

Trout Cove Branch and Tributary Stream Restoration

NCEEP Project Number: 388

Monitoring Year 4

2008 Final Report



**Submitted to
North Carolina Ecosystem Enhancement Program
North Carolina Department of Environment and Natural Resources
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Trout Cove Branch and Tributary Stream Restoration 2008 Monitoring Report (MY 4)

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Trout Cove Branch and Tributary Stream Restoration Site are located in Clay County, North Carolina within the Hiwassee River Basin. The stream was designed and implemented under a North Carolina Clean Water Management Trust Fund (CWMTF) grant in June of 2002. Funds were transferred from the North Carolina Ecosystem Enhancement Program (NCEEP) to the CWMTF in 2004 and the project was first monitored by NCEEP in 2005 to service mitigation needs in the cataloging unit (CU). Based on available data, the actual restored length is approximately 3,120 linear feet for Trout Cove Branch and 888 linear feet for the unnamed tributary. As this was a CWMTF project of that time period, the designer did not resurvey the profile after construction and therefore a geomorphological as-built was not produced. The first geomorphological measurement point was generated in 2005 after transfer to NCEEP, with 2008 representing Monitoring Year 4 (MY 4).

Geomorphology and vegetation data collected in 2008 were repeated for those monitoring locations established in 2005. Two additional longitudinal profile monitoring reaches were established in 2008. Additionally, based on 2008 visual observations and data some cross section classification types (riffles and pools) were reclassified in MY 4 as compared to nomenclature utilized in previous monitoring reports.

Based on the available data, stream profiles have remained relatively stable between monitoring years. The two main issues on the project mainstem had to do with pool aggradation and structural piping. All other metrics indicated performance percentages averaging between 93 and 100%. The extent of pool aggradation is likely the result of historic low flows preventing pool scour and sediment transport. Approximately half the structures surveyed had some level of piping, but the visual observations and the profile indicate no significant or systemic loss of grade. While two aforementioned stability or structural parameters appear to have shifted substantially between MY 3 and MY 4, field observations and discussion with NCEEP made it apparent that these differences may have been more an artifact of data compilation discrepancies in prior submissions and differences in visual thresholds between performers as opposed to a sudden shift in project performance variables.

The MY 4 vegetation monitoring indicates that the project meets the established criteria for planted stem density, which is a minimum survival of 320 stems per acre at the end of Year 3 of the monitoring period. Average stem density for planted stems in MY 4 is approximately 428 stems per acre. However, when planted and natural stems are combined, the average stem density is 775 stems per acre, which is well above the minimum established criteria. While there were differences in data collection methodologies between years, the MY 4 indicates a 31% increase in total stem density since MY 3. Vegetation problem areas consist of bare bench and floodplain areas as well as isolated invasive/exotic species throughout the easement area. While the stem densities and vigor are good, the site does exhibit a few, small isolated bare bench areas and also has approximately 10 currently isolated patches of high threat invasive plant species that span the project extent.

2.0 PROJECT BACKGROUND

2.1 Project Objectives

Project objectives were not explicitly stated in a mitigation plan since the original funding sources and monitoring requirements were not established by the NCEEP for the Trout Cove Branch and Tributary restoration project. NCEEP will attempt to acquire a plan document from the Natural Resource Conservation Services or CWMTF that delineates the project objectives. If documentation is acquired, project objectives will be included in next year's report.

2.2 Project Structure, Restoration Type, and Approach

Prior to restoration, both Trout Cove Branch and the unnamed tributary had been impacted by past land uses including grazing, mowing, channelization, and other maintenance activities (HRWC). Stream reaches lacked riparian corridors and exhibited severe bank erosion with stream bank heights ranging from 1 to 6 feet. The streams were classified as unstable B5 stream types. Soil loss for Trout Cove Branch was estimated at 170 tons per year prior to restoration.

Stream restoration methods were based on natural channel design methodologies as proposed by Rosgen (1996). The approach included channel realignment to restore pattern, dimension, and profile in keeping with a reference condition. It also included installation of rock vanes and root wads for the vertical and lateral stability in this B type step pool channel. The completed restoration included approximately 4,008 linear feet of stream restoration and associated riparian re-vegetation (Table 1a & 1b).

Project Component or Reach ID	Existing Feet	Restoration Level	Approach	Footage or Acreage	Stationing	Buffer Acres	BMP Elements	Comment
Reach I	-	R	-	3,120 lf	0+00 - 31+20	8.6		Included riparian re-vegetation
Reach II -Trib	-	R	-	888 lf	0+00 - 08+88			Included riparian re-vegetation

- Information unavailable.

Table 1b. Component Summations Trout Cove Branch / Project No. 388							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	4,008						
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation							
HQ Preservation							
		0	0				
Totals	4,008	0	0	0	0	8.6	0
Non-Applicable							

2.3 Location and Setting

Trout Cove Branch and the unnamed tributary are located in Clay County, North Carolina within the Hiwassee River Basin. The project is located within Cataloging Unit (USGS 8-digit Hydrologic Unit) 06020002 and the NCDWQ sub-basin 04-05-01. The project site is located between the communities of Warne and Brasstown approximately 7 miles southeast of Murphy, North Carolina (Figure 1).

The headwaters of Trout Cove Branch and the unnamed tributary originate primarily northwest of the project site. The drainage area for Trout Cove Branch is 0.45 square-miles and consists of a mix of pasture, forest, and low-density development. The unnamed tributary has a drainage area of 0.09 square-miles with current land use including pasture and forest.

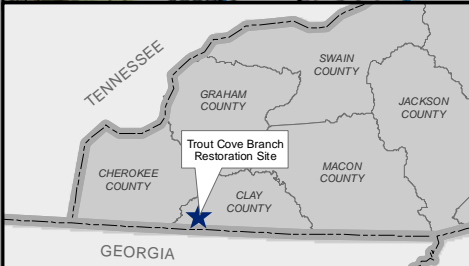
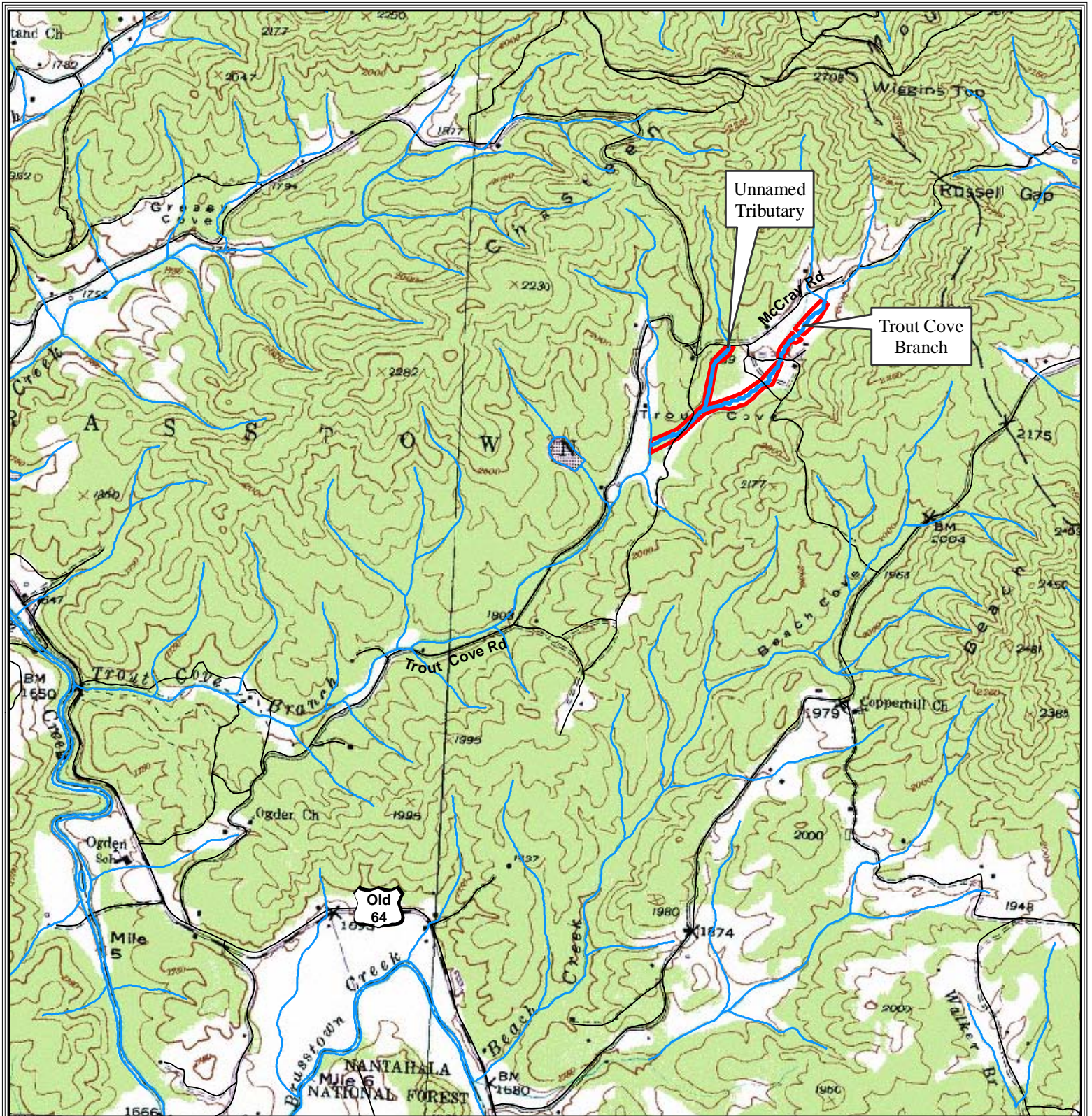
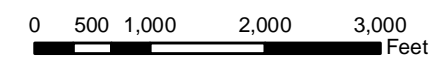


Figure 1 - Vicinity Map

Trout Cove Branch & Tributary
Restoration Site
Project No. 388

Clay County, North Carolina
May 2009



7.5 Minute Series Peachtree Quadrangle

Directions: From I-40, take US-74 West. Turn left onto NC-141 South. Turn left onto US-64 and turn right onto Old US-64 West. Continue through the Town of Brasstown and turn left onto Trout Cove Rd. Turn right onto McCray Rd. The site is located on the right.

2.4 Project History and Background

Trout Cove Branch was originally completed in 2002 as a CWMTF project. In 2004, NCEEP purchased the project to apply towards mitigation needs in the Hiwassee River Basin. Initial data collection efforts occurred in 2005 (MY 1) by the Biological and Agricultural Engineering Department at North Carolina State University with 2008 representing MY 4 of 5.

The project activity and reporting history from 2001 to 2008 are presented in Table 2. Project personnel and contact information for the design and monitoring components are presented in Table 3. Table 4 presents background information for the project site and the reference sites utilized for design.

Table 2. Project Activity and Reporting History Trout Cove Branch / Project No. 388		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	-	2001
Final Design - 90%	-	-
Permitting	N/A	Jan 2002
Construction	N/A	-
Temporary S&E Mix Applied to Project Area	N/A	-
Live Stakes and Bare Root Trees Planted	N/A	-
Project Completion	N/A	May 2002
Baseline / Year 1 Monitoring	2005	2006
Year 2 Monitoring	Nov 2006	Jan 2007
Year 3 Monitoring	Nov 2007	March 2008
Year 4 Monitoring	Nov 2008	May 2009
Year 5 Monitoring		

- Information unavailable.

N/A - Item does not apply.

Table 3. Project Contacts Trout Cove Branch / Project No. 388	
Designer	ARCADIS G&M
Primary Project Design POC	Unknown
Construction Contractor	C & H Services
Primary Project Design POC	Unknown
Planting Contractor	Unknown
Planting Contractor POC	Unknown
Seeding Contractor	Unknown
Seeding Contractor POC	Unknown
Seed Mix Sources	Unknown
Nursery Stock Suppliers	Unknown
Monitoring Performers (Y1) - 2005	North Carolina State University
Stream Monitoring POC	Unknown
Vegetation Monitoring POC	Unknown
Monitoring Performers (Y2) - 2006	Soil & Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 26714
Stream Monitoring POC	Jessica Regan (919) 846-5900
Vegetation Monitoring POC	Jessica Regan (919) 846-5900
Monitoring Performers (Y3) - 2007	Soil & Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 26714
Stream Monitoring POC	Jessica Regan (919) 846-5900
Vegetation Monitoring POC	Jessica Regan (919) 846-5900
Monitoring Performers (Y4) - 2008	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Steve Melton (828) 253-6856
Vegetation Monitoring POC	Sarah Marcinko (828) 253-6856
Monitoring Performers (Y5) - 2009	
Stream Monitoring POC	
Vegetation Monitoring POC	

Unknown - Information was unknown at time of report submittal.

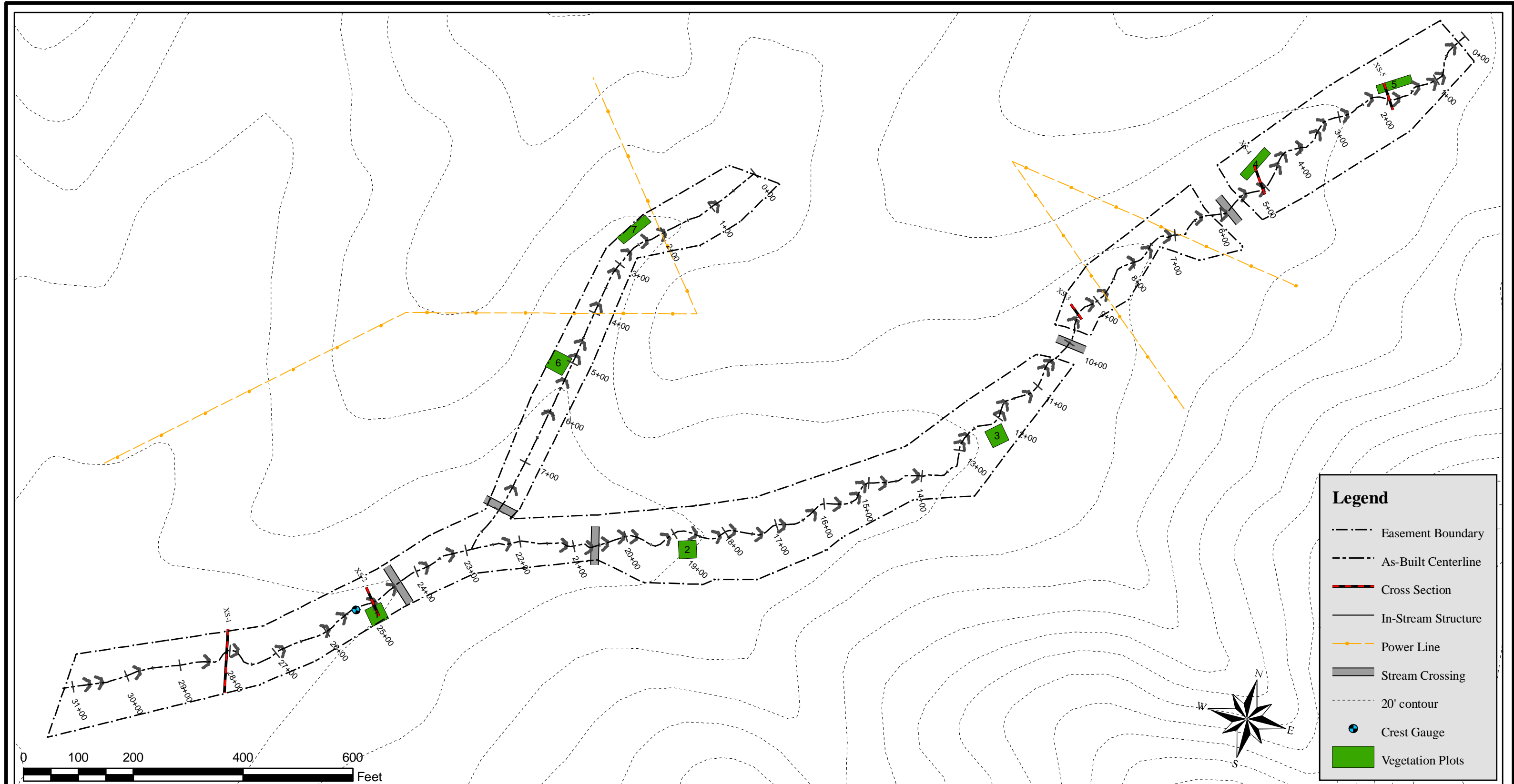
Table 4. Project Background Trout Cove Branch / Project No. 388	
Project County	Clay
Drainage Area	Trout Cove Branch - 0.453 square miles
	Unnamed Tributary - 0.094 square miles
Drainage Impervious Cover Estimate (%)	Trout Cove Branch <1%
	Unnamed Tributary 1.3%
Stream Order	Trout Cove Branch - 2 nd order
	Unnamed Tributary - 1 st order
Physiographic Region	Blue Ridge
Ecoregion	Southern Crystalline Ridges & Mountains (66d)
Rosgen Classification of Proposed Design	Trout Cove Branch - B4a
	Unnamed Tributary - B4a
Cowardin Classification	N/A
Dominant Soil Types	Trout Cove Branch - RhA, LoC, FrA
	Unnamed Tributary - RhA, LoC, FrA
Reference Site ID	Trout Cove Branch - Big Tuni Creek
	Unnamed Tributary - Big Tuni Creek
USGS HUC	Trout Cove Branch - 06020002
	Unnamed Tributary - 06020002
	Big Tuni Creek - 06020002
NCDWQ Sub-basin	Trout Cove Branch 04-05-01
	Unnamed Tributary 04-05-01
	Big Tuni Creek 1-21-5
NCDWQ Classification	Trout Cove Branch WS-IV
	Unnamed Tributary WS-IV
	Big Tuni Creek C; Tr, HQW
Any Portion of Project Segment 303d Listed	No
Any Portion of Project Segment Upstream of a 303d	No
Reasons for 303d Listing or Stressor	N/A
% of Project Easement Fenced	83%


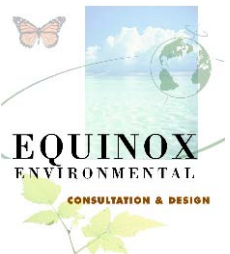
N/A - Item does not apply.

2.5 Monitoring Plan View

See Figure 2 – Monitoring Plan View.

Figure2: Monitoring Plan View



Prepared for	Project: Trout Cove Branch & Tributary Restoration	Notes: 1) Base Map from CAD file "TROUT 2007 MONT.AND PAPV.dwg" Provided by NCEEP	Prepared by
	Year 4 Monitoring Clay County, North Carolina		
	Sheet 1 of 1		
	Date	Project Number	
	May 2009	NCEEP # 388	

3.0 Project Condition and Monitoring Results

The MY 4 vegetation and stream data collection occurred between July and November 2008. The constraints and results of the vegetation and stream assessment are discussed in the following sections and referenced figures and tables.

3.1 Vegetation Assessment

Vegetation monitoring data collected on July 9, 2008 and August 19, 2008 meet the established success criteria for plant density, which is the minimum survival of 320 stems per acre at the end of Year 3 of the monitoring period. Average stem density for both planted and natural stems in MY 4 is approximately 775 stems per acre.

Using the overall site stem density of 590 stems per acre stated in the MY 3 report, there was an approximately 31% increase in stem density between MY 3 and 4. This increase is principally attributed to the accounting in MY 4 of natural stems and six additional species, some of which were previously observed, but not included in Table 5 (Appendix A) of the MY 3 final report. These species include American hop-hornbeam (*Ostrya virginiana*), Black gum (*Nyssa sylvatica*), Box elder (*Acer negundo* var. *negundo*), Black cherry (*Prunus serotina* var. *serotina*), Tulip poplar (*Liriodendron tulipifera*), and Black locust (*Robinia pseudoacacia*). In contrast, there were several species listed in the MY 3 report that were not relocated in MY 4 and therefore were labeled as missing. Furthermore, vegetation monitoring plots 3 and 7 had low total stem densities and do not meet the established success criteria as indicated in Appendix D – Integrated Current Condition Plan View. Nevertheless, if natural stems are excluded from average site stem density calculations, there are still approximately 428 planted stems per acre, which is a 34% higher stem density than the minimum requirement.

Due to differences in monitoring methodologies between MY 3 and MY 4 several assumptions and modifications were made in MY 4 in order to implement the CVS-EEP Level II sampling protocol (Lee *et al.* 2006). First, photo point locations (plot origins) were georeferenced, flagged, and marked with indelible marker. These points will be the location for reference photographs during subsequent monitoring years. Reference photographs were taken from the origin facing the opposite, diagonal plot corner. For each plot, x and y coordinates and other required data were recorded for all stems in accordance with the CVS-EEP Protocol. Second, several different colors of flagging tape were previously used to mark plant stems, but the significance of the colors were unknown. All previously flagged stems were assumed to be planted and were re-marked with pink flagging tape and any un-marked stems that occurred in the plot were flagged with blue and white tape, and are believed to be new recruits from the past monitoring year. Lastly, several trees of Tag alder (*Alnus serrulata*), Black locust, and Red maple (*Acer rubrum* var. *rubrum*) were previously flagged, but did not occur within the bounds of plots 3, 4, 5, and 6. Taxonomic nomenclature follows Weakley (2008).

See Appendix A for vegetation data tables.

3.1.1 Vegetation Problem Areas

Vegetation problem areas identified in MY 4 included bare bench and floodplain areas as well as isolated invasive/exotic species throughout the easement area (Appendix A – Table A6).

Vegetative growth at four stream bench locations is stunted and appears to be related to poor soil

substrate. The bare floodplain problem areas noted are the result of unauthorized mowing and livestock fencing extending into the easement area. An additional problem was identified during the final site visit in November 2008. Mary Jo Deck, one of the existing landowners, indicated that the electrical company recently attempted to mow the existing power line crossings along the upper portion of the project site. A small area was mowed within the easement area prior to the landowners stopping progress. This issue will need to be resolved to prevent potential impacts to the riparian vegetation in proximity to the existing power line crossings. The most significant change in vegetation problem areas between MY 4 and previous monitoring efforts is associated with the extent of invasive/exotic species noted in 2008. The MY 4 efforts documented isolated, dense patches of Japanese honeysuckle (*Lonicera japonica*) and Multiflora rose (*Rosa multiflora*). In particular, Japanese honeysuckle largely accounted for the vine strangulation reported in four of the seven monitoring plots. The species most negatively affected by vine strangulation were Silky dogwood (*Cornus amomum*) and Tag alder.

3.1.2 Vegetation Problem Area Plan View

See Appendix D – Integrated Current Condition Plan View.

3.2 Stream Assessment

3.2.1 Morphometric Criteria

Morphological assessments of Trout Cove Branch and the unnamed tributary reaches were conducted on October 6 through 7 and on November 23, 2008. Longitudinal profile monitoring was increased in 2008 to include a middle survey reach as well as profile measurements for the unnamed tributary. Longitudinal profiles were surveyed for 2,807 linear feet for Trout Cove Branch and 189 linear feet for the tributary. Due to drought conditions in 2008, water surface data collection was limited to the Lower and Middle reaches. Cross-sectional data were collected for the five previously established locations on Trout Cove Branch.

In general, the 2008 stream profiles for the Upper and Lower reaches remained similar to previous data collection efforts. It appears that previous monitoring reports combined pattern and profile measurements for the Upper and Lower survey reaches while data collected in 2008 were calculated for each individual reach.

Based on MY 4 visual observations and data, some cross section classification types (riffles and pools) were reclassified in MY 4 as compared to nomenclature utilized in previous monitoring reports. Cross section 2 previously classified as a riffle is clearly within the scour zone below a step and was reclassified as a pool. Cross sections 3 and 5 previously classified as pools are not influenced by the scour zone of a structure and therefore were reclassified as riffles.

While the calculated cross sectional values reported in 2008 appear variable from previous monitoring results, these differences are associated with different bankfull elevation identification between monitoring years and are not the result of systemic trends in bed movement. The cross sectional plot overlays illustrate that bed form has remained within the variability and sensitivity tolerances expected.

3.2.2 Hydrologic Criteria

Based on the on-site crest gauge reading and old wrack lines within the floodplain area, there appears to have been a bankfull event between MY 3 and the initial site visit in MY 4 (Table 5). The crest gauge was reset and checked during additional site visits and no additional bankfull events were documented during MY 4.

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
2006	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition	
2007	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition	
6/27/08	Unknown	Crest gauge & wrack lines	

3.2.3 Bank Stability Assessments

A comprehensive pre-construction BEHI was not performed on this site and therefore does not provide a pre-construction baseline for a meaningful comparison.

3.2.4 Current Condition Plan View

See Appendix D – Integrated Current Condition Plan View.

3.2.5 Stream Problem Areas

The majority of the stream problem areas identified during the MY 4 visual assessment had been identified during previous monitoring years. Problem areas were primarily associated with stressed or failing engineered structures, which have resulted in areas of bank erosion and stream aggradation. Table B1 in Appendix B provides categorical feature issues by station, the suspected cause, and denotes the number of a representative photo.

3.2.6 Numbered Issue Photos

See Appendix B for photo examples of stream problem areas.

3.2.7 Fixed Station Photos

See Appendix B for fixed photo station photos.

3.2.8 Stream Stability Assessment

A visual stability assessment was conducted for both the Trout Cove Branch and the tributary reach during the initial site assessments on June 27 and July 9, 2008, and again on October 8, 2008. The 2008 stream stability assessment for the unnamed tributary represents the first year of data collection for this reach. While the 2008 visual morphological stability Reach 1 table illustrate significant declines in performance for some feature categories (pools and vanes), this change from previous monitoring years may be associated with data compilation discrepancies in prior reports as well as visual assessment thresholds between monitoring performers rather than a sudden shift in stream stability. Additionally, historic low flow conditions have likely caused a

reduction in sediment transport resulting in increased deposition within the pool scour zones. Additionally, while these two feature categories appear to have significantly declined between years, profile measurements indicated no significant or systemic change in grade. Data collected during the visual stability assessment for Trout Cove Branch and the unnamed tributary reach are included in Table 6 below and in Appendix B - Table B.2. Table 6 provides the categorical stream feature summary for MY 2 through MY 4.

Table 6. Categorical Stream Feature Visual Stability Assessment Trout Cove Branch / Project No. 388 Trout Cove Branch / Reach 1						
Feature	Initial	MY-01	MY-02*	MY-03	MY-04	MY-05
A. Riffles	-	-	94%	99%	99%	
B. Pools	-	-	100%	100%	71%	
C. Thalweg	-	-	100%	100%	95%	
D. Meanders	-	-	100%	100%	97%	
E. Bed General	-	-	100%	98%	94%	
F. Bank Condition	-	-	100%	99%	96%	
G. Vanes	-	-	96%	95%	85%	
H. Wads	-	-	-	-	**	

*Percentages entered were based on the Table B1 from the 2006 report. There are discrepancies between Table X and Table B1 for the 2006 report.

**Data were not collected due to uncertainties in as-built numbers and limited remains of root wads.

- Information unavailable.

Table 6 Continued. Categorical Stream Feature Visual Stability Assessment Trout Cove Branch / Project No. 388 Unnamed Tributary / Reach 2						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	-	-	-	-	98%	
B. Pools	-	-	-	-	100%	
C. Thalweg	-	-	-	-	100%	
D. Meanders	-	-	-	-	100%	
E. Bed General	-	-	-	-	99%	
F. Bank Condition	-	-	-	-	100%	
G. Vanes	-	-	-	-	84%	
H. Wads	N/A	N/A	N/A	N/A	N/A	

- Information unavailable.

N/A - Information does not apply.

3.2.9 Quantitative Measures Summary

Quantitative stream monitoring data are summarized in Tables 7 and 8. As-built geomorphological data is unavailable because of non-standard deliverables associated with CWMTF practices prior to transfer. Additionally, the MY 1 longitudinal and cross sectional values were unavailable. NCEEP and Equinox will address the MY 1 calculations during the subsequent monitoring reports. The associated cross-sectional and longitudinal plots are located in Appendix B.

**Table 7. Baseline Morphology and Hydraulic Monitoring Summary
Trout Cove Branch / Project No. 388
Trout Cove Branch / Upstream from Confluence of Unnamed Tributary**

Parameter	USGS Gauge Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)	-	-	108.0	-	-	-	5.2	22.5	10.4	24.9	34.1	29.5	-	-	14.8	-	-	-
Floodprone Width (ft)	-	-	-	-	-	-	10.6	30.0	19.4	40.0	50.0	45.0	20.7	32.6	26.6	-	-	-
BF Cross Sectional Area (ft ²)	-	-	498.0	-	-	-	4.5	13.9	7.8	34.3	42.4	38.4	-	-	9.7	-	-	-
BF Mean Depth (ft)	-	-	4.6	-	-	-	0.6	0.9	0.7	1.2	1.4	1.3	-	-	0.6	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	0.8	2.9	1.8	1.8	2.0	1.9	1.1	1.2	1.1	-	-	-
Width/Depth Ratio	-	-	23.5	-	-	-	6.0	36.4	14.0	19.2	26.2	22.7	-	-	22.7	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	1.0	2.9	1.9	1.4	1.7	1.6	1.4	2.2	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	1.0	3.5	1.8	-	-	1.0	-	-	1.0	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	-	-	-	-	-	-	60.0	135.0	111.3	66.0	87.0	76.5	33.4	44.1	39.5	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	114.0	860.0	491.0	54.0	147.0	84.3	26.6	74.0	50.3	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	1100.0	1525.0	1292.0	195.0	225.0	210.0	97.7	112.5	105.1	-	-	-
Meander Width Ratio	-	-	-	-	-	-	5.7	12.9	10.7	2.2	2.9	2.6	2.2	2.9	2.6	-	-	-
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	-	-	0.018	0.206	0.061	0.023	0.049	0.041	0.012	0.023	0.023	-	-	-
Pool Length (ft)	-	-	-	-	-	-	1.9	20.1	9.6	2.9	23.6	11.8	1.5	12.1	6.1	-	-	-
Pool Spacing (ft)	-	-	-	-	-	-	19.7	186.7	86.4	10.8	118.1	59.1	4.6	53.2	28.9	-	-	-
Substrate																		
d50 (mm)	-			-			0.3 mm			20.0 mm			-			-		
d84 (mm)	-			-			33.0 mm			120.0 mm			-			-		
Additional Reach Parameters																		
Valley Length (ft)	-			-			-			-			-			-		
Channel Length (ft)	-			-			-			-			-			-		
Sinuosity	-			-			1.09			1.14			1.03			-		
Water Surface Slope (ft/ft)	-			-			0.037			0.044			0.023			-		
BF Slope (ft/ft)	-			-			0.037			0.044			0.023			-		
Rosgen Classification	-			-			B5			B4a			B5			-		
Habitat Index	N/A			N/A			-			-			N/A			-		
Macrobenthos	N/A			N/A			-			-			N/A			-		

- Information unavailable.

N/A - Information does not apply.

**Table 7 Continued. Baseline Morphology and Hydraulic Monitoring Summary
Trout Cove Branch / Project No. 388
Trout Cove Branch / Downstream from Confluence of Unnamed Tributary**

Parameter Dimension	USGS Gauge Data			Regional Curve			Pre-Existing			Project Reference			Design			As-built		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)	-	-	108.0	-	-	-	5.2	22.5	10.4	24.9	34.1	29.5	-	-	15.2	-	-	-
Floodprone Width (ft)	-	-	-	-	-	-	10.6	30.0	19.4	40.0	50.0	45.0	21.3	33.4	27.3	-	-	-
BF Cross Sectional Area (ft ²)	-	-	498.0	-	-	-	4.5	13.9	7.8	34.3	42.4	38.4	-	-	10.2	-	-	-
BF Mean Depth (ft)	-	-	4.6	-	-	-	0.62	0.86	0.74	1.2	1.4	1.3	-	-	0.7	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	0.8	2.9	1.8	1.8	2.0	1.9	1.8	2.0	1.9	-	-	-
Width/Depth Ratio	-	-	23.5	-	-	-	6.0	36.4	14.0	19.2	26.2	22.7	-	-	21.7	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	1.0	2.9	1.9	1.4	1.7	1.6	1.4	2.2	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	1.0	3.5	1.8	-	-	1.0	-	-	1.0	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	-	-	-	-	-	-	60.0	135.0	111.3	66.0	87.0	76.5	32.6	42.9	38.5	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	114.0	860.0	491.0	54.0	147.0	84.3	27.4	76.0	51.9	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	1100.0	1525.0	1292.0	195.0	225.0	210.0	100.3	115.5	107.9	-	-	-
Meander Width Ratio	-	-	-	-	-	-	5.7	12.9	10.7	2.2	2.9	2.6	2.2	2.9	2.6	-	-	-
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	-	-	0.018	0.206	0.061	0.023	0.049	0.041	0.019	0.046	0.039	-	-	-
Pool Length (ft)	-	-	-	-	-	-	1.9	20.1	9.6	2.7	23.1	11.2	1.3	10.4	5.2	-	-	-
Pool Spacing (ft)	-	-	-	-	-	-	19.7	186.7	86.4	10.8	118.1	59.1	4.4	51.8	28.1	-	-	-
Substrate																		
d50 (mm)	-	-	-	-	-	-	0.3 mm			20.0 mm			-			-		
d84 (mm)	-	-	-	-	-	-	33.0 mm			120.0 mm			-			-		
Additional Reach Parameters																		
Valley Length (ft)	-	-	-	-	-	-	-			-			-			-		
Channel Length (ft)	-	-	-	-	-	-	-			-			-			-		
Sinuosity	-	-	-	-	-	-	1.07			1.14			1.1			-		
Water Surface Slope (ft/ft)	-	-	-	-	-	-	0.041			0.044			0.039			-		
BF Slope (ft/ft)	-	-	-	-	-	-	0.041			0.044			0.039			-		
Rosgen Classification	-	-	-	-	-	-	B5			B4a			B5			-		
Habitat Index	-	-	-	-	-	-	N/A			-			N/A			-		
Macrobenthos	-	-	-	-	-	-	N/A			-			N/A			-		

- Information unavailable.

N/A - Information does not apply.

**Table 7 Continued. Baseline Morphology and Hydraulic Monitoring Summary
Trout Cove Branch / Project No. 388
Unnamed Tributary**

Parameter	USGS Gauge Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)	-	-	108	-	-	-	2.6	7.5	5.3	24.9	34.1	29.5	-	-	7.0	-	-	-
Floodprone Width (ft)	-	-	-	-	-	-	5.2	25.0	15.6	40.0	50.0	45.0	9.8	15.4	12.6	-	-	-
BF Cross Sectional Area (ft ²)	-	-	498.0	-	-	-	2.2	3.3	2.9	34.3	42.4	38.4	-	-	3.2	-	-	-
BF Mean Depth (ft)	-	-	4.6	-	-	-	0.4	0.9	0.6	1.2	1.4	1.3	-	-	0.5	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	1.0	2.0	1.4	1.8	2.0	1.9	0.7	0.8	0.7	-	-	-
Width/Depth Ratio	-	-	23.5	-	-	-	3.0	17.0	9.5	19.2	26.2	22.7	-	-	15.0	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	1.0	4.8	3.0	1.4	1.7	1.6	1.4	2.2	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	1.0	1.0	1.5	1.2	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	26.0	66.0	87.0	76.5	-	-	26.0	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	170.0	54.0	147.0	84.3	-	-	170.0	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	195.0	225.0	210.0	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	4.9	2.2	2.9	2.6	-	-	3.7	-	-	-
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	-	-	0.033	0.077	0.052	0.023	0.049	0.041	0.024	0.058	0.049	-	-	-
Pool Length (ft)	-	-	-	-	-	-	17.9	29.2	23.5	2.7	23.1	11.2	0.7	5.6	2.8	-	-	-
Pool Spacing (ft)	-	-	-	-	-	-	76.6	253.7	165.1	108	118.1	59.1	2.1	24.5	13.3	-	-	-
Substrate																		
d50 (mm)	-	-	-	-	-	-	0.3 mm			20.0 mm			-			-		
d84 (mm)	-	-	-	-	-	-	13.0 mm			120.0 mm			-			-		
Additional Reach Parameters																		
Valley Length (ft)	-	-	-	-	-	-	-			-			-			-		
Channel Length (ft)	-	-	-	-	-	-	-			-			-			-		
Sinuosity	-	-	-	-	-	-	1.06			1.14			1.04			-		
Water Surface Slope (ft/ft)	-	-	-	-	-	-	0.048			0.044			0.049			-		
BF Slope (ft/ft)	-	-	-	-	-	-	0.048			0.044			0.049			-		
Rosgen Classification	-	-	-	-	-	-	C5/E5			B4a			B4a			-		
Habitat Index	N/A			N/A			-			-			N/A			-		
Macrobenthos	N/A			N/A			-			-			N/A			-		

- Information unavailable.

N/A - Information does not apply.

**Table 8. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Lower Reach (794 feet)**

Parameter	Cross Section 1					Cross Section 2				
	Pool					Riffle				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	-	15.69	10.96	11.60		-	9.60	6.79	12.50	
Floodprone Width (ft)	-	54.22	32.41	30.70		-	50.00	28.13	45.50	
BF Cross Sectional Area (ft ²)	-	11.21	17.63	20.70		-	10.02	8.78	12.40	
BF Mean Depth (ft)	-	0.71	1.61	1.80		-	1.04	1.29	1.00	
BF Max Depth (ft)	-	2.35	2.22	2.70		-	2.30	2.19	2.80	
Width/Depth Ratio	-	22.10	6.81	6.50		-	9.23	5.26	12.60	
Entrenchment Ratio	-	3.46	2.96	2.60		-	5.21	4.15	3.60	
Bank Height Ratio	-	1.04	1.08	1.00		-	1.20	1.26	1.00	
Wetted Perimeter(ft)	-	16.93	12.77	13.70		-	10.88	8.64	15.30	
Hydraulic Radius (ft)	-	0.66	1.38	1.50		-	0.92	1.02	0.80	
Substrate										
d50 (mm)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
d84 (mm)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	

* Not calculated due to unknown as-built elevations.

N/A - Does not apply to this project.

**Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Lower Reach (794 feet)**

Parameter	MY-01 (2005)			*MY-02 (2006)			*MY-03 (2007)			**MY-04 (2008)			MY-05 (2009)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	-	-	-	24.28	84.50	45.88	22.06	80.88	47.35	21.79	65.15	55.31			
Radius of Curvature (ft)	-	-	-	19.03	38.59	28.26	20.95	35.37	28.49	20.32	21.15	20.72			
Meander Wavelength (ft)	-	-	-	87.75	135.06	103.88	57.00	124.64	90.36	69.93	123.80	111.14			
Meander Width Ratio	-	-	-	3.93	6.05	4.65	3.25	11.91	6.97	4.42	4.77	4.60			
Profile															
Riffle Length (ft)	-	-	-	-	-	-	4.69	7.98	5.98	3.30	69.80	34.40			
***Riffle Slope (ft/ft)	-	-	-	0.087	0.073	0.041	0.024	0.097	0.066	0.023	0.052	0.034			
Pool Length (ft)	-	-	-	4.34	30.09	14.39	4.75	22.33	11.98	7.20	35.90	18.90			
Pool Spacing (ft)	-	-	-	11.29	105.54	52.21	29.94	87.91	57.62	12.20	90.80	53.40			
Additional Reach Parameters															
Valley Length (ft)		-			1746			1746			736				
Channel Length (ft)		-			1876			1876			792				
Sinuosity		-			1.07			1.07			1.08				
Water Surface Slope (ft/ft)		-			0.041			0.041			0.026				
BF Slope (ft/ft)		-			0.041			0.041			0.027				
Rosgen Classification		-			C4b			C4b			C4b				
****Habitat Index		-			N/A			N/A			N/A				
****Macrobenthos		-			N/A			N/A			N/A				

* Calculations appear to be based on combined data sets from Lower and Upper Reaches.

** Calculations derived from Lower Reach data set.

*** The minimum riffle slope data reported for MY 1 is greater than the max and median numbers reported.

**** Inclusion is project specific and determined primarily by as-built monitoring plan/success criteria.

- Information unavailable.

N/A - Does not apply to this project.

**Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Middle Reach (1,030 feet)**

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25.09	67.64	43.51			
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.09	43.34	23.99			
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	80.41	130.17	95.24			
Meander Width Ratio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Profile															
Riffle Length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.80	70.50	31.00			
Riffle Slope (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.030	0.044	0.038			
Pool Length (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.30	23.30	15.10			
Pool Spacing (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	23.40	88.90	46.00			
Additional Reach Parameters															
Valley Length (ft)		N/A			N/A			N/A			919				
Channel Length (ft)		N/A			N/A			N/A			1030				
Sinuosity		N/A			N/A			N/A			1.12				
Water Surface Slope (ft/ft)		N/A			N/A			N/A			0.036				
BF Slope (ft/ft)		N/A			N/A			N/A			0.037				
Rosgen Classification		N/A			N/A			N/A			C4b				
*Habitat Index		N/A			N/A			N/A			N/A				
*Macrobenthos		N/A			N/A			N/A			N/A				

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

N/A - Does not apply to this project.

Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Upper Reach (983 feet)

Parameter	Cross Section 3					Cross Section 4					Cross Section 5				
	Riffle					Riffle					Riffle				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	-	18.63	15.52	12.60		-	23.33	21.64	11.50		-	12.47	11.13	7.00	
Floodprone Width (ft)	-	50.00	32.93	>27.3		-	50.00	48.58	36.40		-	50.00	39.88	17.30	
BF Cross Sectional Area (ft ²)	-	10.10	7.16	3.60		-	10.30	11.35	4.20		-	10.07	8.85	3.90	
BF Mean Depth (ft)	-	0.54	0.46	0.30		-	0.46	0.52	0.40		-	0.81	0.80	0.60	
BF Max Depth (ft)	-	1.48	1.23	1.10		-	1.22	1.43	1.20		-	1.81	1.80	1.20	
Width/Depth Ratio	-	34.50	33.74	44.60		-	48.54	41.62	31.00		-	15.40	13.91	12.40	
Entrenchment Ratio	-	2.68	2.12	>2.2		-	2.24	2.25	3.20		-	4.01	3.58	2.50	
Bank Height Ratio	-	1.54	1.59	1.00		-	1.06	1.08	1.00		-	1.49	1.52	1.00	
Wetted Perimeter(ft)	-	19.35	15.89	13.30		-	22.73	22.07	12.40		-	13.57	12.19	8.00	
Hydraulic Radius (ft)	-	0.52	0.45	0.30		-	0.45	0.51	0.30		-	0.74	0.73	0.50	
Substrate															
d50 (mm)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	
d84 (mm)	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	

* Not calculated due to unknown as-built elevations.

N/A - Does not apply to this project.

**Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Upper Reach (983 feet)**

Parameter	MY-01 (2005)			*MY-02 (2006)			*MY-03 (2007)			**MY-04 (2008)			MY-05 (2009)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	-	-	-	24.28	84.50	45.88	22.06	80.88	47.35	12.55	60.16	36.60			
Radius of Curvature (ft)	-	-	-	19.03	38.59	28.26	20.95	35.37	28.49	19.87	57.66	31.58			
Meander Wavelength (ft)	-	-	-	87.75	135.06	103.88	57.00	124.64	90.36	71.99	110.81	98.98			
Meander Width Ratio	-	-	-	3.93	6.05	4.65	3.25	11.91	6.97	2.90	5.23	3.18			
Profile															
Riffle Length (ft)	-	-	-	-	-	-	4.69	7.98	5.98	13.20	63.30	34.80			
Riffle Slope (ft/ft)	-	-	-	0.087	0.073	0.041	0.020	0.096	0.065	**	*****	*****			
Pool Length (ft)	-	-	-	4.34	30.09	14.39	4.75	22.33	11.98	5.90	14.90	10.60			
Pool Spacing (ft)	-	-	-	11.29	105.54	52.21	29.94	87.91	57.62	22.20	77.40	45.50			
Additional Reach Parameters															
Valley Length (ft)		-			1746			1746			881				
Channel Length (ft)		-			1876			1876			982				
Sinuosity		-			1.07			1.07			1.11				
Water Surface Slope (ft/ft)		-			0.041			0.041			*****				
BF Slope (ft/ft)		-			0.041			0.041			0.042				
Rosgen Classification		-			C4b			C4b			C4b				
****Habitat Index		-			N/A			N/A			N/A				
****Macrobenthos		-			N/A			N/A			N/A				

* Calculations appear to be based on combined data sets from Lower and Upper Reaches.

** Calculations derived from Upper Reach data set.

*** The minimum riffle slope data reported for MY 1 is greater than the max and median numbers reported.

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

***** No water in channel at time of survey preventing calculations.

- Information unavailable.

**Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Trout Cove / Project No. 388
Trout Cove Branch / Unnamed Tributary (189 feet)**

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	3.22	5.79	4.53			
Radius of Curvature (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	3.84	13.36	9.42			
Meander Wavelength (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	14.00	36.33	30.42			
Meander Width Ratio	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Profile															
Riffle Length (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	31.50	62.80	42.90			
Riffle Slope (ft/ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	*	*	*			
Pool Length (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	9.20	19.90	14.10			
Pool Spacing (ft)	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	40.70	77.00	55.00			
Additional Reach Parameters															
Valley Length (ft)		-			N/A			N/A			183				
Channel Length (ft)		-			N/A			N/A			189				
Sinuosity		-			N/A			N/A			1.03				
Water Surface Slope (ft/ft)		-			N/A			N/A			*				
BF Slope (ft/ft)		-			N/A			N/A			0.030				
Rosgen Classification		-			N/A			N/A			N/A				
**Habitat Index		-			N/A			N/A			N/A				
**Macrobenthos		-			N/A			N/A			N/A				

* No water in channel at time of survey preventing calculations.

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

N/A - Does not apply to this project.

3.3 Wetland Assessment

There was no wetland monitoring components for the Trout Cove Branch Restoration Site.

4.0 Methodology

The stream monitoring methodologies utilized in 2008 were intended to replicate those employed during previous monitoring years and are based on standard guidance and procedures documents (Rosgen 1996 and USACOE 2003). Vegetation monitoring followed the standard CVS-EEP Protocol for Recording Vegetation, Level II (Lee *et al.* 2006). Any deviations from MY 3 vegetation monitoring methodologies are stated in Section 3.1, Vegetation Assessment.

5.0 References

HRWC. Hiwassee River Watershed Coalition, Inc. Brasstown Creek Watershed Restoration Projects. <http://www.hrwc.net/troutcove.htm>.

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Appendix A
Trout Cove Branch
Vegetation Data

Table A1. Vegetation Metadata Trout Cove Branch / Project No. 388	
Report prepared by	Sarah Marcinko
Date prepared	11/18/2008 9:39
Database name	cvs-eep-entrytool-v2.2.6.mdb
Database location	Y:\Equinox projects\EEP Veg_monitoring\cvs-eep-entrytool-v2.2.6
Computer name	D16TNK71
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	This worksheet, which is a summary of the project and the project data.
Proj. planted	The number of living planted stems per acre, excluding live stakes.
Proj. total stems	The number of total stems per acre, including live stakes and natural stems.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
Vigor by species	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 species	Damage values tallied by type for each species.
Damage by plot	Damage values tallied by type for each plot.
All stems by plot and species	Count of total living stems of each species; dead and missing stems are excluded.
PROJECT SUMMARY	
Project code	388
Project name	Trout Cove
Description	Trout Cove Stream Restoration
River basin	Hiwassee
Length (ft)	N/A
Stream-to-edge width (ft)	N/A
Area (sq m)	N/A
Required plots (calculated)	N/A
Sampled plots	7

Table A2. Vegetation Vigor by Species Trout Cove Branch / Project No. 388								
	Species	4	3	2	1	0	Missing	Unknown
	<i>Alnus serrulata</i>	13	6				4	
	<i>Betula nigra</i>	4	4					
	<i>Cephalanthus occidentalis</i>	2	1					
	<i>Clethra alnifolia</i>	1						
	<i>Cornus amomum</i>	13	7	1	1		1	
	<i>Salix nigra</i>	2	5	2			2	
	<i>Liriodendron tulipifera</i>	2						
	<i>Platanus occidentalis</i> var. <i>occidentalis</i>	3	1					
	<i>Acer rubrum</i> var. <i>rubrum</i>	4	2					
Total	9	44	26	3	1	0	7	0

Table A3. Vegetation Damage by Species Trout Cove Branch / Project No. 388							
	Species	All damage categories	No damage	Other damage	Diseased	Insects	Vine strangulation
	<i>Acer rubrum var. rubrum</i>	6	2				4
	<i>Alnus serrulata</i>	23	17	1		2	3
	<i>Betula nigra</i>	8					8
	<i>Cephalanthus occidentalis</i>	3				1	2
	<i>Clethra alnifolia</i>	1	1				
	<i>Cornus amomum</i>	23	9	1	1	3	9
	<i>Liriodendron tulipifera</i>	2	2				
	<i>Platanus occidentalis var. occidentalis</i>	4	1			1	2
	<i>Salix nigra</i>	11	3				8
Total	9	81	35	2	1	7	36

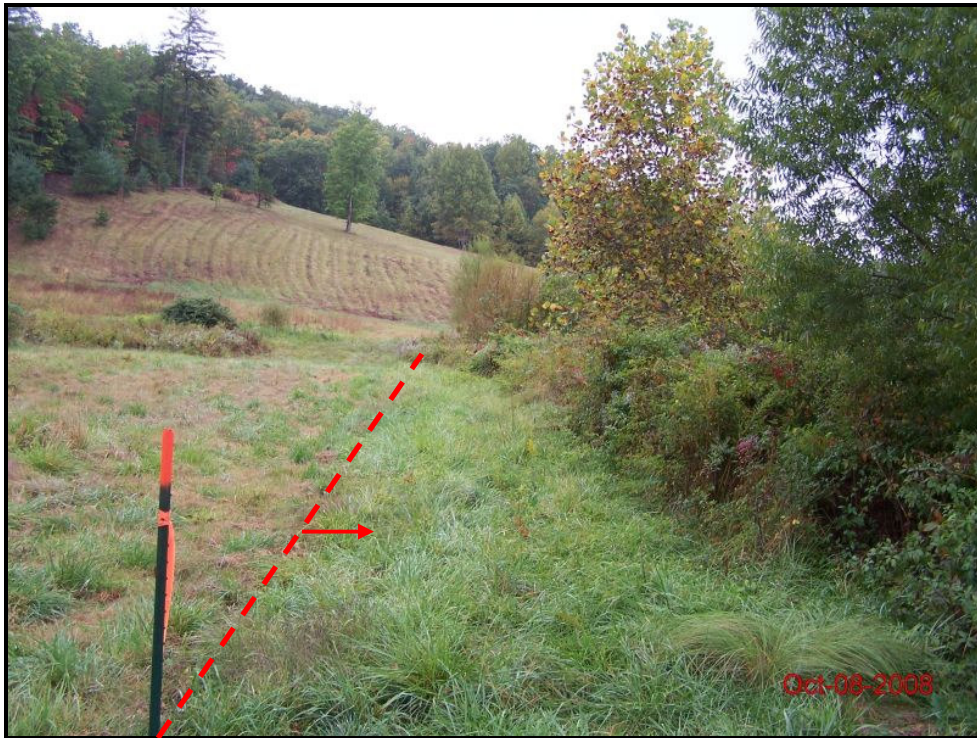
Table A4. Vegetation Damage by Plot Trout Cove Branch / Project No. 388							
	Plot	All damage categories	No damage	Other damage	Diseased	Insects	Vine strangulation
	388-01-0006	11					11
	388-01-0007	7					7
	TC-01-0001	9	8			1	
	TC-01-0002	22	7				15
	TC-01-0003	6	4				2
	TC-01-0004	8	7		1		
	TC-01-0005	21	12	2		6	1
Total	7	81	35	2	1	7	36

Table A5. Stem Count by Plot and Species Trout Cove Branch / Project No. 388											
	Species	Total stems	No. plots	Avg. no. stems	388-01-0006	388-01-0007	TC-01-0001	TC-01-0002	TC-01-0003	TC-01-0004	TC-01-0005
	<i>Alnus serrulata</i>	35	4	8.75			14	3		5	13
	<i>Betula nigra</i>	8	2	4	4	4					
	<i>Cephalanthus occidentalis</i>	6	4	1.5	1		3		1		1
	<i>Clethra alnifolia</i>	3	2	1.5			1			2	
	<i>Cornus amomum</i>	33	6	5.5	2		4	5	2	6	14
	<i>Nyssa sylvatica</i>	1	1	1	1						
	<i>Ostrya virginiana</i>	1	1	1			1				
	<i>Robinia pseudoacacia</i>	1	1	1	1						
	<i>Salix nigra</i>	9	4	2.25	2	2		4		1	
	<i>Liriodendron tulipifera</i>	4	2	2						3	1
	<i>Platanus occidentalis</i> var. <i>occidentalis</i>	4	4	1		1	1	1		1	
	<i>Prunus serotina</i> var. <i>serotina</i>	2	1	2			2				
	<i>Acer negundo</i>	1	1	1							1
	<i>Acer rubrum</i> var. <i>rubrum</i>	26	5	5.2	2		19	2		2	1
Total	14	134	14		13	7	45	15	3	20	31

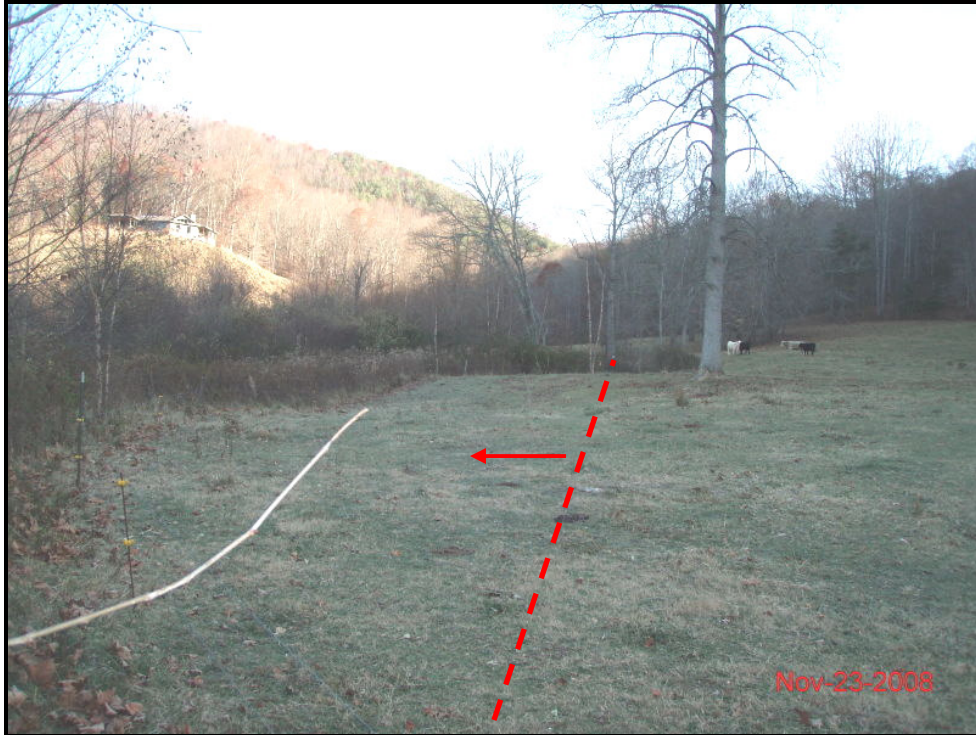
Table A6. Vegetation Problem Areas Trout Cove Branch / Project No. 388			
Feature Issue	Station Numbers	Suspected Cause	Photo Number
Bare Bench	See CCPV	Poor soil substrate	VPA 1
	See CCPV	Poor soil substrate	
Mowed Floodplain	See CCPV	Unauthorized mowing	VPA 2
	See CCPV	Unauthorized mowing	
Livestock Encroachment	See CCPV	Exclusion fence within easement boundary	VPA 3
Invasive / Exotic Populations	See CCPV	<i>Rosa multiflora</i> : On site seed source	VPA 4
	See CCPV	<i>Lonicera japonica</i> : On site seed source	
	See CCPV	<i>Ligustrum sp</i> : On site seed source	



Vegetation Problem Area (VPA 1) – Bare Bench
Monitoring Year 4 – July 9, 2008



Vegetation Problem Area (VPA 2) – Mowed Floodplain
Monitoring Year 4 – October 8, 2008



Vegetation Problem Area (VPA 3) – Livestock Encroachment
Monitoring Year 4 – November 23, 2008



Vegetation Problem Area (VPA 4) – *Lonicera japonica*
Monitoring Year 4 – October 8, 2008



Vegetation Monitoring Plot #1
Monitoring Year 4 – August 19, 2008



Vegetation Monitoring Plot #2
Monitoring Year 4 – July 9, 2008



Vegetation Monitoring Plot #3
Monitoring Year 4 – July 9, 2008



Vegetation Monitoring Plot #4
Monitoring Year 4 – August 19, 2008



Vegetation Monitoring Plot #5
Monitoring Year 4 – August 19, 2008



Vegetation Monitoring Plot #6
Monitoring Year 4 – August 19, 2008



Vegetation Monitoring Plot #7
Monitoring Year 4 – August 19, 2008

Appendix B
Trout Cove Branch
Geomorphologic Data

Table B1. Stream Problem Areas Trout Cove Branch / Project No. 388 Trout Cove Branch / Reach 1 (3,120 feet)			
Feature Issue	Station Numbers	Suspected Cause	Photo Number
Aggradation	0+36	Minimal flow to transport sediment from upstream source	SPA 1
	0+95	Stressed structure preventing downstream pool scour	
	1+10	Minimal flow to transport sediment from upstream source	
	1+45	Failed structure preventing downstream pool scour	
	1+90	Minimal flow to transport sediment from upstream source	
	2+40	Stressed structure preventing downstream pool scour	
	2+95	Stressed structure preventing downstream pool scour	
	3+35	Failed structure preventing downstream pool scour	
	3+55	Failed structure preventing downstream pool scour	
	4+05	Minimal flow to transport sediment from upstream source	
	4+35	Minimal flow to transport sediment from upstream source	
	4+60	Failed structure preventing downstream pool scour	
	5+10	Stressed structure preventing downstream pool scour	
	5+50	Minimal flow to transport sediment from upstream source	
	6+00	Minimal flow to transport sediment from upstream source	
	11+25	Stressed structure preventing downstream pool scour	
	16+30	Failed structure preventing downstream pool scour	
	17+45	Stressed structure preventing downstream pool scour	
	21+20	Stressed structure preventing downstream pool scour	
	22+26	Stressed structure preventing downstream pool scour	
	23+10	Failed structure preventing sediment transport	
	23+30	Failed structure preventing downstream pool scour	
	23+82	Stressed structure preventing downstream pool scour	
	24+55	Stressed structure preventing downstream pool scour	
	25+60	Failed structure preventing downstream pool scour	
	26+03	Stressed structure preventing downstream pool scour	
	26+98	Stressed structure preventing downstream pool scour	
	28+55	Failed structure preventing downstream pool scour	
Bank Scour	1+05	Thalweg migration associated with stressed structure	N/A
	1+50	Thalweg migration associated with failing structure	
	8+18	Undercutting causing bank to slump	
	9+60	Thalweg migration associated with stressed structure	
	13+37	Undercutting causing bank to slump	
	15+20	Thalweg migration associated with stressed structure	
	28+10	Thalweg migration associated with stressed structure	
Engineered Structures	0+85	Structure piping	SPA 2 SPA 3 SPA 4
	1+36	Structure piping	
	2+30	Structure piping	
	2+85	Structure piping	
	3+30	Structure piping	
	3+50	Structure piping	
	4+54	Structure piping	
	5+05	Structure piping	
	8+80	Structure piping	
	9+55	Structure piping	
	11+20	Structure piping	
	12+68	Structure piping	
	14+70	Structure piping	
	15+10	Structure piping	
	15+30	Structure piping	
	16+25	Structure piping	
	16+85	Structure piping	
	17+40	Structure piping	
	17+83	Structure piping	
	19+13	Structure piping	
	19+80	Structure piping	
	20+04	Structure piping	
	21+14	Structure piping	
	22+20	Structure piping	
	23+25	Structure piping	
	23+78	Structure piping	
	24+50	Structure piping	
	25+55	Structure piping	
	25+98	Structure piping	
26+91	Structure piping		
27+95	Structure piping		
28+50	Structure piping		
29+75	Structure piping		
Headcut	6+75	Unknown	N/A

Table B1 Continued. Stream Problem Areas			
Trout Cove Branch / Project No. 388			
Unnamed Tributary / Reach 2 (888 feet)			
Feature Issue	Station Numbers	Suspected Cause	Photo Number
Engineered Structure	0+90	Structure piping	N/A
	2+35	Structure piping	
	3+85	Structure piping	
	4+58	Structure piping	
	4+87	Structure piping	
Headcut	7+14	Unknown	N/A



Stream Problem Area (SPA 1) – Pool aggradation
Monitoring Year 4 – June 27, 2008



Stream Problem Area (SPA 2) – Failed structure
Monitoring Year 4 – June 27, 2008



Stream Problem Area (SPA 3) – Failed structure
Monitoring Year 4 – June 27, 2008



Stream Problem Area (SPA 4) – Stressed structure
Monitoring Year 4 – July 9, 2008

Table B2. Visual Morphological Stability Assessment						
Trout Cove Branch / Project No. 388						
Trout Cove Branch / Reach 1 (3,120 feet)						
Feature Category	Metric (Per As-built and Reference Baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / Feet in Unstable State	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	64	64	N/A	100%	
	2. Armor stable (e.g. no displacement)?	64	64	N/A	100%	
	3. Facet grade appears stable?	64	64	N/A	100%	
	4. Minimal evidence of embedding/fining?	63	64	N/A	98%	
	5. Length appropriate?	63	64	N/A	98%	99%
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	33	59	N/A	56%	
	2. Sufficiently deep (Max Pool D : Mean Bkf >1.6)	33	59	N/A	56%	
	3. Length appropriate?	59	59	N/A	100%	71%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	58	59	N/A	98%	
	2. Downstream of meander (glide/inflection) centering?	54	59	N/A	92%	95%
D. Meanders	1. Outer bend in state of limited/controlled erosion?	54	59	N/A	92%	
	2. Of those eroding, # w/ concomitant point bar formation?	0	N/A	N/A	100%	
	3. Apparent Rc within spec?	59	59	N/A	100%	
	4. Sufficient floodplain access and relief?	58	59	N/A	98%	97%
E. Bed General	1. General channel bed aggradation areas (bar formation)?	N/A	N/A	28 / 387	88%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	1 / 12	100%	94%
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	8 / 224	96%	96%
G. Vanes	1. Free of back or arm scour?	56	59	N/A	95%	
	2. Height appropriate?	55	59	N/A	93%	
	3. Angle and geometry appear appropriate?	59	59	N/A	100%	
	4. Free of piping or other structural failures?	31	59	N/A	53%	85%
H. Wads	1. Free of scour?	*	-	N/A	*	
	2. Footing stable?	*	-	N/A	*	*

N/A - Item does not apply.

- Information unavailable.

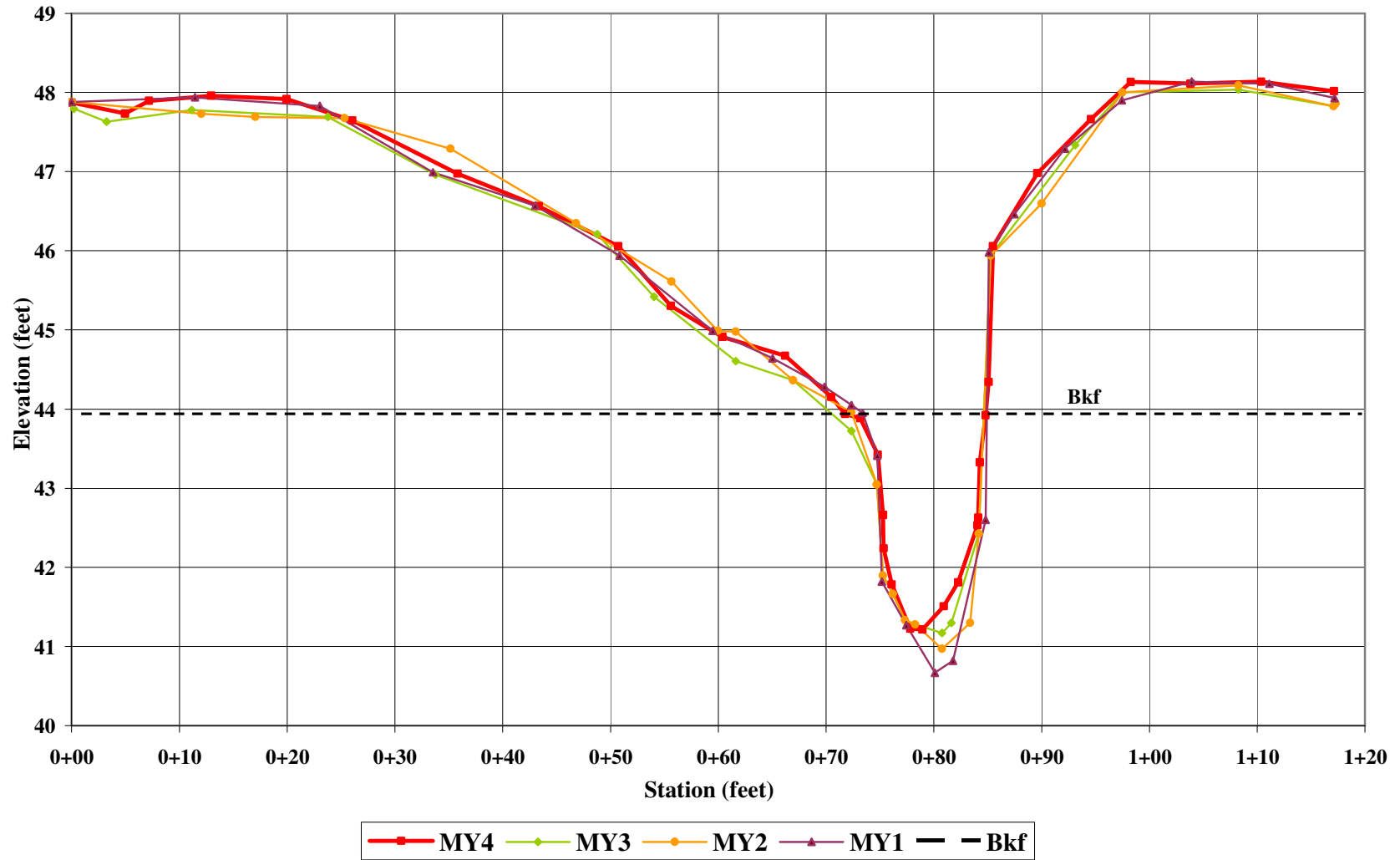
*There were a few remnants of what appeared to be stable root wads during the 2008 assessment. Data not calculated due to unknow numbers for As-built.

Table B2 Continued. Visual Morphological Stability Assessment Trout Cove Branch / Project No. 388 Unnamed Tributary / Reach 2 (888 feet)						
Feature Category	Metric (Per As-built and Reference Baselines)	(# Stable) Number Performing as Intended	Total Number per As-built*	Total Number / Feet in Unstable State	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	8	8	N/A	100%	
	2. Armor stable (e.g. no displacement)?	8	8	N/A	100%	
	3. Facet grade appears stable?	8	8	N/A	100%	
	4. Minimal evidence of embedding/fining?	8	8	N/A	100%	
	5. Length appropriate?	7	8	N/A	88%	98%
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	11	11	N/A	100%	
	2. Sufficiently deep (Max Pool D : Mean Bkf >1.6)	11	11	N/A	100%	
	3. Length appropriate?	11	11	N/A	100%	100%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	4	4	N/A	100%	
	2. Downstream of meander (glide/inflection) centering?	4	4	N/A	100%	100%
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	4	N/A	100%	
	2. Of those eroding, # w/ concomitant point bar formation?	0	N/A	N/A	100%	
	3. Apparent Rc within spec?	4	4	N/A	100%	
	4. Sufficient floodplain access and relief?	4	4	N/A	100%	100%
E. Bed General	1. General channel bed aggradation areas (bar formation)?	N/A	N/A	0 / 0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	1 / 27	97%	99%
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	0 / 0	100%	100%
G. Vanes	1. Free of back or arm scour?	11	11	N/A	100%	
	2. Height appropriate?	10	11	N/A	91%	
	3. Angle and geometry appear appropriate?	11	11	N/A	100%	
	4. Free of piping or other structural failures?	5	11	N/A	45%	84%
H. Wads	1. Free of scour?	N/A	N/A	N/A	N/A	
	2. Footing stable?	N/A	N/A	N/A	N/A	N/A

N/A - Item does not apply.

*As-built numbers were unknown. Numbers provided were established based on visual field assessment.

Trout Cove Branch Cross-Section #1 - Pool



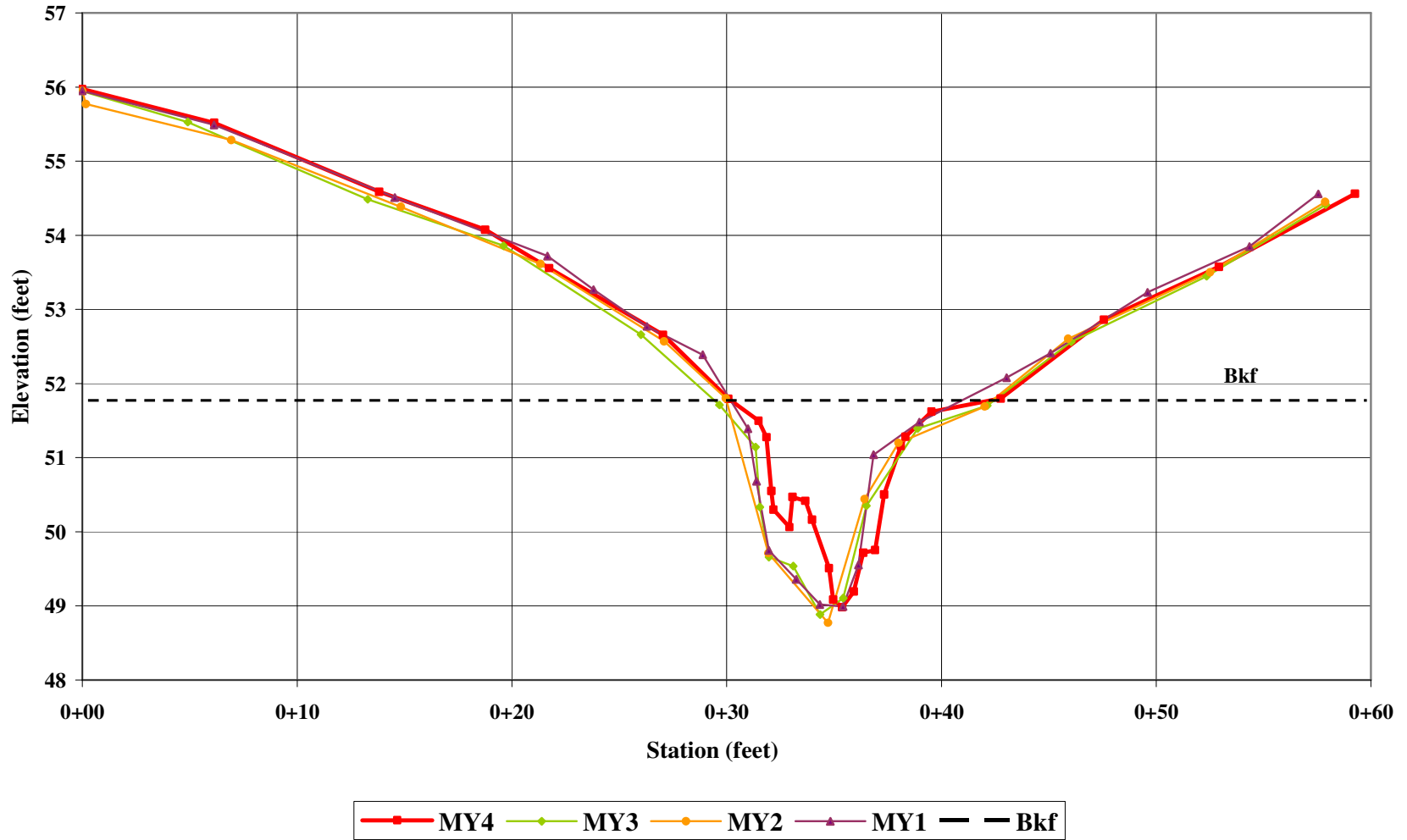


Trout Cove Branch – Cross Section #1 – Pool
(Looking Downstream)
Monitoring Year 4 – October 7, 2008



Trout Cove Branch – Cross Section #1 – Pool
(Looking Upstream)
Monitoring Year 4 – October 7, 2008

Trout Cove Branch Cross-Section #2 - Pool



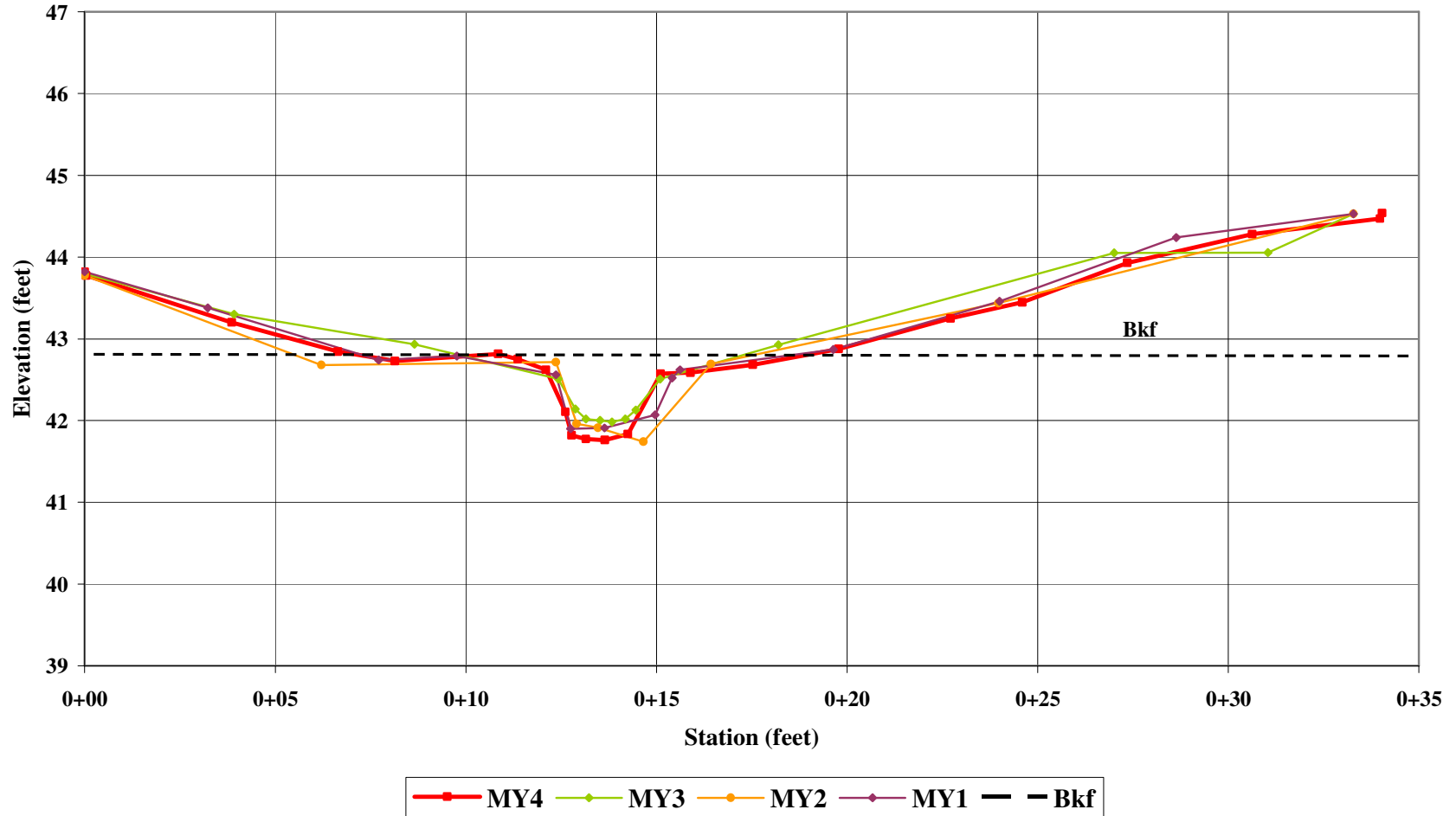


Trout Cove Branch – Cross Section #2 – Pool
(Looking Downstream)
Monitoring Year 4 – October 7, 2008



Trout Cove Branch – Cross Section #2 – Pool
(Looking Upstream)
Monitoring Year 4 – October 7, 2008

Trout Cove Branch Cross-Section #3 - Riffle



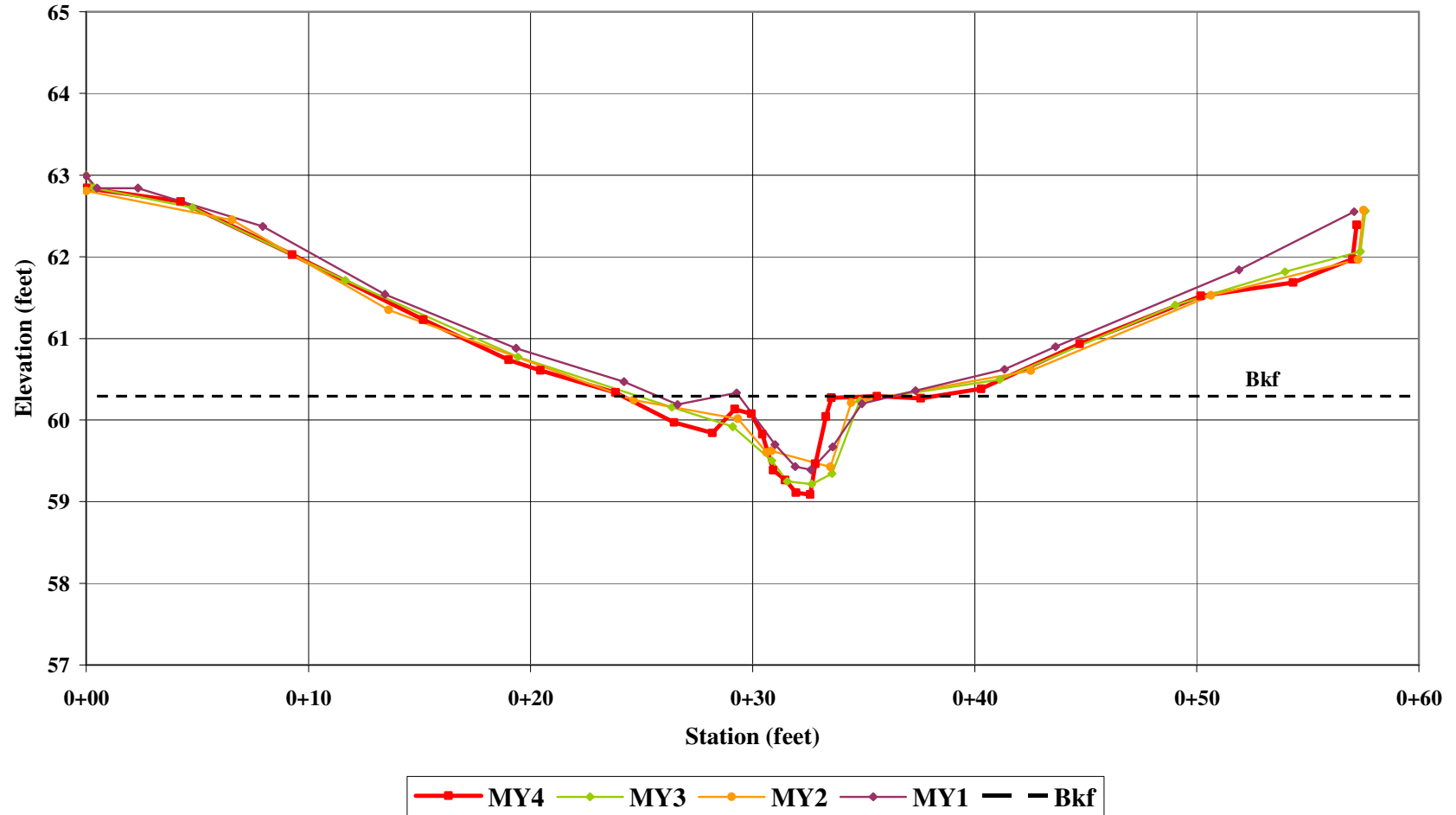


Trout Cove Branch – Cross Section #3 – Riffle
(Looking Downstream)
Monitoring Year 4 – November 23, 2008



Trout Cove Branch – Cross Section #3 – Riffle
(Looking Upstream)
Monitoring Year 4 – November 23, 2008

Trout Cove Branch Cross-Section #4 - Riffle



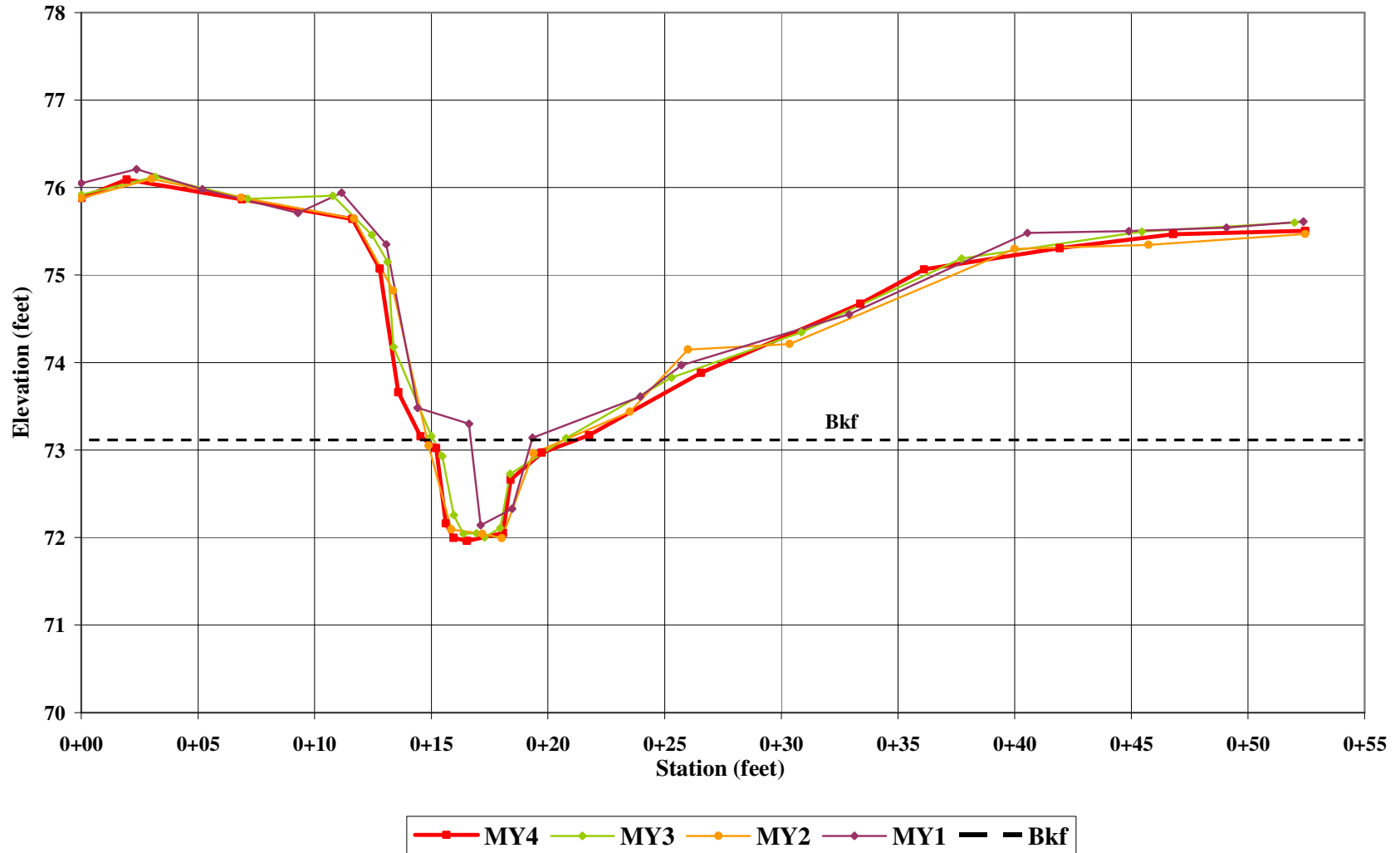


Trout Cove Branch – Cross Section #4 – Riffle
(Looking Downstream)
Monitoring Year 4 – November 23, 2008



Trout Cove Branch – Cross Section #4 – Riffle
(Looking Upstream)
Monitoring Year 4 – November 23, 2008

Trout Cove Branch Cross-Section #5 - Riffle



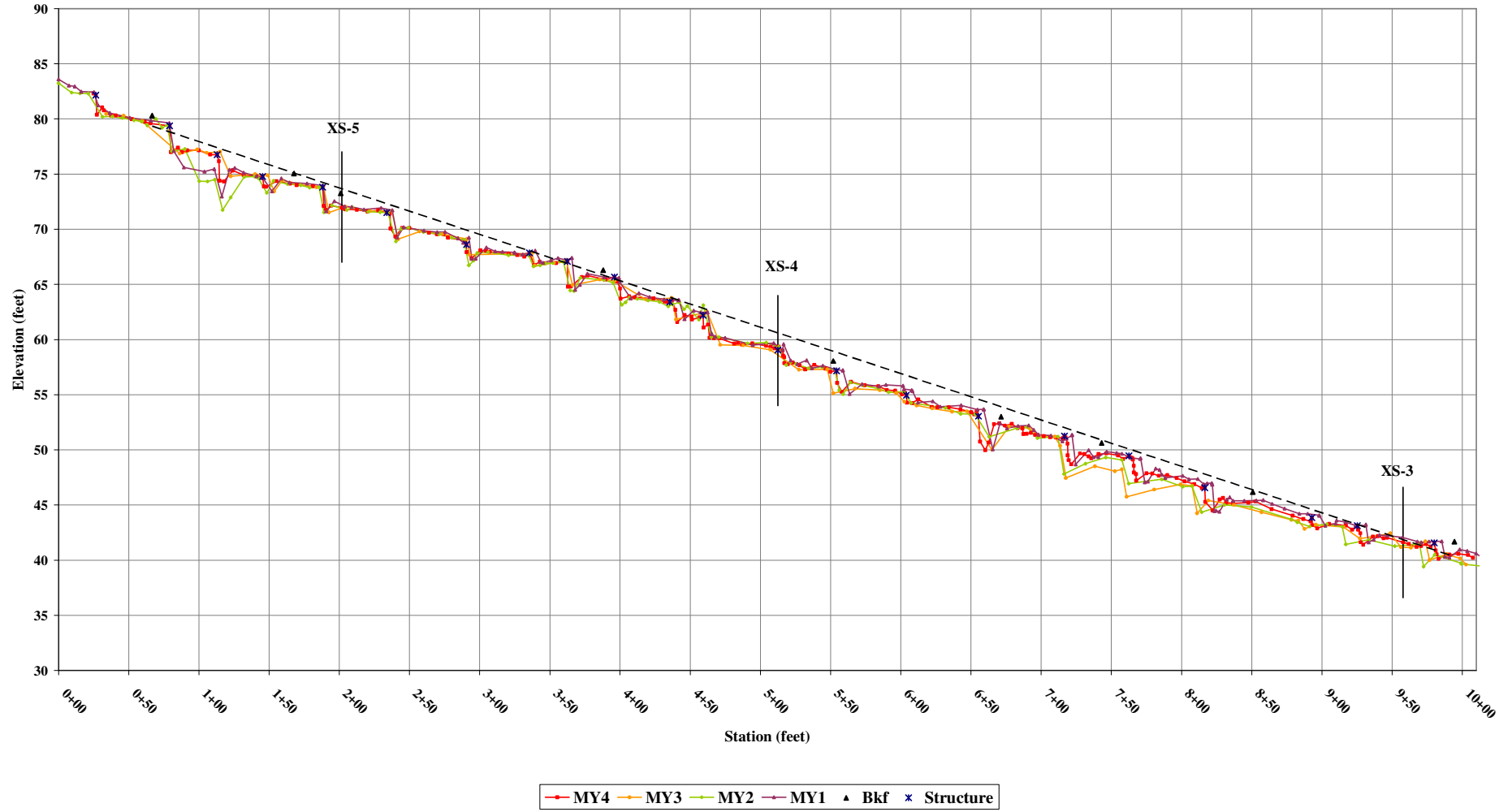


Trout Cove Branch – Cross Section #5 – Riffle
(Looking Downstream)
Monitoring Year 4 – November 23, 2008

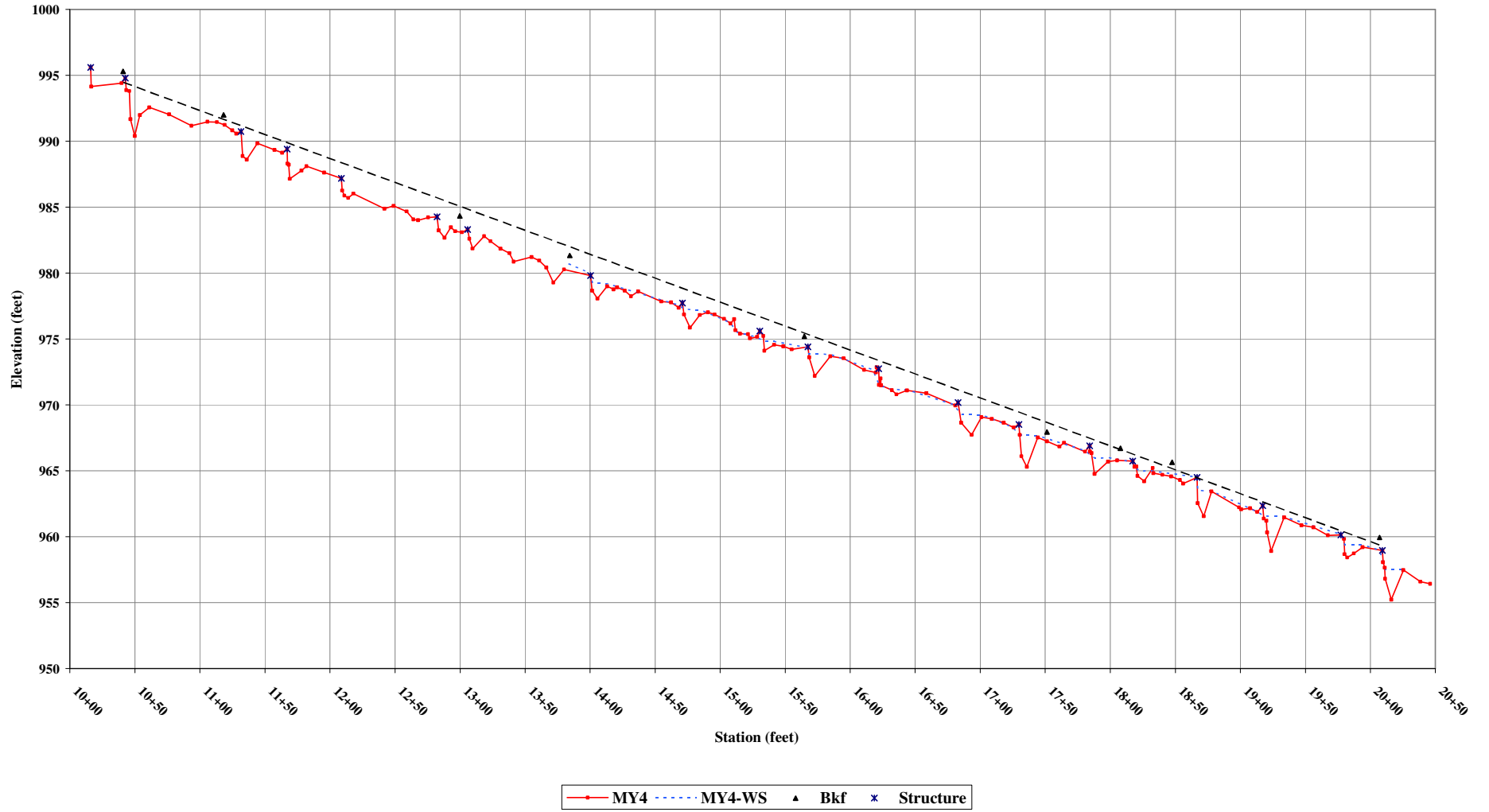


Trout Cove Branch – Cross Section #5 – Riffle
(Looking Upstream)
Monitoring Year 4 – November 23, 2008

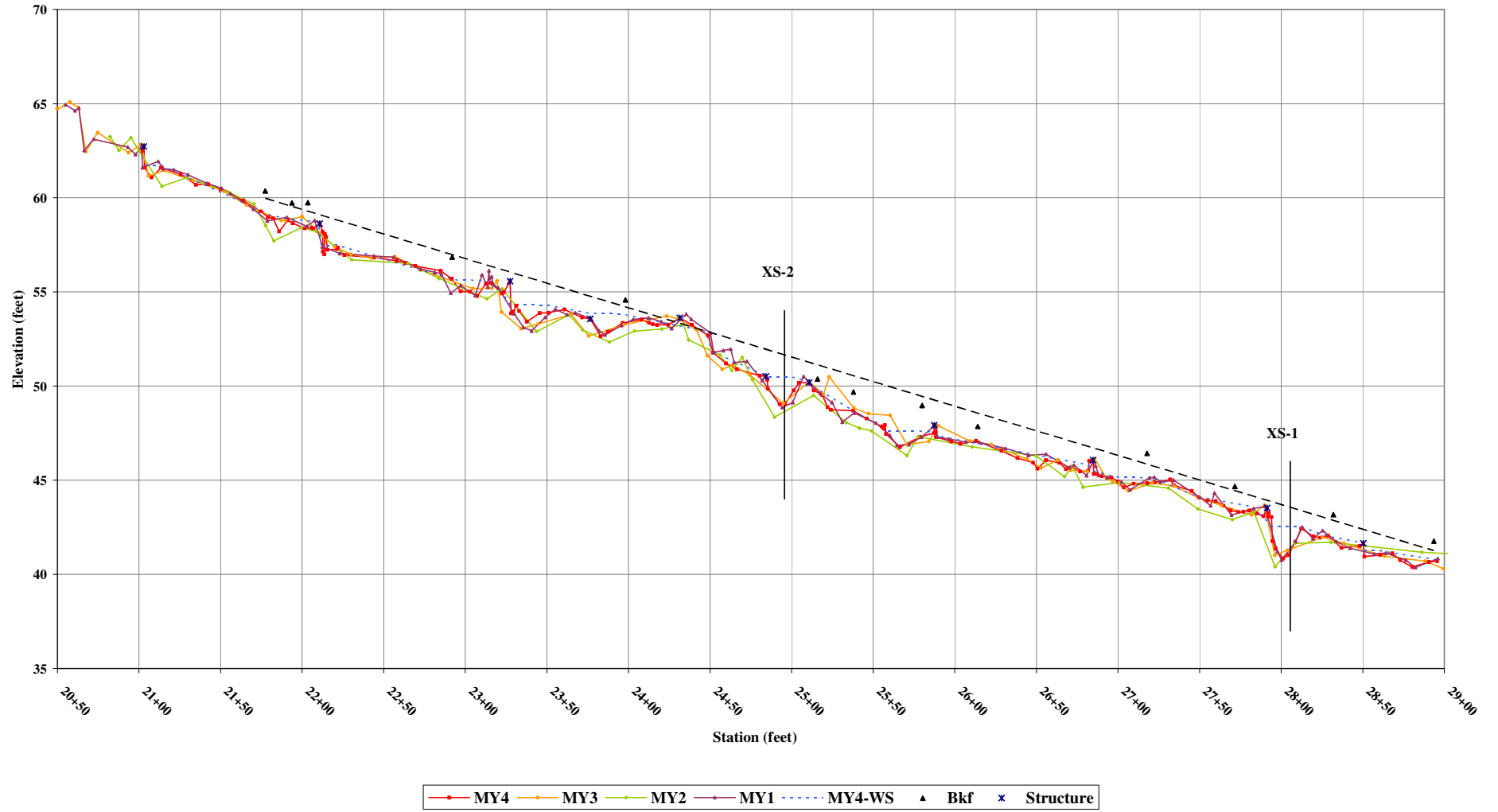
Trout Cove Branch
Longitudinal Profile - Upper Reach



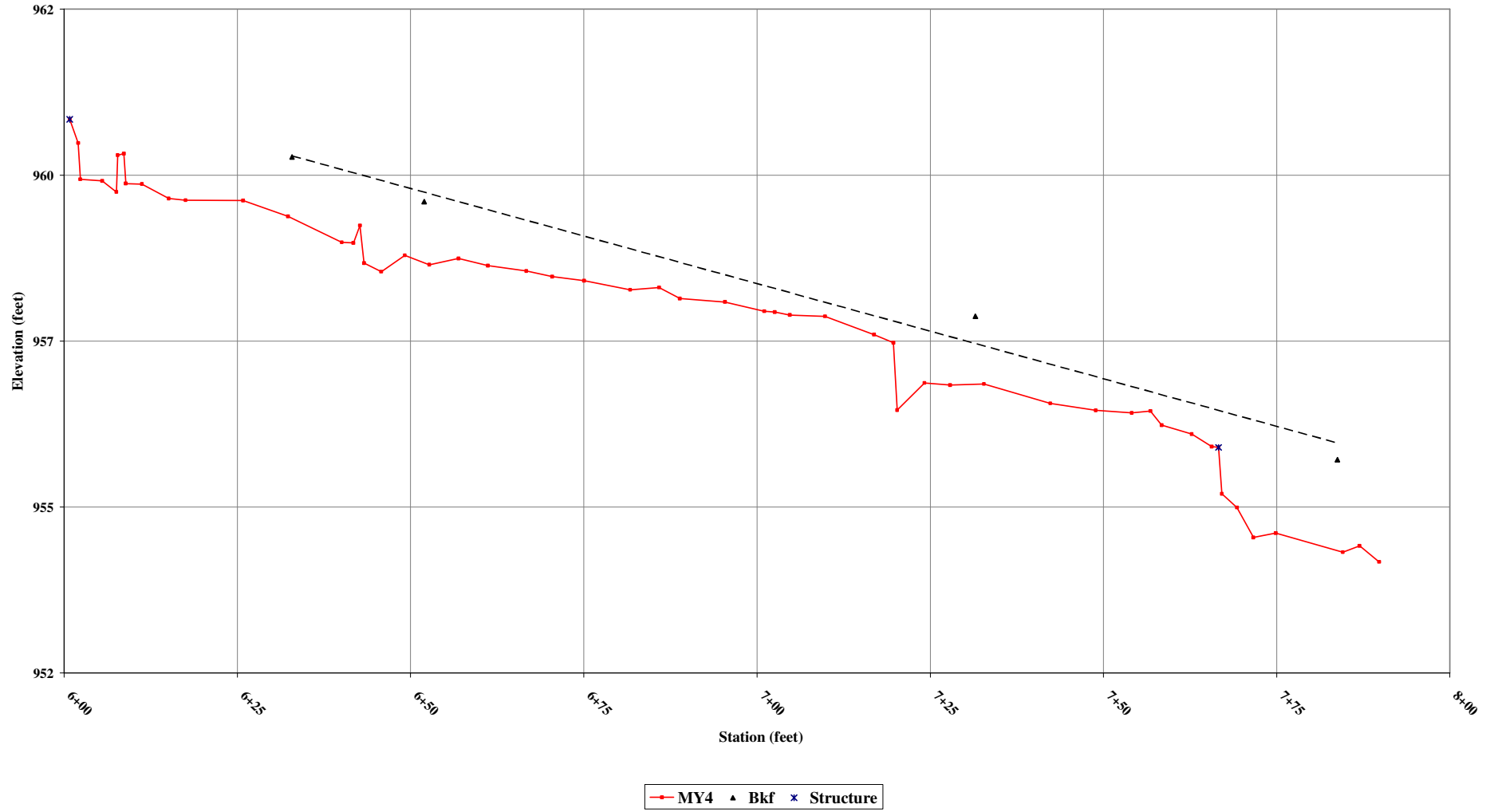
Trout Cove Branch
Longitudinal Profile - Middle Reach



Trout Cove Branch
Longitudinal Profile - Lower Reach

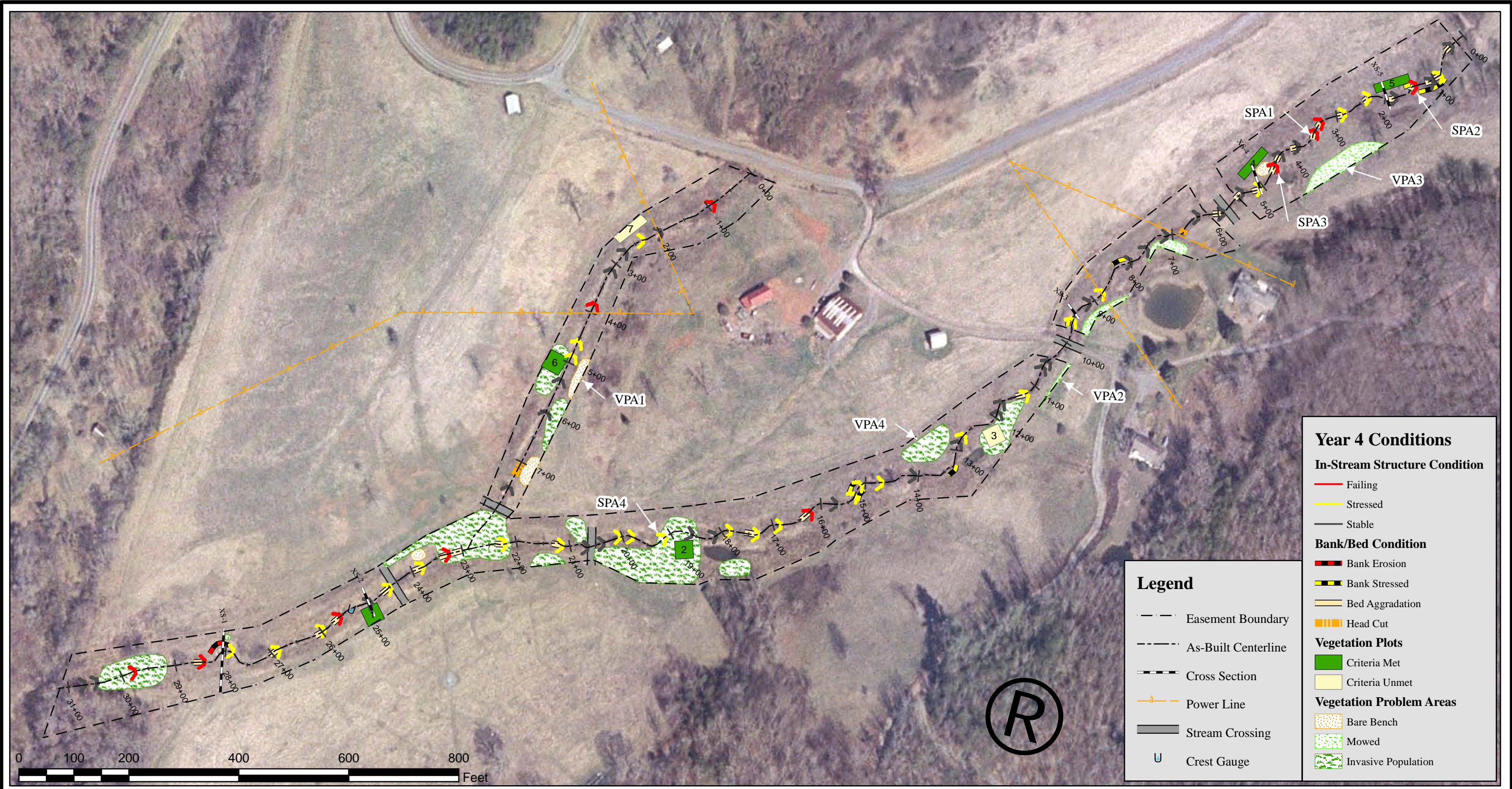




**Trout Cove Branch
Longitudinal Profile - Tributary Reach**



Appendix C
Trout Cove Branch
Wetland Data
(Not Applicable)

Appendix D
Trout Cove Branch
Integrated Current Condition Plan View



Prepared for	Project: Trout Cove Branch & Tributary Restoration	Notes: 1) Base Map from CAD file "TROUT 2007 MONT.AND PAPV.dwg" Provided by NCEEP	Prepared by
	Year 4 Monitoring Clay County, North Carolina	2) 2004 Aerial Photo 3) Invasive/Exotic populations are predominately comprised of <i>Lonicera japonica</i> and <i>Rosa multiflora</i>	
	Sheet 1 of 1		
	Date	Project Number	
	May 2009	NCEEP # 388	