

YEAR 3 MONITORING REPORT

UT TO THE LUMBER RIVER SITE

Robeson County, North Carolina

Contract No. 002027, EEP IMS No. 94068



Submitted to:



NCDENR-Ecosystem Enhancement Program

217 West Jones Street, Suite 3000A

Raleigh, North Carolina 27603

Construction Completed: April 2010

Morphology Data Collected: February 15 and 23, 2012

Vegetation Data Collected: September 27 and 28, 2012

Submitted: December 11, 2012

Prepared by:



Florence & Hutcheson

An **ICA** Company

**Florence & Hutcheson, Inc.
5121 Kingdom Way, Suite 100
Raleigh, North Carolina 27607**

919.851.6066
919.851.6846 (fax)

I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, UT TO THE LUMBER RIVER YEAR 3 MONITORING REPORT WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS 11TH DAY OF DECEMBER 2012.

Chris L. Smith, PE

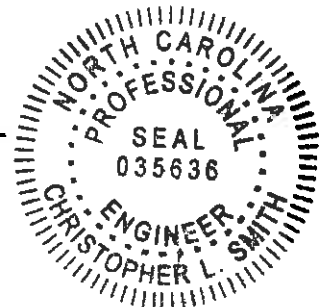


TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 EXECUTIVE SUMMARY.....	2
1.1 GOALS AND OBJECTIVES	2
1.2 VEGETATION	2
1.3 STREAM STABILITY	3
1.4 WETLANDS.....	3
1.5 NOTE.....	4
2.0 METHODOLOGY.....	4
3.0 RERFERENCES.....	4
APPENDICES.....	5
APPENDIX A. PROJECT VICINITY MAP AND BACKGROUND TABLES.....	5
APPENDIX B. VISUAL ASSESSMENT DATA	12
APPENDIX C. VEGETATION PLOT DATA	30
APPENDIX D. STREAM SURVEY DATA.....	33
APPENDIX E. HYDROLOGIC DATA.....	60

LIST OF FIGURES

<u>FIGURE</u>	<u>PAGE</u>
Figure 1. Vicinity Map.....	6
Figures 2.0-2.8. Current Condition Plan View	13
Figures 3.1-3.20. Vegetation Plot Photos and Problem Areas.....	25
Figures 4.1-4.17. Cross Section Plots and Photos	34
Figures 5.1-5.3. Longitudinal Profile Plots.....	52
Figures 6.1 & 6.2 Crest Gauge Photos.....	60

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
Table 1. Project Components and Mitigation Credits.....	8
Table 2. Project Activity and Reporting History	9
Table 3. Project Contacts Table	10
Table 4. Project Attributes Table	11
Table 5. Visual Stream Morphology Stability Assessment	23
Table 6. Vegetation Condition Assessment	24
Table 7. Vegetation Plot Mitigation Success Summary	30
Table 8. CVS Vegetation Metadata	31
Table 9. CVS Stem Count Total and Planted by Plot and Species	32
Table 10. Baseline Stream Data Summary	56
Table 11. Monitoring Data - Dimensional Morphology Summary	57
Table 12. Monitoring Data - Stream Reach Data Summary	58
Table 13. Verification of Bankfull Events	60

1.0 EXECUTIVE SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 3 monitoring for the UT to the Lumber River Site in Robeson County, North Carolina.

1.1 Goals and Objectives

The primary goals of the UT to the Lumber River stream restoration project focus on:

- Improving water quality
- Providing/enhancing flood attenuation
- Restoring/enhancing aquatic and riparian habitat function and connectivity with adjacent pristine habitats
- Assisting the State of North Carolina initiatives along the Lumber River for conservation, including assisting the EEP with meeting its goals of improving water quality and habitat as documented within the Lumber River/Bear Swamp Watershed Management Plan for the Targeted 03040203030010 14-digit Hydrologic Unit.

These goals will be achieved through the following objectives:

- Restore the UT to a stable, more natural sand bed channel.
- Excavate a floodplain and connect flood flows to existing ponds for attenuation.
- Enhance in stream habitat by creating an undulating bedform.
- Establish a vegetated riparian buffer for nutrient and sedimentation reduction.
- Create three stormwater BMPS on three existing ditches to reduce sedimentation and nutrients from contributing waters.
- Connect the Lumber River with a habitat corridor through the existing agricultural fields through a conservation easement, riparian plantings, and stream restoration.
- Preserve much of the Lumber River and its floodplain through a conservation easement to protect habitat and water quality benefits of a mature floodplain and riverine system.

1.2 Vegetation

After the third growing season, bare root and live stake plantings are meeting and exceeding success criteria goals. Each of the 14 vegetation plots met the success criteria of at least 320 stems per acre.

As noted in Year 1 and Year 2 monitoring reports, several areas of the terrace side slopes have sparse ground cover and are experiencing minor erosion (see CCPV). All areas previously documented as experiencing major erosion have stabilized. The majority of bare root plants along the side slopes are surviving and will provide additional root mass to help stabilize the side slopes as they mature. Minor erosion areas will be watched closely over the next monitoring year to ensure they do not progress to more severe erosion. Additional seeding is not recommended at this time.

Eight small clusters of cattail (*Typha latifolia*) were observed in the floodplain and are noted on the Current Condition Plan View (CCPV) map. *Sericea lespedeza* (*Lespedeza cuneata*) was also observed adjacent to Vegetation Plot 4 and is depicted on the CCPV. No corrective action is recommended at this time. Invasive/exotic vegetation is not currently compromising the vegetative success of the site.

1.3 Stream Stability

The UT to the Lumber River appears to be stable and functioning as designed. There is no evidence of trends toward significant change in channel dimension, profile or pattern. Cross-sectional data indicates that the channel has experienced little change in dimension. The profile plots depict some shifting of pools throughout the reach. This is expected in sand bed channels, where the bed form is in constant flux and pools adjust their depths during most storm events. Sediment deposition in pools is common in sand systems and we fully expect these pools to scour and fill throughout the entire monitoring timeframe. The channel is expected to flush excess sediment out in future high flow events. Table 5, Visual Stream Morphology Stability Assessment, details 59 pools that are “stable, performing as intended”. The as-built profile depicted 63 pools. This would give a 94 percent rate of “stable, performing as intended” for Year 3 Monitoring, up from 92 percent for Year 2 Monitoring and 76 percent for Year 1 Monitoring. It is our opinion that the channel is performing as it should. However, it is anticipated that pools will experience scour (deeper) after some storm events and will experience aggradation (shallower) after other storm events, which is a common and natural process in sand systems.

An overall visual assessment of the channel appears to confirm morphological data, in that there are no substantial areas of concern within the bankfull channel. A small beaver dam was observed near station 10+43, approximately 20 feet downstream of Cross-section 1. The beaver dam has not had a significant impact on the stability of the stream, but it will be removed prior to Year 4 Monitoring surveys. After the repair of a floodplain interceptor near station 16+65, some of the smaller rip-rap used during the repair washed into the channel and raised the bed elevation. The rap-rap has not resulted in stream degradation and it will be removed from the channel prior to Year 4 Monitoring surveys. The beaver dam and rip-rap are identified on Figure 5.1.

The site has experienced several bankfull flows throughout the first monitoring year. Crest gauges installed on-site were inspected on February 16 & 23, 2012 and September 28, 2012. The crest gauges revealed that a bankfull event occurred at least twice during 2012 (Table 13). Additional overbank evidence includes debris lines, and vegetation bent in the downstream direction. Evidence of bankfull events can be found in Appendix E.

1.4 Wetlands

No wetland monitoring areas were established for this project report.

1.5 Note

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 Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

The Year 3 Monitoring survey was completed using a Total Station. Each cross section is marked with two rebar monuments at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. The longitudinal stationing was developed from total station data and compared with previous year's data to ensure consistent beginning and ending points. RIVERMorph was used to analyze the profile and cross section data. Tables and figures were created using Microsoft Excel.

The channel is entirely a sand bed system; therefore a pebble count was not conducted. It should be noted however, that the restored channel is dominated by sand, not detritus as was the case in pre-restoration conditions.

Vegetation monitoring was completed using CVS level II methods, for 14, 100 square meter vegetation plots (Lee et al. 2006). The taxonomic standard for vegetation used for this document was Flora of the Southern and Mid-Atlantic States (Weakley 2011).

3.0 REFERENCES

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>).

Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

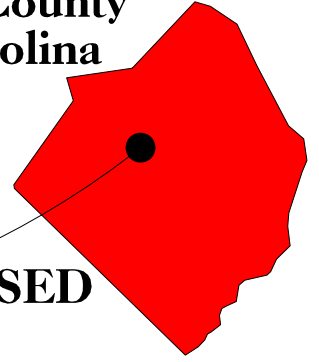
APPENDICES

Appendix A. Project Vicinity Map and Background Tables

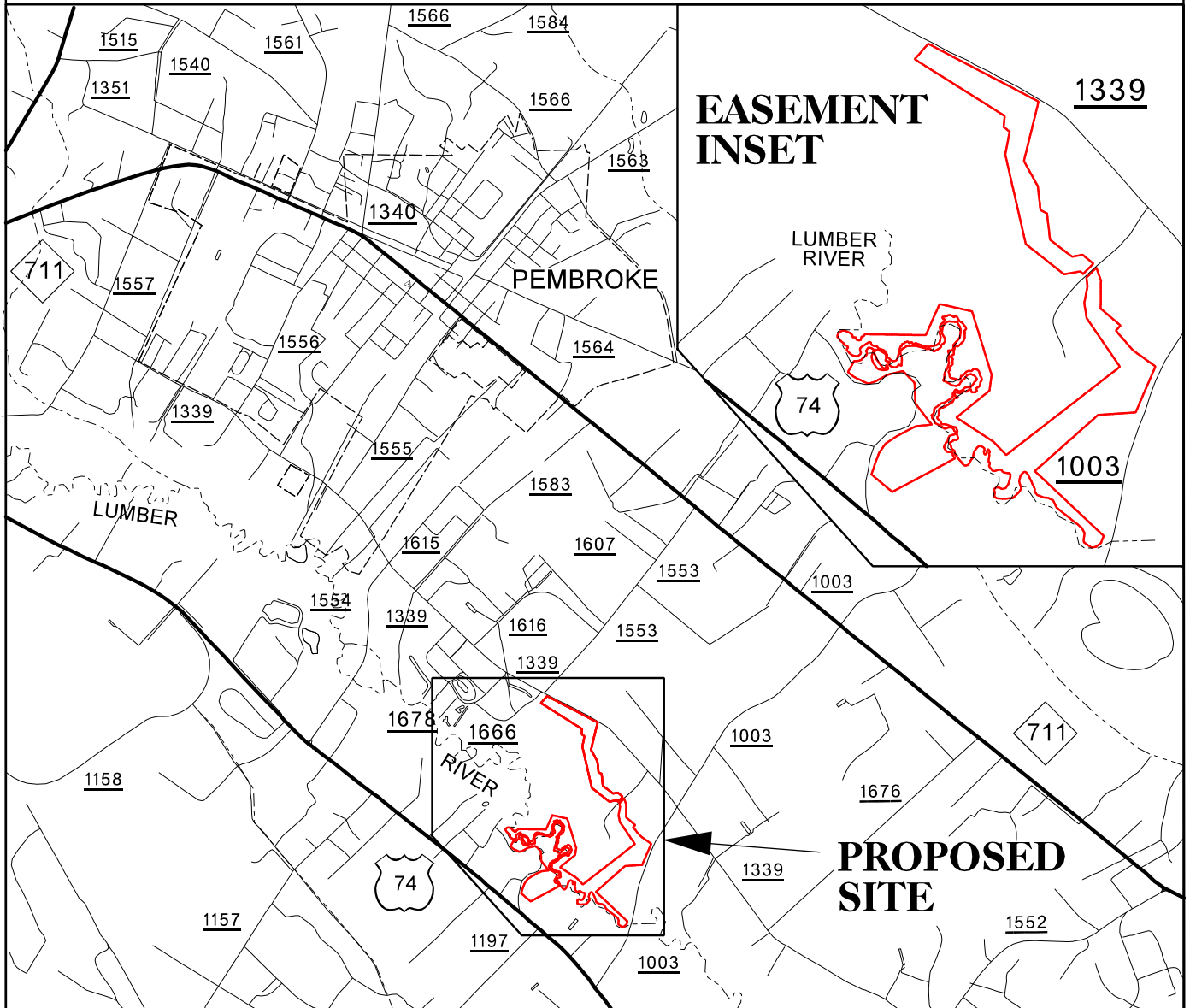


THE SUBJECT PROJECT SITE IS AN ENVIRONMENTAL RESTORATION SITE OF THE NCDENR ECOSYSTEM ENHANCEMENT PROGRAM (EEP) AND IS ENCOMPASSED BY A RECORDED CONSERVATION EASEMENT, BUT IS BORDERED BY LAND UNDER PRIVATE OWNERSHIP. ACCESSING THE SITE MAY REQUIRE TRAVERSING AREAS NEAR OR ALONG THE EASEMENT BOUNDARY AND THEREFORE ACCESS BY THE GENERAL PUBLIC IS NOT PERMITTED. ACCESS BY AUTHORIZED PERSONNEL OF STATE AND FEDERAL AGENCIES OR THEIR DESIGNEES /CONTRACTORS INVOLVED IN THE DEVELOPMENT, OVERSIGHT AND STEWARDSHIP OF THE RESTORATION SITE IS PERMITTED WITHIN THE TERMS AND TIMEFRAMES OF THEIR DEFINED ROLES. ANY INTENDED SITE VISITATION OR ACTIVITY BY ANY PERSON OUTSIDE OF THESE PREVIOUSLY SANCTIONED ROLES AND ACTIVITIES REQUIRES PRIOR COORDINATION WITH EEP.

Robeson County North Carolina



**PROPOSED
SITE**



Florence & Hutcheson

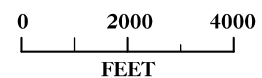
An **ICA** Company

5121 Kingdom Way, Suite 100 Raleigh, NC 27607

NC License No: F-0258

Vicinity Map

UT to the Lumber River
Stream Restoration Plan
Robeson County, North Carolina



Date: 10/02/12

Figure: 1

Project Location and Directions

The UT to the Lumber River Stream Restoration Site (Site) is located approximately two (2) miles southeast of Pembroke in Robeson County, North Carolina (Figure 1). The properties included in this Site span east of State Road (SR) 1003 (Chicken Road) and south from SR 1339 (Deep Branch Road) to US 74 Highway along the Lumber River.

Directions to the Site:

- From Interstate 40 take exit 328A (towards Fayetteville/Benson) onto Interstate 95 South
- From Interstate 95 take exit 17 (towards Pembroke) onto US-711/72. Remain on US 711 at US 711 and US 72 Split.
- Go approximately 7.4 miles west towards Pembroke after exiting I-95.
- Turn left onto SR 1003 (Chicken Road). Go for approximately 1.1 miles to the intersection of Chicken Road and SR 1339 (Deep Branch Road).
- Turn right onto Deep Branch Road. Go for approximately 0.2 miles and turn left onto dirt road that takes you through the Site to the UT.

The subject project is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.

Table 1. Project Components and Mitigation Credits

Restoration Segment/ Reach ID	Existing LF/AC	Restoration Level	Approach	Restored LF/AC	Station Range	Buffer Acres	Comment
UT Lumber River	5,958	R	PII	4,285	10+00 – 53+57	17.2	Restore pattern, dimension, profile, and riparian buffer.
		E II	Plantings	463	10+00 – 14+63	1.9	Plant a native vegetated riparian buffer through agricultural fields.
		P	Easement	2,177	10+00 – 31+77	12.2	Place a permanent conservation easement over lands in preservation areas.
Lumber River	4,123	P	Easement	4,123	10+00 – 50+87	35.9	Place a permanent conservation easement over lands in preservation areas.
Component Summations							
Restoration Level	Stream (LF)		Buffer (AC)				
Restoration	4,285		17.2				
Enhancement I							
Enhancement II	463		1.9				
Preservation	6,300		48.75				
Totals	11,022		67.85				

Mitigation Unit Summary			
Stream	Restoration (SMU)	Enhancement (SMU)	Preservation (SMU)
UT	4,285.0	185.2	435.4
Lumber River			824.6
Total (SMU)	5730.2		

The as-built stationing is 22 feet longer than the proposed channel design stationing (53+35 for design and 53+57 for as-built). The contractor stabilized an additional 22 feet of channel past the designed end point during construction to complete the tie in from the design channel to the existing channel. This area was shown in the as-built, but is not considered a major modification in the channel design. Future monitoring may end at station 53+35.

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	September 2009	October 2009
Final Design – Construction Plans	October 2009	November 2009
Construction	January 18, 2010	April 9, 2010
Temporary S&E Mix Applied to Entire Project Area	January 18, 2010	April 9, 2010
Permanent Seed Mix Applied to Entire Project Area	January 18, 2010	April 9, 2010
Containerized and B&B plantings for Entire Project Area	April, 4 2010	April 7, 2010
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	April 13, 2010	April 22, 2010
Year 1 Monitoring	October 14, 2010	December 3, 2010
Year 2 Monitoring	October 13, 2011	December 5, 2011
Year 3 Monitoring	September 28, 2012	December 11, 2012
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Table

Designer Primary project design POC	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Kevin Williams (919) 851-6066
Construction Contractor Construction Contractor POC	Land Mechanics Design Lloyd Glover 126 Circle G Lane Willow Springs, NC 27592 (919) 639-6132
Planting Contractor Planting Contractor POC	Bruton Natural Systems Charlie Bruton PO Box 1197 Fremont, NC 27830 (919) 242-6555
Seeding Contractor Seeding Contractor POC	Land Mechanics Design Lloyd Glover 126 Circle G Lane Willow Springs, NC 27592 (919) 639-6132
Seed Mix Sources	Green Resources – Triad Office
Nursery Stock Suppliers	ArborGen - South Carolina SuperTree Nursery Bruton Natural Systems
Monitoring Performers	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Evan Corbin (919) 851-6066
Vegetation Monitoring POC	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

Table 4. Project Attributes Table

Project County	Robeson County, North Carolina	
Physiographic Region	Southeastern Plains	
Ecoregion	Southeastern Floodplains and Low Terraces	
Project River Basin	Lumber	
USGS HUC for Project (14 digit)	03040203030010	
NCDWQ Sub-basin for Project	03-07-51	
Within extent of EEP Watershed Plan?	Yes – Lumber River/Bear Swamp Watershed Management Plan 2006	
WRC Class (Warm, Cool, Cold)	Warm	
% of project easement fenced or demarcated	100% demarcated with signs/posts)	
Beaver activity observed during design phase?	Yes	
Restoration Component Attributes		
	UT Lumber River	Lumber River
Drainage Area	0.42 sq mi (At End of Restoration Reach)	432 sq mi
Stream Order (USGS topo)	1 st	Multiple Order
Restored Length (feet)	4,285	0.0
Perennial (P) or Intermittent (I)	P	P
Watershed Type	Primarily rural w/ some urban	Primarily Rural
Watershed impervious cover	~5%	~1%
NCDWQ AU/Index number	14-(7)	14-(7)
NCDWQ Classification	WS-IV, B, Sw, HQW	WS-IV, B, Sw, HQW
303d listed?	No	No
Upstream of a 303d listed	No	No
Reasons for 303d listed segment	N/A	N/A
Total acreage of easement	67.85 ac	
Total vegetated acreage of easement	52.5 ac	
Total planted restoration acreage	15.0 ac	
Rosgen Classification of preexisting	G5/F5	E5
Rosgen Classification of As-built	E5	N/A
Valley type	VIII	X
Valley slope	0.23%	0.07%
Cowardin classification	Coastal Plain Small Stream Swamp	Coastal Plain Small Stream Swamp
Trout waters designation	N/A	N/A
Species of concern, endangered etc.	In County: RCW, Michaux's Sumac	In County: RCW, Michaux's Sumac
Dominant Soil Series	Bibb/Rains	Bibb

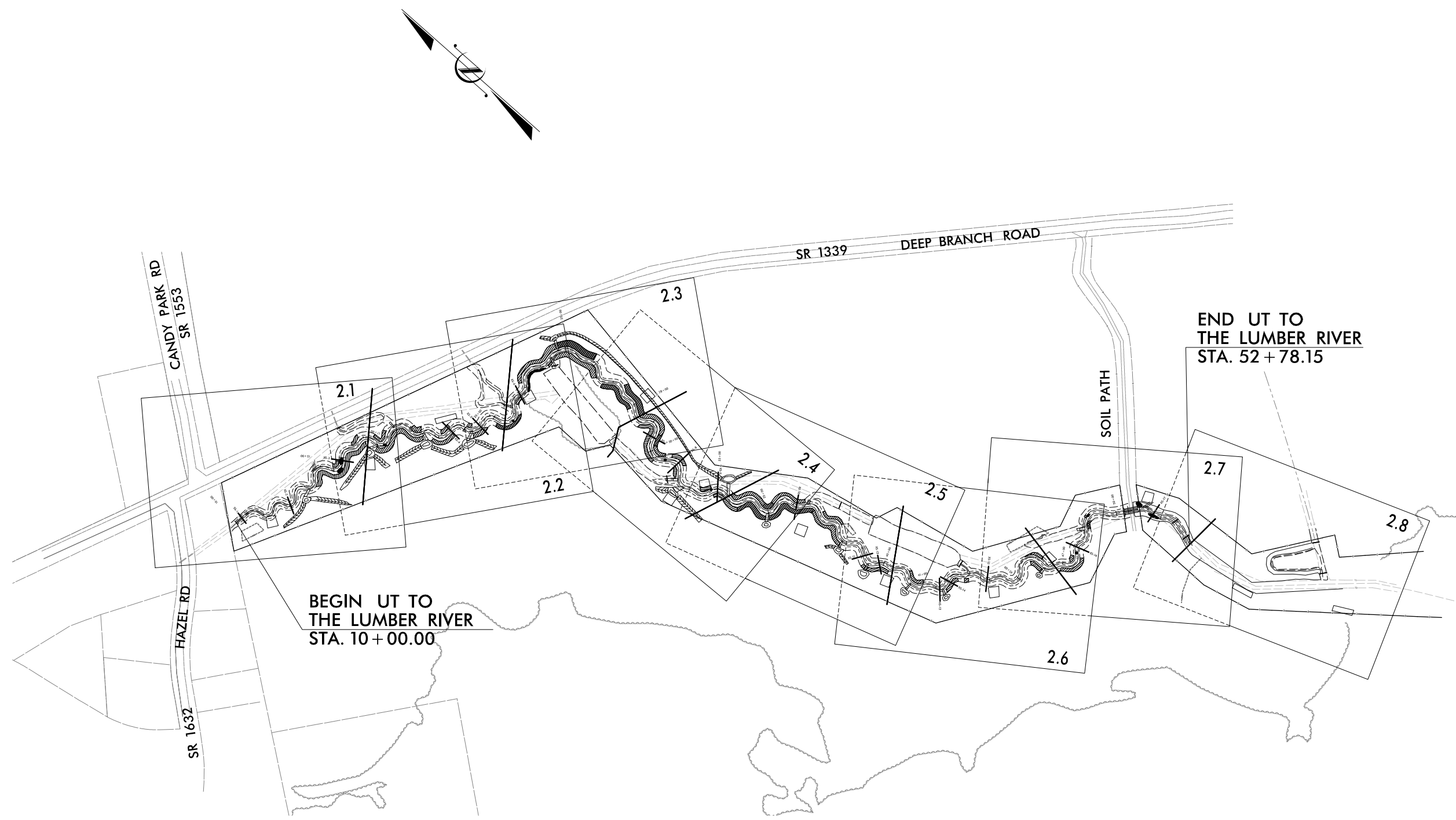
Appendix B. Visual Assessment Data



Figures 2.0-2.8. Current Condition Plan View



**CURRENT CONDITION PLAN VIEW (CCPV)
OVERVIEW MAP**



10/31/2012
 R:\stream\Proj\Monitoring CCPV\Lumber-River-psh2.0_Monitoring_Y2-CCPV.dgn
 Florence & Hutcheson, Inc.



Florence & Hutcheson
 An ICA Company
5121 Kingston Way, Suite 100 Raleigh, NC 27607
 NC License No. P-0086

**UT TO THE LUMBER RIVER
 STREAM RESTORATION PROJECT
 ROBESON COUNTY, NORTH CAROLINA**

NOT TO SCALE

DATE: 10-31-12

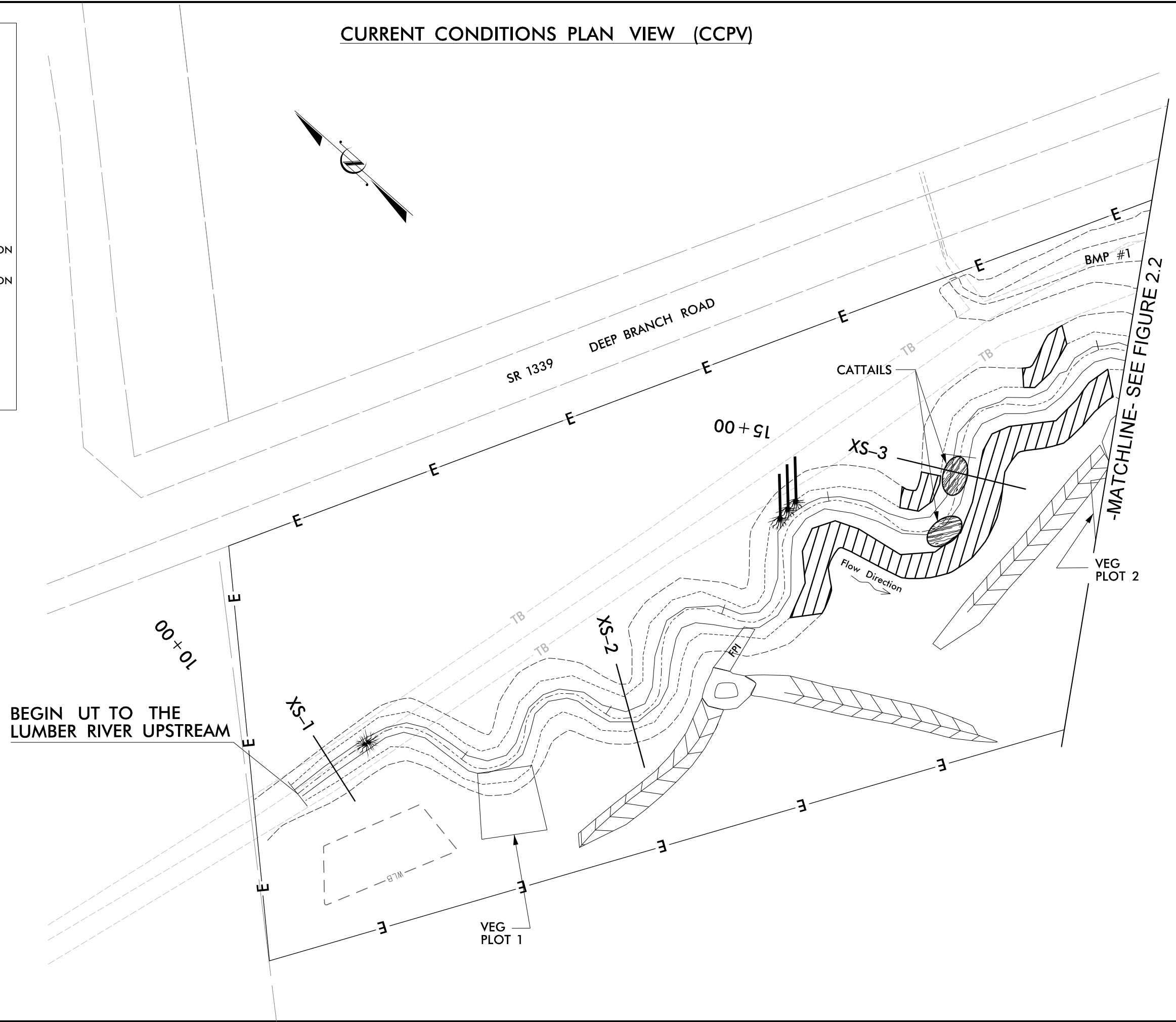
CCPV
OVERVIEW
MAP

Figure
2.0

LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E— EASEMENT BOUNDARY
- ✱ ROOTWAD
- TB --- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG
- ▨ THIN GRASS
- ▩ INVASIVE VEGETATION
- ✱ BEAVER DAM

CURRENT CONDITIONS PLAN VIEW (CCPV)

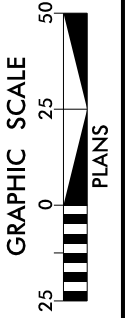


10/31/2012 \\proj\Monitoring CCPV\LumberRiver_psh2.1_Monitoring_Y2_CCPV.dgn
Florence & Hutcheson, Inc.



Florence & Hutcheson
An ICA Company
5411 Kingsman Way, Suite 100, Raleigh, NC 27604
919.876.8600
www.florenceandhutcheson.com

**UT TO THE LUMBER RIVER
STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA**

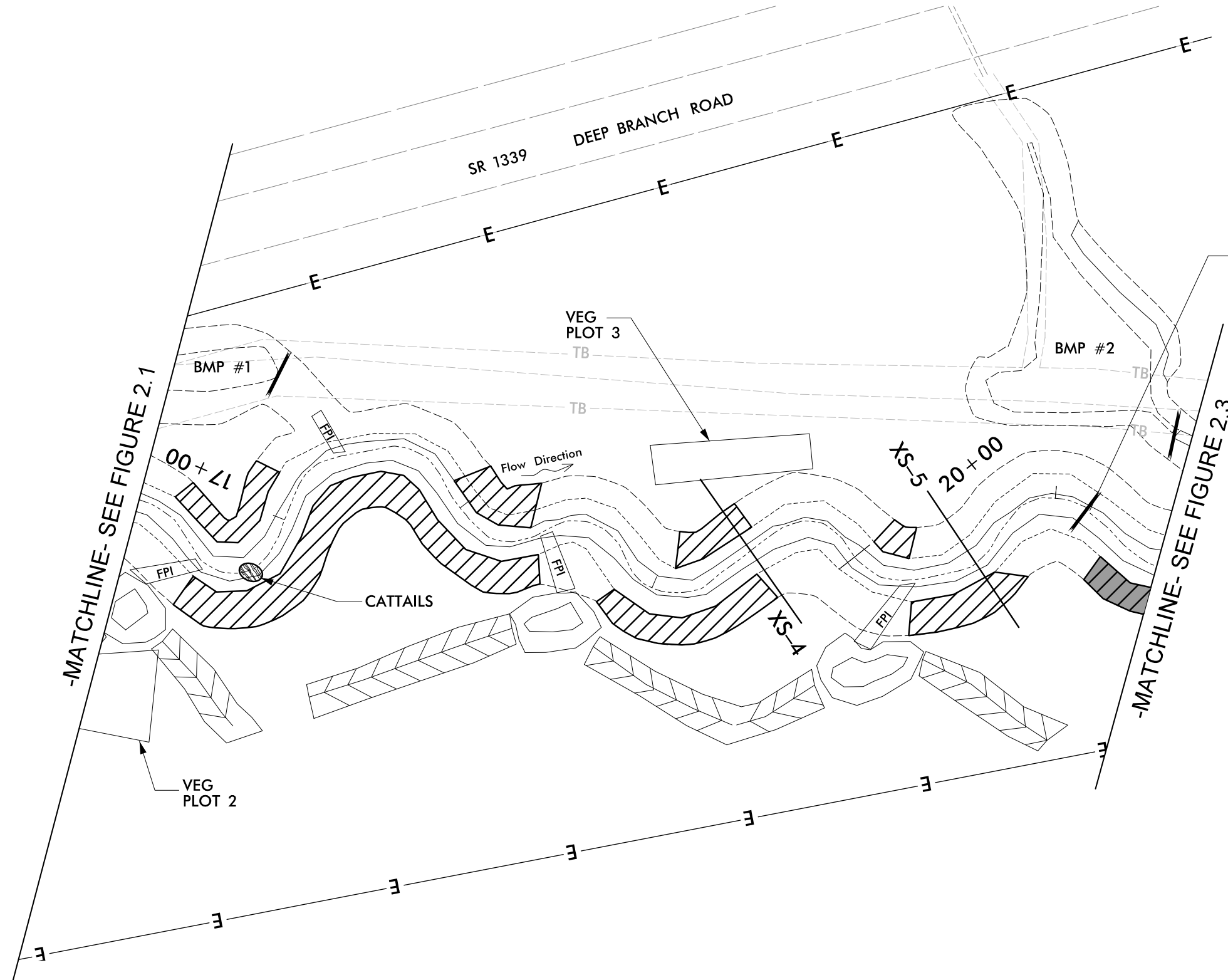
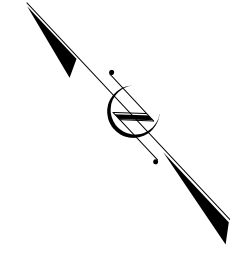


DATE: 10-31-12

CCPV

Figure 2.1

CURRENT CONDITIONS PLAN VIEW (CCPV)



END UT TO THE LUMBER RIVER UPSTREAM

BEGIN UT TO THE LUMBER RIVER DOWNSTREAM

-MATCHLINE- SEE FIGURE 2.1

-MATCHLINE- SEE FIGURE 2.3

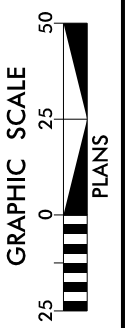
LEGEND	
--- (dashed line)	TOP OF TERRACE
--- (dashed line)	THALWEG
— (solid line)	BANKFULL
--- (dashed line)	TOE OF TERRACE
— (solid line)	CROSS-SECTION LOCATION
E (line with 'E')	EASEMENT BOUNDARY
— (thick solid line)	LOG SILL
--- (dashed line)	PRE-CONSTRUCTION TOP OF BANK
--- (dashed line)	PRE-CONSTRUCTION THALWEG
▨ (diagonal hatching)	THIN GRASS
▩ (cross-hatching)	INVASIVE VEGETATION
▧ (diagonal hatching)	MINOR WASH



Florence & Hutcheson
An ICA Company
1421 Hargett Street, Suite 100, Raleigh, NC 27601
NCE License No. F0006



UT TO THE LUMBER RIVER
STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA



DATE: 10-31-12

CCPV

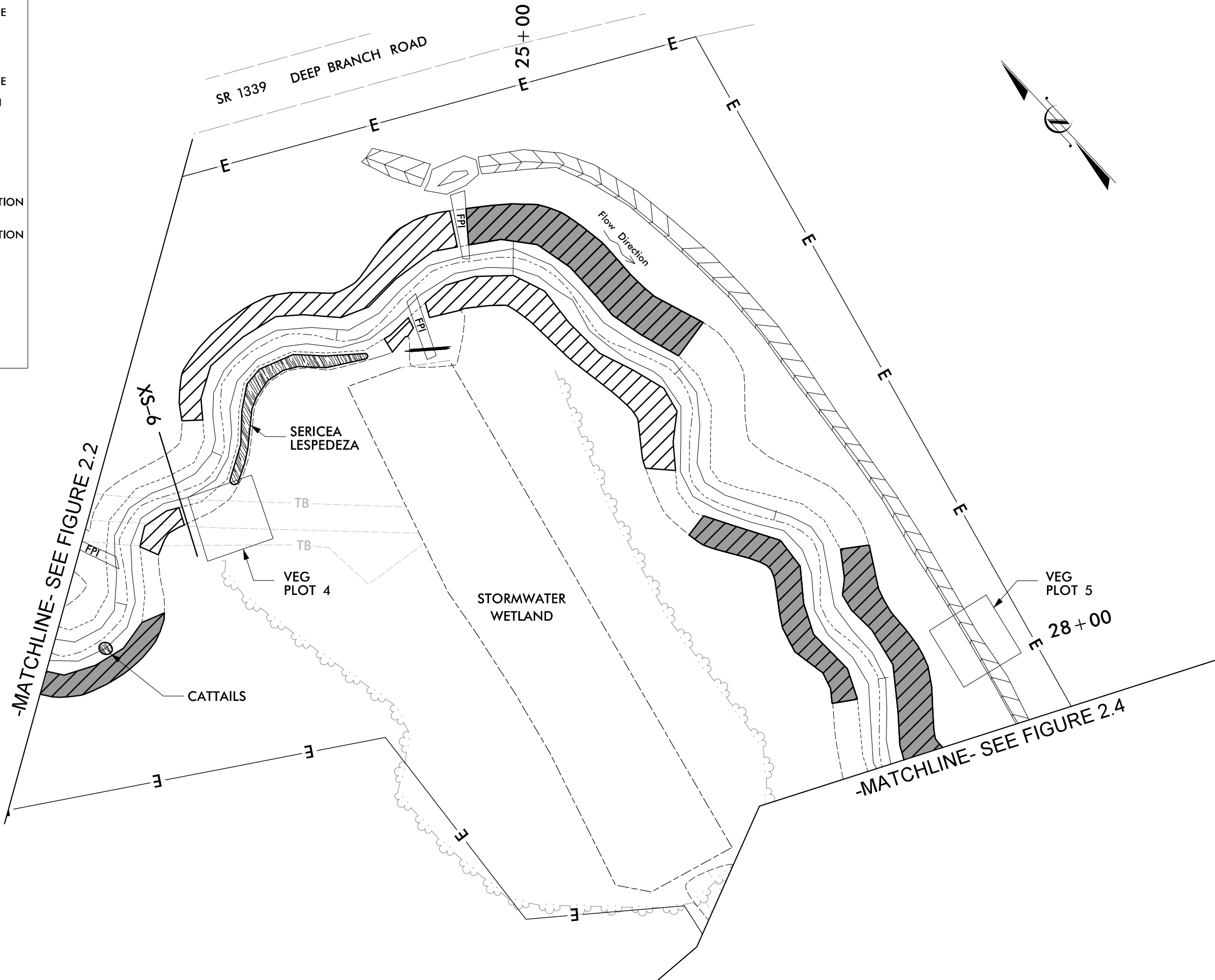
Figure 2.2

10/31/2012 10:58:00 AM C:\Program Files\Autodesk\MapGuide\Projects\StreamRestoration\CCPV\Monitoring\y2_CCPV.dgn

LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E — EASEMENT BOUNDARY
- LOG SILL
- TB --- PRE-CONSTRUCTION TOP OF BANK
- TB --- PRE-CONSTRUCTION THALWEG
- THIN GRASS
- INVASIVE VEGETATION
- MINOR WASH

CURRENT CONDITIONS PLAN VIEW (CCPV)

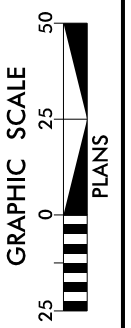


10/31/2012 \\s:\stream\proj\Monitoring CCPV\LumberRiver_psh2.3_Monitoring_v2_CCPV.dgn



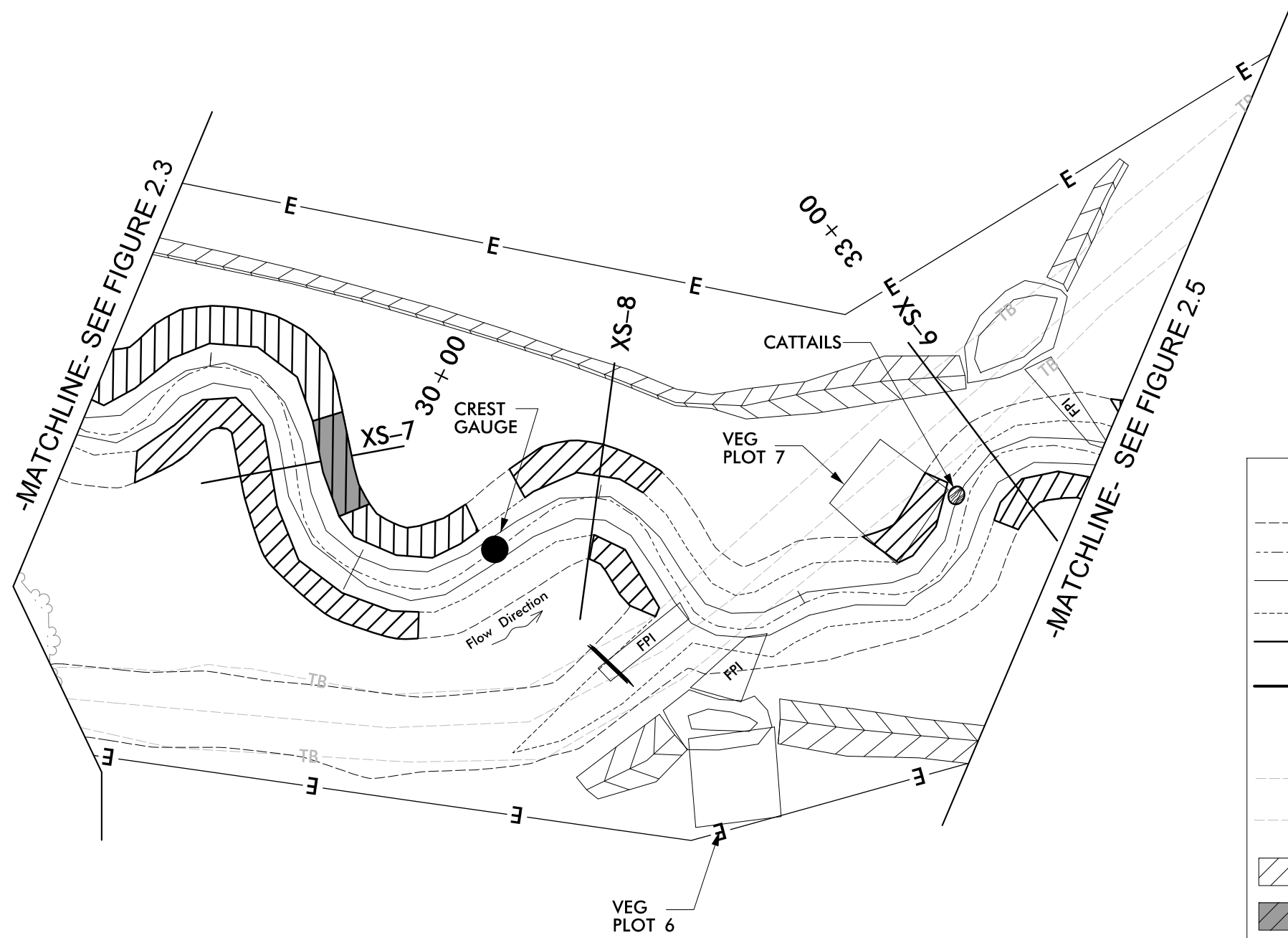
Florence & Hutcheson
 An ICA Company
1427 Highland Way, Raleigh, NC 27605
 NC License No. P0088

**UT TO THE LUMBER RIVER
 STREAM RESTORATION PROJECT**
 ROBESON COUNTY, NORTH CAROLINA

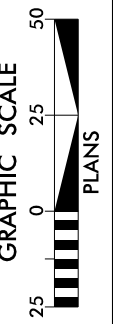


DATE: 10-31-12
 CCPV
 Figure 2.3

CURRENT CONDITIONS PLAN VIEW (CCPV)



LEGEND	
	TOP OF TERRACE
	THALWEG
	BANKFULL
	TOE OF TERRACE
	CROSS-SECTION LOCATION
	EASEMENT BOUNDARY
	LOG SILL
	PRE-CONSTRUCTION TOP OF BANK
	PRE-CONSTRUCTION THALWEG
	THIN GRASS
	MINOR WASH
	INVASIVE VEGETATION



DATE: 10-31-12

CCPV

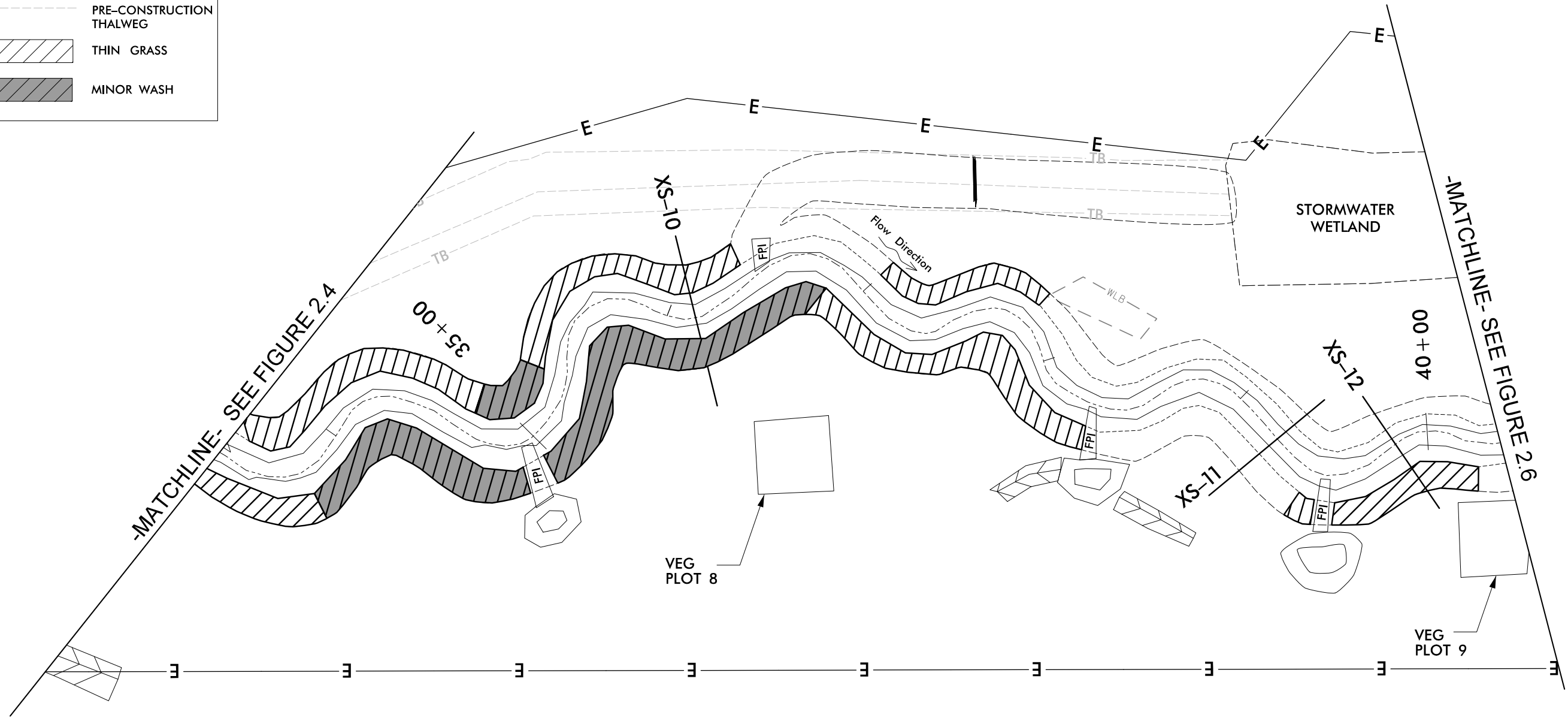
Figure 2.4



LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E — EASEMENT BOUNDARY
- TB --- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG
- ▨ THIN GRASS
- ▩ MINOR WASH

CURRENT CONDITIONS PLAN VIEW (CCPV)

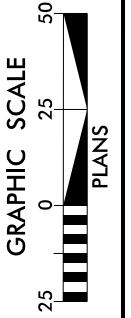


10/31/2012 P:\stream\proj\Monitoring CCPV\LumberRiver_psh2.5_Monitoring_v2_CCPV.dgn Florence & Hutcheson, Inc.



Florence & Hutcheson
An ICA Company
15111 Regency Way, Suite 100, Charlotte, NC 28227
NC License No. P0008

**UT TO THE LUMBER RIVER
STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA**



DATE: 10-31-12

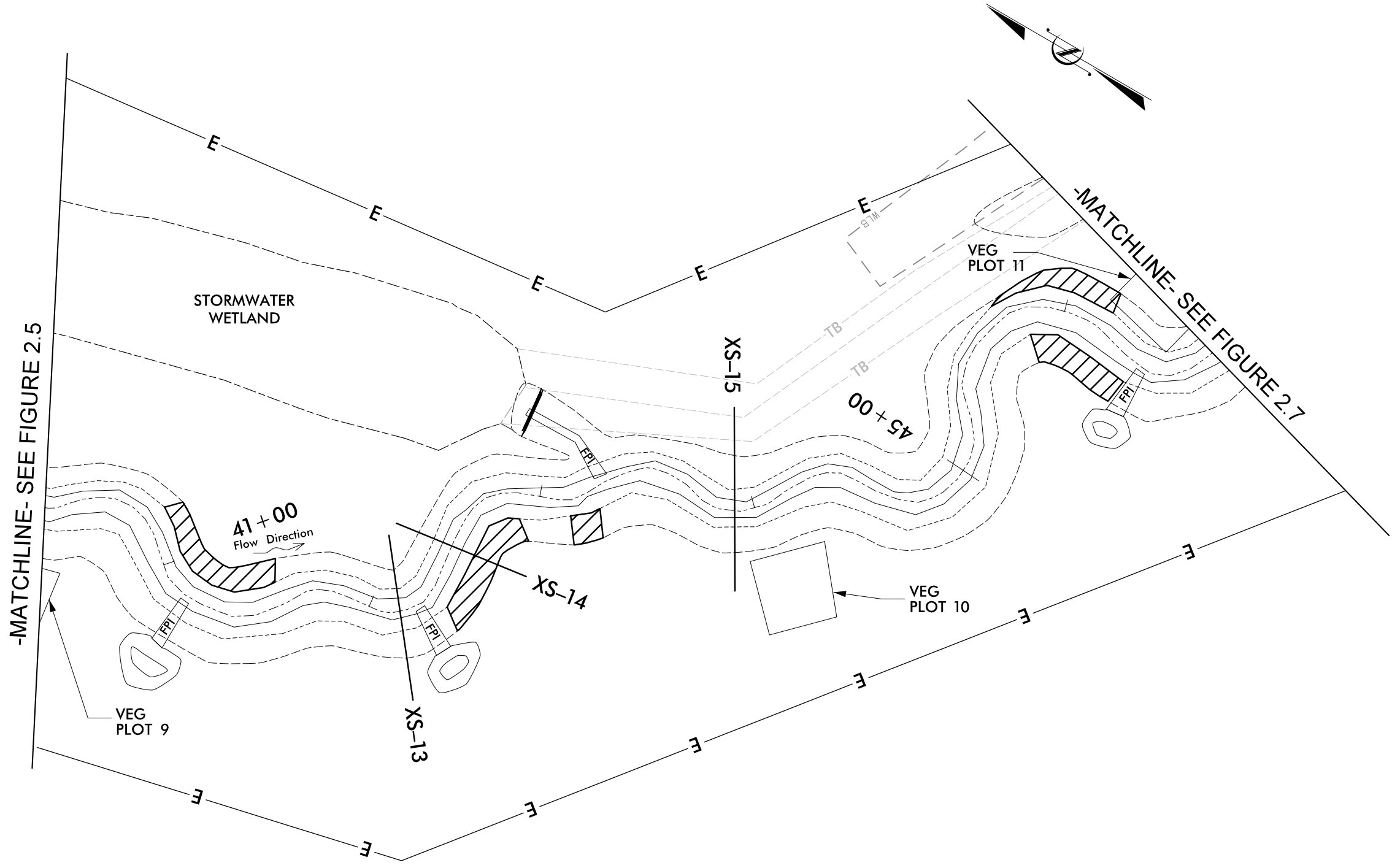
CCPV

Figure 2.5

LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E— EASEMENT BOUNDARY
- ▬ LOG SILL
- TB--- PRE-CONSTRUCTION TOP OF BANK
- TB--- PRE-CONSTRUCTION THALWEG
- ▨ THIN GRASS

CURRENT CONDITIONS PLAN VIEW (CCPV)

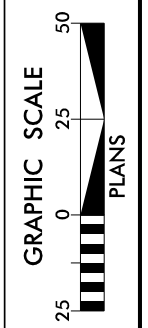


10/31/2012 C:\stream\Project\Monitoring\CCPV\LumberRiver_psh2.6_Monitoring_v2_CCPV.dgn



Florence & Hutcheson
 An ICA Company
5411 Kingsham Way, Suite 100 Raleigh, NC 27617
 NC License No. F-0008

**UT TO THE LUMBER RIVER
 STREAM RESTORATION PROJECT
 ROBESON COUNTY, NORTH CAROLINA**



DATE: 10-31-12

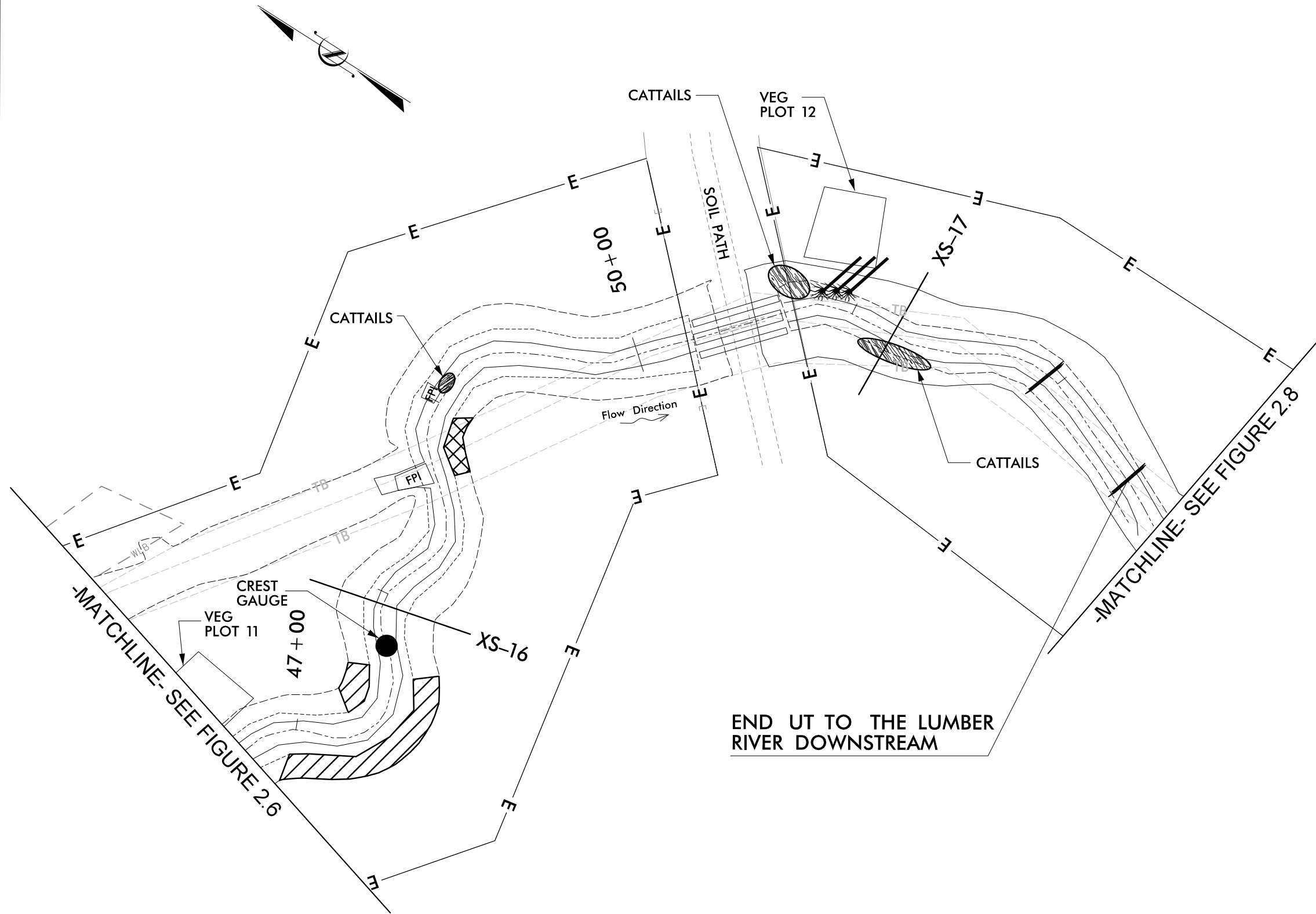
CCPV

Figure 2.6

LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E— EASEMENT BOUNDARY
- R— ROOTWAD
- L— LOG SILL
- TB--- PRE-CONSTRUCTION TOP OF BANK
- TB--- PRE-CONSTRUCTION THALWEG
- [Hatched Box] THIN GRASS
- [Cross-hatched Box] NO GRASS
- [Dotted Box] INVASIVE VEGETATION

CURRENT CONDITIONS PLAN VIEW (CCPV)

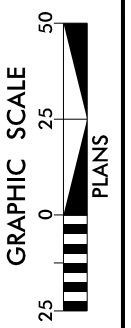


10/31/2012 C:\stream\proj\Monitoring CCPV\LumberRiver_psh2.7_Monitoring_v2_CCPV.dgn



Florence & Hutcheson
An ICA Company
1911 Lenoir Street, Raleigh, NC 27607
NC License No. P0026

UT TO THE LUMBER RIVER
STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA



DATE: 10-31-12

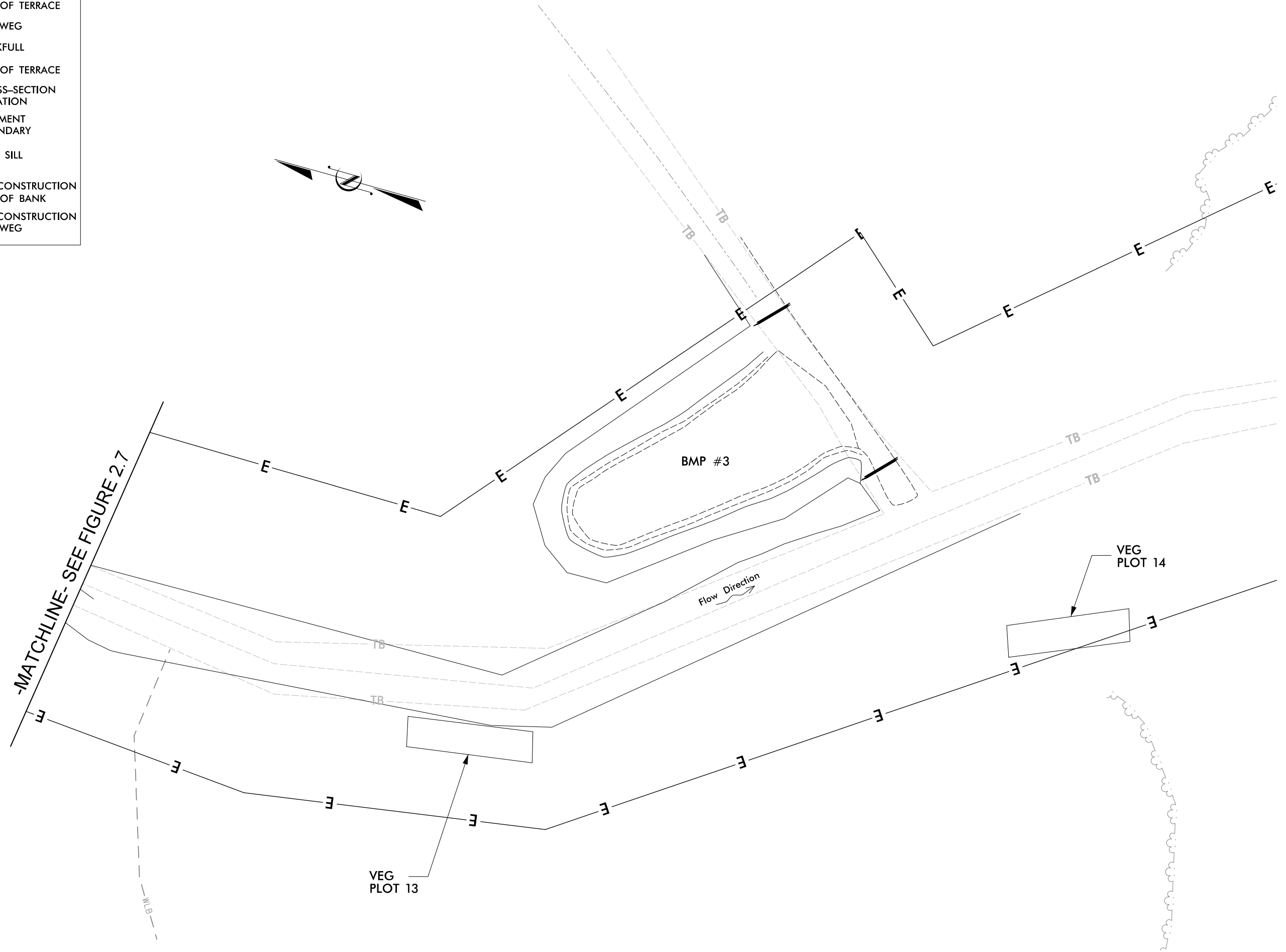
CCPV

Figure 2.7

LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E— EASEMENT BOUNDARY
- ▬ LOG SILL
- TB--- PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG

CURRENT CONDITIONS PLAN VIEW (CCPV)

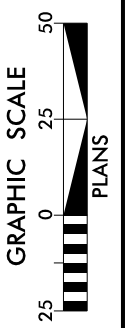


10/31/2012 C:\stream\proj\Monitoring_CCPV\LumberRiver_psh2.8_Monitoring_v2_CCPV.dgn Florence & Hutcheson, Inc.



Florence & Hutcheson
An ICA Company
1421 Virginia Way, Suite 100, Raleigh, NC 27608
P: 919.876.8888

**UT TO THE LUMBER RIVER
STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA**



DATE: 10-31-12

CCPV

Figure 2.8

Table 5. Visual Stream Morphology Stability Assessment
UT to the Lumber River Site, 002027
UT to the Lumber River: 4,285 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	All	N/A			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient	59	63			94%			
		2. <u>Length</u> appropriate	59	63			94%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	All	N/A			100%			
2. Thalweg centering at downstream of meander (Glide)		All	N/A			100%				
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	N/A
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, calving, or collaps			0	0	100%	N/A	N/A	N/A
Totals					0	0	100%	N/A	N/A	N/A
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	4	4			100%			
	4. Habitat	Pool forming structures maintaing ~ Max Pool Depth : Mean Bankfull Depth ratio > 1.6 Rootwads/logs providing some cover at base-flow.	4	4			100%			

Table 6. Vegetation Condition Assessment
UT to the Lumber River Site, 002027
UT to the Lumber River: 4,285 feet

Planted Acreage = 15.0

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited ground cover (grass).	All bare or sparse areas were mapped.	See legend on CCPV (includes thin grass, no grass, and minor wash areas).	45	1.07	7.1
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	None	N/A	N/A	N/A	N/A
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	None	N/A	N/A	N/A	N/A

Easement Acreage = 67.85

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	All populations were mapped	See legend on CCPV	9	0.03	0.2
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	None	N/A	N/A	N/A	N/A

Figures 3.1-3.20. Vegetation Plot Photos and Problem Areas



3.1 Vegetation Plot 1



3.2 Vegetation Plot 2



3.3 Vegetation Plot 3



3.4 Vegetation Plot 4



3.5 Vegetation Plot 5



3.6 Vegetation Plot 6



3.7 Vegetation Plot 7



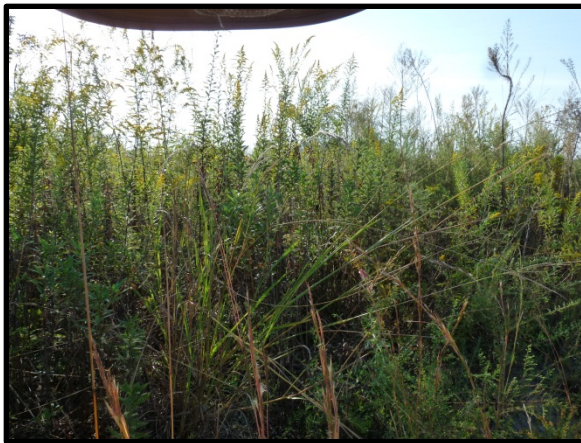
3.8 Vegetation Plot 8



3.9 Vegetation Plot 9



3.10 Vegetation Plot 10



3.11 Vegetation Plot 11



3.12 Vegetation Plot 12



3.13 Vegetation Plot 13



3.14 Vegetation Plot 14



3.15 Cluster of cattail adjacent to VP 7



3.16 Sericea lespedeza near VP 4



3.17 Sparse vegetation on terrace slope near station 24+50



3.18 Minor wash on terrace slope near station 27+50



3.19 Minor wash on terrace slope near station 35+00.



3.20 Area with no grass near station 49+00.

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary

UT to the Lumber River Site, 002027							
Plot ID	Community Type	Planting Zone ID	Reach ID	CVS Level	Planted Stems	Stems Per Acre	Survival Threshold Met?
1	Coastal Plain Small Stream Swamp	CPSSS	Upper	II	17	688	Yes
2	Coastal Plain Small Stream Swamp	CPSSS	Upper	II	15	607	Yes
3	Coastal Plain Small Stream Swamp	CPSSS	Upper	II	12	486	Yes
4	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	17	688	Yes
5	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	16	648	Yes
6	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	15	607	Yes
7	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	20	809	Yes
8	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	20	809	Yes
9	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	14	567	Yes
10	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	15	607	Yes
11	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	14	567	Yes
12	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	18	728	Yes
13	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	20	809	Yes
14	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	16	648	Yes
Average Stems Per Acre						662	



Table 8. CVS Vegetation Metadata

Report Prepared By	Ben Furr
Date Prepared	10/30/2012 11:41
database name	CVS_entry.mdb
database location	S:\Lumber_River\Docs\Monitoring
computer name	NC10465
file size	37224448
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	94068
project Name	UT to the Lumber River
Description	Stream Restoration, Enhancement and Preservation Site
River Basin	Lumber
length(ft)	4285
stream-to-edge width (ft)	75
area (sq m)	59707
Required Plots (calculated)	14
Sampled Plots	14



Table 9. Planted and Total Stem Counts (Specied by Plot with Annual Means)

Table 9. Planted and Total Stem Counts (Specied by Plot with Annual Means)																
Species	Common Name	Type	Current Data (MY3 2012)													
			Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T
<i>Acer rubrum</i>	red maple	Tree								3						
<i>Betula nigra</i>	river birch	Tree								1						
<i>Fraxinus pennsylvanica</i>	green ash	Tree	3	3	3	3	1	1	2	2	3	3			2	2
<i>Liquidambar styraciflua</i>	sweetgum	Tree								2						
<i>Nyssa biflora</i>	swamp tupelo	Tree	3	3			1	1	3	4	1	1	1	1	5	7
<i>Quercus laurifolia</i>	laurel oak	Tree	2	2	1	1	3	3	2	2	2	2	1	1	1	1
<i>Quercus lyrata</i>	overcup oak	Tree							3	3	1	1			4	4
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	1	1	1	1			1	1	1	1				
<i>Quercus nigra</i>	water oak	Tree	2	2			4	4	2	2	4	4	4	4	2	2
<i>Quercus phellos</i>	willow oak	Tree	4	4	6	6	1	1	2	2	3	3	5	5	2	2
<i>Sambucus canadensis</i>	common elderberry	Shrub														1
<i>Taxodium distichum</i>	bald cypress	Tree	2	2	1	1			1	1					4	4
<i>Ulmus americana</i>	American elm	Tree			3	3	2	2	1	1	1	1	4	4		
Plot area (acres)			0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247	
Species count			7	7	6	6	6	6	9	12	8	8	5	5	7	8
Stem Count			17	17	15	15	12	12	17	24	16	16	15	15	20	23
Stems per Acre			688	688	607	607	486	486	688	971	648	648	607	607	809	931
Current Data (MY3 2012)																
Species	Common Name	Type	Current Data (MY3 2012)													
			Plot 8		Plot 9		Plot 10		Plot 11		Plot 12		Plot 13		Plot 14	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T
<i>Acer rubrum</i>	red maple	Tree												6		
<i>Betula nigra</i>	river birch	Tree		1						1						
<i>Fraxinus pennsylvanica</i>	green ash	Tree	3	3	3	3	2	2	2	2	4	4				
<i>Liquidambar styraciflua</i>	sweetgum	Tree												1		
<i>Nyssa biflora</i>	swamp tupelo	Tree	2	2	1	1			3	3	4	4	4	4	4	4
<i>Quercus laurifolia</i>	laurel oak	Tree	4	4			3	3	2	2	3	3				
<i>Quercus lyrata</i>	overcup oak	Tree					1	1	2	2			10	10	8	8
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	6	6	3	3	1	1			2	2				
<i>Quercus nigra</i>	water oak	Tree	4	4	1	1	2	2	1	1	1	1		1		
<i>Quercus phellos</i>	willow oak	Tree	1	1	4	4	3	3	1	1	3	3				
<i>Sambucus canadensis</i>	common elderberry	Shrub														1
<i>Taxodium distichum</i>	bald cypress	Tree			1	1	1	1	3	3			6	6	4	4
<i>Ulmus americana</i>	American elm	Tree			1	1	2	2			1	1				
Plot area (acres)			0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247	
Species count			6	7	7	7	8	8	7	8	7	7	3	6	3	4
Stem Count			20	21	14	14	15	15	14	15	18	18	20	28	16	17
Stems per Acre			809	850	567	567	607	607	567	607	728	728	809	1133	648	688
Annual Means											Notes:					
Species	Common Name	Type	MY3 (2012)		MY2 (2011)		MY1 (2010)		BL/AB (2010)							
			P	T	P	T	P	T	P	T						
<i>Acer rubrum</i>	red maple	Tree		4.50		4.00				N/A						
<i>Baccharis halimifolia</i>	eastern baccharis	Shrub				1.00				N/A						
<i>Betula nigra</i>	river birch	Tree		1.00		1.67				N/A						
<i>Diospyros virginiana</i>	common persimmon	Tree				1.00				N/A						
<i>Fraxinus pennsylvanica</i>	green ash	Tree	2.55	2.55	2.64	2.64	2.64	2.64	2.64	N/A						
<i>Liquidambar styraciflua</i>	sweetgum	Tree		1.50						N/A						
<i>Nyssa biflora</i>	swamp tupelo	Tree	2.67	2.92	2.67	3.15	3.31	3.31	3.69	N/A						
<i>Quercus</i>	oak	Tree				1.00				N/A						
<i>Quercus laurifolia</i>	laurel oak	Tree	2.18	2.18	2.30	2.50	2.50	2.50	2.60	N/A						
<i>Quercus lyrata</i>	overcup oak	Tree	4.14	4.14	4.29	4.86	4.43	4.43	3.67	N/A						
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	2.00	2.00	2.22	2.22	2.22	2.22	1.89	N/A						
<i>Quercus nigra</i>	water oak	Tree	2.45	2.33	2.55	2.73	2.73	2.73	2.82	N/A						
<i>Quercus phellos</i>	willow oak	Tree	2.92	2.92	3.08	3.17	3.00	3.00	3.17	N/A						
<i>Sambucus canadensis</i>	common elderberry	Shrub		1.00						N/A						
<i>Taxodium distichum</i>	bald cypress	Tree	2.56	2.56	2.67	2.60	2.60	2.60	2.82	N/A						
<i>Ulmus americana</i>	American elm	Tree	1.88	1.88	1.75	1.78	1.67	1.67	2.40	N/A						
Plot area (acres)																
Species count			6.36	7.07	6.36	7.07	6.57	6.57	6.86	N/A						
Stem Count			16.36	17.86	16.36	17.86	18.21	18.21	19.79	N/A						
Stems per Acre			662	723	662	723	737	737	801	N/A						

Appendix D. Stream Survey Data

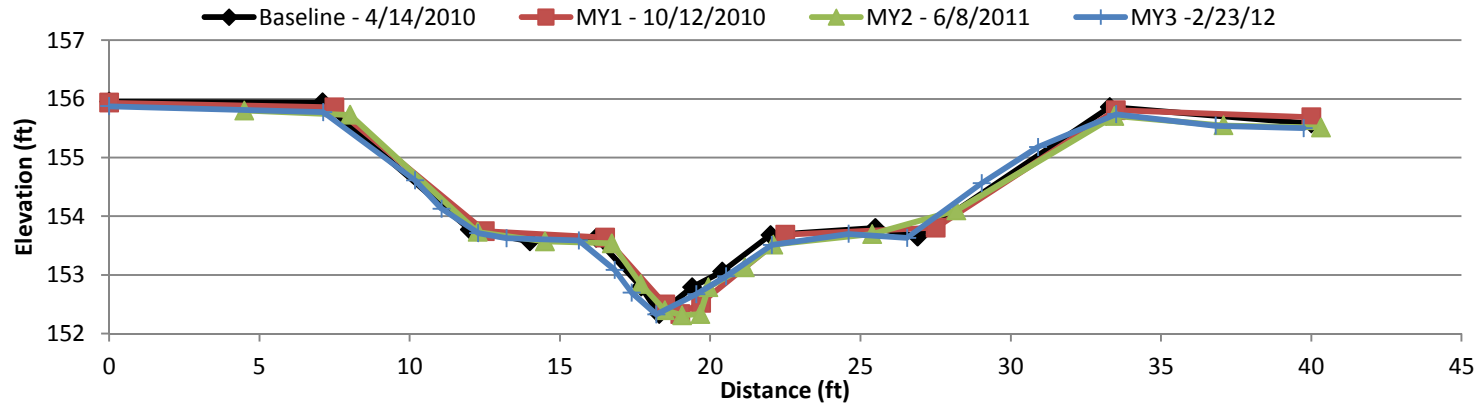


Figures 4.1-4.17. Cross Section Plots and Photos



UT to the Lumber River, 002027 (Figure 4.1)

Upper Reach, XS 1, Sta. 10+22 Riffle



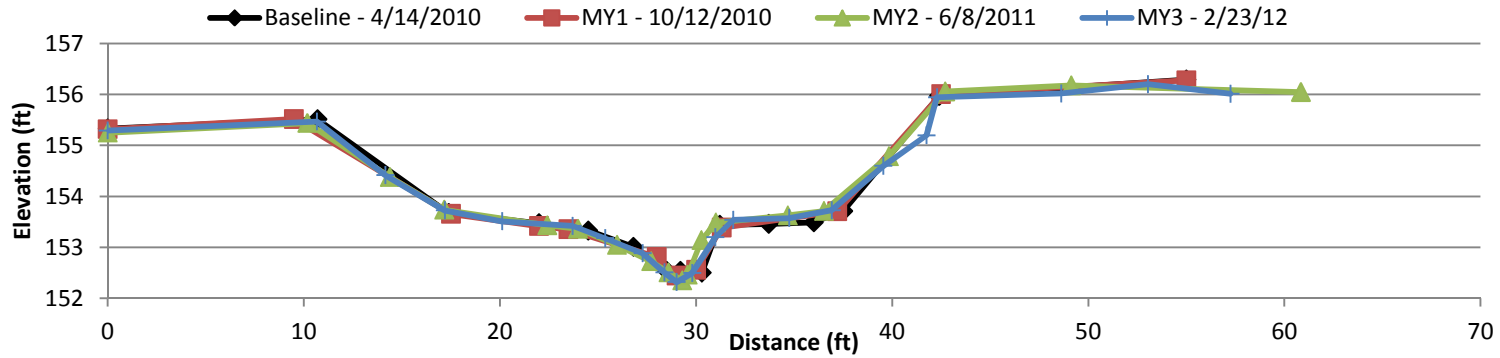
STA	ELEV
0	155.87
7.12	155.77
10.18	154.61
11.06	154.13
12.28	153.71
13.22	153.62
15.63	153.59
16.82	153.08
17.39	152.70
18.21	152.33
19.54	152.67
20.53	152.98
22.05	153.51
24.6	153.70
26.55	153.63
29.04	154.56
30.91	155.18
33.51	155.74
36.82	155.54
39.75	155.50



XS 1, Sta. 10+22, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.2)

Upper Reach, XS 2, Sta. 12+14.5 Pool



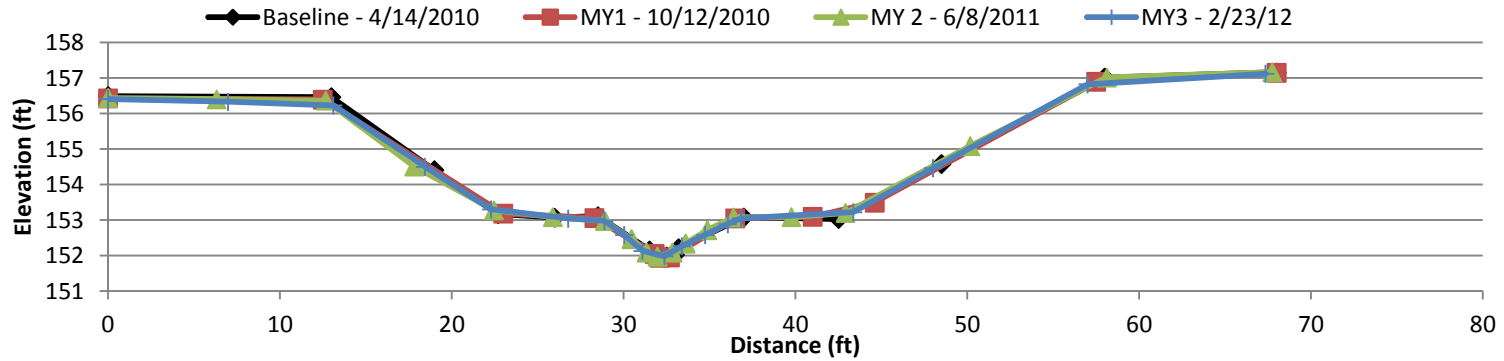
STA	ELEV
0.00	155.29
10.67	155.46
14.17	154.41
17.19	153.72
20.11	153.51
23.71	153.42
25.37	153.18
27.28	152.88
28.39	152.50
29.01	152.32
29.80	152.49
30.98	153.20
31.90	153.54
34.74	153.57
36.91	153.72
39.55	154.59
41.75	155.20
42.28	155.94
48.62	156.02
53.04	156.20
57.26	156.01



XS 2, Sta. 12+14.5, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.3)

Upper Reach, XS 3, Sta. 14+92 Riffle



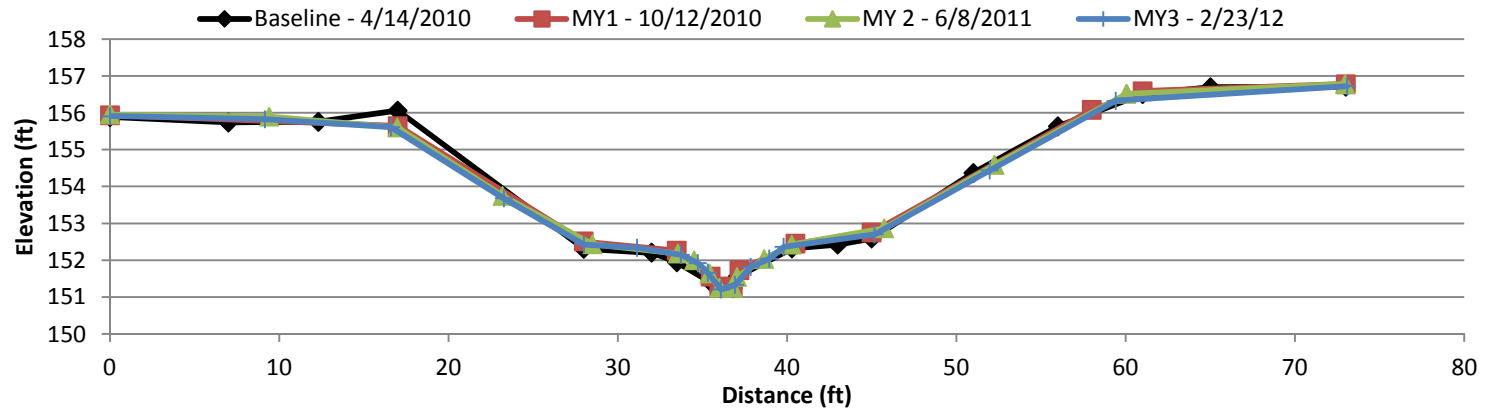
STA	ELEV
0	156.41
6.98	156.33
13.11	156.23
18.43	154.50
22.28	153.30
26.77	153.04
28.87	152.98
30.04	152.58
31.1	152.14
32.38	151.98
33.38	152.27
34.75	152.58
36.07	152.89
36.82	153.05
43.36	153.23
48	154.46
57	156.82
67.36	157.12



XS 3, Sta. 14+92, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.4)

Upper Reach, XS 4, Sta. 19+51 Riffle



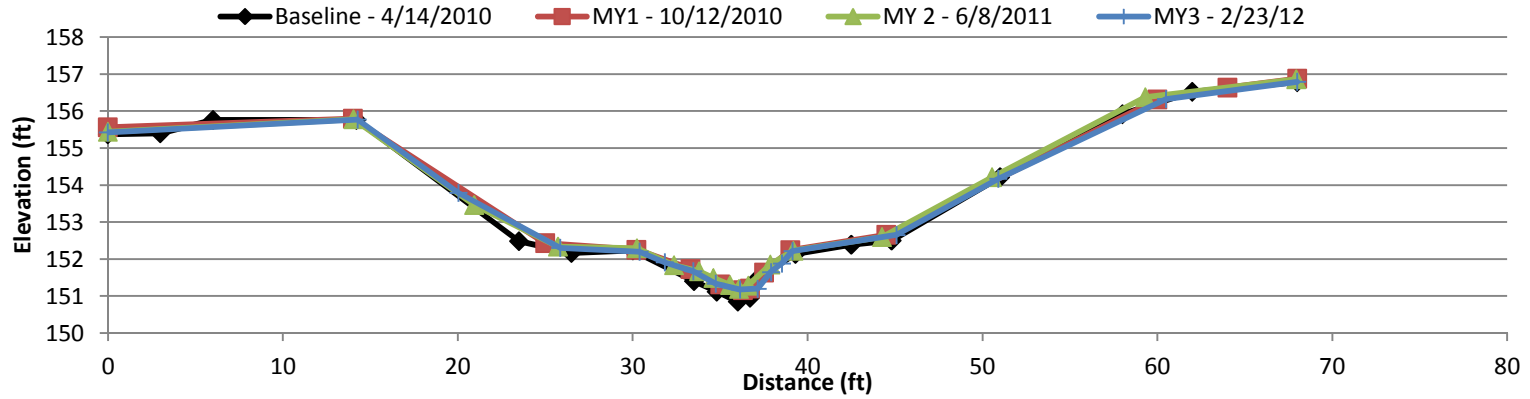
STA	ELEV
0.00	155.92
9.16	155.83
16.59	155.61
23.27	153.68
28.01	152.43
31.15	152.34
33.73	152.14
34.74	151.92
35.32	151.66
36.10	151.20
36.93	151.33
37.85	151.82
38.95	152.04
39.81	152.36
45.17	152.70
51.98	154.44
59.42	156.33
73.07	156.73



XS 4, Sta. 19+51, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.5)

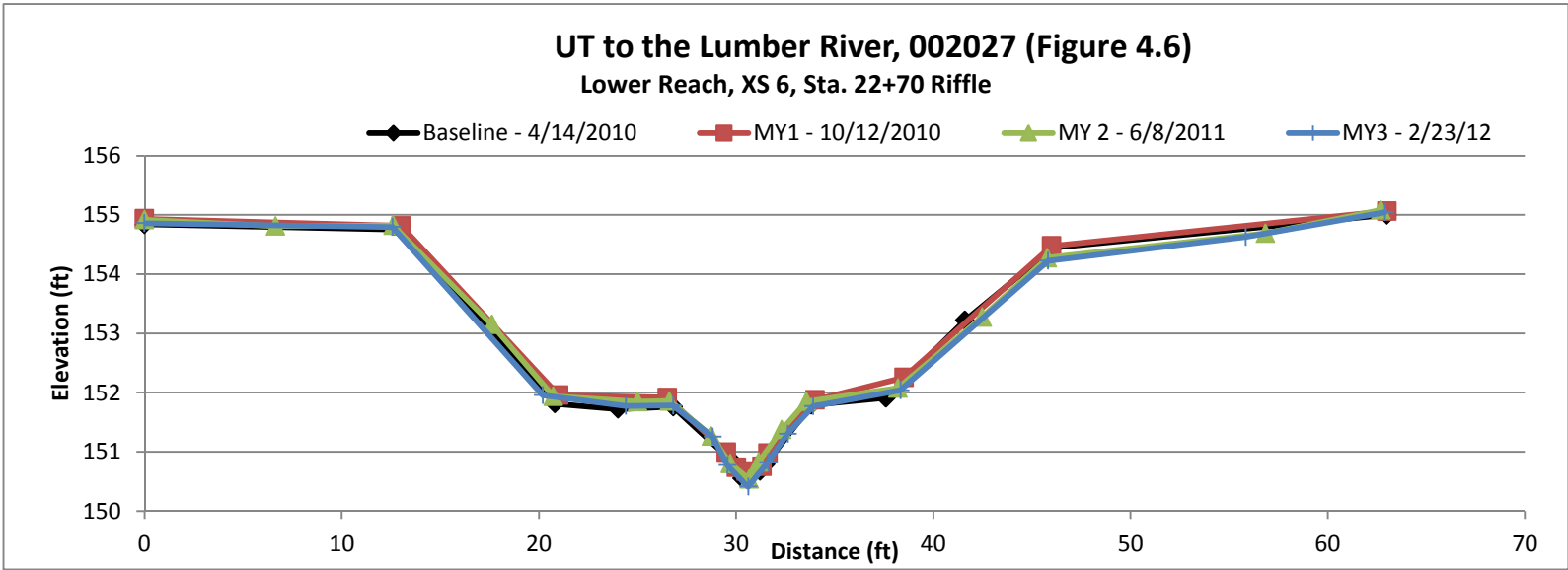
Upper Reach, XS 5, Sta. 20+58 Pool



STA	ELEV
0.00	155.42
14.28	155.77
20.04	153.79
25.85	152.30
30.39	152.20
31.83	151.91
33.46	151.67
34.75	151.33
36.13	151.17
37.14	151.20
37.90	151.65
38.53	151.88
39.13	152.21
45.08	152.65
50.91	154.17
60.50	156.33
68.00	156.79



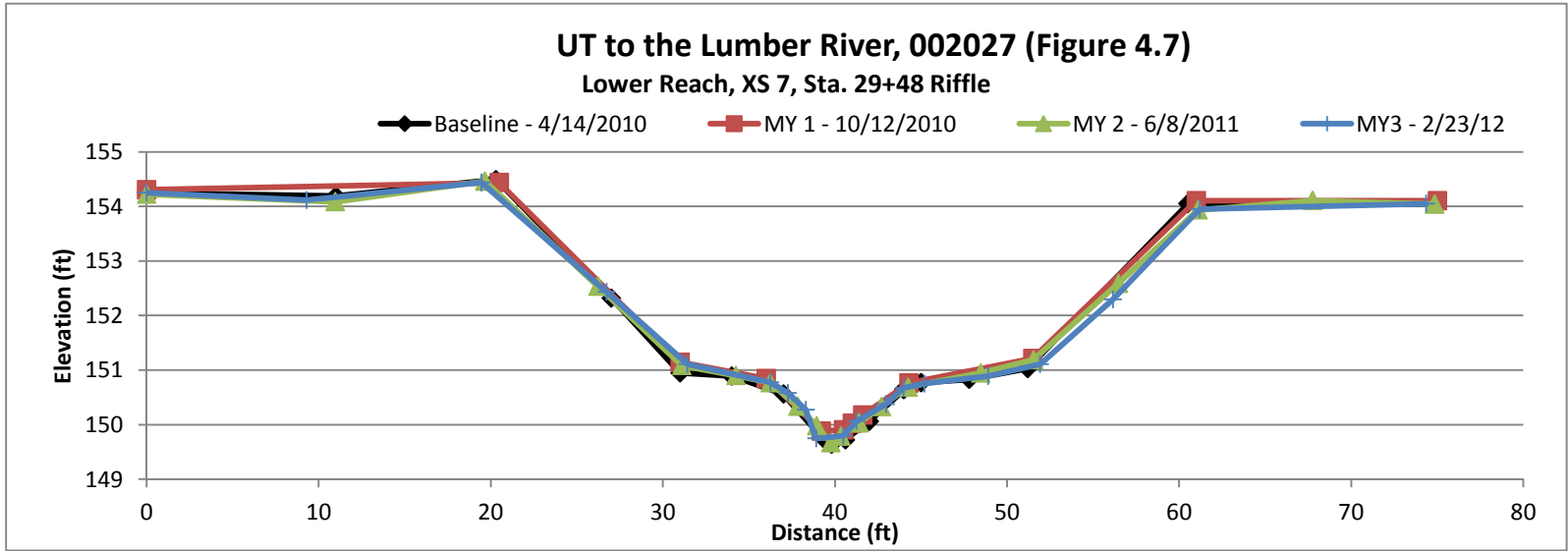
XS 5, Sta. 20+58, Looking Downstream



STA	ELEV
0.00	154.86
12.58	154.79
20.20	151.95
24.41	151.77
26.80	151.78
28.81	151.25
29.56	150.77
30.61	150.41
31.62	150.82
32.61	151.30
33.90	151.77
38.33	152.04
45.82	154.22
55.85	154.63
62.90	155.04



XS 6, Sta. 22+70, Looking Downstream



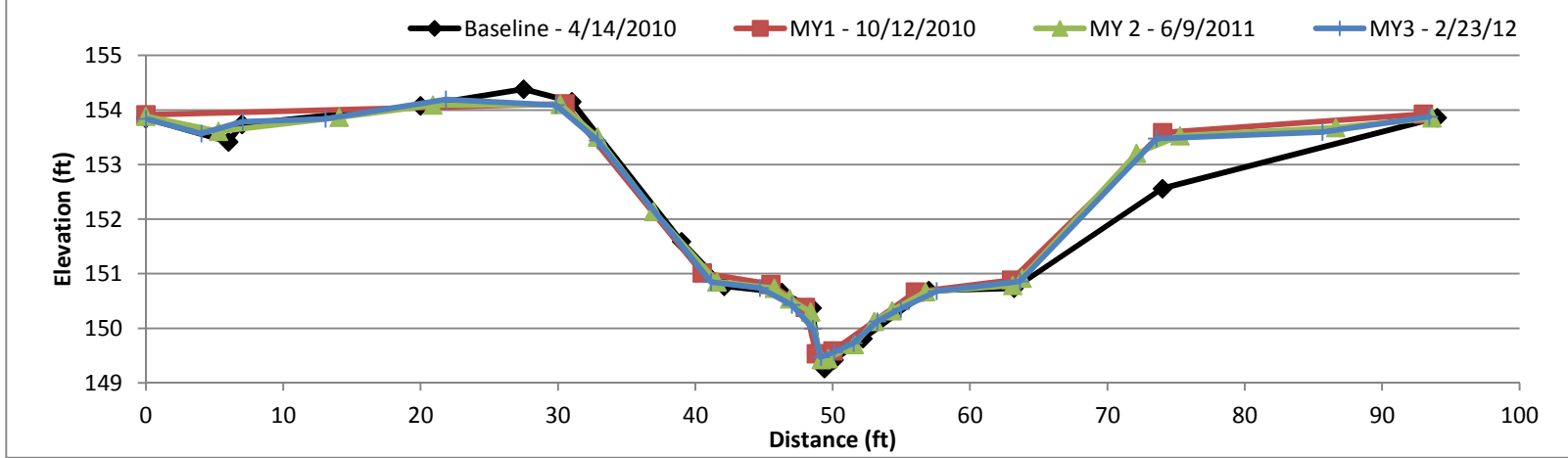
STA	ELEV	STA	ELEV
0.00	154.25	41.25	150.06
9.30	154.12	42.96	150.38
19.45	154.44	43.98	150.67
26.73	152.43	45.18	150.75
31.42	151.11	48.92	150.89
36.24	150.78	51.93	151.11
37.26	150.58	56.16	152.30
38.31	150.28	61.20	153.95
38.91	149.75	74.35	154.05
40.48	149.80		



XS 7, Sta. 29+48, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.8)

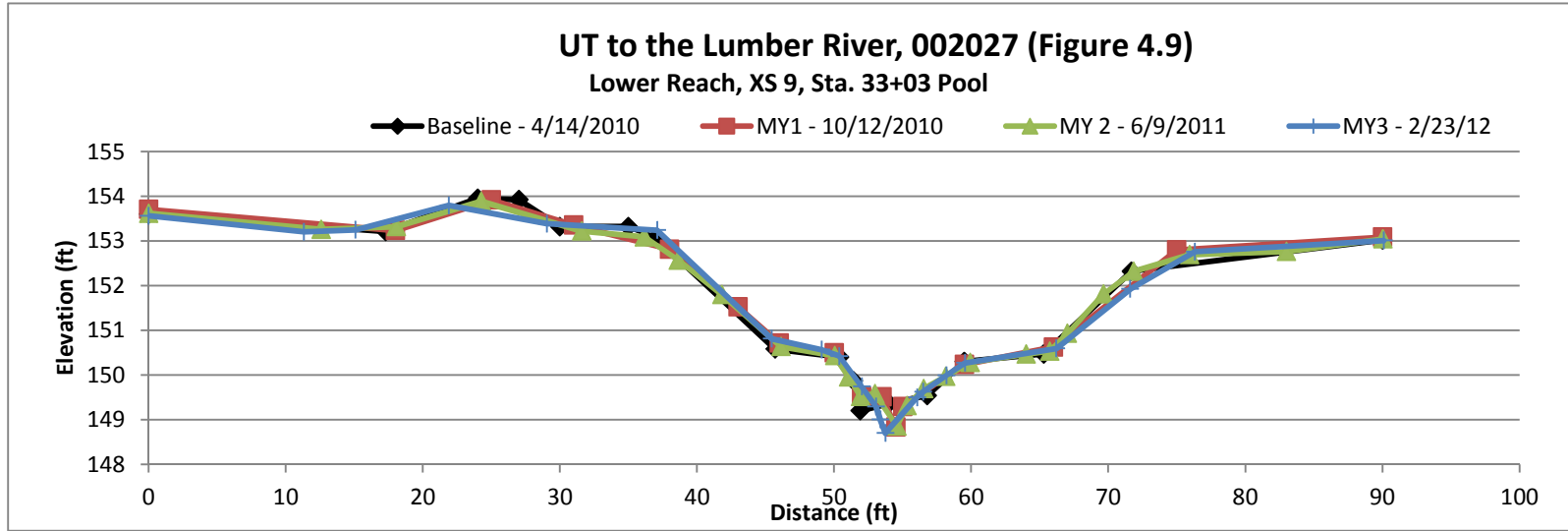
Lower Reach, XS 8, Sta. 30+98 Pool



STA	ELEV	STA	ELEV
0.00	153.83	49.14	149.47
4.03	153.57	50.10	149.56
7.04	153.79	51.51	149.73
13.08	153.83	53.25	150.13
21.84	154.19	54.95	150.36
29.84	154.09	57.56	150.68
32.89	153.44	63.63	150.86
41.14	150.85	73.58	153.47
44.70	150.74	85.67	153.59
47.03	150.43	93.43	153.87
48.56	150.00		



XS 8, Sta. 30+98, Looking Downstream



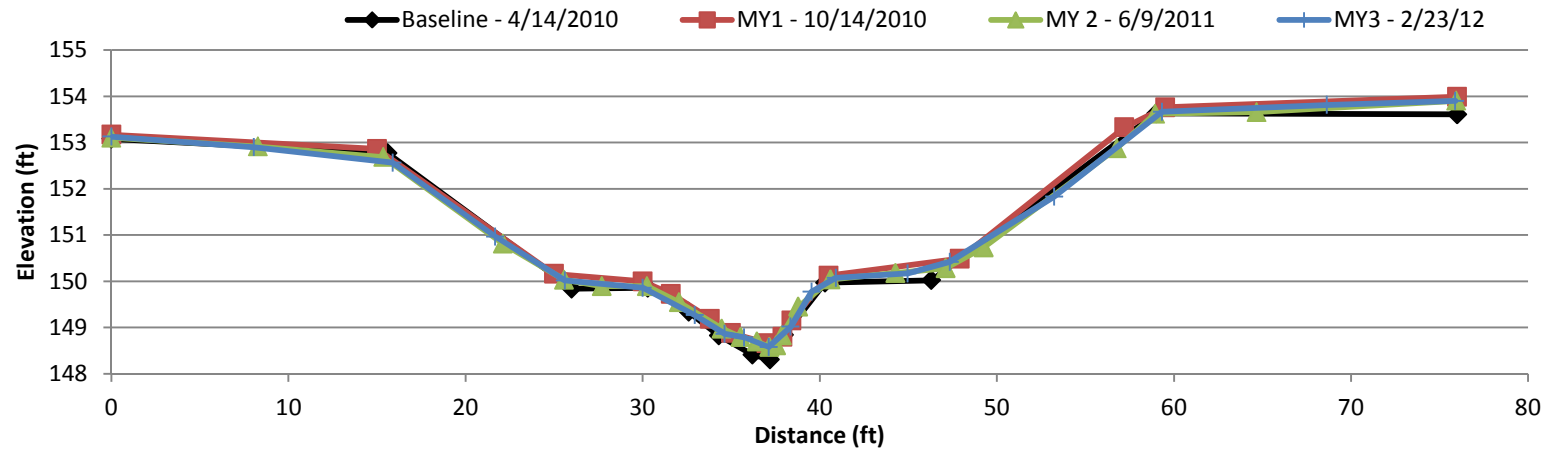
STA	ELEV	STA	ELEV
0.00	153.56	53.37	149.01
11.34	153.20	53.74	148.70
15.10	153.24	56.05	149.50
21.89	153.79	56.50	149.62
29.05	153.38	58.20	149.99
37.09	153.24	59.55	150.27
45.44	150.81	66.22	150.59
49.09	150.56	71.61	151.92
50.38	150.42	76.33	152.76
52.02	149.74	90.10	153.01
53.06	149.29		



XS 9, Sta. 33+03, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.10)

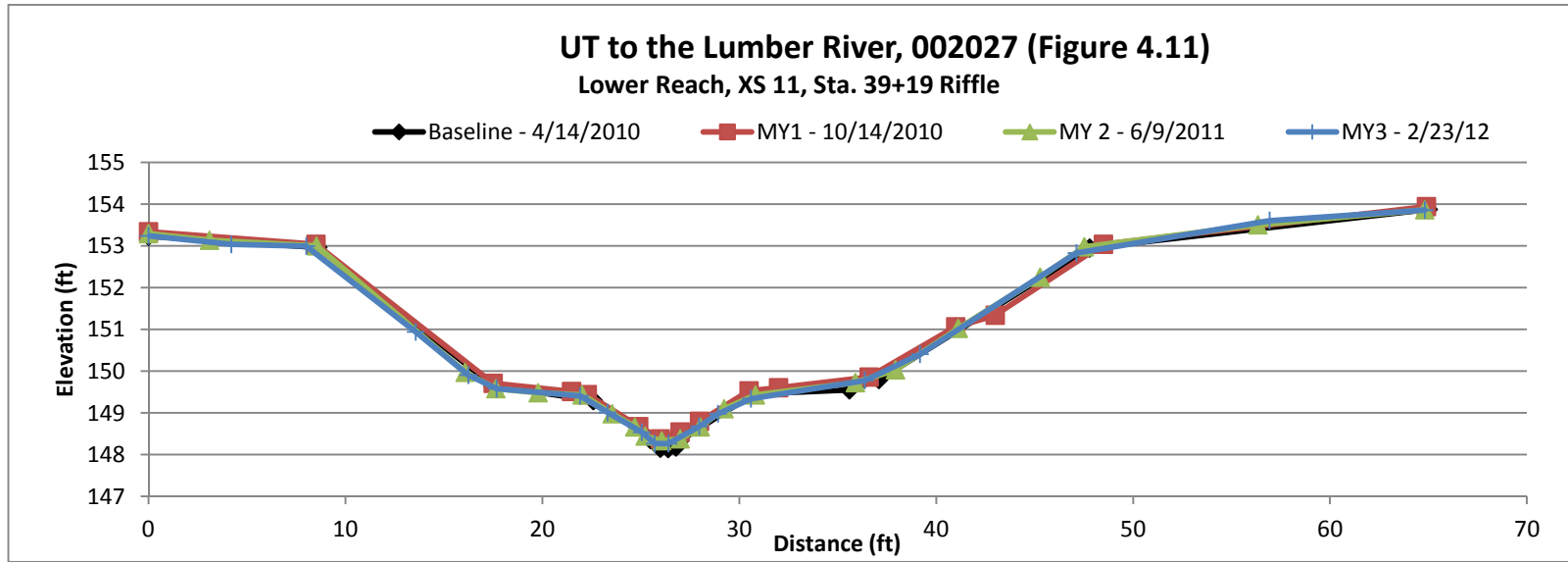
Lower Reach, XS 10, Sta. 36+13.5 Pool



STA	ELEV	STA	ELEV
0.00	153.13	38.36	149.02
8.04	152.90	39.54	149.77
15.88	152.56	40.91	150.07
21.68	150.96	44.97	150.17
25.61	150.02	47.34	150.42
30.01	149.86	53.23	151.83
32.95	149.27	59.32	153.66
34.64	148.86	68.62	153.81
35.74	148.79	75.89	153.90
37.12	148.58		



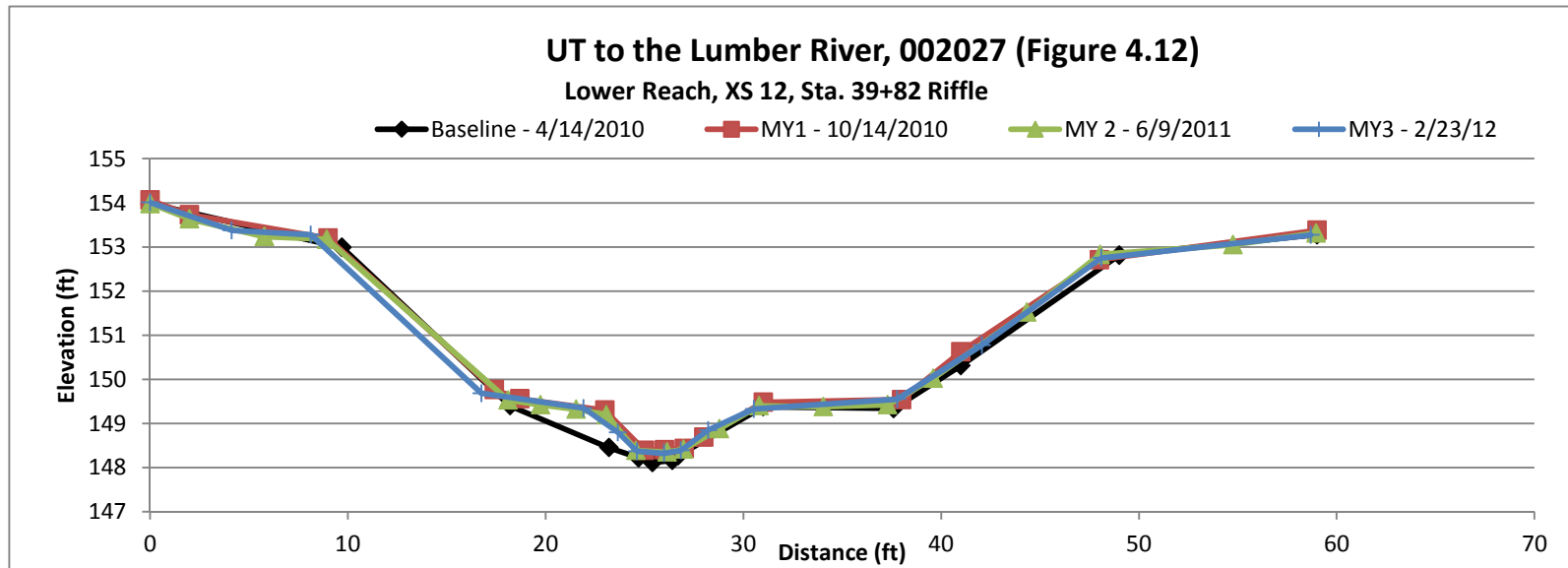
XS 10, Sta. 36+13.5, Looking Downstream



STA	ELEV	STA	ELEV
0.00	153.24	26.41	148.26
4.21	153.04	27.98	148.68
8.01	152.99	28.93	148.97
13.57	150.94	30.61	149.34
16.25	149.90	36.39	149.78
17.67	149.58	39.19	150.41
21.92	149.41	47.13	152.83
23.33	149.00	56.93	153.61
25.06	148.53	64.81	153.86
25.72	148.27		



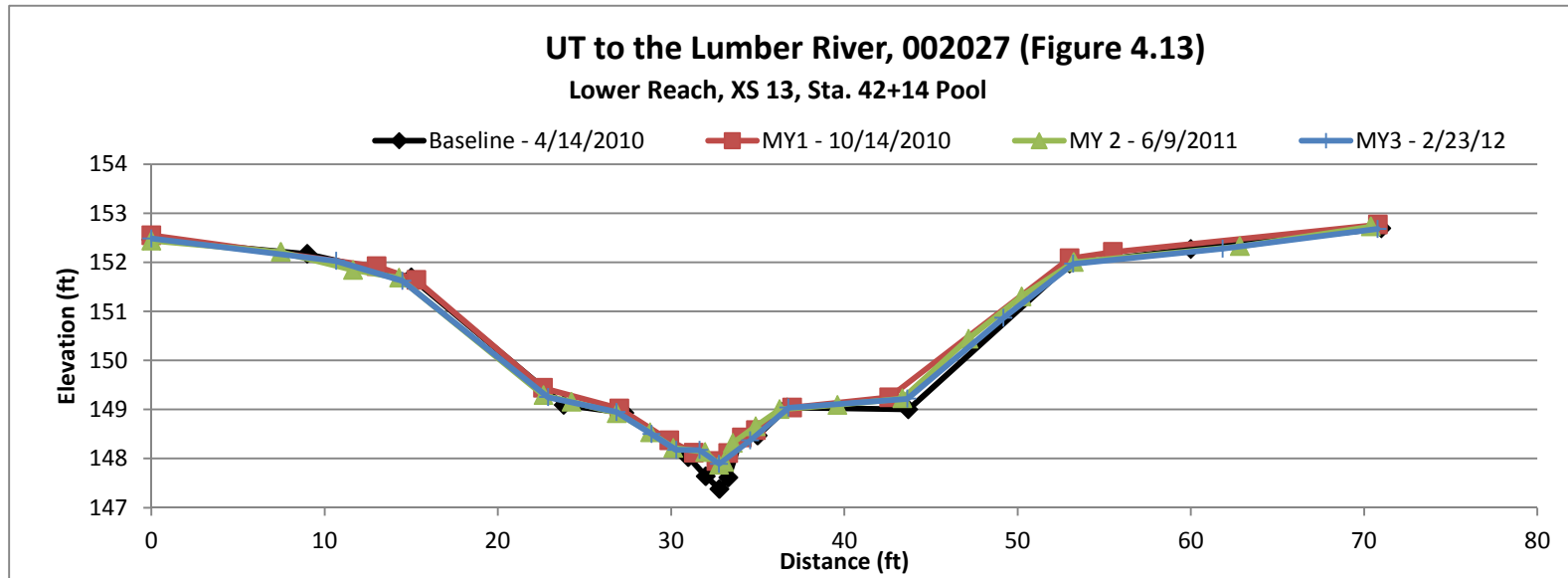
XS 11, Sta. 39+19, Looking Downstream



STA	ELEV
0.00	154.00
4.12	153.37
8.13	153.28
16.75	149.68
21.91	149.35
23.65	148.80
24.62	148.37
25.99	148.32
26.83	148.39
28.22	148.85
30.52	149.33
37.78	149.55
42.06	150.78
48.10	152.75
58.69	153.27



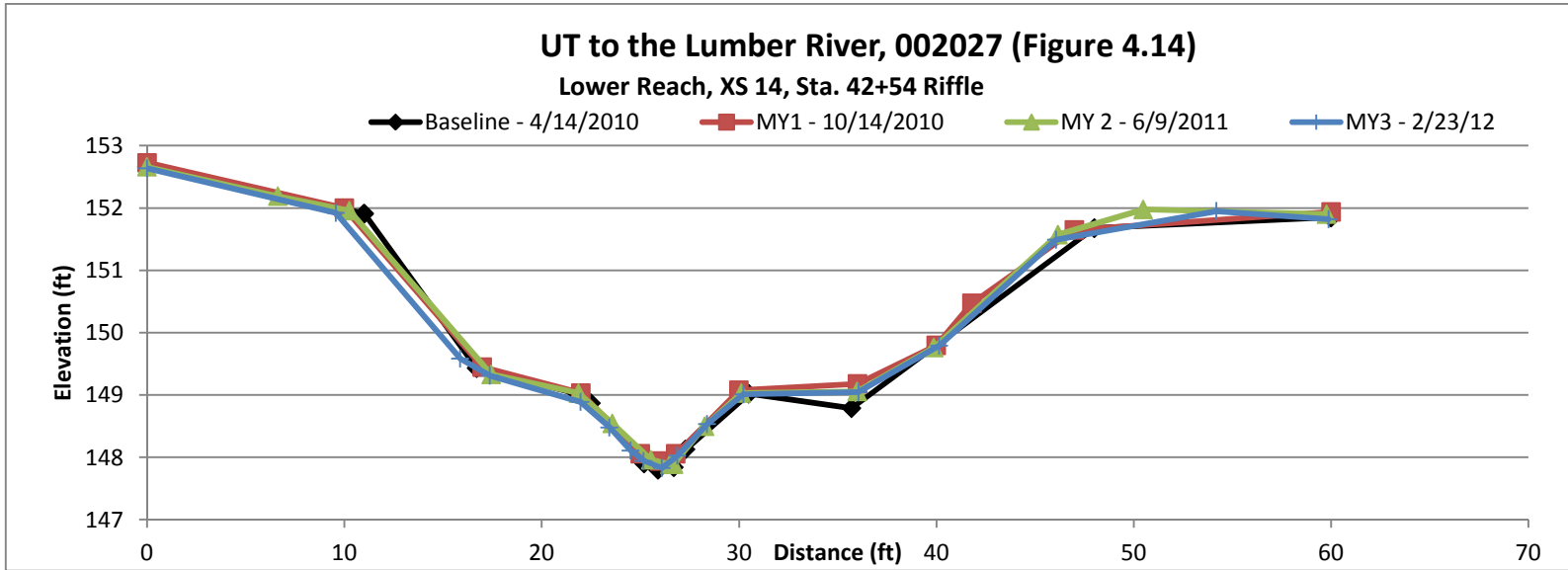
XS 12, Sta. 39+82, Looking Downstream



STA	ELEV
0.00	152.49
10.67	152.03
14.49	151.62
22.89	149.25
26.84	148.95
28.87	148.50
30.29	148.17
31.64	148.17
32.78	147.89
34.57	148.37
36.78	149.04
43.64	149.22
49.19	150.87
53.21	151.97
61.84	152.28
70.78	152.68



XS 13, Sta. 42+14, Looking Downstream



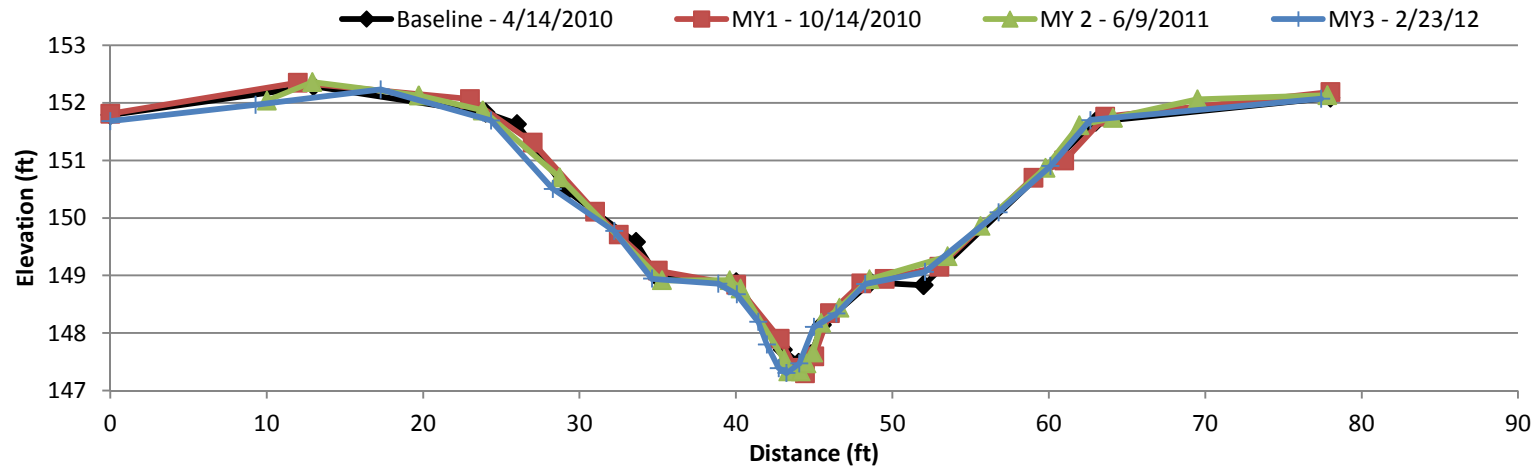
STA	ELEV
0.00	152.64
9.57	151.92
15.88	149.58
17.38	149.31
21.97	148.89
23.44	148.48
24.51	148.11
25.16	147.94
26.10	147.83
26.88	148.03
28.39	148.54
30.22	149.01
36.05	149.05
40.14	149.79
46.06	151.49
54.18	151.95
59.87	151.82



XS 14, Sta. 42+54, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.15)

Lower Reach, XS 15, Sta. 43+94 Pool



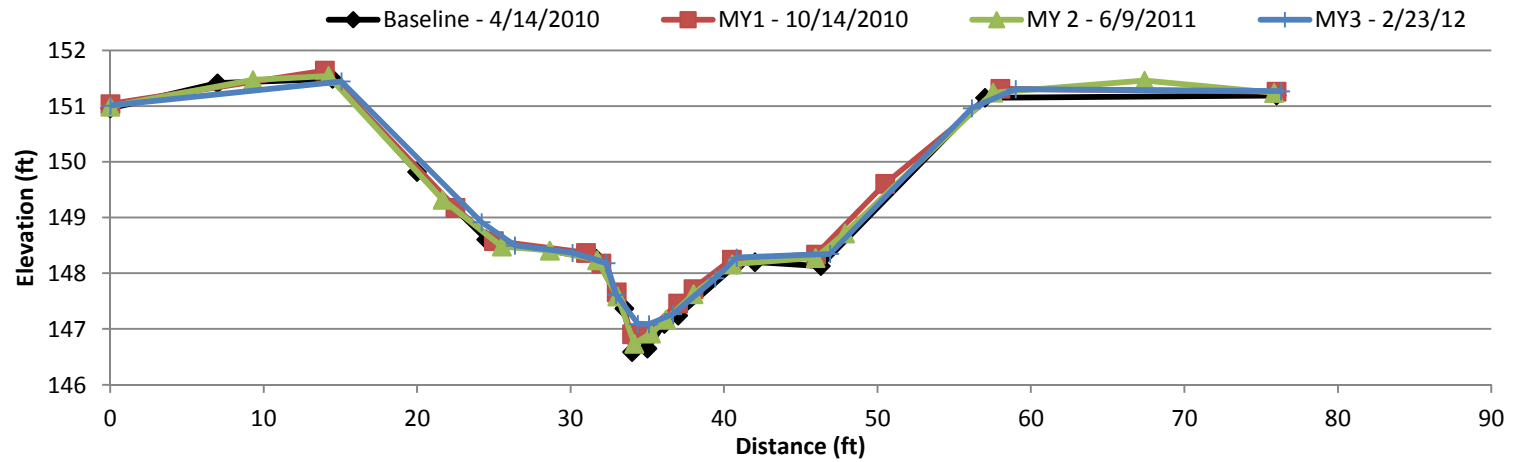
STA	ELEV	STA	ELEV
0.00	151.68	42.74	147.39
9.29	151.97	43.23	147.30
17.29	152.23	44.04	147.47
24.34	151.69	44.97	148.10
28.29	150.50	46.41	148.34
32.22	149.77	48.26	148.85
34.64	148.94	52.07	149.06
38.87	148.86	56.78	150.10
40.05	148.67	60.12	150.91
41.42	148.19	62.67	151.70
41.98	147.80	77.41	152.07



XS 15, Sta. 43+94, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.16)

Lower Reach, XS 16, Sta. 47+98.5 Pool



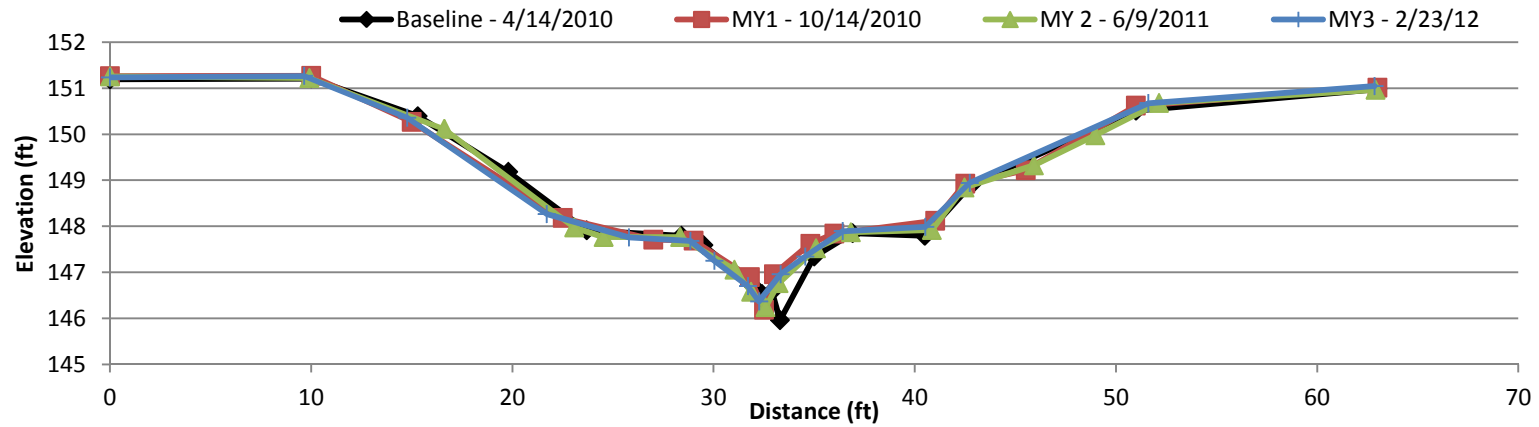
STA	ELEV
0.00	151.01
15.07	151.44
24.21	148.92
26.38	148.50
30.13	148.37
32.33	148.18
32.97	147.62
34.39	147.09
35.11	147.09
36.68	147.27
39.43	147.91
40.83	148.28
46.90	148.35
56.15	150.96
58.99	151.31
76.30	151.27



XS 16, Sta. 47+98.5, Looking Downstream

UT to the Lumber River, 002027 (Figure 4.17)

Lower Reach, XS 17, Sta. 51+26 Riffle



STA	ELEV
0.00	151.23
9.66	151.26
14.77	150.36
21.71	148.27
25.79	147.76
28.85	147.68
30.04	147.25
31.70	146.70
32.26	146.37
33.33	146.96
34.55	147.34
36.42	147.89
40.52	147.99
42.72	148.94
51.61	150.67
62.85	151.05



XS 17, Sta. 51+26, Looking Downstream

Figures 5.1-5.3. Longitudinal Profile Plots



Figure 5.1 UT to the Lumber River, 002027, Upper Reach Longitudinal Profile

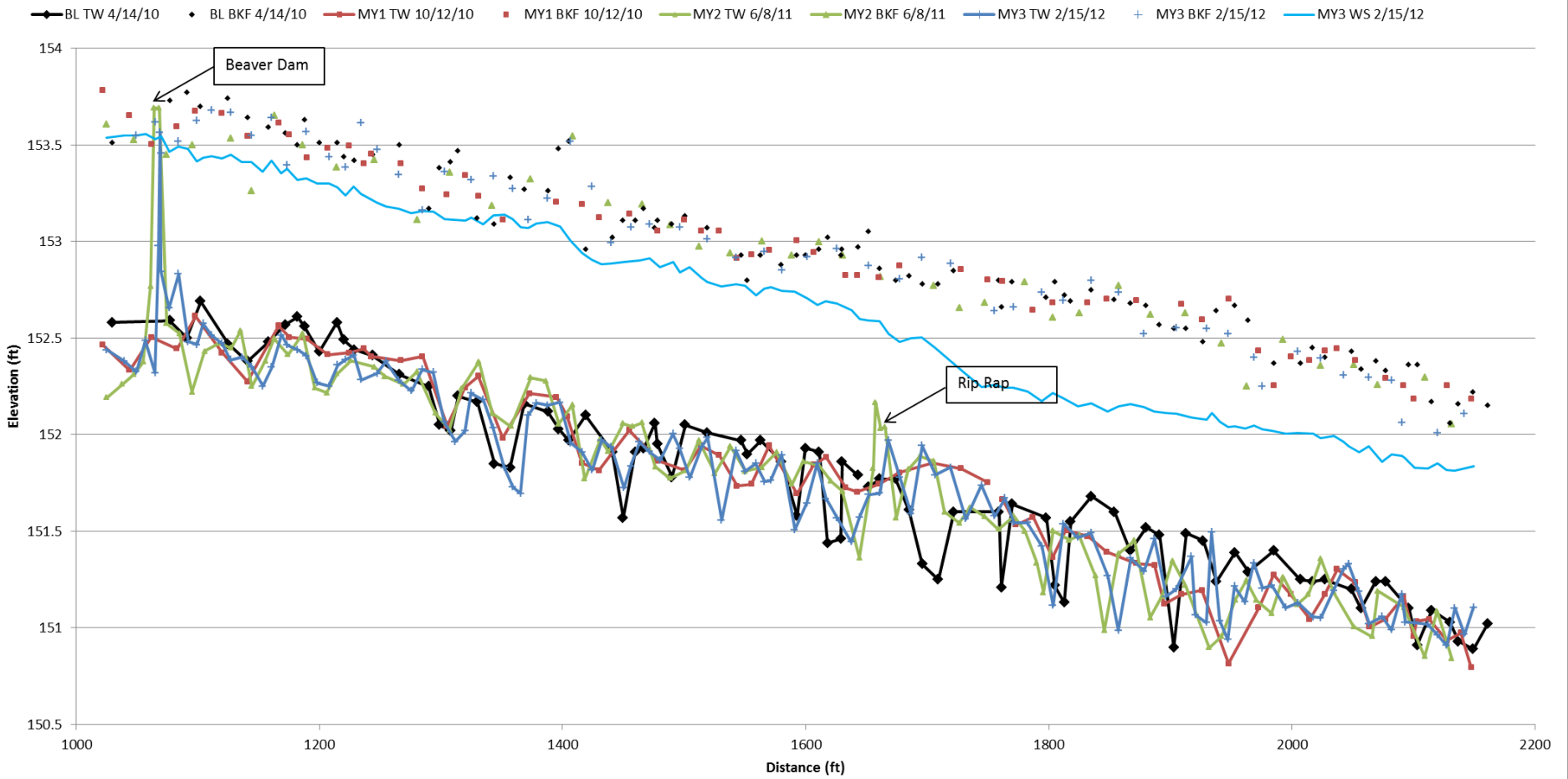


Figure 5.2 UT to the Lumber River, 002027, Lower Reach (1) Longitudinal Profile

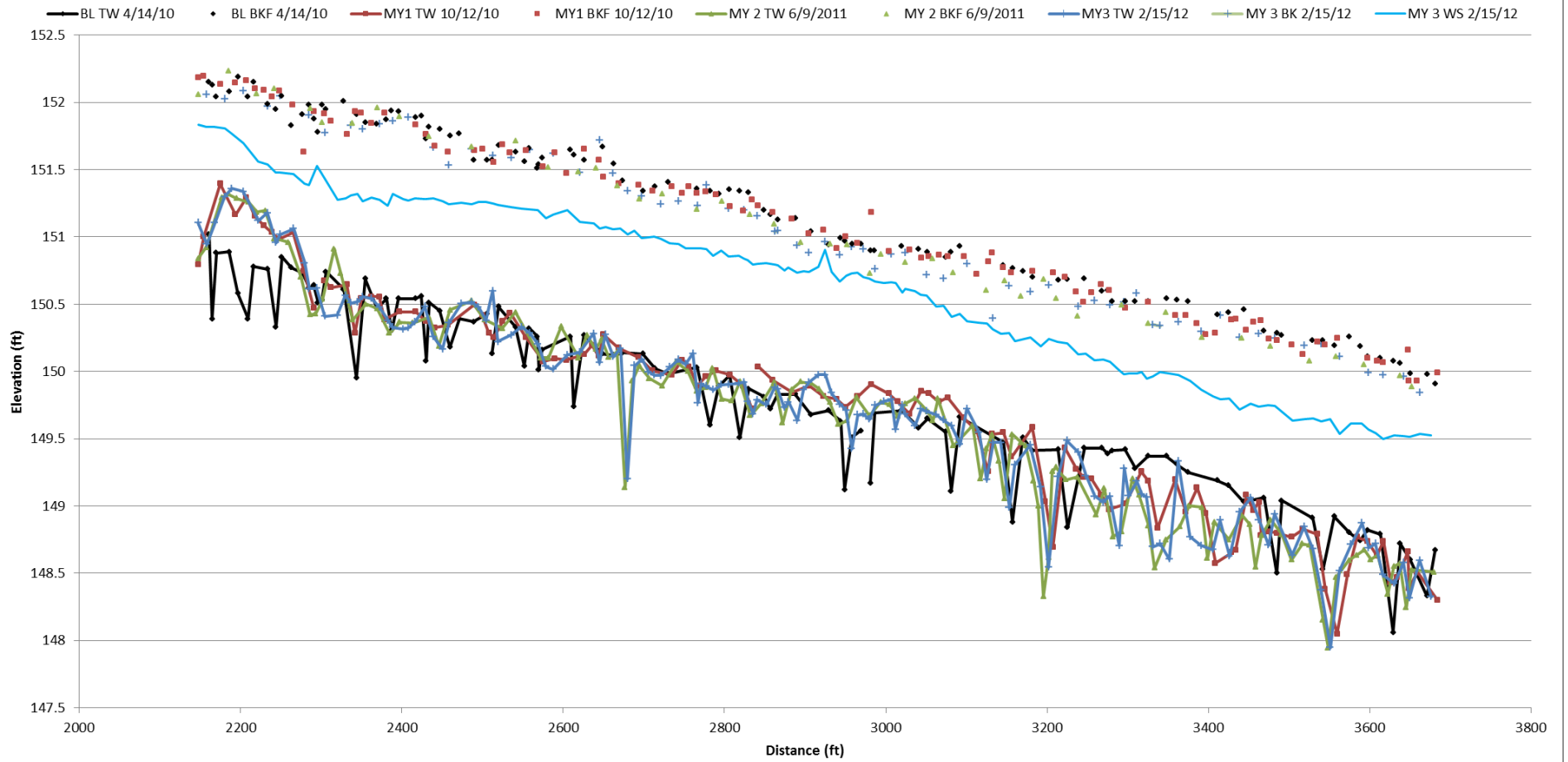


Figure 5.3 UT to the Lumber River, 002027, Lower Reach (2) Longitudinal Profile

— BL TW 4/14/10 ♦ BL BKF 4/14/10 — MY1 TW 10/14/10 ■ MY1 BKF 10/14/10 — MY 2 TW 6/9/11 ▲ MY 2 BKF 6/9/11 — MY3 TW 2/15/12 + MY3 BKF 2/15/12 — MY3 WS 2/15/12

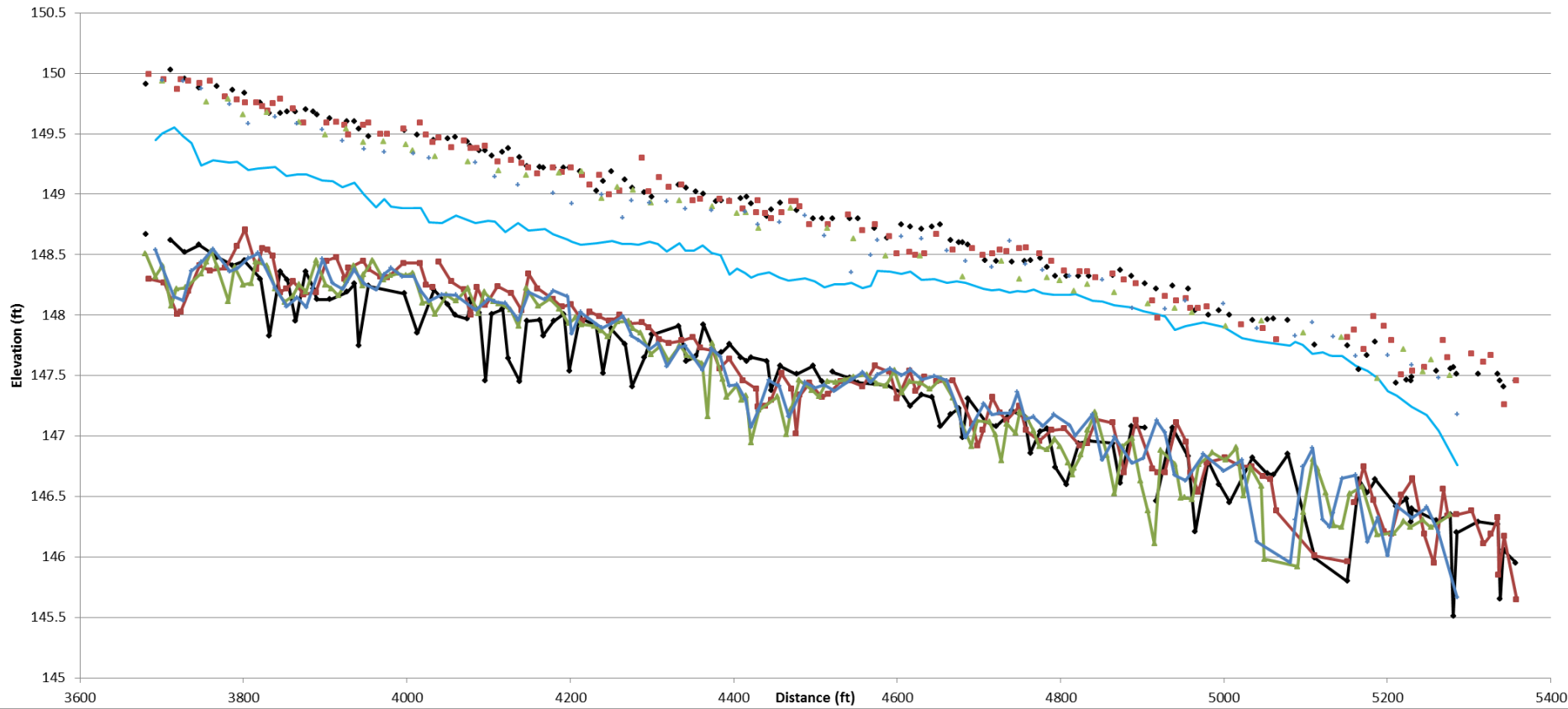


Table 10. Baseline Stream Data Summary
UT to the Lumber River Site, 002027
UT to the Lumber River: 4,285 feet

Parameter	Regional Curve			Pre-Existing Condition			UT Ironhill Branch Reference Reach			UT to Lumber River Reference Reach			Design - Upstream			Design - Downstream			As-built/Baseline - Upstream			As-built/Baseline - Downstream		
	LL	UL	Eq.	Mean	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max		
Dimension and Substrate - Riffle																								
Bankfull Width (ft)	6.41	10.33	8.03	8.70		10.30			9.50				7.80		8.80		5.67	7.31	8.47	6.95	8.07	8.97		
Floodprone Width (ft)				13.30		290.00			100.00				25.00		27.00		21.23	23.39	27.54	23.23	25.73	28.30		
Bankfull Mean Depth (ft)	0.76	1.45	0.99	0.94		0.95			0.85				0.74		0.83		0.46	0.58	0.64	0.52	0.63	0.73		
Bankfull Max Depth (ft)				1.77		1.58			1.42				1.11		1.25		0.96	1.13	1.30	1.00	1.30	1.83		
Bankfull Cross Sectional Area (ft ²)	9.08	12.57	8.19	8.16		9.76			8.03				4.90		6.20		3.56	4.19	5.45	4.02	5.10	5.74		
Width/Depth Ratio				9.20		10.80			11.20				10.50		10.50		9.00	13.05	16.93	10.68	12.99	15.74		
Entrenchment Ratio				1.53		28.21			28.21				3.20		3.10		2.75	3.25	3.74	2.77	3.20	3.44		
Bank Height Ratio				2.94		1.00			1.03				1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00		
d50 (mm)				Detritus		0.30			0.30															
Profile																								
Riffle Length (ft)				NA	11.66	33.00	67.02	17.04	18.60	20.16	0.78	18.20	77.00	0.65	18.70	91.60	5.50	21.67	47.00	5	22.77	87		
Riffle Slope (ft/ft)				0.0000		0.0043			0.0013			0.0020		0.0019		0.0000	0.0023	0.0129	0	0.0024	0.0107			
Pool Length (ft)				NA	20.74	28.03	42.51	11.69	17.63	21.13	8.50	35.00	42.00	5.90	35.00	39.00	11.00	27.50	48.00	6	23.77	51		
Pool Max depth (ft)				2.02	ream Da	1.78			1.50			1.48		1.67		1.01	1.33	1.65	1.16	1.55	2.1			
Pool Spacing (ft)				115.00		37.20	71.50	105.75	26.18	40.12	54.06	15.50	31.00	46.50	21.00	37.20	53.40	23.00	49.96	91.00	16	22.77		
Pool Cross Sectional Area (ft ²)				NA		12.90			4.69			7.44		9.48		3.92	8.93	5.69	5.94	6.75	7.86			
Pattern																								
Channel Beltwidth (ft)				NA	30.00	44.50	59.00	16.00	17.50	19.00	15.50	31.00	46.50	17.50	35.00	52.50	15.50	31.00	46.50	17.50	35.00	52.50		
Radius of Curvature (ft)				NA	13.70	17.25	20.80	7.42	8.53	9.63	15.50	19.40	23.30	17.50	21.90	26.30	15.50	19.40	23.30	17.50	21.90	26.30		
Rc: Bankfull Width (ft/ft)				NA	1.33	1.68	2.02	0.78	0.90	1.02	2.00	2.50	3.00	2.00	2.50	3.00	2.00	2.50	3.00	2.00	2.50	3.00		
Meander Wavelength (ft)				NA	42.00	57.00	72.00	38.00	38.00	38.00	23.30	50.40	77.50	26.30	56.90	87.50	23.30	50.40	77.50	26.30	56.90	87.50		
Meander Width Ratio				NA	4.09	5.55	7.00	4.01	4.01	4.01	3.00	6.50	10.00	3.00	6.50	10.00	3.00	6.50	10.00	3.00	6.50	10.00		
Substrate, bed and transport parameters																								
R1%/P%				NA		54.1 / 45.9			51.4 / 48.6								44.1 / 55.9			49.3 / 50.7				
SC%/Sa%/G%/C%/B%/Be%				Detritus		100% Sa			100% Sa															
d16/d35/d50/d84/d95/d ^p /di ^p (mm)				Detritus		0.30			0.30															
Reach Shear Stress (competency) lb/ft ²				0.148								0.055		0.060		0.073		0.061						
Max part size (mm) mobilized at bankfull				10.62 - 37.22								3.83 - 18.12		4.16 - 19.2		5.1 - 22.2		4.2 - 19.3						
Unit Stream Power (transport capacity) lbs/ft.s				0.100								0.059		0.070		0.075		0.083						
Additional Reach Parameters																								
Drainage Area (SM)				0.42		1.61			0.63															
Impervious cover estimate (%)				5.00		5.00			5.00															
Rosgen Classification				G-F/5		E5			E5				E5		E5		E5		E5		E5			
Bankfull Velocity (fps)	0.65	1.11	1.08	0.74								1.02		1.12		1.19		1.37						
Bankfull Discharge (cfs)	5.90	14.06	8.87	6.00												5.00		7.00						
Valley length (ft)				3428.00		200.00			115.40							920.00		2508.00						
Channel Thalweg length (ft)				3428.00		264.00			150.00			1162.00		*3123.00		1162.00		*3123.00						
Sinuosity (ft)				1.00		1.32			1.30			1.25		1.25		1.25		1.25						
Water Surface Slope (Channel) (ft/ft)				0.0000 (Backwater Blockage)		0.0020			0.0028			0.0015		0.0014		0.0018		0.00154						
BF slope (ft/ft)				0.0023		0.0020			0.0028			0.0015		0.0014		0.0018		0.00154						
Bankfull Floodplain Area (acres)				0.00								0.67		1.97		0.67		1.97						
Proportion over wide (%)				50.00		0.00			0.00															
Entrenchment Class (ER Range)				1.53		28.21			10.55															
Incision Class (BHR Range)				2.94		1.00			1.06															
BEHI VL%/L%/M%/H%/VH%/E%				NA		100% VL			100% VL															
Channel Stability or Habitat Metric				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Biological or Other				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			

It should be noted that As-built conditions were completed at the end of construction. Many storm events had occurred between beginning of construction and end of construction that naturally modified constructed parameters.
 *50 foot easement crossing is taken out of the stationing to get 3,123 linear feet of construction.

Table 11. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Section) - Upstream Reach Sections 1 -5; Downstream Reach Sections 6 - 17

UT to the Lumber River Site, 002027

UT to the Lumber River: 4.285 feet

Dimension and substrate	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	5.67	5.88	5.59	6.87				8.66	7.75	8.22	7.94				8.47	9.32	7.01	7.65				7.79	6.13	5.73	5.47				8.92	8.74	9.25	8.78			
Floodprone Width (ft)	21.23	21.21	20.2	19.92				24.14	23.61	24.98	25.53				27.54	27.49	26.03	26.05				21.41	21.43	20.92	21.1				27.37	25.25	25.64	25.06			
Bankfull Mean Depth (ft)	0.63	0.69	0.65	0.59				0.45	0.43	0.44	0.49				0.64	0.52	0.53	0.53				0.46	0.46	0.43	0.43				0.64	0.55	0.51	0.58			
Bankfull Max Depth (ft)	1.3	1.3	1.22	1.22				0.94	0.91	1.07	1.1				1.12	1.12	1	1				0.96	0.98	0.93	0.94				1.29	1.08	1.07	1.03			
Bankfull Cross Sectional Area (ft ²)	3.56	4.08	3.61	4.08				3.92	3.32	3.62	3.93				5.45	4.89	3.68	4.02				3.56	2.84	2.46	2.36				5.69	4.85	4.76	5.07			
Bankfull Width/Depth Ratio	9	8.52	8.6	11.64				19.24	18.02	18.68	16.2				13.23	17.92	13.23	14.43				16.93	13.33	13.33	12.72				13.94	15.89	18.14	15.14			
Bankfull Entrenchment Ratio	3.74	3.61	3.61	2.9				2.79	3.05	3.04	3.21				3.25	2.95	3.72	3.41				2.75	3.5	3.65	3.86				3.07	2.89	2.77	2.85			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1			
Dimension and substrate	Cross Section 6 (Riffle)						Cross Section 7 (Riffle)						Cross Section 8 (Pool)						Cross Section 9 (Pool)						Cross Section 10 (Pool)										
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	6.95	7.37	6.92	7.29				7.73	8.03	7.76	9.08				11.85	9.67	9.77	8.05				8.91	8.96	9.56	8.8				9.78	10.24	9.9	10.04			
Floodprone Width (ft)	23.23	23.4	24.52	25.15				24.09	23.51	24.35	25.22				34.06	28.72	28.64	25.68				25.68	27.62	27.18	29.38				30.76	30.05	30.24	29.3			
Bankfull Mean Depth (ft)	0.63	0.63	0.62	0.63				0.52	0.5	0.5	0.47				0.56	0.55	0.53	0.45				0.69	0.6	0.61	0.68				0.8	0.73	0.68	0.68			
Bankfull Max Depth (ft)	1.22	1.2	1.31	1.37				1	0.88	1.02	1.01				1.43	1.13	1.18	0.92				1.1	1.4	1.43	1.57				1.55	1.34	1.32	1.28			
Bankfull Cross Sectional Area (ft ²)	4.4	4.66	4.27	4.56				4.02	4.02	3.85	4.29				6.63	5.36	5.18	3.61				6.1	5.35	5.87	6				7.86	7.46	6.72	6.87			
Bankfull Width/Depth Ratio	11.03	11.7	11.16	11.57				14.87	16.06	15.52	19.32				21.16	17.58	18.43	17.89				12.91	14.93	15.67	12.94				12.22	14.03	14.56	14.76			
Bankfull Entrenchment Ratio	3.34	3.18	3.55	3.45				3.12	2.93	3.14	2.78				2.88	2.97	2.93	3.19				2.88	3.08	2.84	3.34				3.15	2.93	3.05	2.92			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1			
Dimension and substrate	Cross Section 11 (Riffle)						Cross Section 12 (Riffle)						Cross Section 13 (Pool)						Cross Section 14 (Riffle)						Cross Section 15 (Pool)										
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.97	8.93	8.87	9.02				7.8	7.32	6.97	8.7				10.56	9.91	9.64	10.29				8.7	7.84	8.23	7.79				8.6	7.92	8.3	9.36			
Floodprone Width (ft)	24.87	24.47	24.85	24.66				26.85	23.54	22.89	25.37				30.02	25.24	25.92	26.63				27.03	25.7	26.14	25.82				27.48	27.66	27.78	29.17			
Bankfull Mean Depth (ft)	0.57	0.57	0.59	0.55				0.73	0.57	0.54	0.56				0.63	0.55	0.52	0.57				0.64	0.61	0.61	0.56				0.69	0.71	0.73	0.69			
Bankfull Max Depth (ft)	1.23	1.13	1.1	1.11				1.27	0.91	0.85	1.01				1.61	1.07	1.09	1.1				1.22	1.09	1.14	1.06				1.4	1.54	1.52	1.55			
Bankfull Cross Sectional Area (ft ²)	5.15	5.05	5.26	4.98				5.7	4.15	3.79	4.9				6.68	5.45	4.99	5.83				5.59	4.78	5.01	4.36				5.94	5.6	6.07	6.42			
Bankfull Width/Depth Ratio	15.74	15.67	15.03	16.4				10.68	12.84	12.91	15.54				16.76	18.02	18.54	18.05				13.59	12.85	13.49	13.91				12.46	11.15	11.37	13.57			
Bankfull Entrenchment Ratio	2.77	2.74	2.8	2.73				3.44	3.22	3.29	2.92				2.84	2.55	2.69	2.59				3.11	3.28	3.18	3.32				3.19	3.49	3.35	3.12			
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1				1	1	1	1			
Dimension and substrate	Cross Section 16 (Pool)						Cross Section 17 (Riffle)																												
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+																					
Bankfull Width (ft)	9	8.87	8.62	8.85				8.28	6.18	8	6.83																								
Floodprone Width (ft)	32.36	29.35	30.41	27.97				28.3	26.31	26.66	23.69																								
Bankfull Mean Depth (ft)	0.81	0.68	0.7	0.67				0.69	0.52	0.61	0.58																								
Bankfull Max Depth (ft)	1.62	1.34	1.42	1.14				1.83	1.5	1.53	1.31																								
Bankfull Cross Sectional Area (ft ²)	7.27	6.06	6.01	5.89				5.74	3.2	4.89	3.99																								
Bankfull Width/Depth Ratio	11.11	13.04	12.31	13.21				12	11.88	13.11	11.78																								
Bankfull Entrenchment Ratio	3.6	3.31	3.53	3.16				3.42	4.26	3.33	3.47																								
Bankfull Bank Height Ratio	1	1	1	1				1	1	1	1																								

Table 12. Monitoring Data - Stream Reach Data Summary
UT to the Lumber River Site, 002027
Reach 1 (Upper), UT to the Lumber River: 1,162 feet

Parameter	Baseline			MY-1			MY-2			MY-3			MY-4			MY-5		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Dimension and substrate - Riffle only																		
Bankfull Width (ft)	5.67	7.31	8.47	5.88	7.11	9.32	5.59	6.11	7.01	5.47	7.34	8.76						
Floodprone Width (ft)	21.23	23.39	27.54	21.21	23.38	27.49	20.20	22.38	26.03	19.92	23.53	26.05						
Bankfull Mean Depth (ft)	0.46	0.58	0.64	0.46	0.56	0.69	0.43	0.54	0.65	0.43	0.52	0.59						
Bankfull Max Depth (ft)	0.96	1.13	1.30	0.98	1.13	1.30	0.93	1.05	1.22	0.94	1.06	1.22						
Bankfull Cross Sectional Area (ft ²)	3.56	4.19	5.45	2.84	3.94	4.89	2.46	3.25	3.68	2.36	3.89	5.07						
Bankfull Width/Depth Ratio	9.00	13.05	16.93	8.52	13.26	17.92	8.60	11.72	13.33	11.64	14.03	16.20						
Bankfull Entrenchment Ratio	2.75	3.25	3.74	2.95	3.35	3.61	3.61	3.66	3.72	2.85	3.25	3.86						
Bankfull Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1						
Profile																		
Riffle Length (ft)	5.50	21.67	47.00	14.99	51.77	121.03	16.07	33.74	122.1	6.68	14.68	23.56						
Riffle Slope (ft/ft)	0.000	0.002	0.013	0.0012	0.0031	0.0050	0.0007	0.0025	0.0051	0.0002	0.0046	0.0099						
Pool Length (ft)	11.00	27.50	48.00	11.78	43.97	68.55	17.14	35.85	58.91	10.33	22.76	45.95						
Pool Max Depth (ft)	1.01	1.33	1.65	1.13	1.33	1.91	1.18	1.4	1.68	0.88	1.34	1.78						
Pool Spacing (ft)	23.00	49.96	91.00	20.35	54.62	131.74	27.85	63.86	155.3	12.11	37.62	63.03						
Pattern																		
Channel Beltwidth (ft)	15.5	31	46.5															
Radius of Curvature (ft)	15.5	19.4	23.3															
Rc:Bankfull Width (ft/ft)	2	2.5	3															
Meander Wavelength (ft)	23.3	50.4	77.5															
Meander Width Ratio	3	6.5	10															
Additional Reach Parameters																		
Rosgen Classification	E5			E5			E5			E5								
Channel Thalweg length (ft)	1162			1113			1106			1120								
Sinuosity (ft)	1.25			1.21			1.2			1.22								
Water Surface Slope (Channel) (ft/ft)	0.0018			0.00163			0.00127			0.0015								
BF slope (ft/ft)	0.0018			0.00143			0.0014			0.0014								
³ Ri% / P%	44.1 / 55.9			44.8 / 55.2			44.6 / 55.4			43.1 / 56.9								
³ SC% / Sa% / G% / C% / B% / Be%																		
³ d16 / d35 / d50 / d84 / d95																		
² % of Reach with Eroding Banks																		
Channel Stability or Habitat Metric																		
Biological or Other																		

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4 = Of value/needed only if the n exceeds 3

Table 12. Monitoring Data - Stream Reach Data Summary
UT to the Lumber River Site, 002027
Reach 2 (Lower), UT to the Lumber River: 3,123 feet

Parameter	Baseline			MY-1			MY-2			MY-3			MY-4			MY-5		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Dimension and substrate - Riffle only																		
Bankfull Width (ft)	6.95	8.07	8.97	6.18	7.61	8.93	6.92	7.79	8.87	6.83	8.68	10.29						
Floodprone Width (ft)	23.23	25.73	28.30	23.40	24.49	26.31	22.89	24.90	26.66	23.69	26.50	29.38						
Bankfull Mean Depth (ft)	0.52	0.63	0.73	0.50	0.57	0.63	0.50	0.58	0.62	0.45	0.59	0.69						
Bankfull Max Depth (ft)	1.00	1.30	1.83	0.88	1.12	1.50	0.85	1.16	1.53	0.92	1.20	1.57						
Bankfull Cross Sectional Area (ft ²)	4.02	5.10	5.74	3.20	4.31	5.05	3.79	4.51	5.26	3.61	5.14	6.87						
Bankfull Width/Depth Ratio	10.68	12.99	15.74	11.70	13.50	16.06	11.16	13.54	15.52	11.57	14.91	19.32						
Bankfull Entrenchment Ratio	2.77	3.20	3.44	2.74	3.27	4.26	2.80	3.22	3.55	2.73	3.08	3.47						
Bankfull Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1						
Profile																		
Riffle Length (ft)	5.00	22.77	87.00	10.3	25.29	81.89	12.74	43.35	102.48	8.57	30.16	182.08						
Riffle Slope (ft/ft)	0.000	0.002	0.011	0.0000	0.0029	0.0081	0.0005	0.0019	0.0039	0.0003	0.0070	0.0214						
Pool Length (ft)	6.00	23.77	51.00	6.02	35.47	109.59	11.64	39.88	67.26	5.36	29.85	83.54						
Pool Max Depth (ft)	1.16	1.55	2.10	1.41	1.70	2.19	1.27	1.64	2.37	1.12	1.60	2.27						
Pool Spacing (ft)	16.00	22.77	87.00	16.61	47.70	104.41	17.78	52.02	131.75	12.85	54.95	214.21						
Pattern																		
Channel Beltwidth (ft)	17.5	35	52.5															
Radius of Curvature (ft)	17.5	21.9	26.3															
Rc:Bankfull Width (ft/ft)	2	2.5	3															
Meander Wavelength (ft)	26.3	56.9	87.5															
Meander Width Ratio	3	6.5	10															
Additional Reach Parameters																		
Rosgen Classification	E5			E5			E5			E5								
Channel Thalweg length (ft)	*3123			*3166			*3129			*3138								
Sinuosity (ft)	1.25			1.26			1.25			1.26								
Water Surface Slope (Channel) (ft/ft)	0.00154			0.00169			0.00159			0.00142								
BF slope (ft/ft)	0.00154			0.00149			0.00145			0.00144								
³ Ri% / P%	49.3 / 50.7			48.7 / 51.3			46.1 / 53.9			44.3 / 55.7								
³ SC% / Sa% / G% / C% / B% / Be%																		
³ d16 / d35 / d50 / d84 / d95																		
² % of Reach with Eroding Banks																		
Channel Stability or Habitat Metric																		
Biological or Other																		

Shaded cells indicate that these will typically not be filled in.

*50 foot easement crossing is taken out of the stationing to get channel thalweg length.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4 = Of value/needed only if the n exceeds 3

Appendix E. Hydrologic Data

Table 13. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
9/28/2012	XS 16	48+13	2.2	146.9	149.1	148.4	0.7	6.1
2/16/2012	XS 8	30+90	1.5	149.5	151.0	150.8	0.2	6.2



Figures 6.1 & 6.2 Crest Gauge Photos