

# EEP Project Closeout Summary



EEP Project Closeout Summary					
Project ID and Status		Project Setting & Classifications		Project Timeline	
Name	UT to Bear Swamp Ck	Basin	Tar/Pamlico	Construction Completed	July-02
EEP ID #	27	Physiographic Region	Piedmont	As-built Survey	August-02
County	Franklin	Ecoregion	Northern Outer Piedmont	Repair (minor)	May-03
Type	Stream Restoration	USGS Hydro Unit	03020101-040010	Monitoring Year-1	September-03
Status	5 Years of Monitoring Complete	NCDWQ Subbasin	03-03-01	Monitoring Year-2	July-04
		Thermal Regime	Warm	Monitoring Year-3	October-05
		Trout Water	No	Monitoring Year-4	November-06
		Designer	Arcadis	Monitoring Year-5	September-07
		Monitoring	Arcadis, NCSU, Ecoscience		

Watershed Data and Characteristics						
Stream Type	Wetland	DA	Stream	%	Land	
P//E	Type	(SM)	Order	Imper	Use	303d
Perennial	-	0.26	1st	<1%	Ag-Past	No
Perennial	-	0.26	1st	<1%	Ag-Past	No

## Background

The UT to Bear Swamp Creek was constructed approximately five years ago along approximately 1400 feet of a first order perennial stream in the Tar River Basin. The stream valley is narrow and the stream was incised into the narrow valley bottom. This valley morphology supports the design target of a B-type stream. Prior to construction, livestock had unrestricted access to the stream channel.

## Goals and Objectives

The overall goal of the project was to improve water quality in the Tar-Pamlico River Basin by reducing sediment contributions from the project channel bed and banks, and reduce nutrient inputs to the stream channel through the establishment of a permanent riparian buffer. Additionally, the riparian buffer was also expected to shade the stream and provide wildlife habitat.

## Construction Summary

Restoration was implemented through the grading of existing banks and construction of rock cross-vanes and rootwad structures primarily along the pre-construction channel alignment. Additionally, the stream crossing was constructed to include one large low-flow culvert, two smaller overflow culverts, and cattle crossings on either side of the paved driveway. Approximately 30 feet from the top of each constructed stream bank was planted with woody riparian species, and this same area was fenced for cattle exclusion.



Table 1. Project Restoration Components and Mitigation Assets									
Stream			Asset Data						
	Drainage/Hydrology Component	Restoration Component	Asset Map #	Approach	Level	Ratio	Feet	SMU	
	UT to Bear Swamp Ck	Segment 1 (Top down to crossing)	1	P2/P3	R	1.00	460	460	
	UT to Bear Swamp Ck	Segment 2 (Crossing down to end)	2	P2/P3	R	1.00	900	900	
<b>Project Ratios</b>				<b>Asset Summary</b>					
		Level	Ratio	Multiplier	Level	Ratio	Multipl	Feet	SMU
	Stream/Wetland	R	1	1.000	R	1:1	1.00	1360	1360
	Wetland	E	2	0.500	E	2:1	0.50		
	Stream	EI	1.5	0.667	EI	1.5:1	0.67	0	0
	Stream	EII	2	0.500	EII	2.5:1	0.50	0	0
	Wetland	C	3	0.333	C	3:1	0.33		
	Stream/Wetland	P	5	0.200	P	5:1	0.20	0	0
								<b>1360</b>	<b>1360</b>



UT to Bear Swamp Ck pre-construction. Left valley gully downstream of driveway crossing.

### Results

The UT to Bear Swamp Creek project has demonstrated morphologic stability over the five year monitoring period. Repeat channel X-section surveys demonstrate little change in channel dimension. Longitudinal profile data indicates no systemic aggradation or incision, and demonstrates the maintenance of bedform diversity in keeping with the As-built condition. Total stream restoration footage was determined based on project centerline stationing (1410 feet) less the footage contained in the road and cattle crossings (50 feet).

## Site Map and Directions



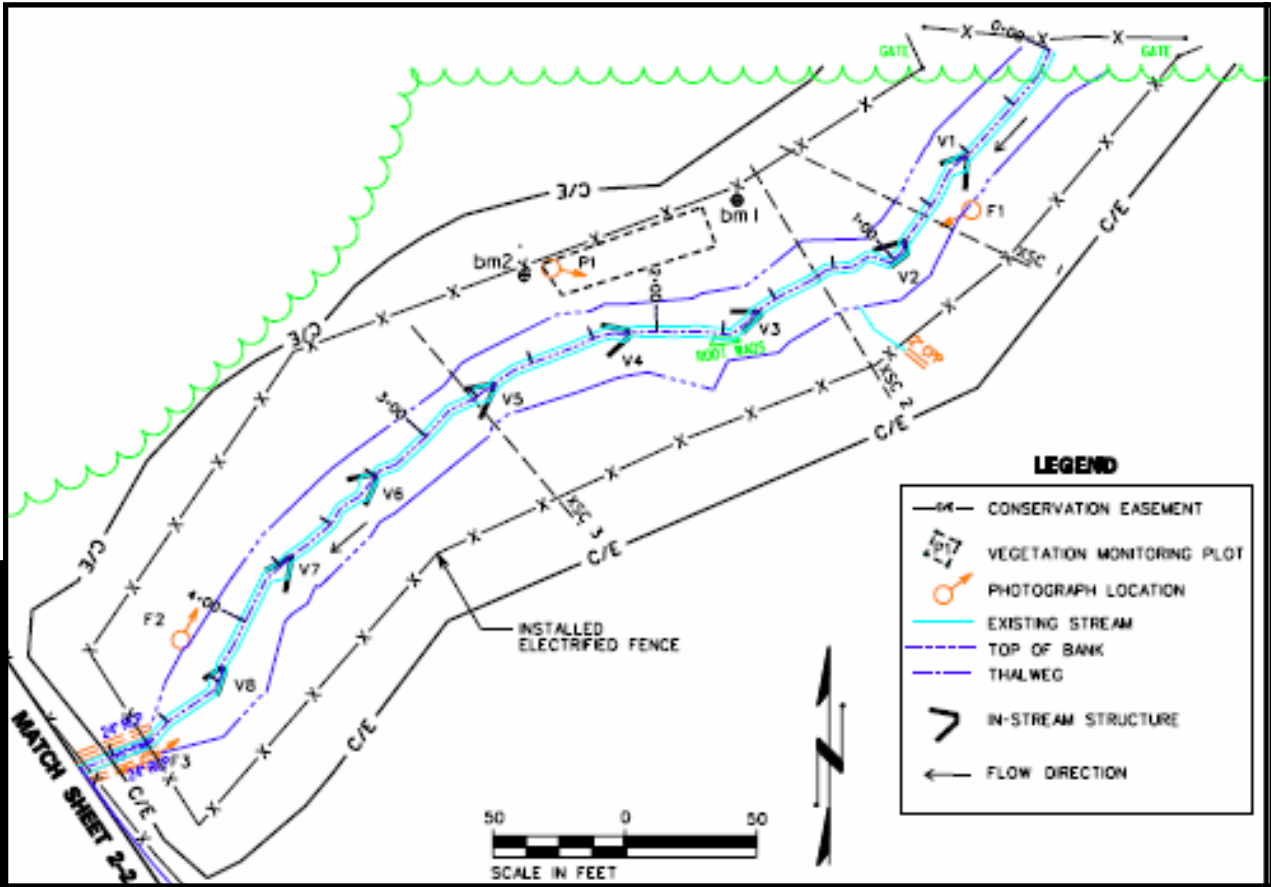
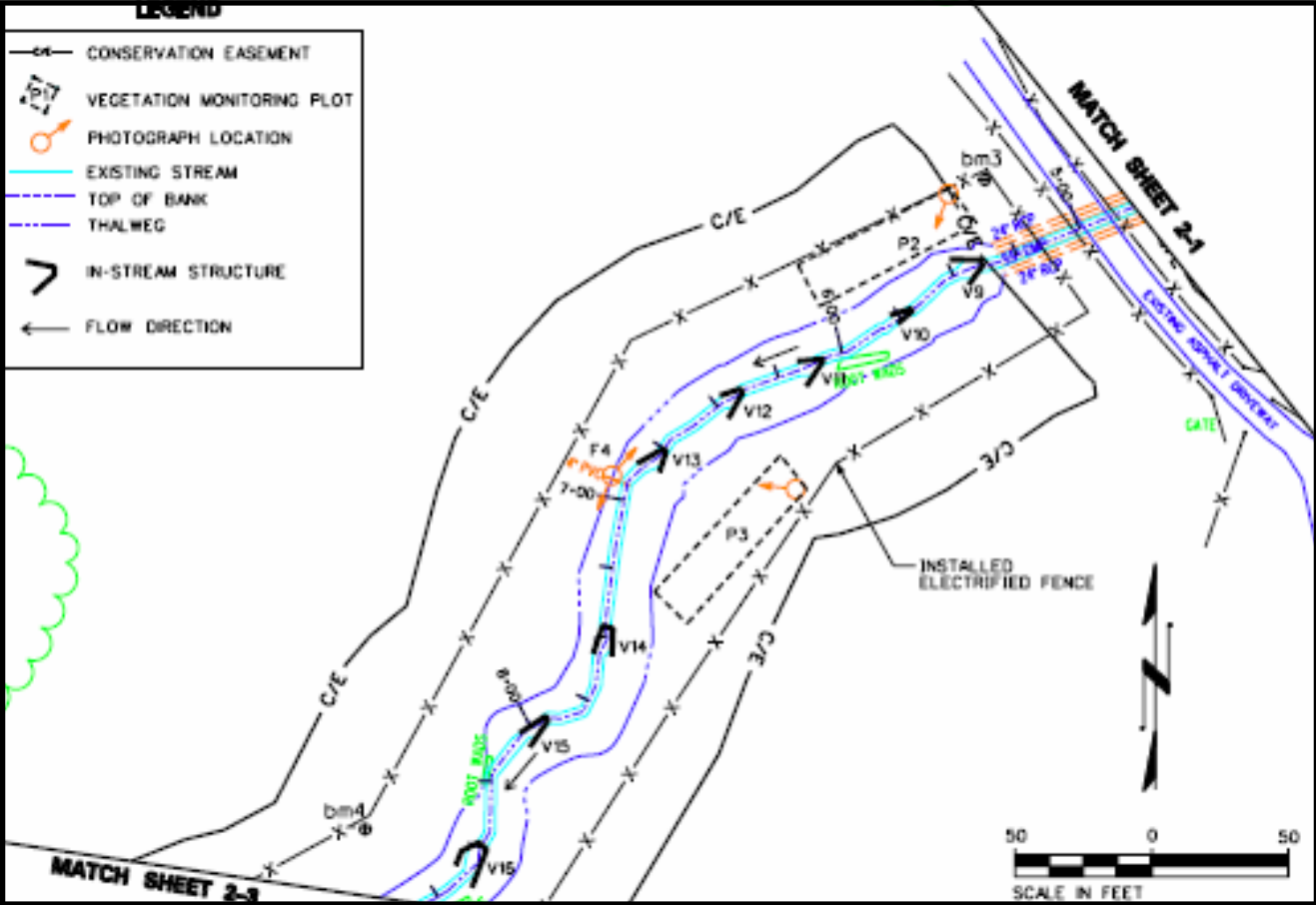
The Site is located north of Louisburg in Franklin County, NC, immediately south of Dyking Road (SR 1235) at the Murphy Hay Farm (Figure 1). From Raleigh follow Highway 401 north to Louisburg. Approximately one mile past the Highway 561 split in Louisburg take a left onto Dyking Road. The Murphy Hay Farm will be approximately one mile on your left. The entrance to the stream restoration area is accessed by several gates through the electric fence. The stream restoration reach begins approximately 460 feet upstream of the road crossing and ends approximately 775 feet downstream.



# Monitoring Plan View

# Top of Project to Road Crossing

# From Road Crossing Down

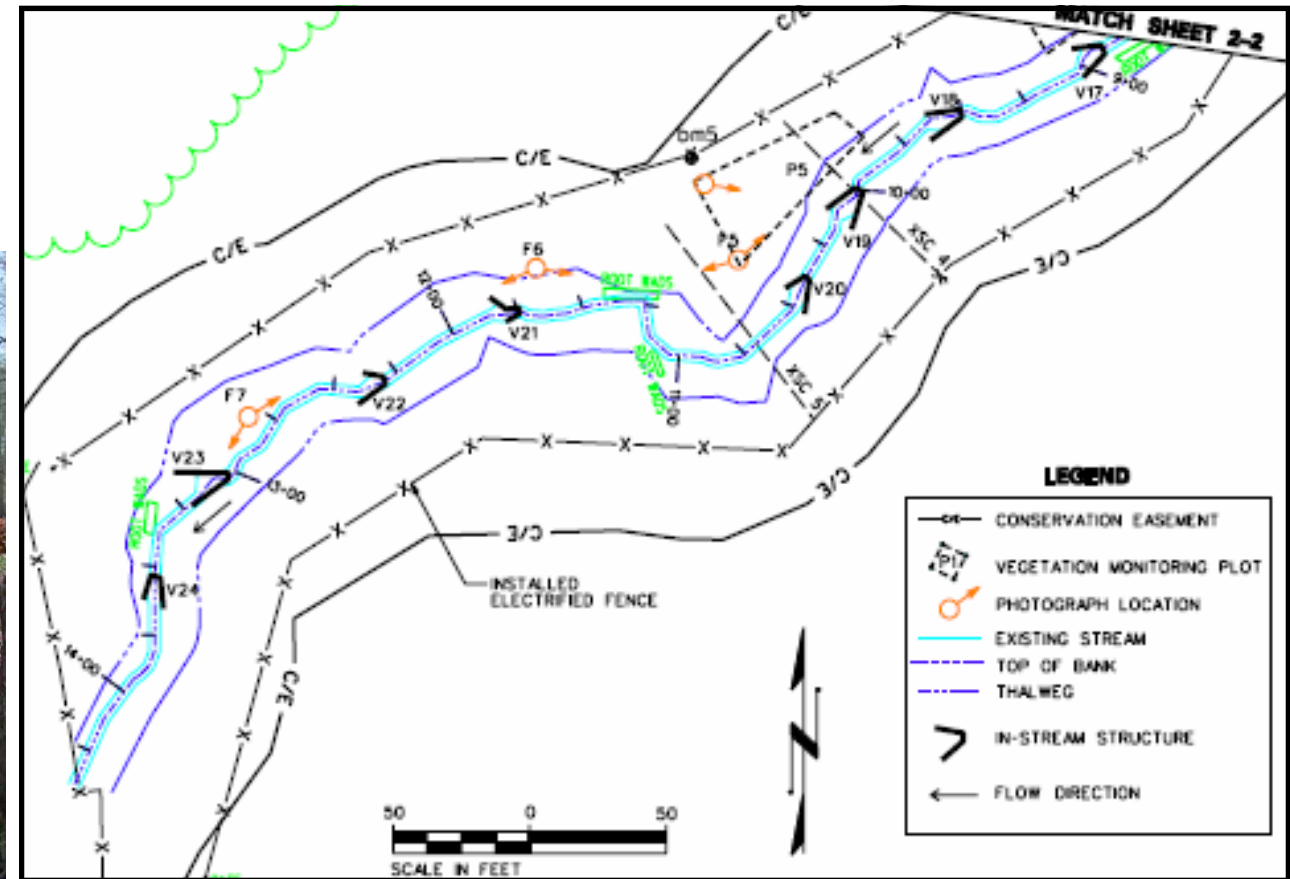


# Monitoring Plan View cont.



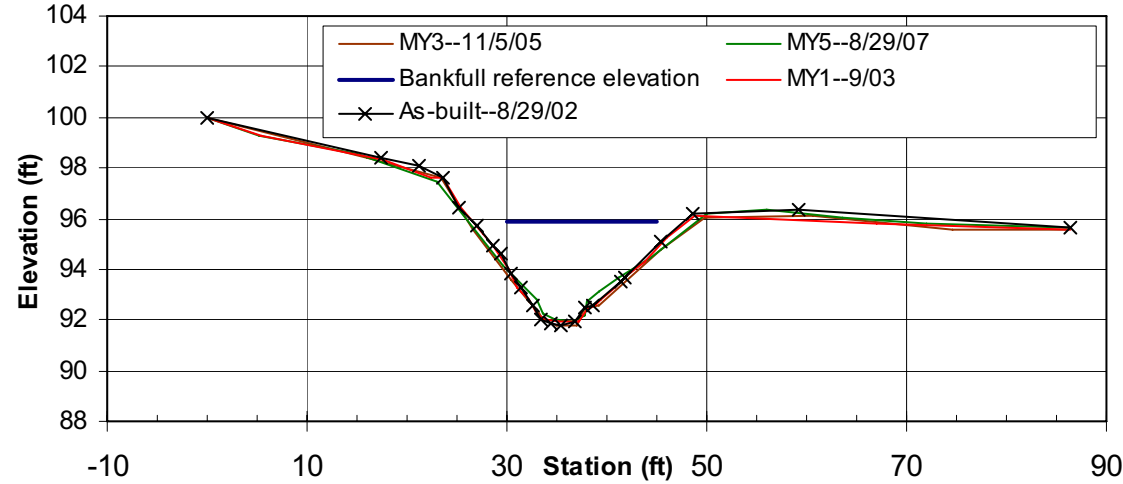
UT to Bear Swamp Ck April 2008, view upstream from bottom of project.

# Down to Bottom of Project

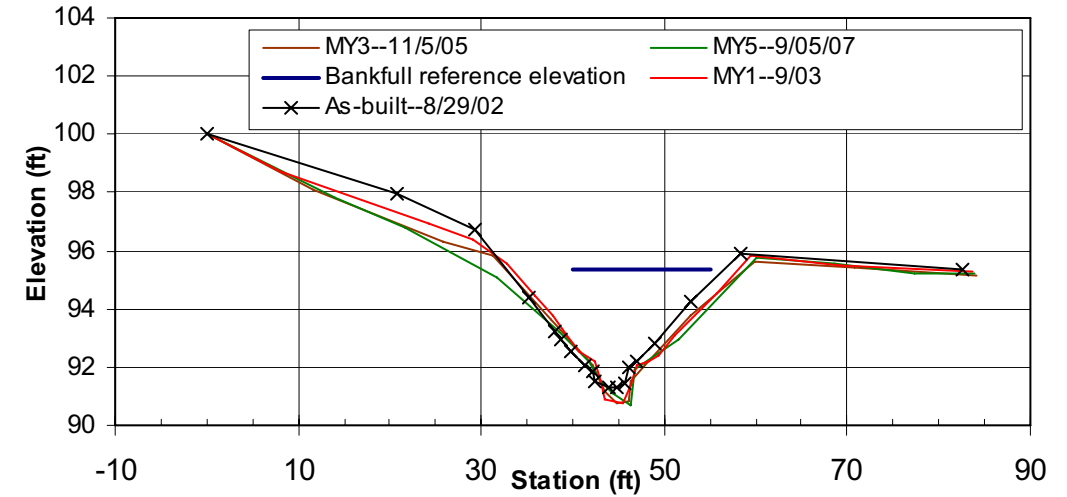


# Annual X-section Survey Overlays

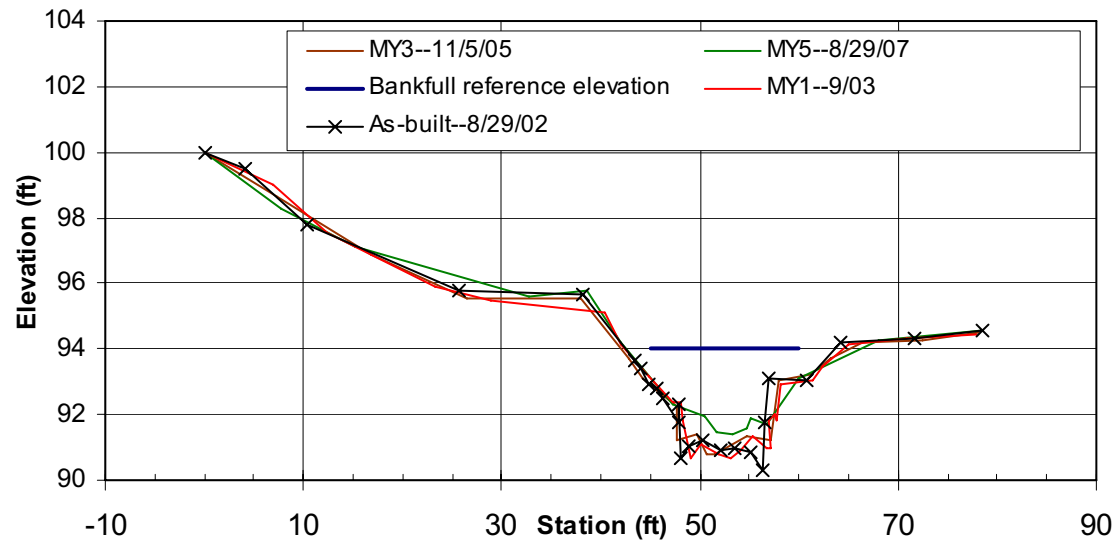
UT to Bear Swamp Ck X-section 1 (Riffle 0+76)



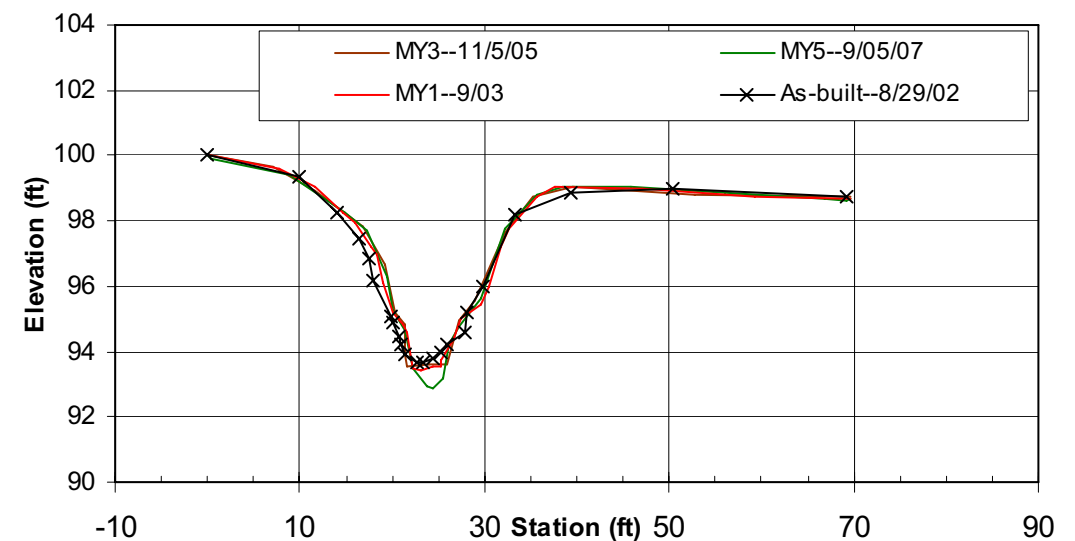
UT to Bear Swamp Ck X-section 2 (Riffle)



UT to Bear Swamp Ck X-section 3 (Pool)

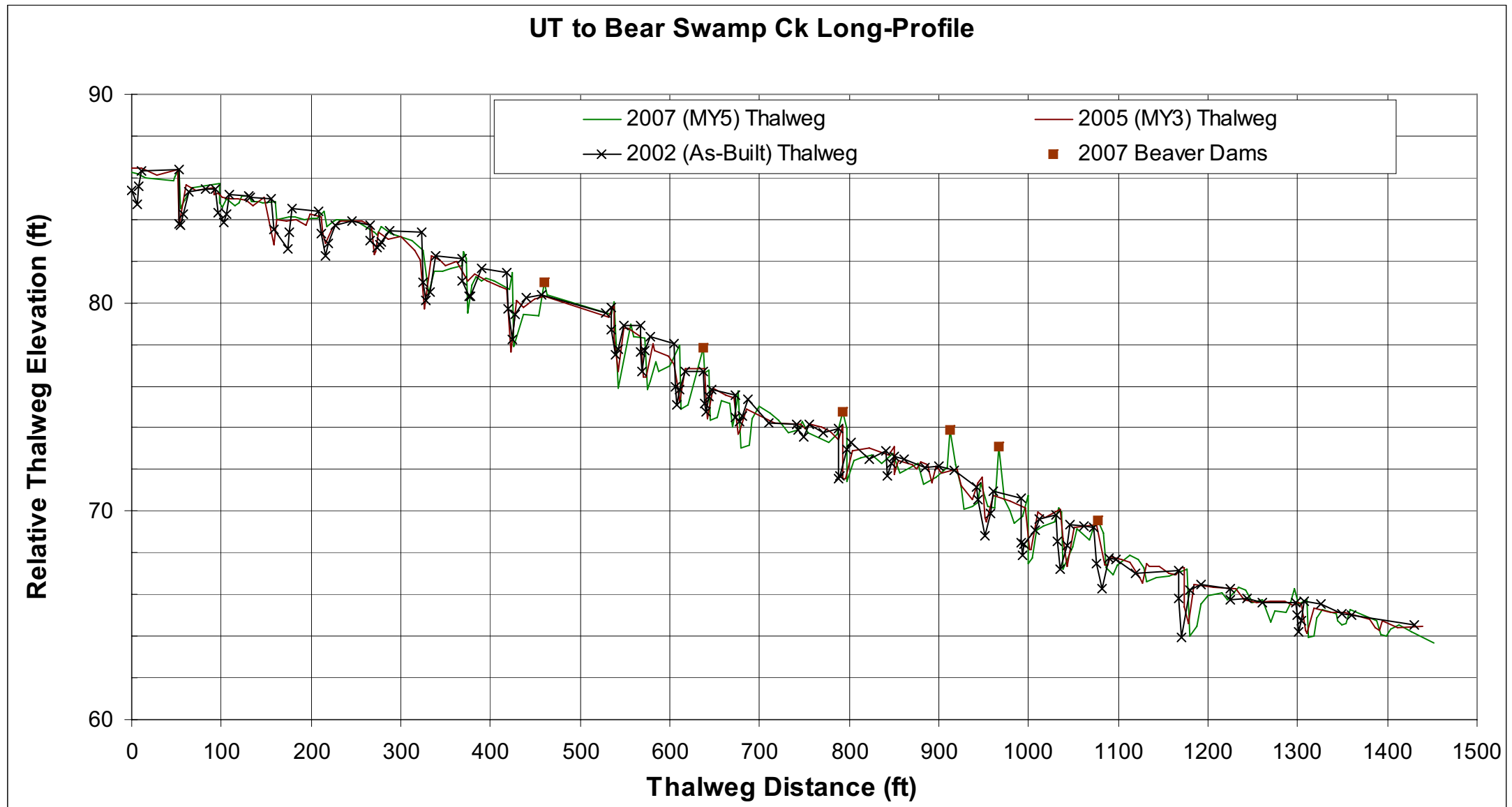


UT to Bear Swamp Ck X-section 5 (Riffle)



Channel Stability--Dimension: overlays of annual surveys demonstrating stable X-section geometry. Minor filling of pool X-section (# 3) and cutting of riffle X-section (# 5) apparent. X-sections plotted at the same scale for comparison.

# Annual Long-Profile Survey Overlays



Channel Stability--Profile: overlays of three annual long-profile thalweg surveys along UT to Bear Swamp Ck. Repeat surveys document maintenance of most As-built channel bedforms in spite of numerous beaver dams constructed in 2007. Beavers and dams were removed late in 2007.

## Photo Station # 4 Repeat Photographs



UT to Bear Swamp Ck pre-construction.  
View downstream near the bottom of the project.



View downstream, April 2005



View downstream, August 2007





# Bear Swamp Vegetation Summary Data



**Table 1**

Stem Counts Per Acre By Plot									
MY	CY	Ave	Plots						
			1	2	3	4	5		
Y1	2003	309.8	290.4	338.8	338.8	338.8	242.0	Bare Root	
Y1	2003	309.8	822.8	96.8	0.0	629.2	0.0	Live Stakes	
Y1	2003	3204.1	4936.8	3339.6	1548.8	3581.6	2613.6	Volunteer Trees	
Y1	2003	619.5	1113.2	435.6	338.8	968.0	242.0	Bare Root and Live Stakes	
Y1	2003	3823.6	6050.0	3775.2	1887.6	4549.6	2855.6	Bare Root, Live Stakes and Volunteers	
Y2	2004	60.0	80	120	40	0		Planted Trees (NCSU Quads)	
Y2	2004	2860.0	6360	2760	200	2120		Volunteer Trees (NCSU Quads)	
Y2	2004	2940.0	6520	2880	240	2120		Total Trees (NCSU Quads)	
Y3	2005	600.2	629.2	1742.4	48.4	435.6	145.2	Planted Trees	
Y3	2005	7356.8	16456	8034.4	2081.2	5469.2	4743.2	Volunteer Trees	
Y4	2006	See CVS-EEP Protocol Summary Below					CVS-EEP Protocol		
Y5	2007	See CVS-EEP Protocol Summary Below					CVS-EEP Protocol		

Although the monitoring data generally illustrates substantial mortality for planted stems, the 2007 data indicates the buffer has been colonized by natural stems. The combined natural and planted stem coverage is currently estimated to be 5129.4 stems per acre, with the dominant species being *Pinus taeda*. Moreover, the 2007 data indicates the combined per acre stem total for planted stems and live stakes currently meets the minimum stem count criteria at a rate of 293.4 per acre.

**Table 2**

						Living Stems						Species		Vigor								
						Planted & Natural	Planted					# spp	Most Dominant Species									
Sampling Dates							Total Live	All planted			Excl. Live Stake		(most stems per project)		4	3	2	1	0			
name	year	req'd stems	plots	Start	End	per acre		per acre	diff to req	mortality	per acre	diff to req		Species Name	% of stems	excel	good	weak	unlikely to survive year	dead	miss	unkn
Bear Swamp	4	288	4	08/30/06	08/30/06	5817.4	374.3	86.3	0.0%	313.6	25.6	22	Pinus taeda	66.1%	32%	41%	27%					
Bear Swamp	5	260	4	07/31/07	07/31/07	5129.4	293.4	33.4	21.7%	212.5	-47.5	20	Pinus taeda	59.2%	72%	21%	7%					

## Substrate Particle Size Distribution

The existing and design channel substrate was characterized by a D50 from 0.2 to 0.4 mm (fine to medium sand). Channel substrate has coarsened slightly since project construction, and the reach average D50 in monitoring year 5 was 1.3 mm (coarse sand) with individual pebble counts ranging up to a D50 of 6.9 mm (fine gravel) at X-section 5.



## Engineered Structures

The monitoring year 5 *Visual Morphologic Stability Assessment* evaluated cross-vane (N = 24) and rootwad (N = 8) stability and reported 17 cross vanes (71%) free of scour or piping, and 7 (88%) rootwads with stable footings and lacking scour. A number of cross-vanes were identified as “compromised” by the monitoring firm because of pool aggradation in year 5 mapping. Although a pool is the target channel unit associated with a cross-vane, pool filling does not equate to structural instability.

## Bankfull Verification

Overbank flow events were documented using an on-site crest gauge for storm events in June 2006 and July 2007. These overbank events correspond with 5.05 inches and 1.18 inches of rainfall recorded at the nearby USGS stream gauge site # 02081747 (Tar River at US 401 at Louisburg). Using the 1.18 inch storm (July, 2007) as a reference, 27 storms produced greater daily rainfall totals during the period 10/1/2003 through 1/1/2008 at USGS station #02081747. While it is not assumed that all of these storms produced overbank events at the project, it seems likely that the project experienced at least one overbank flow event in 2004, 2005, 2006, and 2007.

