

CANE & MARYS STREAM RESTORATION PROJECTS

MONITORING REPORT (YEAR 1 OF 5)

Alamance County, North Carolina
SCO Project Number 01055150A
EEP Project Number CMC/CPF/02



Prepared for:
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652



Status of Plan: Draft
Submission Date: March 2007

Monitoring and Design Firm:



Stantec

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EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (EEP) restored 2,081.8 linear feet of an Unnamed Tributary (UT) to Cane Creek located on the McPherson properties, south of Snow Camp, in Alamance County, North Carolina and 2,231.7 linear feet of two UTs to Marys Creek located on the Dixon property southeast of Saxapahaw, in Alamance County, North Carolina. In addition, just over five acres of riparian buffer were restored at each site. At the UT to Cane Creek, construction of the project began on November 8, 2005, the stream restoration was completed on February 28, 2006 and planting was completed on March 7, 2006. At the UT to Marys Creek project, construction began on January 5, 2006, the stream restoration was completed on March 10, 2006 and planting was completed on March 15, 2006. Four bankfull events occurred during construction.

On February 16, 2007 the year one monitoring survey was completed for the three restored stream reaches. Each of the three project reaches is stable and performing as intended. Within the first post-construction year there have been multiple high flow events that have reached or exceeded the design bankfull stage. There are no depositional indicators on any of the monitoring reaches that suggest that the bankfull or dominate discharge stages vary significantly from the designed bankfull stage. There has been minor adjustment to the channel dimension as a result of the first year of stormflow received by the project reaches. Three stream problem areas of concern have been noted within the monitoring reaches and seven additional stream problem areas of concern have been noted downstream of the project reaches. There are five vegetation problem areas of concern. The project is performing well despite construction activities that have many of the vanes placed out of the design specifications, and many other construction revisions to the intended design. There are four observed keys to the current stability of the project reaches:

- Floodplain connection: High flows can readily access the floodplain
- Sediment Load: There is a fair quantity of sediment supplied to the project reaches that allows for channel adjustment.
- Bedrock Confinement: There are many exposed areas of bedrock that serve as grade control for the project reaches
- Vegetation: In general the streambanks of the project reaches have dense vegetation from volunteer species and live stakes. Juncus matting has also volunteered on many of the toe slopes of the streambanks.

Problem Areas:

The vegetation problem areas consist of a number of bare sections at UT to Cane Creek and one invasive species near the two UTs to Marys Creek.

SP1 - UT Mary's Creek (Within the Monitoring Reach)

Left Bank STA 14+90 Confluence of the Main reach and the UT – There is minor bank erosion and undermining of rootwad structures. The cause of this minor instability is due to the construction of higher banks at a confluence and the installation of rootwads to armor the banks of this unnatural feature. Confluences should have the lowest bank heights relative to the reach directly upstream or downstream of the confluence.

SP2 UT Mary's Creek (Not within the Monitoring Reach)

STA 19+50 Left Vane Arm – This vane arm was installed very steep and stubby. The armor was repaired because of piping but there is currently minor bank erosion occurring on the vane arm. The causes of the instability are due to too much of a drop and incorrect vertical angles, horizontal angles, and arm lengths on the vane arms. Many of the vanes on this project reach have been installed incorrectly but most of the vanes are still providing the intended function, this vane has the risk of piping and failure to provide the intended function.

SP3 UT Mary's Creek (Not within the Monitoring Reach)

STA 21+25 Culverts– There is a bedrock vertical constraint downstream that limits the slope through this culvert. There is a steep slope upstream of the culvert that is efficient at routing sediments. The downstream backward coupled with a flat culvert slope encourages deposition in the culvert. The deposition both directly upstream and in the culvert limits the capacity of water that can be routed through the culvert. With the limited capacity water backs up and floods over the road crossing during high flows. This is an urgent problem that needs to be addressed or the road crossing will fail and the stream will cut a new channel to the right of the installed culverts.

SP4 UT Cane Creek (Within the Monitoring Reach)

Right Bank STA 11+50 – The outside of this meander bend has very poor establishment of vegetation, that has led to excess bank erosion underneath a degrading erosion control matting. The causes of the instability might be due to over compaction of the soil during construction.

SP5 UT Cane Creek (Within the Monitoring Reach)

STA 16+00 thru 19+50 – There is channel aggradation occurring for approximately 350 ft on the lower end of the monitoring reach. The cause of the instability is due to the ford crossing being installed too high.

SP6 UT Cane Creek (Not within the Monitoring Reach)

STA 19+50 – The fence at the ford crossing is catching debris causing backwater upstream.

SP7 UT Cane Creek (Not within the Monitoring Reach)

STA 21+50 – There is channel aggradation in the form of a mid channel bar but the banks around the bar are stable.

SP8 UT Cane Creek (Not within the Monitoring Reach)

STA 24+50 – There is minor bank erosion on the left bank.

SP9 UT Cane Creek (Not within the Monitoring Reach)

STA 28+50 thru 32+00 – The channel is under the effects of back water, structures are under water, there are no riffles present and the flow is slow but streambanks are stable throughout this section.

SP10 UT Cane Creek (Not within the Monitoring Reach)

STA 32+00 – The left bank is high which could cause channel instability issues in the future because of excess shear stress in the channel.

Table of Contents

Executive Summary.....i

1.0 Project Background..... 1

 1.1 Project objectives 1

 1.2 Project structure 1

 1.3 Location and Setting 2

 1.4 Project History and Background..... 5

 1.5 Monitoring Plan View..... 6

2.0 Project Condition and Monitoring Results..... 9

 2.1 Vegetation Assessment 9

 2.1.1 Vegetation Problem Areas 9

 2.1.2 Vegetation Problem Area Plan View 9

 2.2 Stream Assessment 9

 2.2.1 Hydrology 9

 2.2.2 Bank Stability..... 10

 2.2.3 Stream Problem Areas 10

 2.2.4 Stream Problem Area Plan View 10

 2.2.5 Stability Assessment 10

 2.2.6 Quantitative Measures Summary 11

3.0 References..... 16

- Appendix A. Vegetation Raw Data
- Appendix B. Geomorphologic Raw Data
- Appendix C. Wetland Data (N/A)
- Appendix D. Integrated Problem Area Plan Views

1.0 Project Background

1.1 PROJECT OBJECTIVES

Project goals and objectives for the UT to Cane Creek and the UT to Marys Creek projects included:

- Improving water quality;
- Providing wildlife habitat through the creation of a riparian zone;
- Improving aquatic habitat with the use of natural material stabilization structures and a riparian buffer;
- Excluding cattle from the stream;
- Reducing nutrient loads from entering the stream via the buffer acting as a filter exclusion of cattle;
- Increasing the stream's access to its floodplain; and
- Reducing erosion and sedimentation.

1.2 PROJECT STRUCTURE

The UT to Cane Creek is a third order stream that flows in a general southwest to northeast direction on the McPherson properties and has a drainage area of 2003 acres. The conservation easement is approximately 6.9 acres. Prior to construction, the 2,301 linear foot project reach was relatively sinuous upstream but downstream grew wider and straighter suggesting channelization. Cattle also had unfettered access to the UT to Cane Creek causing bank erosion, vegetation degradation, and decreased water quality. The channel was classified as an unstable C4 channel type. Wetland restoration was not undertaken at the UT to Cane Creek site.

The UT to Marys Creek project area is divided into two reaches: the main channel and the tributary. The main channel is a third order channel and flows south to north through the majority of the project area before making a more than 90 degree turn to the east. The tributary is a first order stream that flows in from the south and joins the main channel in the upstream portion of the reach. The project is located on the southeast corner of the Dixon property off of Dixon Lamb Road (SR 2336) and has a total drainage area of 1,145 acres. The project is contained within a 6.8 acre conservation easement. Prior to construction, the banks of both reaches were severely eroded and unstable with little or no riparian buffer. Cattle had unlimited access to the stream channels, and as many as 30 cattle crossings were observed in the project reaches. The tributary and the smaller upstream portion of the main channel were classified as unstable C4 channel types while the downstream portion of the main channel was classified as an F4 channel type. Wetland restoration was not undertaken at the UT to Marys Creek site.

Priority 2 stream restoration was carried out on each of the reaches resulting in restored C type channels. The pattern, dimension, and profile were restored throughout the two project sites. Rock structures and root wads were installed to provide further stability to the streams. Cattle were excluded from each of the newly planted riparian areas. Streambanks, the floodplain and the upland areas within the easements were all planted with vegetation to stabilize the channel and provide shading, food, and habitat as well as a vegetated buffer to treat surrounding overland flows.

**Exhibit Table I. Project Restoration Components
Cane & Marys Stream Restoration Projects (CMC/CPF/02)**

Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
UT to Cane Creek	2301	R	P2	2231.7	1.0	2231.7	10+45.6 to 32+77.3	
UT to Marys Creek (Main Channel)	1750	R	P2	1631.8	1.0	1631.8	10+00.0 to 26+31.8	
UT to Marys Creek (Tributary)	360	R	P2	450.0	1.0	450.0	10+00.0 to 14+50.0	
Mitigation Unit Summations								
Stream (lf)	Riparian Wetland (ac)	Nonriparian Wetland (ac)	Total Wetland (ac)	Buffer (ac)	Comment			
4313.5	0.0	0.0	0.0	0.0				

R = Restoration

P2 = Priority 2

1.3 LOCATION AND SETTING

Both restoration sites are located within rural areas in the Carolina Slate Belt and are immediately surrounded by cattle pastures. The UT to Cane Creek Restoration Site is located on the Stephen and Tammy McPherson and Herbert and Yvonne McPherson properties off Snow Camp Road (SR 1004) south of Snow Camp, North Carolina. The UT to Marys Creek Restoration Site is located on the Dixon property off of Dixon Lamb Road (SR 2336), east of Lindley Mill Road (SR 1003) and northwest of the Eli Whitney community (Figure 1. Location Map). Both projects are located in Alamance County, North Carolina, in the Cape Fear 03030002 Cataloging Unit (CU) and North Carolina Division of Water Quality Subbasin 03-06-04.






Figure 1. Location Map

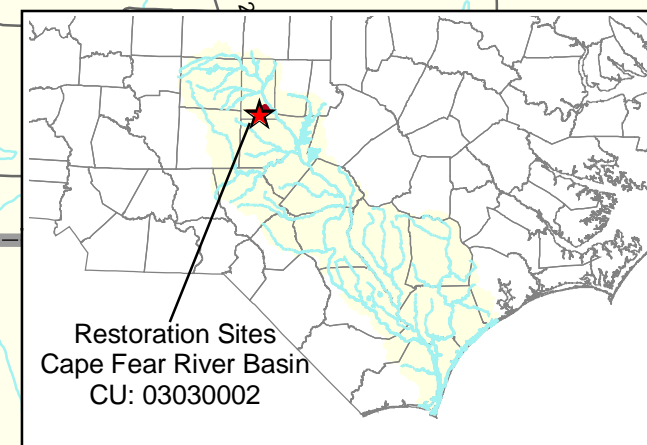
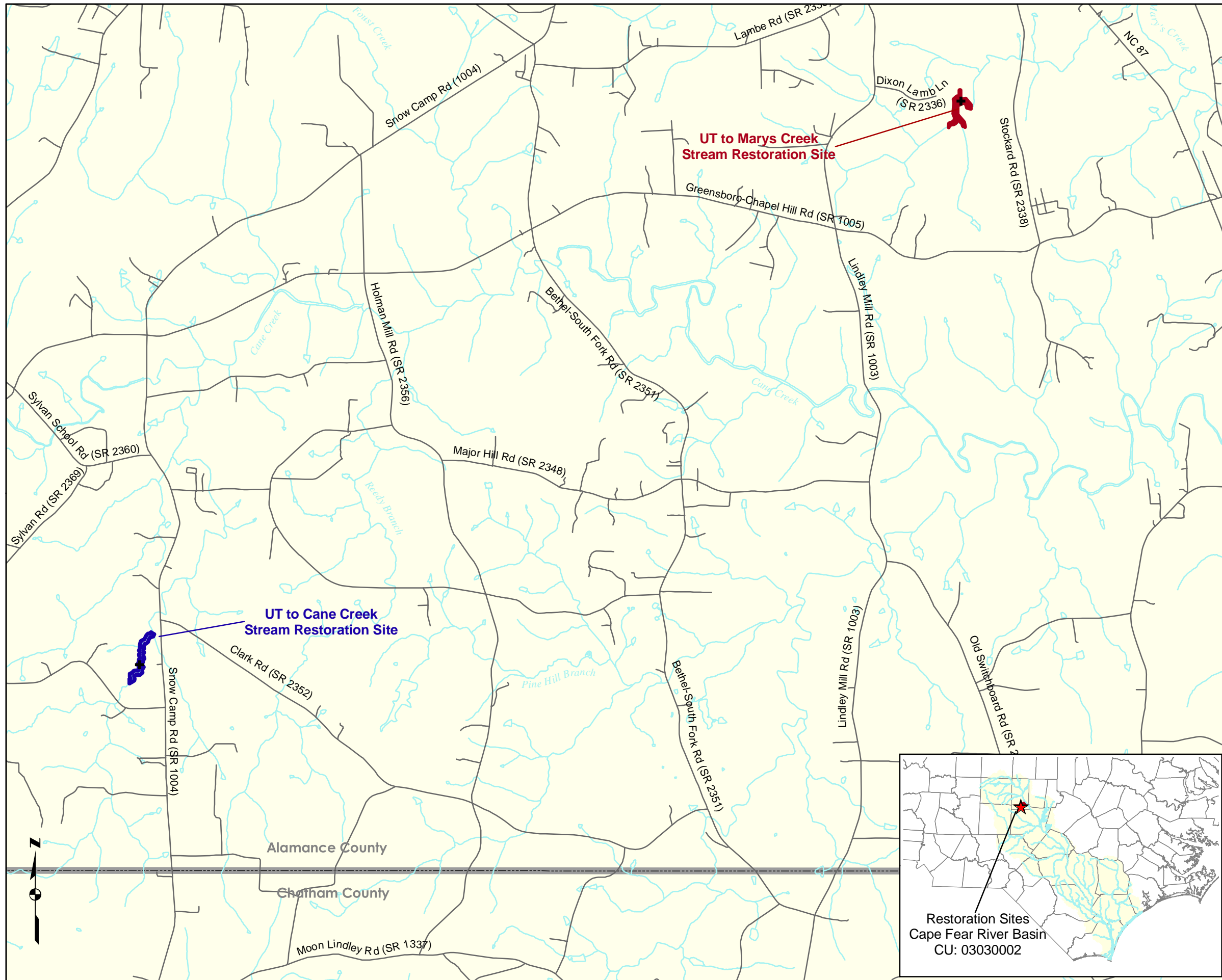
Cane and Marys
Stream Restoration Projects
EEP Number: CMC/CPF/02
Alamance County, North Carolina

Monitoring Year 1 of 5
March 2007



Legend

-  Marys Restoration Site
35.9160N, 79.3361W
-  Cane Restoration Site
35.8630N, 79.4304W
-  DOT Roads
-  County Boundary
-  1:24000 Hydrography



Directions to Marys Stream Restoration Site:
From Raleigh, take US 64 West to Pittsboro. Turn right to go north on NC 87 into Alamance County. Approximately 5 miles past the county line turn left onto SR 1005 (Greensboro- Chapel Hill Road). In 2.5 miles turn right onto Lindley Mill Rd (SR 1003), then turn right onto Dixon Lamb Ln (SR 2336). Follow the road beyond the pavement and past the barn. The entrance to the easement is through a farm gate on the right.

Directions to Cane Stream Restoration Site:
From the Marys Site, turn left onto Lindley Mill Rd (SR 1003). Turn right onto Greensboro-Chapel Hill Road (SR 1005) and follow for about 5 miles. Turn left onto Snow Camp Road (SR 1004). Follow for almost 2 miles past the intersection with Clark Rd (SR 2352). The project entrance is on the right approximately 1500 feet beyond the intersection. Turn right onto the farm road, then immediately make the first right and follow the gravel construction road through the pasture to the restoration site.

1.4 PROJECT HISTORY AND BACKGROUND

Exhibit Table II. Project Activity and Reporting History Cane & Marys Stream Restoration Projects (CMC/CPF/02)		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	-	Apr 2003
Final Design - 90%	NA	Oct 2005
Construction	NA	Mar 2006
Temporary S&E mix applied to entire project area	NA	during construction
Permanent seed mix applied to entire project area	NA	Mar 2006
Containerized and B&B plantings	NA	Mar 2006
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	May 2006	Jun 2006
Year 1 Monitoring	Feb 2007	Mar 2007

Exhibit Table III. Project Component Table Cane & Marys Stream Restoration Projects (CMC/CPF/02)	
Designer	Stantec Consulting, Ltd. 801 Jones Franklin Road, Ste 300 Raleigh, NC 27606
Primary project design POC	David Bidelsbach - (919)851-6866
Construction Contractor	Shamrock Environmental Corp. 6106 Corporate Park Drive Browns Summit, NC 27699
Construction contractor POC	Bill Wright (800)881-1098
Planting Contractor	Seal Brothers Contracting, LLC PO Box 86 Dobson, NC 27017
Planting Contractor POC	Brian Seal
Seeding Contractor	Shamrock Environmental Corp. 6106 Corporate Park Drive Browns Summit, NC 27699
Seeding Contractor POC	Bill Wright (800)881-1098
Seed Mix Sources	contact Shamrock Environmental Corp.
Nursery Stock Suppliers	Hillis Nursery Co., Inc. (931)668-4364
Monitoring Performers	Stantec Consulting, Ltd. 801 Jones Franklin Road, Ste 300 Raleigh, NC 27606
Stream Monitoring POC	David Bidelsbach (919)851-6866
Vegetation Monitoring POC	Melissa Ruiz (919)851-6866
Wetland Monitoring POC	NA

Exhibit Table IV. Project Background Table Cane & Marys Stream Restoration Projects (CMC/CPF/02)		
	Stream	
Project County		Alamance
Drainage Area	Cane Marys	2003 ac 1145 ac
Drainage impervious cover estimate (%)	Cane Marys	<5% <5%
Stream Order	Cane Marys	3rd Main: 3rd, Trib: 1st
Physiographic Region		Piedmont
Ecoregion		45c - Carolina Slate Belt
Rosgen Classification of As-built		C
Cowardin Classification		N/A
Dominant soil types	Cane Marys	Herndon silt loam Starr loam
Reference site ID		UT to Cabin Branch (CB) Landrum Creek (LC)
USGS HUC for Project & Reference	Proj CB LC	03030002 03020201 03030003
NCDWQ Subbasin for Project & Reference	Proj CB LC	03-06-04 03-04-01 03-06-12
NCDWQ Classification for Project and Reference	Proj CB LC	C NSW WS-IV NSW C
Any portion of any project segment 303d listed?		no
Any portion of any project segment upstream of a 303d listed segment?		no
Reasons for 303d listing or stressor		N/A
% of project easement fenced		100%

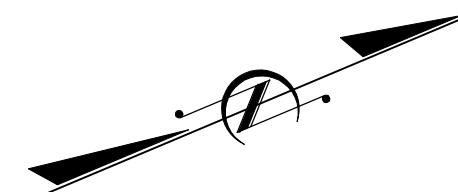
1.5 MONITORING PLAN VIEW

See Figures 2 and 3 for the Monitoring Plan Views.



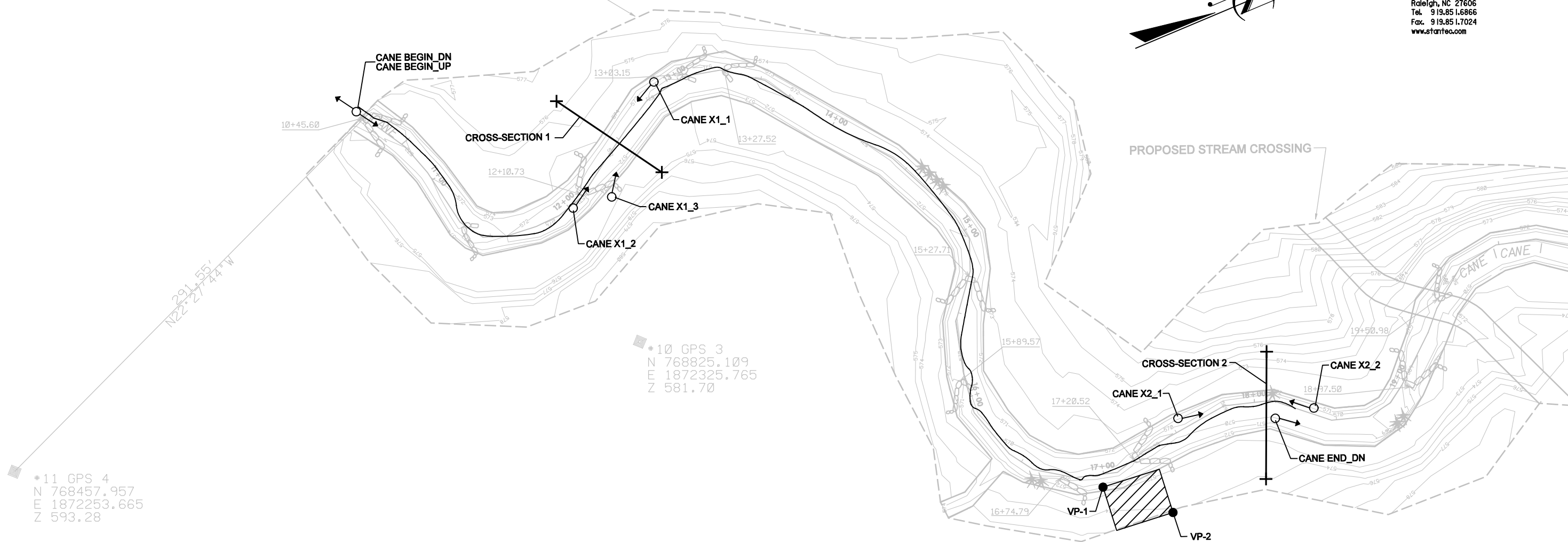
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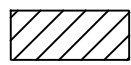




LIMITS OF DISTURBANCE

PROPOSED STREAM CROSSING

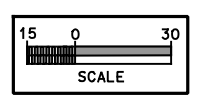
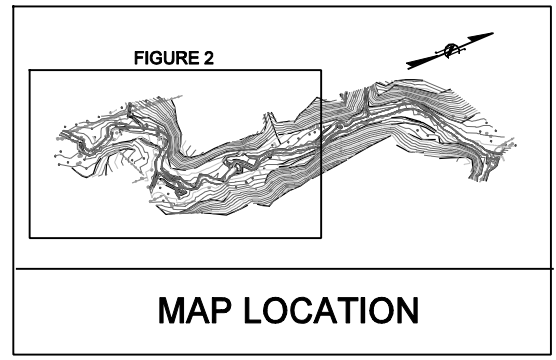


LEGEND

-  ROCK CROSS VANE
-  J-HOOK VANE
-  ROCK VANE
-  ROOT WAD
-  VEG PLOT PINS
-  VEG PLOTS
-  CROSS-SECTIONS
-  PHOTO POINTS

VEG PLOT PIN COORDINATES		
PIN	X	Y
VP-1	1872509.4977	769042.1784
VP-2	1872539.1102	769074.1637

CROSS-SECTION	CROSS-SECTION COORDINATES			
	LEFT		RIGHT	
	X	Y	X	Y
CROSS-SECTION 1	1872177.0477	768834.7380	1872473.6479	769161.2531
CROSS-SECTION 2	1872239.3630	768875.5027	1872542.1455	769132.0083



UT TO CANE CREEK
NCEEP # : CMC/CFR/02

Monitoring
 Alamance County, North Carolina

Monitoring Plan View
 Figure 2



Stantec

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GPS 2
N 788057.011
E 1900130.307
Z 523.33

GPS 1
N 787837.232
E 1900113.276
EL 519.08

AS-BUILT STATION 10+00.00

PROPOSED
STREAM
LOCATION

167.79'
S17°09'39.42"

LIMITS OF DISTURBANCE

MARY MAIN END_UP

MONITORING STATION 10+00.00

MARY MAIN BEGIN_DN

MARY MAIN END_DN

MARY MAIN BEGIN_UP

MAIN CROSS-SECTION 2

MARY MAIN X2_1

MARY MAIN X2_2

MAIN CROSS-SECTION 1

MARY MAIN X1_1

MARY MAIN X1_2

MARY MAIN VEG_2

MARY MAIN VEG_1

MARY TRIB END_UP

MARY TRIB END_DN

TRIB CROSS-SECTION 2

MARY TRIB VEG

MARY TRIB X2_1

MARY TRIB X2_2

MARY TRIB X1_1

TRIB CROSS-SECTION 1

MARY TRIB X1_2

MARY TRIB BEGIN_UP1

MARY TRIB BEGIN_DN

MONITORING STATION 10+00.00

PROPOSED
STREAM
LOCATION

MARY TRIB BEGIN_UP2

GPS 1
N 787837.232
E 1900113.276
Z 519.08

468.83'
S66°35'07"E

LEGEND



ROCK CROSS VANE



ROCK VANE



ROOT WAD



VEG PLOT PINS



VEG PLOT



CROSS-SECTIONS



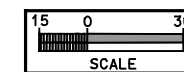
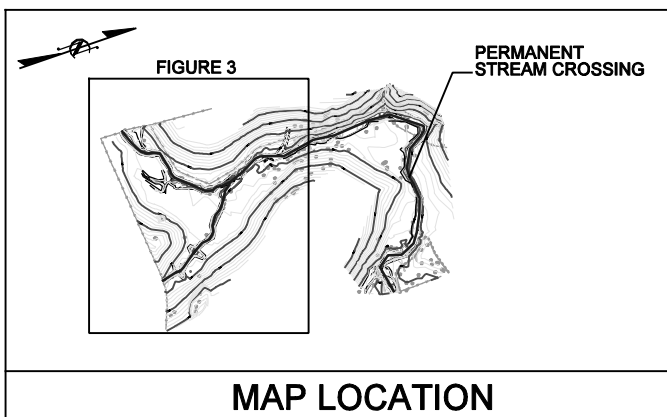
PHOTO POINTS

VEG PLOT PIN COORDINATES

PIN	X	Y
VP-1	1900514.9870	787738.8464
VP-2	1900450.4853	787779.8646
VP-3	1900441.4089	787765.9571
VP-4	1900483.8318	787765.4050

CROSS-SECTION COORDINATES

CROSS-SECTION	LEFT		RIGHT	
	X	Y	X	Y
CROSS-SECTION 1	1900514.9870	787738.8464	1900558.5179	787757.3850
CROSS-SECTION 2	1900450.4853	787779.8646	1900486.0404	787814.5657
CROSS-SECTION 3	1900284.0652	787794.5987	1900326.6578	787773.2383
CROSS-SECTION 4	1900295.3173	787869.4329	1900334.7273	787842.6464



**UT to Marys Creek
NCEEP # : CMC/CFR/02**

Monitoring
Alamance County, North Carolina

Monitoring Plan View

Figure 3

2.0 Project Condition and Monitoring Results

2.1 VEGETATION ASSESSMENT

Vegetative sample plots were quantitatively monitored during the first growing season. One 100m² plot was established for each of the three stream reaches (three plots total). Species composition, density, and survival were monitored. As per the project scope, the vegetation was not assessed using the CVS-EEP Protocol. In each plot two plot corners are permanently located with rebar.

As per the mitigation plan, the vegetative success criteria is based on the US Army Corps of Engineers Stream Mitigation Guidelines (USACE, 2003). Vegetation monitoring will be considered successful if at least 260 trees/acre are surviving at the end of five years. The Year 1 stem counts within each of the vegetative monitoring plots is included in Exhibit Tables A1 and A2 in Appendix A.

2.1.1 Vegetation Problem Areas

See Exhibit Table B1 as well as accompanying photos provided in Appendix B.

2.1.2 Vegetation Problem Area Plan View

Vegetative problem areas are shown on the Integrated Problem Area Plan View in Appendix D.

2.2 STREAM ASSESSMENT

2.2.1 Hydrology

Any changes to land use in the two watersheds that would affect changes to flow within the project streams will be assessed over the five-year monitoring period. As per the project scope, Stantec did not measure flows with peak stage recorders.

Exhibit Table V. Verification of Bankfull Events Cane & Marys Stream Restoration Projects (CMC/CPF/02)			
Date of Data Collection	Date of Occurrence	Method	Photo #
Late 2005/ Early 2006	Late 2005/ Early 2006	Visual observance of 4 bankfull events during construction	N/A

*As per scope, Stantec did not monitor hydrology onsite

2.2.2 Bank Stability

Using Rosgen (1996) methodology, Stantec monitored the near bank stress (NBS) and/or bank erodibility hazard index (BEHI) as needed at any problem areas during the first year monitoring effort. Initial conditions at the project reaches for both the NBS and BEHI rated as ‘low’ to ‘moderate’ with no existing problem areas.

Exhibit Table VI. BEHI and Sediment Export Estimates Cane & Marys Stream Restoration Projects (CMC/CPF/02)
No major problem areas present.

2.2.3 Stream Problem Areas

See Exhibit Table A3 as well as accompanying photos provided in Appendix A.

2.2.4 Stream Problem Area Plan View

Stream problem areas are shown on the Integrated Problem Area Plan View in Appendix D.

2.2.5 Stability Assessment

Exhibit Table VII. Categorical Stream Feature Visual Stability Assessment Cane & Marys Stream Restoration Projects (CMC/CPF/02)						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	85%				
B. Pools	100%	100%				
C. Thalweg	100%	87%				
D. Meanders	100%	93%				
E. Bed General	100%	91%				
F. Bank Condition	100%	95%				
G. Vanes / J Hooks, etc.	100%	84%				
H. Wads and Boulders	100%	58%				

2.2.6 Quantitative Measures Summary

Exhibit Table VIII. Baseline Morphology and Hydraulics Summary Cane Stream Restoration Project (CMC/CPF/02)															
Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Design			As-Built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension															
BF Width (ft)									44.5			24			26.6
Flood Prone Width (ft)									88			72			72
BF Cross Sectional Area (SF)									46.5			47.7			51
BF Mean Depth (ft)									1			2			2.2
Width/Depth Ratio									43			12			13.9
Entrenchment Ratio									2			3			2.7
Bank Height Ratio															1
Wetted Perimeter (ft)															32
Hydraulic Radius (ft)															0.67
Pattern															
Channel Beltwidth (ft)									63			105			110
Radius of Curvature (ft)									24	48	72	60	44	83	64
Meander Wavelength (ft)									218	53	192	123	205	48	127
Meander Width ratio									1.4			4.38			4.14
Profile															
Riffle Length													48	60	54
Riffle Slope									0.0162			0.0034	0.0023	0.004	0.032
Pool Length													31	79	43
Pool Spacing													77	160	100
Substrate															
d50															2.3
d84															11
Additional Reach Parameters															
Valley Length (ft)												1960			1960
Channel Length (ft)									2301			2232			2232
Sinuosity									1			1.14			1.14
Water Surface Slope									0.0056			0.0023			0.0029
BF Slope									0.0056			0.0023			0.0032
Rosgen Classification									C4			C4			C4
Habitat Index															
Macroinvertebrates															

**Exhibit Table IXa. Morphology and Hydraulic Monitoring Summary
Cane & Marys Stream Restoration Projects (CMC/CPF/02)**

Parameter	Cross Section 1 Cane#1 Riffle						Cross Section 2 Cane #2 Pool						Cross Section 3 Main Mary Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	27.2						24.2						18.3					
Floodprone Width (ft)	72						72						54					
BF Cross Sectional Area	48						53.6						27.3					
BF Mean Width/Depth	1.8						2.2						1.5					
Entrenchment	15.4						11						12.3					
Bank Height	2.65						2.97						2.95					
Wetted Perimeter (ft)	1						1						1					
Hydraulic Radius (ft)	32						26						19.5					
Substrate	1.5						2						1.4					
d50	2.36																	
d85	8.72																	

Parameter	Cross Section 4 Main Mary Riffle						Cross Section 5 Trib Mary Pool						Cross Section 6 Trib Mary Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	26.6						14.7						11.2					
Floodprone Width (ft)	54						36						36					
BF Cross Sectional Area	26.6						13						8.8					
BF Mean Width/Depth	1						0.9						0.8					
Entrenchment	26.6						16.5						14.3					
Bank Height	2						2.4						3.2					
Wetted Perimeter (ft)	1						1						1					
Hydraulic Radius (ft)	30						15						11					
Substrate	0.89						0.87						0.8					
d50	0.23												1.8					
d85	11.7												15.06					

**Exhibit Table IXb. Morphology and Hydraulic Monitoring Summary
Cane Stream Restoration Project (CMC/CPF/02)**

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+ (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)			110															
Radius of Curvature (ft)	43	74	70															
Meander Wavelength (ft)	167	205	185															
Meander Width Ratio			4															
Profile																		
Riffle Length (ft)	55	43	49															
Riffle Slope (ft)	0.0036	0.0080	0.0058															
Pool Length (ft)	24	89	57															
Pool Spacing (ft)	55	287	129															
Additional Reach Parameters																		
Valley Length		1960																
Channel Length		2232																
Sinosity		1.140																
Water Surface Slope (ft/ft)		0.003																
BF Slope (ft/ft)		0.003																
Rosgen Classification		C4																
Habitat Index																		
Macrobenthos																		

**Exhibit Table IXb. Morphology and Hydraulic Monitoring Summary
Marys Stream Restoration Project (CMC/CPF/02)**

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+ (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	4	26	20															
Radius of Curvature (ft)	16	39	25															
Meander Wavelength (ft)	28	84	54															
Meander Width Ratio	1.11	1.97	1.75															
Profile																		
Riffle Length (ft)	18.00	23.00	19.50															
Riffle Slope (ft)	0.008	0.017	0.014															
Pool Length (ft)	22	67	31															
Pool Spacing (ft)	35	92	70															
Additional Reach Parameters																		
Valley Length																		
Channel Length		1632																
Sinosity		1.2																
Water Surface Slope (ft/ft)		0.0038																
BF Slope (ft/ft)		0.0034																
Rosgen Classification		C4																
Habitat Index																		
Macrobenthos																		

**Exhibit Table IXb. Morphology and Hydraulic Monitoring Summary
Marys Trib Stream Restoration Project (CMC/CPF/02)**

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY+ (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	26	41	33															
Radius of Curvature (ft)	24	42	33															
Meander Wavelength (ft)	69	120	82															
Meander Width Ratio	2.2	3.47	2.8															
Profile																		
Riffle Length (ft)	17	34	29															
Riffle Slope (ft)	0.008	0.022	0.011															
Pool Length (ft)	13	50	18															
Pool Spacing (ft)	32	74	65															
Additional Reach Parameters																		
Valley Length																		
Channel Length		450																
Sinosity		1.2																
Water Surface Slope (ft/ft)		0.0034																
BF Slope (ft/ft)		0.0037																
Rosgen Classification		C4																
Habitat Index																		
Macrobenthos																		

3.0 References

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Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Appendix A. Vegetation Raw Data

A.1 VEGETATION DATA TABLES

Exhibit Table A1. Stem Counts - UT to Cane Creek Cane & Marys Stream Restoration Projects (CMC/CPF/02)			
Common Name	Scientific Name	Year 0 stems	Year 1 stems
Elderberry	<i>Sambucus canadensis</i>	11	3
Green ash	<i>Fraxinus pennsylvanica</i>	1	0
Overcup oak	<i>Quercus lyrata</i>	1	0
Silky dogwood	<i>Cornus amomum</i>	6	7
Silky willow	<i>Salix sericea</i>	13	4
Black willow	<i>Salix nigra</i>	28	30
Total Stems		60	44
Density (Stems / Acre)		2428	1781

Exhibit Table A2. Stem Counts - UT to Marys Creek Cane & Marys Stream Restoration Projects (CMC/CPF/02)			
Common Name	Scientific Name	Year 0 stems	Year 1 stems
Tributary Plot			
Elderberry	<i>Sambucus canadensis</i>	4	2
Silky dogwood	<i>Cornus amomum</i>	15	15
Black willow	<i>Salix nigra</i>	7	6
Total Stems		26	23
Density (Stems / Acre)		1052	931
Main Channel Plot			
Black willow	<i>Salix nigra</i>	12	16
Elderberry	<i>Sambucus canadensis</i>	6	4
Total Stems		18	20
Density (Stems / Acre)		728	809

Exhibit Table A3. Vegetative Problem Areas Cane & Marys Stream Restoration Projects (CMC/CPF/02)				
Feature/Issue	Reach	Station # / Range	Probable Cause	Photo #
Invasive/Exotic Populations	UT Marys Creek Trib	MaryTrib Veg Plot	A few privet saplings in veg plot - nearby privet likely source	VPA1 & VPA2
Bare Bank/Floodplain	UT Cane Creek	11+50 - 11+80	Bare right bank, corresponds with SP4	VPA3
		20+15	Bare left bank	VPA4
		28+00	Bare left floodplain	VPA5

A.2 VEGETATION PROBLEM AREA PHOTOS



Photo VPA1: Small privet sapling at UT to Marys Creek Tributary Vegetation Plot



Photo VPA2: Larger privet near UT to Marys Creek Tributary Vegetation Plot



Photo VPA3: Corresponds to SP4 – bare banks and floodplain on UT Cane Creek



Photo VPA4: Bare left bank on UT Cane Creek



Photo VPA5: Bare left floodplain on UT Cane Creek

A.3 VEGETATION MONITORING PLOT PHOTOS



1. Photo Station: CaneVeg (UT to Cane Creek)



2. Photo Station: MaryMainVeg_1 (UT to Marys Creek - Main Channel Veg Plot)



3. Photo Station: MaryMainVeg_2 (UT to Marys Creek - Main Channel Veg Plot)



4. Photo Station: MaryTribVeg_1 (UT to Marys Creek – Tributary Veg Plot)

Appendix B. Geomorphologic Raw Data

B.1 PROBLEM AREA PLAN VIEW (STREAM)

Please see the Integrated Problem Area Plan View in Appendix D for stream problem areas.

B.2 STREAM PROBLEM AREAS TABLE

Exhibit Table B1. Stream Problem Areas Cane & Marys Stream Restoration Projects (CMC/CPF/02)				
Feature/Issue	Stream Reach	Station # / Range	Probable Cause	Photo #
NONE	UT to UT Mary's Creek			
Bank Scour and Erosion	UT Mary's Creek	14+90 - 15+40	Construction, High Banks, Confined Confluence	SP1
Bank Erosion Vane Arm		19+50 *	To Step of Vane arm and too much Drop	SP2
Loss in Culvert Capacity and Risk of Crossing Failure, Bank Erosion		21+25 - 21+40*	Backwater from bedrock control downstream to flat of a culvert	SP3
Bank Erosion	UT Cane Creek	11+50 - 11+80	Outside meander bend - no bank protection, poor soils, no veg	SP4
		24+50*	Left bank exhibiting minor erosion	SP8
Channel Aggradation		16+00 - 19+50	Backwater from ford crossing	SP5
		21+50*	Mid channel bar	SP7
Debris Jam		19+50*	Large storm event caused debris jam on ford crossing electric fence, worst on upstream side - fence may be damaged	SP6
Backwater Effects		28+50 - 32+00*	Structures are submerged and therefore not functioning as intended	SP9
High Bank		32+00*	Left bank is high, may lead to future channel instability due to excess shear stress	SP10

* Not in 2006-2007 surveyed monitoring stream reaches

B3. Representative Stream & Problem Areas Photos

UT Cane and Marys Creek
Typical Reach Photos
Stream Problem Area Photos

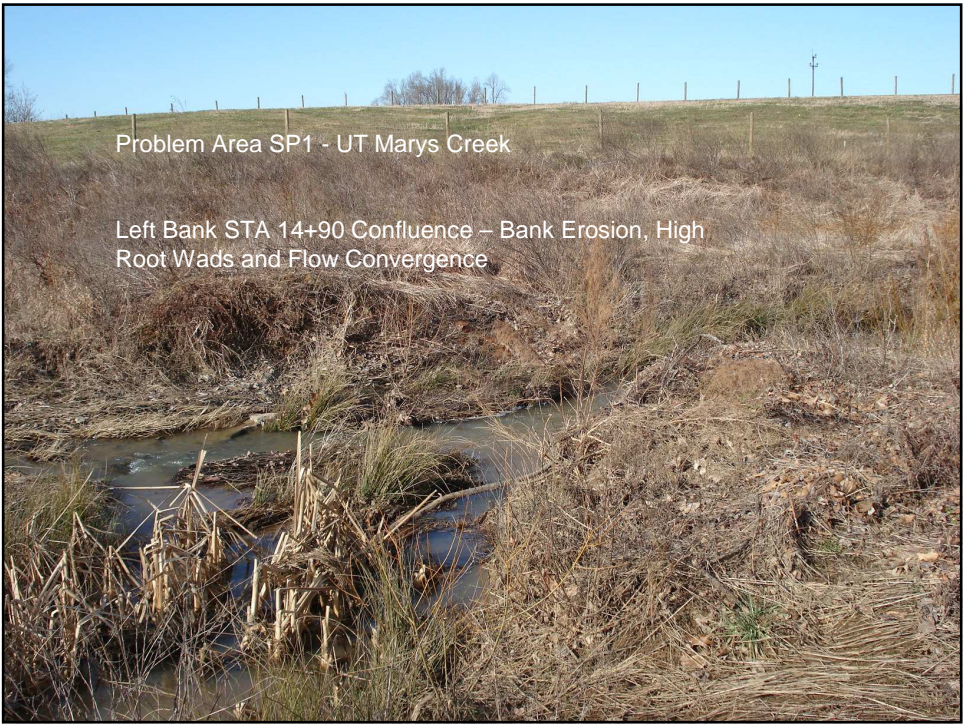




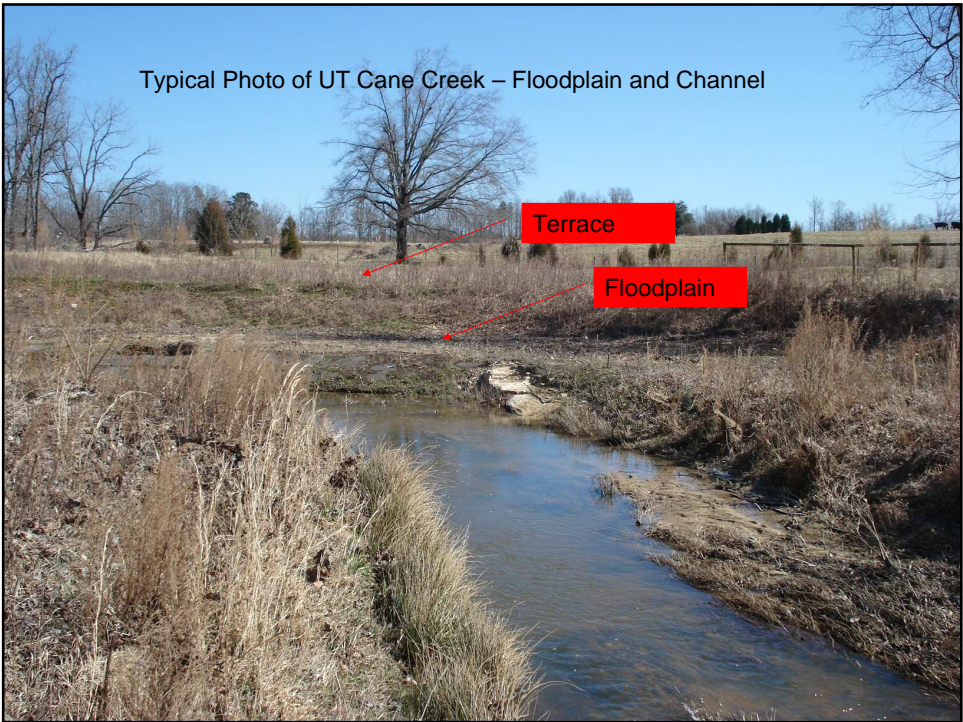
Typical Photo of UT Marys Creek - Floodplain



Typical Photo of UT
Marys Creek –
Floodplain and Channel









Typical UT Cane Creek – Floodplain and Channel
Reach is fairly stable



Problem Area SP4 - UT Cane Creek Right Bank STA 11+50 – 11+80
Outside of meander bend exhibits poor vegetation establishment, bank erosion, and erosion under erosion control matting







B.4 STREAM PHOTO STATION PHOTOS



1. Photo Station: CaneBegin_Dn (UT to Cane Creek)



2. Photo Station: CaneBegin_Up (UT to Cane Creek)



3. Photo Station: CaneX1_2 (UT to Cane Creek)



4. Photo Station: CaneX1_3 (UT to Cane Creek)



5. Photo Station: CaneX1_1 (UT to Cane Creek)



6. Photo Station: CaneX2_1 (UT to Cane Creek)



7. Photo Station: CaneX2_2 (UT to Cane Creek)



8. Photo Station: CaneEnd_Dn (UT to Cane Creek)



9. Photo Station: MaryMainBegin_Up (Main channel - UT to Marys Creek)



10. Photo Station: MaryMainBegin_Dn (Main channel - UT to Marys Creek)



11. Photo Station: MaryMainX1_2 (Main channel - UT to Marys Creek)



12. Photo Station: MaryMainX1_1 (Main channel - UT to Marys Creek)



13. Photo Station: MaryMainX2_2 (Main Channel – UT to Marys Creek)



14. Photo Station: MaryMainX2_1 (Main Channel – UT to Marys Creek)



15. Photo Station: MaryMainEnd_Up (Main Channel – UT to Marys Creek)



16. Photo Station: MaryMainEnd_Dn (Main Channel – UT to Marys Creek)



17. Photo Station: MaryTribBegin_Up2 (Tributary – UT to Marys Creek)



18. Photo Station: MaryTribBegin_Up1 (Tributary – UT to Marys Creek)



19. Photo Station: MaryTribBegin_Dn (Tributary – UT to Marys Creek)



20. Photo Station: MaryTribX1_1 (Tributary – UT to Marys Creek)



21. Photo Station: MaryTribX1_2 (Tributary – UT to Marys Creek)



22. Photo Station: MaryTribX2_1 (Tributary – UT to Marys Creek)



23. Photo Station: MaryTribX2_2 (Tributary – UT to Marys Creek)



24. Photo Station: MaryTribEnd_Up (Tributary – UT to Marys Creek)



25. Photo Station: MaryTribEnd_Dn (Tributary – UT to Marys Creek)

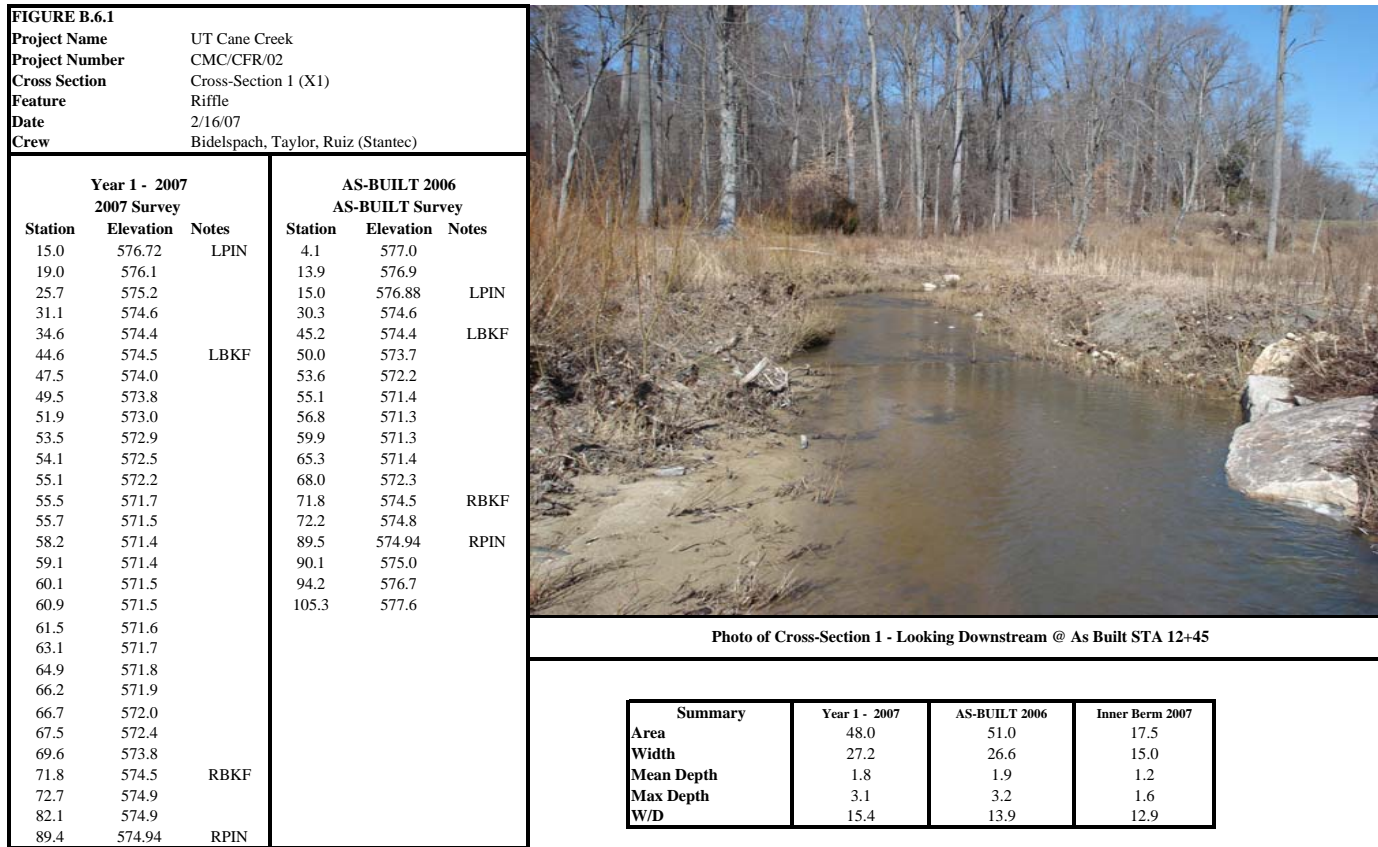
B.5 QUALITATIVE VISUAL STABILITY ASSESSMENT

Exhibit Table B.2.1. Visual Morphological Stability Assessment - UT to CANE CREEK Cane & Marys Stream Restoration Projects (CMC/CPF/02)						
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number/Feet in Unstable State	%Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	2	2	N/A	100%	
	2. Armor stable (eg no displacement?)	2	2	N/A	100%	
	3. Facet grade appears stable?	1	2	N/A	50%	
	4. Minimal evidence of embedding/fining?	2	2	N/A	100%	
	5. Length appropriate?	1	2	N/A	50%	80%
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	6	6	N/A	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf > 1.6?)	5	6	N/A	83%	
	3. Length appropriate?	5	6	N/A	83%	89%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	5	6	N/A	83%	
	2. Downstream of meander (glide/inflection) centering?	4	5	N/A	80%	82%
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	5	N/A	80%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	N/A	N/A	
	3. Apparent Rc within spec?	5	5	N/A	100%	
	4. Sufficient floodplain access and relief?	4	5	N/A	80%	87%
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	200/800	75%	
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting?	N/A	N/A	100/800	88%	81%
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	75/800	91%	91%
G. Vanes	1. Free of back or arm scour?	7	8	N/A	88%	
	2. Height appropriate?	3	8	N/A	38%	
	3. Angle and geometry appear appropriate?	4	8	N/A	50%	
	4. Free of piping or other structural failures?	8	8	N/A	100%	69%
H. Wads/Boulders	1. Free of scour?	1	3	N/A	33%	
	2. Footing stable?	3	3	N/A	100%	67%

Exhibit Table B.2.2. Visual Morphological Stability Assessment - UT to MARYS CREEK Cane & Marys Stream Restoration Projects (CMC/CPF/02)						
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?	4	5	N/A	80%	
	2. Armor stable (eg no displacement?)	5	5	N/A	100%	
	3. Facet grade appears stable?	3	5	N/A	60%	
	4. Minimal evidence of embedding/fining?	5	5	N/A	100%	
	5. Length appropriate?	4	5	N/A	80%	84%
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	10	10	N/A	100%	
	2. Sufficiently deep (Max Pool D:Mean Bkf > 1.6?)	10	10	N/A	100%	
	3. Length appropriate?	9	10	N/A	90%	97%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	7	9	N/A	78%	
	2. Downstream of meander (glide/inflection) centering?	8	8	N/A	100%	89%
D. Meanders	1. Outer bend in state of limited/controlled erosion?	9	9	N/A	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	N/A	N/A	
	3. Apparent Rc within spec?	9	9	N/A	100%	
	4. Sufficient floodplain access and relief?	7	9	N/A	78%	93%
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	20/550	96%	
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting?	N/A	N/A	55/550	90%	93%
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	30/550	95%	95%
G. Vanes	1. Free of back or arm scour?	7	7	N/A	100%	
	2. Height appropriate?	5	7	N/A	71%	
	3. Angle and geometry appear appropriate?	6	7	N/A	86%	
	4. Free of piping or other structural failures?	7	7	N/A	100%	89%
H. Wads/Boulders	1. Free of scour?	1	4	N/A	25%	
	2. Footing stable?	3	4	N/A	75%	50%

Exhibit Table B.2.3. Visual Morphological Stability Assessment - UT to MARYS CREEK - TRIB Cane & Marys Stream Restoration Projects (CMC/CPF/02)						
Feature Category	Metric (per As-built and reference baselines)	(# Stable Number Performing as Intended)	Total Number per As-built	Total Number/Feet in Unstable State	%Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	5	5	N/A	100%	
	2. Armor stable (eg no displacement?)	5	5	N/A	100%	
	3. Facet grade appears stable?	5	5	N/A	100%	
	4. Minimal evidence of embedding/fining?	4	5	N/A	80%	
	5. Length appropriate?	4	5	N/A	80%	92%
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	6	5	N/A	120%	
	2. Sufficiently deep (Max Pool D:Mean Bkf > 1.6?)	5	5	N/A	100%	
	3. Length appropriate?	6	5	N/A	120%	113%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	4	5	N/A	80%	90%
	2. Downstream of meander (glide/inflection) centering?	5	5	N/A	100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	5	5	N/A	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	N/A	N/A	
	3. Apparent Rc within spec?	5	5	N/A	100%	
	4. Sufficient floodplain access and relief?	5	5	N/A	100%	100%
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/300	100%	100%
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting?	N/A	N/A	0/300	100%	
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	0/300	100%	100%
G. Vanes	1. Free of back or arm scour?	5	5	N/A	100%	
	2. Height appropriate?	4	5	N/A	80%	
	3. Angle and geometry appear appropriate?	5	5	N/A	100%	
	4. Free of piping or other structural failures?	5	5	N/A	100%	95%
H. Wads/ Boulders	1. Free of scour?	0	0	N/A	100%	100%
	2. Footing stable?	0	0	N/A	100%	

B.6 CROSS SECTION PLOTS



UT Cane Creek - Riffle
Cross Section 1 As built STA: 12+45

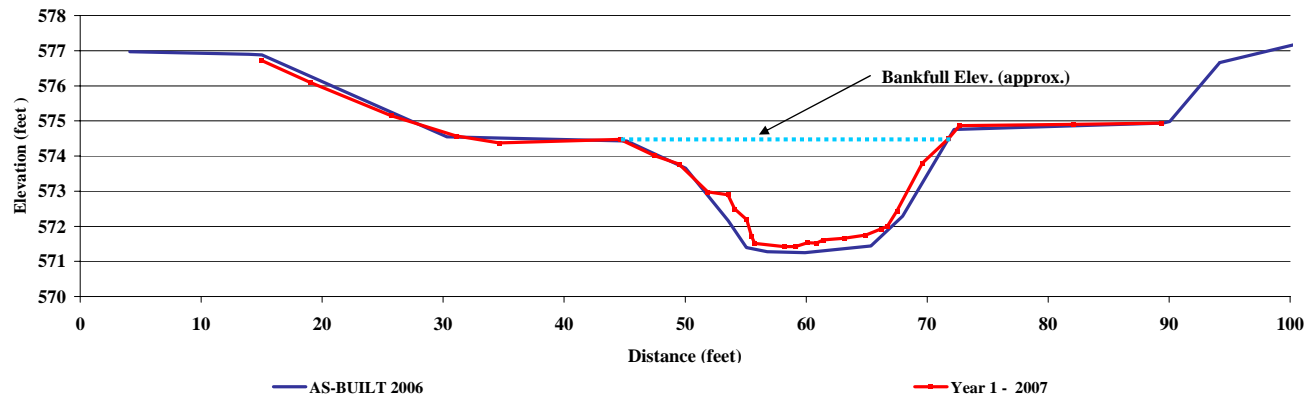


FIGURE B.6.2

Project Name UT Cane Creek
Project Number CMC/CFR/02
Cross Section Cross-Section 2 (X2)
Feature Riffle
Date 2/16/07
Crew Bidelspach, Taylor, Ruiz (Stantec)

Year 1 - 2007 2007 Survey			AS-BUILT 2006 AS-BUILT Survey		
Station	Elevation	Notes	Station	Elevation	Notes
27.8	574.64	LPIN	6.9	579.0	
30.9	574.0		17.3	577.1	
34.2	573.7		28.1	574.74	LPIN
40.4	572.9		31.7	573.6	
45.8	572.8		38.1	573.0	
48.8	572.4	LBKF	47.7	572.4	LBKF
51.6	570.9		47.8	572.5	
52.4	570.7		50.5	571.7	
53.0	570.0		52.0	570.6	
54.8	569.5		54.2	569.9	
56.5	569.2		56.9	569.3	
58.2	569.1		59.6	568.9	
59.8	569.2		63.1	569.3	
62.5	569.4		66.1	569.7	
64.3	569.7		67.8	570.5	
65.4	569.6		68.6	571.5	
66.5	570.1		73.9	572.8	RBKF
67.1	570.6		74.2	572.9	
67.5	570.9		85.6	573.7	
68.1	571.3		102.6	574.39	RPIN
69.0	571.5		105.8	574.6	
73.0	572.7	RBKF			
75.8	573.0				
85.2	573.8				
95.2	574.5				
102.5	574.43	RPIN			
102.7	574.4				



Photo of Cross-Section 2 - Looking Downstream @ As built STA 18+05

Summary	Year 1 - 2007	AS-BUILT 2006	Inner Berm 2007
Area	53.6	56.5	20.1
Width	24.2	26.2	15.9
Mean Depth	2.2	2.2	1.3
Max Depth	3.6	3.7	1.8
W/D	11.0	12.1	12.6

UT Cane Creek - Pool
Cross Section 2 As built STA: 18+05

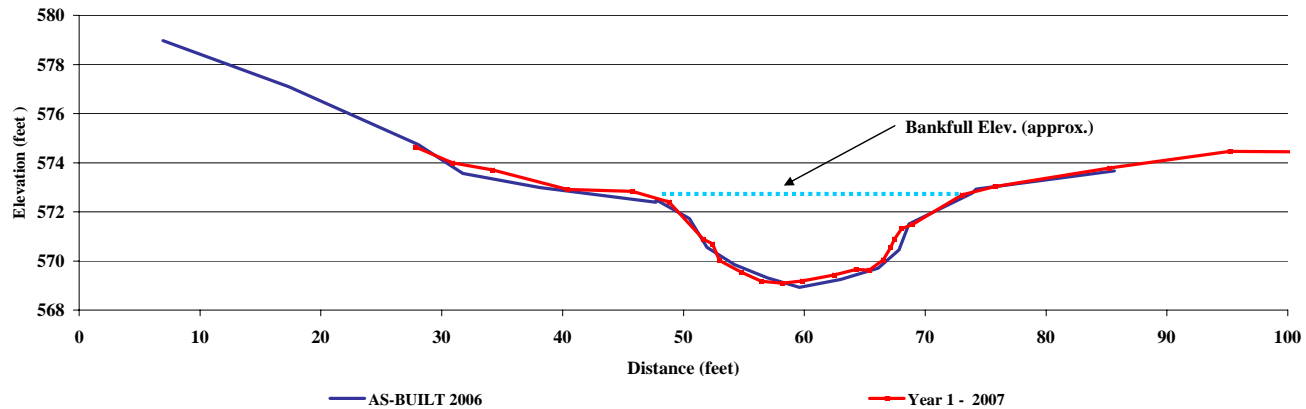


FIGURE B.6.3
Project Name UT Mary Creek
Project Number CMC/CFR/02
Cross Section Cross-Section 1 (X1)
Feature Pool
Date 2/16/07
Crew Bidelspach, Taylor, Ruiz (Stantec)

Year 1 - 2007 2007 Survey			AS-BUILT 2006 AS-BUILT Survey		
Station	Elevation	Notes	Station	Elevation	Notes
22.0	505.85	LPIN	13.3	506.1	
25.2	505.8		21.3	505.7	
29.7	506.0		22.3	506.10	LPIN
36.0	505.8	LBKF	35.5	505.9	LBKF
40.8	504.7		37.4	505.4	
42.6	504.6		38.7	505.0	
43.8	504.6		42.6	504.7	
45.0	504.2		46.5	503.9	
45.6	504.1		49.1	502.9	
45.9	503.9		51.1	502.9	
46.6	503.7		52.7	503.2	
47.0	503.4		54.1	505.2	
48.4	503.2		55.2	505.8	RBKF
49.1	503.2		56.1	506.2	
50.4	503.1		56.6	506.5	
51.8	503.3		59.5	506.2	
53.4	505.4		70.0	506.52	RPIN
54.3	505.8	RBKF	71.0	506.4	
56.2	506.5		97.9	508.4	
61.1	506.2				
66.6	506.3				
69.5	506.40				



Photo of Cross-Section 1 - Looking Downstream @ As built STA 12+87

Summary	Year 1 - 2007	AS-BUILT 2006	Inner Berm 2007
Area	27.3	30.4	9.0
Width	18.3	19.7	10.0
Mean Depth	1.5	1.5	0.9
Max Depth	2.8	3.0	1.6
W/D	12.3	12.8	11.1

UT Mary Creek - Pool
 Cross Section 1 As built STA: 12+87

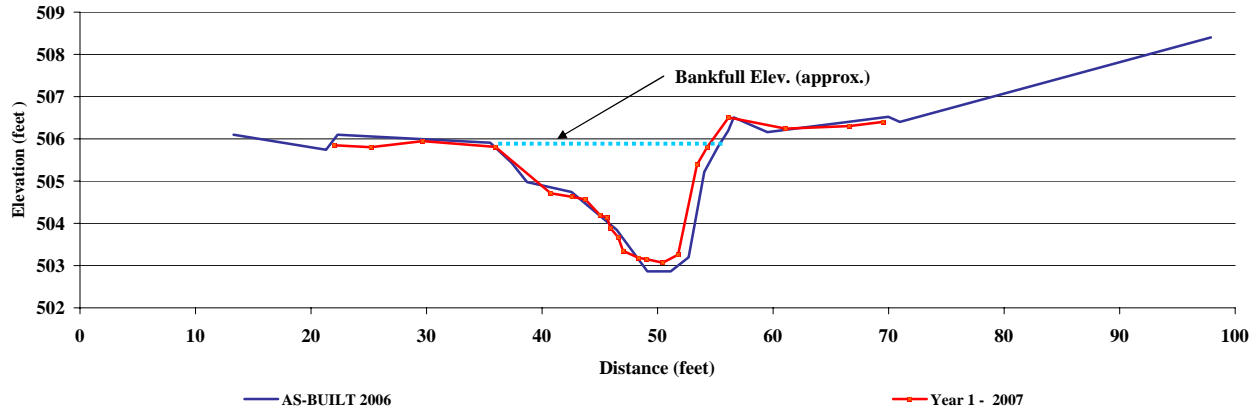


FIGURE B.6.4
Project Name UT Mary Creek
Project Number CMC/CFR/02
Cross Section Cross-Section 2 (X2)
Feature Riffle
Date 2/16/07
Crew Bidelspach, Taylor, Ruiz (Stantec)

Year 1 - 2007 2007 Survey			AS-BUILT 2006 AS-BUILT Survey		
Station	Elevation	Notes	Station	Elevation	Notes
28.2	506.50	LPIN	12.6	508.1	
31.3	505.9		26.4	506.6	
35.3	505.5	LBKF	28.2	506.84	LPIN
41.4	505.2		36.9	505.4	LBKF
45.5	504.8		45.4	504.9	
47.7	504.5		48.0	503.9	
48.5	503.9		50.9	503.4	
49.2	503.3		52.4	503.3	
50.0	503.1		54.1	503.4	
51.8	503.1		56.2	503.5	
53.3	503.3		58.2	503.8	
55.2	503.3		59.7	503.9	
56.3	503.5		60.7	504.4	
57.1	503.9		63.4	505.3	RBKF
57.2	504.2		64.1	505.4	
58.4	504.2		75.9	506.16	RPIN
59.8	504.2		78.0	505.9	
60.3	504.6		104.0	507.2	
61.8	505.0	RBKF			
64.6	505.5				
70.4	505.8				
75.6	505.84	RPIN			



Photo of Cross-Section 2 - Looking Downstream @ As built STA 13+61

Summary	Year 1 - 2007	AS-BUILT 2006	Inner Berm 2007
Area	26.6	28.1	9.0
Width	26.6	26.5	10.0
Mean Depth	1.0	1.1	0.9
Max Depth	2.2	2.1	1.6
W/D	26.6	25.0	11.1

UT Mary Creek - Riffle
 Cross Section 2 As built STA: 13+61

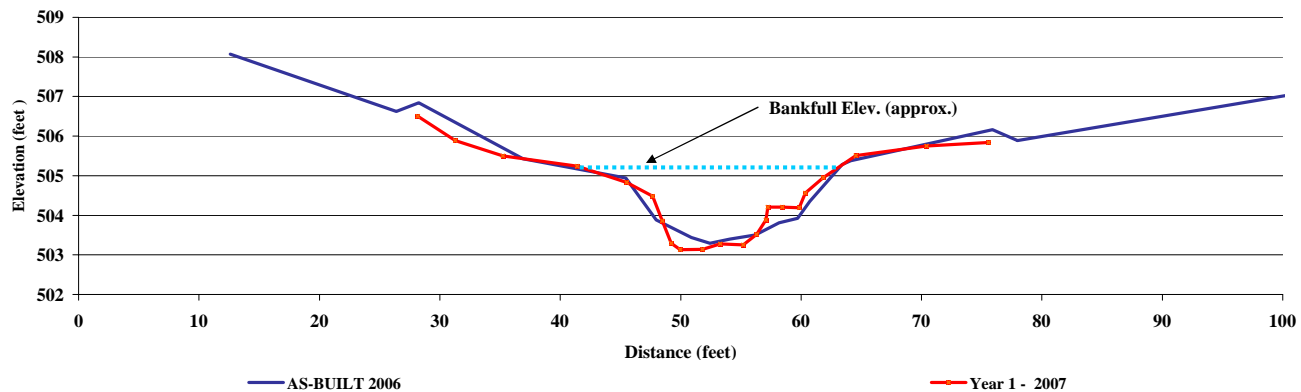


FIGURE B.6.5
Project Name UT Mary Creek UT
Project Number CMC/CFR/02
Cross Section Cross-Section 1 (Trib X1)
Feature Pool
Date 2/16/07
Crew Bidelspach, Taylor, Ruiz (Stantec)

Year 1 - 2007 2007 Survey			AS-BUILT 2006 AS-BUILT Survey		
Station	Elevation	Notes	Station	Elevation	Notes
2.6	506.15	LPIN	1.1	506.0	
4.1	506.2		3.0	506.1	
10.1	506.3		3.0	506.13	LPIN
13.0	506.2	LBKF	3.1	506.2	LBKF
16.0	506.0		12.8	506.1	
18.1	505.7		15.3	505.8	
18.8	505.6		19.0	505.2	
19.4	504.8		20.0	504.5	
20.0	504.6		21.9	504.2	
21.0	504.5		23.5	504.1	
22.4	504.4		25.5	504.4	
23.7	504.4		27.9	505.9	
24.8	504.5		35.9	506.8	RBKF
25.4	504.9		42.8	508.2	
25.7	505.2		49.8	510.61	RPIN
25.9	505.5		50.3	511.6	
26.9	505.9		50.4	511.6	
27.7	506.1	RBKF	50.4	511.6	
28.2	506.1		54.0	511.2	
32.5	506.5				
37.2	507.2				
43.2	508.7				
47.4	510.2				
49.8	510.75	RPIN			



Photo of Trib Cross-Section 1 - Looking Downstream @ As built STA 11+01

Summary	Year 1 - 2007	AS-BUILT 2006
Area	13.0	17.2
Width	14.7	15.1
Mean Depth	0.9	1.1
Max Depth	1.8	2.1
W/D	16.5	13.3

UT Mary Creek - Tributary - Pool
 Cross Section 1 As built STA: 11+01

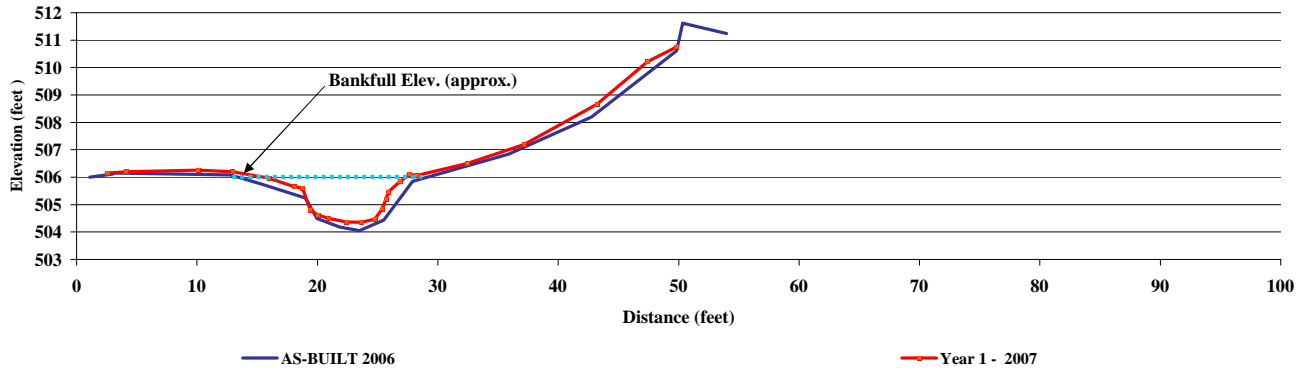


FIGURE B.6.6
Project Name UT Mary Creek UT
Project Number CMC/CFR/02
Cross Section Cross-Section 2 (Trib X2)
Feature Riffle
Date 2/16/07
Crew Bidelspach, Taylor, Ruiz (Stantec)

Year 1 - 2007 2007 Survey			AS-BUILT 2006 AS-BUILT Survey		
Station	Elevation	Notes	Station	Elevation	Notes
9.4	506.30	LPIN	1.7	507.9	
10.0	505.9		9.5	506.27	LPIN
12.5	505.9		9.5	506.3	
17.1	506.0		10.0	505.9	
21.6	505.9		25.3	505.7	LBKF
25.4	505.8	LBKF	27.2	505.1	
26.9	505.4		29.2	504.6	
27.1	505.1		31.6	504.3	
28.8	504.8		33.9	504.5	
29.5	504.7		37.1	505.8	RBKF
29.9	504.5		45.3	505.8	
30.6	504.4		56.8	507.5	
31.3	504.4		59.1	507.7	
32.6	504.3		59.2	507.71	RPIN
33.3	504.4		66.5	508.0	
33.4	504.5				
33.9	504.9				
34.8	505.2				
36.6	505.7	RBKF			
39.8	505.7				
43.1	505.8				
46.6	506.1				
50.7	506.8				
55.3	507.4				
58.8	507.6				
59.0	507.57	RPIN			



Photo of Trib Cross-Section 2 - Looking Downstream @ As built STA 11+89

Summary	Year 1 - 2007	AS-BUILT 2006
Area	8.8	10.0
Width	11.2	11.8
Mean Depth	0.8	0.8
Max Depth	1.4	1.4
W/D	14.3	13.9

UT Mary Creek - Tributary - Riffle
 Cross Section 2 STA: 11+89

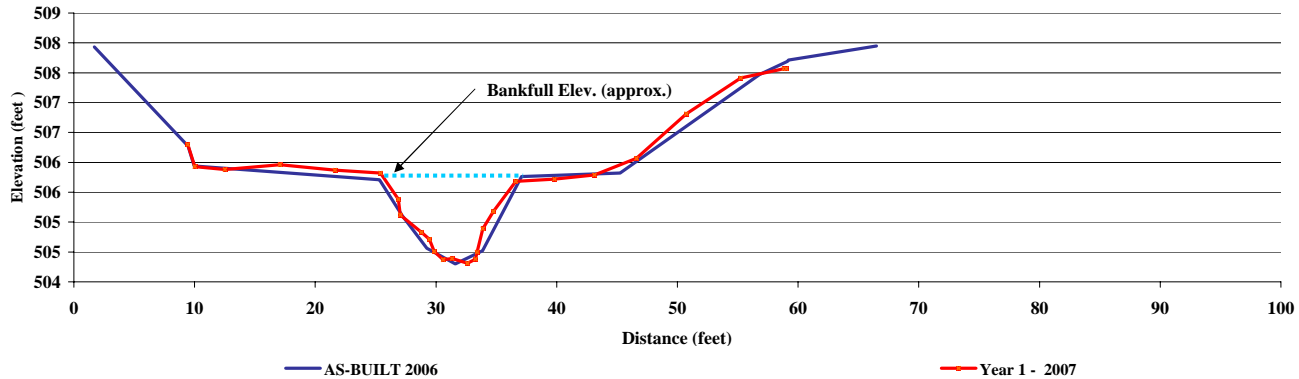
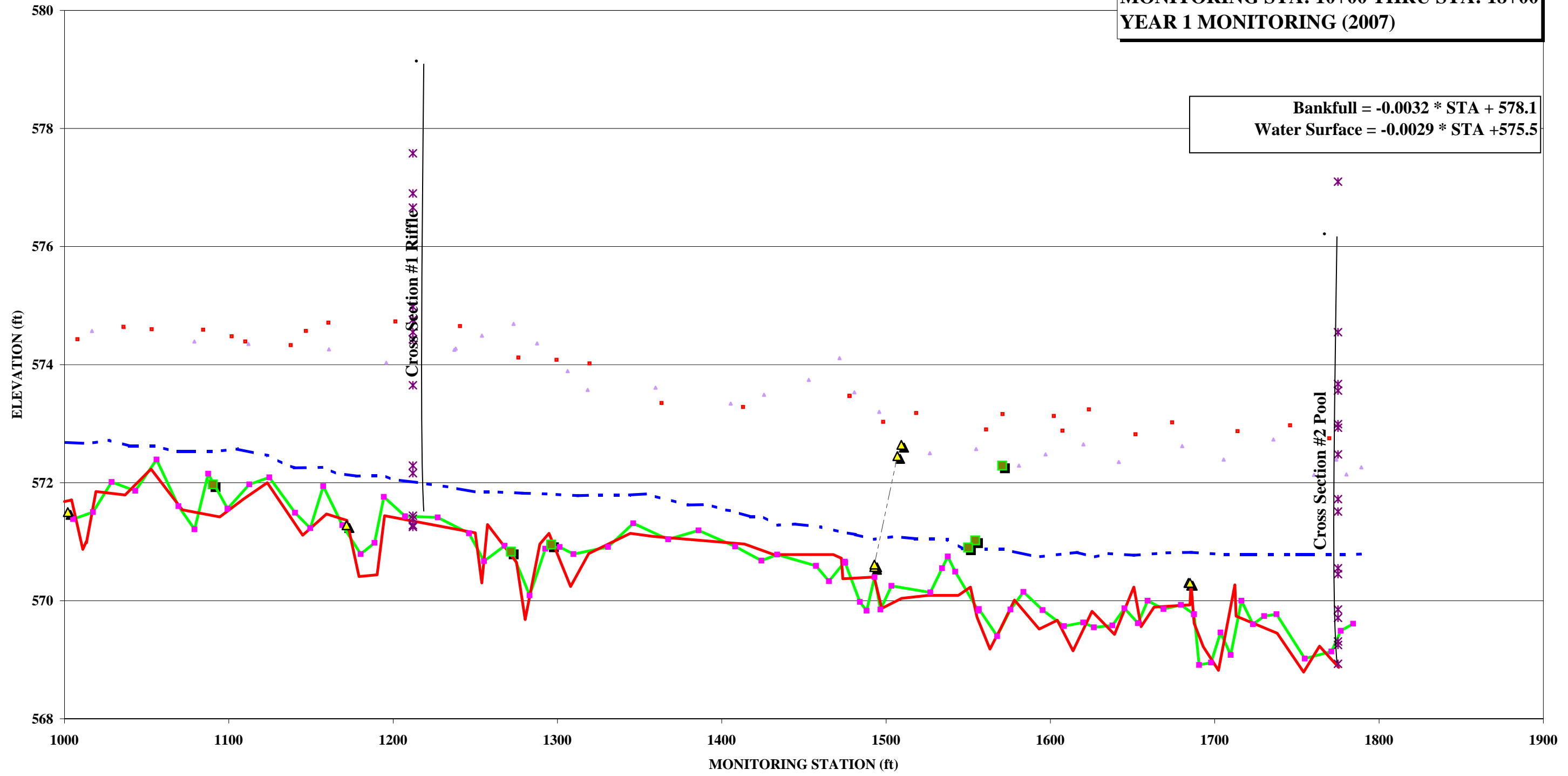


FIGURE B.7.1
UT CANE CREEK - LONG PROFILE
MONITORING STA: 10+00 THRU STA: 18+00
YEAR 1 MONITORING (2007)



Bankfull = $-0.0032 * STA + 578.1$
 Water Surface = $-0.0029 * STA + 575.5$

- 2007-Water Surface
- 2007-Thalweg
- 2006-Thalweg
- ▲ LBKF
- RBKF
- ▲ ROCK CROSS VANES
- J-Hook
- × Cross Sections

FIGURE B.7.2
UT MARY CREEK - LONG PROFILE
MONITORING STA: 10+00 THRU STA: 16+00
YEAR 1 MONITORING (2007)

Bankfull = $-0.0034 * STA + 509.2$
Water Surface = $-0.0038 * STA + 508.4$

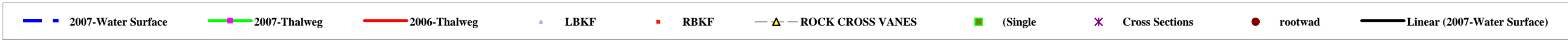
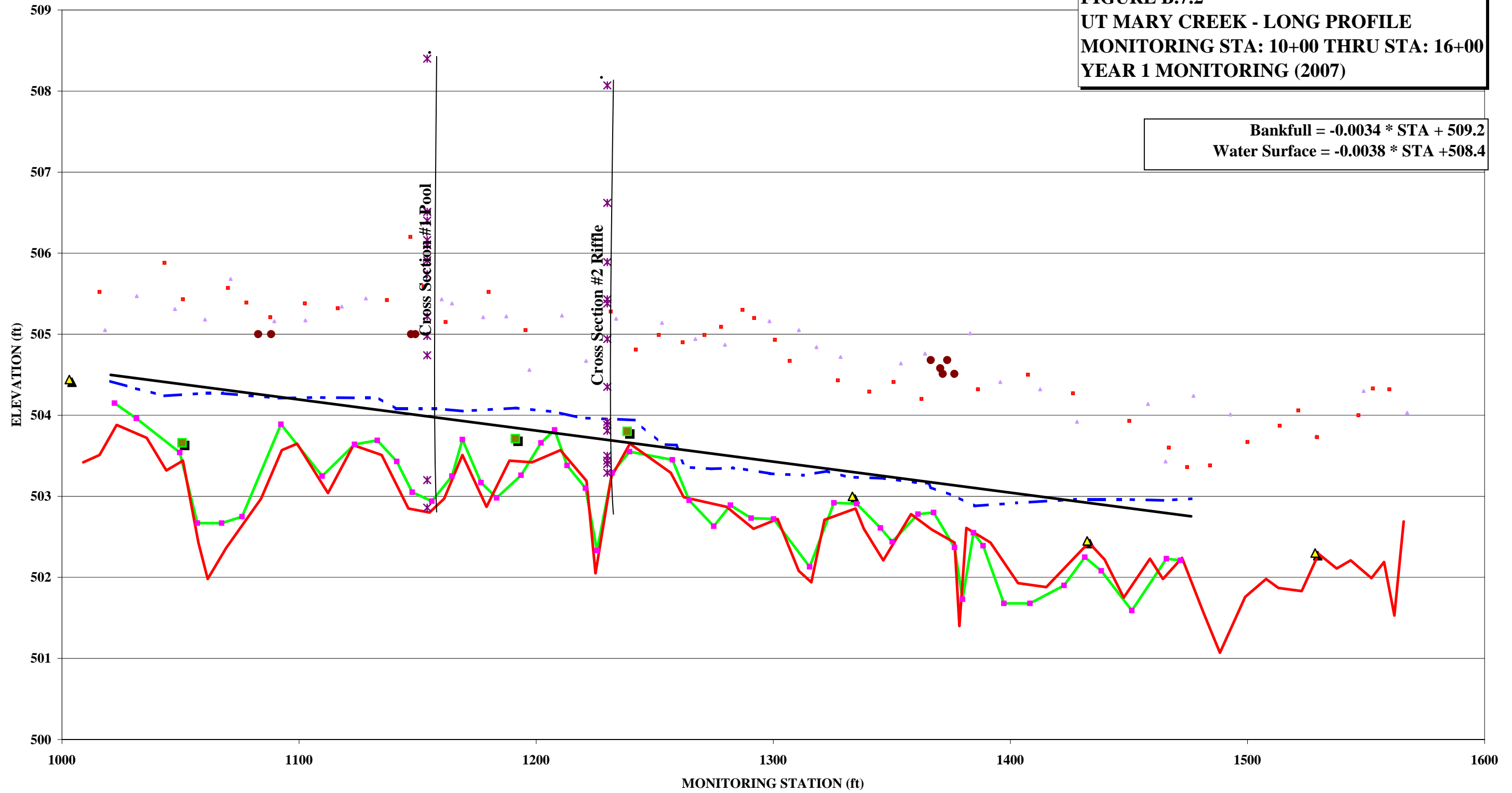
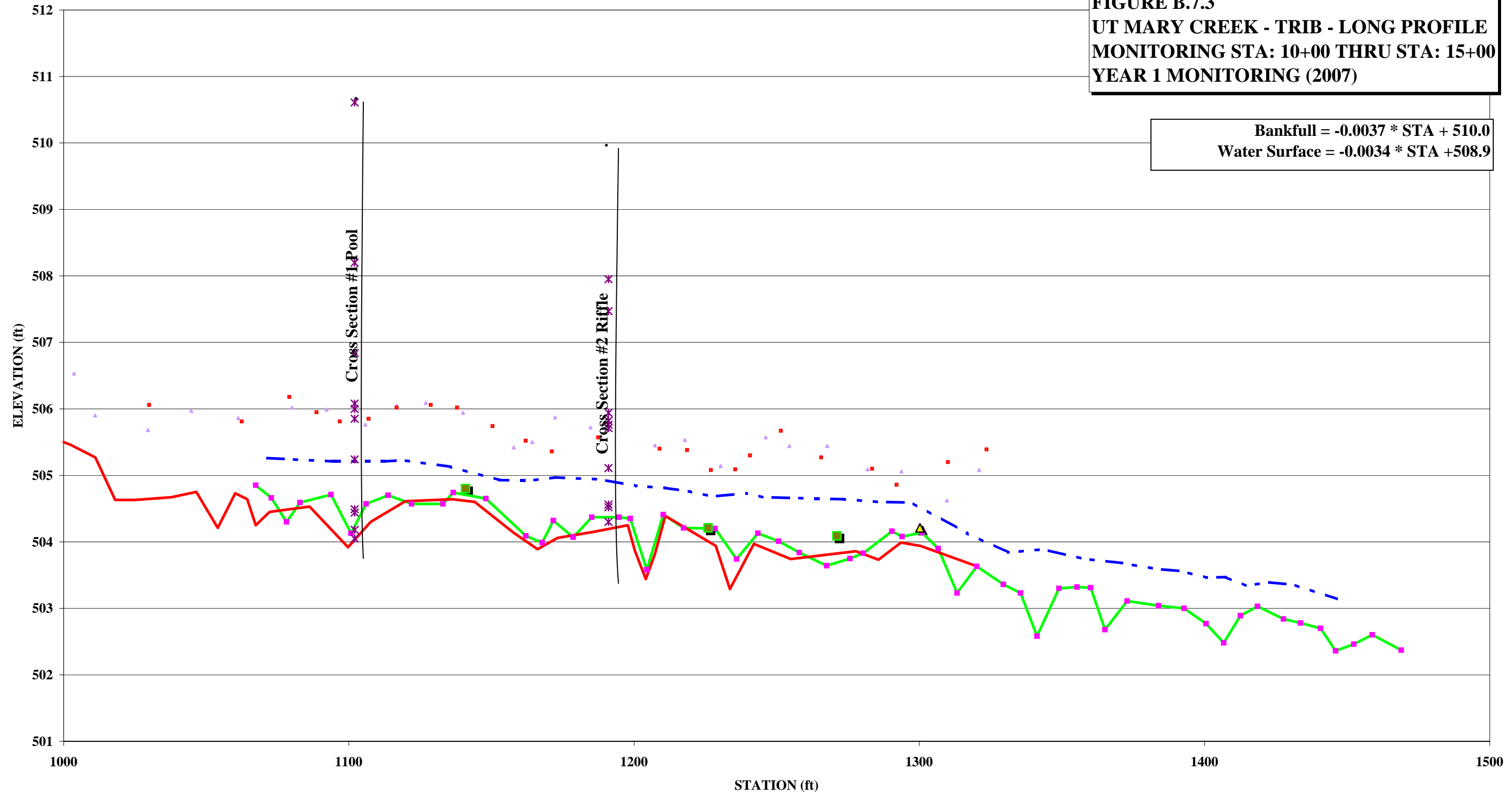


FIGURE B.7.3
UT MARY CREEK - TRIB - LONG PROFILE
MONITORING STA: 10+00 THRU STA: 15+00
YEAR 1 MONITORING (2007)

Bankfull = $-0.0037 * STA + 510.0$
Water Surface = $-0.0034 * STA + 508.9$



B.8 Pebble Count Distribution

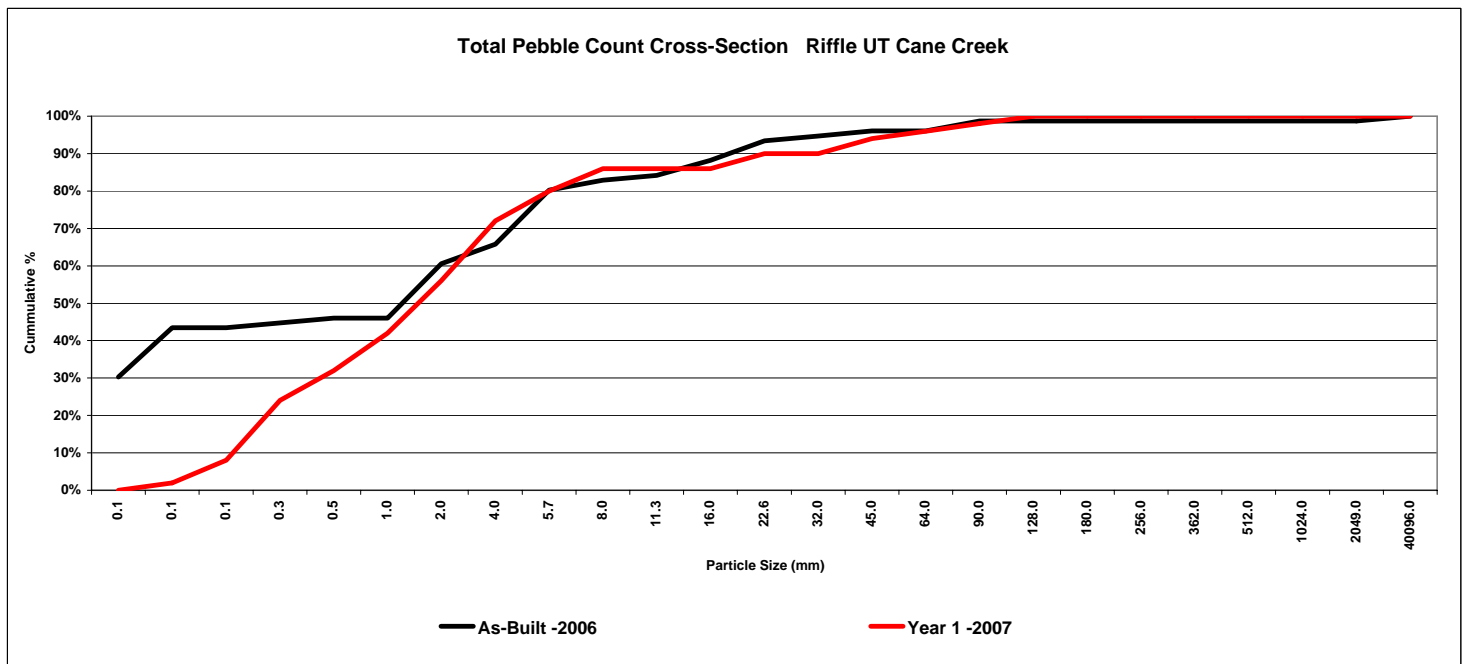
Project Name	UT Cane Creek		
Cross Section			
Feature	Riffle		
Date	2/16/07	Monitoring Year 1	
Crew	Bidelspach, Taylor, Ruiz		

As-Built -2006

Year 1 -2007

Description	Material	Size(mm)	Riffle - Bed	%	Cum %	Riffle - Bank	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061	23	30.3%	30.3%	10	0	0.0%	0.0%
Sand	very fine sand	0.062	10	13.2%	43.4%	6	1	2.0%	2.0%
	fine sand	0.125		0.0%	43.4%	0	3	6.0%	8.0%
	medium sand	0.25	1	1.3%	44.7%	2	8	16.0%	24.0%
	course sand	0.50	1	1.3%	46.1%	0	4	8.0%	32.0%
	very course sand	1.0		0.0%	46.1%	0	5	10.0%	42.0%
Gravel	very fine gravel	2.0	11	14.5%	60.5%	0	7	14.0%	56.0%
	fine gravel	4.0	4	5.3%	65.8%	0	8	16.0%	72.0%
	fine gravel	5.7	11	14.5%	80.3%	0	4	8.0%	80.0%
	medium gravel	8.0	2	2.6%	82.9%	0	3	6.0%	86.0%
	medium gravel	11.3	1	1.3%	84.2%	0	0	0.0%	86.0%
	course gravel	16.0	3	3.9%	88.2%	0	0	0.0%	86.0%
	course gravel	22.6	4	5.3%	93.4%	0	2	4.0%	90.0%
	very course gravel	32	1	1.3%	94.7%	0	0	0.0%	90.0%
	very course gravel	45	1	1.3%	96.1%	0	2	4.0%	94.0%
	Cobble	small cobble	64		0.0%	96.1%	0	1	2.0%
medium cobble		90	2	2.6%	98.7%	0	1	2.0%	98.0%
large cobble		128	0	0.0%	98.7%	0	1	2.0%	100.0%
very large cobble		180	0	0.0%	98.7%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	98.7%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	98.7%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	98.7%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	98.7%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	98.7%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	1	1.3%	100.0%	0	0	0.0%	100.0%
TOTAL/ % of whole count			76	100.0%		18	50	100.0%	

	d16	d35	d50	d85	d95
Year 1 -2007	0.28	0.98	2.36	8.72	65.75C



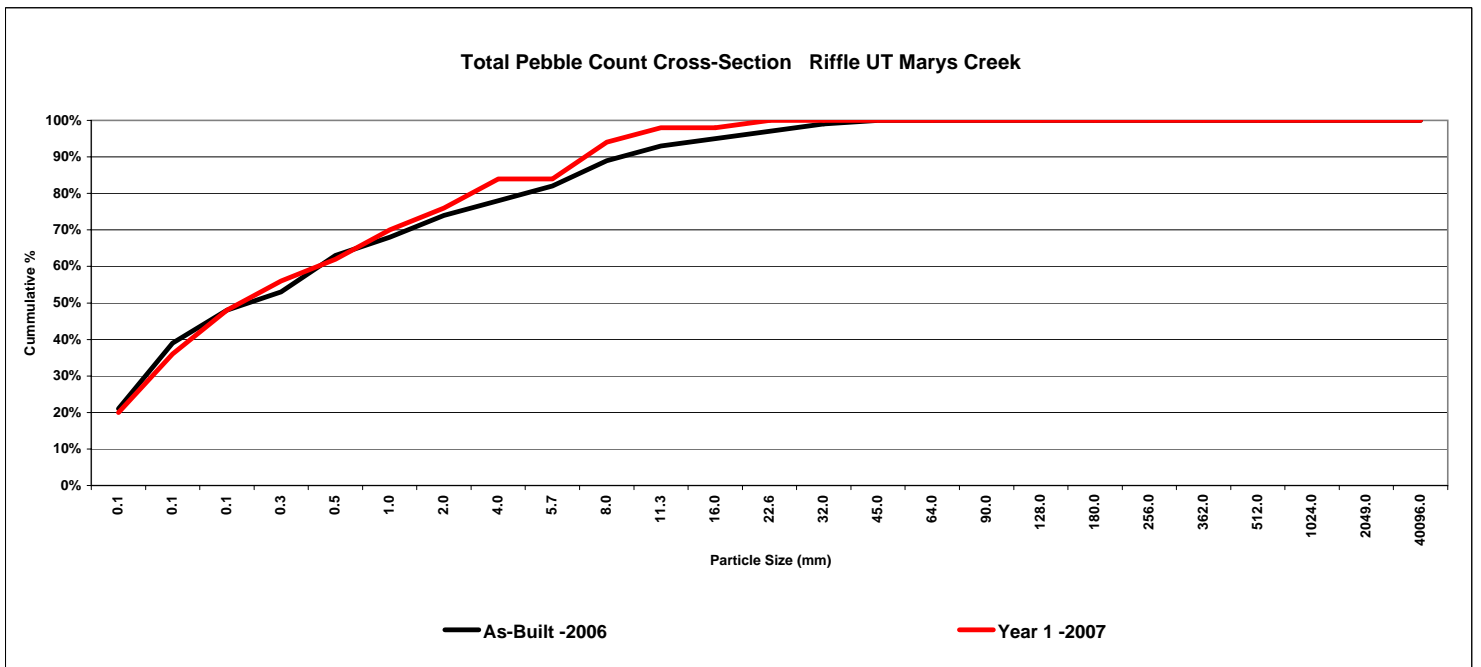
Project Name	UT Marys Creek		
Cross Section			
Feature	Riffle		
Date	2/16/07	Monitoring Year 1	
Crew	Bidelspach, Taylor, Ruiz		

As-Built -2006

Year 1 -2007

Description	Material	Size (mm)	Riffle - Bed	%	Cum %	Riffle - Bank	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061	21	21.0%	21.0%	8	10	20.0%	20.0%
Sand	very fine sand	0.062	18	18.0%	39.0%	5	8	16.0%	36.0%
	fine sand	0.125	9	9.0%	48.0%	2	6	12.0%	48.0%
	medium sand	0.25	5	5.0%	53.0%	0	4	8.0%	56.0%
	course sand	0.50	10	10.0%	63.0%	0	3	6.0%	62.0%
	very course sand	1.0	5	5.0%	68.0%	0	4	8.0%	70.0%
G r a v e l	very fine gravel	2.0	6	6.0%	74.0%	0	3	6.0%	76.0%
	fine gravel	4.0	4	4.0%	78.0%	0	4	8.0%	84.0%
	fine gravel	5.7	4	4.0%	82.0%	0	0	0.0%	84.0%
	medium gravel	8.0	7	7.0%	89.0%	0	5	10.0%	94.0%
	medium gravel	11.3	4	4.0%	93.0%	0	2	4.0%	98.0%
	course gravel	16.0	2	2.0%	95.0%	0	0	0.0%	98.0%
	course gravel	22.6	2	2.0%	97.0%	0	1	2.0%	100.0%
	very course gravel	32	2	2.0%	99.0%	0	0	0.0%	100.0%
	very course gravel	45	1	1.0%	100.0%	0	0	0.0%	100.0%
Cobble	small cobble	64	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium cobble	90	0	0.0%	100.0%	0	0	0.0%	100.0%
	large cobble	128	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL /% of whole count				100%	100.0%	15	50	100.0%	

	d16	d35	d50	d85	d95
Year 1 -2007	0.00	0.09	0.23	11.70	10.65



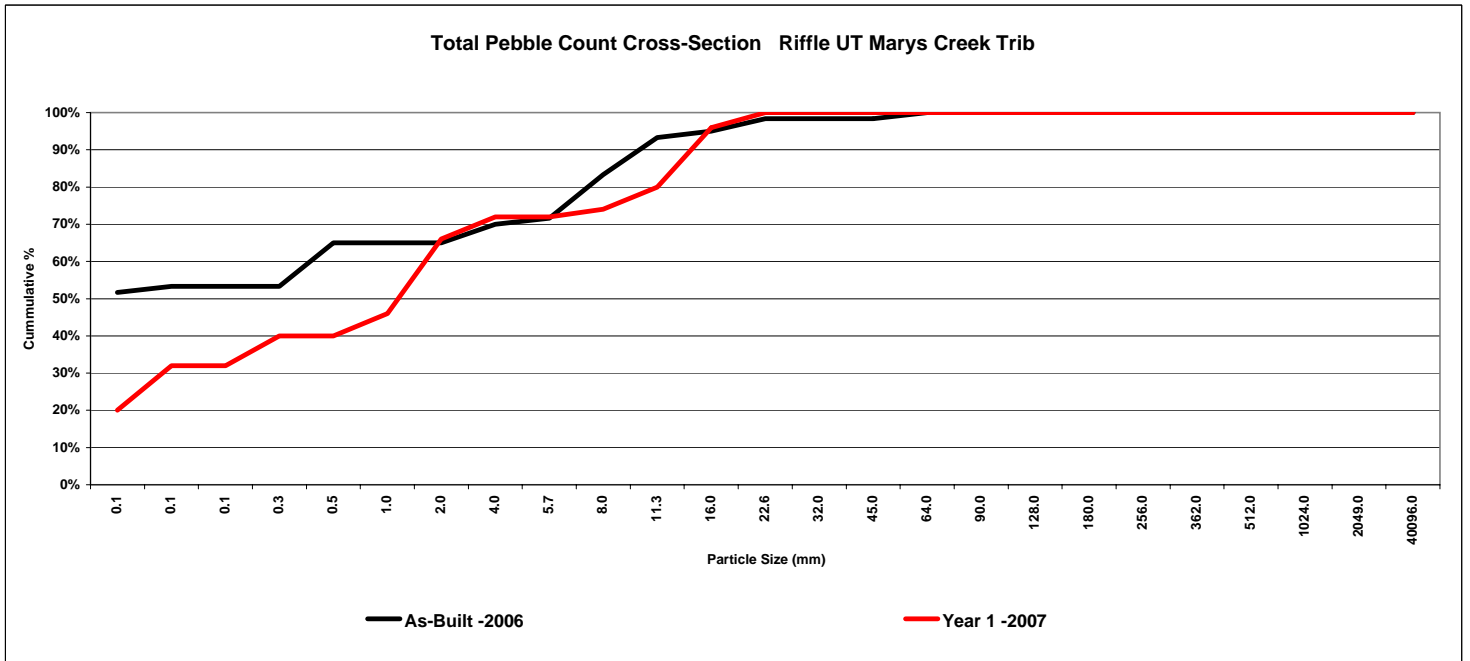
Project Name	UT Marys Creek Trib
Cross Section	
Feature	Riffle
Date	2/16/07 Monitoring Year 1
Crew	Bidelspach, Taylor, Ruiz

As-Built -2006

Year 1 -2007

Description	Material	Size (mm)	Riffle - Bed	%	Cum %	Riffle - Bank	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061	31	51.7%	51.7%	10	10	20.0%	20.0%
Sand	very fine sand	0.062	1	1.7%	53.3%	6	6	12.0%	32.0%
	fine sand	0.125		0.0%	53.3%	0	0	0.0%	32.0%
	medium sand	0.25		0.0%	53.3%	2	4	8.0%	40.0%
	course sand	0.50	7	11.7%	65.0%	0	0	0.0%	40.0%
	very course sand	1.0		0.0%	65.0%	0	3	6.0%	46.0%
Gravel	very fine gravel	2.0		0.0%	65.0%	0	10	20.0%	66.0%
	fine gravel	4.0	3	5.0%	70.0%	0	3	6.0%	72.0%
	fine gravel	5.7	1	1.7%	71.7%	0	0	0.0%	72.0%
	medium gravel	8.0	7	11.7%	83.3%	0	1	2.0%	74.0%
	medium gravel	11.3	6	10.0%	93.3%	0	3	6.0%	80.0%
	course gravel	16.0	1	1.7%	95.0%	0	8	16.0%	96.0%
	course gravel	22.6	2	3.3%	98.3%	0	2	4.0%	100.0%
	very course gravel	32		0.0%	98.3%	0	0	0.0%	100.0%
	very course gravel	45		0.0%	98.3%	0	0	0.0%	100.0%
Cobble	small cobble	64	1	1.7%	100.0%	0	0	0.0%	100.0%
	medium cobble	90		0.0%	100.0%	0	0	0.0%	100.0%
	large cobble	128	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096		0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / % of whole count			60	100.0%		18	50	100.0%	

	d16	d35	d50	d85	d95
Year 1 -2007	0.00	0.26	1.80	15.06	18.95



Appendix C. Wetland Raw Data (N/A)

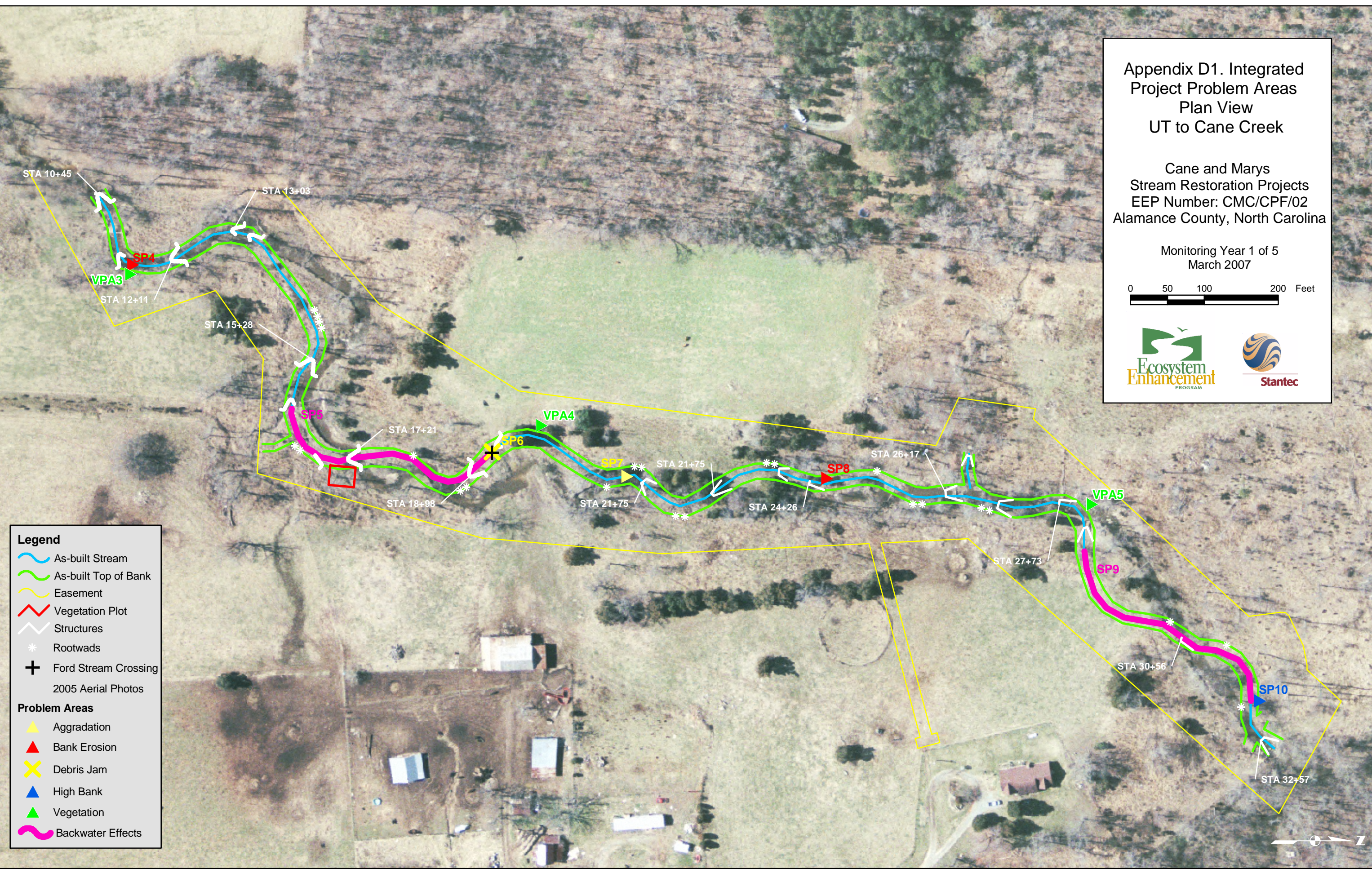
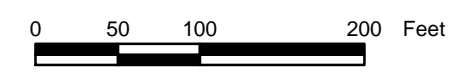
Wetlands were not restored at the Cane & Marys Stream Restoration Sites.

Appendix D. Integrated Problem Area Plan View

Appendix D1. Integrated
Project Problem Areas
Plan View
UT to Cane Creek

Cane and Marys
Stream Restoration Projects
EEP Number: CMC/CPF/02
Alamance County, North Carolina

Monitoring Year 1 of 5
March 2007



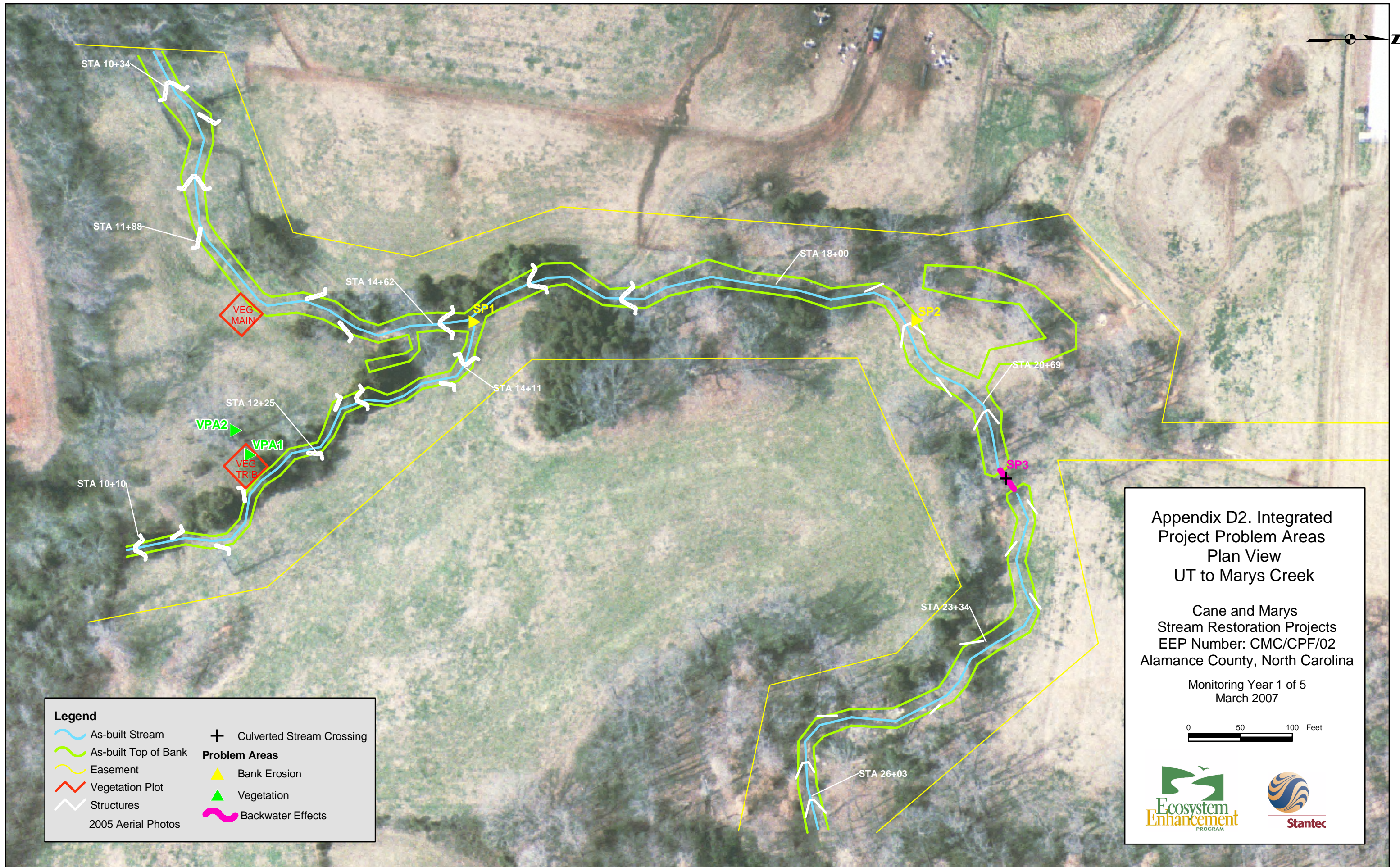
Legend

- As-built Stream
- As-built Top of Bank
- Easement
- Vegetation Plot
- Structures
- Rootwads
- Ford Stream Crossing
- 2005 Aerial Photos

Problem Areas

- Aggradation
- Bank Erosion
- Debris Jam
- High Bank
- Vegetation
- Backwater Effects





STA 10+34

STA 11+88

STA 14+62

STA 18+00

STA 20+69

STA 10+10

STA 12+25

STA 14+11

STA 23+34

STA 26+03

VEG MAIN

VEG TRIB

VPA2

VPA1

SP1

SP2

SP3

Legend

- As-built Stream
- As-built Top of Bank
- Easement
- Vegetation Plot
- Structures
- 2005 Aerial Photos
- Culverted Stream Crossing
- Problem Areas**
- Bank Erosion
- Vegetation
- Backwater Effects

Appendix D2. Integrated Project Problem Areas Plan View
UT to Marys Creek

Cane and Marys Stream Restoration Projects
 EEP Number: CMC/CPF/02
 Alamance County, North Carolina

Monitoring Year 1 of 5
 March 2007

0 50 100 Feet