Mary's Creek (EEP #241)
Restoration Site
2009 Annual Monitoring Report (Year 3)

Alamance County
EEP Project No. 241
Design Firm: Stantec Consulting Services, Inc.

December 2009

Prepared for:

NCDENR/ Ecosystem Enhancement Program
1619 Mail Service Center
Raleigh, NC 27699-1619

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APPENDICES

I. Executive Summary

The Mary's Creek (EEP #241) stream restoration project consists of 2,082 linear feet of stream restoration with just over 7.3 acres of buffer restoration. The project is in Alamance County north of Siler City, north of Greensboro Chapel Hill Road (SR 1005) and east of Lindley Mill Road (SR 1003) (Figure 1). Site construction and plantings were completed in March of 2006. The goals and objectives for Mary's Creek (EEP #241) stream restoration are:

- 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 through a filtration buffer
- Increasing the streams access to its floodplain
- Reducing erosion and sedimentation

Level II of the CVS-EEP protocol was administered for Monitoring Year (MY)-03, which includes planted woody stems and natural woody stems. Three vegetation monitoring plots (1, 2, and 3) were added in MY-02 to the original two established during baseline data collection. Planted stems could not be distinguished from natural stems during the MY-02 vegetation data collection, therefore all stems were labeled as natural, except for some black willow livestakes located within Plot 4 that were labeled as planted stems. Including all five monitoring plots, there are 4225 stems/acre including natural and planted stems. The success criterion for planted woody species is 320 stems/acre after MY-03. A mortality rate of ten percent will be allowed after MY-04 (288 stems/acre), with another ten percent allowed after MY-05 (260 stems/acre). An accurate number of planted stems /acre could not be determined since the planted stems could not be distinguished from natural stems.

Invasive exotics are the only notable vegetation problem for MY-03. Invasive exotics include tall fescue (*Schedonurus arundinaceus*), Gill over the ground (*Glechoma hederacea*), Johnson Grass (*Sorghum halapense*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstegium vimineum*), tree of heaven (*Ailanthus altissima*), multiflora rose (*Rosa multiflora*), and Chinese privet (*Ligustrum sinense*). According to the NC Native Plant Society, all of these species, with the exception of tall fescue, Johnson grass, and gill over the ground, are classified as "Rank 1", which is defined as exotic plant species that have invasive characteristics and spread readily into native plant communities, displacing native vegetation. Johnson grass and gill over the ground are classified as "Rank 2" which are exotic plant species that display some invasive characteristics, but do not appear to present as great a threat as Rank 1 species. Although these species have been given these ranks, the functionality of the project is not expected to be impaired significantly. Tall fescue is identified as invasive by the United States Department of Agriculture (Miller 2003). The conservation easement contains tall fescue that resided pre-construction and is still the dominant grass in the adjacent cattle fields. At this point, the fescue appears to be inhibiting some growth of planted stems

and there is little evidence of natural succession in these fescue dominated areas. For additional information relating to vegetation, see Appendix C.

Overall, the banks are stable and well vegetated on Mary's Creek (EEP #241) and the unnamed tributary to Mary's Creek (EEP #241). The majority of the structures are also functioning properly and there is little evidence of needed repairs except at the stream crossing on Mary's Creek (EEP #241). It should be noted that during MY-03 data collection, the main channel was dry upstream of the confluence with the tributary.

Changes from MY-02 to MY-03 in Mary's Creek (EEP #241) are minimal. Riffle and pool stability and performance are comparable with the riffles' substrate trending coarser. The beaver dam located on top of the bedrock outcrop (station 24+60) in MY-02 is no longer present, resulting in decreased backwater effects upstream. However, the bedrock does still back water upstream for more than 200 feet. The streambed remains stable with no significant aggradation or degradation. This is also reflected in a comparison of the cross sectional data between MY-02 and MY-03. The structures that had shown problems in MY-02 (stations 19+75 and 20+95) continue to pipe water and further degrade. Additionally, upstream of the crossing at station 21+50 continues to erode around the culverts.

The unnamed tributary to Mary's Creek (EEP #241) did show some changes between MY-02 and MY-03. Sediment that aggraded at the top of the reach has started to move downstream, filling some of the pools in the upper portion. This is also shown when comparing cross-sectional data between the MY-02 and MY-03. The sediment shift is also evident in the riffle pebble count, which is trending towards a coarser $d_{50.}$ The reach is stable, and the channel is heavily vegetated. No problem areas were noted to the structures, banks, or bed.

Summary information/data related to the occurrences 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 plan 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.

II. Methodology

Methodologies follow the current EEP monitoring report template, Version 1.2.1-06/01/09, and the CVS-EEP protocol for recording vegetation (Lee et al 2008). Photos were taken with a digital camera. A Trimble Geo XT handheld unit with sub-meter accuracy was used to locate stream and vegetation problem areas.

A. Vegetation Methodologies

Level II of the EEP/CVS protocol Version 4.2, which includes natural stems, was used to collect data for MY-03 for five vegetation monitoring plots. Data collected for these plots are in Appendix C.

B. Stream Methodologies

Stream profile and cross-sections were surveyed using total station equipment and methods. The survey data was plotted using AutoCAD Civil3D. The longitudinal profile was generated using the MY-02 alignment. Cross sectional data was extracted based on a linear alignment between the end pins. Pattern parameters were calculated by measuring the plotted dimensions of the MY-03 surveyed thalweg. Profile parameters were determined through analysis of a Microsoft Excel generated plot of the profile based on the aforementioned baseline alignment.

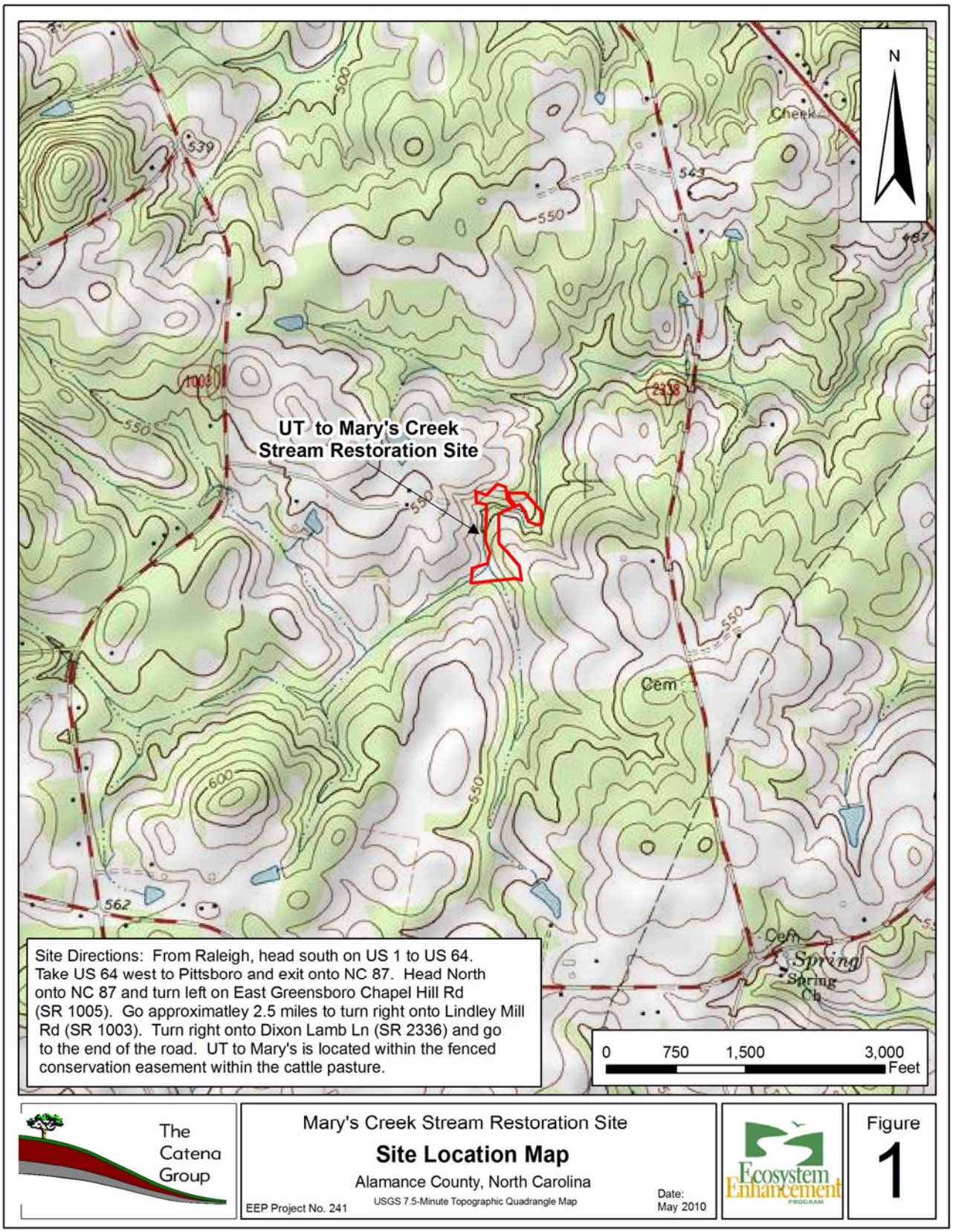
III. References

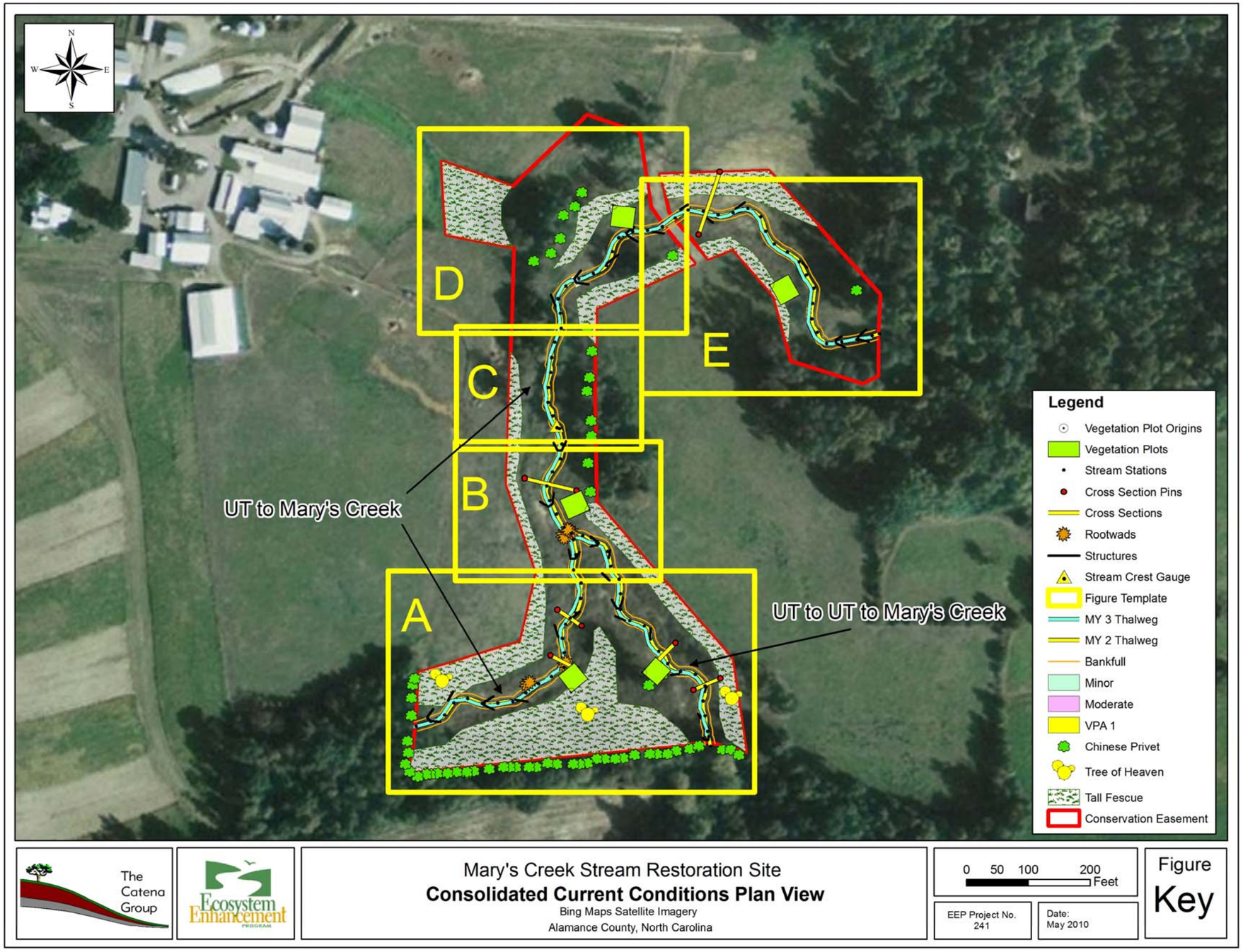
Lee, Michael T. Peet, Robert K. Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation Version 4.2.*

Miller, James H. 2003. Nonnative invasive plants of southern forests: a field guide for identification and control. Gen. Tech. Rep. SRS–62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 93 p.

Weakley, Alan (2007). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. http://www.herbarium.unc.edu/flora.htm.

Appendix A. General Figures and Plan View


N
UT to Mary's Creek
Stream Restoration Site
Site Directions: From Raleigh, head south on US 1 to US 64. Take US 64 west to Pittsboro and exit onto NC 87. Head North onto NC 87 and turn left on East Greensboro Chapel Hill Rd (SR 1005). Go approximatley 2.5 miles to turn right onto Lindley Mill Rd (SR 1003). Turn right onto Dixon Lamb Ln (SR 2336) and go to the end of the road. UT to Mary's is located within the fenced conservation easement within the cattle pasture.
0 750 1,500 3,000
Feet
The Catena Group
Mary's Creek Stream Restoration Site
Site Location Map
Alamance County, North Carolina
USGS 7.5-Minute Topographic Quadrangle Map
EEP Project No. 241
Date: May 2010
Ecosystem Enhancement Program
Figure 1


N
W
E
S
D
E
C
B
A
UT to Mary's Creek
UT to UT to Mary's Creek
Legend
Vegetation Plot Origins
Vegetation Plots
Stream Stations
Cross Section Pins
Cross Sections
Rootwads
Structures
Stream Crest Gauge
Figure Template
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MY 2 Thalweg
Bankfull
Minor
Moderate
VPA 1
Chinese Privet
Tree of Heaven
Tall Fescue
Conservation Easement
The Catena Group
Ecosystem Enhancement Program
Mary's Creek Stream Restoration Site
Consolidated Current Conditions Plan View
Bing Maps Satellite Imagery
Alamance County, North Carolina
0 50 100 200 Feet
EEP Project No. 241
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Figure
Key

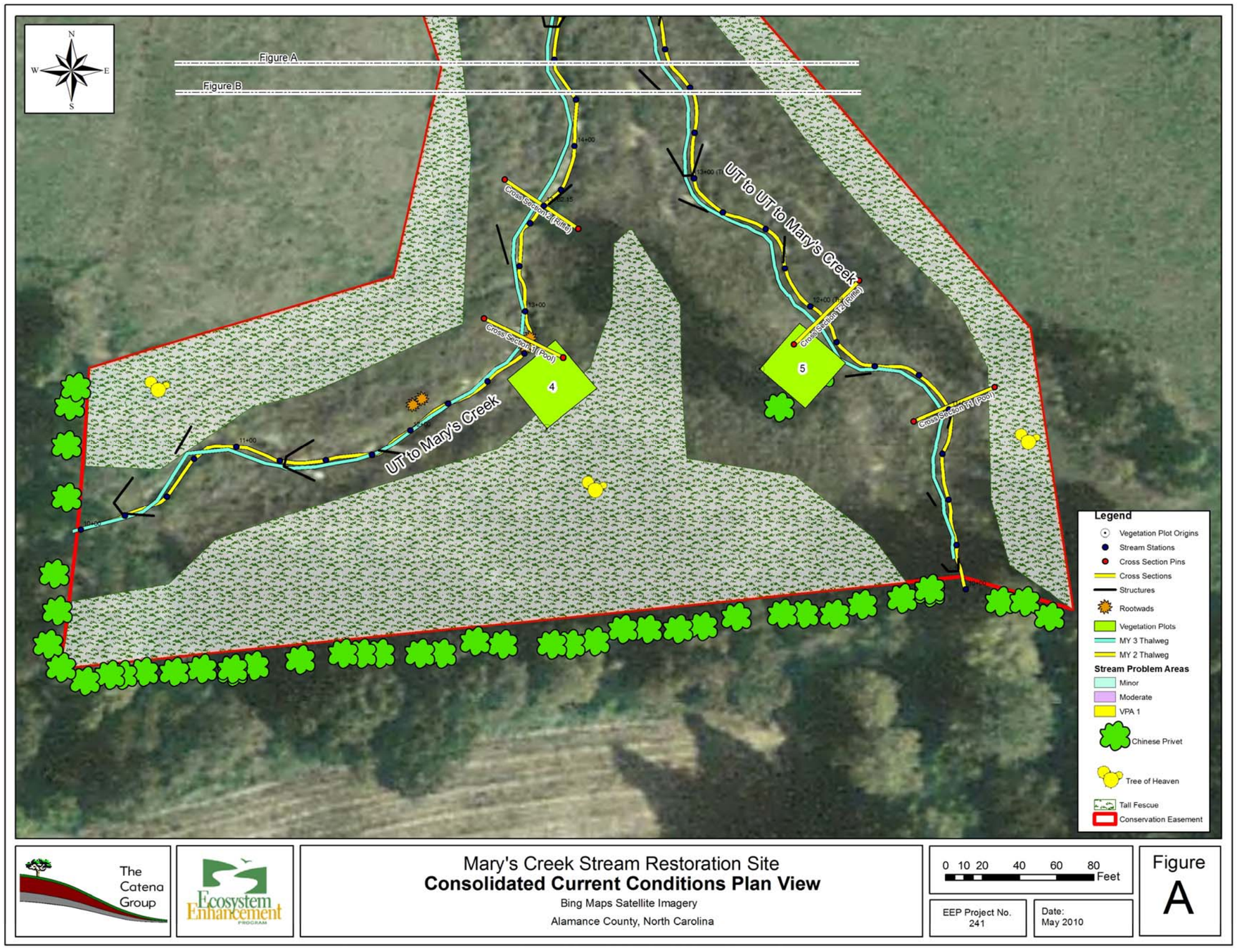
N
W
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Figure A
Figure B
UT to Mary's Creek
UT to UT to Mary's Creek
Cross Section 2 (Riffle)
Cross Section 1 (Pool)
Cross Section 12 (Riffle)
Cross Section 11 (Pool)
4
5
11+00
12+00
13+00
14+00
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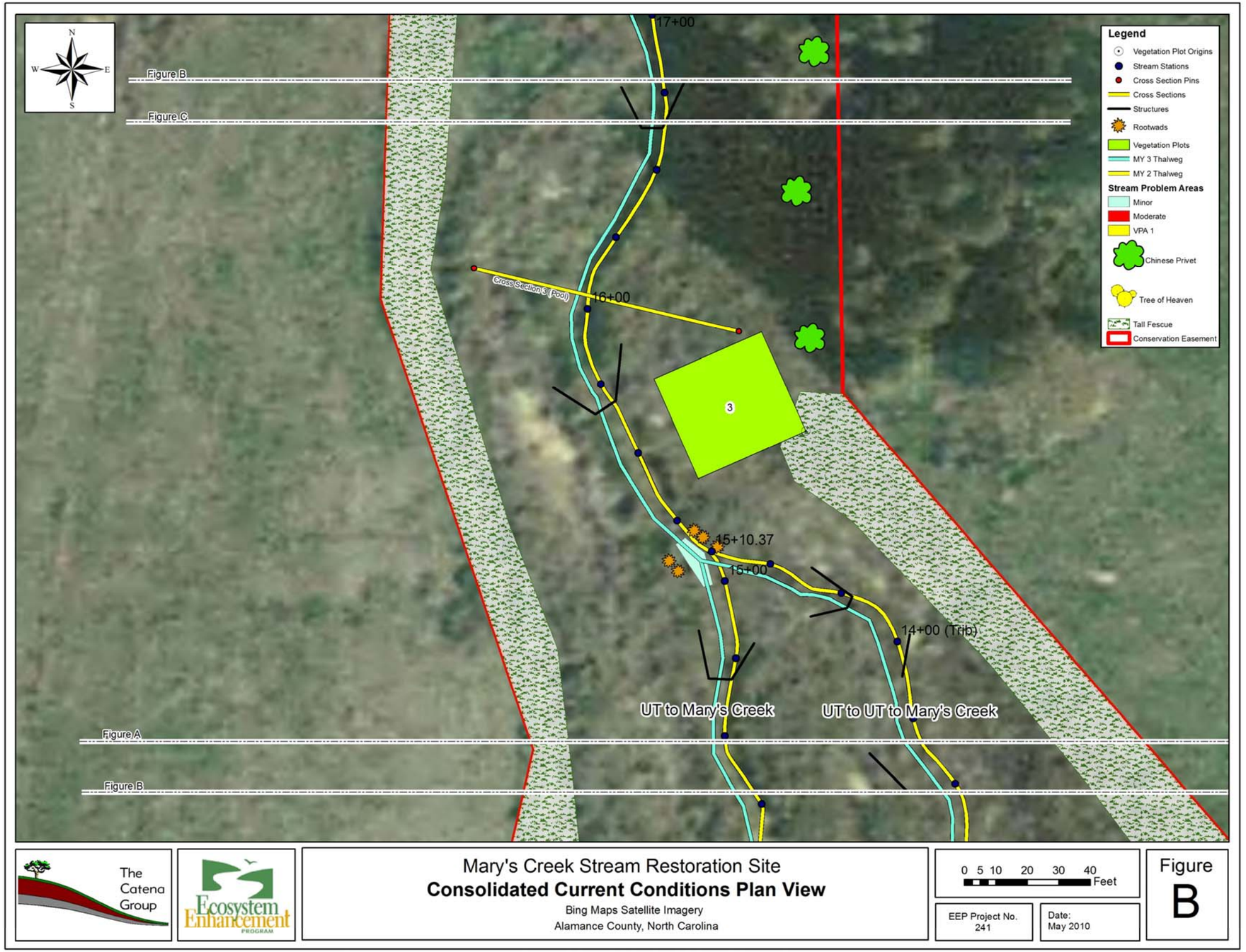
Consolidated Current Conditions Plan View
Bing Maps Satellite Imagery
Alamance County, North Carolina
0 10 20 40 60 80
Feet
EEP Project No. 241
Date: May 2010
Figure A


N
W
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S
Figure B
Figure C
17+00
Cross Section 3 (Pool)
16+00
3
15+10.37
15+00
14+00 (Trib)
UT to Mary's Creek
UT to UT to Mary's Creek
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Figure B
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Bing Maps Satellite Imagery
Alamance County, North Carolina
0 5 10 20 30 40
Feet
EEP Project No. 241
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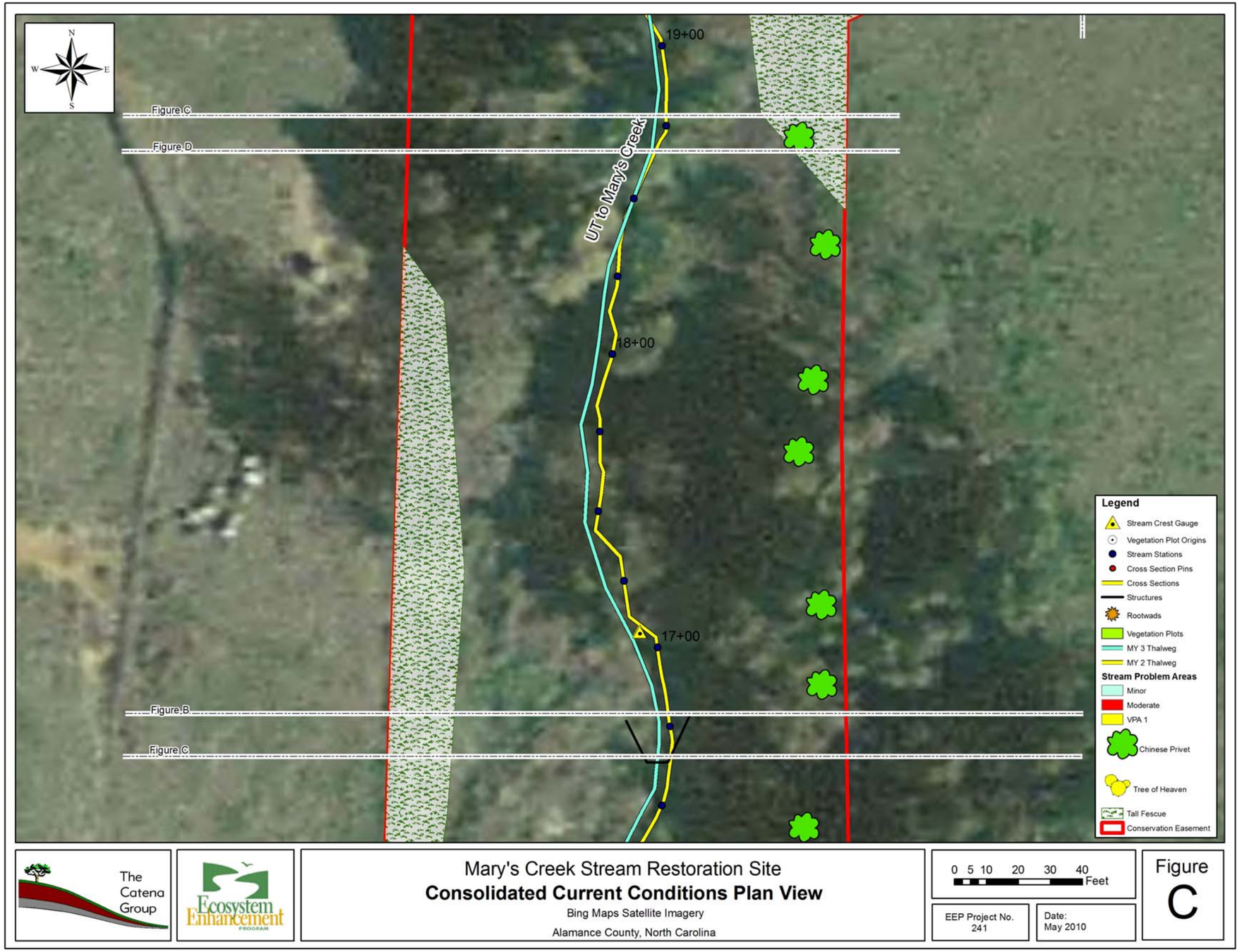
Figure B


N
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E
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Figure C
Figure D
19+00
UT to Mary's Creek
18+00
17+00
Figure B
Figure C
Legend
Stream Crest Gauge
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Bing Maps Satellite Imagery
Alamance County, North Carolina
0 5 10 20 30 40
Feet
EEP Project No. 241
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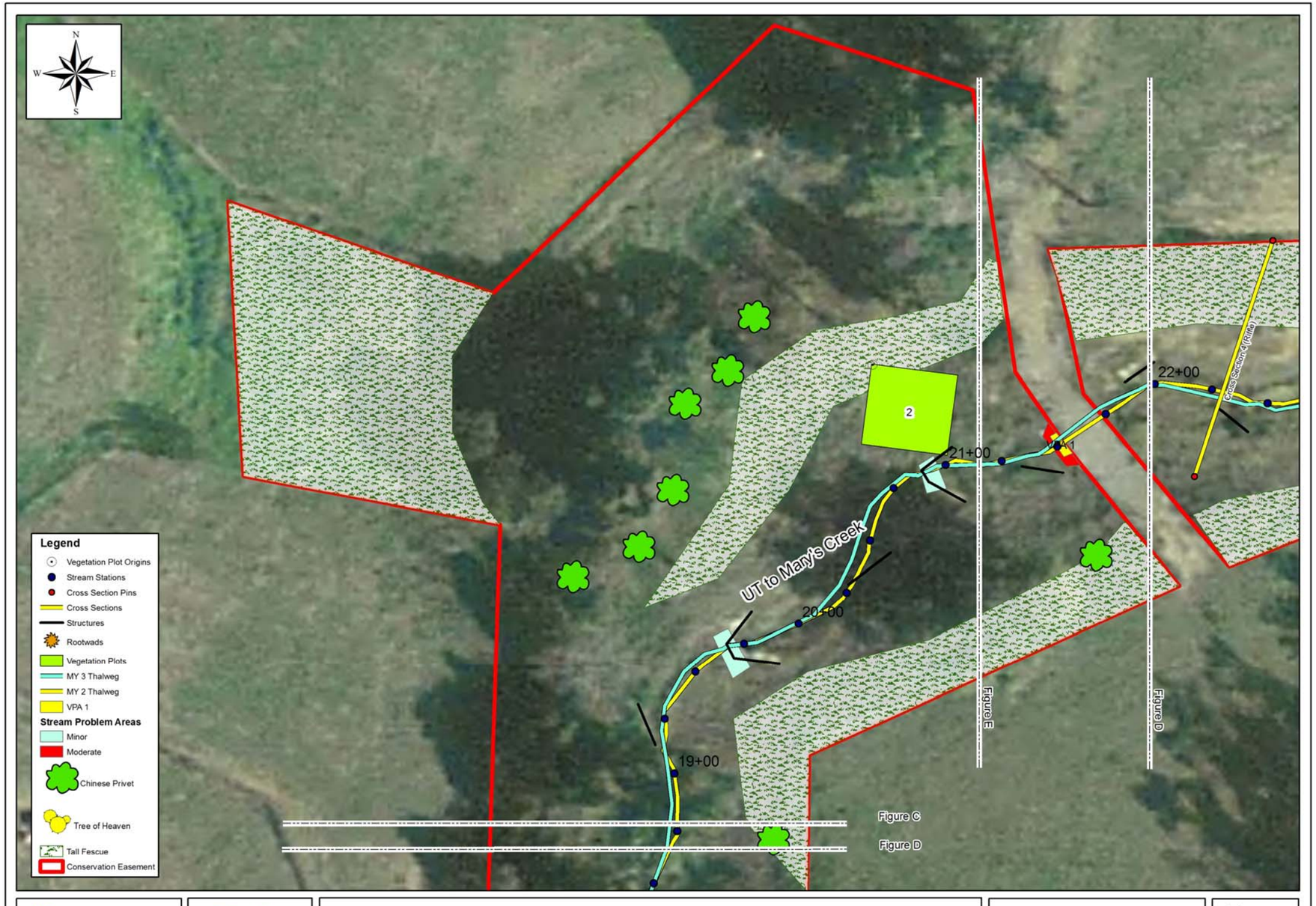
Figure C



The Catena Group

Ecosystem Enhancement Program

Mary's Creek Stream Restoration Site
Consolidated Current Conditions Plan View

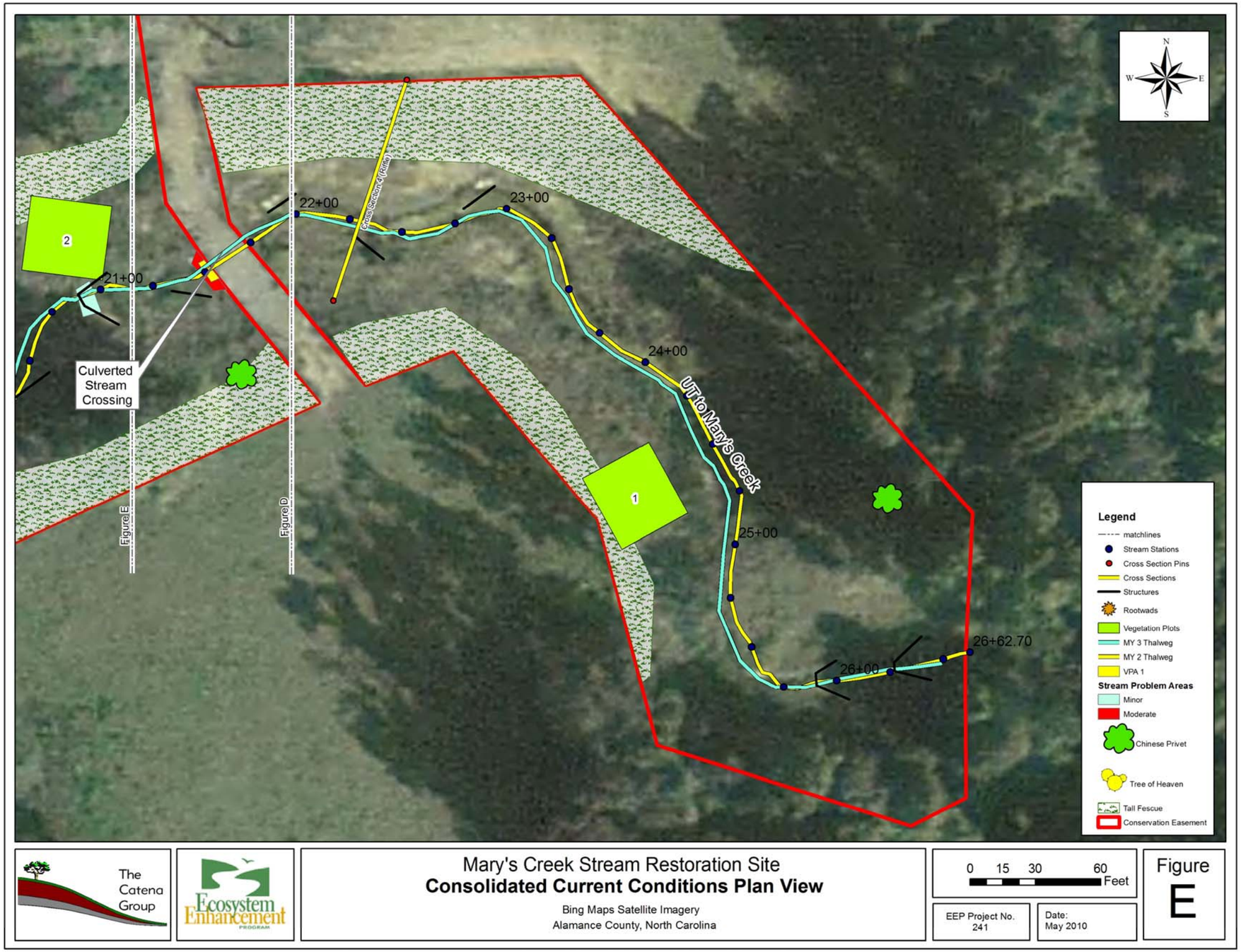
Bing Maps Satellite Imagery
Alamance County, North Carolina

0 15 30 60 Feet

EEP Project No. 241

Date: May 2010

Figure D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22+00
23+00
24+00
25+00
26+00
26+62.70
21+00
Culverted Stream Crossing
Cross Section C (Riffle)
Figure E
Figure D
2
1
UT to Mary's Creek
Legend
matchlines
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Cross Section Pins
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Alamance County, North Carolina
0 15 30 60
Feet
EEP Project No. 241
Date: May 2010
Figure E

Appendix B. General Project Tables

Table 1A and B. Project Components and Summations

Table 1.a. Project Components
Mary's Creek (EEP #241)

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Buffer Acres	BMP Elements[1]	Comment
UT to Mary's Creek	1750	R	P2	1632 lf	10+00-26+31.8	6.1	CF=4505 lf	Instream Structure and Vegetated Buffers
Tributary to the UT to Mary's Creek	360	R	P2	450 lf	10+00 – 14+50	1.2		Instream Structure and Vegetated Buffers

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area; O = Other
CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

Table 1b. Component Summations

Table 1.b. Component Summations
Mary's Creek (EEP #241)

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	2082						
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation							
HQ Preservation							
		0	0				
Totals	**2082**	**0**		**0**	**0**	**0**	**Count**
	=Non-Applicable						

Table 2. Project Activity and Reporting History

Mary's Creek (EEP #241)			
Activity or Reporting	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion Date**
Restoration Plan	N/A	-	April 2003
Final Design-90%	N/A	N/A	October 2005
Construction	N/A	N/A	March 2006
Temporary S&E mix applied to entire project area	N/A	N/A	March 2006
Permanent seed mix applied to entire project area	N/A	N/A	March 2006
Containerized, B&B, and livestake planting	N/A	N/A	March 2006
Mitigation Plan/As-built (Year 0 Monitoring-baseline)	N/A	May 2006	June 2006
Year 1 Monitoring	N/A	February 2007	March 2007
Year 2 Monitoring	N/A	July 2008	December 2008
Year 3 Monitoring	N/A	November 2008	May 2009

Table 3. Project Contact Table

Project Contact Table Mary's Creek (EEP #241)	
Designer	Stantec Consulting Services Inc 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 David Bidelspach - (919) 851-6866
Construction Contractor	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699 Bill Wright - (800) 881-1098
Planting Contractor POC	Seal Brothers Contracting, LLC P.O.Box 86 Dobson, North Carolina 27017 Brian Seal
Seeding Contractor POC	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699 Bill Wright - (800) 881-1098
Seed Mix Sources	contact Shamrock Environmental Corp.
Nursury Stock Suppliers	Hills Nursery Co., Inc. (931) 668-4364
Monitoring Performers	
Stream Monitoring	Ward Consulting Engineers 8368 Six Forks Road, Suite 104 Raleigh, NC 27613-5083
Vegetation Monitoring	The Catena Group 410-B Millstone Dr. Hillsborough, NC 27278

Table 4. Project Attribute Table

Project Background Table Mary's Creek (EEP #241)	
Project County	Alamance
Drainage Area	
UT to Mary's Creek	1145 acres
Drainage impervious surface cover estimate (%)	< 5%
Stream Order	
Main Channel	3rd
Tributary	1st
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-Built	C
Cowardin Classification	Stream (R3UB1)
Dominant Soil Types	Starr loam
Reference Site ID	UT to Cabin Branch (CB) & Landrum Creek (LC)
USGS HUC for Project	03030002
USGS HUC for Reference-CB	03020201
USGS HUC for Reference-LC	03030003
NCDWQ Sub-basin for Project	03-06-04
NCDWQ Sub-basin for Reference Reach-CB	03-04-01
NCDWQ Sub-basin for Reference Reach-LC	03-06-12
NCDWQ Classification for Project	C, NSW
NCDWQ Classification for Reference -CB	WS-IV NSW
NCDWQ Classification for Reference -LC	C
Is any portion of any project segment 303D listed?	No
Is any portion of any project segment upstream of a 303D listed segment?	Downstream of the site, Mary's Creek was listed on the 2002 list, but removed from the 2006 list
Reasons for 303D listing or stressor	Unknown
% of project easement fenced	100%

Appendix C. Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table

Mary's Creek (EEP #241)		
Veg Plot ID	**Veg Survival Threshold Met?**	**Tract Mean**
VP1	N/A	100%
VP2	N/A	
VP3	N/A	
VP4	Yes	
VP5	N/A	

Vegetation Monitoring Plot Photos

Photo 1. Vegetation Monitoring Plot 1

Photo 2. Vegetation Monitoring Plot 2

Photo 3. Vegetation Monitoring Plot 3

Photo 4. Vegetation Monitoring Plot 4

Photo 5. Vegetation Monitoring Plot 5

Table 6. Vegetation Metadata Table

database name	cvs-eep-entrytool-v2.2.5.mdb
database location	
computer name	
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.
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	241
project Name	Mary's Creek (EEP #241)
Description	2096 lf of stream restoration; no wetlands
River Basin	Cape Fear
length(ft)	2096
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	5

Table 7. Stem Count Total Planted by Plot and Species

EEP Project Code 241. Project Name: Mary's Creek

			Current Plot Data (MY3 2009)																Annual Means					
			241-01-VP1			241-01-VP2			241-01-VP3			241-01-VP4			241-01-VP5			MY3 (2009)			MY2 (2008)		
Scientific Name	Common Name	Species Type	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Acer rubrum	red maple	Tree																					7
Acer rubrum var. rubrum	red maple	Tree			3									5			5			13			12
Alnus serrulata	hazel alder	Shrub Tree									1									1			1
Baccharis halimifolia	eastern baccharis	Shrub Tree												3			3			6			1
Carpinus caroliniana	American hornbeam	Shrub Tree																					10
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Shrub Tree			13															13			
Celtis laevigata	sugarberry	Shrub Tree																					3
Cornus amomum	silky dogwood	Shrub									2			3			3			8			3
Crataegus	hawthorn	Shrub Tree			1									1			1			3			
Diospyros virginiana	common persimmon	Tree																					2
Fraxinus pennsylvanica	green ash	Tree			143			21			5									169			202
Gleditsia triacanthos	honeylocust	Shrub Tree			2															2			
Hypericum	St. Johnswort	Shrub																					2
Juniperus virginiana var. virginiana	eastern redcedar	Tree			1			2						95			95			193			103
Liquidambar styraciflua	sweetgum	Tree			22			3			5			24			24			78			61
Pinus taeda	loblolly pine	Tree			8															8			8
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree									1									1			1
Prunus serotina	black cherry	Shrub Tree																					2
Prunus serotina var. serotina	black cherry	Shrub Tree						1						1			1			3			
Quercus	oak	Shrub Tree												1			1			2			
Salix nigra	black willow	Tree										3	3	9			6	3	3	15	3	3	14
Sambucus canadensis	Common Elderberry	Shrub Tree			3															3			6
Ulmus	elm	Tree			1			1						1			1			4			
Ulmus alata	winged elm	Tree																					5
Ulmus rubra	slippery elm	Tree																					1
		Stem count	0	0	197	0	0	28	0	0	14	3	3	143	0	0	140	3	3	522	3	3	444
		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	0	0	10	0	0	5	0	0	5	1	1	10	0	0	10	1	1	17	1	1	19
		Stems per ACRE	0	0	7972	0	0	1133	0	0	566.6	121.4	121.4	5787	0	0	5666	24.28	24.28	4225	24.28	24.28	3594

Appendix D. Stream Assessment Data

Stream Station Photos

Photo 6. XS-1-Downstream View

Photo 9. XS-4 Downstream View

Photo 7. XS-2 Downstream View

Photo 10. XS-T1 Downstream View

Photo 8. XS-3 Downstream View

Photo 11. XS-T2-Downstream View

Table 8A and B. Visual Morphological Stability Assessment- Mary's Creek (EEP #241)						
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?	16	23	NA	70%	
	2. Armor stable (e.g.no displacement?)	12	23	NA	52%	
	3. Facet grade appears stable?	15	23	NA	65%	
	4. Minimal evidence of embedding/fining?	15	23	NA	65%	
	5. Length appropriate?	12	23	NA	52%	**61%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	15	21	NA	71%	
	2. Sufficiently deep (Max. Pool D:Mean Bkf>1.6?)	13	21	NA	62%	
	3. Length appropriate?	11	21	NA	52%	**62%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	23	23	NA	100%	
	2. Downstream of meander (glide/inflection) centering?	23	23	NA	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	23	23	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	23	23	NA	100%	
	4. Sufficient floodplain access and relief?	23	23	NA	100%	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	0/0	100%	
	2. Channel bed degradation-areas of increasingdowncutting of head cutting?	NA	NA	1/15	99%	**100%**
F. Bank	1. Actively eroding, wasting, or slumping bank?	NA	NA	3/40	99%	**99%**
G. Cross vanes, sills, single wing vanes	1. Free of back or arm scour?	16	17	NA	94%	
	2. Height appropriate?	13	17	NA	76%	
	3. Angle and geometry appear appropriate?	16	17	NA	94%	
	4. Free of piping or other structural failures?	15	17	NA	88%	**88%**
H. Wads/ Boulders	1. Free of scour?	4	4	NA	100%	
	2. Footing stable?	4	4	NA	100%	**100%**

Table 8B. Visual Morphological Stability Assessment-UT to Mary's Creek (EEP #241)						
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built [1]	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform Mean or Total
A. Riffles	1. Present?	7	10	NA	70%	
	2. Armor stable (e.g.no displacement?)	5	10	NA	50%	
	3. Facet grade appears stable?	5	10	NA	50%	
	4. Minimal evidence of embedding/fining?	2	10	NA	20%	
	5. Length appropriate?	6	10	NA	60%	**50%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	7	11	NA	64%	
	2. Sufficiently deep (Max. Pool D:Mean Bkf>1.6?)	6	11	NA	55%	
	3. Length appropriate?	2	11	NA	18%	**45%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	11	11	NA	100%	
	2. Downstream of meander (glide/inflection) centering?	11	11	NA	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	11	11	NA	100%	
	2. Of those eroding, # w/concomitant point bar formation?	0	0	NA	100%	
	3. Apparent Rc within spec?	11	11	NA	100%	
	4. Sufficient floodplain access and relief?	11	11	NA	100%	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	3/188	58%	
	2. Channel bed degradation-areas of increasing downcutting of head cutting?	NA	NA	0	100%	**79%**
F. Bank	1. Actively eroding, wasting, or slumping bank?	NA	NA	0	100%	**100%**
G. Cross vanes, sills, single wing vanes	1. Free of back or arm scour?	5	5	NA	100%	
	2. Height appropriate?	5	5	NA	100%	
	3. Angle and geometry appear appropriate?	5	5	NA	100%	
	4. Free of piping or other structural failures?	5	5	NA	100%	**100%**
H. Wads/ Boulders	1. Free of scour?	0	0	NA	NA	
	2. Footing stable?	0	0	NA	NA	**NA**

Table 9. Verification of Bankfull Events

Mary's Creek (EEP #241)			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo #**
Late 2005/Early 2006	Late 2005/Early 2006	Visual during construction	N/A
September 18, 2008	September 7, 2008	Wrack lines	N/A
July 24, 2009	Unsure (June 6, 2009)	Crest Gauge	N/A

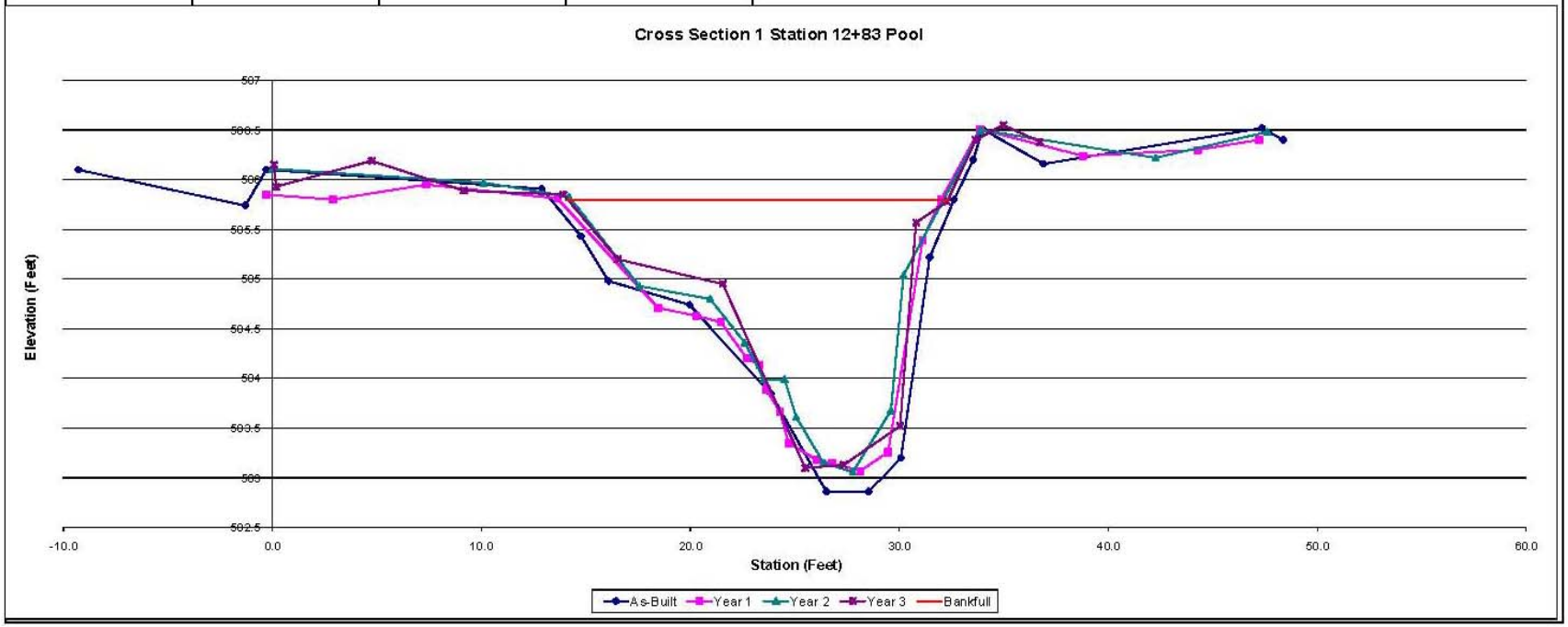
Project:	Mary's Creek
Cross Section:	Cross Section 1
Feature	Pool
Station:	12+83
Date:	9/22/09
Crew:	RL, BW, SV, RW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	30.4	27.3	24.5	22.9		
W (BKF)	19.7	18.3	18.0	18.2		
Max d	3.0	2.8	2.8	2.7		
Mean d	1.5	1.5	1.4	1.3		
W/D	12.8	12.3	13.2	14.5		

MY0-2006*			MY1-2007			MY2-2008			MY3-2009		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
-9.3	506.1		-0.3	505.85	LPIN	0.00	506.11	LPIN	0.07	506.15	LPIN
-1.3	505.74		2.89	505.8		10.12	505.97		0.17	505.93	
-0.3	506.1	LPIN	7.36	505.95		14.20	505.83	LBKF	4.75	506.19	
12.9	505.91	LBKF	13.65	505.81	LBKF	17.56	504.93		9.16	505.89	
14.8	505.43		18.45	504.71		20.95	504.80		13.93	505.85	
16.1	504.98		20.28	504.63		22.60	504.36		16.52	505.20	LBKF
20.0	504.74		21.45	504.57		23.53	503.99		21.56	504.95	
23.9	503.85		22.71	504.2		24.51	503.99		25.49	503.10	
26.5	502.86		23.32	504.14		25.07	503.61		27.32	503.13	TW
28.5	502.86		23.63	503.89		26.38	503.15		30.04	503.52	
30.1	503.2		24.28	503.67		27.77	503.06	TW	30.80	505.57	
31.5	505.22		24.7	503.35		29.60	503.68		32.29	505.78	
32.6	505.8	RBKF	26.06	503.18		30.20	505.04		33.65	506.40	RBKF
33.5	506.2		26.76	503.15		33.89	506.50	RBKF	34.98	506.55	
34.0	506.51		28.14	503.07		42.26	506.22		36.72	506.38	
36.9	506.16		29.46	503.26		47.61	506.48	RPIN	38.76	506.34	
47.4	506.52	RPIN	31.11	505.39					45.95	506.42	
48.4	506.4		31.99	505.8	RBKF				47.65	506.48	
			33.86	506.51							
			38.78	506.24							
			44.28	506.3							
			47.2	506.4							

Photo of XS-1, looking in the downstream direction



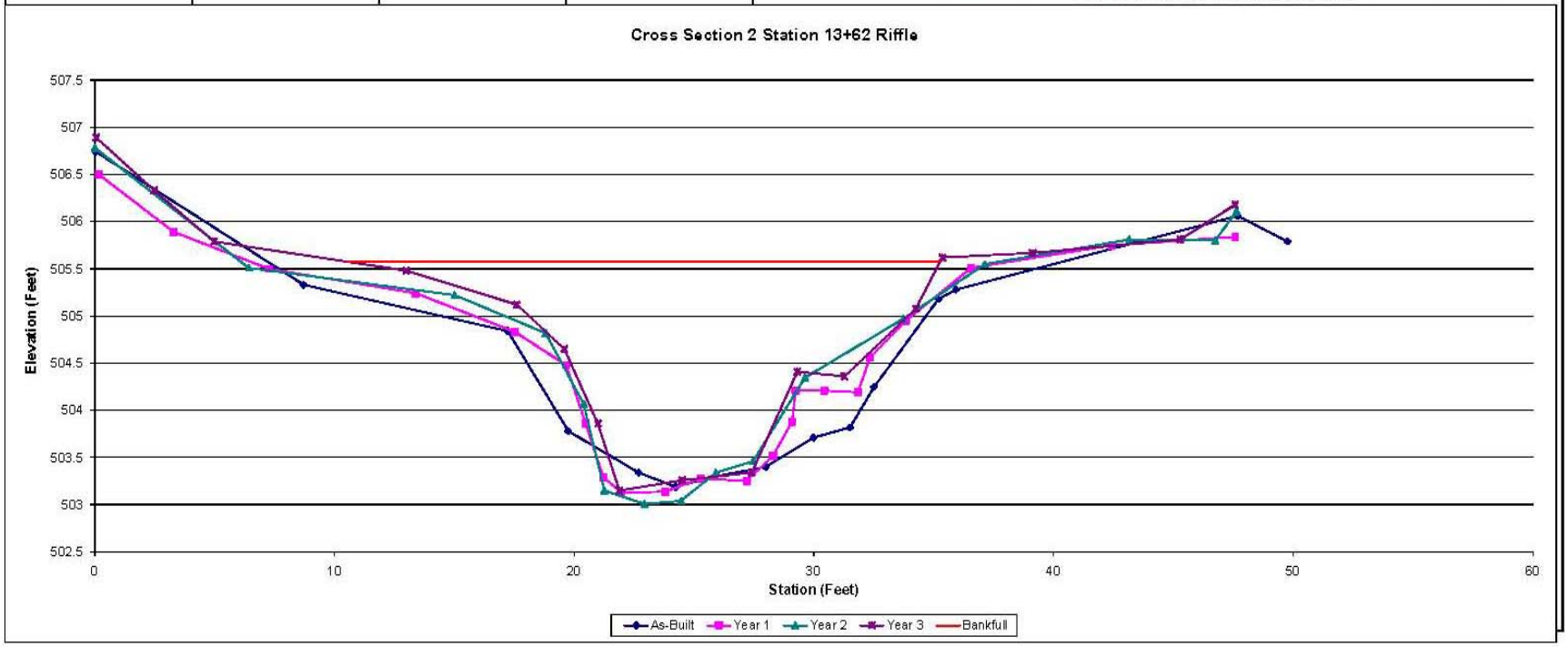
Project:	Mary's Creek
Cross Section:	Cross Section 2
Feature	Riffle
Station:	13+62
Date:	9/22/09
Crew:	RL, BW, SV, RW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	28.1	26.6	21.4	27.9		
W (BKF)	26.5	26.6	20.2	24.7		
Max d	2.1	2.2	2.2	2.4		
Mean d	1.1	1.0	1.1	1.1		
W/D	25.0	26.6	19.0	22.0		

MY0-2006			MY1-2007			MY2-2008			MY3-2009		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.04	506.74	LPIN	0.16	506.5	LPIN	0	506.78	LPIN	0.05	506.89	LPIN
8.71	505.33	LBKF	3.29	505.89		6.42	505.51		2.47	506.33	X2
17.23	504.84		7.25	505.5	LBKF	15.01	505.22	LBKF	4.96	505.79	X2
19.76	503.78		13.39	505.24		18.81	504.82		12.99	505.48	LBKF
22.69	503.34		17.53	504.83		20.4	504.07		17.61	505.12	
24.23	503.19		19.67	504.48		21.26	503.15		19.59	504.65	
25.88	503.3		20.48	503.86		22.93	503.01		20.99	503.86	
28	503.4		21.22	503.29		24.45	503.04	TW	21.88	503.15	
29.98	503.71		21.96	503.13		25.91	503.34		24.51	503.26	TW
31.51	503.82		23.81	503.14		27.46	503.46		27.41	503.34	
32.52	504.25		25.27	503.28		29.64	504.35		29.31	504.41	
35.2	505.18	RBKF	27.2	503.25		33.73	504.97	RBKF	31.28	504.36	
35.93	505.28		28.3	503.52		37.14	505.55		34.26	505.08	
47.69	506.06	RPIN	29.09	503.88		43.16	505.81		35.36	505.62	
49.76	505.79		29.24	504.21		46.75	505.8		39.13	505.67	RBKF
			30.44	504.21		47.64	506.11	RPIN	45.29	505.81	
			31.84	504.19					47.58	506.18	RPIN
			32.34	504.56					0	0	
			33.84	504.95	RBKF				0	0	
			36.56	505.51					0	0	
			42.43	505.75					0	0	
			47.58	505.84	RPIN				0	0	
									0	0	

Photo of XS-2, looking in the downstream direction



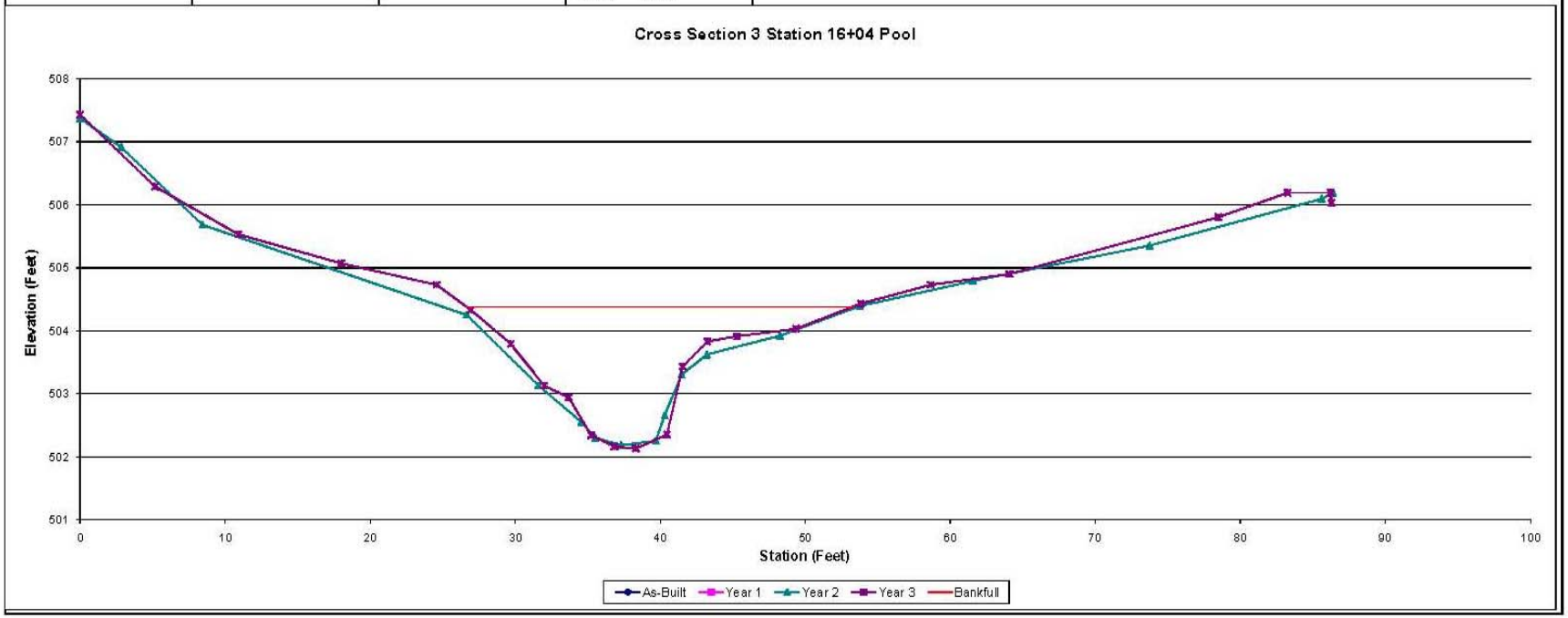
Project:	Mary's Creek
Cross Section:	Cross Section 3
Feature	Pool
Station:	16+04
Date:	9/22/09
Crew:	RL, BW, SV, RW

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	NA	NA	23.6	25.6		
W (BKF)	NA	NA	25.2	26.6		
Max d	NA	NA	2.1	2.3		
Mean d	NA	NA	0.9	1.0		
W/D	NA	NA	27.0	27.7		

MY0-2006			MY1-2007			MY2-2008			MY3-2009		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	507.37	LPIN	0.00	507.43	LPIN
						2.84	506.91		5.16	506.29	
						8.44	505.68		10.92	505.53	
						26.65	504.25	LBKF	18.00	505.07	
						31.60	503.13		24.57	504.73	
						34.56	502.55		26.94	504.33	LBKF
						35.53	502.30		29.70	503.79	
						37.28	502.18		31.99	503.13	
						39.70	502.25		33.69	502.94	
						40.30	502.65		35.23	502.34	
						41.47	503.30		36.84	502.16	
						43.22	503.62	RBKF	38.32	502.13	TW
						48.26	503.92		40.47	502.35	
						53.74	504.39		41.55	503.43	
						61.56	504.79		43.25	503.83	RBKF
						73.73	505.35		45.29	503.91	
						85.60	506.09		49.35	504.03	
						86.38	506.19	RPIN	53.83	504.43	
									58.66	504.73	
									64.10	504.90	
									78.48	505.80	
									83.26	506.19	
									86.24	506.19	RPIN
									86.29	506.03	
									95.00	507.00	

Photo of XS-3, looking in the downstream direction

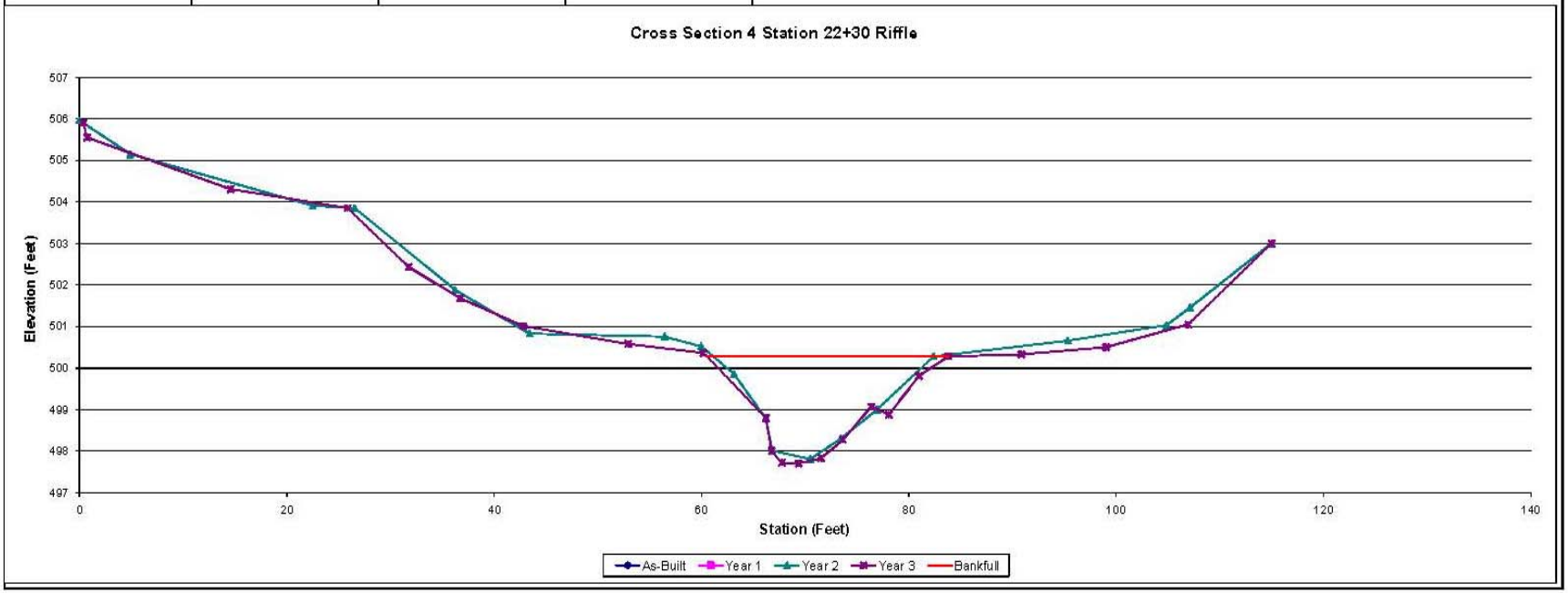


Project:	Mary's Creek
Cross Section:	Cross Section 4
Feature	Riffle
Station:	22+30
Date:	9/22/09
Crew:	RL, BW, SV, RW

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	NA	NA	29.4	33.8		
W (BKF)	NA	NA	21.3	23.3		
Max d	NA	NA	2.5	2.6		
Mean d	NA	NA	1.4	1.5		
W/D	NA	NA	15.4	16.1		

MY0-2006			MY1-2007			MY2-2008			MY3-2009		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	505.96	LPIN	0.37	505.91	LPIN
						4.91	505.15		0.72	505.55	
						22.52	503.91		14.56	504.31	
						26.54	503.85		25.86	503.85	
						36.24	501.88		31.76	502.43	
						43.42	500.83		36.72	501.68	
						56.44	500.76		42.79	501.01	
						59.97	500.52	LBKF	52.92	500.58	
						63.15	499.85		60.21	500.36	LBKF
						66.23	498.78		66.21	498.80	
						66.83	498.01		66.77	498.01	
						70.49	497.81	TW	67.75	497.72	
						73.45	498.30		69.37	497.70	TW
						76.93	499.00		71.55	497.83	
						82.39	500.28	RBKF	73.63	498.27	
						95.33	500.66		76.39	499.07	
						104.85	501.03		78.07	498.88	
						107.13	501.45	RPIN	80.99	499.81	
						115.00	503.00		83.81	500.28	RBKF
									90.86	500.33	
									99.03	500.50	
									106.97	501.05	RPIN
									115.00	503.00	

Photo of XS-4, looking in the downstream direction

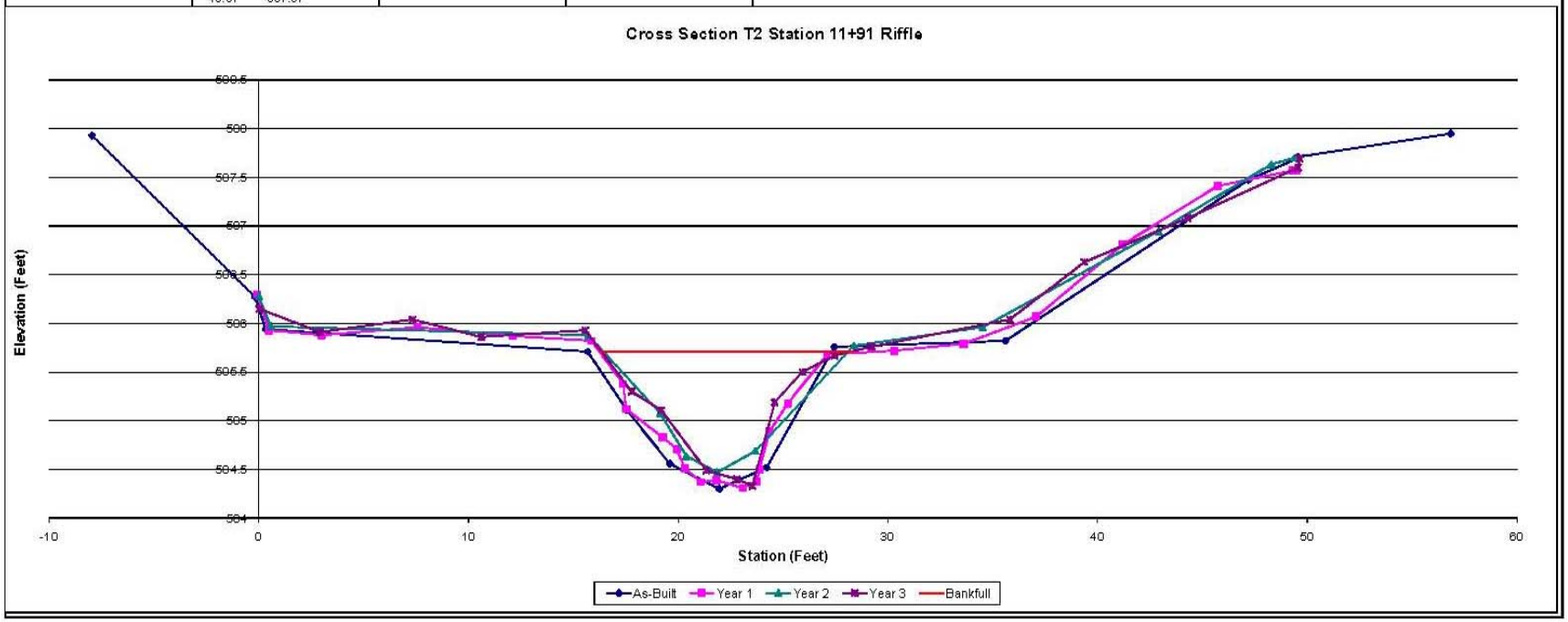


Project:	Mary's Creek
Cross Section:	Cross Section T2 (Tributary)
Feature	Riffle
Station:	11+91
Date:	9/22/09
Crew:	RL, BW, SV, RW

Summary (bankfull)						
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	10.0	8.8	8.9	7.4		
W (BKF)	11.8	11.2	12.2	12.0		
Max d	1.4	1.4	1.3	1.4		
Mean d	0.8	0.8	0.7	0.6		
W/D	13.9	14.3	16.8	19.5		

MY0-2006			MY1-2007			MY2-2008			MY3-2009		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
-7.96	507.93		-0.1	506.3	LPIN	0.00	506.28	LPIN	0.02	506.15	LPIN
-0.18	506.27	LPIN	0.49	505.93		0.57	505.97		2.92	505.91	
-0.18	506.27		2.99	505.88		15.70	505.88	LBKF	7.34	506.04	
0.32	505.94		7.54	505.96		19.13	505.08		10.61	505.86	
15.68	505.71	LBKF	12.09	505.87		20.37	504.64		15.56	505.93	LBKF
17.55	505.11		15.86	505.82	LBKF	21.85	504.47	TW	17.77	505.30	
19.59	504.56		17.36	505.38		23.68	504.89		19.18	505.11	
21.96	504.3		17.52	505.12		28.37	505.77	RBKF	21.33	504.49	
24.21	504.52		19.26	504.83		34.52	505.96		22.79	504.40	TW
27.45	505.76	RBKF	19.92	504.71		42.91	506.95		23.54	504.33	
35.61	505.82		20.33	504.51		48.27	507.63		24.60	505.19	
47.17	507.47		21.07	504.37		49.39	507.70	RPIN	25.92	505.50	RBKF
49.48	507.69		21.81	504.39					27.46	505.67	
49.54	507.71	RPIN	23.09	504.31					29.21	505.76	
56.83	507.95		23.75	504.38					35.82	506.04	
			23.87	504.5					39.37	506.63	
			24.36	504.89					44.29	507.08	
			25.23	505.18					49.56	507.60	
			27.09	505.68	RBKF				49.64	507.69	RPIN
			30.3	505.72							
			33.61	505.79							
			37.07	506.07							
			41.2	506.81							
			45.73	507.41							
			49.31	507.57							

Photo of XS-T2, looking in the downstream direction



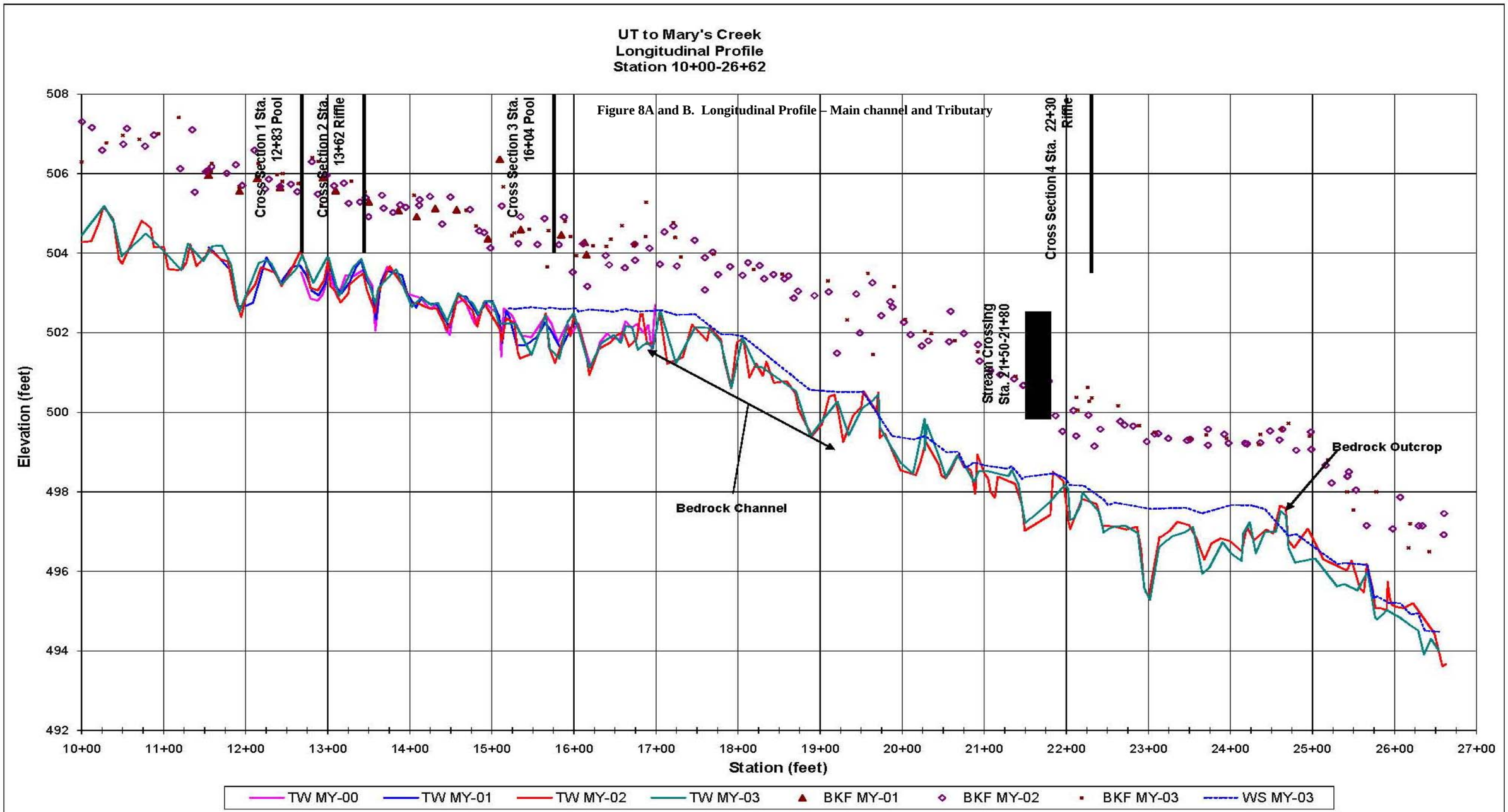


Figure 8A and B. Longitudinal Profile – Main channel and Tributary

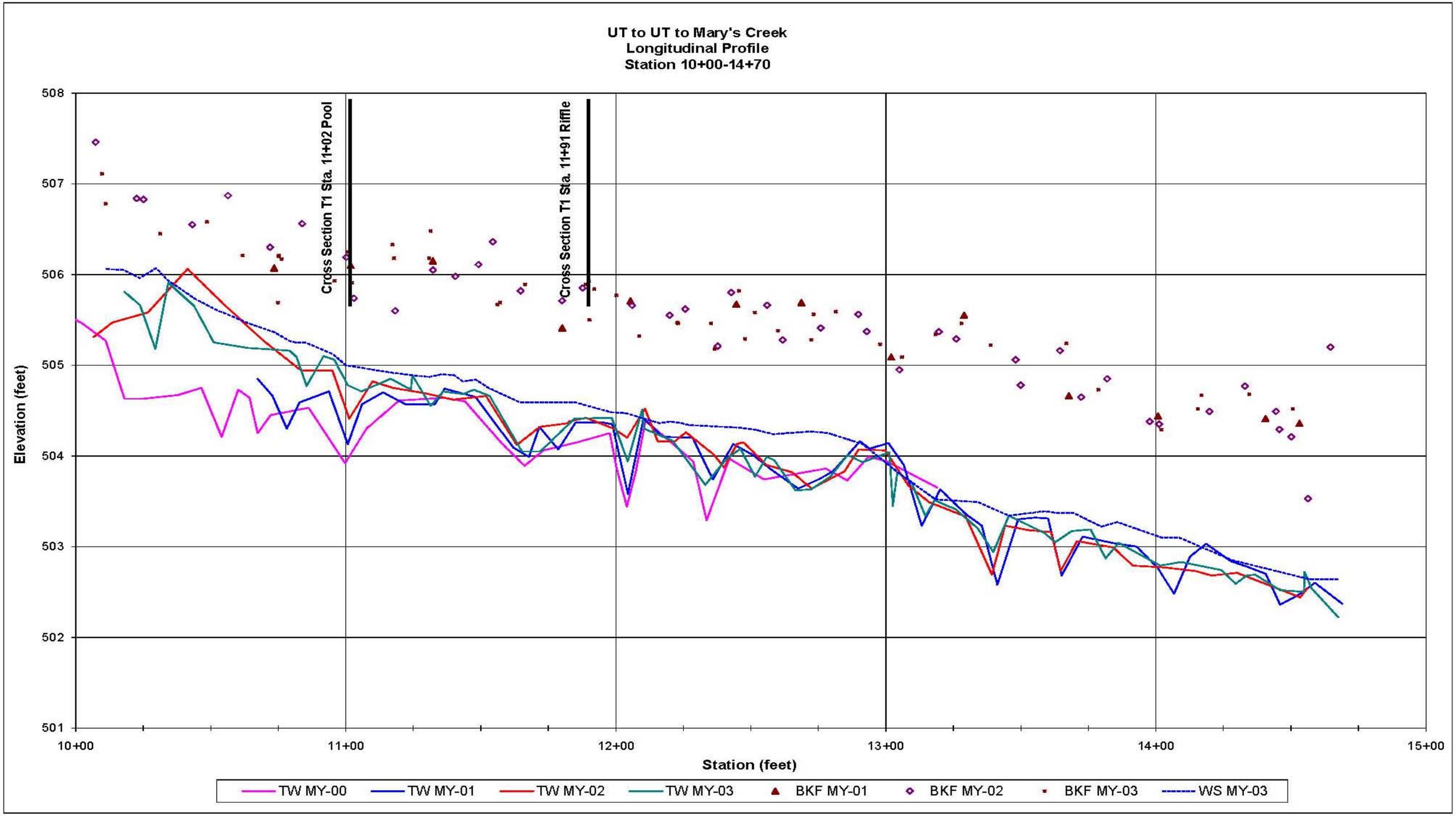

UT to UT to Mary's Creek
Longitudinal Profile
Station 10+00-14+70
Cross Section T1 Sta. 11+02 Pool
Cross Section T1 Sta. 11+91 Riffle
Elevation (feet)
508
507
506
505
504
503
502
501
10+00
11+00
12+00
13+00
14+00
15+00
Station (feet)
TW MY-00
TW MY-01
TW MY-02
TW MY-03
BKF MY-01
BKF MY-02
BKF MY-03
WS MY-03

Figure 9. Pebble Count Plots – Cross-Section 2 – Mary's Creek (EEP #241)

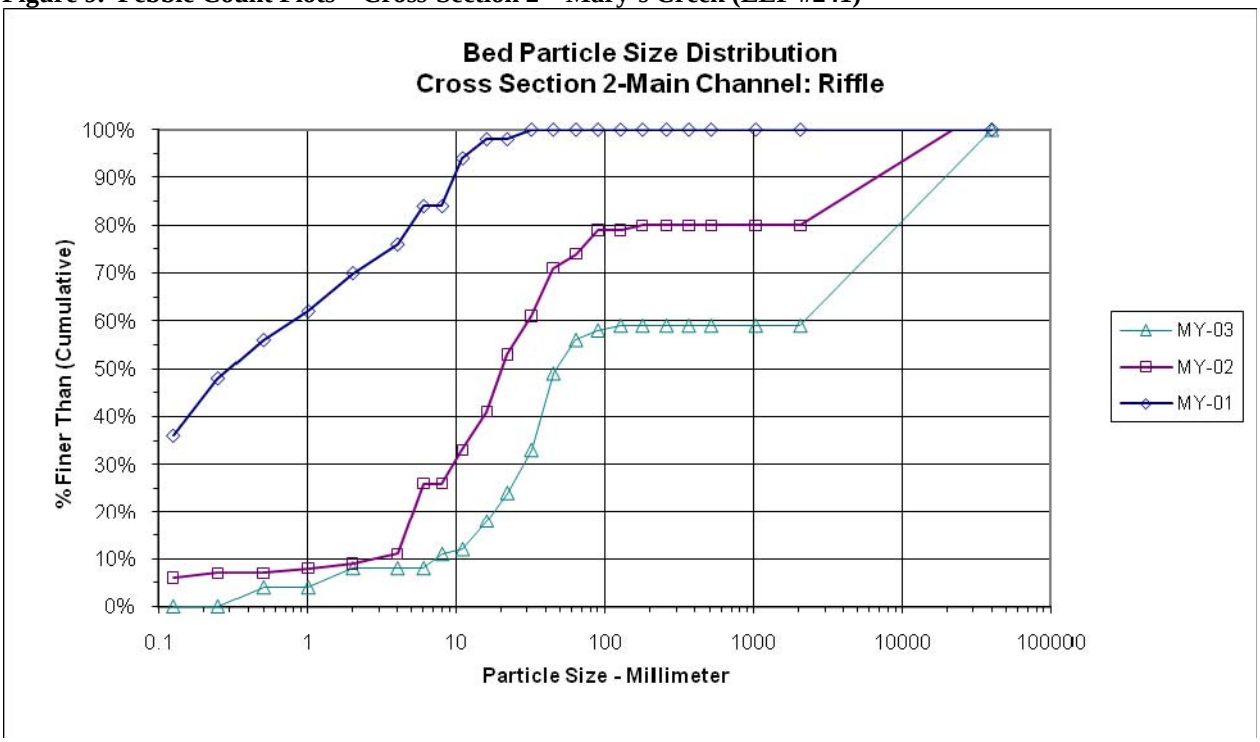


Figure 10. Pebble Count Plots – Cross-Section 4 – Mary's Creek (EEP #241)

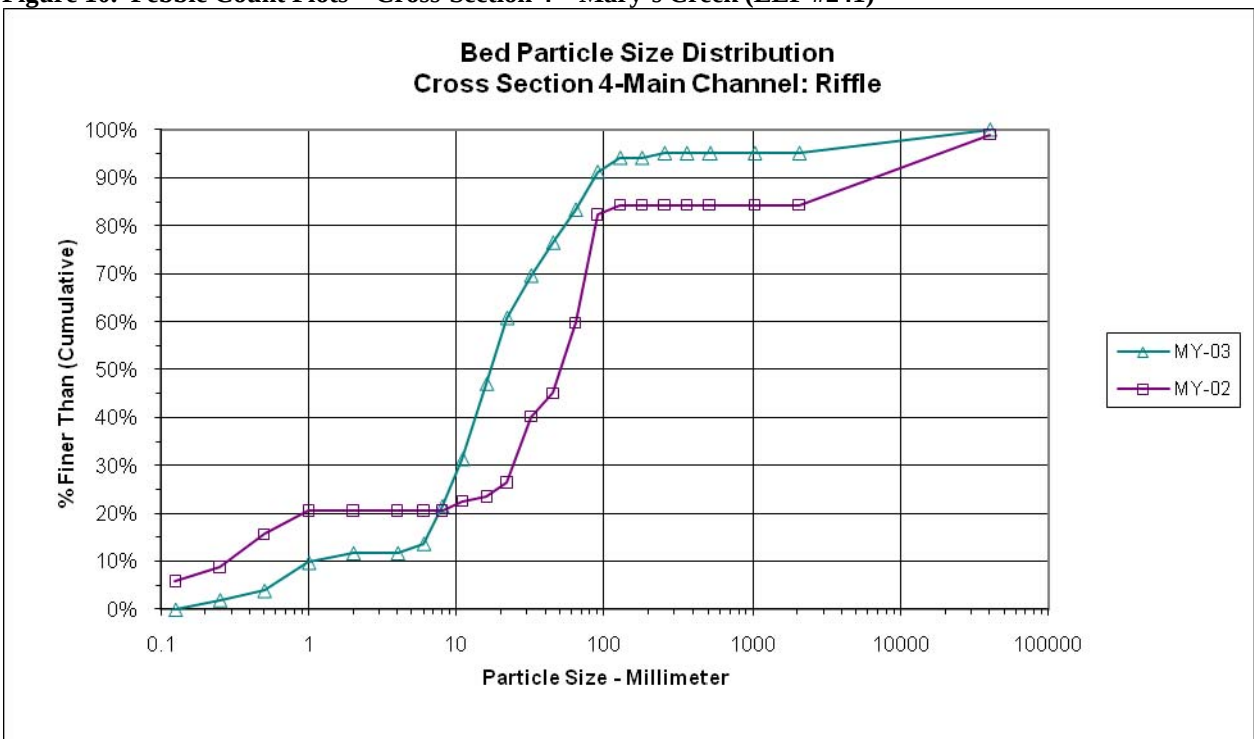


Figure 11. Pebble Count Plots – Cross-Section2 – Mary's Creek (EEP #241)