

YEAR 4 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: March 14, 2013

Vegetation Data Collected: October 11, 2013

Submitted: November 1, 2013

Prepared by:



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I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, UT TO THE LUMBER RIVER YEAR 4 MONITORING REPORT WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS 1ST DAY OF NOVEMBER 2013.

A handwritten signature in blue ink, appearing to read "Chris L. Smith", is written over a solid black horizontal line.

Chris L. Smith, PE

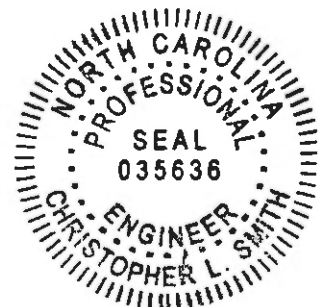


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1.0 EXECUTIVE SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 4 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 fourth 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. The 11.05 acres of the site was supplemented with bare root and live stake plants on January 12 through 16, 2013. The species planted include river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), silky dogwood (*Corunus amomum*), and button bush (*Cephalanthus occidentalis*). See Appendix F for Supplemental Planting Plans.

Sparse ground cover and minor erosion along the side slopes is noted along the terrace slopes. These areas are continuing to fill in with herbaceous vegetation (see Current Condition Plan View (CCPV) map and Figure 3.15). 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.

Nine small clusters of cattail (*Typha latifolia*) were observed in the floodplain and are noted on the CCPV map and Figure 3.16. *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.

Mowing has occurred just within the easement along Deep Branch Road underneath the power line. The Town of Pembroke has been contacted several times to determine who is mowing inside of the conservation easement. The Town believes that the power company is the responsible party. The Town and ICA Engineering are in coordination and attempting to determine who the responsible party is. Once the responsible party has been determined, ICA Engineering will coordinate with them to ensure all mowing within the easement ceases.

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 47 pools that are “stable, performing as intended”. The as-built profile depicted 63 pools. This would give a 75 percent rate of “stable, performing as intended” for Year 4 Monitoring, down from 94 percent for Year 3 Monitoring, 92 percent for Year 2 Monitoring and 76 percent for Year 1 Monitoring. These numbers are anticipated to continue to fluctuate in a sand bed system. 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. The two areas of minor erosion shown on the CCPV depict bare areas on the terrace slope. A small beaver dam was observed near station 10+43, approximately 20 feet downstream of Cross-section 1 during Year 3 monitoring and has been removed prior to Year 4 Monitoring. The beaver dam has not had a significant impact on the stability of the stream. 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 rip-rap has not resulted in significant stream degradation. The beaver dam and rip-rap are identified on Figure 5.1.

The site has experienced several bankfull flows throughout the monitoring period. Crest gauges installed on-site were inspected on February 16 and 23, 2012; September 28, 2012; and March 14, 2013. The crest gauges revealed that a bankfull event occurred at least twice during 2012 and at least once during 2013 (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 4 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 and Dan Mecklenburg's The Reference Reach Spreadsheet Version 4.3L 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 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>).

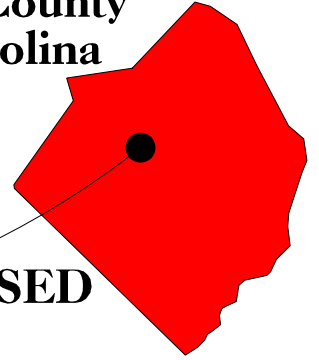
Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North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

4.0 APPENDICES

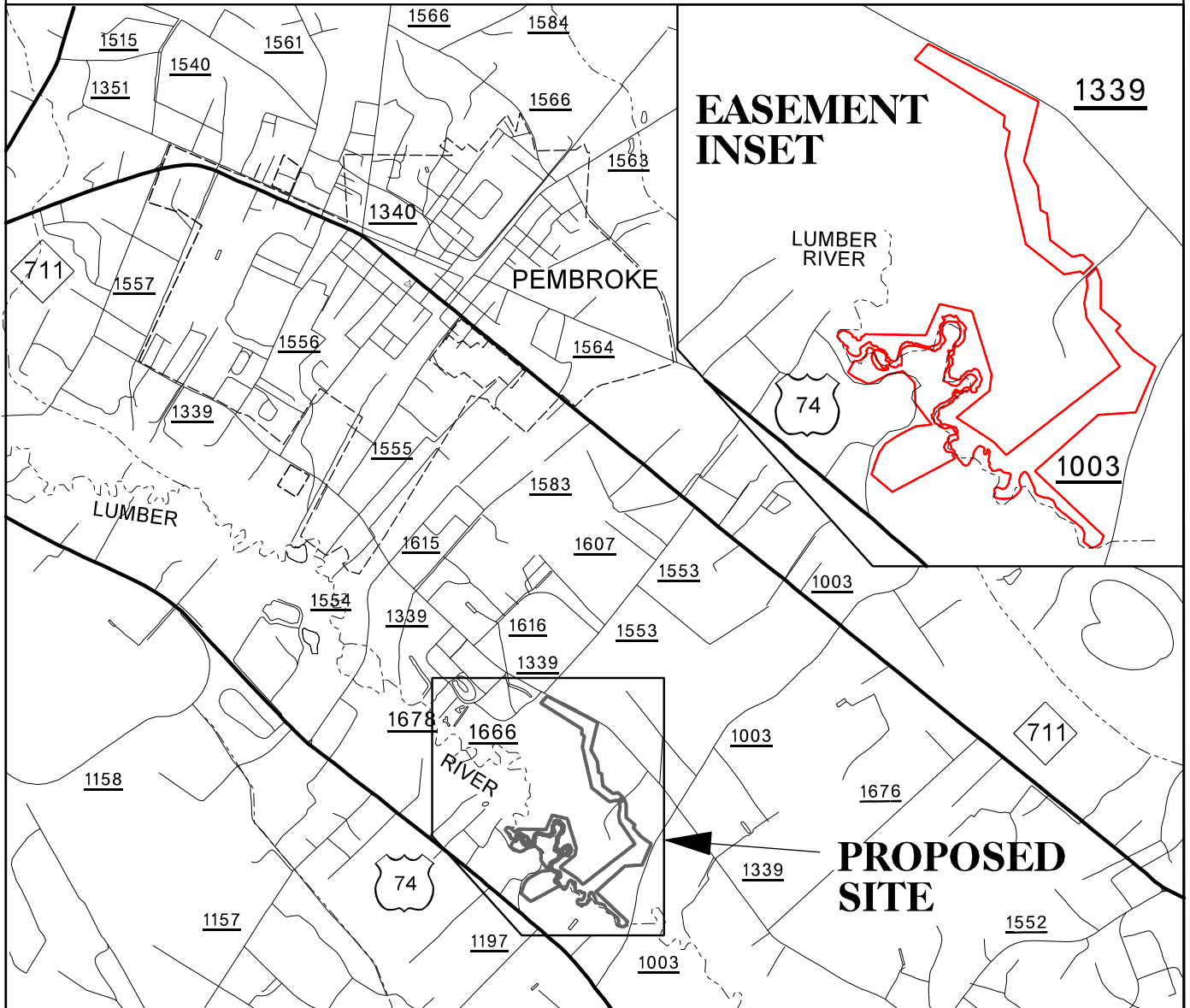
Appendix A. Project Vicinity Map and Background Tables

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**



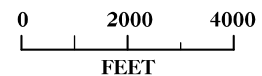
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Vicinity Map

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



Date: 10/31/13

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	October 11, 2013	November 1, 2013
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	ICA Engineering, Inc. f/k/a Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	ICA Engineering, Inc. f/k/a Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Evan Corbin (919) 851-6066
Vegetation Monitoring POC	ICA Engineering, Inc. f/k/a Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

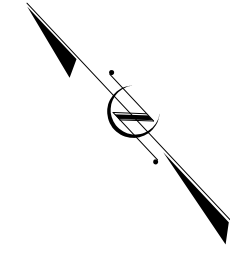
Table 4. Project Attributes Table

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

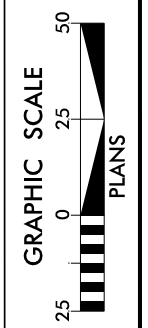
CURRENT CONDITIONS PLAN VIEW (CCPV)



-MATCHLINE- SEE FIGURE 2.1

-MATCHLINE- SEE FIGURE 2.3

LEGEND	
	TOP OF TERRACE
	THALWEG
	BANKFULL
	TOE OF TERRACE
	CROSS-SECTION LOCATION
	EASEMENT BOUNDARY
	LOG SILL
	PRE-CONSTRUCTION TOP OF BANK
	PRE-CONSTRUCTION THALWEG
	EXISTING WETLANDS
	MOWING ENCROACHMENT
BANK/BED CONDITION	
	MINOR EROSION
IN-STREAM STRUCTURE CONDITION	
	STABLE
VEGETATION PROBLEM AREAS	
	INVASIVE POPULATION
	THIN GRASS
VEGETATION PLOT CONDITIONS	
	CRITERIA MET
	CRITERIA UNMET



DATE: 10-30-13

CCPV

Figure 2.2

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

ICF
Engineering
/s/ K. Florence & Hutchison, Inc.

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Suite 100
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NC License No. F-0258



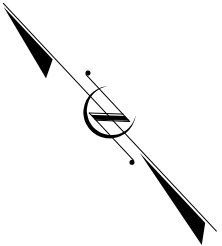
LEGEND

- 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
- EXISTING WETLANDS

YEAR 4 CONDITIONS

- MOWING ENCROACHMENT
- BANK/BED CONDITION
- MINOR EROSION
- IN-STREAM STRUCTURE CONDITION
- STABLE
- VEGETATION PROBLEM AREAS
- INVASIVE POPULATION
- THIN GRASS
- VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

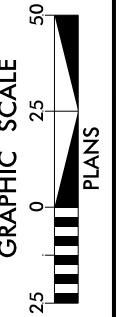
CURRENT CONDITIONS PLAN VIEW (CCPV)



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



DATE: 10-30-13

CCPV

Figure 2.3

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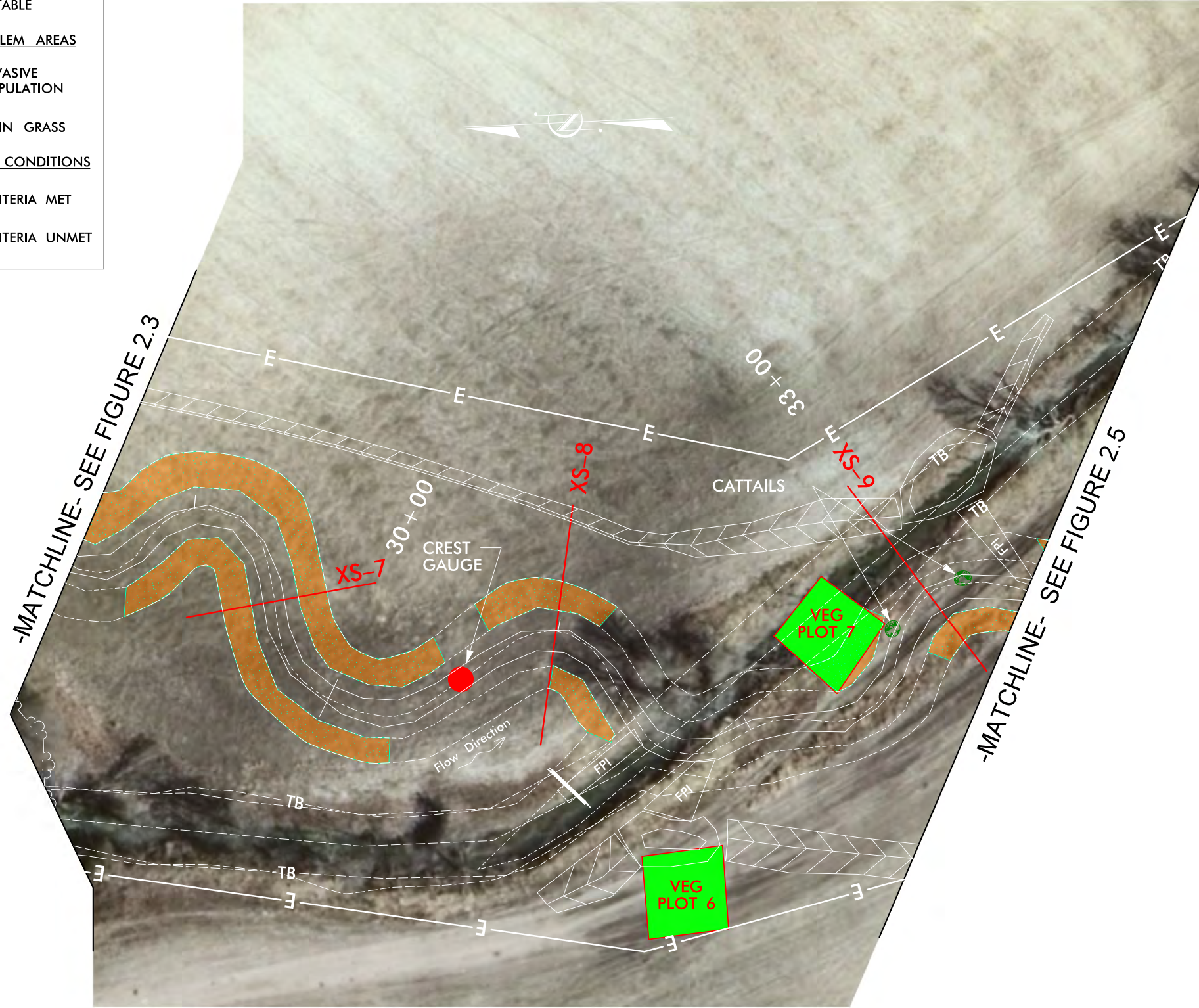
LEGEND

- 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
- EXISTING WETLANDS

YEAR 4 CONDITIONS

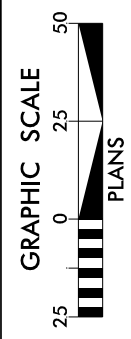
- IN-STREAM STRUCTURE CONDITION
- STABLE
- VEGETATION PROBLEM AREAS
- INVASIVE POPULATION
- THIN GRASS
- VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

CURRENT CONDITIONS PLAN VIEW (CCPV)



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



DATE: 10-30-13

CCPV

Figure 2.4

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
- EXISTING WETLANDS

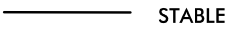
YEAR 4 CONDITIONS

BANKBED CONDITION



MINOR EROSION

IN-STREAM STRUCTURE CONDITION



STABLE

VEGETATION PROBLEM AREAS



INVASIVE POPULATION



THIN GRASS

VEGETATION PLOT CONDITIONS

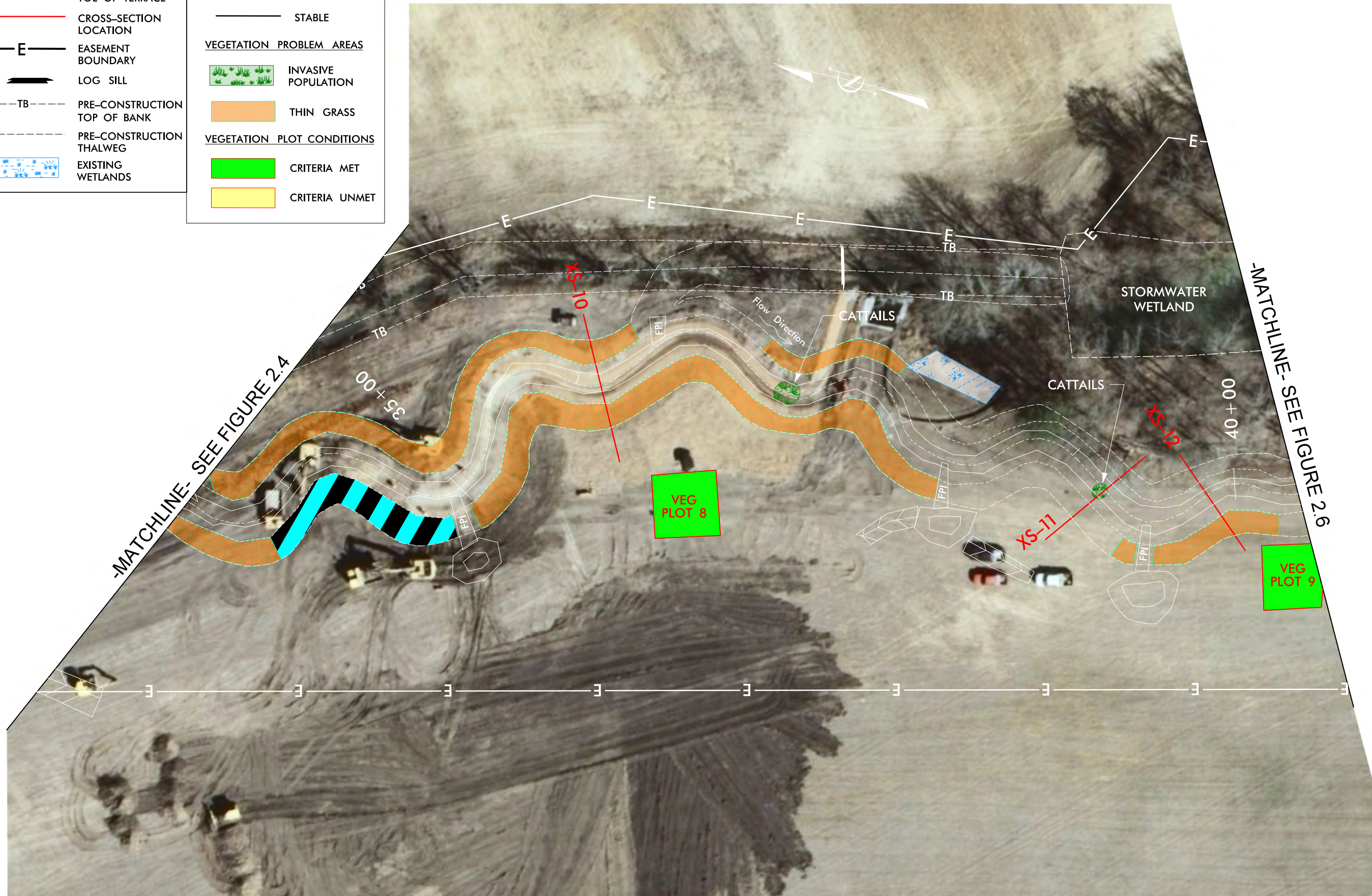


CRITERIA MET



CRITERIA UNMET

CURRENT CONDITIONS PLAN VIEW (CCPV)



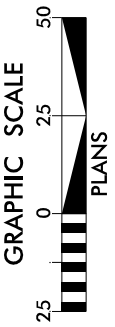
10/31/2013 10:00:00 AM C:\Users\jflance\Documents\Projects\Monitoring CCPV Year 4\LumberRiver-psn2.5-Monitoring_Y4_CCPV.dgn
 jflance@hatcheson.com



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

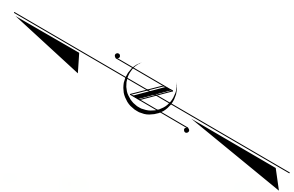


DATE: 10-30-13

CCPV

Figure 2.5

CURRENT CONDITIONS PLAN VIEW (CCPV)



LEGEND		YEAR 4 CONDITIONS	
-----	TOP OF TERRACE	-----	IN-STREAM STRUCTURE CONDITION
-----	THALWEG	————	STABLE
————	BANKFULL		VEGETATION PROBLEM AREAS
-----	TOE OF TERRACE	■	THIN GRASS
—	CROSS-SECTION LOCATION	■	CRITERIA MET
—E—	EASEMENT BOUNDARY	■	CRITERIA UNMET
—	LOG SILL		
-----	PRE-CONSTRUCTION TOP OF BANK		
-----	PRE-CONSTRUCTION THALWEG		
■	EXISTING WETLANDS		

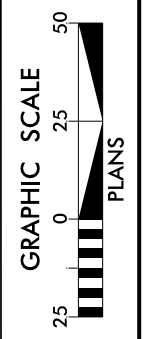


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 Florence & Hutcheson, Inc.



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 (fka Florence & Hutcheson, Inc.)

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

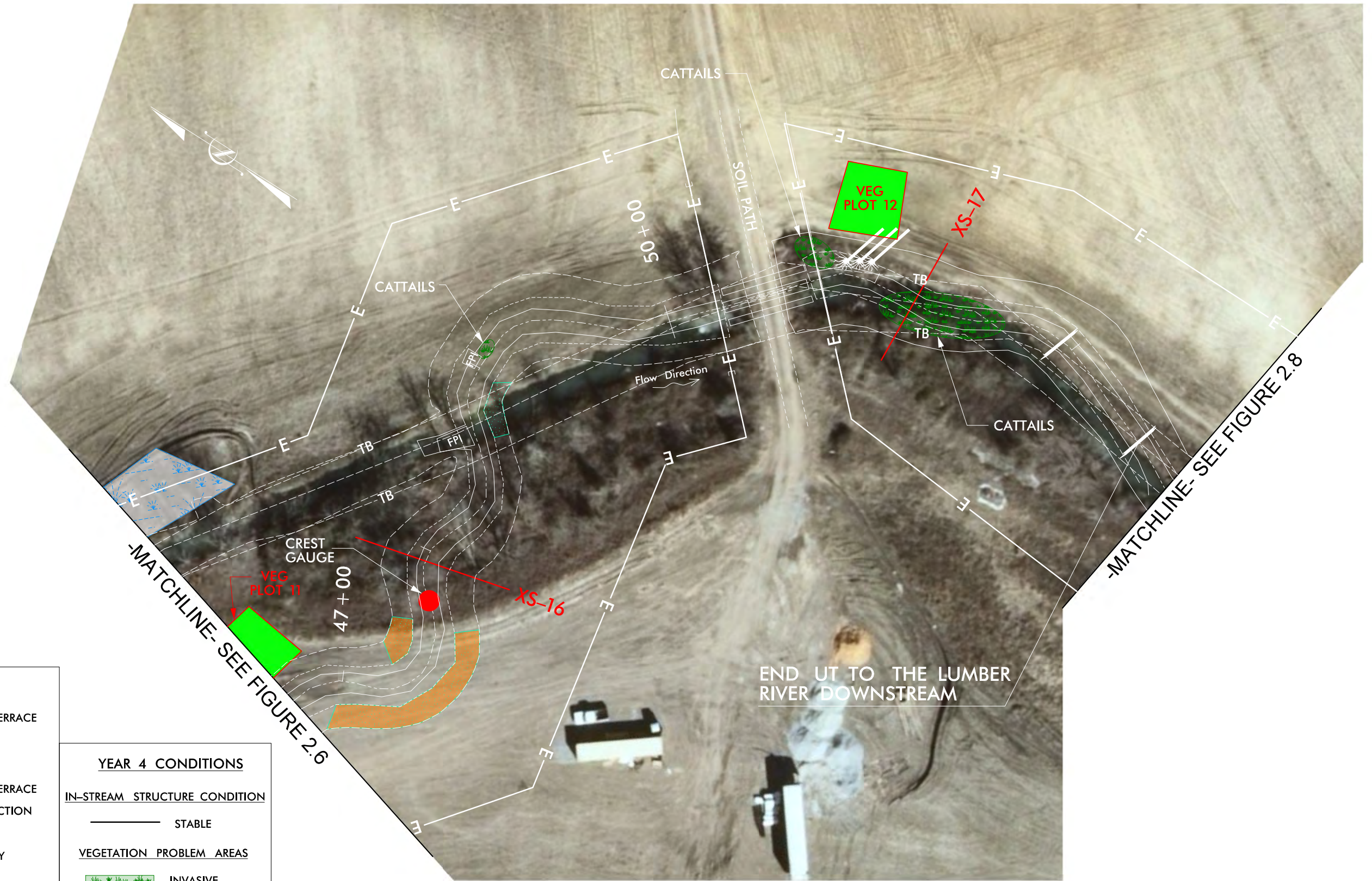


DATE: 10-30-13

CCPV

Figure 2.6

CURRENT CONDITIONS PLAN VIEW (CCPV)



LEGEND

- TOP OF TERRACE
- THALWEG
- BANKFULL
- TOE OF TERRACE
- CROSS-SECTION LOCATION
- E EASEMENT BOUNDARY
- ROOTWAD
- LOG SILL
- TB PRE-CONSTRUCTION TOP OF BANK
- PRE-CONSTRUCTION THALWEG
- EXISTING WETLANDS

YEAR 4 CONDITIONS

- IN-STREAM STRUCTURE CONDITION**
- STABLE
- VEGETATION PROBLEM AREAS**
- INVASIVE POPULATION
 - THIN GRASS
- VEGETATION PLOT CONDITIONS**
- CRITERIA MET
 - CRITERIA UNMET

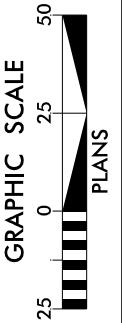
10/31/2013 \\proj\Monitoring CCPV Year 4 LumberRiver-psih2.7_Monitoring_Y4_CCPV.dgn
 R:\stream\Hatcheson & Hineson, Inc



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



DATE: 10-30-13

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

YEAR 4 CONDITIONS

VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

CURRENT CONDITIONS PLAN VIEW (CCPV)



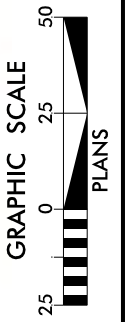
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UT TO THE LUMBER RIVER
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DATE: 10-30-13

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	47	63			75%			
		2. <u>Length</u> appropriate	47	63			75%			
	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).	34	0.87	5.8
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	14	0.06	0.4
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	Area was mapped	See legend of CCPV	1	0.14	0.97

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 Representative sparse side slope
(near Station 15+00)**



**3.16 Representative cluster of cattail
(Station 10+70) facing upstream**

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	20	809	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	19	769	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	24	971	Yes
8	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	21	850	Yes
9	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	15	607	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	18	728	Yes
14	Coastal Plain Small Stream Swamp	CPSSS	Lower	II	15	607	Yes
Average Stems Per Acre						685	

Table 8. CVS Vegetation Metadata

Report Prepared By	Ryan Smith
Date Prepared	10/28/2013 16:06
database name	CVS_entry - 2013.mdb
database location	S:\Lumber_River\Docs\Monitoring
computer name	NC10493
file size	41660416
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

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

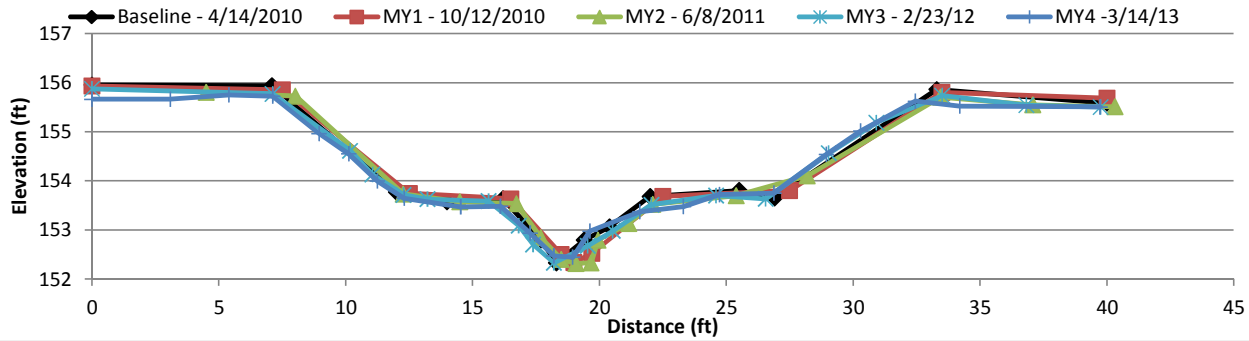
Table 9. Planted and Total Stem Counts (Specied by Plot with Annual Means)																	
Species	Common Name	Type	Current Data (MY3 2012)														
			Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	
<i>Acer rubrum</i>	red maple	Tree		10													
<i>Betula nigra</i>	river birch	Tree		1					1	1					2	2	
<i>Diospyros virginiana</i>	common persimmon	Tree														3	
<i>Fraxinus pennsylvanica</i>	green ash	Tree	4	4	3	3	1	1	3	3	3	3			3	3	
<i>Nyssa biflora</i>	swamp tupelo	Tree	3	3			1	1	3	3	1	1	1	1	6	6	
<i>Pinus taeda</i>	loblolly pine	Tree		4													
<i>Platanus occidentalis</i>	Amercian sycamore	Tree	1	1													
<i>Quercus laurifolia</i>	laurel oak	Tree	3	3	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>Salix nigra</i>	black willow	Tree															
<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			8	11	6	6	6	6	10	10	8	8	5	5	8	9	
Stem Count			20	35	15	15	12	12	19	19	16	16	15	15	24	27	
Stems per Acre			809	1416	607	607	486	486	769	769	648	648	607	607	971	1093	
Current Data (MY3 2012)																	
Species	Common Name	Type	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															
<i>Betula nigra</i>	river birch	Tree	1	1	1	1											
<i>Diospyros virginiana</i>	common persimmon	Tree															
<i>Fraxinus pennsylvanica</i>	green ash	Tree	3	3	4	4	2	2	3	3	4	4					
<i>Nyssa biflora</i>	swamp tupelo	Tree	2	2	1	1			2	2	4	4	4	4	4	4	
<i>Pinus taeda</i>	loblolly pine	Tree		1													
<i>Platanus occidentalis</i>	Amercian sycamore	Tree											1	1			
<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			7	9	7	7	
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	6	6	3	3	2	2			2	2					
<i>Quercus nigra</i>	water oak	Tree	4	4	1	1	2	2	1	2	1	1					
<i>Quercus phellos</i>	willow oak	Tree	1	1	4	4	2	2	1	1	3	3					
<i>Salix nigra</i>	black willow	Tree														3	
<i>Taxodium distichum</i>	bald cypress	Tree					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			7	8	7	7	8	8	7	7	7	7	4	4	3	4	
Stem Count			21	22	15	15	15	15	14	15	18	18	18	20	15	18	
Stems per Acre			850	890	607	607	607	607	567	607	728	728	728	809	607	728	
Annual Means																	
Species	Common Name	Type	Annual Means										Notes:				
			MY4 (2013)		MY3 (2012)		MY2 (2011)		MY1 (2010)		BL/AB (2010)						
			P	T	P	T	P	T	P	T	P	T					
<i>Acer rubrum</i>	red maple	Tree		10.00		4.50		4.00								N/A	
<i>Baccharis halimifolia</i>	eastern baccharis	Shrub						1.00									
<i>Betula nigra</i>	river birch	Tree	1.25	1.20		1.00		1.67								N/A	
<i>Diospyros virginiana</i>	common persimmon	Tree		3.00				1.00								N/A	
<i>Fraxinus pennsylvanica</i>	green ash	Tree	3.00	3.00	2.55	2.55	2.64	2.64	2.64	2.64	2.64	2.64				N/A	
<i>Liquidambar styraciflua</i>	sweetgum	Tree				1.50											
<i>Nyssa biflora</i>	swamp tupelo	Tree	2.67	2.67	2.67	2.92	2.67	3.15	3.31	3.31	3.69					N/A	
<i>Pinus taeda</i>	loblolly pine	Tree		2.50													
<i>Platanus occidentalis</i>	Amercian sycamore	Tree	1.00	1.00													
<i>Quercus</i>	oak	Tree						1.00									
<i>Quercus laurifolia</i>	laurel oak	Tree	2.27	2.27	2.18	2.18	2.30	2.50	2.50	2.50	2.60					N/A	
<i>Quercus lyrata</i>	overcup oak	Tree	3.57	3.86	4.14	4.14	4.29	4.86	4.43	4.43	3.67					N/A	
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	2.13	2.13	2.22	2.22	2.22	2.22	2.22	2.22	1.89					N/A	
<i>Quercus nigra</i>	water oak	Tree	2.45	2.55	2.55	2.33	2.55	2.73	2.73	2.73	2.82					N/A	
<i>Quercus phellos</i>	willow oak	Tree	2.83	2.83	2.92	2.92	3.08	3.17	3.00	3.00	3.17					N/A	
<i>Salix nigra</i>	black willow	Tree		3.00													
<i>Sambucus canadensis</i>	common elderberry	Shrub				1.00											
<i>Taxodium distichum</i>	bald cypress	Tree	2.75	2.75	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	1.88	1.88	1.75	1.78	1.67	1.67	2.40					N/A	
Plot area (acres)			6.71		7.07		6.71		6.57		6.86		N/A				
Species count			6.71	7.14	6.36	7.07	6.71	7.14	6.57	6.57	6.86						N/A
Stem Count			16.93	18.71	16.36	17.86	16.93	18.71	18.21	18.21	19.79						N/A
Stems per Acre			685	757	662	723	685	757	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

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

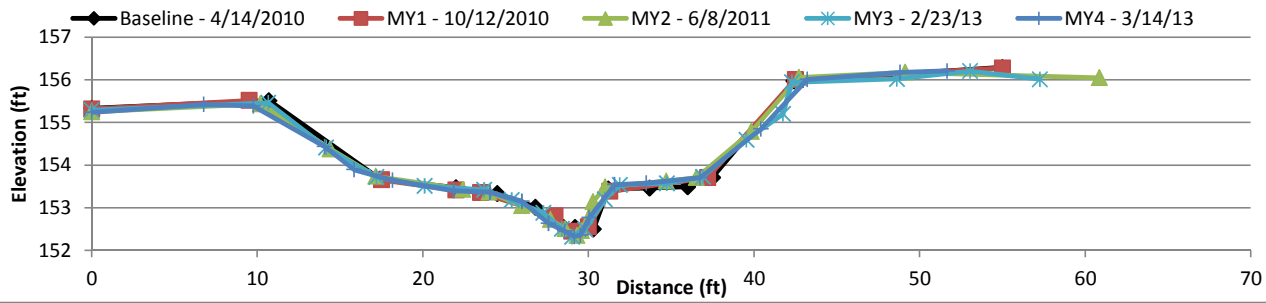


STA	ELEV
0.00	155.66
3.09	155.66
5.40	155.75
7.12	155.73
8.95	154.96
10.12	154.55
11.25	153.99
12.30	153.65
14.53	153.47
16.10	153.48
17.27	152.93
18.21	152.47
18.95	152.44
19.63	152.97
21.60	153.37
23.31	153.48
24.73	153.72
26.88	153.75
28.94	154.54
30.29	155.01
32.45	155.62
34.20	155.52
39.72	155.51



XS 1, Sta. 10+22, Looking Downstream

UT to the Lumber River, 002027
Upper Reach, XS 2, Sta. 12+14.5 Pool

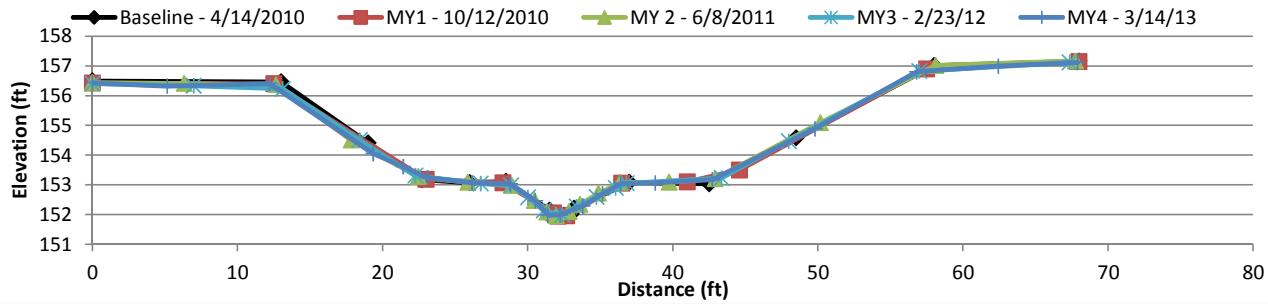


STA	ELEV
0.00	155.24
6.77	155.42
9.76	155.39
14.07	154.43
15.85	153.89
18.16	153.64
21.86	153.40
24.05	153.36
25.99	153.15
27.58	152.64
28.57	152.45
29.15	152.33
29.51	152.36
30.05	152.77
31.58	153.54
33.50	153.58
36.75	153.70
40.41	154.85
43.22	156.01
48.82	156.18
51.65	156.21



XS 2, Sta. 12+14.5, Looking Downstream

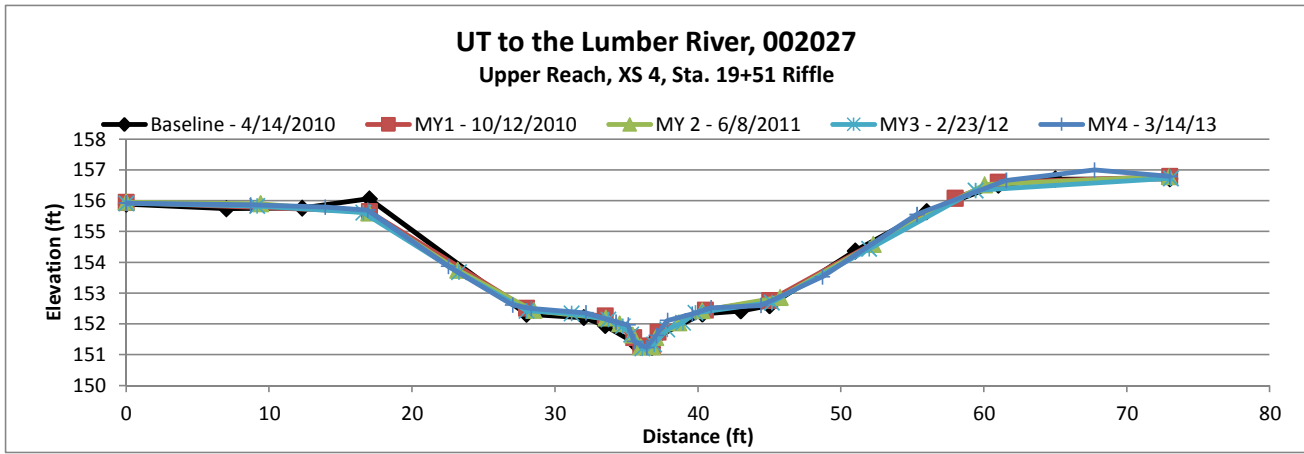
UT to the Lumber River, 002027
Upper Reach, XS 3, Sta. 14+92 Riffle



STA	ELEV
0.00	156.43
5.15	156.32
12.22	156.40
19.36	154.05
21.43	153.61
23.10	153.24
26.18	153.07
28.79	153.03
30.53	152.46
31.40	151.98
32.26	151.99
33.79	152.28
35.17	152.70
36.43	153.05
38.81	153.06
42.74	153.17
49.81	154.88
56.82	156.80
62.44	156.99
67.91	157.11



XS 3, Sta. 14+92, Looking Downstream



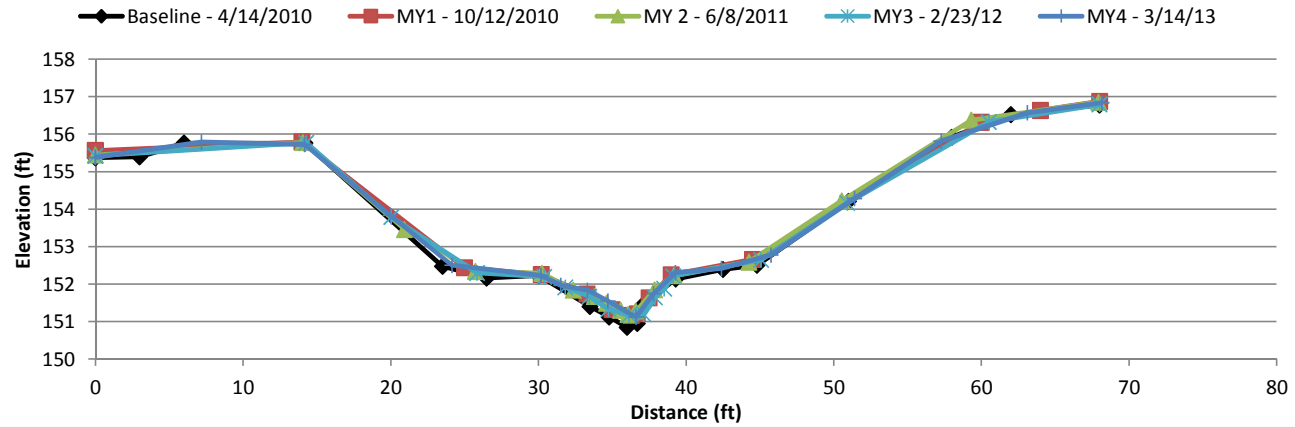
STA	ELEV
0.00	155.92
0.03	155.92
8.70	155.86
13.92	155.79
16.90	155.69
22.53	153.87
27.03	152.61
28.34	152.50
32.16	152.36
34.26	152.06
35.12	151.96
35.56	151.43
36.41	151.23
37.08	151.63
37.86	152.11
39.60	152.32
40.92	152.52
44.40	152.60
48.70	153.53
55.32	155.55
61.58	156.66
67.75	156.99
73.01	156.79



XS 4, Sta. 19+51, Looking Downstream

UT to the Lumber River, 002027

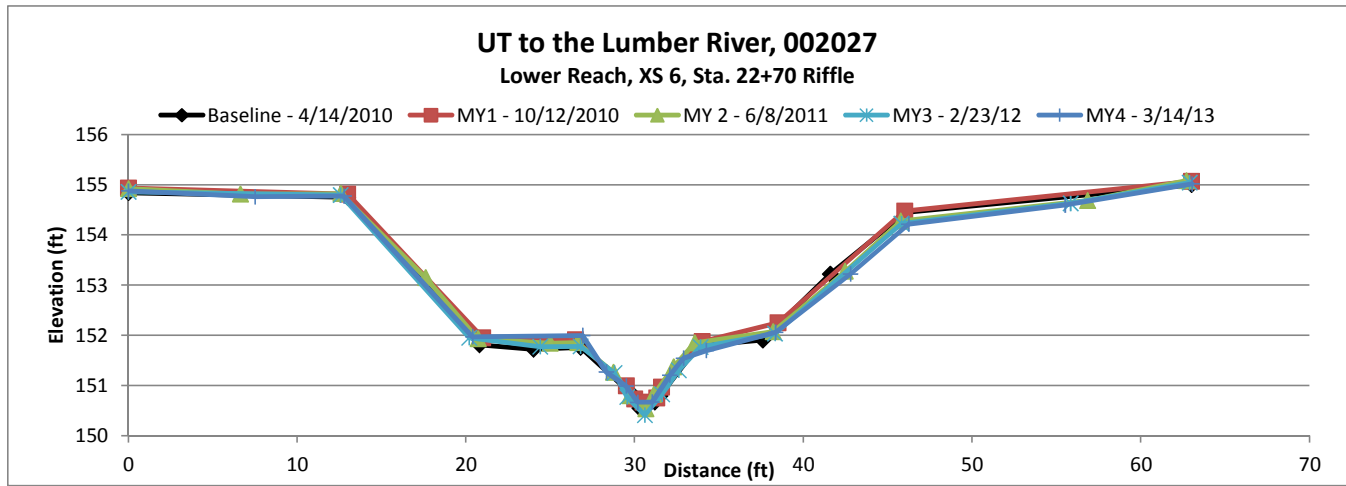
Upper Reach, XS 5, Sta. 20+58 Pool



STA	ELEV
0.00	155.38
7.20	155.79
14.17	155.73
19.97	153.83
24.15	152.50
30.17	152.23
31.52	151.97
33.33	151.83
34.71	151.54
36.61	151.12
37.81	151.75
39.28	152.31
42.39	152.42
45.76	152.78
51.42	154.29
57.29	155.82
63.11	156.57
68.16	156.84



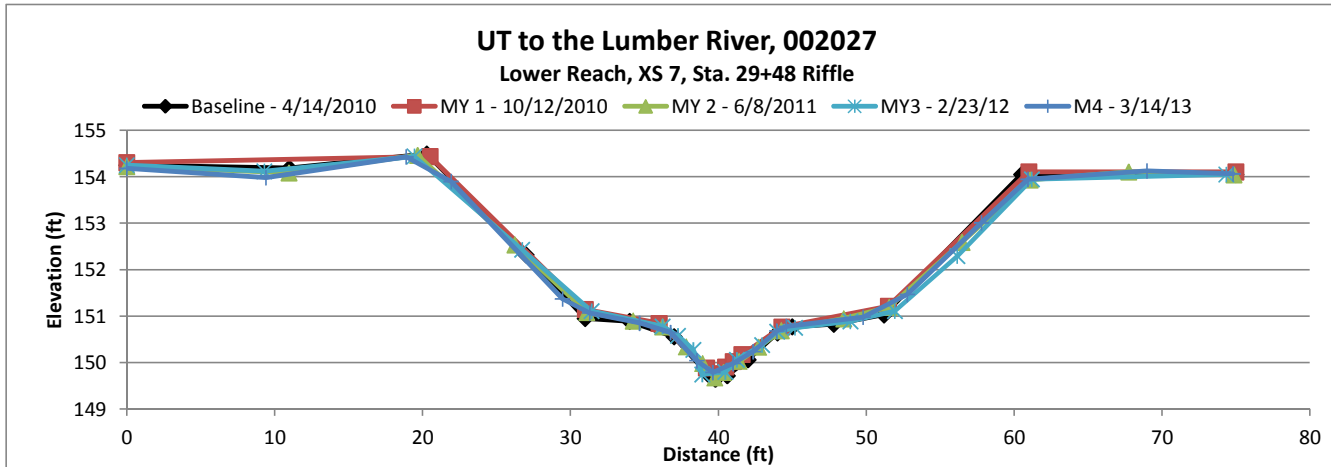
XS 5, Sta. 20+58, Looking Downstream



STA	ELEV
0.00	154.88
7.51	154.76
12.78	154.77
20.40	151.97
26.92	152.00
28.33	151.27
29.50	150.99
30.18	150.67
31.05	150.67
32.09	151.21
32.90	151.54
34.25	151.69
38.36	152.06
42.79	153.22
46.24	154.21
55.51	154.59
63.04	155.01



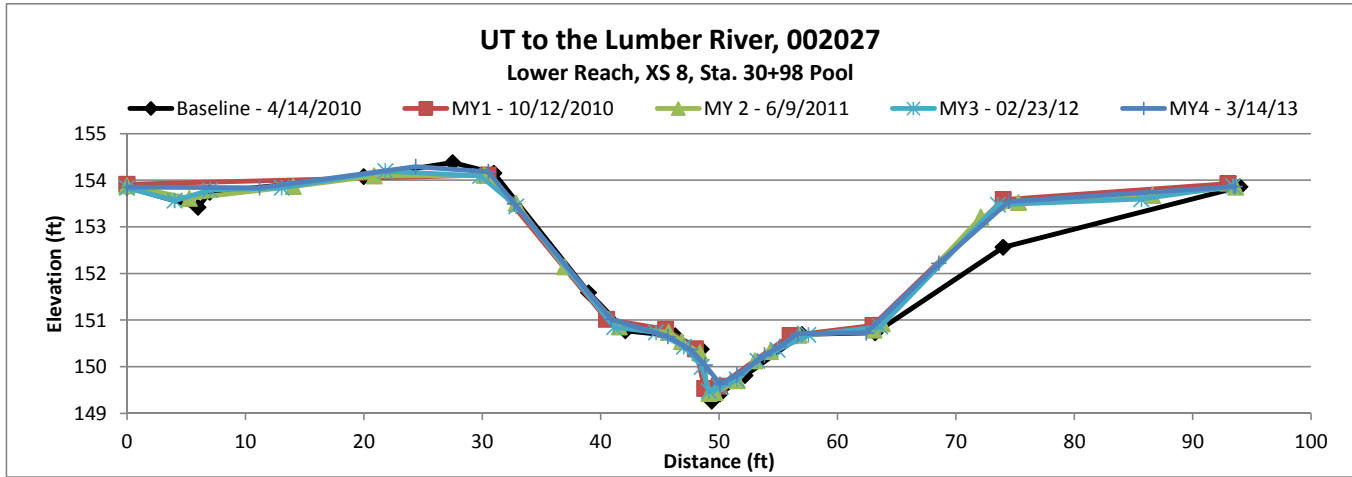
XS 6, Sta. 22+70, Looking Downstream



STA	ELEV
0.00	154.18
9.42	153.98
18.89	154.43
21.93	153.90
29.47	151.37
31.30	151.07
34.68	150.85
36.77	150.65
38.54	150.04
39.62	149.79
40.99	149.98
42.35	150.23
43.96	150.68
44.61	150.78
49.79	150.98
52.77	151.47
57.79	153.01
60.94	153.95
68.97	154.12
74.80	154.06



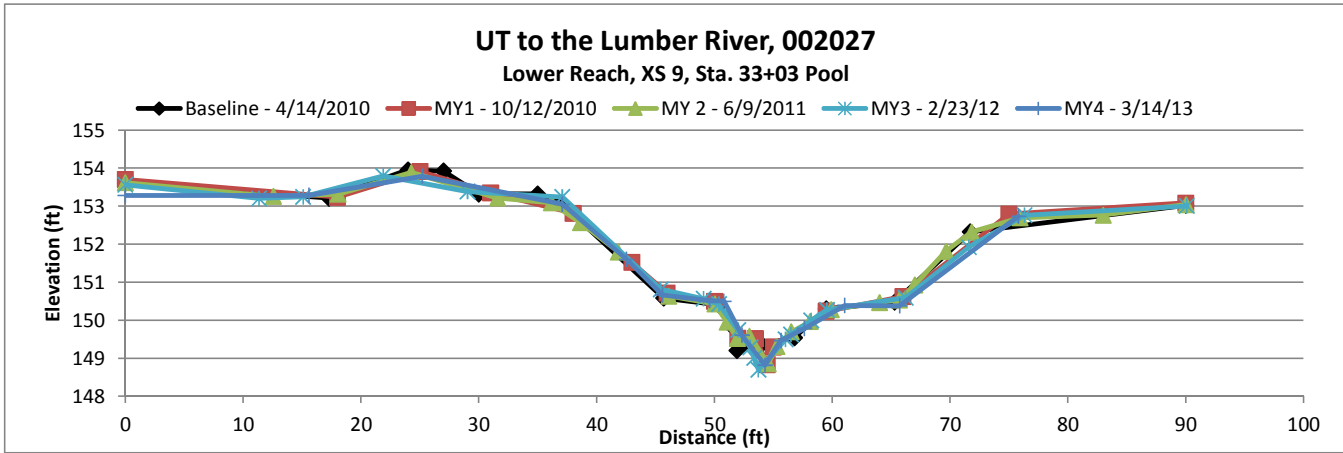
XS 7, Sta. 29+48, Looking Downstream



STA	ELEV
0.00	153.85
11.22	153.84
24.39	154.29
30.53	154.18
32.73	153.49
40.89	151.02
45.68	150.64
47.58	150.37
48.82	150.04
50.08	149.63
51.53	149.82
53.85	150.25
55.12	150.43
56.66	150.71
62.43	150.72
68.57	152.22
74.48	153.54
93.59	153.87



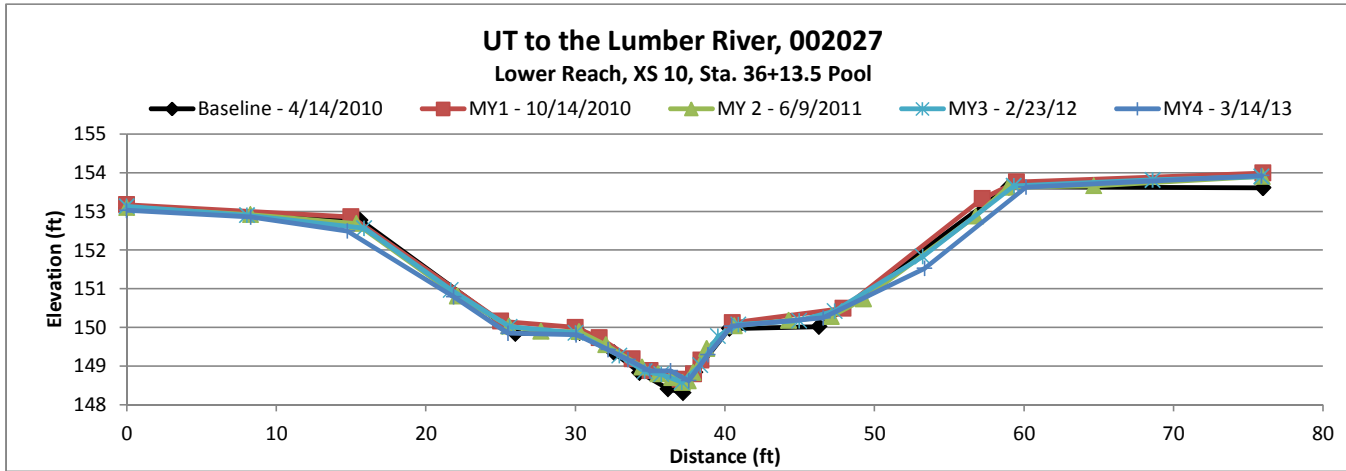
XS 8, Sta. 30+98, Looking Downstream



STA	ELEV
0.00	153.28
15.57	153.28
25.20	153.79
37.09	153.05
42.55	151.60
45.61	150.67
49.60	150.51
50.81	150.50
52.34	149.60
54.29	148.82
55.66	149.47
57.64	149.78
61.06	150.39
65.73	150.38
75.80	152.73
90.45	153.05



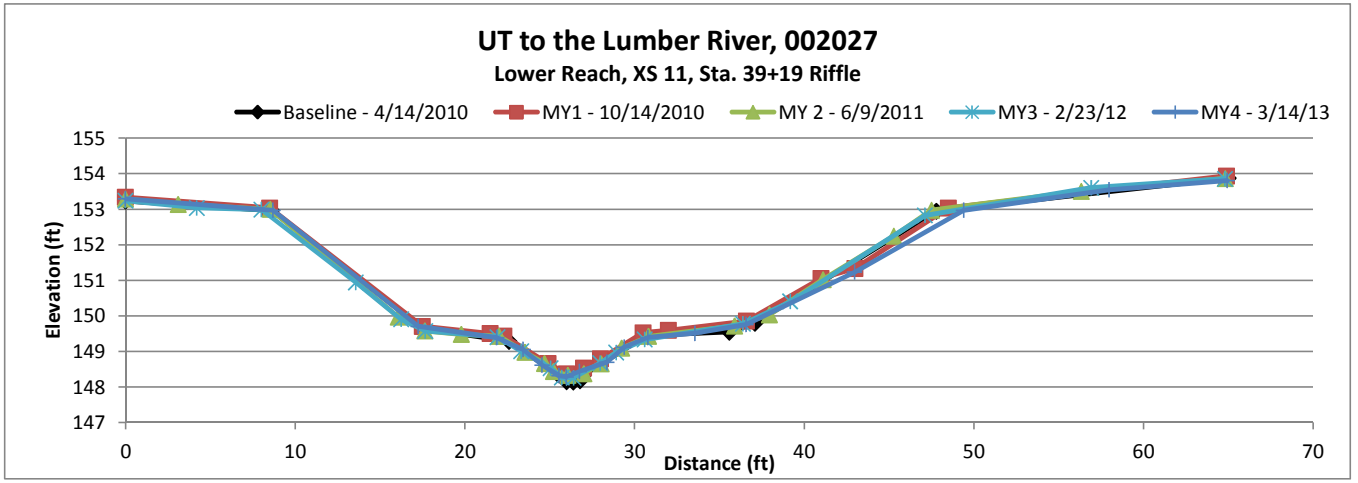
XS 9, Sta. 33+03, Looking Downstream



STA	ELEV
0.00	153.03
8.29	152.85
14.75	152.49
21.86	150.79
25.50	149.85
30.06	149.81
32.20	149.42
33.53	149.17
34.97	148.87
36.36	148.88
37.58	148.62
38.87	149.29
40.46	150.03
46.58	150.25
53.35	151.53
60.14	153.62
75.90	153.92



XS 10, Sta. 36+13.5, Looking Downstream



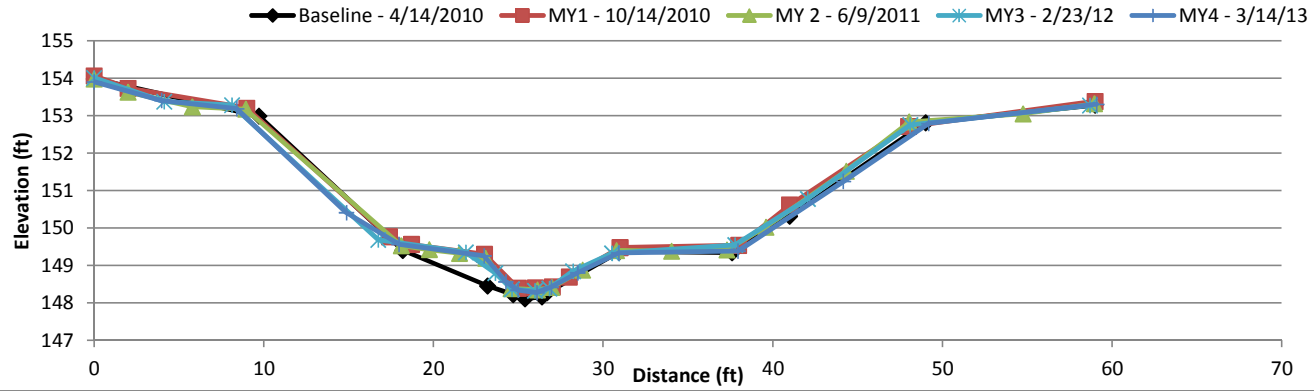
STA	ELEV
0.00	153.30
8.69	152.97
17.25	149.71
21.87	149.39
23.43	149.06
24.55	148.62
25.54	148.32
25.99	148.29
26.76	148.44
28.38	148.71
29.40	149.13
30.79	149.39
33.56	149.51
36.58	149.76
42.98	151.23
49.40	152.97
57.98	153.55
64.95	153.81



XS 11, Sta. 39+19, Looking Downstream

UT to the Lumber River, 002027

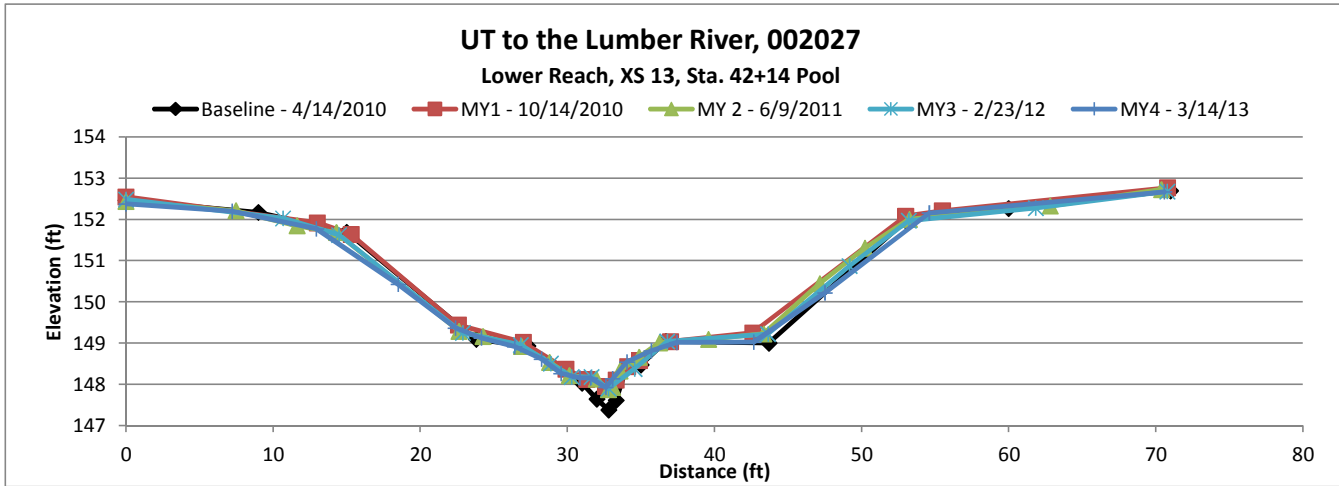
Lower Reach, XS 12, Sta. 39+82 Riffle



STA	ELEV
0.00	153.90
3.98	153.40
8.40	153.19
14.87	150.41
17.97	149.56
22.98	149.26
24.27	148.56
24.98	148.34
26.09	148.27
26.94	148.42
28.50	148.80
30.92	149.33
37.95	149.38
44.16	151.24
49.19	152.79
59.10	153.30



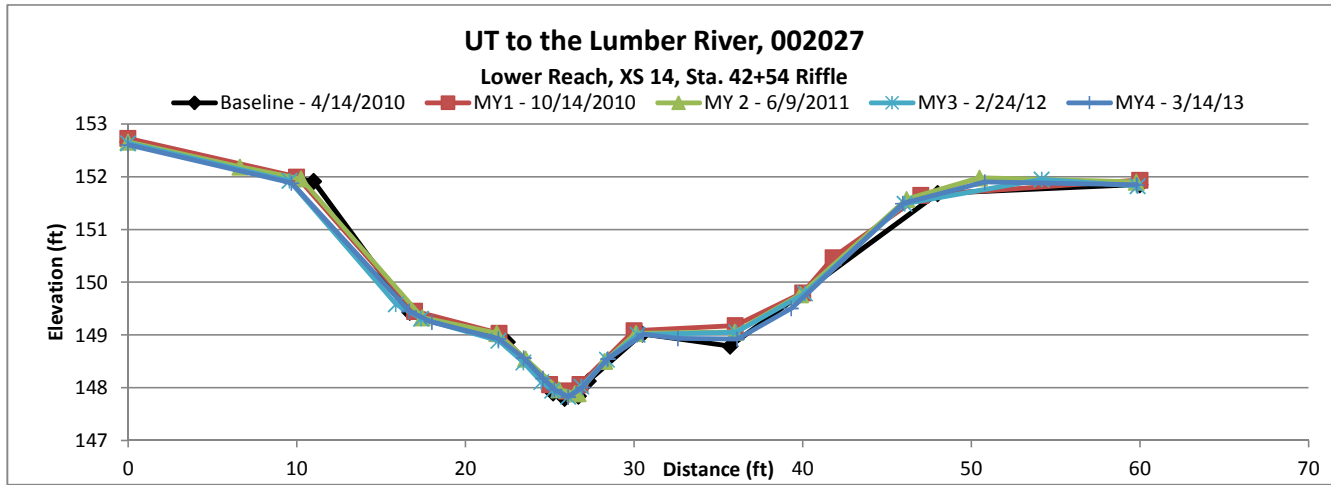
XS 12, Sta. 39+82, Looking Downstream



STA	ELEV
0.00	152.37
7.21	152.20
12.94	151.77
18.50	150.43
22.40	149.37
24.16	149.12
26.42	148.91
28.25	148.61
29.58	148.26
30.85	148.16
31.58	148.15
32.62	147.93
33.08	148.13
34.04	148.54
35.71	148.81
37.45	149.02
42.67	149.02
47.51	150.22
54.59	152.16
70.58	152.67



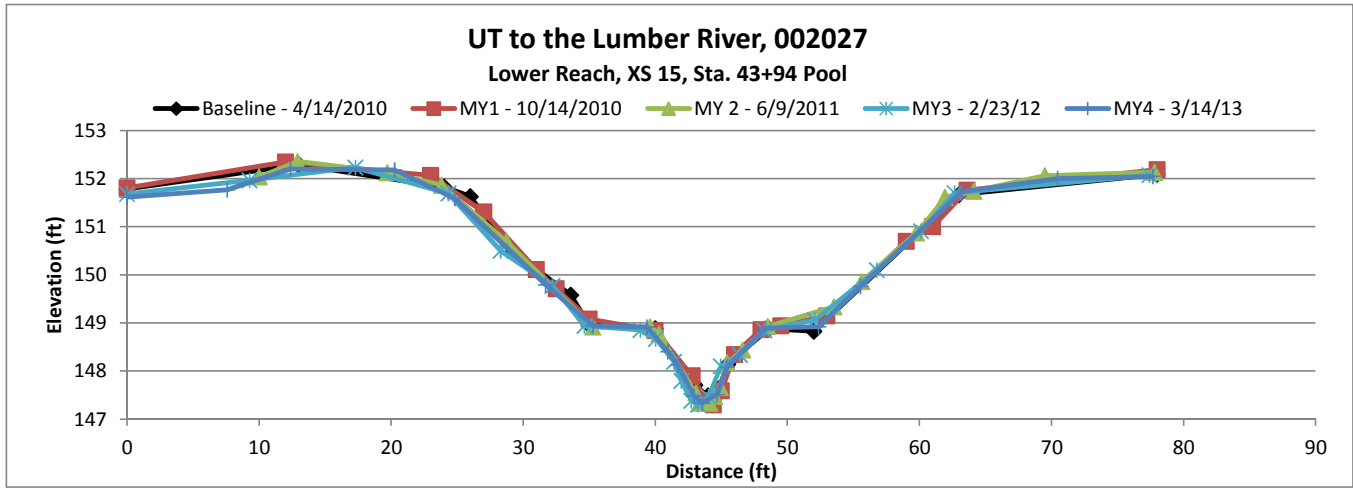
XS 13, Sta. 42+14, Looking Downstream



STA	ELEV
0.00	152.60
9.70	151.88
16.68	149.45
18.01	149.24
21.97	148.93
23.46	148.56
24.61	148.17
25.28	147.96
26.09	147.82
26.95	148.01
28.45	148.54
30.56	149.01
32.61	148.94
36.12	148.92
39.33	149.50
45.95	151.49
50.80	151.90
59.81	151.85



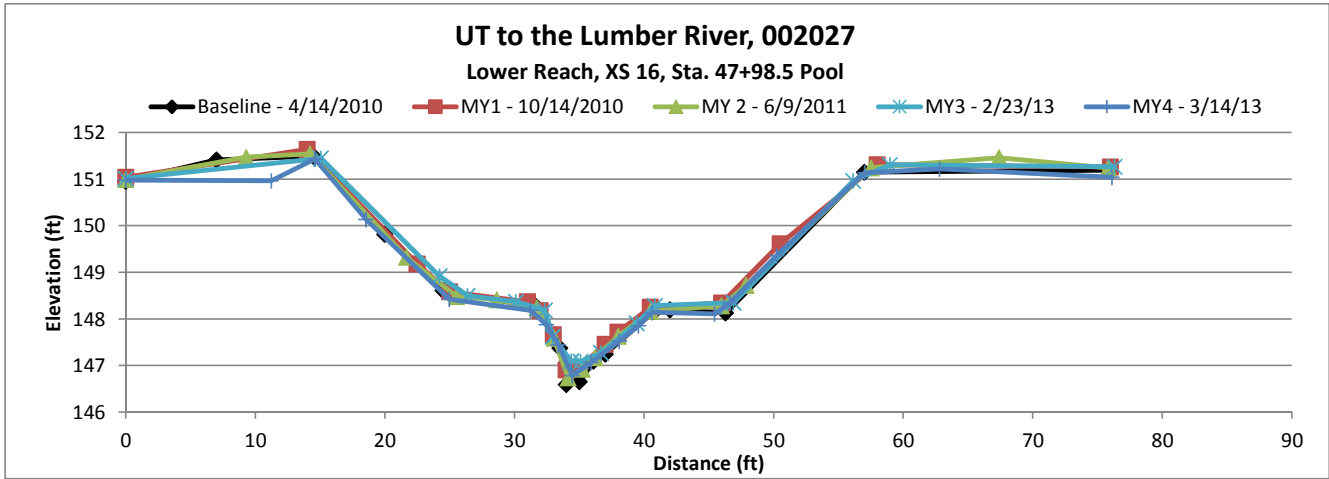
XS 14, Sta. 42+54, Looking Downstream



STA	ELEV
0.00	151.62
7.58	151.77
12.37	152.20
20.27	152.18
24.82	151.59
31.71	149.79
35.29	148.94
39.39	148.91
40.95	148.40
41.71	148.12
42.95	147.48
43.57	147.34
44.68	147.51
45.44	148.08
48.36	148.89
52.36	148.92
55.54	149.76
63.22	151.73
70.46	152.00
77.69	152.04



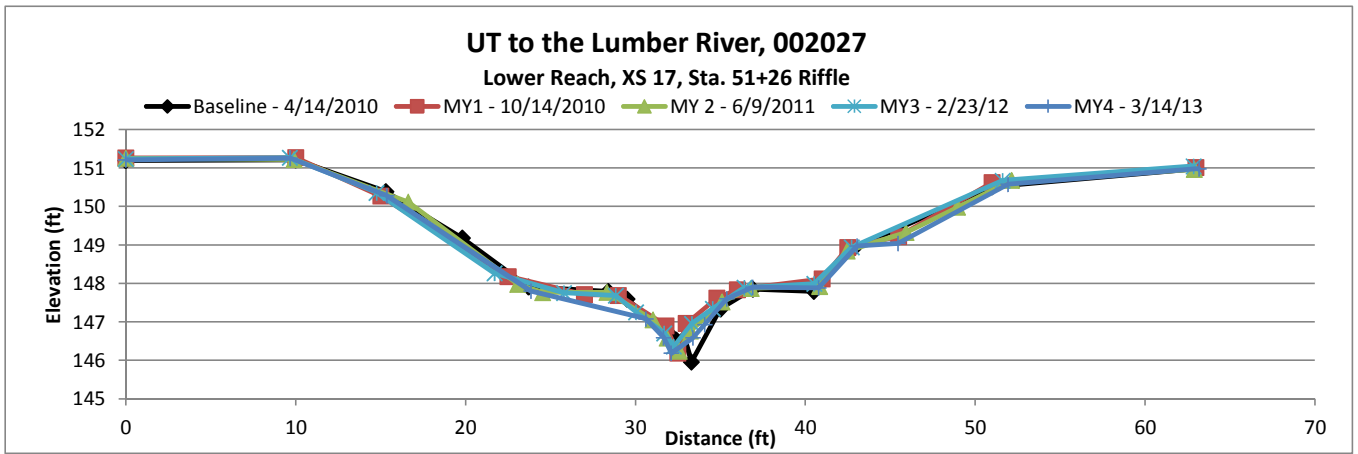
XS 15, Sta. 43+94, Looking Downstream



STA	ELEV
0.00	150.98
11.23	150.97
14.61	151.43
18.54	150.14
24.98	148.42
31.25	148.18
32.46	147.88
33.39	147.44
34.46	146.78
35.91	147.06
38.10	147.52
39.57	147.85
40.61	148.14
45.46	148.11
46.66	148.34
50.24	149.36
57.03	151.13
62.80	151.22
76.12	151.04



XS 16, Sta. 47+98.5, Looking Downstream



STA	ELEV
0.00	151.21
9.68	151.25
15.37	150.28
23.85	147.80
30.61	147.08
31.66	146.59
32.11	146.19
33.39	146.58
34.08	146.93
35.38	147.60
36.90	147.90
40.78	147.88
43.05	148.97
45.46	149.04
51.94	150.58
63.17	150.98



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

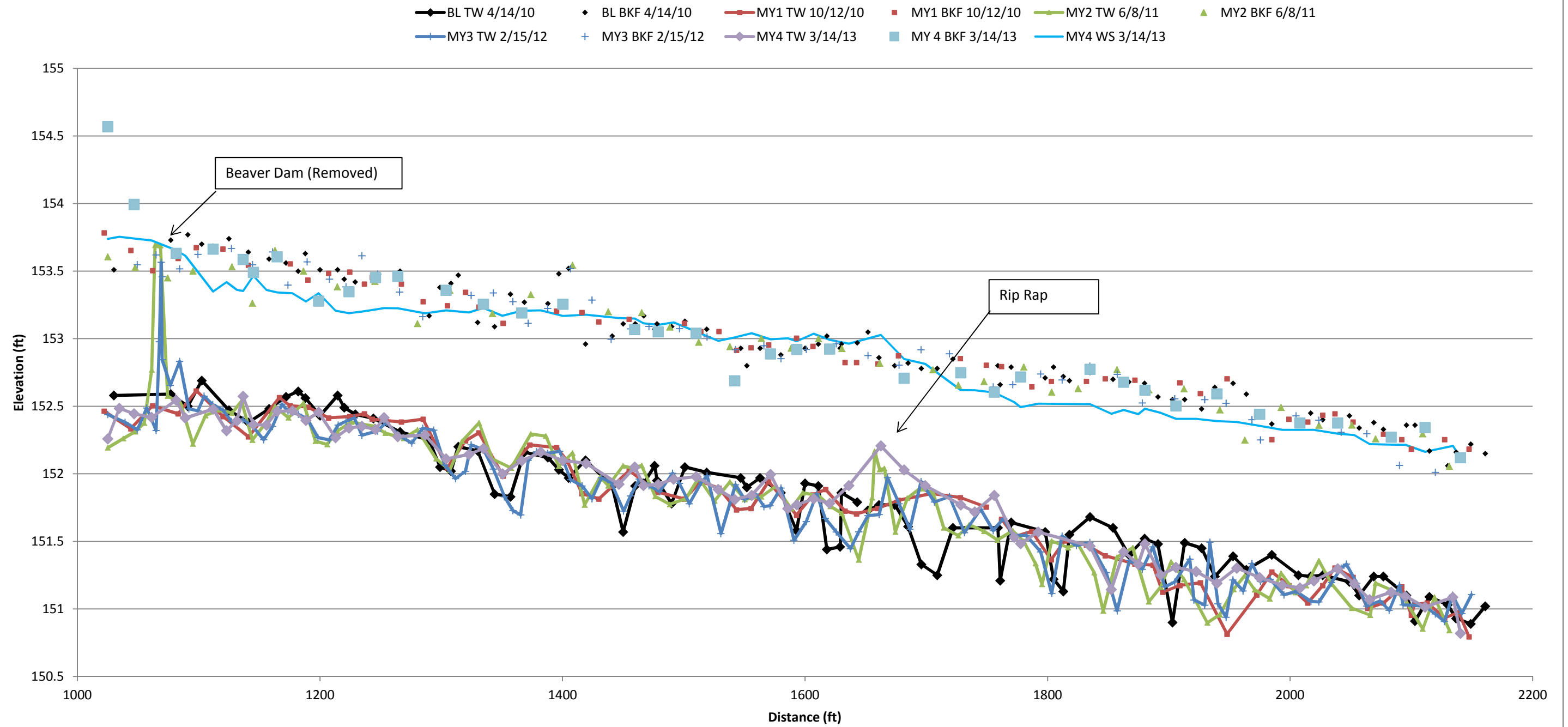


Figure 5.2 UT to the Lumber River, 002027, Lower Reach (1) Longitudinal Profile

- BL TW 4/14/10
- BL BKF 4/14/10
- MY1 TW 10/12/10
- MY1 BKF 10/12/10
- MY 2 TW 6/9/2011
- MY 2 BKF 6/9/2011
- MY3 TW 2/15/12
- MY 3 BK 2/15/12
- MY 4 TW 3/14/13
- MY 4 BKF 3/14/13
- MY 4 WS 3/14/13

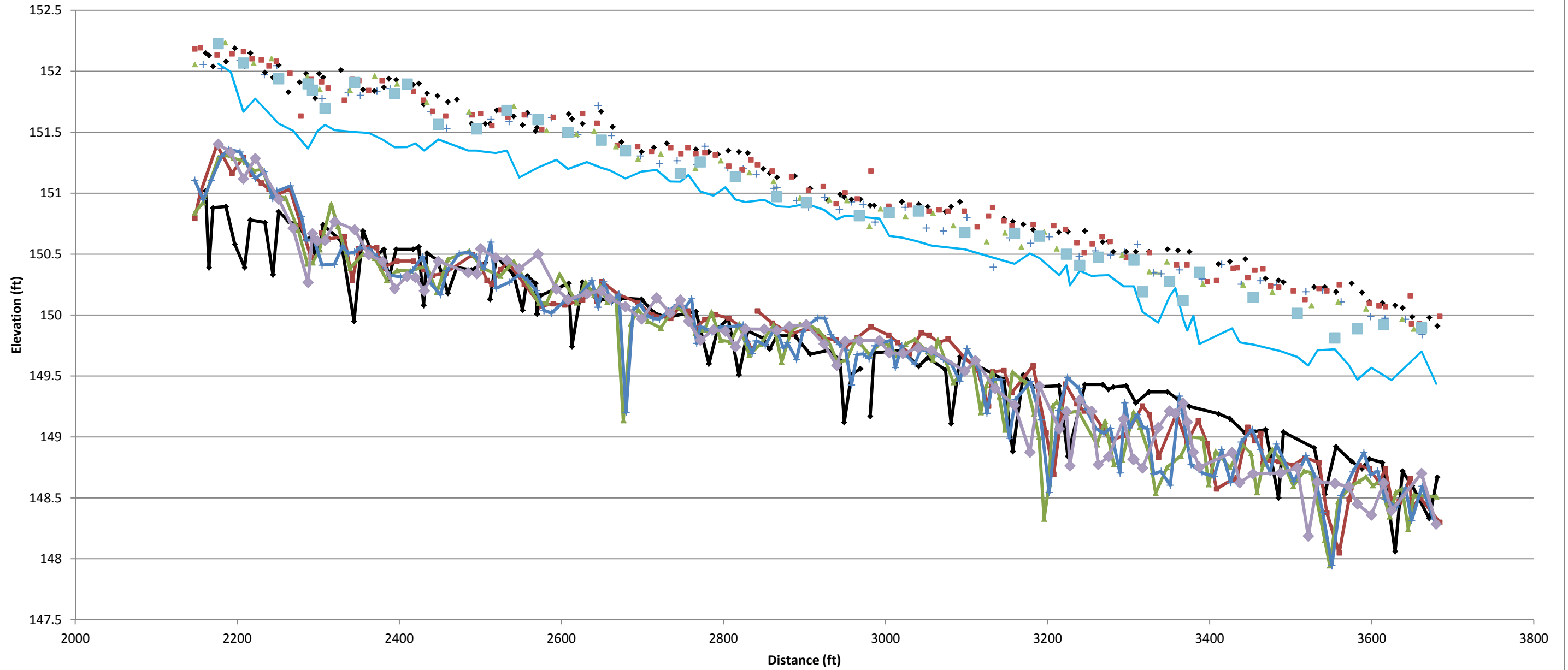


Figure 5.3 UT to the Lumber River, 002027, Lower Reach (2) Longitudinal Profile

- 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
- MY 4 TW 3/14/13
- MY 4 BKF 3/14/13
- MY4 WS 3/14/13

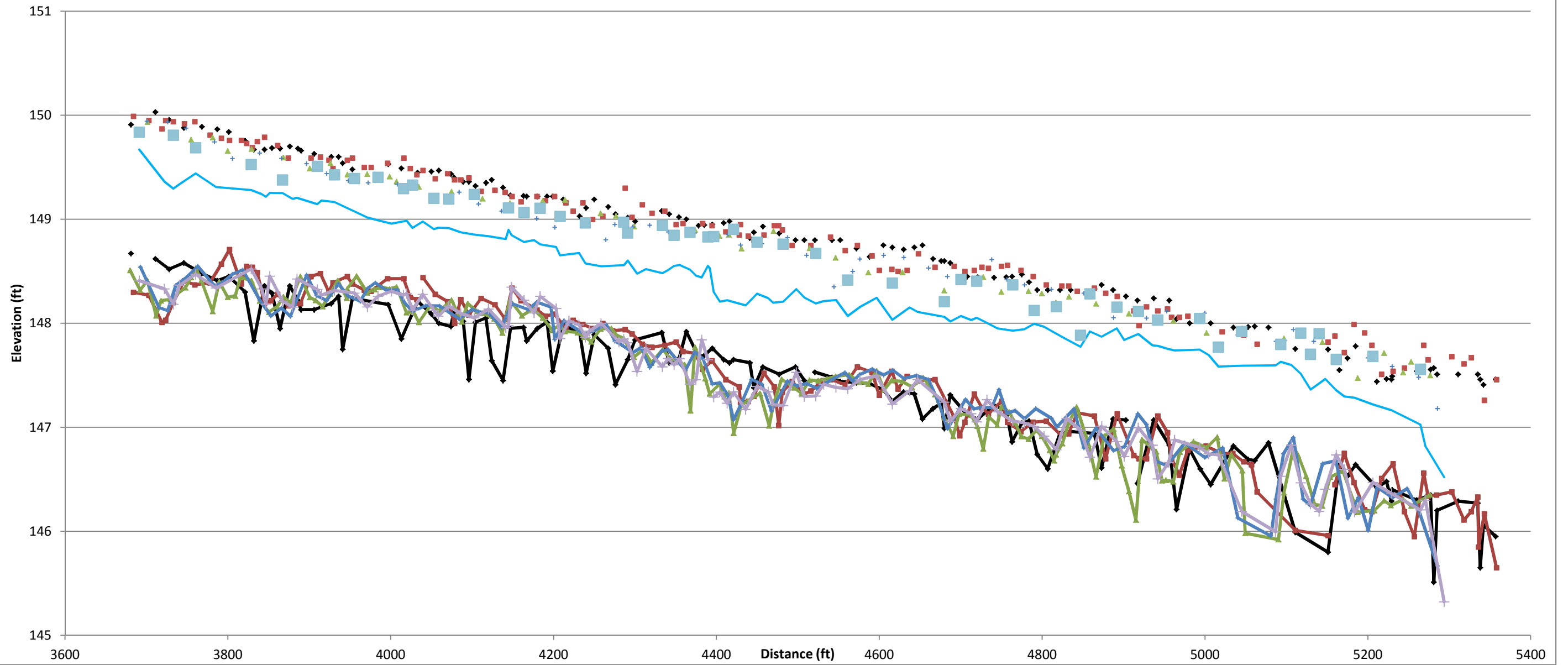


Table 10. Baseline Stream Data Summary
UT to the Lumber River Site, 002027
UT to the Lumber River: 4,285 feet

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.		Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Dimension and Substrate - Riffle				Mean	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
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 ⁹⁰ (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	
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	NA
Biological or Other				NA	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	7.37			8.66	7.75	8.22	7.94	7.61			8.47	9.32	7.01	7.65	8.11			7.79	6.13	5.73	5.47	7.58			8.92	8.74	9.25	8.78	8.89		
Floodprone Width (ft)	21.23	21.21	20.2	19.92	18.60			24.14	23.61	24.98	25.53	24.88			27.54	27.49	26.03	26.05	27.38			21.41	21.43	20.92	21.10	24.45			27.37	25.25	25.64	25.06	26.32		
Bankfull Mean Depth (ft)	0.63	0.69	0.65	0.59	0.40			0.45	0.43	0.44	0.49	0.46			0.64	0.52	0.53	0.53	0.55			0.46	0.46	0.43	0.43	0.39			0.64	0.55	0.51	0.58	0.5		
Bankfull Max Depth (ft)	1.3	1.3	1.22	1.22	1.03			0.94	0.91	1.07	1.10	1.04			1.12	1.12	1.00	1.00	1.06			0.96	0.98	0.93	0.94	1.12			1.29	1.08	1.07	1.03	1.11		
Bankfull Cross Sectional Area (ft ²)	3.56	4.08	3.61	4.08	2.97			3.92	3.32	3.62	3.93	3.53			5.45	4.89	3.68	4.02	4.48			3.56	2.84	2.46	2.36	2.97			5.69	4.85	4.76	5.07	4.48		
Bankfull Width/Depth Ratio	9	8.52	8.6	11.64	18.43			19.24	18.02	18.68	16.2	16.54			13.23	17.92	13.23	14.43	14.75			16.93	13.33	13.33	12.72	19.44			13.94	15.89	18.14	15.14	17.78		
Bankfull Entrenchment Ratio	3.74	3.61	3.61	2.9	2.52			2.79	3.05	3.04	3.21	3.27			3.25	2.95	3.72	3.41	3.38			2.75	3.5	3.65	3.86	3.23			3.07	2.89	2.77	2.85	2.96		
Bankfull Bank Height Ratio	1	1	1	1	1			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	7.86			7.73	8.03	7.76	9.08	8.85			11.85	9.67	9.77	8.05	10.62			8.91	8.96	9.56	8.8	9.93			9.78	10.24	9.9	10.04	10.02		
Floodprone Width (ft)	23.23	23.4	24.52	25.15	23.63			24.09	23.51	24.35	25.22	25.24			34.06	28.72	28.64	25.68	27.52			25.68	27.62	27.18	29.38	31.01			30.76	30.05	30.24	29.3	29.55		
Bankfull Mean Depth (ft)	0.63	0.63	0.62	0.63	0.52			0.52	0.5	0.5	0.47	0.49			0.56	0.55	0.53	0.45	0.48			0.69	0.6	0.61	0.68	0.70			0.8	0.73	0.68	0.68	0.62		
Bankfull Max Depth (ft)	1.22	1.2	1.31	1.37	1.11			1	0.88	1.02	1.01	0.97			1.43	1.13	1.18	0.92	1.02			1.1	1.4	1.43	1.57	1.55			1.55	1.34	1.32	1.28	1.19		
Bankfull Cross Sectional Area (ft ²)	4.4	4.66	4.27	4.56	4.09			4.02	4.02	3.85	4.29	4.31			6.63	5.36	5.18	3.61	5.09			6.1	5.35	5.87	6.00	6.90			7.86	7.46	6.72	6.87	6.22		
Bankfull Width/Depth Ratio	11.03	11.7	11.16	11.57	15.12			14.87	16.06	15.52	19.32	18.06			21.16	17.58	18.43	17.89	22.13			12.91	14.93	15.67	12.94	14.19			12.22	14.03	14.56	14.76	16.16		
Bankfull Entrenchment Ratio	3.34	3.18	3.55	3.45	3.01			3.12	2.93	3.14	2.78	2.85			2.88	2.97	2.93	3.19	2.59			2.88	3.08	2.84	3.34	3.12			3.15	2.93	3.05	2.92	2.95		
Bankfull Bank Height Ratio	1	1	1	1	1			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	8.71			7.8	7.32	6.97	8.7	8.29			10.56	9.91	9.64	10.29	11.66			8.7	7.84	8.23	7.79	7.88			8.6	7.92	8.3	9.36	9.85		
Floodprone Width (ft)	24.87	24.47	24.85	24.66	24.27			26.85	23.54	22.89	25.37	25.81			30.02	25.24	25.92	26.63	26.97			27.03	25.7	26.14	25.82	25.61			27.48	27.66	27.78	29.17	29.12		
Bankfull Mean Depth (ft)	0.57	0.57	0.59	0.55	0.56			0.73	0.57	0.54	0.56	0.55			0.63	0.55	0.52	0.57	0.47			0.64	0.61	0.61	0.56	0.53			0.69	0.71	0.73	0.69	0.69		
Bankfull Max Depth (ft)	1.23	1.13	1.1	1.11	1.08			1.27	0.91	0.85	1.01	1.02			1.61	1.07	1.09	1.10	1.06			1.22	1.09	1.14	1.06	1.07			1.4	1.54	1.52	1.55	1.56		
Bankfull Cross Sectional Area (ft ²)	5.15	5.05	5.26	4.98	4.87			5.7	4.15	3.79	4.9	4.59			6.68	5.45	4.99	5.83	5.50			5.59	4.78	5.01	4.36	4.21			5.94	5.6	6.07	6.42	6.83		
Bankfull Width/Depth Ratio	15.74	15.67	15.03	16.4	15.55			10.68	12.84	12.91	15.54	15.07			16.76	18.02	18.54	18.05	24.81			13.59	12.85	13.49	13.91	14.87			12.46	11.15	11.37	13.57	14.28		
Bankfull Entrenchment Ratio	2.77	2.74	2.8	2.73	2.79			3.44	3.22	3.29	2.92	3.11			2.84	2.55	2.69	2.59	2.31			3.11	3.28	3.18	3.32	3.25			3.19	3.49	3.35	3.12	2.96		
Bankfull Bank Height Ratio	1	1	1	1	1			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	9.3			8.28	6.18	8	6.83	10.77																							
Floodprone Width (ft)	32.36	29.35	30.41	27.97	30.12			28.3	26.31	26.66	23.69	26.84																							
Bankfull Mean Depth (ft)	0.81	0.68	0.7	0.67	0.68			0.69	0.52	0.61	0.58	0.56																							
Bankfull Max Depth (ft)	1.62	1.34	1.42	1.14	1.38			1.83	1.5	1.53	1.31	1.49																							
Bankfull Cross Sectional Area (ft ²)	7.27	6.06	6.01	5.89	6.3			5.74	3.2	4.89	3.99	5.99																							
Bankfull Width/Depth Ratio	11.11	13.04	12.31	13.21	13.68			12	11.88	13.11	11.78	19.23																							
Bankfull Entrenchment Ratio	3.6	3.31	3.53	3.16	3.24			3.42	4.26	3.33	3.47	2.49																							
Bankfull Bank Height Ratio	1	1	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	6.66	7.65	7.37	7.69	8.11			
Floodprone Width (ft)	21.23	23.39	27.54	21.21	23.38	27.49	20.20	22.38	26.03	19.92	22.36	26.05	18.60	23.48	27.38			
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	0.39	0.45	0.55			
Bankfull Max Depth (ft)	0.96	1.13	1.30	0.98	1.13	1.30	0.93	1.05	1.22	0.94	1.05	1.22	1.03	1.07	1.12			
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	3.49	4.08	2.97	3.47	4.48			
Bankfull Width/Depth Ratio	9.00	13.05	16.93	8.52	13.26	17.92	8.60	11.72	13.33	11.64	12.93	14.43	14.75	17.54	19.44			
Bankfull Entrenchment Ratio	2.75	3.25	3.74	2.95	3.35	3.61	3.61	3.66	3.72	2.90	3.39	3.86	2.52	3.04	3.38			
Bankfull Bank Height Ratio	1	1	1	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	7.2	43.6	77.3			
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	0.0000	0.0023	0.0062			
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	9.50	32.90	91.10			
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	0.99	1.24	1.52			
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	24.68	68.27	156.93			
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			E5					
Channel Thalweg length (ft)	1162			1113			1106			1120			1123					
Sinuosity (ft)	1.25			1.21			1.20			1.22			1.22					
Water Surface Slope (Channel) (ft/ft)	0.0018			0.00163			0.00127			0.0015			0.0015					
BF slope (ft/ft)	0.0018			0.00143			0.0014			0.0014			0.0015					
³ R1% / P%	44.1 / 55.9			44.8 / 55.2			44.6 / 55.4			43.1 / 56.9			49.9 / 50.1					
³ SC% / Sa% / G% / C% / B% / Be%																		
³ d16 / d35 / d50 / d84 / d95																		
⁷ % 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	8.12	9.08	7.86	8.73	10.77			
Floodprone Width (ft)	23.23	25.73	28.30	23.40	24.49	26.31	22.89	24.90	26.66	23.69	24.99	25.82	23.63	25.23	26.84			
Bankfull Mean Depth (ft)	0.52	0.63	0.73	0.50	0.57	0.63	0.50	0.58	0.62	0.47	0.56	0.63	0.49	0.54	0.56			
Bankfull Max Depth (ft)	1.00	1.30	1.83	0.88	1.12	1.50	0.85	1.16	1.53	1.01	1.15	1.37	0.97	1.12	1.49			
Bankfull Cross Sectional Area (ft ²)	4.02	5.10	5.74	3.20	4.31	5.05	3.79	4.51	5.26	3.99	4.51	4.98	4.09	4.68	5.99			
Bankfull Width/Depth Ratio	10.68	12.99	15.74	11.70	13.50	16.06	11.16	13.54	15.52	11.57	14.75	19.32	14.87	16.32	19.23			
Bankfull Entrenchment Ratio	2.77	3.20	3.44	2.74	3.27	4.26	2.80	3.22	3.55	2.73	3.11	3.47	2.49	2.92	3.25			
Bankfull Bank Height Ratio	1	1	1	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	14.68	73.06	235.25			
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	0.000797	0.0030	0.0090			
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	15.73	45.95	145.44			
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	0.88	1.43	2.10			
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	22.86	102.80	280.29			
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			E5					
Channel Thalweg length (ft)	*3123			*3166			*3129			*3138			*3142					
Sinuosity (ft)	1.25			1.26			1.25			1.26			1.25					
Water Surface Slope (Channel) (ft/ft)	0.00154			0.00169			0.00159			0.00142			0.0018					
BF slope (ft/ft)	0.00154			0.00149			0.00145			0.00144			0.0015					
² Ri% / P%	49.3 / 50.7			48.7 / 51.3			46.1 / 53.9			44.3 / 55.7			53.8 / 46.2					
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

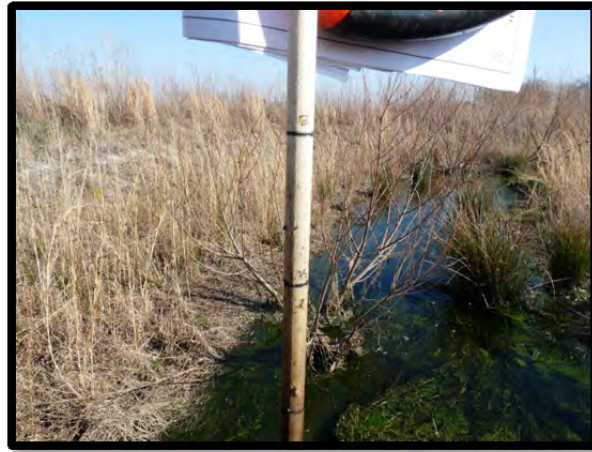
Appendix E. Hydrologic Data

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
3/14/2013	XS 8	30+90	1.75	149.5	151.25	150.8	0.45	6.3



Figures 6.1 & 6.2 2012 Crest Gauge Photos

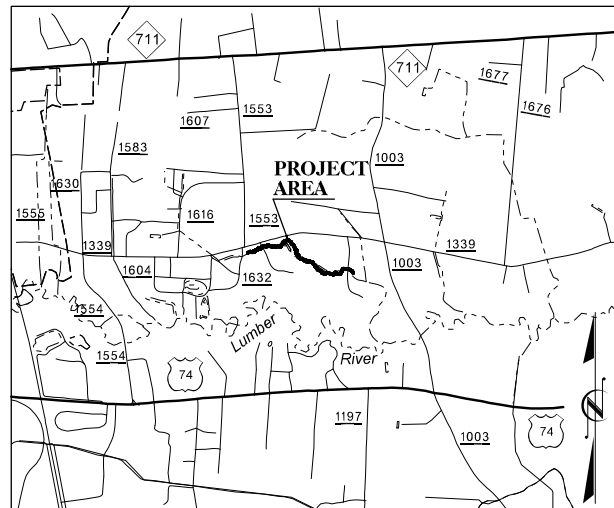


Figures 7.3 2013 Crest Gauge Photo

Appendix F. Supplemental Planting Plan

12/21/2012 R:\Stream\Proj\Construction Plans\Revised Planting Plans 2010_03_29\LumberRiver_tsh_pl_i.dgn
 Florence & Hutcheson, Inc.

CONTRACT: UT TO THE LUMBER RIVER DENR# 002027



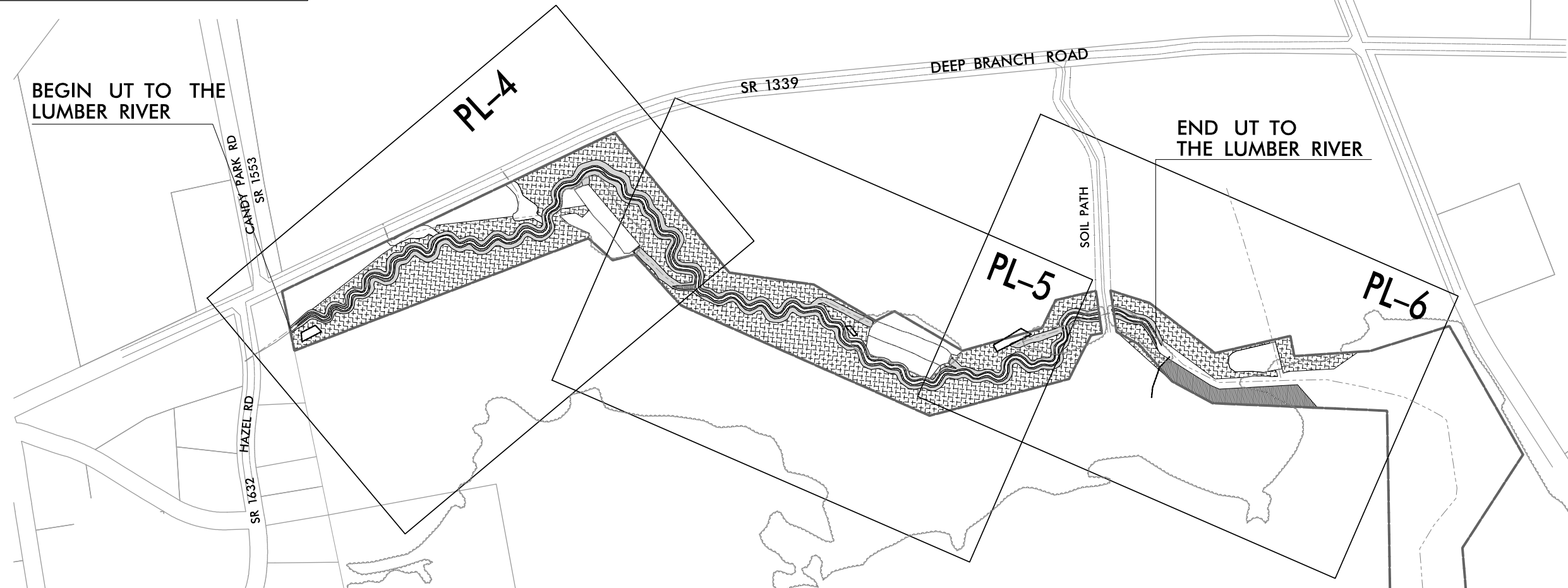
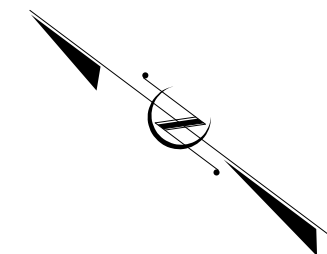
VICINITY MAP

SUPPLEMENTAL PLANTING PLANS UT TO THE LUMBER RIVER

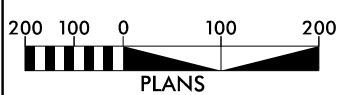
LOCATION: ROBESON COUNTY, NORTH CAROLINA
LAT: 34°39'08.98" LONG: 79°10'59.23"
TYPE OF WORK: PLANTING PLAN

STATE	UT TO THE LUMBER RIVER	SHEET NO.	TOTAL SHEETS
N.C.		PL-1	PL-6

Symbol	Description	
	Channel Side Slope	8600 LF.
	Terrace	11.05 Ac.
	Terrace Side Slope	1.8 Ac.
	Floodplain	1.0 Ac.



GRAPHIC SCALES



PROJECT LENGTH

PLANTING ACREAGE = 13.90 ACRES
 STREAM PLANTING LENGTH = 4,500 FEET

INDEX OF SHEETS

TITLE SHEET.....PL-1
 DETAILS.....PL-2
 SITE MAP.....PL-3
 PLAN SHEETS.....PL-4 - PL-6

Prepared in the Office of:



Florence & Hutcheson

An **ICA** Company

5121 Kingdom Way, Suite 100 Raleigh, NC 27607

NC License No: F-0258

RYAN V. SMITH
PROJECT MANAGER

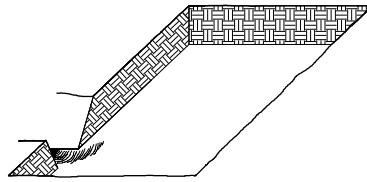
R. KEVIN WILLIAMS
PROJECT ENGINEER

CHRISTOPHER L. SMITH
PROJECT DESIGNER

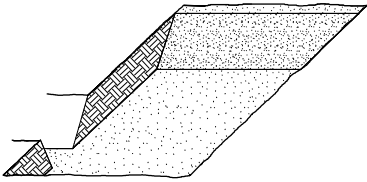
PLANTING DETAILS
SEEDLING / LINER BAREROOT PLANTING DETAIL

HEALING IN

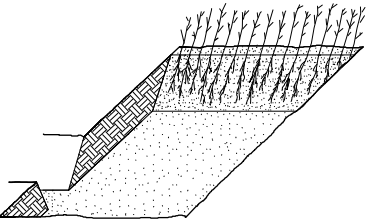
1. Locate a healing-in site in a shady, well protected area.
2. Excavate a flat bottom trench 12IN. deep and provide drainage.



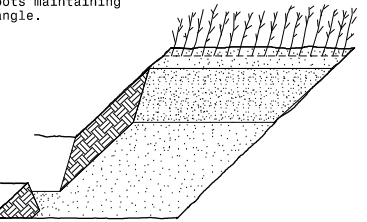
3. Backfill the trench with 2IN. of compost. Place a 2IN. layer of compost at a sloping angle at one end of the trench.



4. Place a single layer of plants against the sloping end so that the root collar is at ground level.



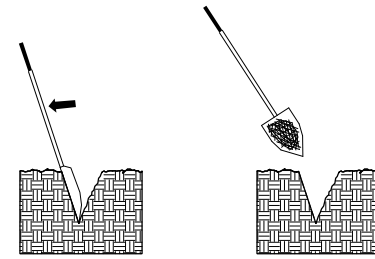
5. Place a 2IN. layer of compost over the roots maintaining a sloping angle.



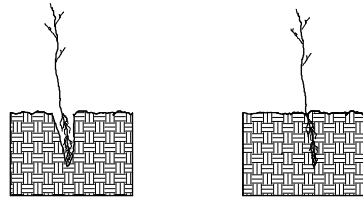
6. Repeat layers of plants and compost as necessary and water thoroughly.

TREE REFORESTATION SHALL BE PLANTED 8' ON CENTER, RANDOM SPACING, APPROXIMATELY 260 PLANTS PER ACRE.

PLANTING METHOD USING A SHOVEL



1. Dig hole with shovel to appropriate depth and width for seedling.
2. Remove soil from hole with shovel. Hole shall not be made by compacting soil away from the hole.



3. Remove shovel and place seedling at correct depth.
4. Fill hole with soil. Tamp soil to remove air pockets. Water Thoroughly.

PLANTING NOTES:

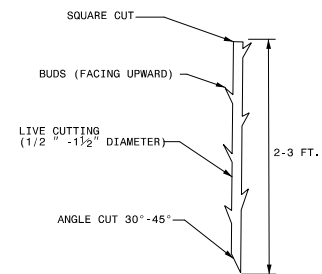
PLANTING BAG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 24inches (24IN.) below the root collar.

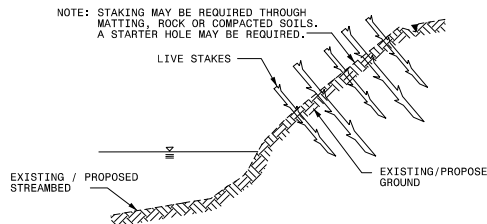


LIVE STAKE DETAIL

SCALE: NTS



LIVE STAKE



NOTE: STAKING MAY BE REQUIRED THROUGH MATTING, ROCK OR COMPACTED SOILS. A STARTER HOLE MAY BE REQUIRED.

1. PLACE ONE LIVE STAKE AT TOP OF BANKFULL CHANNEL AND THEN THE NEXT LIVE STAKE AT THE TOE OF BANKFULL CHANNEL IN AN ALTERNATING PATTERN.
2. LIVE STAKES SHALL BE EVENLY SPACED 4 FT. APART.
3. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF LIVE STAKE IS WITHIN GROUND.
4. IF STARTER HOLE IS NEEDED, MINIMIZE AIR POCKET.
5. UTILIZE ALL ON SITE TRANSPLANT MATERIALS MADE AVAILABLE BY THE OWNER, ONCE SOURCE OF TRANSPLANT MATERIAL HAS BEEN HARVESTED, THEN UTILIZE LIVE STAKING.

BANK STABILIZATION WITH LIVE STAKES

PLANTING TABLE

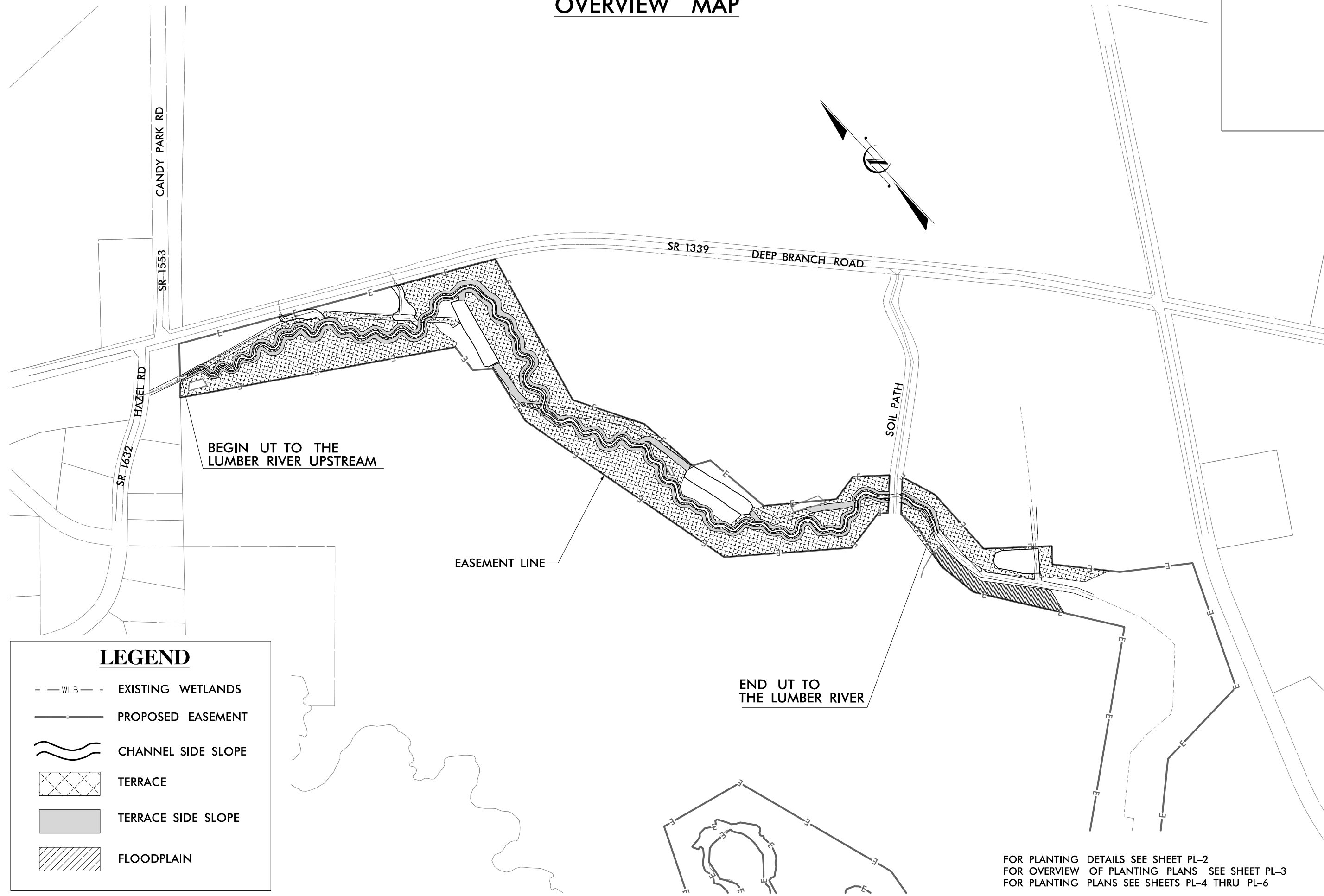
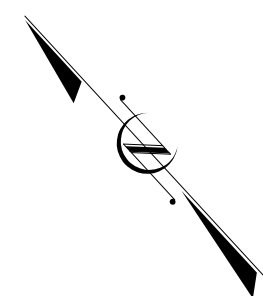
									Acres to be Planted			11.05
Species	Common Name	Max Spacing (Ft)	Unit Type*	Size**	Indiv. Spacing (Ft)	% of Total	# of Stems	lbs per Acre	Total lbs			
Terrace									11.05			
<i>Betula nigra</i>	River Birch	16	R	2-3'	16	33	620					
<i>Fraxinus pennsylvanica</i>	Green Ash	16	R	2-3'	16	33	620					
<i>Platanus occidentalis</i>	Sycamore	16	R	2-3'	16	34	639					
Total									100	1879		
Floodplain									1.00			
<i>Betula nigra</i>	River Birch	8	R	2-3'	8	25	170					
<i>Fraxinus pennsylvanica</i>	Green Ash	8	R	2-3'	8	25	170					
<i>Platanus occidentalis</i>	Sycamore	8	R	2-3'	8	25	170					
<i>Salix nigra</i>	Black Willow	8	L	2-3'	8	7.5	51					
<i>Cornus amomum</i>	Silky Dogwood	8	L	2-3'	8	10	68					
<i>Cephalanthus occidentalis</i>	Button Bush	8	L	2-3'	8	7.5	51					
Total									100	680		
Channel Side Slope									8600.00			
<i>Salix nigra</i>	Black Willow	6	L	2-3'	6	33	473					
<i>Cornus amomum</i>	Silky Dogwood	6	L	2-3'	6	33	473					
<i>Cephalanthus occidentalis</i>	Button Bush	6	L	2-3'	6	34	487					
Total									100	1433		
Terrace Side Slope									1.80			
<i>Betula nigra</i>	River Birch	12	R	2-3'	12	33	180					
<i>Fraxinus pennsylvanica</i>	Green Ash	12	R	2-3'	12	33	180					
<i>Platanus occidentalis</i>	Sycamore	12	R	2-3'	12	34	185					
Total									100	545		

* Unit Type choices include: Transplant (T), Lives stake (L), Ball and Burlap (B), Pot (P), Tubling (T), Bare Root (R), Mechanically Planted (M), and Seed (S)

** Size units may vary, but must be stated.



SUPPLEMENTAL PLANTING PLAN OVERVIEW MAP



LEGEND

- - WLB - - EXISTING WETLANDS
- PROPOSED EASEMENT
- CHANNEL SIDE SLOPE
- TERRACE
- TERRACE SIDE SLOPE
- FLOODPLAIN

12/21/2012
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 Florence & Hutcheson, Inc.

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

NOT TO SCALE

DATE: 12-2012

SUPPLEMENTAL
PLANTING PLAN
OVERVIEW
MAP

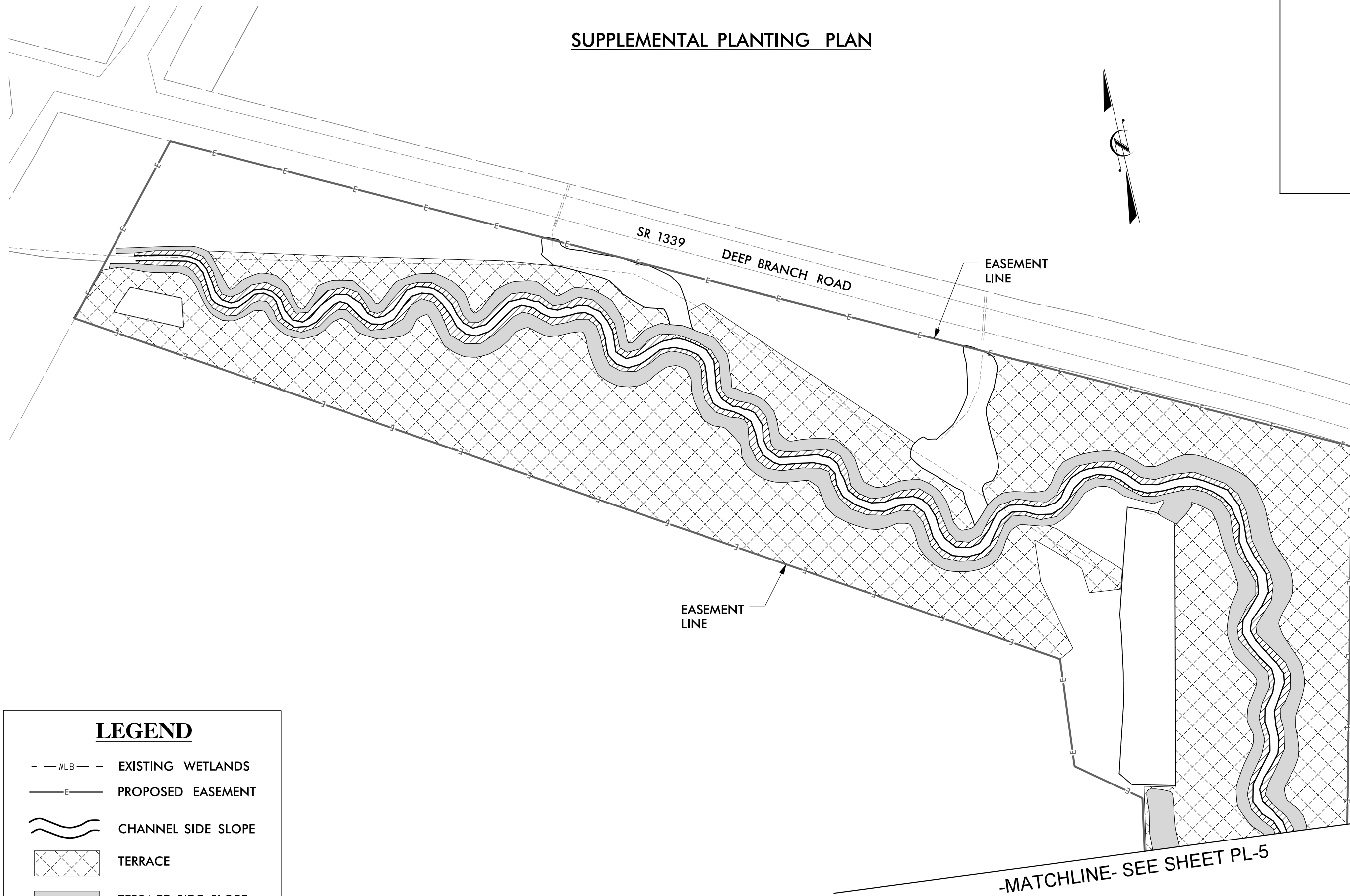
SHEET

PL-3

OF PL-6

FOR PLANTING DETAILS SEE SHEET PL-2
 FOR OVERVIEW OF PLANTING PLANS SEE SHEET PL-3
 FOR PLANTING PLANS SEE SHEETS PL-4 THRU PL-6

SUPPLEMENTAL PLANTING PLAN



SR 1339

DEEP BRANCH ROAD

EASEMENT LINE

EASEMENT LINE

-MATCHLINE- SEE SHEET PL-5

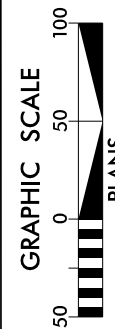
LEGEND

- WLB --- EXISTING WETLANDS
- E — PROPOSED EASEMENT
- ~ ~ ~ CHANNEL SIDE SLOPE
- ▨ TERRACE
- TERRACE SIDE SLOPE
- ▧ FLOODPLAIN

12/21/2012 C:\stream\Proj\Construction Plans\Revised Planting Plans 2010.03.29\LumberRiver_psh_pl_4.dgn Florence & Hutcheson, Inc.

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ROBESON COUNTY, NORTH CAROLINA



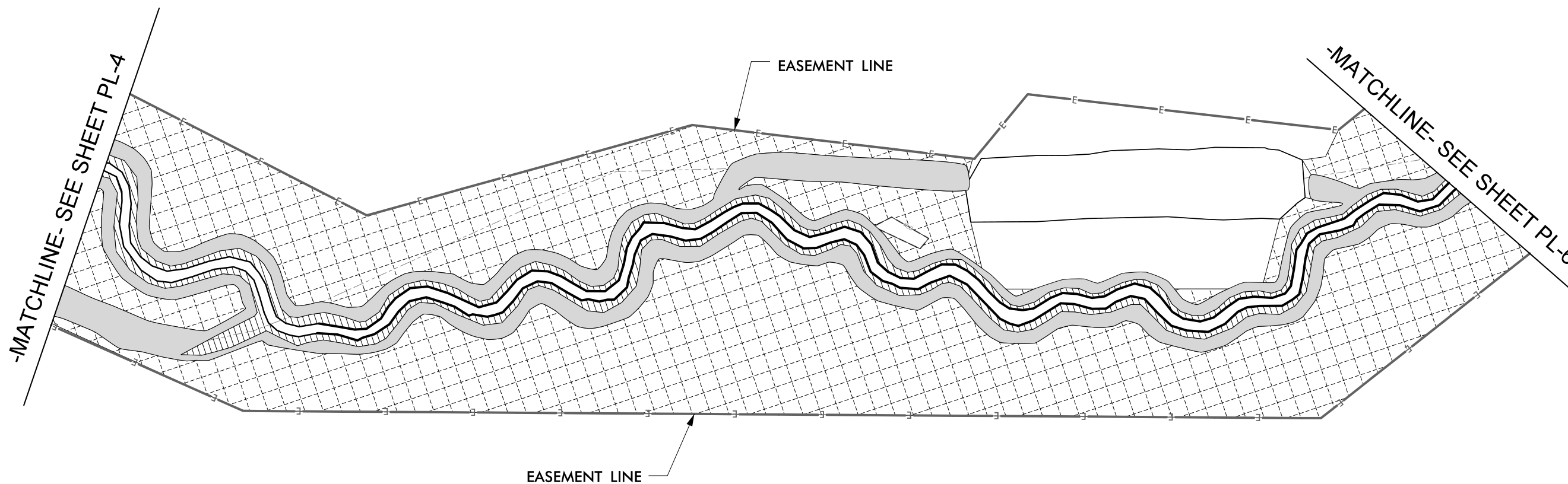
DATE: 12-2012

SUPPLEMENTAL
PLANTING
PLAN

SHEET
PL-4
OF PL-6

FOR PLANTING DETAILS SEE SHEET PL-2
FOR OVERVIEW OF PLANTING PLANS SEE SHEET PL-3
FOR PLANTING PLANS SEE SHEETS PL-4 THRU PL-6


SUPPLEMENTAL PLANTING PLAN



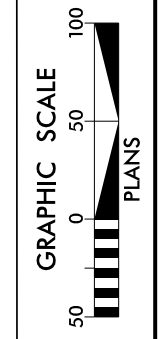
LEGEND	
--- WLB ---	EXISTING WETLANDS
— E —	PROPOSED EASEMENT
~~~~~	CHANNEL SIDE SLOPE
▨	TERRACE
■	TERRACE SIDE SLOPE
▩	FLOODPLAIN

FOR PLANTING DETAILS SEE SHEET PL-2  
 FOR OVERVIEW OF PLANTING PLANS SEE SHEET PL-3  
 FOR PLANTING PLANS SEE SHEETS PL-4 THRU PL-6

12/21/2012  
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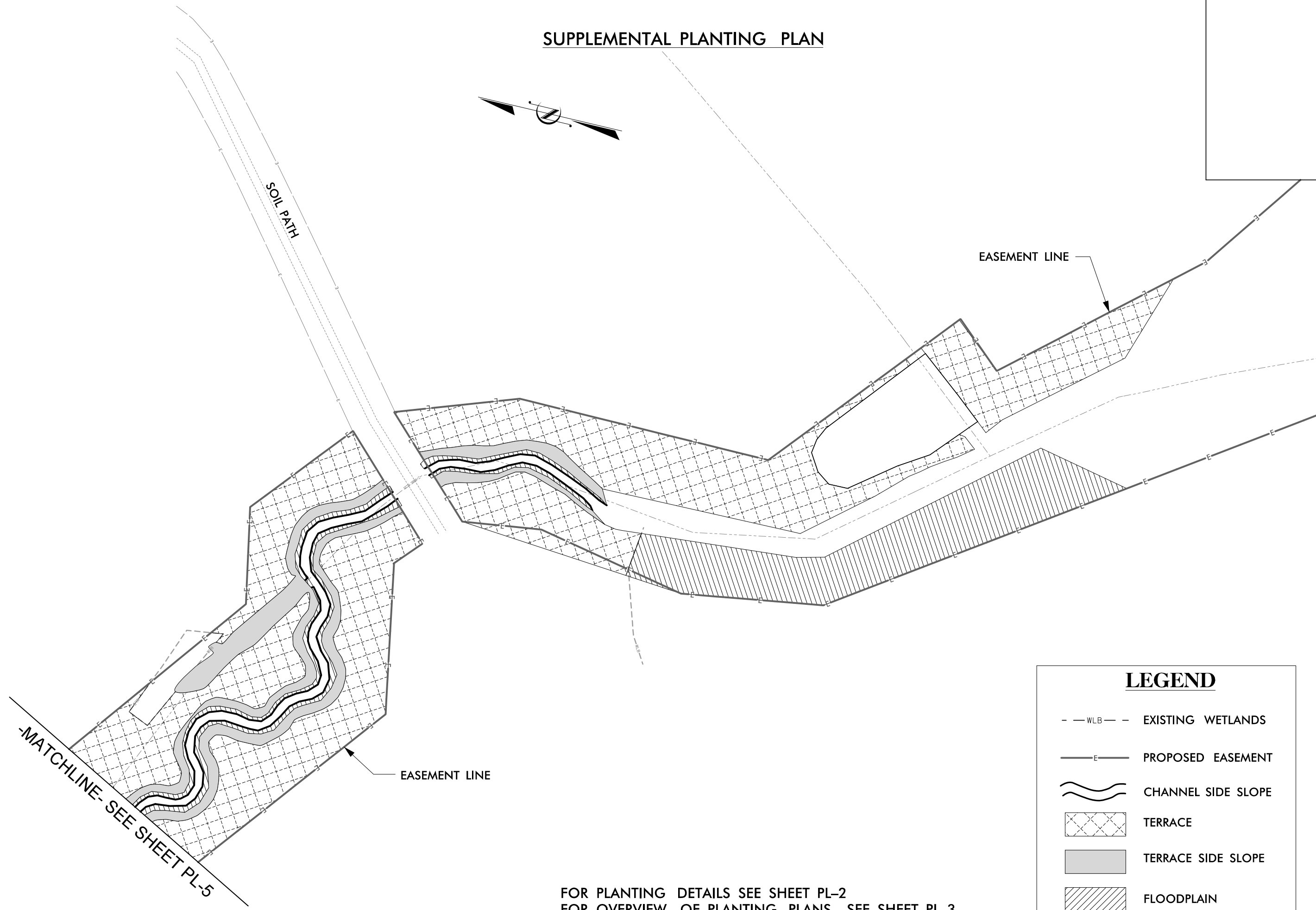

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 STREAM RESTORATION PROJECT**  
 ROBESON COUNTY, NORTH CAROLINA



DATE: 12-2012  
 SUPPLEMENTAL  
 PLANTING  
 PLAN  
 SHEET  
**PL-5**  
 OF PL-6

# SUPPLEMENTAL PLANTING PLAN



-MATCHLINE- SEE SHEET PL-5

### LEGEND

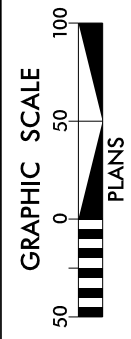
- - WLB - - EXISTING WETLANDS
- E - PROPOSED EASEMENT
- ~ ~ ~ CHANNEL SIDE SLOPE
- [X] TERRACE
- [Grey Box] TERRACE SIDE SLOPE
- [Diagonal Lines Box] FLOODPLAIN

FOR PLANTING DETAILS SEE SHEET PL-2  
 FOR OVERVIEW OF PLANTING PLANS SEE SHEET PL-3  
 FOR PLANTING PLANS SEE SHEETS PL-4 THRU PL-6

12/21/2012  
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DATE: 12-2012  
 SUPPLEMENTAL PLANTING PLAN  
 SHEET  
**PL-6**  
 OF PL-6