



**UT to BILLY'S CREEK
FINAL MONITORING REPORT
YEAR 4 OF 5
2009**

EEP Project # 36
Franklin County, North Carolina

Submitted to:



NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699

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MONITORING SUMMARY

The Unnamed Tributary (UT) to Billy's Creek Stream Restoration Project is located northeast of Franklinton in Franklin County, North Carolina. The project reach is located in a sparsely developed agricultural watershed, mostly used for cattle pasture. Pre-construction conditions of the UT to Billy's Creek included a 1,878 linear foot section of degraded, perennial channel and several ditch-like tributaries. The upstream portions of the project reach retained an active floodplain area, whereas the downstream portions were severely incised (4 to 6 feet). The restoration of the UT to Billy's Creek was conducted as a Priority I restoration by returning the channel to an elevation such that the historic floodplain is utilized for over-bank flows. The proposed stream classification for the project reach was a meandering E5 channel, with a total length of 2,101 linear feet. The goals and objectives for the Unnamed Tributary to Billy's Creek Stream Restoration Project are to:

- Restore the project reach to a more natural dimension, pattern and profile so that the stream will be able to efficiently transport water and sediment loads provided by the watershed;
- Reconnect the project reach's channel to its historic floodplain where feasible;
- Eliminate the excessive sediment contribution to the system by the mass wasting and erosion of the stream banks along the reach; and
- Repair and restore the riparian corridor along the project reach in order to improve habitat and protect the stream from further erosion.

Good planted stem densities were found for all five vegetation plots for UT to Billy's Creek. Stem densities were above the final Monitoring Year 5 goal of 260 stems per acre for all plots. The overall stem density (excluding livestock) across all vegetation plots was 380.4 living planted stems per acre.

The majority of the UT Billys restoration reach remained stable through Monitoring Year 4, with the exception of a 378 foot section of sand deposition at the upstream end of the reach (Station 10+00 to 13+78). Excess sand deposition has completely filled the channel and blanketed out over the floodplain making it very difficult to locate the main channel in the upstream-most 150 feet due to braiding. This deposition has changed the channel dimension and profile significantly over the monitoring period. Cross Section 1 (Station 11+73) clearly shows a steady stream-bed elevation rise through Monitoring Year 4 that is likely correlated with this deposition. Furthermore, the Monitoring Year 4 bankfull cross sectional area of Cross Section 1 was the lowest documented compared to the three previous monitoring years. There were a few additional aggradation areas found further downstream that appear to have excess sediment deposits for long sections (See 'Stream Problem Area Plan View' Appendix A). Other problem areas were associated with bank erosion. Bank erosion is not a major problem in the reach because it has impacted a low percentage of the total banks. The two areas of past severe concern (Station 18+73 and 20+63) have apparently stabilized. No further signs of active erosion were observed at these locations in 2010. All structures appeared to be in good physical condition. The only structure-associated problems noted for Monitoring Year 4 are several structures and their associated pools that have been buried under excess sand deposition.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents

available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

METHODOLOGY

Vegetation Methodology

The following methodology was used for the stem count. The configuration of the vegetation plots was marked out with tape to measure 10 meters by 10 meters (or equivalent to 100 square meters) depending on buffer width. The planted material in the plot was marked with flagging. Plot inventories were conducted per the 2006 CVS-EEP Protocol for Recording Vegetation (EEP 2006).

Stream Methodology

The project monitoring for the stream channel included a longitudinal survey, cross-sectional surveys, problem area identification, and photo documentation. The specific methodology for each portion of the stream monitoring is described in detail below.

Longitudinal Profile and Plan View

A longitudinal profile was surveyed with a Nikon DTM-520 Total Station, prism, and a TDS Recon Pocket PC. The heads of features (i.e., riffles, runs, pools, and glides) were surveyed, as well as the point of maximum depth of each pool, boundaries of problem areas, and any other significant slope-breaks or points of interest. At the head of each feature and at the maximum pool depth, thalweg, water surface, edge of water, left and right bankfull, and left and right top of bank (if different than bankfull) were surveyed. All profile measurements were extracted from this survey, including channel and valley length and length of each feature, water surface slope for each reach and feature, bankfull slope for the reach, and pool spacing. This survey also was used to draw plan view figures with Microstation v8 (Bentley Systems, Inc., Exton, PA). All pattern measurements (i.e. meander length, radius of curvature, belt width, meander width ratio, and sinuosity) were extracted from the plan view. Stationing was calculated along the thalweg.

Permanent Cross Sections

Four permanent cross sections (two riffles and two pools) were surveyed. The beginning and end of each permanent cross section were originally marked with a long PVC tube. Cross sections were installed perpendicular to the stream flow. Each cross section survey noted all changes in slopes, tops of both banks (if different from bankfull), left and right bankfull, edges of water, thalweg and water surface. The cross sections were then plotted, and Monitoring Year 4 data was overlain on data from all previous monitoring years for comparison. All dimension measurements (i.e. bankfull width, floodprone width, bankfull mean depth, cross sectional area, width-to-depth ratio, entrenchment ratio, bank height ratio, wetted perimeter, and hydraulic radius) were extracted from these plots and compared to the Monitoring Year 1 data.

Pebble Counts

Based on the fact that UT Billy's is a sandbed stream, it was determined that pebble counts were unnecessary as they would fail to detect changes in fine sediment amounts in the channel bed. Therefore, pebble counts were not performed for Monitoring Year 4.

Photo Documentation

Permanent photo points were established during Monitoring Year 1. A set of three photographs (facing upstream, facing downstream, and facing the channel) were taken at each photo point with a digital camera.

Two photographs were taken at each cross-section (facing upstream and downstream). A representative photograph of each vegetation plot was taken at the designated corner of the vegetation plot and in the same direction as the Monitoring Year 1 photograph. An arrow was placed on the designated corner of each vegetation plot on the plan view sheets to document the corner and direction of each photograph. Photos were also taken of all significant stream and vegetation problem areas.

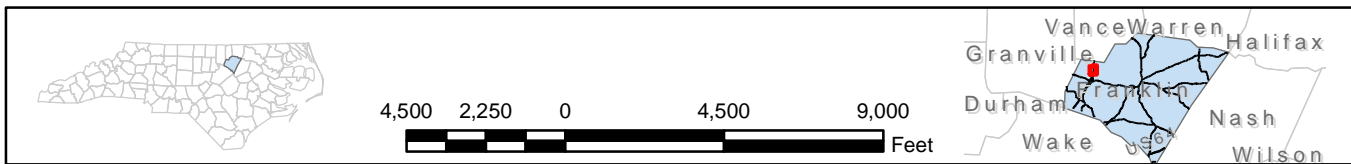
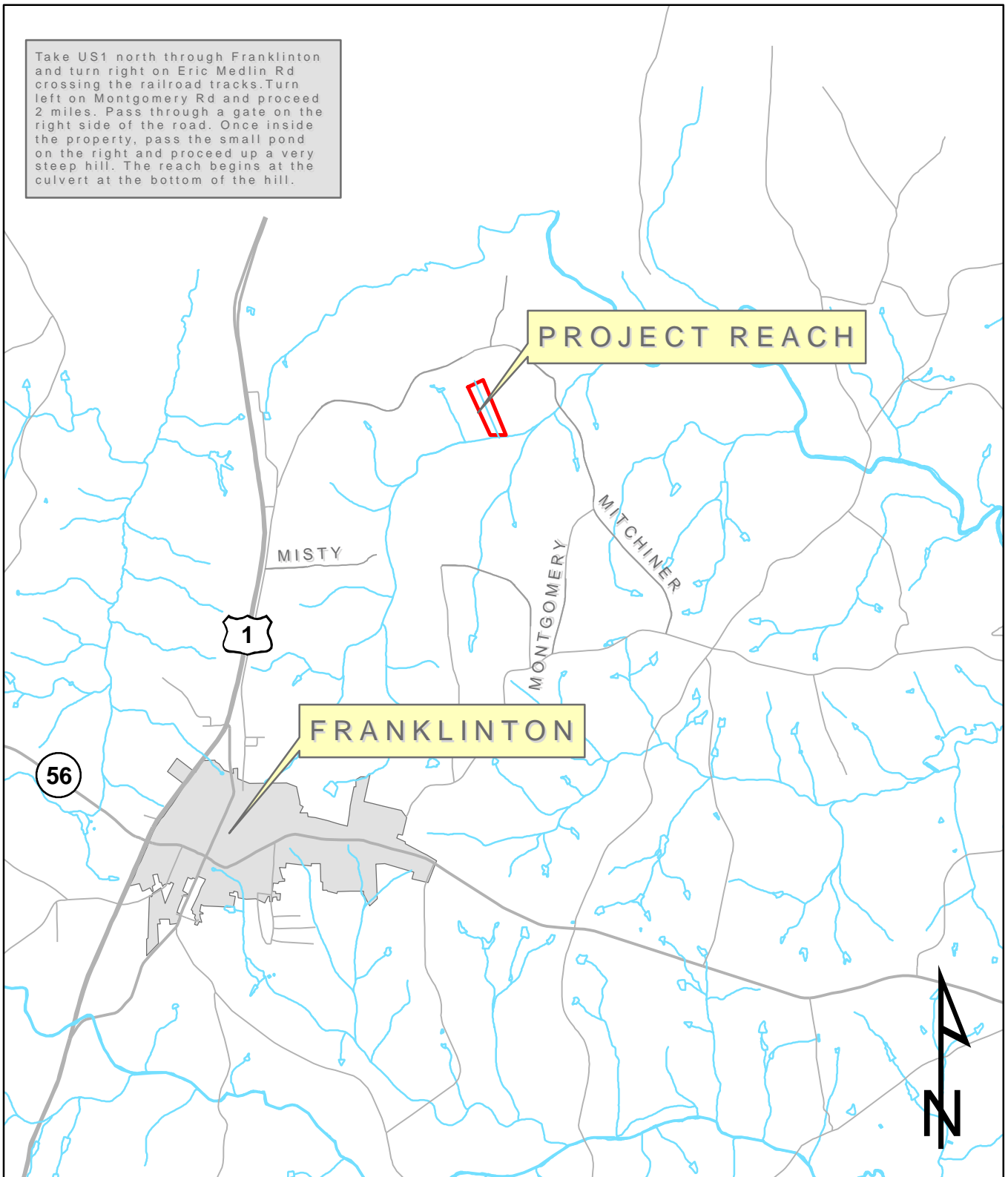
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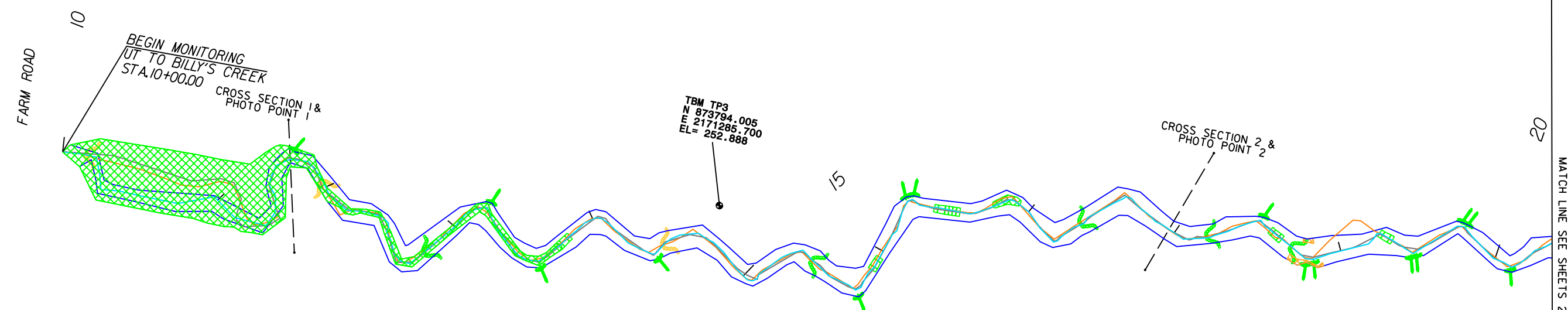
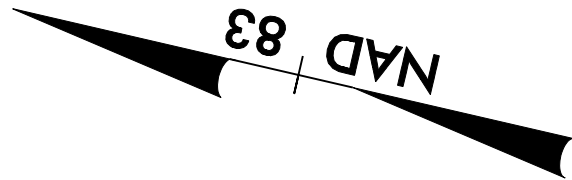
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http://www.saw.usace.army.mil/wetlands/Mitigation/stream_mitigation.html

APPENDIX A

GENERAL FIGURES AND PLAN VIEWS

Take US1 north through Franklinton and turn right on Eric Medlin Rd crossing the railroad tracks. Turn left on Montgomery Rd and proceed 2 miles. Pass through a gate on the right side of the road. Once inside the property, pass the small pond on the right and proceed up a very steep hill. The reach begins at the culvert at the bottom of the hill.





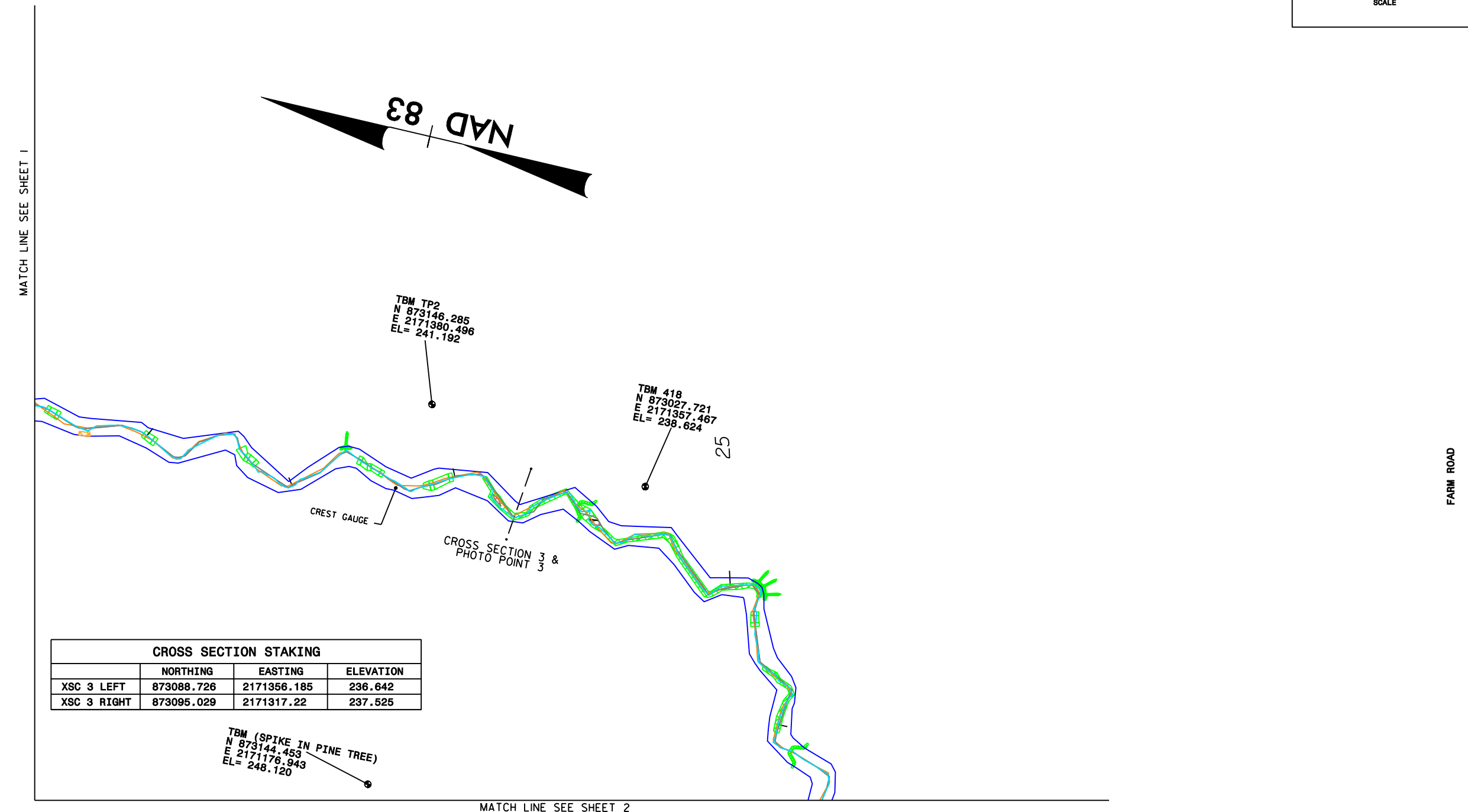
CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 1 LEFT	874028.417	2171290.902	255.783
XSC 1 RIGHT	874013.105	2171221.723	255.566
XSC 2 LEFT	873538.889	2171358.973	247.328
XSC 2 RIGHT	873564.247	2171291.268	247.904

LEGEND

<p>STREAM FEATURES</p> <ul style="list-style-type: none"> THALWEG AS-BUILT THALWEG 2008 THALWEG 2009 BANKFULL 2009 BANK EROSION SEVERE BANK EROSION AGGRADATION EXPOSED SEDIMENT BAR 	<p>PROJECT ELEMENTS</p> <ul style="list-style-type: none"> CROSS-SECTION/PHOTO-POINT CONTROL POINT/BENCHMARK (TBM) EASEMENT BOUNDARY 	<p>STRUCTURE TYPES</p> <ul style="list-style-type: none"> ROCK CROSS VANE ROCK STEP STRUCTURE ROOTWAD 	<p>COLOR CODE FOR STRUCTURES</p> <ul style="list-style-type: none"> GOOD STRUCTURE (ACTUAL LOCATION) STRUCTURE WITH POTENTIAL PROBLEM (ACTUAL LOCATION) FAILING STRUCTURE (ACTUAL LOCATION)
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LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL STREAM - YEAR 4	
PROJ #: 36	COUNTY: FRANKLIN
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 3/01/2010



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 3 LEFT	873088.726	2171356.185	236.642
XSC 3 RIGHT	873095.029	2171317.22	237.525

MATCH LINE SEE SHEET 2

LEGEND

<p>STREAM FEATURES</p> <ul style="list-style-type: none"> THALWEG AS-BUILT THALWEG 2008 THALWEG 2009 BANKFULL 2009 BANK EROSION SEVERE BANK EROSION AGGRADATION EXPOSED SEDIMENT BAR 	<p>PROJECT ELEMENTS</p> <ul style="list-style-type: none"> CROSS-SECTION/PHOTO-POINT CONTROL POINT/BENCHMARK (TBM) EASEMENT BOUNDARY 	<p>STRUCTURE TYPES</p> <ul style="list-style-type: none"> ROCK CROSS VANE ROCK STEP STRUCTURE ROOTWAD 	<p>COLOR CODE FOR STRUCTURES</p> <ul style="list-style-type: none"> GOOD STRUCTURE (ACTUAL LOCATION) STRUCTURE WITH POTENTIAL PROBLEM (ACTUAL LOCATION) FAILING STRUCTURE (ACTUAL LOCATION)
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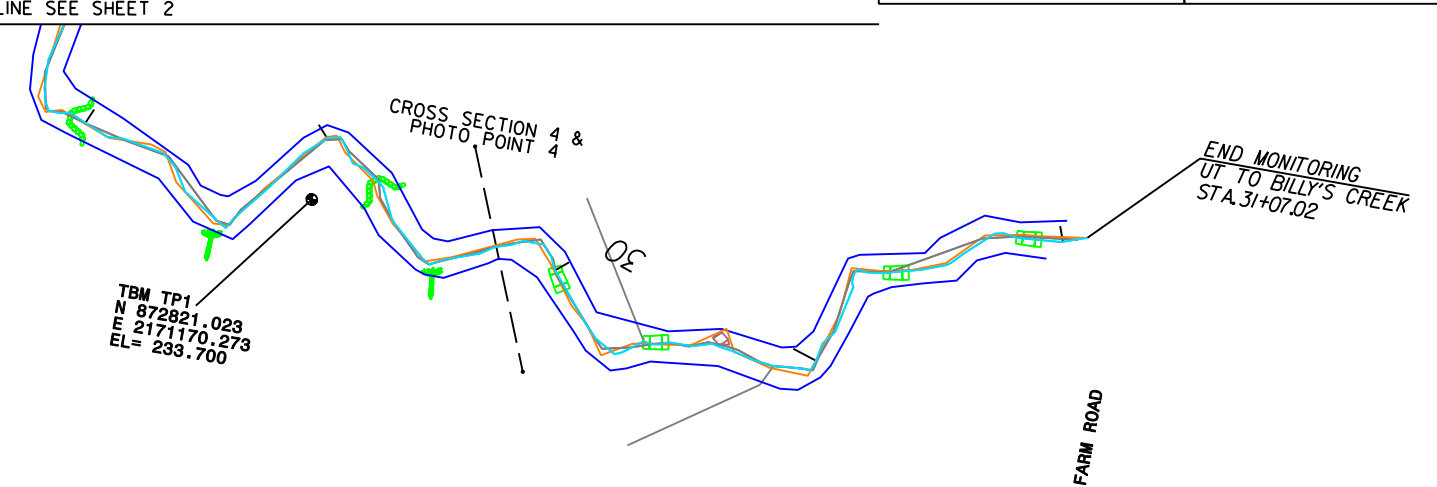
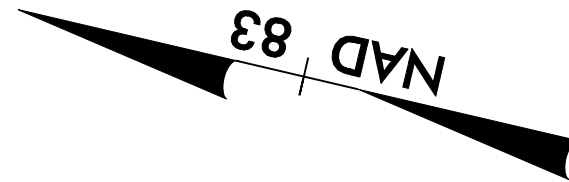


LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL STREAM - YEAR 4	
PROJ #:	COUNTY:
36	FRANKLIN
PREPARED BY:	
IPJ	
CHECKED BY:	DATE:
PDB	3/01/2010



MATCH LINE SEE SHEET 2

MATCH LINE SEE SHEET 1



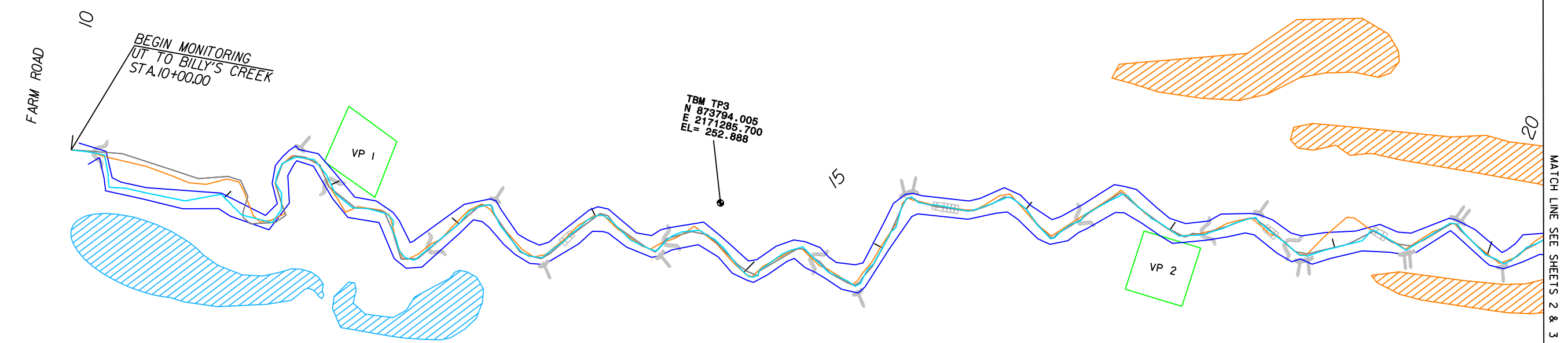
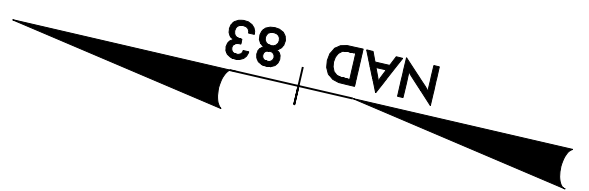
CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 4 LEFT	872773.671	2171195.536	233.787
XSC 4 RIGHT	872746.677	2171128.852	233.510

LEGEND

<p>STREAM FEATURES</p> <ul style="list-style-type: none"> THALWEG AS-BUILT THALWEG 2008 THALWEG 2009 BANKFULL 2009 BANK EROSION SEVERE BANK EROSION AGGRADATION EXPOSED SEDIMENT BAR 	<p>PROJECT ELEMENTS</p> <ul style="list-style-type: none"> CROSS-SECTION/PHOTO-POINT CONTROL POINT/BENCHMARK (TBM) EASEMENT BOUNDARY 	<p>STRUCTURE TYPES</p> <ul style="list-style-type: none"> ROCK CROSS VANE ROCK STEP STRUCTURE ROOTWAD 	<p>COLOR CODE FOR STRUCTURES</p> <ul style="list-style-type: none"> GOOD STRUCTURE (ACTUAL LOCATION) STRUCTURE WITH POTENTIAL PROBLEM (ACTUAL LOCATION) FAILING STRUCTURE (ACTUAL LOCATION)
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LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL STREAM - YEAR 4	
PROJ #: 36	COUNTY: FRANKLIN
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 3/01/2010



VEGETATION PLOT STAKING*		
	NORTHING	EASTING
VP 1	873978.304	2171256.380
VP 2	873539.050	2171274.022

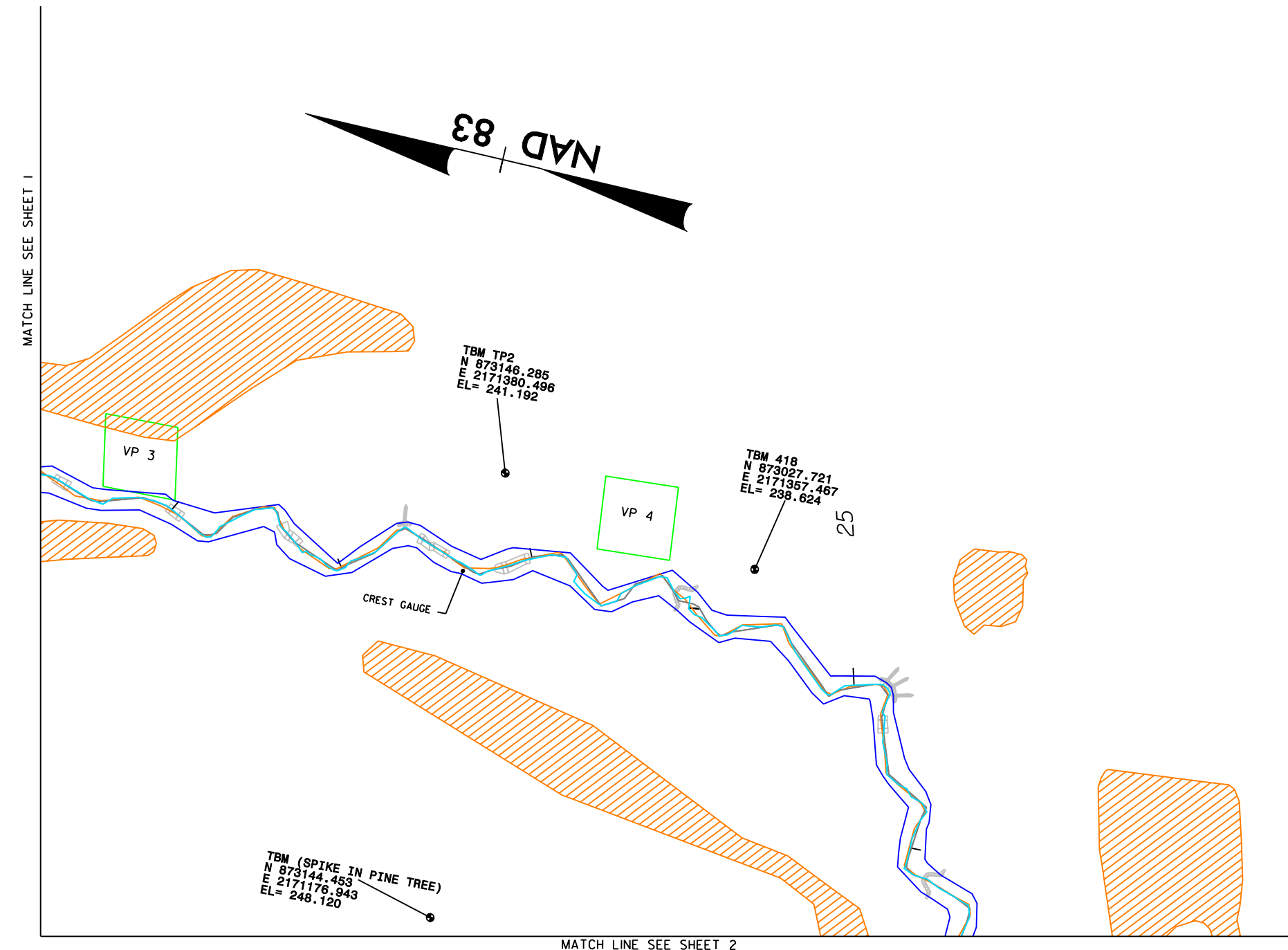
*COORDINATES REPRESENT WESTERN-MOST CORNER OF PLOT

LEGEND

	THALWEG AS-BUILT		BARE BENCH/BANK	STRUCTURE TYPES	
	THALWEG 2008		BARE FLOODPLAIN		
	THALWEG 2009		<i>LIGUSTRUM SINENSE</i> PRESENT	ROCK CROSS VANE STRUCTURE	ROCK STEP STRUCTURE
	BANKFULL 2009				ROOTWAD
	VEGETATION PLOT WITH PHOTO CORNER				



LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL VEGETATION - YEAR 4	
PROJ #: 36	COUNTY: FRANKLIN
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 3/01/2010



VEGETATION PLOT STAKING*		
	NORTHING	EASTING
VP 3	873503.234	2171175.424
VP 4	873514.964	2171366.995

*COORDINATES REPRESENT WESTERN-MOST CORNER OF PLOT

LEGEND

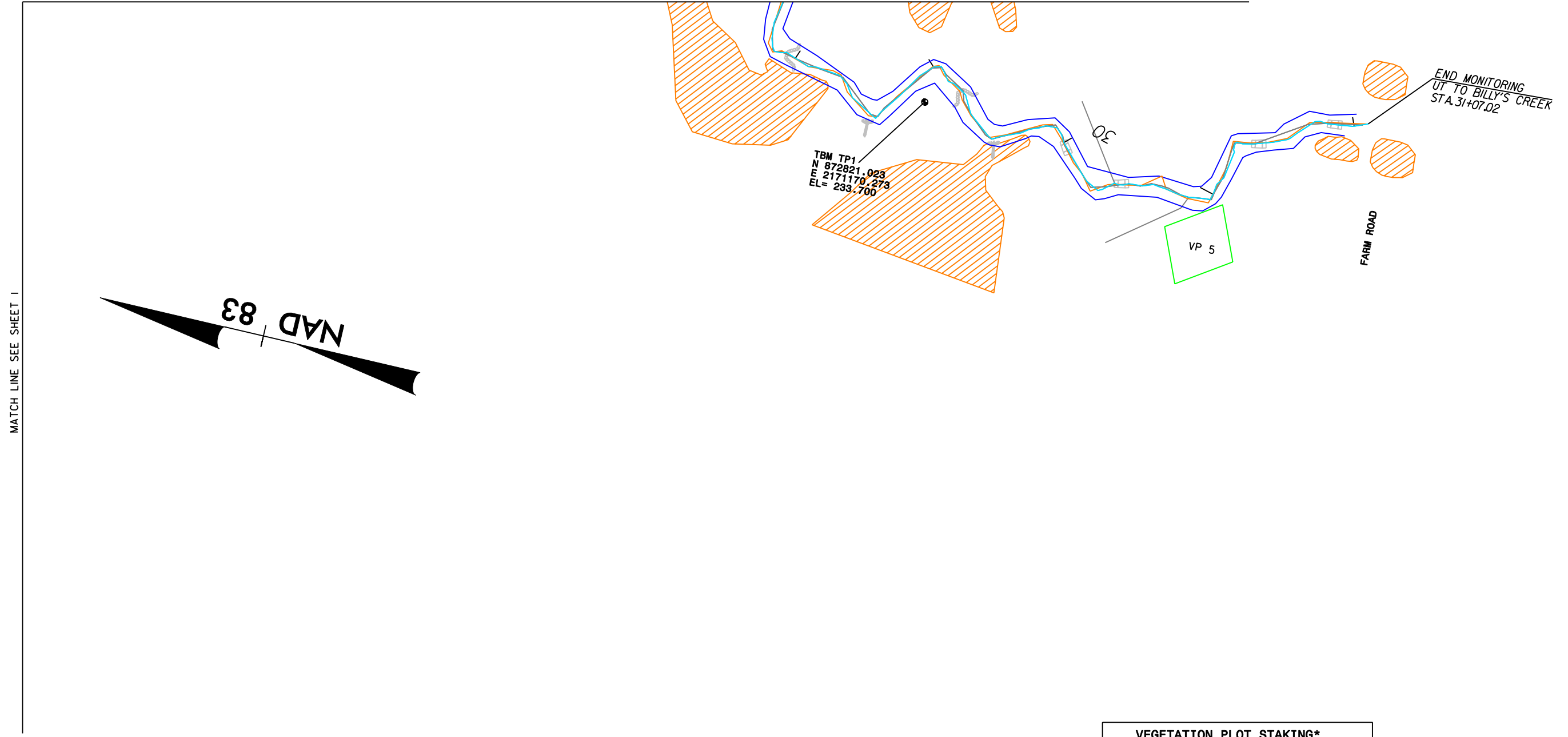
	THALWEG AS-BUILT		BARE BENCH/BANK	STRUCTURE TYPES	
	THALWEG 2008		BARE FLOODPLAIN		
	THALWEG 2009		<i>LIGUSTRUM SINENSE</i> PRESENT	ROCK CROSS VANE	ROCK STEP STRUCTURE
	BANKFULL 2009				ROOTWAD
	VEGETATION PLOT WITH PHOTO CORNER				



LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL VEGETATION - YEAR 4	
PROJ #: 36	COUNTY: FRANKLIN
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 3/01/2010



MATCH LINE SEE SHEET 2



VEGETATION PLOT STAKING*		
	NORTHING	EASTING
VP 5	873257.591	2171797.134

*COORDINATES REPRESENT WESTERN-MOST CORNER OF PLOT

LEGEND

	THALWEG AS-BUILT		BARE BENCH/BANK	STRUCTURE TYPES	
	THALWEG 2008		BARE FLOODPLAIN		
	THALWEG 2009		<i>LIGUSTRUM SINENSE</i> PRESENT		ROCK CROSS VANE STRUCTURE
	BANKFULL 2009				ROCK STEP STRUCTURE
	VEGETATION PLOT WITH PHOTO CORNER				ROOTWAD



LOCATION: UT TO BILLY'S CREEK	
CURRENT CONDITIONS PLAN VIEW	
FINAL VEGETATION - YEAR 4	
PROJ #: 36	COUNTY: FRANKLIN
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 3/01/2010

APPENDIX B

GENERAL PROJECT TABLES

Project Segment or Reach ID	Pre-Existing Footage	Type	Approach	As-Built Footage	As-Built Stationing	Monitoring Year 4 Stationing	Comments
UT to Billy's Creek	1,878	Restoration	PI/PII	2,101	0+00 – 21+01	10+00 – 30+92	Includes 2,101 linear feet per As-Built. The first 100 ft and the last 100 ft of project reach) is PII.

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	4/15/2003	NA	August 2003
Final Design - 90%	5/31/2003	NA	8/11/2004
Construction	7/31/2003	NA	June 2005
Planting	Fall 2004	NA	December 2005
Mitigation Plan/ As-built	Fall 2005	Winter 2006	April 2006
Year 1 monitoring	September 2006	September 2006	November 2006
Year 2 monitoring	Fall 2007	October 2007	December 2007
Year 3 monitoring	Fall 2008	October 2008	November 15, 2008
Year 4 monitoring	Fall 2009	October 2009	November 15, 2009
Year 5 monitoring	Fall 2010		
Year 5+ monitoring	Not scheduled		

Designer	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560
Construction Contractor	McQueen Construction Inc. 619 Patrick Road Bahama, NC 27503
Planting Contractor	Carolina Environmental PO Box 1905 Mt. Airy, NC 27030
Seeding and Matting Contractor	Erosion Control Solutions 5508 Peakton Road Raleigh, NC 27604
Monitoring Year 1 (2006) Monitoring Performers	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560
Monitoring Year 2 & 3 (2007 & 2008) Monitoring Performers	SEPI Engineering Group 1025 Wade Avenue Raleigh, NC 27607 Phillip Todd (919) 789-9977
Stream Monitoring POC	Ira Poplar-Jeffers (919) 573-9914
Vegetation Monitoring POC	Phil Beach (919) 573-9936
Wetland Monitoring POC	N/A

Table 4. Project Background Table	
UT to Billy's Creek/EEP Project No. 36	
Project County	Franklin County, NC
Drainage Area	0.22 square miles
Drainage impervious cover estimate (%)	< 5%
Stream Order	1
Physiographic Region	Piedmont
Ecoregion	Northern Outer Piedmont (45f)
Rosgen Classification of As-built	E5
Dominant soil types	Chewcala, Altavista
Reference site ID	N/A
USGS HUC for Project and Reference	03020101
NCDWQ Sub-basin for Project and Reference	03-03-01
NCDWQ classification for Project and Reference	WS-IV; NSW
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
% of project easement demarcated with bollards (if fencing absent)	N/A

APPENDIX C

VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary Table			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean (Stems per Acre)
UT Billy's Creek	1	Yes	380
	2	Yes	
	3	Yes	
	4	Yes	
	5	Yes	

**APPENDIX C
PHOTOLOG UT to Billy's Creek**

VEGETATION PLOTS



Photo 1: Vegetation Plot 1 (10-21-2009).



Photo 2: Vegetation Plot 2 (10-21-2009).



Photo 3: Vegetation Plot 3 (10-21-2009).



Photo 4: Vegetation Plot 4 (10-21-2009).



Photo 5: Vegetation Plot 5 (10-21-2009).

Table 6. Vegetation Metadata Table

Report Prepared By	PHILIP BEACH
Date Prepared	11/11/2009 11:08
database name	SEPI-2009-A.mdb.mdb
database location	G:\Environmental\EN08.004 - EEP Monitoring 2008-09\CVS-EEP DATABASE\CVS Database - 2009 Version (WFCC and UT Billys Creek)
computer name	W47
file size	64946176
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	36
project Name	Billy's Creek (G)
Description	UTTAR MONITORING 08
River Basin	Tar-Pamlico
length(ft)	2,101 (as-built)
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	5
Sampled Plots	5

Table 7. Stem Count Total and Planted by Plot and Species

EEP Project Code 36. Project Name: Billy's Creek (G)

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2008)															Annual Means														
			E36-01-0001			E36-01-0002			E36-01-0003			E36-01-0004			E36-01-0005			MY4 (2008)			MY3 (2007)			MY2 (2007)								
			Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T	Pw/oL	P-all	T						
Albizia julibrissin	silk tree	Shrub Tree						1			1							2														
Alnus serrulata	hazel alder	Shrub Tree					1	1					1	1				2	2		2	2			1	1						
Aronia arbutifolia	Red Chokeberry	Shrub					1	1			1	1			2	2			4	4		4	4		6	6						
Betula nigra	river birch	Tree					2	2									1	1		3	3		3	3		5	5					
Celtis laevigata	sugarberry	Shrub Tree		1	1						1	1			1				2	3		1	1			1	1					
Cephalanthus occidentalis	common buttonbush	Shrub Tree		1	1			1	1						1	1			3	3												
Cornus amomum	silky dogwood	Shrub	4	5	5		1	1	1			3	3	3			1	1	1	1		9	10	11		7	13	13	12	22	22	
Cornus florida	flowering dogwood	Shrub Tree																														
Fraxinus pennsylvanica	green ash	Tree		1	1			1	3			1	1						2				3	7		3	3		2	2		
Ligustrum sinense	Chinese privet	Shrub Tree																			5											
Liquidambar styraciflua	sweetgum	Tree							3						7									5								
Nyssa sylvatica	blackgum	Tree									1	1										1	1			1	1		2	2		
Pinus taeda	loblolly pine	Tree			2			1	4											17		9			1	32		1	26			
Quercus falcata	southern red oak	Tree															2	2		2	2					1	1		5	5		
Quercus phellos	willow oak	Tree		2	2			2	2			2	2		3	3			5	5					14	14		12	12		15	15
Salix nigra	black willow	Tree			1						3	3	3				1	1		3	4	5		4	5	5	5	5	6	6		
Sambucus canadensis	Common Elderberry	Shrub Tree									1	2										1	2			1	1		2	2		
Ulmus rubra	slippery elm	Tree							3																3							
Viburnum nudum	possumhaw	Shrub Tree																									1	1		1	1	
Viburnum dentatum	southern arrowwood	Shrub Tree					1	1						2	2			1	1					4	4		2	2		3	3	
Rhus copallinum	flameleaf sumac	Shrub Tree							1			2	2		1	5			1	2				4	10		5	5		5	5	
Carpinus caroliniana	American hornbeam	Shrub Tree																											2	2		
Juniperus virginiana	eastern redcedar	Tree							1																	1						
Quercus	oak	Shrub Tree											1													1						
Liriodendron tulipifera	tuliptree	Tree		1	1																		1	1			1	1		1	1	
Stem count			4	11	14		1	11	25		6	15	18		0	9	41		1	13	28		12	59	126		11	57	82	17	80	80
size (ares)			1				1				1				1				1				5				5					
size (ACRES)			0.02				0.02				0.02				0.02				0.02				0.12				0.12					
Species count			1	6	8		1	9	14		2	9	11		0	5	10		1	8	10		2	16	22		2	17	17	2	17	17
Stems per ACRE			161.9	445.2	566.6		40.47	445.2	1012		242.8	607	728.4		0	364.2	1659		40.47	526.1	1133		97.12	477.5	1020		89.03	461.3	663.7	137.6	647.5	647.5

APPENDIX D

STREAM ASSESSMENT DATA

APPENDIX D
PHOTOLOG UT Billy's Creek

Cross Sections/Photo Points



Cross-Section/Photo Point 1: View Upstream
(5-13-2009).



Cross-Section/Photo Point 1: Facing Channel
(5-13-2009).



Cross-Section/Photo Point 1: View Downstream
(5-13-2009).



Cross-Section/Photo Point 2: View Upstream
(5-19-2009).



Cross-Section/Photo Point 3: View Upstream
(6-09-2009).



Cross-Section/Photo Point 2: View Downstream
(5-19-2009).



Cross-Section/Photo Point 3: View Downstream
(6-09-2009).



Cross-Section/Photo Point 2: Facing Channel
(5-19-2009).



Cross-Section/Photo point 3: Facing Channel
(6-09-2009).



Cross-Section/Photo Point 4: View Upstream
(6-11-2009).



Cross-Section/Photo Point 4: View Downstream
(6-11-2009).



Cross-Section/Photo Point 4: Facing Channel (6-11-2009).

Table 8. Visual Morphological Stability Assessment

UT Billys Creek

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	% Performing in Stable Condition	Feature Performance Mean or Total
A. Riffles	1. Present	47	49	NA	96%	
	2. Armor stable	35	49	NA	71%	
	3. Facet grade appears stable	39	49	NA	80%	
	4. Minimal evidence of embedding/fining	40	49	NA	82%	
	5. Length appropriate	43	49	NA	88%	83%
B. Pools	1. Present	46	48	NA	96%	
	2. Sufficiently deep	46	48	NA	96%	
	3. Length appropriate	10	48	NA	21%	71%
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	28	29	NA	97%	
	2. Downstream of meander (glide/inflection) centering	23	28	NA	82%	89%
D. Meanders	1. Outer bend in state of limited/controlled erosion	54	56	NA	96%	
	2. Of those eroding, # w/concomitant point bar formation	0	2	NA	0%	
	3. Apparent Rc within specifications	41	56	NA	73%	
	4. Sufficient floodplain access and relief	56	56	NA	100%	67%
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	4/645.5	69%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	85%
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	3/35.5	99%	99%
G. Vanes / J Hooks	1. Free of back or arm scour	25	26	NA	96%	
	2. Height appropriate	23	26	NA	88%	
	3. Angle and geometry appear appropriate	23	26	NA	88%	
	4. Free of piping or other structural failures	26	26	NA	100%	93%
H. Wads and Boulders	1. Free of scour	9	11	NA	82%	
	2. Footing stable	11	11	NA	100%	91%

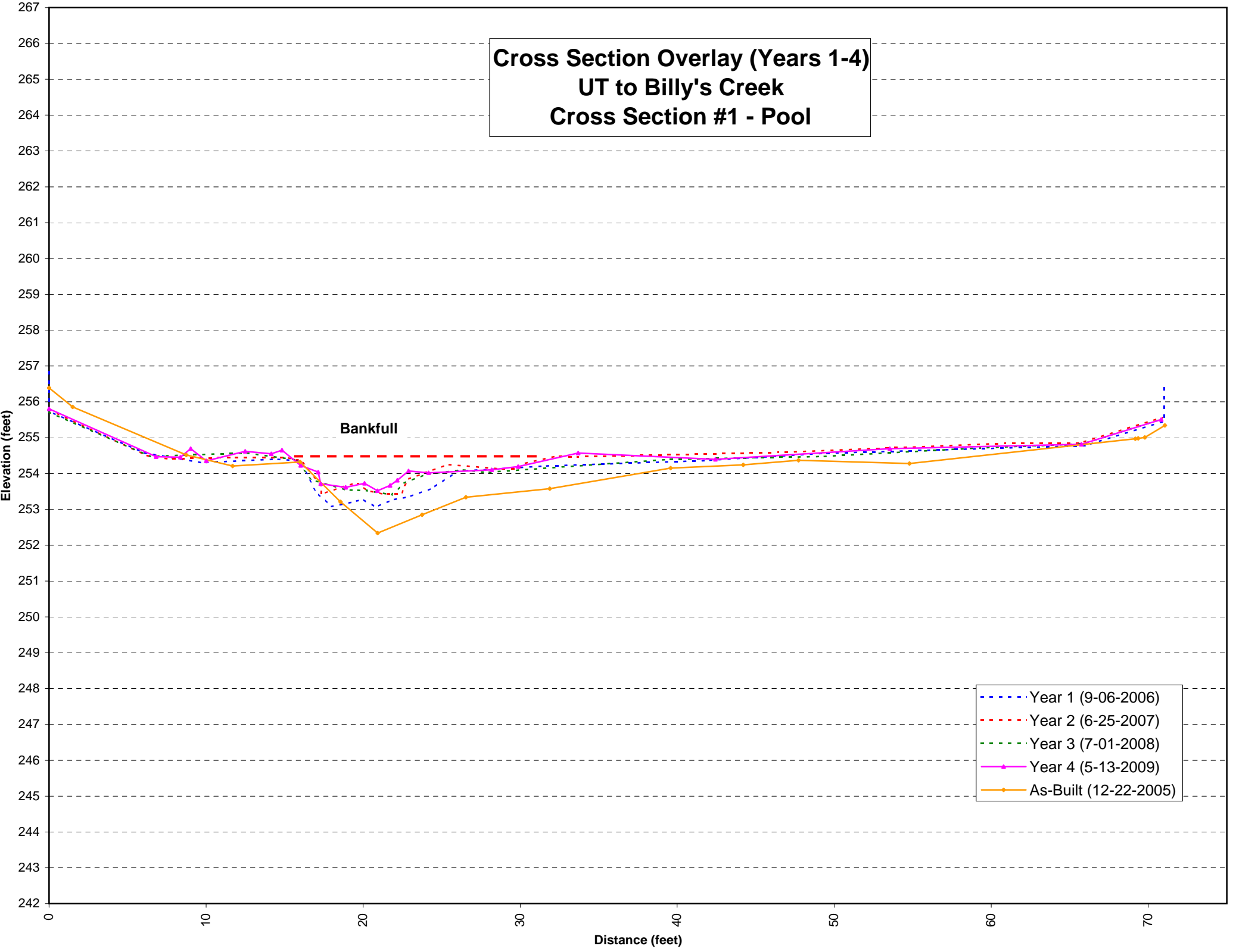
Table V. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
6/28/2006	6/14/2006	Per NOAA staff member, Jonathan Blaes, Tropical Storm Alberto produced a 50-year storm event in the Franklinton/Louisburg area. The storm produced approximately 5.55 inches of rain on 6/14.	
6/4/2007	6/3/2007	Result of 1.5' rainfall event. Wrack lines noted.	None
10/15/2008	4/27/2008	According to NCDC Station Coop ID 313123 - Louisburg NC , 2.15 inches of precipitation fell over this 24 hour period. It was assumed, but not verified, that this rainfall produced a bankfull event.	None
10/15/2008	9/6/2008	According to NCDC Station Coop ID 313123 - Louisburg NC , 3.27 inches of precipitation fell over this 24 hour period. It was assumed, but not verified, that this rainfall produced a bankfull event.	None
1/27/2009	Unknown; but probably between the dates of January 5 and January 21, 2009.	Crest gauge reading of 6" on stick. Base of crest gauge (measuring stick) located at bankfull elevation. Date of bankfull flow unknown, but two 1+ inch precipitation events occurred between January 5 and January 27, 2009. Presumably, one of these two events caused the over-bank flow.	None

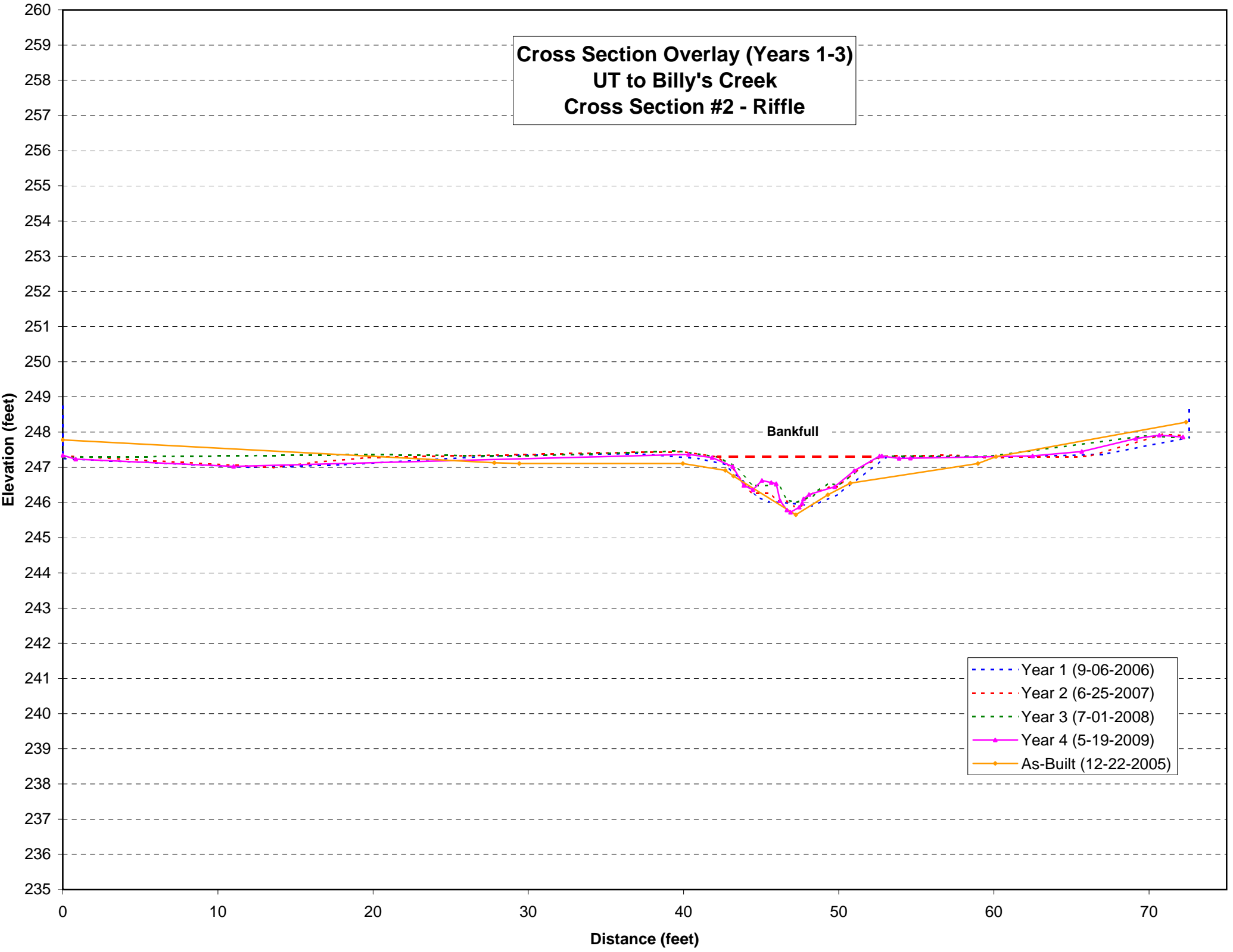
Cross Section Overlay (Years 1-4)
UT to Billy's Creek
Cross Section #1 - Pool

Bankfull

- Year 1 (9-06-2006)
- Year 2 (6-25-2007)
- Year 3 (7-01-2008)
- Year 4 (5-13-2009)
- As-Built (12-22-2005)



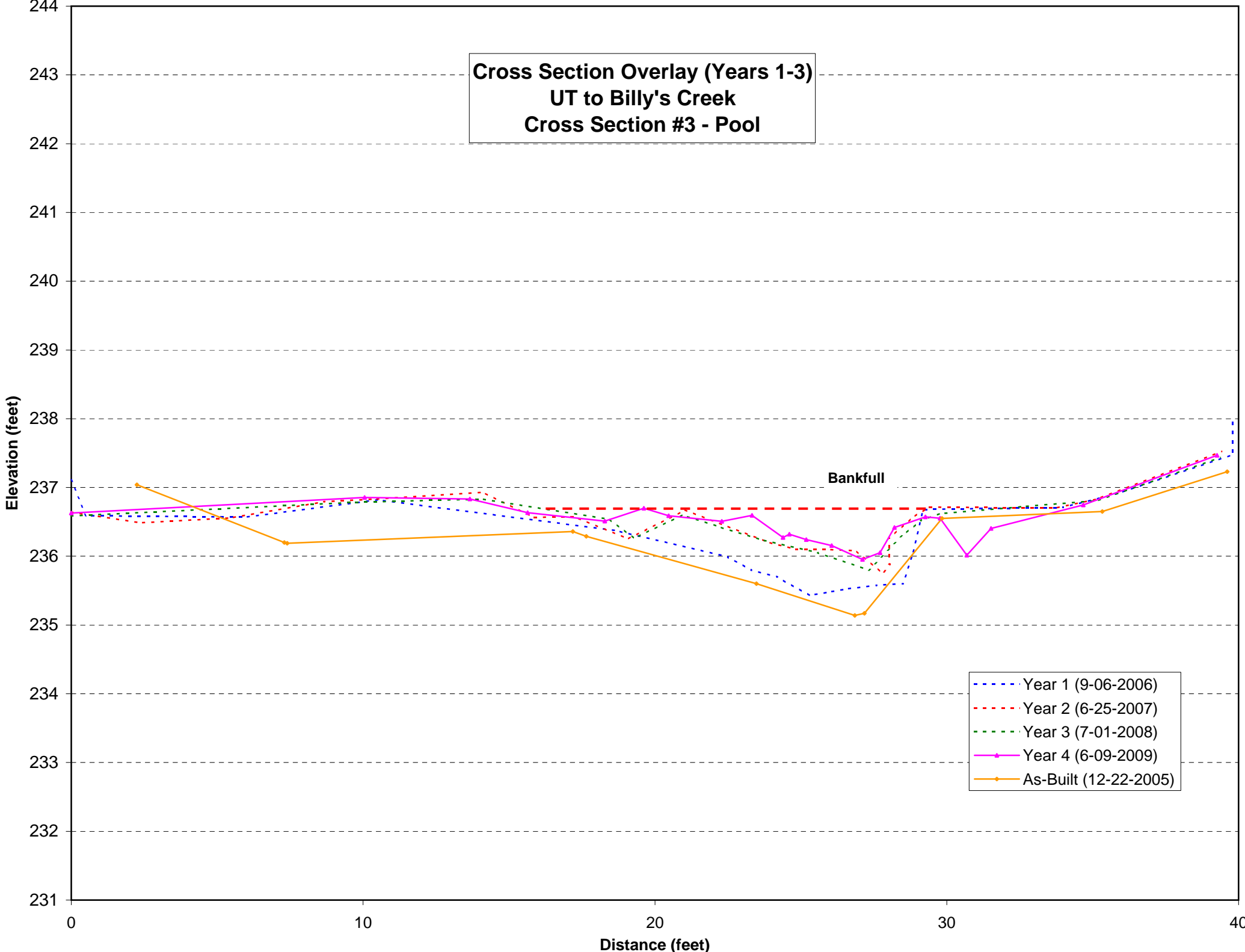
Cross Section Overlay (Years 1-3)
UT to Billy's Creek
Cross Section #2 - Riffle



Bankfull

- Year 1 (9-06-2006)
- Year 2 (6-25-2007)
- Year 3 (7-01-2008)
- Year 4 (5-19-2009)
- As-Built (12-22-2005)

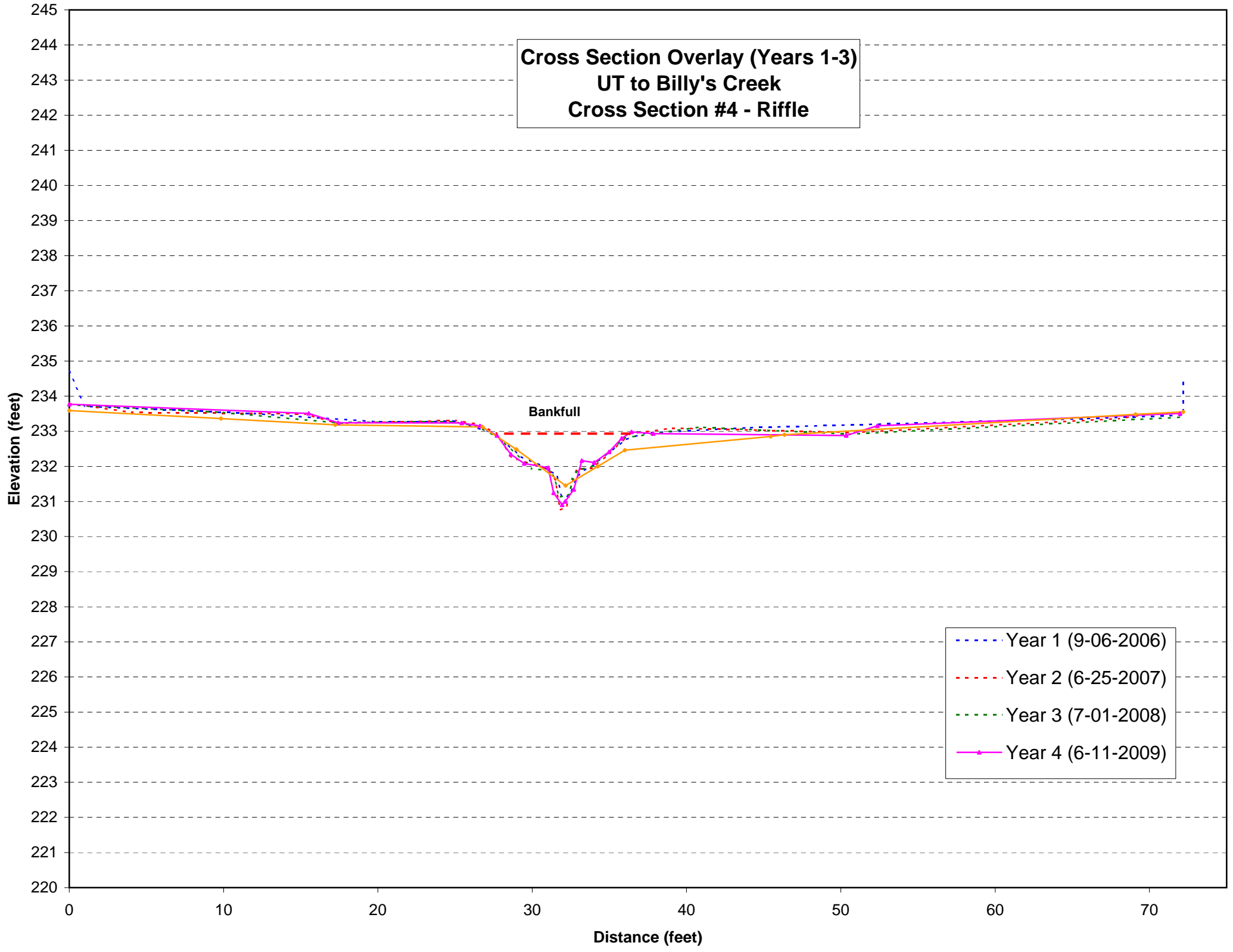
Cross Section Overlay (Years 1-3)
UT to Billy's Creek
Cross Section #3 - Pool



Bankfull

- Year 1 (9-06-2006)
- Year 2 (6-25-2007)
- Year 3 (7-01-2008)
- Year 4 (6-09-2009)
- As-Built (12-22-2005)

Cross Section Overlay (Years 1-3)
UT to Billy's Creek
Cross Section #4 - Riffle

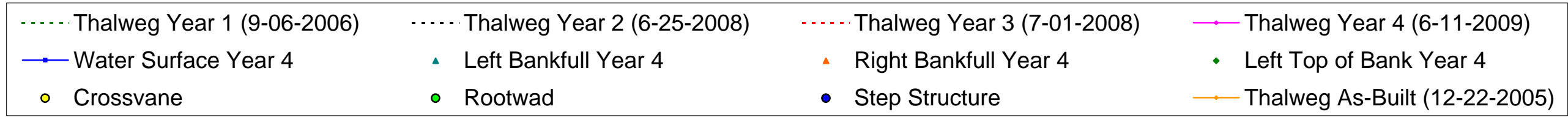
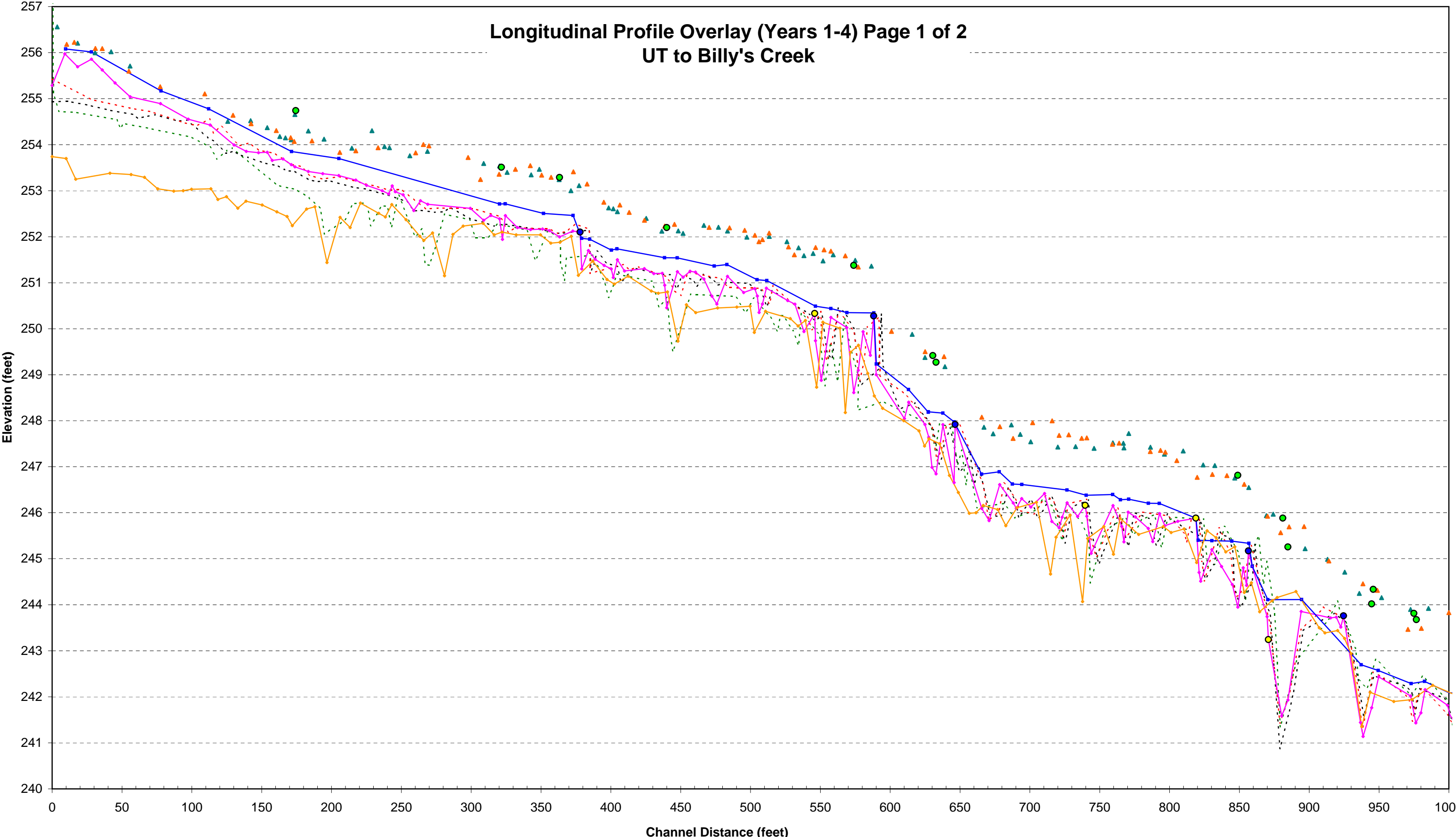


Bankfull

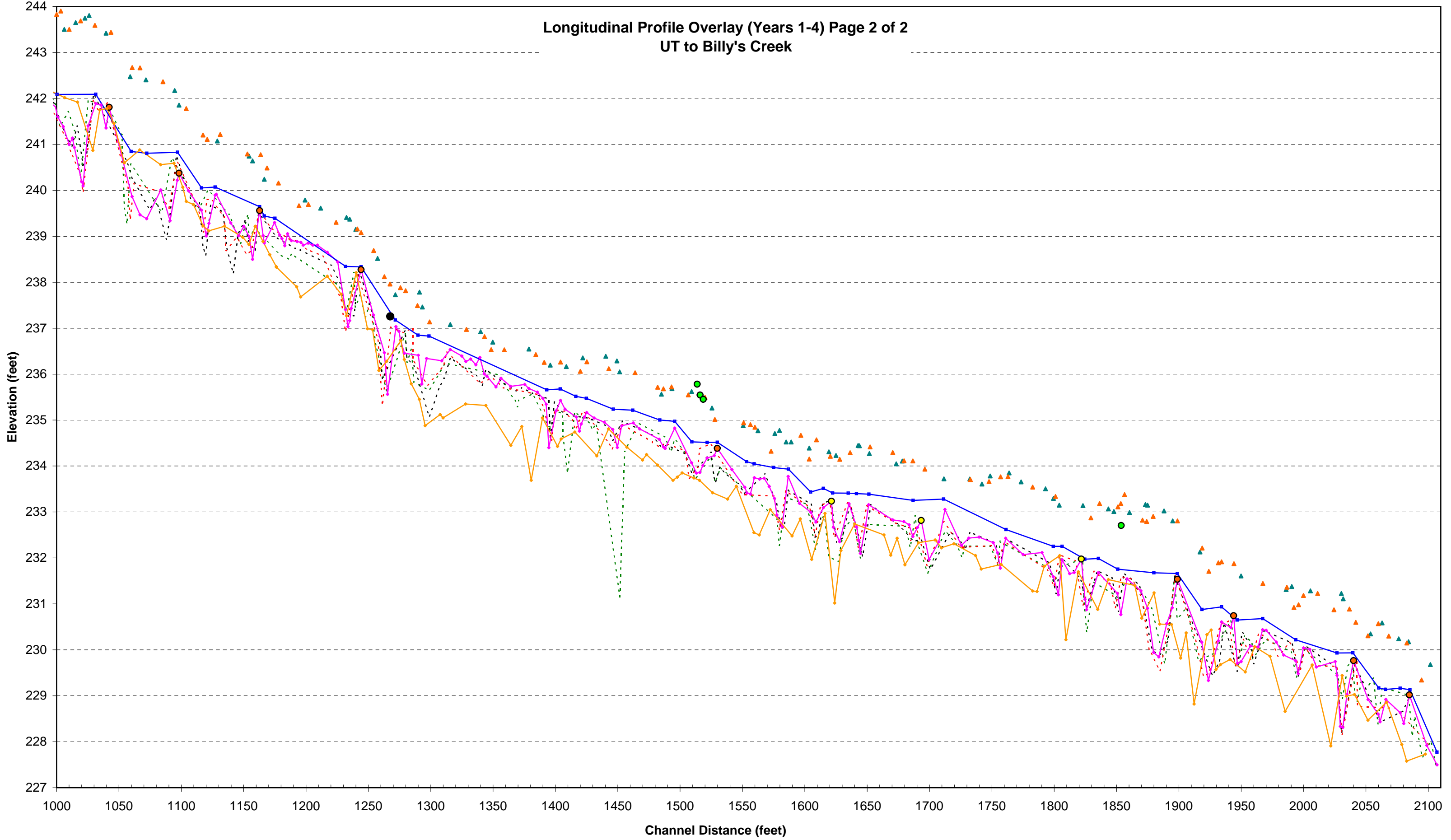
- Year 1 (9-06-2006)
- Year 2 (6-25-2007)
- Year 3 (7-01-2008)
- Year 4 (6-11-2009)

Longitudinal Profile Overlay (Years 1-4) Page 1 of 2

UT to Billy's Creek



Longitudinal Profile Overlay (Years 1-4) Page 2 of 2
UT to Billy's Creek



- | | | | |
|--------------------------------|----------------------------------|----------------------------------|---------------------------------|
| --- Thalweg Year 1 (9-06-2006) | Thalweg Year 2 (6-25-2007) | -.-.- Thalweg Year 3 (7-01-2008) | — Thalweg Year 4 (6-11-2009) |
| — Water Surface Year 4 | ▲ Left Bankfull Year 4 | ▲ Right Bankfull Year 4 | ● Crossvane |
| ● Rootwad | ● Step Structure | ● Crest Gauge | — Thalweg As-Built (12-22-2005) |

Pebble counts were not performed for UT Billy's Creek during Monitoring Year 4 because it is a sandbed stream and the counts would not successfully detect changes in the amounts of fine sediments in the channel bed.