced 1.9 acres of wetlands, and preserved 1.5 acres of wetlands. See Figure 2 in Appendix A for an overview of the site layout.

The preservation reach and wetlands are located on the west side of the LTC. In addition to UT2, the preservation wetland has two additional drainage features that contribute to the site hydrology. These two features are not classified as streams and are not eligible for credit.

Two reference reaches were used in the design process, a section of Collins Creek in Orange County and a section of UT to Wilkinson Creek in Chatham County. Based on the reference and existing site conditions, LTC was restored according to a Priority Level II approach and UT1 utilized a Priority Level III approach. LTC was remeandered and a

floodplain was constructed along both sides of the restored channel, creating an E4/C4 channel type. UT1 was remeandered to create a B4c channel type. UT2 was preserved along with the wetlands on the west side of the stream. The wetlands on the east side of the stream were enhanced by filling drainage features and planting additional stems to increase the diversity in the already vegetated wetlands. The site's unvegetated areas were planted with native trees and shrubs consistent with Piedmont Levee Forest and Piedmont Alluvial Forest communities. The site was also treated for invasive/exotic vegetation. For a list of planted species see Appendix C.

1.4 Project History, Contacts and Attribute Data

The project was identified for restoration in the EEP's Upper Cape Fear Basin Local Watershed Plan, and the project was initiated by the EEP in the summer of 2006. The restoration plan was completed in June 2007. Construction began in late October 2008. Due to extremely wet site conditions, construction was stopped during the winter of 2008 and completed in December 2009. The site was planted in December 2009.

2.0 Success Criteria

2.1 Dimension

The dimensional data from the yearly cross-section survey should show minimal change over the course of the monitoring period. However, some change is natural and expected, indicating that the site is becoming more stable. Changes that may indicate destabilizing conditions include significant widening or deepening of the riffle section or a consistent trend of change over the course of the monitoring. For a pool cross-section, deepening is frequently a positive change while consistent filling of the pool may indicate destabilization.

2.2 Pattern and Profile

For the profile, the reach under assessment should not demonstrate any trends in thalweg aggradation or degradation over any significant continuous portion of its length. The profile should also demonstrate contrasting bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so around design distributions. The majority of pools should be maintained at greater depths with lower water surface slopes while riffles should be shallow with greater water surface slopes. Pattern features should show little adjustment over the monitoring period.

2.3 Substrate

Substrate measurements, from annual pebble count data, should indicate the progression towards, or the maintenance of, the known distributions from the design phase. While stream projects are designed to transport bedload in equilibrium and carry overall sediment loads at bankfull, fines can be transported even at low discharges and upstream instability beyond design projections can also lead to deposition as storm events recede in areas of energy dissipation such as restoration reaches. This can have the effect of obscuring bedform and fining of riffles especially in the first few years after the implementation of a stream project. In many cases subsequent narrowing and reduction of W/D ratios as a project develops/stabilizes can then increase transport efficiency and return bedform to intended distributions, but some fining can persist due to upstream disturbance.

2.4 Sediment Transport

Maintenance of sediment transport will be evident by the monitored cross-sections and profile. From these two indicators, there should be no evidence of any significant trend in aggradation or degradation throughout the channel.

2.5 Vegetation

Vegetation success is based on the criteria established in the USACE Stream Mitgation Guidelines (2003). This document states that vegetation monitoring results indicate the following planted stem density minimums in the corresponding monitoring years: 320 stems/acre through year three, 288 stems/acre in year four, and 260 stems/acre in year five. If monitoring indicates that the specified survival rate is not being met, appropriate corrective actions will be developed to include invasive species control, the removal of dead/dying plants, and replanting.

2.6 Hydrology

A minimum of two bankfull events, occurring in separate years, must be documented within the monitoring period.

3.0 Monitoring Plan

3.1 Dimension

Seven permanent monitoring cross-sections have been established on the site. Three riffle cross-sections and one pool cross-section have been set up on LTC and two riffle cross-sections and one pool cross-section have been installed on UT1. Permanent monuments of rebar in concrete have been established at each end of these cross-sections. These cross-sections will be surveyed each year, with measurements occurring at bankfull, top of bank, edge of water, and other significant breaks in slope.

3.2 Profile

The entire profile of the restored streams will be surveyed each monitoring year. The profile will be surveyed in detail, documenting the elevations of the thalweg, water surface, and bankfull. Pool and riffle features will be called out to calculate feature slopes and lengths.

3.3 Pattern

Pattern measurements have been taken for the as-built condition and are documented in this report. Future pattern measurements will not be taken unless there is evidence that significant geomorphological adjustments have occurred.

3.4 Substrate

Pebble counts will be conducted at all of the permanent cross-sections. These pebble counts will occur each year of the monitoring period and be used to calculate the sediment distribution at the cross-sections and the D50 and D84 at each location.

3.5 Visual Assessment

A visual assessment of the stream to include an assessment of the bank (lateral stability), bed (vertical stability), the easement boundary, and site vegetation will be completed each year to document the necessary parameters required for the EEP monitoring report.

3.6 Vegetation

Eight vegetation plots were set up and assessed for the baseline vegetation monitoring. Vegetation data collection must follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2006, http://cvs.bio.unc.edu/methods.htm). The baseline vegetation monitoring was conducted as a Level 1: Inventory of Planted Stems, as will the first year monitoring. Beginning in year two and continuing throughout the rest of the monitoring period, the site will be monitored using the Level 2 protocol.

3.7 Digital Photos

Seven permanent photo stations have been established as part of the baseline monitoring. Four of these photo stations have two photos assigned to them, so there is a total of 11 photos taken from these photo stations. Starting in the first monitoring year, these photos will be taken in late October / early November, so that vegetative conditions are similar at the site between monitoring years.

3.8 Watershed Conditions

Yearly monitoring will document any evident changes in the watershed. Any large hydrologic events in the watershed, such as tropical storms or hurricanes, will also be documented in the yearly monitoring reports.

4.0 Baseline Conditions

The site was built as designed with the addition of a riffle grade control before the cross vane at Station 22+00 on LTC and a log sill and rock stabilization at Station 54+00 on UT1. The site was also planted as designed with a few species substitutions. Several large rain events flooded the site during the beginning of 2010. These events caused isolated areas of bed degradation on UT1. Future monitoring will determine if these areas will stabilize over time or if they will require repairs.

A detailed baseline survey was conducted post-construction by KCI in January 2010. The baseline survey of the longitudinal profile and cross-sections shows that the as-built LTC channel closely reflects the design conditions. The baseline conditions of UT1 reflect some initial erosion immediately following construction. This erosion has caused the cross-sections to be slightly larger than designed and created poor feature definition towards the beginning of the reach.

There were some species from the designed planting plan that were unavailable at the time of planting and approved substitutions were made. These changes included substituting pin oak (*Quercus palustris*) for box elder (*Acer negundo*), chokeberry (*Aronia arbutifolia*) for spicebush (*Lindera benzoin*), and possumhaw (*Viburnum nudum*) for blackhaw (*Viburnum prunifolium*). Other than these changes, the site was planted per the designed planting plan. The eight vegetation monitoring plots established during the baseline conditions survey calculated a site average of 804 planted stems/acre and 759 plantedstems/acre, excluding live stakes. All plots had an average density of at least 486 total planted stems/acre. Due to the baseline vegetation monitoring being conducted during the dormant season, many of the stems were unidentifiable. These stems will be positively identified during the first year of monitoring.

5.0 Maintenance and Contingency Plans

Problem areas at the Little Troublesome Stream Restoration Site will be dealt with accordingly based on the severity of the problem and at the discretion of the EEP. Site maintenance may include reinstallation of coir matting, removal of debris from the channel, stabilization of bank erosion with protective structures, or adjustments to in-stream structures. All maintenance activities will be documented in the yearly monitoring reports.

6.0 References

EEP. 2004. Troublesome and Little Troublesome Local Watershed Plan. (http://www.nceep.net/services/lwps/Troublesome_Creek/trouble-summ.pdf)

EEP. 2009. Cape Fear River Basin Restoration Priorities. (http://www.nceep.net/services/lwps/cape_fear/RBRP%20Cape%20Fear%202008.pdf)

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)

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

APPENDIX A

General Figures and Tables

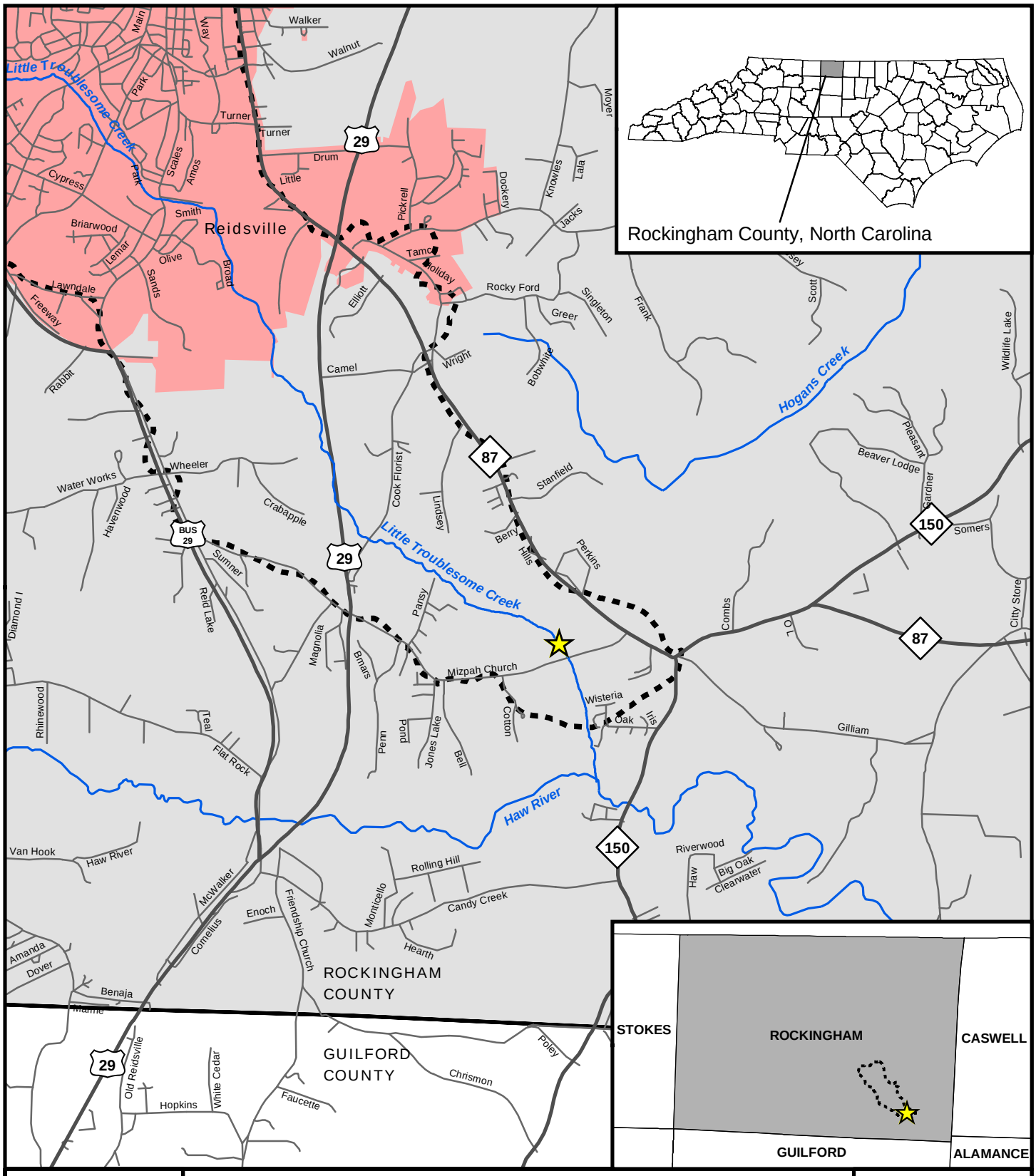

Figure 1. Vicinity Map

- Project Site Location
- Major Streams and Rivers
- Major Roads
- Other Roads
- Local Watershed Plan Boundary
- Cities and Towns
- County Boundaries

1:63,360
1 inch = 1 miles

0 0.5 1 Miles

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Conservation Easement Boundary
Stream Preservation
Stream Restoration
Other Streams
Other Drainage Features
Previous Stream Alignment
FEMA 100 yr Floodplain Boundary
Riparian Wetland Preservation
Riparian Wetland Enhancement

Wetland #1
Preservation Wetland
Wetland #2
LTC
UT 1
UT 2
Mizpah Church Road

Figure 2. Site Map
Little Troublesome Creek, Rockingham County, EEP Project 749

1:2,400

1 inch = 200 feet

200 100 0 200 Feet

N W E S

Source: Rockingham County Orthoimagery, NC, 2008

3/30/2010

Ecosystem Enhancement Program

KCI Associates of NC

Table 1a. Project Components Little Troublesome / Project No. 749								
Project Component or Reach ID	**Existing Feet/Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Buffer Acres**	**BMP Elements**	**Comment**
LTC	175	R	P3	175	10+00 - 11+75	23.6		In-stream structures, including offset rock cross vanes, riffle grade controls, and rock sills, were used to stabilize restored channel. Planted a riparian buffer.
	975	R	P2	1,020	11+75 - 21+95			In-stream structures, including offset rock cross vanes, riffle grade controls, and rock sills, were used to stabilize restored channel. Planted a riparian buffer.
	179	R	P3	180	21+95 - 23+75			In-stream structures, including offset rock cross vanes, riffle grade controls, and rock sills, were used to stabilize restored channel. Planted a riparian buffer.
UT1	873	R	P3	813	50+00 - 58+13			Stream channel stabilized with in-stream structures, including step pools and riffle grade control. Riffles enhanced with graded gravel material to mimic existing stable riffle features. Planted a riparian buffer.
UT2	2,754	P		2,754				
Enhancement Wetland #1	1.17 ac	E		1.17 ac				Enhanced hydrology and vegetation by plugging ditches to increase groundwater; planted vegetation to increase species diversity. Invasive vegetation was treated.
Enhancement Wetland #2	0.74 ac	E		0.74 ac				Enhanced hydrology and vegetation by plugging ditches to increase groundwater; planted vegetation to increase species diversity. Invasive vegetation was treated.
Preservation Wetland	4.5 ac	P		4.5 ac				Preserved a Piedmont Bottomland Hardwood community

Table 1b. Component Summations Little Troublesome / Project No. 749							
Restoration Level	**Stream (lf)**	**Riparian Wetland (Ac)**		**Non-Ripar (Ac)**	**Upland (Ac)**	**Buffer (Ac)**	**BMP**
		Riverine	**Non-Riverine**				
Restoration	2,188						
Enhancement		1.91					
Enhancement I							
Enhancement II							
Creation							
Preservation	2,754	4.5					
HQ Preservation							
		6.41					
Totals	**4,942**	**6.41**					

Table 2. Project Activity & Reporting History Little Troublesome / Project No. 749		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Environmental Resource Technical Report	Sep 2006	Sep 2006
Restoration Plan	May 2007	June 2007
Final Design - Construction Plans		Feb 2007
Construction		Dec 2009
Temporary S&E mix applied		Oct 2009
Permanent seed mix applied		Dec 2009
Planting		Dec 2009
Mitigation Plan / As-built (Year 0 Monitoring - Baseline)	Feb 2010	May 2010
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Little Troublesome / Project No. 749	
Designer	KCI Associates of North Carolina 4601 Six Forks Road, Suite 220 Raleigh, NC 27609
Primary Project Design POC	April Helms (919) 783-9214
Construction Contractor	Angler Environmental 12811 Randolph Ridge Lane Manassas, VA 20109
Construction Contractor POC	Andrew Griffey (703) 393-4844
Planting Contractor	HARP, Inc. 301 McCullough Drive, 4th Floor Charlotte, NC 28262
Planting Contractor POC	Alan Peoples (704) 841-2841
Seeding Contractor	Angler Environmental Manassas, VA 20109
Seeding Contractor POC	Andrew Griffey (703) 393-4844
Seed Mix Sources	MD Seed and Environmental Services Gaithersburg, MD 20879
Monitoring Performers	KCI Associates of North Carolina 4601 Six Forks Road, Suite 220 Raleigh, NC 27609
Monitoring POC	Adam Spiller (919) 278-2514

Table 4. Project Attributes Little Troublesome / Project No. 749		
Project County	Rockingham County	
Physiographic Region	Piedmont	
Ecoregion	Northern Inner Piedmont	
River Basin	Cape Fear	
USGS HUC	03030002010030	
NCDWQ Sub-Basin	03-06-01	
Within Extent of EEP Watershed Plan	Yes - Upper Cape Fear Basin LWP	
WRC Class	Warm	
% of Project Easement Demarcated	100%	
Beaver Activity Observed During Design Phase	No	
Restoration Component Attributes		
	LTC	**UT1**
Drainage Area (sq.mi.)	12.09	0.10 sq.mi.
Stream Order	Third	First
Restored Length (feet)	1,375	813
Perennial or Intermittent	Perennial	Perennial
Watershed Type	Rural	Rural
Watershed LULC Distribution		
Forest/Wetland	49%	
Pasture/Managed Herbaceous	21%	
Developed	30%	
Watershed Impervious Cover	21%	
NCDWQ AU/Index Number	16-7	
NCDWQ Classification	C; NSW	
303d Listed	Yes	
Upstream of 303d Listed Segment	Yes	
Reasons for 303d Listing or Stressor	Aquatic life	
Total Acreage of Easement	30.3	
Total Vegetated Acreage within Easement	30.0	
Total Planted Acreage as Part of Restoration	12.2	
Rosgen Classification of Pre-Existing	E4	G4c
Rosgen Classification of As-Built	E4/C4	B4c
Valley Type		
Valley Slope	0.002	0.021
Valley Side Slope Range		
Valley Toe Slope Range		
Cowardin Classification		
Trout Waters Designation	No	
Species of Concern, Endangered, Etc.	Carolina ladle crayfish (*Cambarus davidi*)	
Dominant Soil Series and Characteristics		
Series	Chewacla	
Depth	Deep	
Clay%		
K		
T		

APPENDIX B

Morphological Summary Data and Plots

Table 5a. Baseline Stream Data Summary: LTC

Little Troublesome / Project No. 749

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			As-built					
Dimension and Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)				21.3	24.2	23.3	29.0	3.4	4	11.9			20.1		2		31.6		32.1	32.7	32.6	33.3	0.6	3
Floodprone Width (ft)					>65				3		>60				2		>60			>200				3
Bankfull Mean Depth (ft)				4.4	4.7	4.8	5.0	0.2	4	1.7			2.7		2		3.7		3.6	3.7	3.7	3.7	0.1	3
Bankfull Max Depth (ft)				6.2	6.6	6.7	6.9	0.3	4	3.3			4.2		2		4.9		4.7	4.8	4.8	4.9	0.1	3
Bankfull Cross-Sectional Area (ft^2)				106.1	114.3	107.6	135.8	14.4	4	32.4			33.4		2		118.0		118.6	118.8	118.6	119.2	0.3	3
Width/Depth Ratio				4.2	5.0	4.7	6.2	1.0	3	4.4			12.1		2		8.5		8.7	9.0	8.9	9.3	0.3	3
Entrenchment Ratio				2.0	2.6	2.7	3.0	0.5	3	2.0			3.0		2		>3.0			>6.0				3
Bank Height Ratio				1.0	1.1	1.1	1.2	0.1	3	1.0			1.1		2		1.0		1.0	1.0	1.0	1.0	0.0	3
d50 (mm)				4.5	6.8	6.8	9.1	3.3	2	1.9			3.4		2				4.1	12.7	14.0	20.0	8.0	3
Profile																								
Riffle Length (ft)																	58		60	90	89	121	21	6
Riffle Slope (ft/ft)										0.0010			0.0070			0.002		0.004	0.0008	0.0022	0.0018	0.0039	0.0013	6
Pool Length (ft)										13			21			20		56	11	60	42	144	42	7
Pool Max Depth										1.5			2.5				7.5		4.9	5.7	5.8	6.2	0.5	7
Pool Spacing (ft)										32			80			50		212	169	199	180	285	44	6
Pool Volume (ft^3)																								
Pattern																								
Channel Beltwidth (ft)										50			60				125		51	63	55	85	15	6
Radius of Curvature (ft)										24			31			72		126	59	87	90	120	24	7
Rc:Bankfull width (ft/ft)										1.2			2.6			2.3		4.0	1.8	2.7	2.8	3.7		
Meander Wavelength (ft)										77			138			158		358	293	328	318	385	35	5
Meander Width Ratio										2.5			5.0				3.9		1.6	1.9	1.7	2.6		
Substrate, bed and transport parameters																								
Ri%/Ru%/P%/G%/S%																								
SC% / Sa% / G% / C% / B% / Be%				3% / 54% / 40% / 3% / 0% / 0%						0% / 52% / 48% / 0% / 0% / 0%									1% / 19% / 75% / 6% / 0% / 0%					
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				0.26 / 0.56 / 1.4 / 8.1 / 15 / - / -						0.7 / 1.2 / 1.9 / 16 / 26 / - / -									0.79 / 6.1 / 10 / 18 / 42 / 71 / - / -					
Reach Shear Stress (competency) lb/ft^2																0.38			0.28					
Max part size (mm) mobilized at bankfull																28			20					
Stream Power (transport capacity) W/m^2																								
Additional Reach Parameters																								
Drainage Area (SM)				12.09						1.68						12.09			12.09					
Impervious cover estimate				21%												21%			21%					
Rosgen Classification				E4						E4						E4/C4			E4/C4					
Bankfull Velocity (fps)				4.1 - 5.3						3.4 - 4.4						4.3								
Bankfull Discharge (cfs)				553 - 564						115 - 150						510 - 550								
Valley length (ft)				1,273												1,273			1,273					
Channel thalweg length (ft)				1,329												1,379			1,401					
Sinuosity				1.06												1.10			1.10					
Water Surface Slope (Channel) (ft/ft)				0.0020						0.0030						0.0020			0.0015					
BF slope (ft/ft)				0.0020												0.0020			0.0018					
Bankfull Floodplain Area (acres)																								
Proportion over wide (%)																								
Entrenchment Class (ER Range)																								
Incision Class (BHR Range)																								
BEHI VL% / L% / M% / H% / VH% / E%																								
Channel Stability or Habitat Metric																								
Biological or Other																								

Table 5b. Baseline Stream Data Summary: UT1

Little Troublesome / Project No. 749

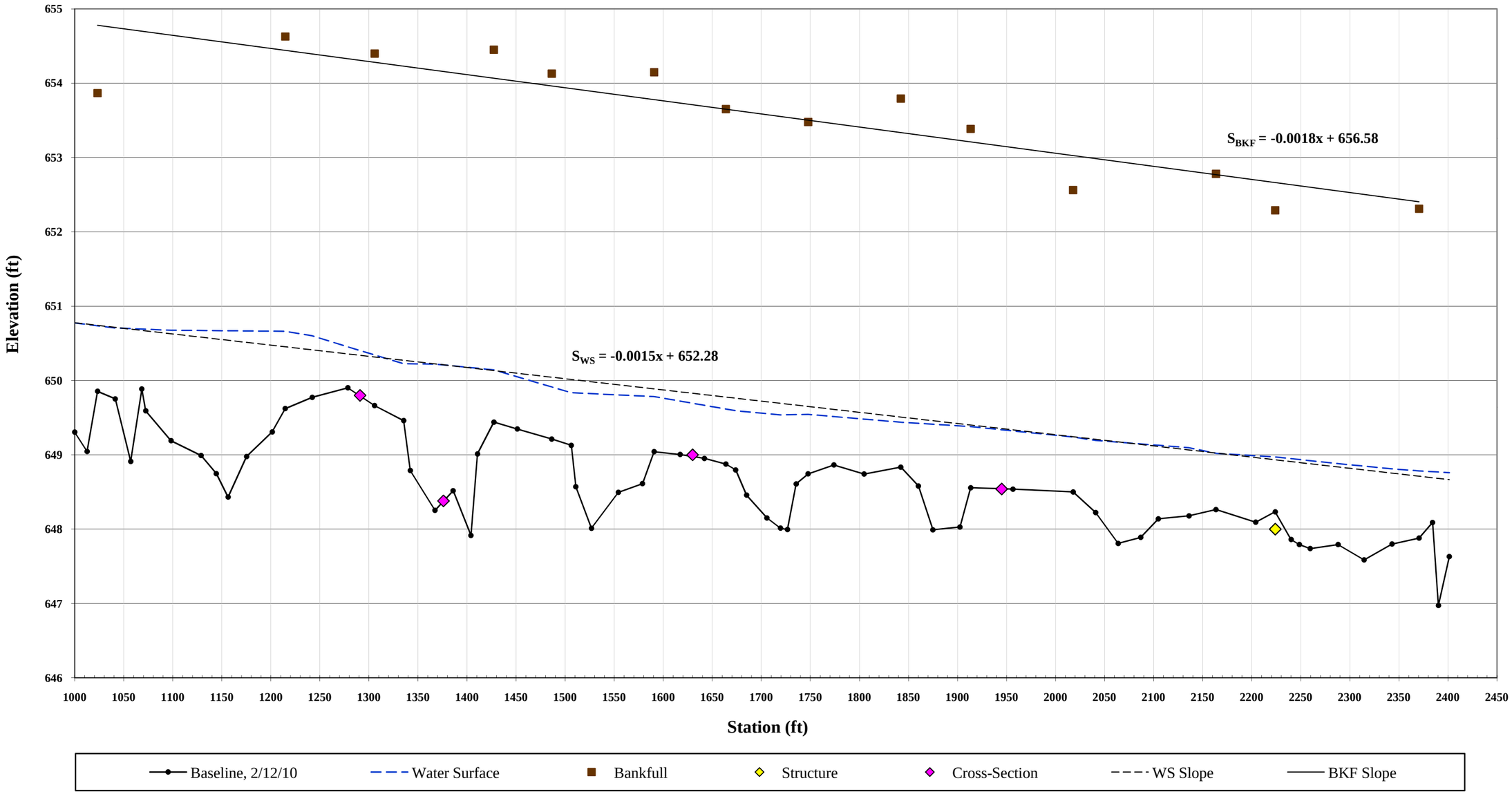
Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			As-built					
Dimension and Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)				4.0	5.4	5.1	7.7	1.4	5	7.7			10.8				6.3		7.2	7.6		7.9	0.5	2
Floodprone Width (ft)				5	6	6	7	0.9	3	13			16				12		13	13		14	0.6	2
Bankfull Mean Depth (ft)				0.7	0.9	0.9	1.1	0.2	5	0.7			0.9				0.6		0.6	0.6		0.6	0	2
Bankfull Max Depth (ft)				1.0	1.3	1.1	1.9	0.4	5	1.1			1.4				1.0		1.1	1.1		1.1	0	2
Bankfull Cross-Sectional Area (ft^2)				3.6	4.6	4.3	5.8	1.0	5	6.1			8.8				3.5		4.5	4.7		4.8	0.2	2
Width/Depth Ratio				4.4	5.7	5.6	7.0	1.3	3	8.5			11.4				11.4		11.5	12.3		13.0	1.1	2
Entrenchment Ratio				1.0	1.3	1.4	1.5	0.3	3	1.6			2.1				1.9		1.6	1.8		1.9	0.2	2
Bank Height Ratio				5.3	6.1	6.4	6.5	0.7	3								1.0		1.0	1.0		1.0	0	2
d50 (mm)				2.2	11.2	12.3	19.2	8.6	3										0.8	1.0		1.1	0.2	2
Profile																								
Riffle Length (ft)																			3	11	8	32	9	11
Riffle Slope (ft/ft)										0.0120			0.0280			0.0180		0.0400	0.0077	0.0378	0.0318	0.1022	0.0283	11
Pool Length (ft)										5			9			3		11	5	13	12	36	8	14
Pool Max Depth										0.8			0.9				1.4		1.7	2.3	2.2	3.0	0.5	12
Pool Spacing (ft)																			21	44	41	81	22	13
Pool Volume (ft^2)																								
Pattern																								
Channel Beltwidth (ft)											22						13		6	9	9	14	2.1	19
Radius of Curvature (ft)										11			23			13		32	14	18	18	27	4.5	27
Rc:Bankfull width (ft/ft)										1.0			3.0			2.0		5.0	1.8	2.4	2.4	3.6		
Meander Wavelength (ft)										45			59			32		63	40	51	49	69	7.6	25
Meander Width Ratio										2.0			2.9			2.0		2.9	0.8	1.2	1.2	1.9		
Substrate, bed and transport parameters																								
Ri%/Ru%/P%/G%/S%																								
SC% / Sa% / G% / C% / B% / Be%				0% / 27% / 73% / 0% / 0%						6% / 45% / 42% / 7% / 0%									1% / 63% / 36% / 0% / 0%					
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)				1.4 / 3.2 / 7.3 / 15 / 20						0.14 / 0.38 / 1.8 / 18 / 139									0.22 / 0.47 / 0.87 / 2.1 / 7.3 / 23					
Reach Shear Stress (competency) lb/ft^2																0.42			0.60					
Max part size (mm) mobilized at bankfull																32			35					
Stream Power (transport capacity) W/m^2																								
Additional Reach Parameters																								
Drainage Area (SM)				0.10						0.15						0.10			0.10					
Impervious cover estimate																								
Rosgen Classification				G4c						B4c						B4c			B4c					
Bankfull Velocity (fps)				4.3 - 4.7						5.1 - 5.8						3.7			3.7					
Bankfull Discharge (cfs)				16 - 20						31 - 49						13 - 20			17					
Valley length (ft)				769												769			769					
Channel thalweg length (ft)				873												813			824					
Sinuosity				1.02						1.20						1.10			1.10					
Water Surface Slope (Channel) (ft/ft)				0.019						0.012						0.018			0.017					
BF slope (ft/ft)				0.021						0.017						0.021			0.016					
Bankfull Floodplain Area (acres)																								
Proportion over wide (%)																								
Entrenchment Class (ER Range)																								
Incision Class (BHR Range)																								
BEHI VL% / L% / M% / H% / VH% / E%																								
Channel Stability or Habitat Metric																								
Biological or Other																								

Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross-Sections)
Little Troublesome / Project No. 749

Dimension and Substrate	Cross-Section 1 (LTC, Riffle)							Cross-Section 2 (LTC, Pool)							Cross-Section 3 (LTC, Riffle)							Cross-Section 4 (LTC, Riffle)							Cross-Section 5 (UT1, Riffle)						
Based on fixed baseline elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	32.6							36.0							32.1							33.3							7.9						
Floodprone Width (ft)	>200							-							>200							>200							13						
Bankfull Mean Depth (ft)	3.7							3.4							3.7							3.6							0.6						
Bankfull Max Depth (ft)	4.8							6.0							4.9							4.7							1.1						
Bankfull Cross-Sectional Area (ft^2)	119.2							123.1							118.6							118.6							4.8						
Bankfull Width/Depth Ratio	8.9							-							8.7							9.3							13						
Bankfull Entrenchment Ratio	>6.0							-							>6.0							>6.0							1.6						
Bankfull Bank Height Ratio	1.0							-							1.0							1.0							1.0						
Cross-Sectional Area Between End Pins (ft^2)	142.4							158.5							156.0							162.2							150.8						
d50 (mm)	20.0							1.8							14.0							4.1							1.1						

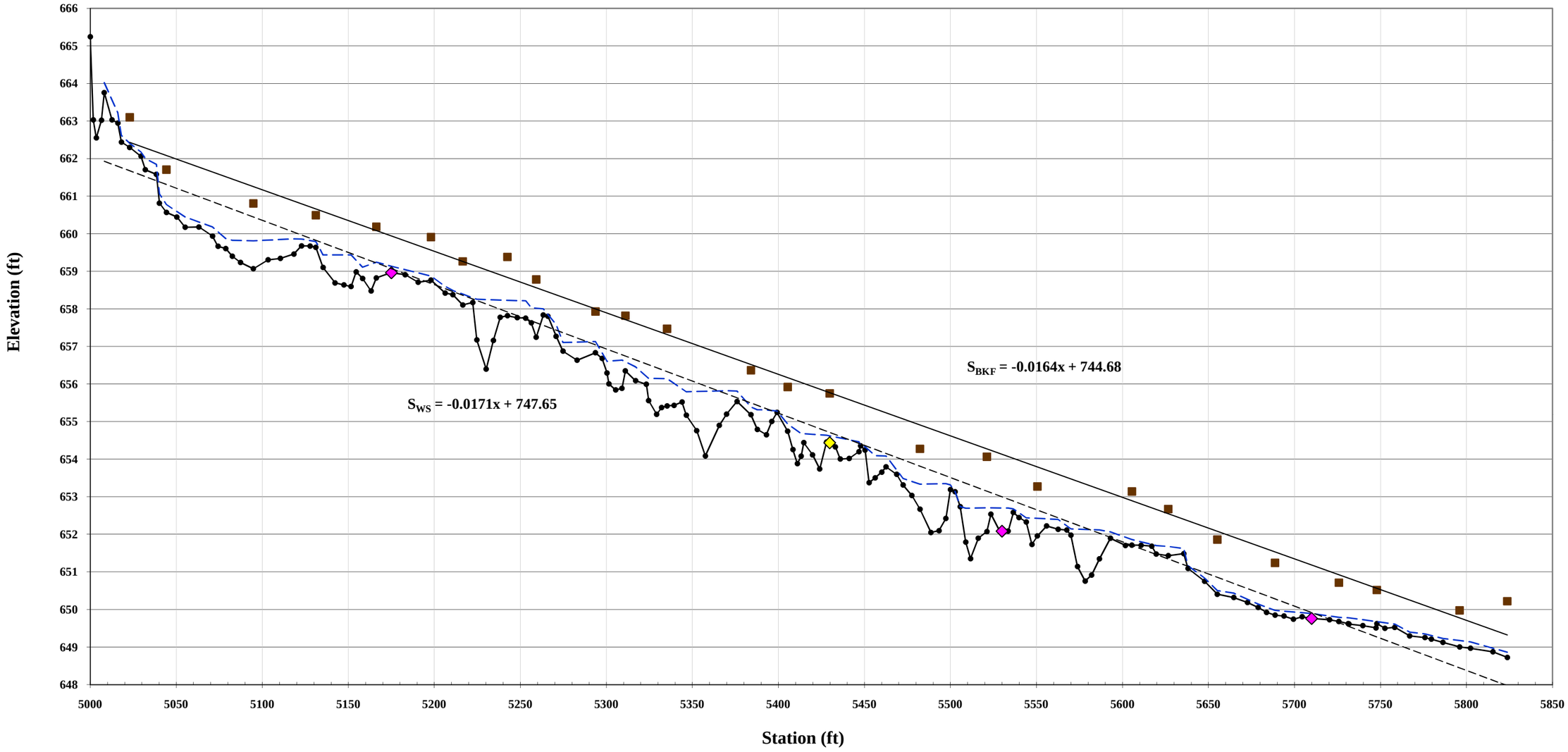
	Cross-Section 6 (UT1, Pool)							Cross-Section 7 (UT1, Riffle)						
Based on fixed baseline elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	4.6							7.2						
Floodprone Width (ft)	-							14						
Bankfull Mean Depth (ft)	0.9							0.6						
Bankfull Max Depth (ft)	1.4							1.1						
Bankfull Cross-Sectional Area (ft^2)	4.2							4.5						
Bankfull Width/Depth Ratio	-							11.5						
Bankfull Entrenchment Ratio	-							1.9						
Bankfull Bank Height Ratio	-							1.0						
Cross-Sectional Area Between End Pins (ft^2)	146.9							120.6						
d50 (mm)	1.0							0.82						

Longitudinal Profile
Little Troublesome Creek
EEP Project Number - 749
Station 10+00 - 24+50



*Cross Vane header stone at Station 22+24 beneath deposited sand.

Longitudinal Profile
UT1 to Little Troublesome Creek
EEP Project Number - 749
Station 50+00 - 58+50



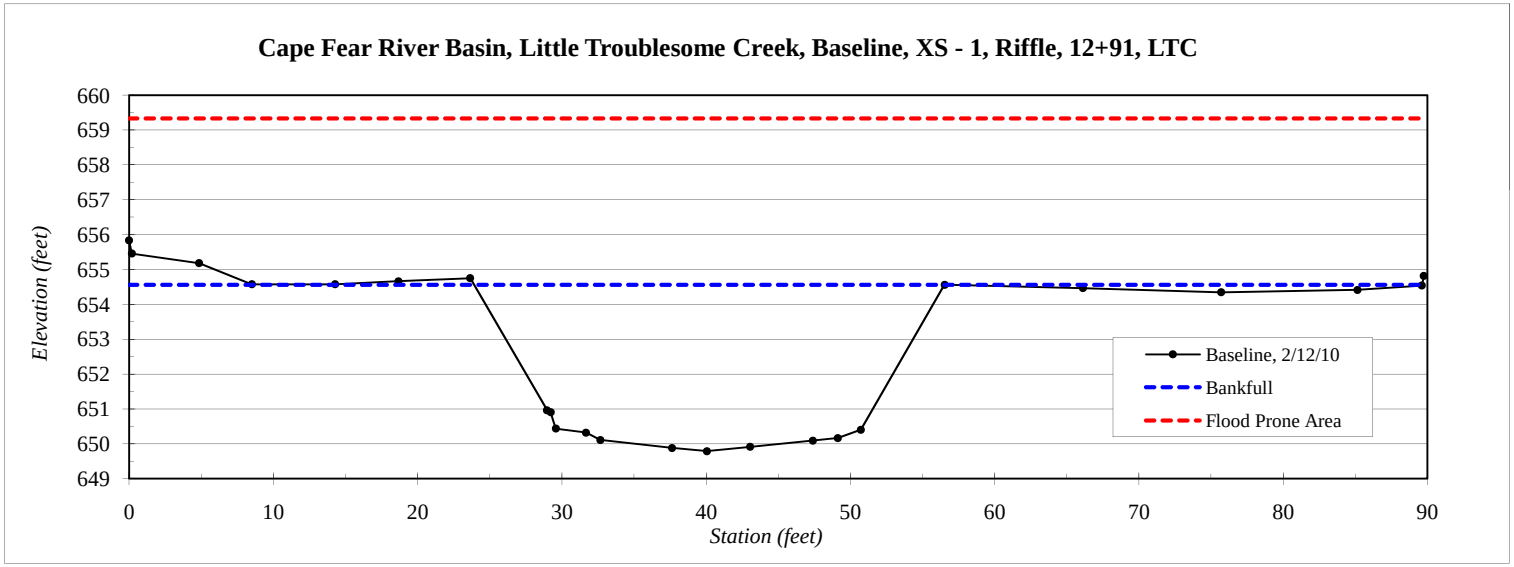
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 1, Riffle, 12+91, LTC
Drainage Area (sq mi):	12.09
Date:	2/12/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	655.83
0.2	655.46
4.9	655.18
8.5	654.57
14.3	654.57
18.7	654.66
23.6	654.75
29.0	650.96
29.2	650.90
29.6	650.44
31.7	650.32
32.7	650.11
37.6	649.88
40.1	649.79
43.0	649.91
47.4	650.09
49.1	650.16
50.7	650.40
56.5	654.56
66.1	654.47
75.7	654.35
85.2	654.41
89.6	654.54
89.8	654.81

SUMMARY DATA	
Bankfull Elevation:	654.6
Bankfull Cross-Sectional Area:	119.2
Bankfull Width:	32.6
Flood Prone Area Elevation:	659.3
Flood Prone Width:	>200
Max Depth at Bankfull:	4.8
Mean Depth at Bankfull:	3.7
W / D Ratio:	8.9
Entrenchment Ratio:	>6.0
Bank Height Ratio:	1.0

Stream Type	E4/C4

Station 12+91 Looking Downstream



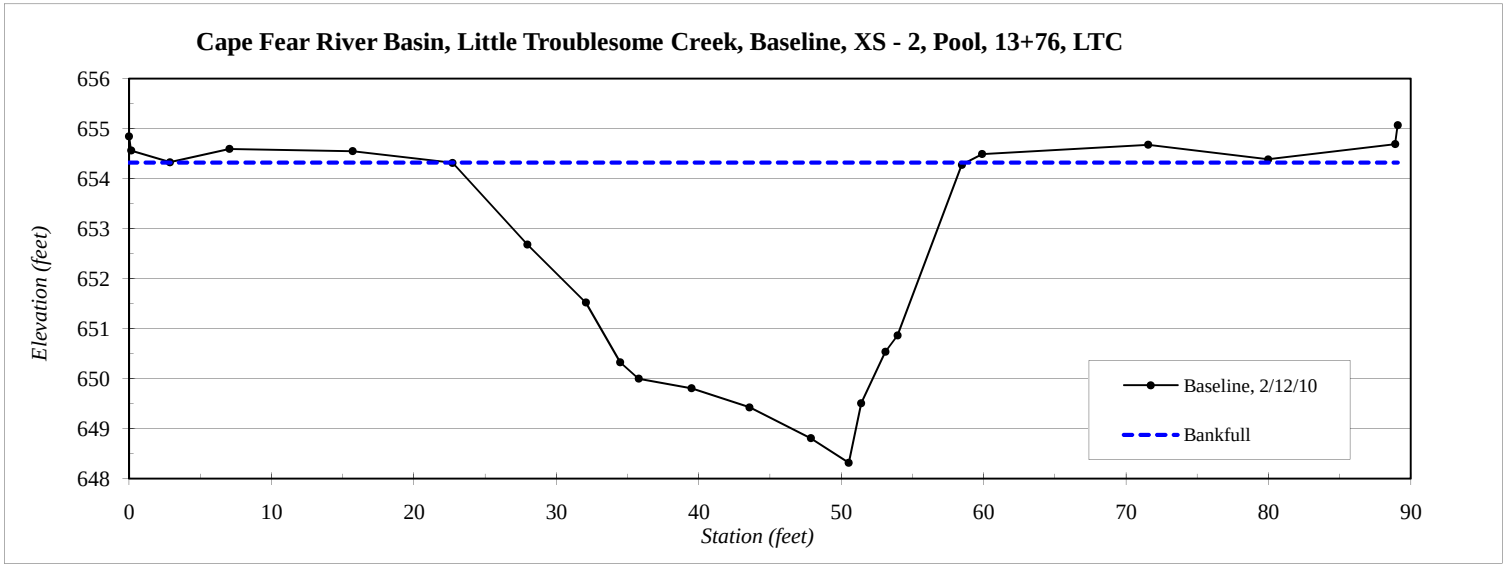
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 2, Pool, 13+76, LTC
Drainage Area (sq mi):	12.09
Date:	2/12/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	654.84
0.1	654.56
2.9	654.33
7.0	654.60
15.7	654.55
22.7	654.32
28.0	652.68
32.1	651.53
34.5	650.33
35.8	650.00
39.5	649.81
43.6	649.43
47.9	648.81
50.5	648.32
51.4	649.51
53.1	650.54
54.0	650.86
58.5	654.28
59.9	654.49
71.6	654.68
80.0	654.39
88.9	654.69
89.1	655.07

SUMMARY DATA	
Bankfull Elevation:	654.3
Bankfull Cross-Sectional Area:	123.1
Bankfull Width:	36.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.4
Mean Depth at Bankfull:	6.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E4/C4

Station 13+76 Looking Downstream



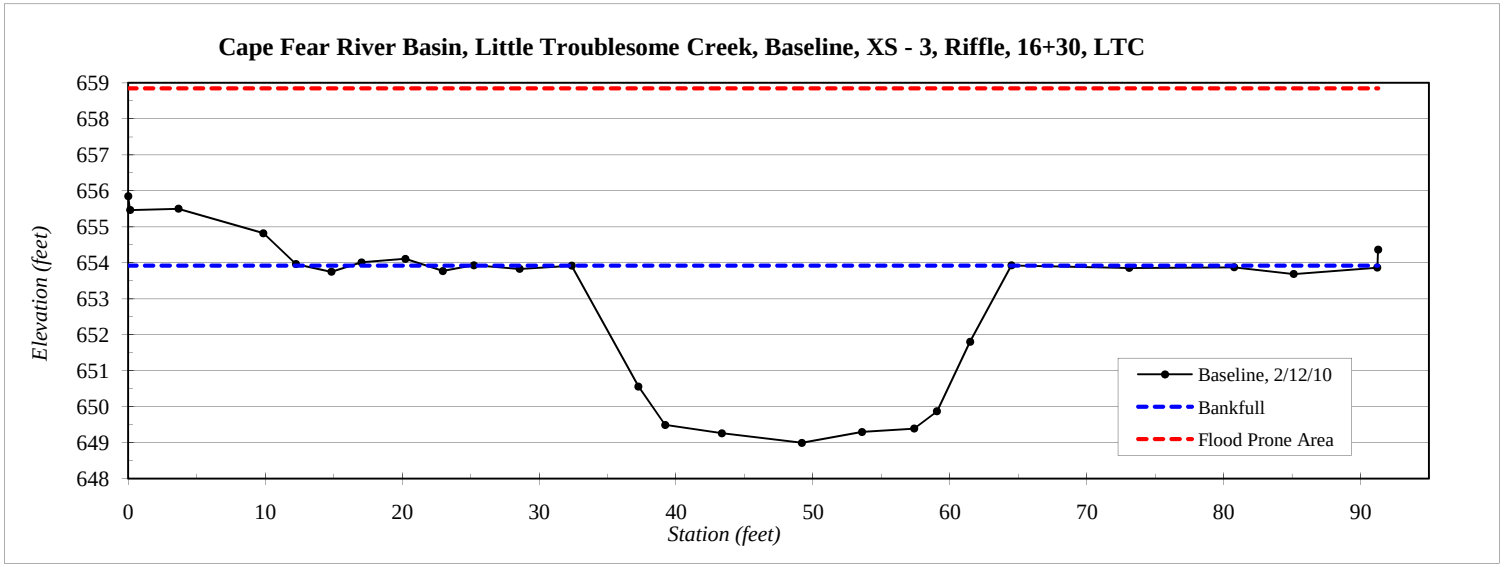
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 3, Riffle, 16+30, LTC
Drainage Area (sq mi):	12.09
Date:	2/12/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	655.85
0.1	655.47
3.7	655.50
9.9	654.82
12.3	653.96
14.8	653.75
17.0	654.01
20.2	654.11
23.0	653.77
25.2	653.93
28.6	653.83
32.4	653.92
37.3	650.56
39.2	649.49
43.3	649.27
49.2	649.00
53.6	649.30
57.4	649.39
59.1	649.87
61.5	651.81
64.5	653.93
73.1	653.86
80.8	653.88
85.1	653.69
91.2	653.86
91.3	654.36

SUMMARY DATA	
Bankfull Elevation:	653.9
Bankfull Cross-Sectional Area:	118.6
Bankfull Width:	32.1
Flood Prone Area Elevation:	658.8
Flood Prone Width:	>200
Max Depth at Bankfull:	4.9
Mean Depth at Bankfull:	3.7
W / D Ratio:	8.7
Entrenchment Ratio:	>6.0
Bank Height Ratio:	1.0

Stream Type	E4/C4

Station 16+30 Looking Downstream



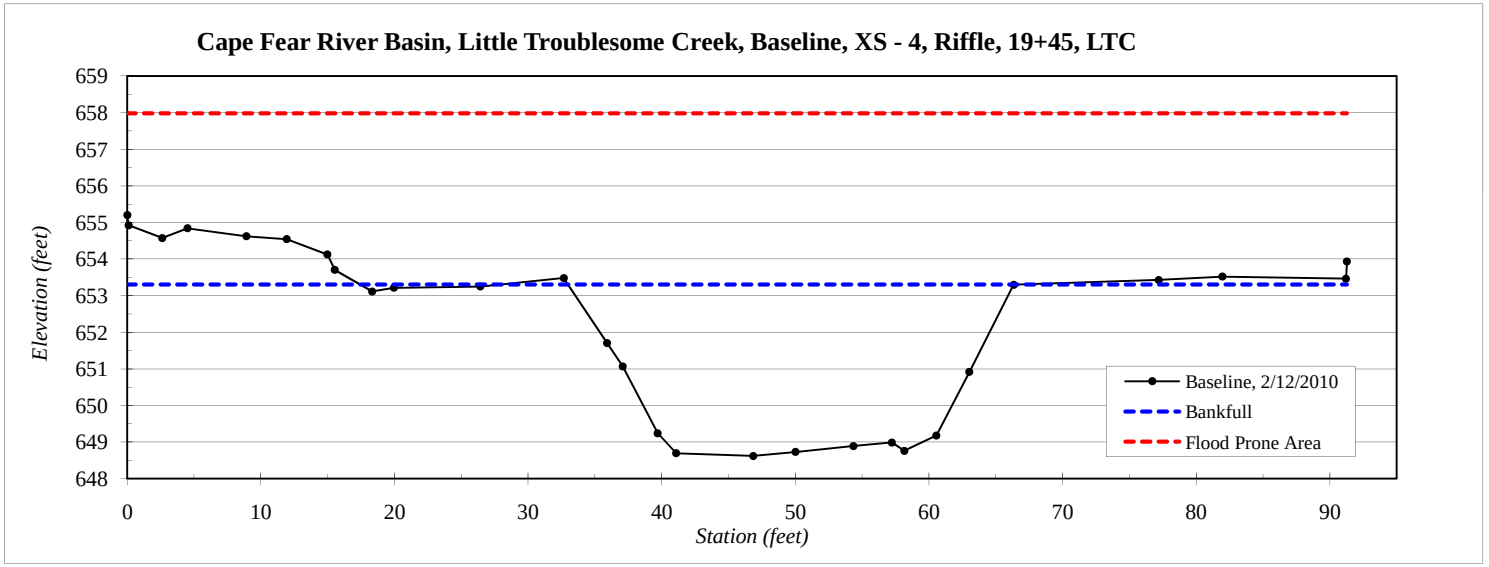
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 4, Riffle, 19+45, LTC
Drainage Area (sq mi):	12.09
Date:	2/12/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	655.20
0.1	654.92
2.6	654.57
4.5	654.84
8.9	654.62
11.9	654.54
15.0	654.12
15.5	653.71
18.3	653.11
19.9	653.22
26.4	653.25
32.7	653.48
35.9	651.71
37.1	651.07
39.7	649.24
41.1	648.69
46.8	648.62
50.0	648.73
54.4	648.89
57.2	648.99
58.1	648.76
60.6	649.18
63.0	650.91
66.3	653.30
77.2	653.43
82.0	653.52
91.2	653.46
91.3	653.93

SUMMARY DATA	
Bankfull Elevation:	653.3
Bankfull Cross-Sectional Area:	118.6
Bankfull Width:	33.3
Flood Prone Area Elevation:	658.0
Flood Prone Width:	>200
Max Depth at Bankfull:	4.7
Mean Depth at Bankfull:	3.6
W / D Ratio:	9.3
Entrenchment Ratio:	>6.0
Bank Height Ratio:	1.0

Stream Type	E4/C4

Station 19+45 Looking Downstream



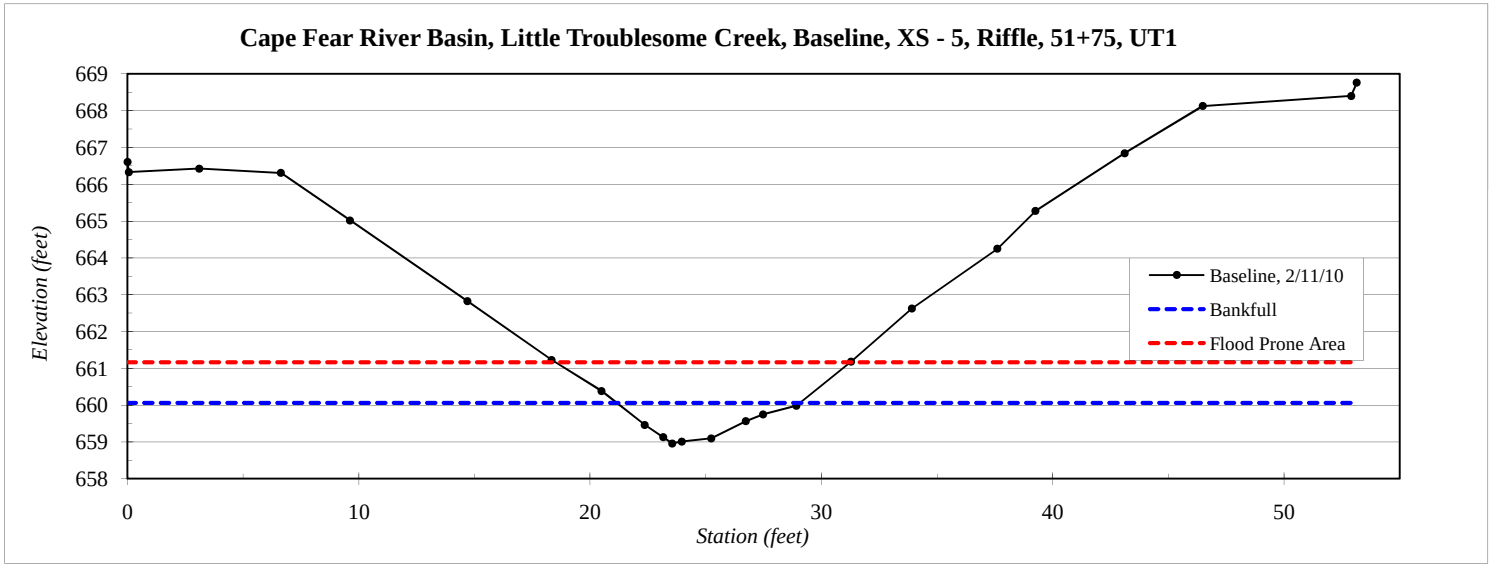
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 5, Riffle, 51+75, UT1
Drainage Area (sq mi):	0.10
Date:	2/11/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	666.61
0.1	666.33
3.1	666.43
6.6	666.31
9.6	665.02
14.7	662.82
18.3	661.22
20.5	660.38
22.4	659.46
23.2	659.13
23.6	658.96
24.0	659.01
25.2	659.09
26.7	659.56
27.5	659.75
28.9	659.98
31.3	661.18
33.9	662.62
37.6	664.24
39.3	665.27
43.1	666.84
46.5	668.12
52.9	668.40
53.2	668.8

SUMMARY DATA	
Bankfull Elevation:	660.1
Bankfull Cross-Sectional Area:	4.8
Bankfull Width:	7.9
Flood Prone Area Elevation:	661.2
Flood Prone Width:	12.7
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.6
W / D Ratio:	13.0
Entrenchment Ratio:	1.6
Bank Height Ratio:	1.0

Stream Type	B4c

Station 51+75 Looking Downstream



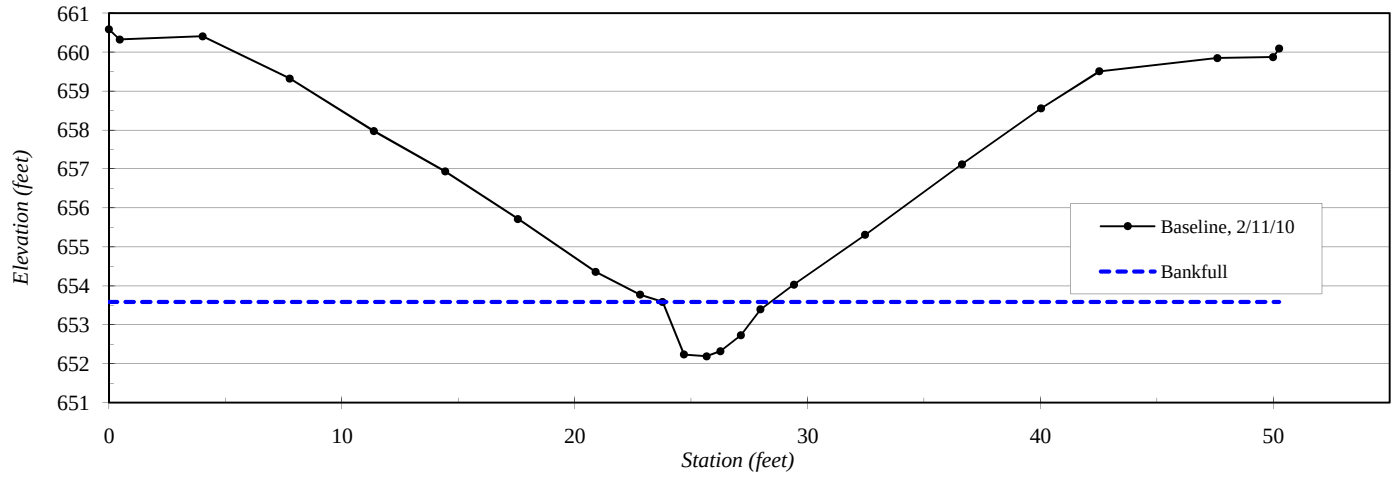
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 6, Pool, 55+30, UT1
Drainage Area (sq mi):	0.10
Date:	2/11/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	660.58
0.5	660.32
4.0	660.41
7.8	659.32
11.4	657.98
14.4	656.94
17.6	655.72
20.9	654.35
22.8	653.77
23.8	653.59
24.7	652.24
25.7	652.19
26.3	652.32
27.1	652.74
28.0	653.39
29.4	654.03
32.5	655.31
36.6	657.12
40.0	658.55
42.5	659.51
47.6	659.85
50.0	659.87
50.3	660.09

SUMMARY DATA	
Bankfull Elevation:	653.6
Bankfull Cross-Sectional Area:	4.2
Bankfull Width:	4.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	B4c

Station 55+30 Looking Downstream



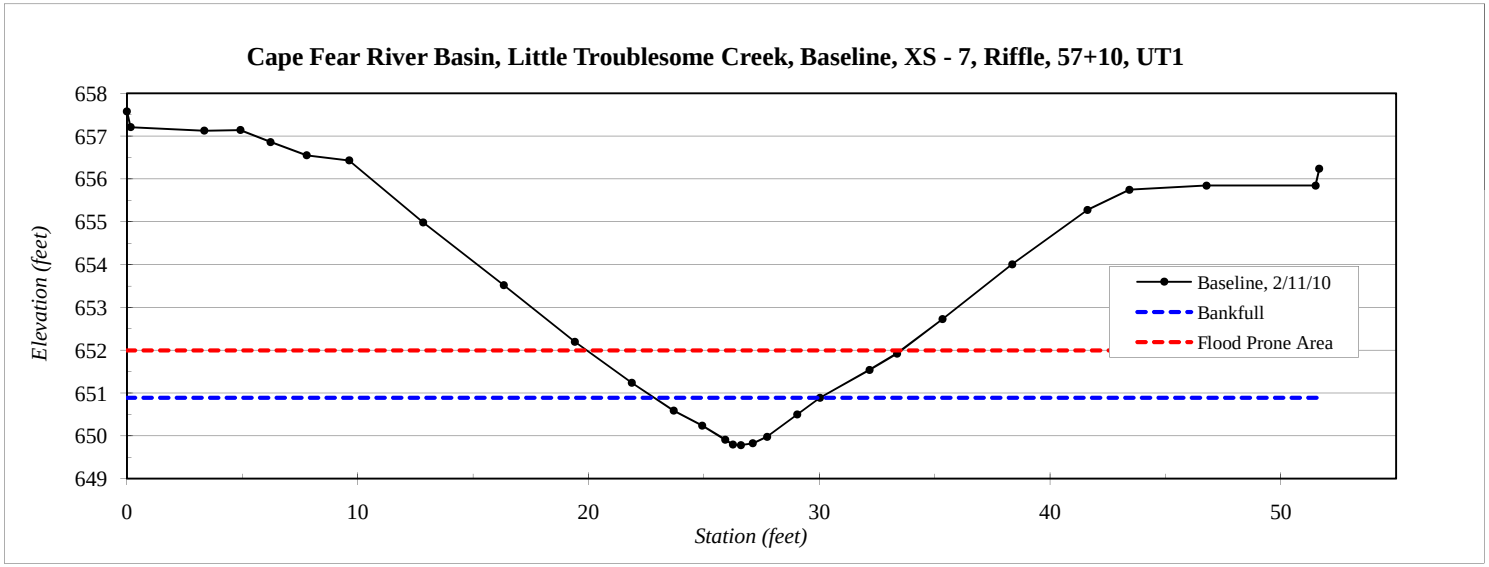
River Basin:	Cape Fear
Watershed:	Little Troublesome Creek, Baseline
XS ID	XS - 7, Riffle, 57+10, UT1
Drainage Area (sq mi):	0.10
Date:	2/11/2010
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	657.58
0.2	657.21
3.4	657.13
4.9	657.14
6.2	656.86
7.8	656.55
9.6	656.43
12.8	654.99
16.3	653.52
19.4	652.20
21.9	651.24
23.7	650.59
24.9	650.24
25.9	649.91
26.3	649.80
26.6	649.79
27.1	649.83
27.7	649.98
29.0	650.50
30.0	650.89
32.2	651.54
33.4	651.92
35.3	652.73
38.4	654.01
41.6	655.28
43.4	655.75
46.8	655.85
51.5	655.85
51.7	656.24

SUMMARY DATA	
Bankfull Elevation:	650.9
Bankfull Cross-Sectional Area:	4.5
Bankfull Width:	7.2
Flood Prone Area Elevation:	652.0
Flood Prone Width:	13.6
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.6
W / D Ratio:	11.5
Entrenchment Ratio:	1.9
Bank Height Ratio:	1.0

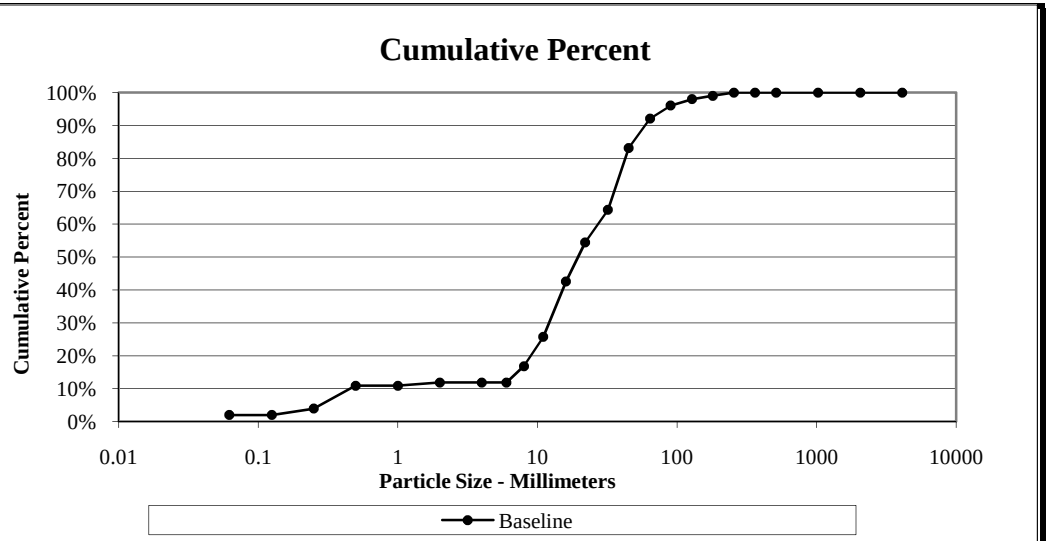
Stream Type	B4c

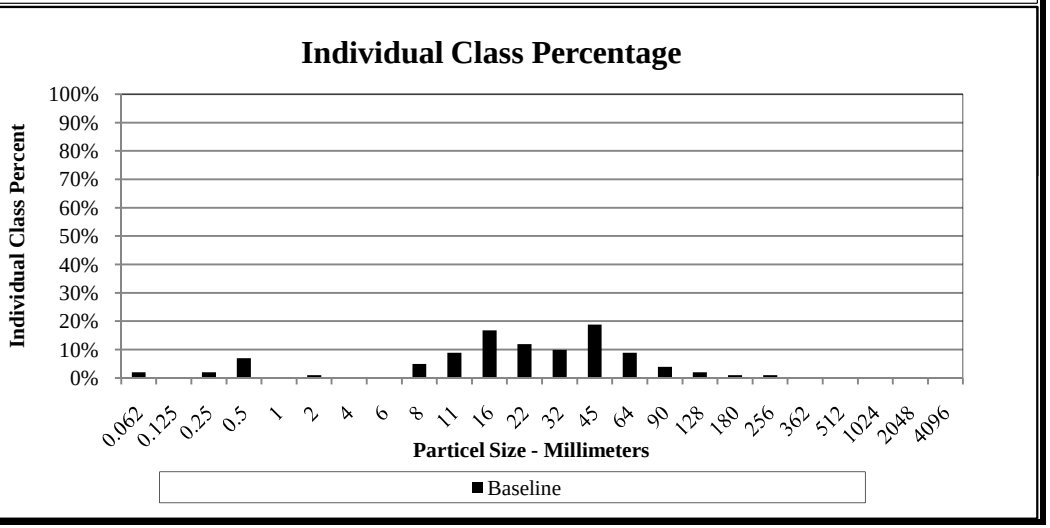
Station 57+10 Looking Downstream



Cross-Section 1 Riffle - LTC Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C	2	2%	2%
Very Fine	.062 - .125	S		0%	2%
Fine	.125 - .25	A	2	2%	4%
Medium	.25 - .50	N	7	7%	11%
Coarse	.50 - 1	D		0%	11%
Very Coarse	1 - 2	S	1	1%	12%
Very Fine	2 - 4			0%	12%
Fine	4 - 5.7	G		0%	12%
Fine	5.7 - 8	R	5	5%	17%
Medium	8 - 11.3	A	9	9%	26%
Medium	11.3 - 16	V	17	17%	43%
Coarse	16 - 22.6	E	12	12%	54%
Coarse	22.6 - 32	L	10	10%	64%
Very Coarse	32 - 45	S	19	19%	83%
Very Coarse	45 - 64		9	9%	92%
Small	64 - 90	C	4	4%	96%
Small	90 - 128	O	2	2%	98%
Large	128 - 180	B	1	1%	99%
Large	180 - 256	L	1	1%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	101	100%	100%

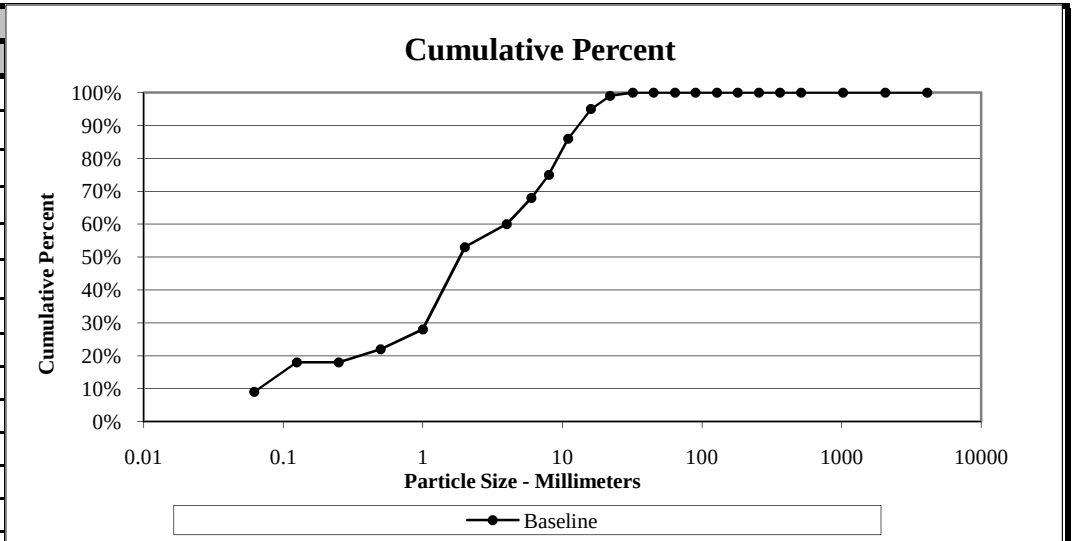
Summary Data	
D50	20
D84	47
D95	82

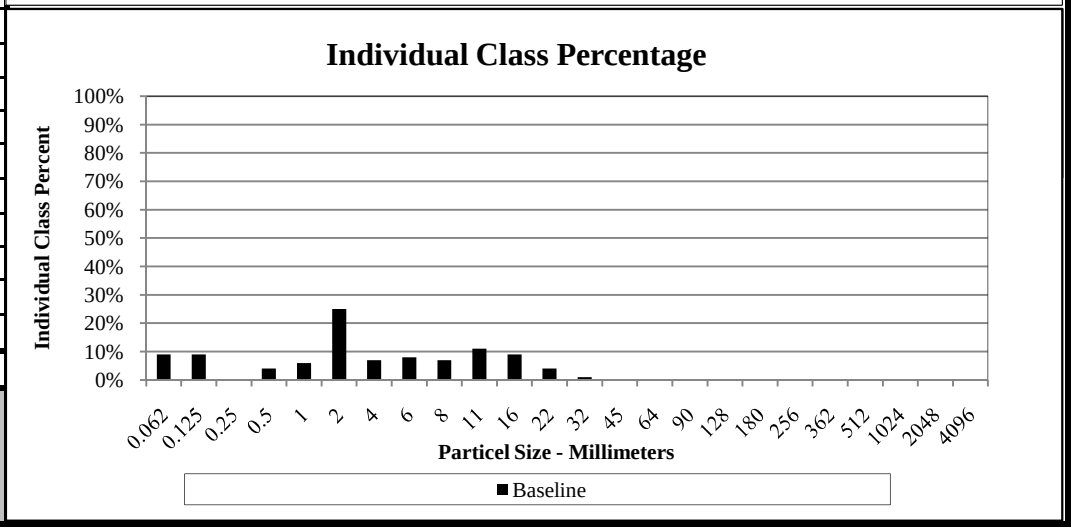




Cross-Section 2 Pool - LTC Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C	9	9%	9%
Very Fine	.062 - .125	S	9	9%	18%
Fine	.125 - .25	A		0%	18%
Medium	.25 - .50	N	4	4%	22%
Coarse	.50 - 1	D	6	6%	28%
Very Coarse	1 - 2	S	25	25%	53%
Very Fine	2 - 4		7	7%	60%
Fine	4 - 5.7	G	8	8%	68%
Fine	5.7 - 8	R	7	7%	75%
Medium	8 - 11.3	A	11	11%	86%
Medium	11.3 - 16	V	9	9%	95%
Coarse	16 - 22.6	E	4	4%	99%
Coarse	22.6 - 32	L	1	1%	100%
Very Coarse	32 - 45	S		0%	100%
Very Coarse	45 - 64			0%	100%
Small	64 - 90	C		0%	100%
Small	90 - 128	O		0%	100%
Large	128 - 180	B		0%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	100	100%	100%

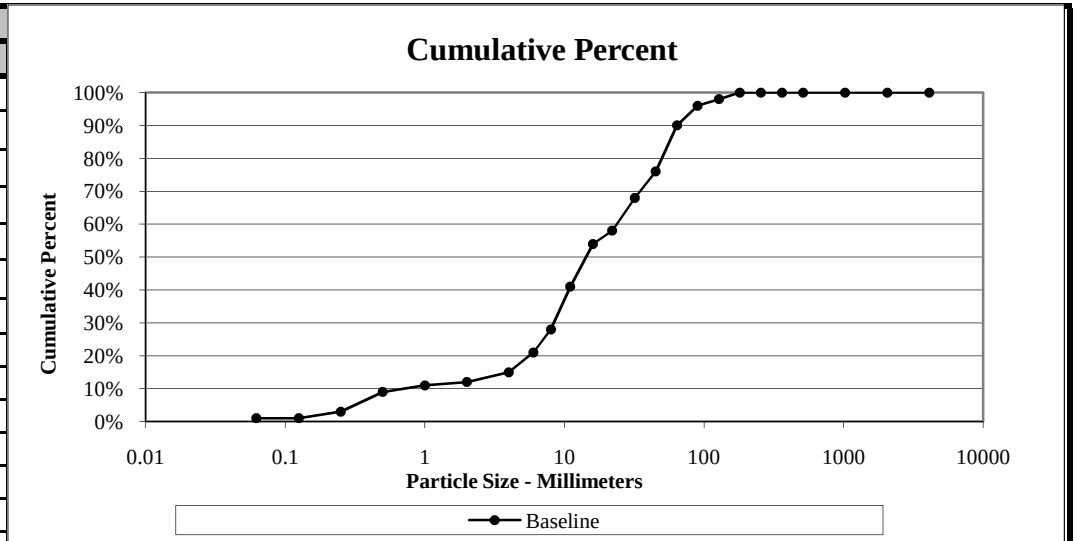
Summary Data	
D50	1.8
D84	10
D95	16

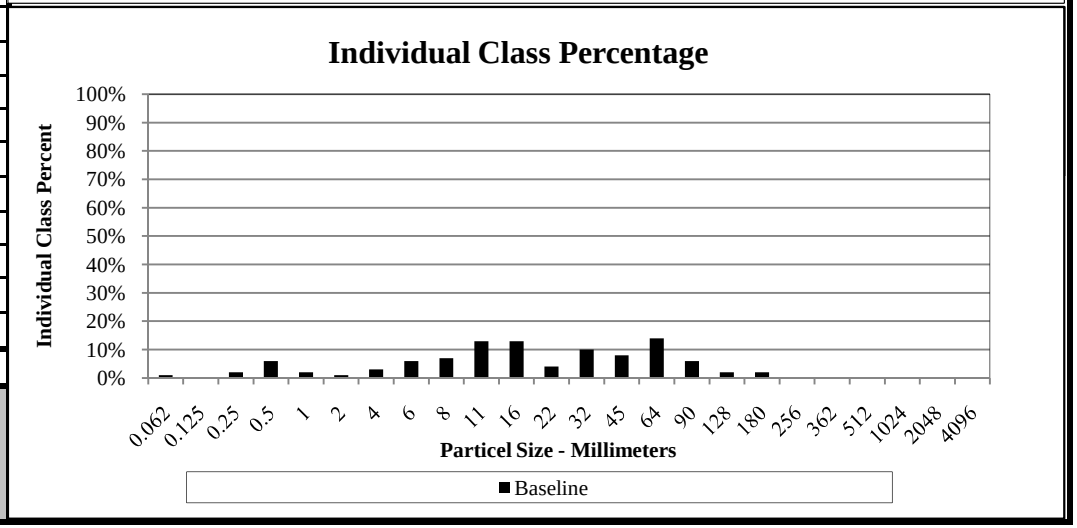




Cross-Section 3 Riffle - LTC Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C	1	1%	1%
Very Fine	.062 - .125	S		0%	1%
Fine	.125 - .25	A	2	2%	3%
Medium	.25 - .50	N	6	6%	9%
Coarse	.50 - 1	D	2	2%	11%
Very Coarse	1 - 2	S	1	1%	12%
Very Fine	2 - 4		3	3%	15%
Fine	4 - 5.7	G	6	6%	21%
Fine	5.7 - 8	R	7	7%	28%
Medium	8 - 11.3	A	13	13%	41%
Medium	11.3 - 16	V	13	13%	54%
Coarse	16 - 22.6	E	4	4%	58%
Coarse	22.6 - 32	L	10	10%	68%
Very Coarse	32 - 45	S	8	8%	76%
Very Coarse	45 - 64		14	14%	90%
Small	64 - 90	C	6	6%	96%
Small	90 - 128	O	2	2%	98%
Large	128 - 180	B	2	2%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	100	100%	100%

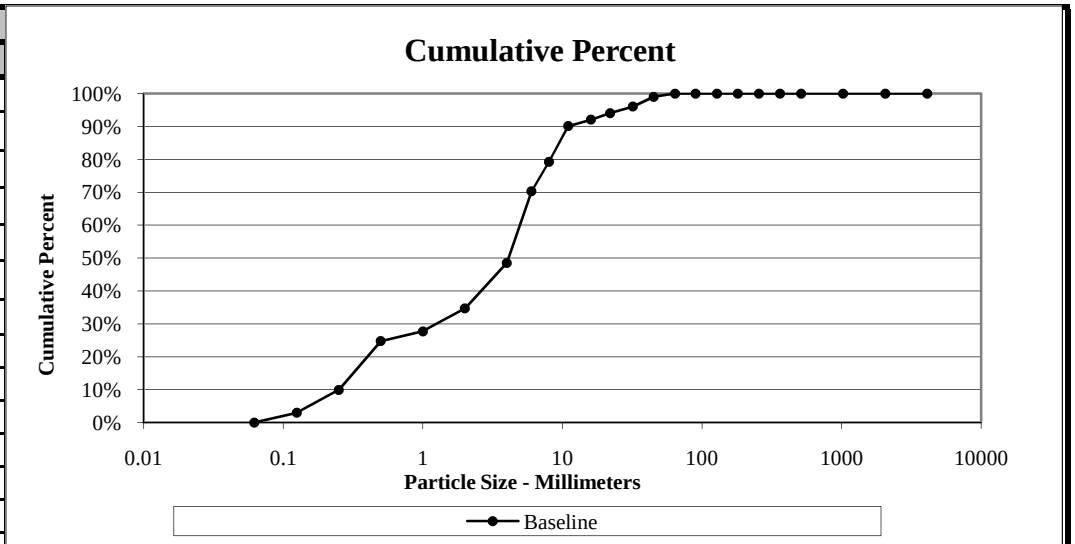
Summary Data	
D50	14
D84	55
D95	85

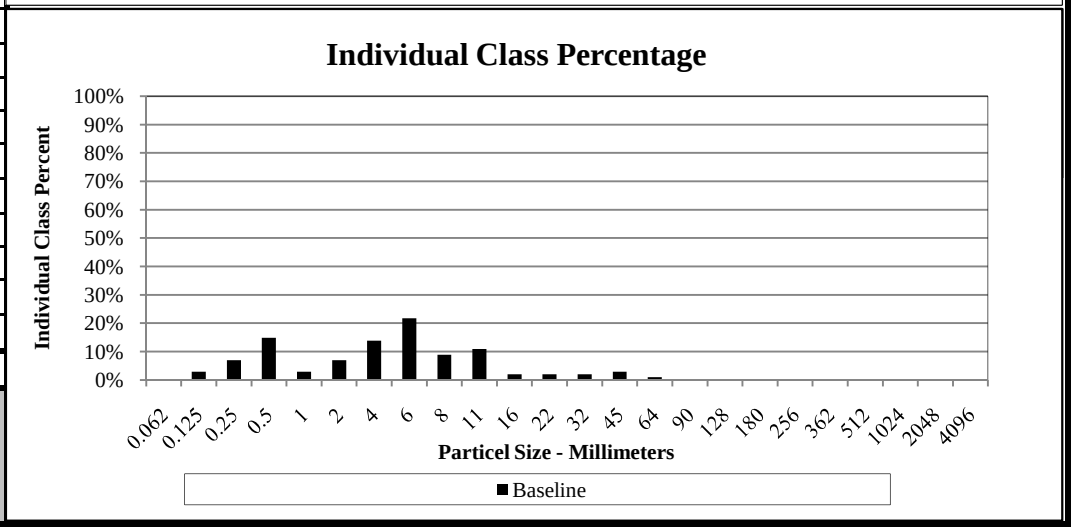




Cross-Section 4 Riffle - LTC Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C		0%	0%
Very Fine	.062 - .125	S	3	3%	3%
Fine	.125 - .25	A	7	7%	10%
Medium	.25 - .50	N	15	15%	25%
Coarse	.50 - 1	D	3	3%	28%
Very Coarse	1 - 2	S	7	7%	35%
Very Fine	2 - 4		14	14%	49%
Fine	4 - 5.7	G	22	22%	70%
Fine	5.7 - 8	R	9	9%	79%
Medium	8 - 11.3	A	11	11%	90%
Medium	11.3 - 16	V	2	2%	92%
Coarse	16 - 22.6	E	2	2%	94%
Coarse	22.6 - 32	L	2	2%	96%
Very Coarse	32 - 45	S	3	3%	99%
Very Coarse	45 - 64		1	1%	100%
Small	64 - 90	C		0%	100%
Small	90 - 128	O		0%	100%
Large	128 - 180	B		0%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	101	100%	100%

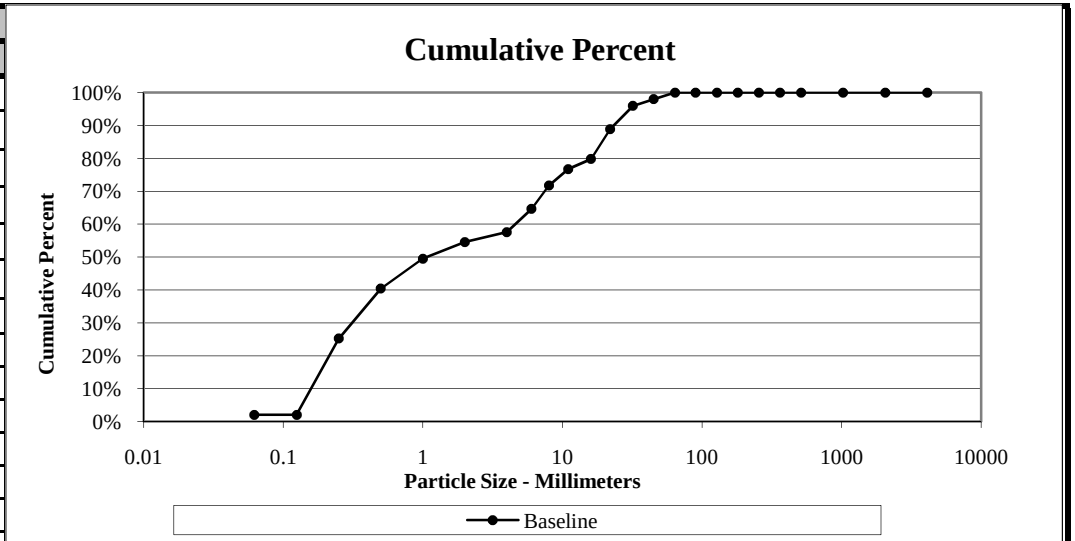
Summary Data	
D50	4.1
D84	9.2
D95	26

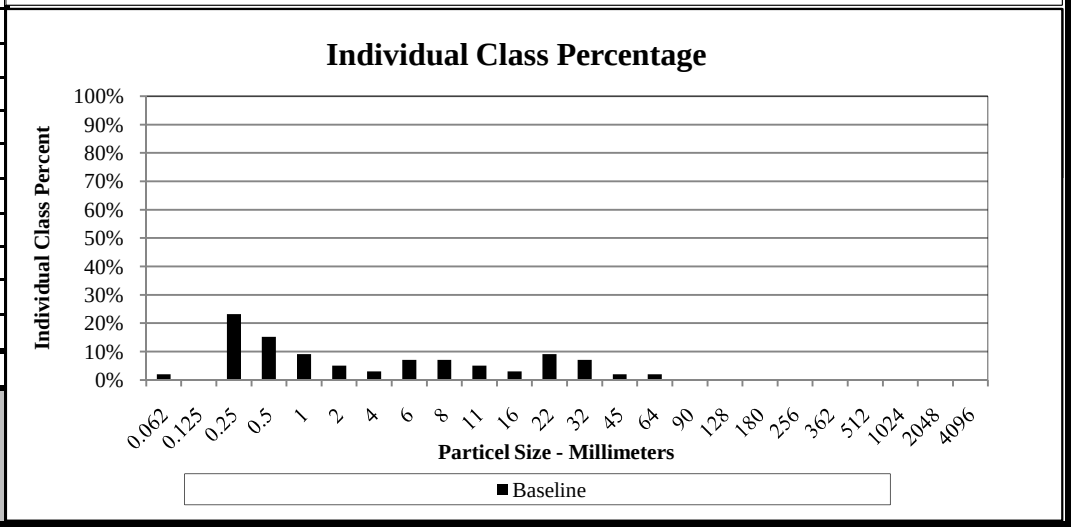




Cross-Section 5 Riffle - UT1 Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C	2	2%	2%
Very Fine	.062 - .125	S		0%	2%
Fine	.125 - .25	A	23	23%	25%
Medium	.25 - .50	N	15	15%	40%
Coarse	.50 - 1	D	9	9%	49%
Very Coarse	1 - 2	S	5	5%	55%
Very Fine	2 - 4		3	3%	58%
Fine	4 - 5.7	G	7	7%	65%
Fine	5.7 - 8	R	7	7%	72%
Medium	8 - 11.3	A	5	5%	77%
Medium	11.3 - 16	V	3	3%	80%
Coarse	16 - 22.6	E	9	9%	89%
Coarse	22.6 - 32	L	7	7%	96%
Very Coarse	32 - 45	S	2	2%	98%
Very Coarse	45 - 64		2	2%	100%
Small	64 - 90	C		0%	100%
Small	90 - 128	O		0%	100%
Large	128 - 180	B		0%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	99	100%	100%

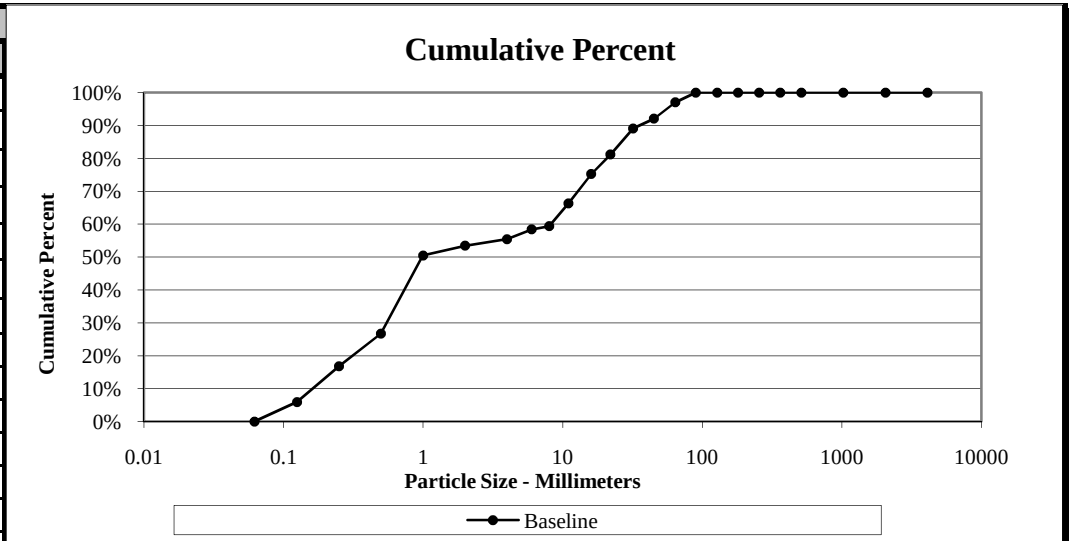
Summary Data	
D50	1.1
D84	19
D95	30

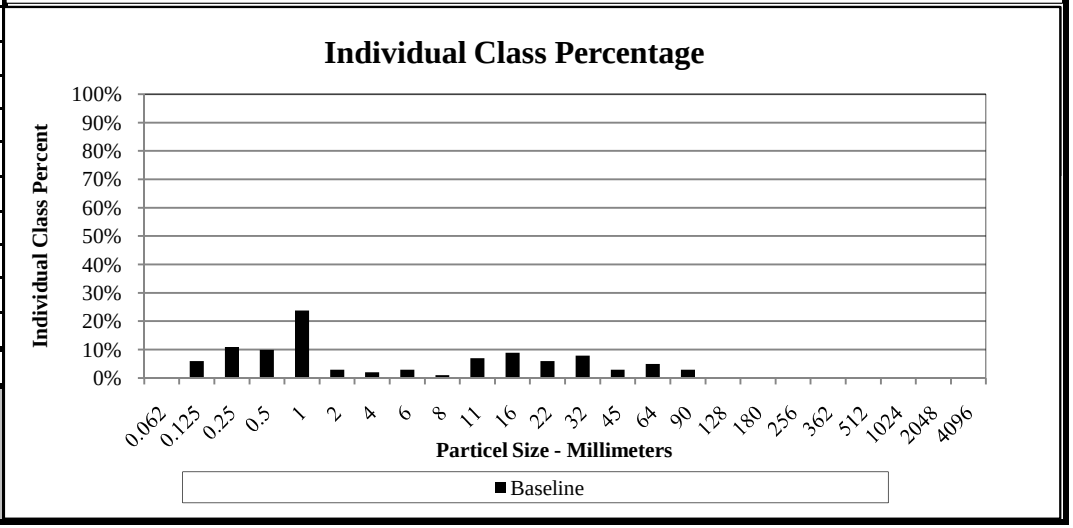




Cross-Section 6 Pool - UT1 Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C		0%	0%
Very Fine	.062 - .125	S	6	6%	6%
Fine	.125 - .25	A	11	11%	17%
Medium	.25 - .50	N	10	10%	27%
Coarse	.50 - 1	D	24	24%	50%
Very Coarse	1 - 2	S	3	3%	53%
Very Fine	2 - 4		2	2%	55%
Fine	4 - 5.7	G	3	3%	58%
Fine	5.7 - 8	R	1	1%	59%
Medium	8 - 11.3	A	7	7%	66%
Medium	11.3 - 16	V	9	9%	75%
Coarse	16 - 22.6	E	6	6%	81%
Coarse	22.6 - 32	L	8	8%	89%
Very Coarse	32 - 45	S	3	3%	92%
Very Coarse	45 - 64		5	5%	97%
Small	64 - 90	C	3	3%	100%
Small	90 - 128	O		0%	100%
Large	128 - 180	B		0%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	101	100%	100%

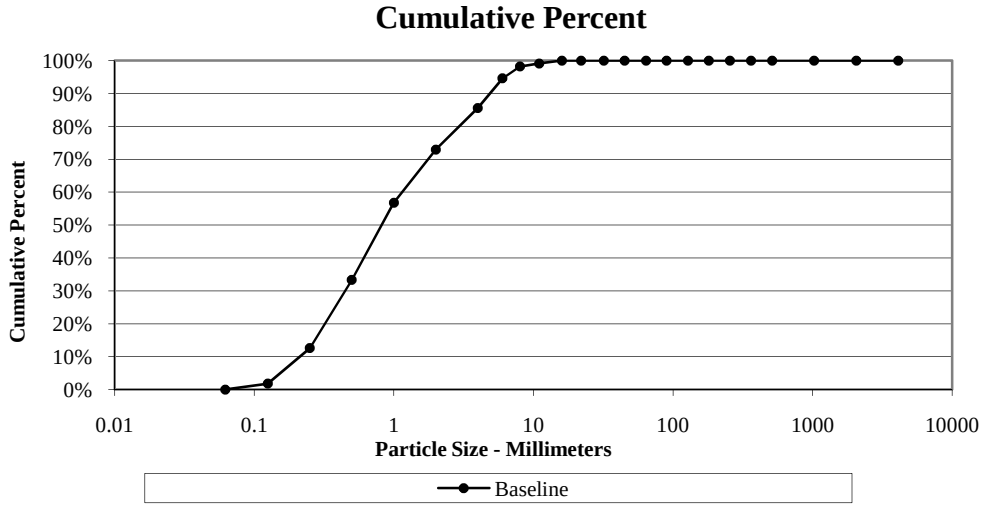
Summary Data	
D50	0.99
D84	25
D95	55

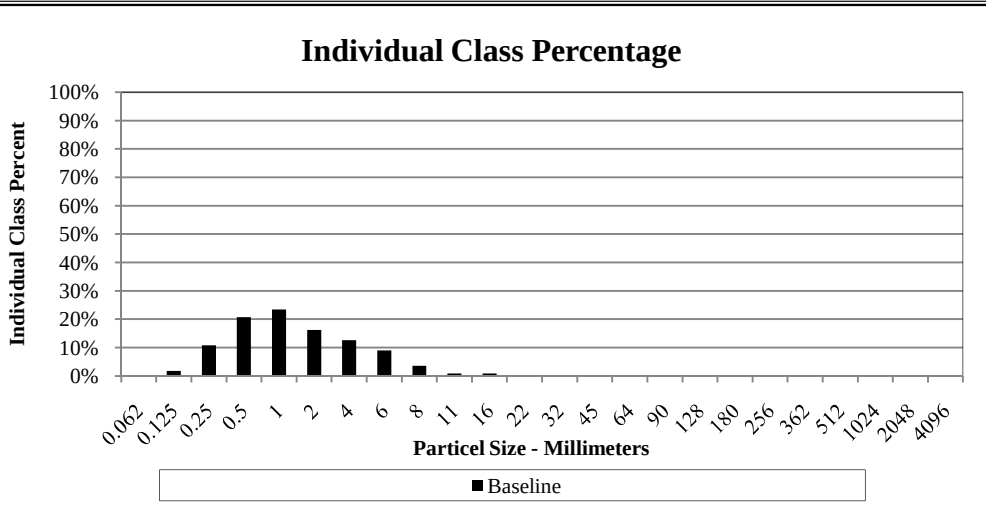




Cross-Section 7 Riffle - UT1 Baseline					
Particle	Millimeter	Material	Count	Item %	Cum %
Silt/Clay	< 0.062	S/C		0%	0%
Very Fine	.062 - .125	S	2	2%	2%
Fine	.125 - .25	A	12	11%	13%
Medium	.25 - .50	N	23	21%	33%
Coarse	.50 - 1	D	26	23%	57%
Very Coarse	1 - 2	S	18	16%	73%
Very Fine	2 - 4		14	13%	86%
Fine	4 - 5.7	G	10	9%	95%
Fine	5.7 - 8	R	4	4%	98%
Medium	8 - 11.3	A	1	1%	99%
Medium	11.3 - 16	V	1	1%	100%
Coarse	16 - 22.6	E		0%	100%
Coarse	22.6 - 32	L		0%	100%
Very Coarse	32 - 45	S		0%	100%
Very Coarse	45 - 64			0%	100%
Small	64 - 90	C		0%	100%
Small	90 - 128	O		0%	100%
Large	128 - 180	B		0%	100%
Large	180 - 256	L		0%	100%
Small	256 - 362	B		0%	100%
Small	362 - 512	L		0%	100%
Medium	512 - 1024	D		0%	100%
Lrg- Very Lrg	1024 - 2048	R		0%	100%
Bedrock	>2048	BDRK		0%	100%
		Total	111	100%	100%

Summary Data	
D50	0.82
D84	3.7
D95	6.2





APPENDIX C

Vegetation Data

Table 7. Vegetation Plot Data
Little Troublesome / Project No. 749

			Current Plot Data (MY0 2010)																							Annual Means		
			749-A-0001			749-A-0002			749-A-0003			749-A-0004			749-A-0005			749-A-0006			749-A-0007			749-A-0008			MY0 (2010)		
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**	**P-LS**	**P-all**	**T**
Betula nigra	river birch	Tree		4	4		3	3								8	8		5	5		5	5		10	10		35	35
Cornus amomum	silky dogwood	Shrub								1	1	2	2	2													2	3	3
Platanus occidentalis	American sycamore	Tree		1	1		2	2		6	6		3	3		2	2		5	5		9	9		1	1		29	29
Quercus spp.	oak	Shrub Tree		2	2		4	4		2	2		3	3		2	2		3	3		5	5		1	1		22	22
Quercus phellos	willow oak	Tree					2	2											1	1		1	1					4	4
Salix spp.	willow	Shrub Tree										6	6	6													6	6	6
Sambucus canadensis	common elderberry	Shrub Tree										1	1	1													1	1	1
Unknown		unknown		5	5		6	6		9	9		11	11		8	8		3	3		6	6		11	11		59	59
		Stem count	0	12	12	0	17	17	0	18	18	9	26	26	0	20	20	0	17	17	0	26	26	0	23	23	9	159	159
		size (ares)	1			1			1			1			1			1			1			1			8		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.20		
		Species count	0	4	4	0	5	5	0	4	4	3	6	6	0	4	4	0	5	5	0	5	5	0	4	4	3	8	8
		Stems per ACRE	0	485.6	485.6	0	688	688	0	728.4	728.4	364.2	1052	1052	0	809.4	809.4	0	688	688	0	1052	1052	0	930.8	930.8	45.53	804.3	804.3

P-LS = Planted Live Stakes T = Total stems, including planted and volunteer stems
P-all = Planted Stems, including live stakes

Table 8. Vegetation Plot Attribute Table
Little Troublesome / Project No. 749

Plot ID	Community Type	Planting Zone ID	Reach ID	CVS Level
749-A-0001	Piedmont Alluvial Forest	Bare Root	LTC	1
749-A-0002	Piedmont Alluvial Forest	Bare Root	LTC	1
749-A-0003	Piedmont Alluvial Forest	Bare Root	LTC	1
749-A-0004	Piedmont Alluvial Forest	Bare Root/Live Stake	LTC	1
749-A-0005	Piedmont Alluvial Forest	Bare Root	LTC	1
749-A-0006	Piedmont Alluvial Forest	Bare Root	UT1	1
749-A-0007	Piedmont Alluvial Forest	Bare Root	UT1	1
749-A-0008	Piedmont Alluvial Forest	Bare Root	UT1	1

Table 9. Planted Vegetation Little Troublesome / Project No. 749				
Planting Zone	**Species**	**Common Name**	**Size**	**Quantity**
Woody Trees and Shrubs				
Alluvial Forest (Wetland/Terrace)	*Aronia arbutifolia*	Red-chokeberry	bare root	200
Alluvial Forest (Wetland/Terrace)	*Celtis laevigata*	Sugarberry	bare root	900
Alluvial Forest (Wetland/Terrace)	*Diospyros virginiana*	Persimmon	bare root	200
Alluvial Forest (Wetland/Terrace)	*Viburnum nudum*	Possumhaw	bare root	200
Alluvial Forest (Wetland/Terrace) & Floodplain (Bankfull Bench)	*Betula nigra*	River Birch	bare root	1,000
Alluvial Forest (Wetland/Terrace) & Floodplain (Bankfull Bench)	*Platanus occidentalis*	American Sycamore	bare root	1,000
Alluvial Forest (Wetland/Terrace) & Floodplain (Bankfull Bench)	*Quercus michauxii*	Swamp Chestnut Oak	bare root	1,000
Alluvial Forest (Wetland/Terrace) & Floodplain (Bankfull Bench)	*Quercus phellos*	Willow Oak	bare root	500
Floodplain (Bankfull Bench)	*Quercus palustris*	Pin Oak	bare root	200
Stream Zone (Stream Banks)	*Cornus amomum*	Silky Dogwood	bare root	645
Stream Zone (Stream Banks)	*Salix nigra*	Black Willow	bare root	645
Stream Zone (Stream Banks)	*Salix sericea*	Silky Willow	bare root	645
Stream Zone (Stream Banks)	*Sambucus canadensis*	Elderberry	bare root	645
Permanent Seed Mix				
All Disturbed Areas	*Dactylis glomerata*	Orchard Grass	seed	1.5 lbs./acre
All Disturbed Areas	*Andropogon glomeratus*	Bluestem	seed	3.0 lbs./acre
All Disturbed Areas	*Elymus virginicus*	Virginia Wildrye	seed	3.0 lbs./acre
All Disturbed Areas	*Chasmanthium latifolium*	River Oats	seed	1.5 lbs./acre
All Disturbed Areas	*Dichanthelium clandestinum*	Deer-Tongue	seed	6.0 lbs./acre
All Disturbed Areas	*Panicum virgatum*	Switchgrass	seed	4.5 lbs./acre
All Disturbed Areas	*Carex vulipinoidea*	Fox Sedge	seed	3.0 lbs./acre

Vegetation Plot 1: 2/10/10 – Baseline

Vegetation Plot 2: 2/10/10 – Baseline

Vegetation Plot 3: 2/10/10 – Baseline

Vegetation Plot 4: 2/10/10 – Baseline

Vegetation Plot 5: 2/10/10 – Baseline

Vegetation Plot 6: 2/10/10 – Baseline

Vegetation Plot 7: 2/10/10 – Baseline

Vegetation Plot 8: 2/10/10 – Baseline

APPENDIX D

Stream Photos

Photo Point 1u: View looking upstream near Station 11+10. 2/23/10 – Baseline

Photo Point 1d: View looking downstream near Station 11+10. 2/23/10 – Baseline

Photo Point 2u: View looking upstream taken near Station 17+40. 2/23/10 – Baseline

Photo Point 2d: View looking downstream taken near Station 17+40. 2/23/10 – Baseline

Photo Point 3u: View looking upstream near Station 22+25. 2/23/10 – Baseline

Photo Point 3d: View looking downstream near Station 22+25. 2/23/10 – Baseline

Photo Point 4: View looking upstream near Station 24+00. 2/23/10 – Baseline

Photo Point 5: View looking downstream near Station 50+00. 2/23/10 – Baseline

Photo Point 6u: View looking upstream near Station 54+90. 2/23/10 – Baseline

Photo Point 6d: View looking downstream near Station 54+90. 2/23/10 – Baseline

Photo Point 7: View looking upstream tributary at confluence. 2/23/10 – Baseline

APPENDIX E

Current Condition Plan View

LITTLE TROUBLESOME CREEK
PROJECT #749 - MONITORING YEAR 00

ROCKINGHAM COUNTY, NORTH CAROLINA

LITTLE TROUBLESOME CREEK AND UT1

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

Ecosystem Enhancement PROGRAM

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

DATE: APRIL 2010
SCALE: 1" = 100'

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1