MITIGATION PLAN
AS-BUILT BASELINE REPORT

UT TO THE LUMBER RIVER SITE

Robeson County, North Carolina
Contract No. 002027

Prepared for:

NCDENR-Ecosystem Enhancement Program
2728 Capital Boulevard, Suite 1H 103
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September 28, 2010

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I HEREBY CERTIFY THAT THE DOCUMENTS CONTAINED HEREIN, UT TO THE LUMBER RIVER MITIGATION PLAN AND AS-BUILT BASELINE REPORT WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED SEALED, AND DATED THIS 14 DAY OF SEPTEMBER 2010.

Chris L. Smith, PE

EXECUTIVE SUMMARY

The UT to the Lumber River 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. The Site is located in the United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03040203030010 (North Carolina Division of Water Quality Subbasin 03-07-51) of the Lumber River Basin and will service the USGS 8-digit Cataloging Unit 03040203. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (EEP) in meeting its stream and wetland mitigation goals.

The primary goals of this 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, and 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, and 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.

Site mitigation activities included the construction of a stable stream channel on the UT to Lumber River (UT) resulting in 4,285 linear feet of stream restoration, planting of a riparian buffer adjacent to the UT that resulted in 463 linear feet of stream enhancement (Level II), and preserving 4,123 linear feet and both banks of currently stable stream channels of the Lumber River and 2,177 linear feet of the UT. Additionally, 3,489 linear feet of the left bank and floodplain of the Lumber River was preserved, however this footage will not be used for mitigation since adjacent (opposite bank) landowners were not willing to place their land in a conservation easement. In comparison to the design and planting plans, the project in as-built conditions is stable with no major deviations from construction plans.

A 67.85-acre conservation easement was placed on the Site to incorporate all mitigation activities. The first year monitoring report will be submitted at the end of December after Site implementation. Monitoring will continue for five years or until agreed upon success criteria are

achieved, with a report submitted by the end of December for each monitoring year. Monitoring will include a survey of representative stream profiles and cross-sections, representative surveys of vegetation, and an annual monitoring report verifying that the Site has remained relatively unchanged.

At this time, no issues or mitigating factors have arisen in the period immediately following the completion of grading and planting.

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1.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

1.1 Location and Setting

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.

The contributing watershed to the Lumber River is characterized primarily by forest/wetland (69 percent of the watershed area), cultivated cropland (28 percent), pasture/managed herbaceous (4 percent), urban areas (1 percent) and surface water (1 percent) (NCDWQ 2003). The contributing watershed to the UT to the Lumber River is characterized primarily by cropland (65 percent of the total area), forest land (15 percent), low-density residential development (15 percent) and impervious surfaces (5 percent). The UT to the Lumber River lies on active agricultural/cropland adjacent to the Lumber River.

The Site is located in the United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03040203030010 (North Carolina Division of Water Quality Subbasin 03-07-51) of the Lumber River Basin and will service the USGS 8-digit Cataloging Unit 03040203. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (EEP) in meeting its stream and wetland mitigation goals.

1.2 Project Goals and Objectives

The primary goals of this stream restoration project focus on:

1. Improving water quality,
2. Providing/enhancing flood attenuation,
3. Restoring aquatic and riparian habitat and function,
4. Restore and enhance habitat connectivity with adjacent pristine habitats,
5. Assisting the EEP with meeting its stated 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,
6. Assisting the State of North Carolina initiatives along the Lumber River for conservation.

These goals will be accomplished through the following objectives:

1. Restore the existing UT to a more natural, sand bed channel able to transport its sediment/organic debris and flow without aggrading or degrading;
2. Enhancing the capacity of the Site to mitigate flood flows by excavating a floodplain and connecting flood flows to existing ponds on-site (that will be retrofitted as stormwater wetlands) that will add water storage within the Site limits;
3. Enhancing in stream habitat by creating an undulating bedform (shallows/deeps) using meander geometry to maintain deeps, and by placing woody structures in the channel that provide shading, natural food sources, and protective areas for propagation;
4. Reducing sedimentation and nutrient inputs through the reestablishment of a native riparian buffer that will average 95 feet from the top bank of bank of the UT. Additionally, the reestablishment of the buffer will remove approximately 15.0 acres of currently active agricultural production that is adjacent to the existing UT.
5. Reduce sedimentation and nutrient inputs by transforming existing ponds within the valley of the UT to stormwater wetlands that will collect flow from the UT and drainage ditches, which will filter many of the contributing pollutants;
6. Reduce nutrient inputs by creating three stormwater retention areas (BMPs) along three contributing drainage ditches entering the Site. These retention areas will be placed specifically for sediment and nutrient reduction.
7. It is fully anticipated that excavated floodplain areas within the site will quickly revert to wetlands due to a shallow groundwater table and existing hydric soils. The proposed planting plan is comprised of hydrophytic vegetation and it is anticipated that volunteer species from the floodplain of the Lumber River may also populate the Site. These wetlands are expected to enhance the Site's function to retain and absorb nutrients while also providing a diversity of aquatic, semi-aquatic and upland habitats.
8. Enhancing the entire ecosystem by reestablishing a large habitat corridor between the agricultural fields on-site and the well developed Lumber River floodplain. The restored corridor will replace the existing agricultural fields with native species that are similar to the Reference Forest Ecosystem (studied on-site) which is comparable to a

Coastal Plain Small Stream Swamp – Blackwater Subtype (Schafale and Weakley 1990);

9. Preserve and protect 4,123 linear feet and associated floodplain (approximately 29.1 acres) along both sides of the Lumber River from future development and logging by placing a conservation easement that averages nearly 340 feet in width. An additional 3,489 feet of the Lumber River and its associated floodplain (approximately 6.7 acres) will be included with the easement on the left (eastern) bank (this portion of the Lumber River and floodplain cannot be used for mitigation credits because the landowners on the southern side of this reach were not interested in participating);
10. Preserving large portions of the Lumber River and its associated floodplain will assist the State in its stated efforts through the Lumber River State Park and its associated designation of the Lumber River as a North Carolina Natural and Scenic River to protect the River and adjoining lands. Preserve and protect both sides of the UT by placing a conservation easement that exceeds required standards (will average approximately 75 feet from the top of each bank);

The Lumber River/Bear Swamp Watershed Management Plan (Plan) was completed by the EEP in February of 2006 (EEP 2006). The watersheds investigated are both targeted local watersheds by the EEP. The proposed Site is located within the watershed studied on the Lumber River (14-digit Hydrologic Unit 03040203030010), which is also a Targeted Local Watershed. The report concluded that the primary factors contributing to functional degradation within the UT's watershed include:

- Lack of riparian buffers;
- Fragmentation and loss of terrestrial habitat diversity by clearing and drainage activities;
- Increasing impervious surface area through residential/commercial uses;
- Loss of in-stream habitat as a result of channelization.

Furthermore, the Plan specifically stated that the three most common degradational conditions within the watershed can be directly attributed to channelization, sedimentation, and a narrow riparian zone.

The objectives listed in the Plan that will address functional degradation within the watershed include the following:

- Improve water quality where it is degraded by pollutant inputs;
- Improve terrestrial habitat diversity;
- Improve terrestrial habitat connectivity;
- Reduce impacts of present and future impervious surfaces;
- Improve in-stream habitat.

The practices listed for the objectives include the following:

- Riparian buffer restoration;
- Sediment reduction BMPs;

- Nutrient reduction BMPs;
- Stormwater BMPs;
- Stream Restoration;
- Wetland restoration;
- Land use ordinances.

It should be noted that the Site was a priority site specifically identified in the Plan to achieve the proposed objectives.

The following lists how the project will utilize specific practices/objectives to satisfy the Plan's goals.

- Riparian Buffer Restoration: The project restored riparian buffers through revegetation of buffer zones with native riparian and wetland species along the UT.
- Sediment Reduction BMPs: Sediment entering the site will be retained by the placement of three stormwater retention areas on the contributing drainage ditch flowing from off-site.
- Nutrient Reduction BMPs: Nutrient reduction will be achieved by excavating a floodplain that will store and absorb nutrients, the use of the three retention BMPs, retrofitting two ponds within the site boundaries to act as stormwater wetlands that will collect flow from the UT at approximately the half bankfull discharge stage, and restoring a native riparian buffer through active agricultural fields that will average nearly 95 feet from the top of both banks of the UT.
- Stormwater BMPs: Stormwater BMPs were constructed along the three ditches entering the site and two existing ponds on-site were retrofitted to act as stormwater wetlands.
- Stream Restoration: The UT was restored to a more natural channel that exhibits a stable meandering pattern that will convey its discharge and sediment without aggrading or degrading. Additionally, the restored channel will exhibit bed features such as deeps and shallows that are not currently exhibited which will enhance aquatic habitat.
- Wetland Restoration: It is anticipated that excavated floodplain areas within the site will revert to wetlands once construction is completed due to a shallow groundwater table, existing hydric soils, and because hydrophytic vegetation will be planted as part of the Site's planting plan.

1.3 Project Structure, Restoration Type and Approach

The UT had been detrimentally impacted in the past due to channelization and deepening. Evidence of channelization includes the fact that the channel followed the fall line of the valley through the large majority of the Site with no natural meander geometry, the channel was overly deep, and conversations with the landowner has revealed the UT was channelized and relocated many years ago.

An assessment of the channel's pre-restoration cross-section and profile through channelized areas revealed that the channel had been dug to a depth of over 5.2 feet from the top of the

lowest bank. The estimated bankfull depth was 1.77 feet. The channel alterations deepened the channel to the point that bankfull flows were approximately 3.43 feet below the existing top of bank (i.e. bank height ratio equals approximately 2.94), which did not allow bankfull flows to access its historical floodplain. Additionally, the HEC-RAS analysis of the pre-restoration conditions determined that the 100 year storm event was contained within the existing banks throughout the agricultural field. This is further evidence that the channel had been substantially enlarged.

Site mitigation activities included the construction of a stable stream channel on the UT to Lumber River (UT) resulting in 4,285 linear feet of stream restoration (matching the design and RFP proposal length), planting of a riparian buffer adjacent to the UT that resulted in 463 linear feet of Level II stream enhancement (matching the design and RFP proposal length), and preserving 4,123 linear feet and both banks of currently stable stream channels of the Lumber River and 2,177 linear feet of the UT (matching the design and RFP proposal lengths). Additionally, 3,489 linear feet of the left bank and floodplain of the Lumber River was preserved, however this footage will not be used for mitigation since adjacent (opposite bank) landowners were not willing to place their land in a conservation easement.

Table 1. Project Components

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 1		
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	185	435
Lumber River			824
Total (SMU)	**5729**		

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.

F&H has provided all resources (restoration, enhancement, preservation, buffers) that were proposed and awarded from the RFP.

1.4 Project History, Contacts and Attribute Data

Onsite elevations are moderate with a high of 160 feet in the upper extents of the Site and a low of 145 feet on the National Geodetic Vertical Datum (NGVD) (Pembroke, North Carolina USGS 7.5-minute topographic quadrangle). Drainage areas for site streams are listed in Table 4 (Project Attributes Table).

- Lumber River: 432 sq mi (276,480 ac)
- UT Lumber (Entering Site): 0.35 sq mi (227 ac)
- UT Lumber (at convergence with Lumber River): 0.77 sq mi (490 ac)

The Site contains the Lumber River and an Unnamed Tributary to the Lumber River (UT). The Site is located within the 03040203030010 14-digti Hydrologic Unit, which is also an EEP Targeted Hydrologic Unit for Cataloging Unit 03040203 of the Lumber River Basin. The Lumber River has a watershed drainage area of approximately 432 square miles at its convergence with Chicken Road. The UT has a watershed drainage area of approximately 0.35 square miles (227 acres) as it enters the Site and a watershed drainage area of approximately 0.77 square miles (490 acres) at its confluence with the Lumber River (Figure 2 and 3).

The contributing watershed to the Lumber River is characterized primarily by forest/wetland (69 percent of the total area), cultivated cropland (28 percent), pasture/managed herbaceous (4 percent), urban areas (1 percent) and surface water (1 percent) (NCDWQ 2003). The contributing watershed to the UT to the Lumber River is characterized primarily by cropland (65 percent of the total area), forest land (15 percent), low-density residential development (15 percent) and impervious surfaces (5 percent).

The UT's and immediately surrounding watersheds are experiencing substantial growth from residential and commercial development associated with the town of Pembroke. Recently numerous businesses have been built in the watershed north of the Site and a large scale trailer manufacturing plant was built adjacent to the Site. The landowners of Pates Feed and Livestock sold the land to the manufacturing plant and have been in discussions with other buyers for the property where the Site is located. Due to the growth of Pembroke towards the Lumber River and the landowners speaking with businesses about purchasing property that the Site is located on, it is expected that the UT's watershed will experience even more dramatic changes within the near future. Land south of the Lumber River (off right bank) on the Lowery Property that is part of the Site has recently been subdivided and a residential community has been established.

The Lumber River within the Site (Stream Index Number/Assessment Unit Number 14 - (7)) is classified as a WS-IV, B, Sw, HQW within the project boundaries (NCDWQ 2009). A classification of WS-IV signifies waters used as sources of water supply for drinking, culinary or food processing purposes where a WS-I, II or III classification is not feasible. These waters are also protected for Class C uses. WS-IV waters are generally in moderately to highly developed watersheds or Protected Areas. A classification of B signifies waters protected for all Class C uses in addition to primary recreation. Primary recreational activities include swimming, skin

diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. A classification of Sw signifies supplemental classification intended to recognize those waters which have low velocities and other natural characteristics which are different from adjacent streams. A classification of HQW signifies Supplemental classification intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission. The following waters are HQW by definition:

- WS-I,
- WS-II,
- SA (commercial shell fishing),
- ORW,
- primary nursery areas (PNA) designated by the Marine Fisheries Commission, and
- Waters for which the DWQ has received a petition for reclassification to either WS-I or WS-II.

Neither the Lumber River nor the UT are on the North Carolina Impaired (303(d)) list. However, Mill Branch (Stream Index Number/Assessment Unit Number # 14 - 6) is on the Draft 2008 303 (d) list. Mill Branch enters the Lumber River ~ two miles upstream of the Site. Mill Branch's watershed is directly adjacent to the Lumber River. Mill Branch is a direct tributary to the Lumber River. According to the 2003 Lumber River Basinwide Water Quality Plan, all waters in the Lumber River Basin are considered "impaired" for fish consumption due to elevated mercury levels. The 2003 Lumber River Basinwide Water Quality Plan shows the Lumber River as having a Use Support Rating of Supporting within the Site. The UT has a Use Support Rating of "Not Rated".

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2 through 4.

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		
Year 2 Monitoring		
Structural maintenance (bench expansion, vane, etc.)		
Year 3 Monitoring		
Supplemental planting of containerized material		
Year 4 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 Ryan Smith (919) 851-6066
Stream Monitoring POC	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ryan Smith (919) 851-6066
Vegetation Monitoring POC	Florence & Hutcheson, Inc. 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ryan Smith (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	0% Currently / 100% Post Construction (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)	1st	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

2.0 SUCCESS CRITERIA

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring is proposed for the stream channel and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the *Stream Mitigation Guidelines* (USACE et al. 2003).

2.1 Streams

The restored stream reaches are proposed to be monitored for geometric activity. Annual fall monitoring will include development of channel cross-sections on riffles and pools and profiles of the channel's invert, bankfull and water surface. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) meander wavelength, 7) belt-width, 8) water surface slope, and 9) sinuosity. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year. A photographic record that will include pre- and post-construction pictures has been initiated with current Site photographs.

2.1.1 Stream Success Criteria

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system.

A longitudinal profile will be completed on the entire restored section of the UT to collect invert, surface water and bankfull elevation data. The amount of permanent cross-sections installed and monitored was determined by dividing the total channel length by 30 bankfull widths because the restored portion of the UT is narrow (8.8 feet wide). A total of 17 cross-sections (approximately half riffles and half pools) have been installed. Permanent photo stations will be established at each permanent cross-section. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

2.1.2 Stream Dimension

General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. Some changes in dimension (such as lowering of bankfull width) should be expected. Key

parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modes overall change. Riffle sections should generally maintain a Bank Height ratio of 1.0 – 1.5, with some variation in this ratio naturally occurring. Pool sections naturally adjust based on recent flows and time between flows, therefore more variation on pool section geometry is expected.

2.1.3 Stream Pattern and Profile

The profile should not demonstrate significant trends towards degradation or aggradation over a significant portion of a reach. Additionally, bed form variables should remain noticeably intact and consistent with original design parameters that were based off of reference conditions.

Pattern features should show little adjustment over the standard 5 year monitoring period.

2.1.4 Substrate

Sampling of the substrate distribution will not be completed because the restored section of the UT to Lumber River is composed of a sand/silt substrate. Coarsening of the substrate is not anticipated.

2.1.5 Sediment Transport

There should be an absence of any significant trend in the aggradational or depositional potential of the channel.

2.1.6 Hydrology

A minimum of two bankfull events must be documented within the standard 5 year monitoring period. The two bankfull events shall occur within separate years.

2.1.7 Stream Contingency

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

<u>Structure Failure</u>

In the event that structures are compromised the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures which remain intact, but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the pilings.

Structures which have been compromised, resulting in shifting or collapse of header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site

In the event that a headcut occurs within the Site (identified visually or through measurements [i.e. bank-height ratios exceeding 1.5]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

Bank Erosion

In the event that severe bank erosion occurs within the Site, resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of log-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

2.2 Vegetation

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. After planting has been completed in winter or early spring, an initial evaluation will be performed to verify planting methods and to determine initial species composition and density. Supplemental planting and additional modifications will be implemented, if necessary. A photographic record of plant growth should be included in each annual monitoring report.

During the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) in September/early October of the first monitoring year and annually between June 1 and September 30 for the remainder of the monitoring period until vegetation success criteria are achieved.

Fourteen (14) sample plots (10 meters by 10 meters) have been randomly placed within the restored buffer on-site. The amount of vegetation plots was determined using the CVS protocol.

2.2.1 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. An average density of 320 stems per acre of planted stems must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4 and 260 planted stems per acre in year 5.

2.2.2 Vegetation Contingency

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

2.3 Scheduling and Reporting

The first year monitoring report will be submitted at the end of December after Site implementation. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of December for each monitoring year.

3.0 MONITORING DATA COLLECTION

3.1 Hydrology

To ensure accuracy and make note of any site changes, all data collected for monitoring purposes will be taken manually and in the field.

Verification of bankfull events and changes in stream hydrology will be recorded by crest gauges installed in the stream as well as visual evidence of above bankfull flows. Evidence of above bankfull flows may include trash/debris lines in or above the floodplain, vegetation pushed over towards the downstream direction in the floodplain, terrace slope scour, and staining of vegetation. Early monitoring of crest gauges will allow for additional verification of bankfull design targets.

All visits to the site for purposes of data collection will be documented by the monitoring performer and will describe in detail: weather conditions; physical appearance of the site; highest stage for that monitoring interval as recorded on the crest gauge; a reset of the crest gauge; photo documentation. Data collected for the purposes of bankfull verification will be compiled and summarized in each annual version of the monitoring report.

3.2 Stream Channel Stability and Geomorphology

Assessment of the UT to the Lumber River dimension, pattern and profile is necessary to ensure that the reach maintains reference geomorphology. Visual based assessments, photographic documentation, and surveys of profiles and representative cross-sections will be used to monitor channel stability. Visual assessment is sufficient for reaches that undergo little geomorphologic changes (i.e. Enhancement II). Vegetation assessments will be monitored annually to ensure an average density of 320 stems per acre of planted stems must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4 and 260 planted stems per acre in year 5. This section serves as the general guide to the extent and type of monitoring of different stream features.

3.2.1 Dimension

Cross sections of representational pools and riffles will be surveyed throughout the site to ensure that banks have not collapsed, accreted sediment, or otherwise changed in meanders and straight sections. For the as-built survey, 17 cross sections (nine of representative riffles and eight of representative pools) were installed. Visual assessment is sufficient for reaches that undergo little geomorphologic changes (i.e. Enhancement II), thus 463 linear feet of the UT to the Lumber River will not be surveyed.

These planned cross sections exceed the EEP recommendations of five riffle cross sections and three pool cross sections for a reach of between 4,001 and 5,000 linear feet. This detailed survey of stream dimensions should provide a good amount of annual data that can be used to monitor any changes in geomorphology.

3.2.2 Profile

The entire length of the restored channel in the Upper and Lower sections of the UT will be surveyed for geomorphological changes to the profile for as-built and monitoring purposes.

3.2.3 Visual Assessment

A visual assessment by the monitoring agent is meant to supplement the quantitative reach survey data and vegetation monitoring data. A cursory check of conditions of various features throughout the site will contribute to a better understanding of changes to the site between monitoring years.

For every monitoring year, each of the following features should be checked visually and recorded as failed or stable for every reach: riffles; pools; thalweg; meanders; bed general; bank condition; structures (see example table below). The percentage of stable features out of all features on site will serve as a narrative of overall site condition before more detailed monitoring surveys and will be listed in a table such as shown below.

Categorical Stream Feature Visual Stability Assessment UT to the Lumber River

Feature	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
A. Riffles					
B. Pools					
C. Thalweg					
D. Meanders					
E. Bed General					
F. Banks					
H. Structures					

3.2.4 Bank Stability Assessments

Bank stability should be assessed as part of the annual visual assessment. Recording linear feet of unstable or collapsed banks will help guide repairs in the future, should they be necessary. This will be accomplished visually during all walkthroughs of the site. Near Bank Stress (NBS) and Bank Erosion Hazard Index (BEHI) assessments were not part of the pre-construction existing conditions surveys, therefore they will not be completed in year 5 unless substantial lengths of channel display degradation.

3.2.5 Vegetation

Following Site construction, fourteen 100 m^2 plots were established and erected with metal fence posts at all plot corners. One fence post was painted red at each plot origin. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix D. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia,*

and Surrounding Areas (Weakley 2007). The locations of vegetation monitoring plots were placed to accurately represent the entire Site and are depicted on the As-built drawings submitted with the Mitigation Plan.

Surveys of vegetation plots will conform to Level I standards. An inventory of all planted stems will be used to determine average stems per acre, proper spacing, and any intrusion of invasive species within the vegetative plot. Significant changes in success criteria will lead to supplemental plantings to ensure vegetative success.

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Character Tree Species." Character Tree Species include planted species, species identified through visual inventory of an approved reference (relatively undisturbed) forest community used to orient the Site design, and appropriate community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) including Coastal Plain Small Stream Swamp. All canopy tree species planted and identified in the reference forest will be utilized to define "Character Tree Species" as termed in the success criteria. Table 5 below outlines planted and reference forest species.

Table 5. Planted and Reference Forest Ecosystem

Planted and Reference Forest Ecosystem Character Tree Species
Red maple (*Acer rubrum*)
Water hickory (*Carya aquatica*.)
Silky dogwood (*Cornus amomum*)
Green ash (*Fraxinus pennsylvanica*)
American holly (*Ilex opaca*)
Tulip poplar (*Liriodendron tulipifera*)
Sweetgum (*Liquidambar styraciflua*)
Sweet bay (*Magnolia virginiana*)
Swamp tupelo (*Nyssa biflora*)
Red bay (*Persea palustris*)
Sycamore (*Platanus occidentalis*)
Laurel oak (*Quercus laurifolia*)
Overcup Oak (*Quercus lyrata*)
Swamp chestnut oak (*Quercus michauxii*)
Water oak (Q*uercus nigra*)
Willow oak (*Quercus phellos*)
Black willow (*Salix nigra*)
Elderberry (*Sambucus canadensis*)
Horse sugar (*Symplocus tinctoria*)
Bald cypress (*Taxodium distichum*)
American elm (*Ulmus americana*)

Success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Character Tree Species per acre must be surviving in year 4 and 260 Character Tree Species per acre in year 5.

3.2.6 Digital Photos

Permanent photo stations were established at each of the seventeen cross-sections and at every vegetation plot. Photos of the stream and vegetation plots will be taken annually during monitoring, preferably when vegetation is minimal. Vegetation photos will be taken on the same day that cover surveys take place. All digital photo records will indicate location, date and monitoring year.

3.2.7 Watershed

Any changes to the project watershed should be monitored and recorded. In the event that a change to the watershed might introduce new sediment or changes in water flow to the site, such as a new development upstream, it should be closely monitored and analyzed. Any significant

effects to site streams should be documented so that action can be taken if necessary. Additionally, rare or significant hydrologic and weather events should be recorded in detail so that changes to site streams can be accounted for.

3.2.8. Monitoring Plan View

Monitoring activities for the Site are detailed in Figures 4 through 11.

4.0 MAINTENANCE AND CONTINGENCY PLANS

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure; 2) headcut migration through the Site; 3) bank erosion; and/or 4) failure to meet vegetation criteria.

Structure Failure

In the event that structures are compromised, the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel

Headcut Migration through the Site

In the event that a headcut occurs within the Site (identified visually or through measurements [i.e. bank-height ratios exceeding 1.5]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel repairs with backfill and stabilizing the material with erosion control matting, vegetative transplants, soil lifts, and/or willow stakes.

Bank Erosion

In the event that severe bank erosion occurs within the Site, resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of stream structures to deter scour of the banks or soil lifts/bioengineering of side slopes. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

Vegetation Contingency

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

5.0 AS-BUILT STATE

This section documents the as-built/baseline condition. Tables 6, 7 and 8 detail specific geomorphic and vegetative data in relation to the as-built conditions. As-built/baseline drawings are submitted as a separate document in association with the Mitigation Plan.

5.1 Sediment Transport

As-built sheer stress (competency) and capacity (unit stream power) are depicted in Table 6 and can be compared with design and existing values for each. For sand based systems such as the UT Lumber River capacity is the preeminent tool for assessing the channel's ability to transport sediment through the system. The as-built state of the Upstream and Downstream Reaches displays minor variations from the design models as is seen in Table 6.

5.2 Planted Vegetation

Based on a survey of 14 representative ten by ten meter plots within the Site (completed on 4/28/2010 and 4/30/2010) damage to planted stems is insignificant or non-existent. Of the plants surveyed, 100 percent achieved a rating of high vigor and high likelihood of survival to the next monitoring year. CVS vegetation data is depicted in Appendix D.

5.3 Photo Documentation

Photos of the stream were taken at the beginning and end of both profile sections, as well as facing downstream of each cross-section. Photos of each vegetation plot were taken from the upstream, right-hand corner of the plot (plot origin). All permanent photo stations have been documented and included as an appendix.

5.4 Stream Gauges

Crest gauges were built and installed in three representative riffles throughout the Site and are being monitored regularly to track any large storm events that effect the Site. Crest gauges locations have been documented in the as-built record drawings.

Table 6. 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		
Dimensiona and Substrate - Riffle	LL	UL	Eq.	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	7.72	9.01	6.95	8.07	8.97
Floodprone Width (ft)				13.30		290.00			100.00			25.00			27.00		21.23	25.05	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		0.63	0.67	0.73	0.52	0.63	0.73
Bankfull Max Depth (ft)[1]				1.77		1.58			1.42			1.11			1.25		1.12	1.19	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	5.19	6.55	4.02	5.10	5.74
Width/Depth Ratio				9.20		10.80			11.20			10.50			10.50		9.00	11.52	13.23	10.68	12.99	15.74
Entrenchment Ratio				1.53		28.21			28.21			3.20			3.10		2.93	3.31	3.74	2.77	3.20	3.44
Bank Height Ratio[1]				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		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	87
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																						
Ri%/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_i^{sp}/di^{sp} (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 bankful				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			0.071			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			0.96			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												
Biological or Other				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 7a. Morphology and Hydraulic Monitoring 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

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation[1]																																			
Bankfull Width (ft)	5.67							8.66							8.47							9.01							8.92						
Floodprone Width (ft)	21.23							24.14							27.54							26.38							27.37						
Bankfull Mean Depth (ft)	0.63							0.45							0.64							0.73							0.64						
Bankfull Max Depth (ft)	1.3							0.94							1.12							1.15							1.29						
Bankfull Cross Sectional Area (ft^2)	3.56							3.92							5.45							6.55							5.69						
Bankfull Width/Depth Ratio	9							19.24							13.23							12.34							13.94						
Bankfull Entrenchment Ratio	3.74							2.79							3.25							2.93							3.07						
Bankfull Bank Height Ratio	1							1							1							1							1						
Based on current/developing bankfull feature[2]																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 6 (Riffle)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Pool)							Cross Section 10 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation[1]																																			
Bankfull Width (ft)	6.95							7.73							11.85							8.91							9.78						
Floodprone Width (ft)	23.23							24.09							34.06							25.68							30.76						
Bankfull Mean Depth (ft)	0.63							0.52							0.56							0.69							0.8						
Bankfull Max Depth (ft)	1.22							1							1.43							1.1							1.55						
Bankfull Cross Sectional Area (ft^2)	4.4							4.02							6.63							6.1							7.86						
Bankfull Width/Depth Ratio	11.03							14.87							21.16							12.91							12.22						
Bankfull Entrenchment Ratio	3.34							3.12							2.88							2.88							3.15						
Bankfull Bank Height Ratio	1							1							1							1							1						
Based on current/developing bankfull feature[2]																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

1 = Widths and depths for each resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. 2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline, bankfull datum then should be tracked and quantified in these cells.

Table 7b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section) - Upstream Reach
UT to the Lumber River Site, 002027
UT to the Lumber River: 4,285 feet

	Cross Section 11 (Riffle)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation[1]																																			
Bankfull Width (ft)	8.97							7.8							10.56							8.7							8.6						
Floodprone Width (ft)	24.87							26.85							30.02							27.03							27.48						
Bankfull Mean Depth (ft)	0.57							0.73							0.63							0.64							0.69						
Bankfull Max Depth (ft)	1.23							1.27							1.61							1.22							1.4						
Bankfull Cross Sectional Area (ft^2)	5.15							5.7							6.68							5.59							5.94						
Bankfull Width/Depth Ratio	15.74							10.68							16.76							13.59							12.46						
Bankfull Entrenchment Ratio	2.77							3.44							2.84							3.11							3.19						
Bankfull Bank Height Ratio	1							1							1							1							1						
Based on current/developing bankfull feature[2]																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 16 (Pool)							Cross Section 17 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	9							8.28						
Floodprone Width (ft)	32.36							28.3						
Bankfull Mean Depth (ft)	0.81							0.69						
Bankfull Max Depth (ft)	1.62							1.83						
Bankfull Cross Sectional Area (ft^2)	7.27							5.74						
Bankfull Width/Depth Ratio	11.11							12						
Bankfull Entrenchment Ratio	3.6							3.42						
Bankfull Bank Height Ratio	1							1						
Based on current/developing bankfull feature[2]														
Bankfull Width (ft)														
Floodprone Width (ft)														
Bankfull Mean Depth (ft)														
Bankfull Max Depth (ft)														
Bankfull Cross Sectional Area (ft^2)														
Bankfull Width/Depth Ratio														
Bankfull Entrenchment Ratio														
Bankfull Bank Height Ratio														
Cross Sectional Area between end pins (ft^2)														
d50 (mm)														

1 = Widths and depths for each resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. 2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline, bankfull datum then should be tracked and quantified in these cells.

Table 8. Vegetation Plot Attribute Data UT to the Lumber River Site, 002027						
Plot ID	**Community Type**	**Planting Zone ID**	**Reach ID**	**CVS Level**	**Planted Stems**	**Stems Per Acre**
1	Coastal Plain Small Stream Swamp	CPSSS	Upper	I	19	769
2	Coastal Plain Small Stream Swamp	CPSSS	Upper	I	20	810
3	Coastal Plain Small Stream Swamp	CPSSS	Upper	I	20	810
4	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	22	891
5	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	18	729
6	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	20	810
7	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	20	810
8	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	20	810
9	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	20	810
10	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	17	688
11	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	15	607
12	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	18	729
13	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	27	1093
14	Coastal Plain Small Stream Swamp	CPSSS	Lower	I	23	931
					Average Stems Per Acre	807

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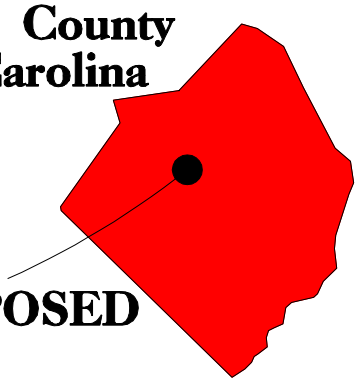
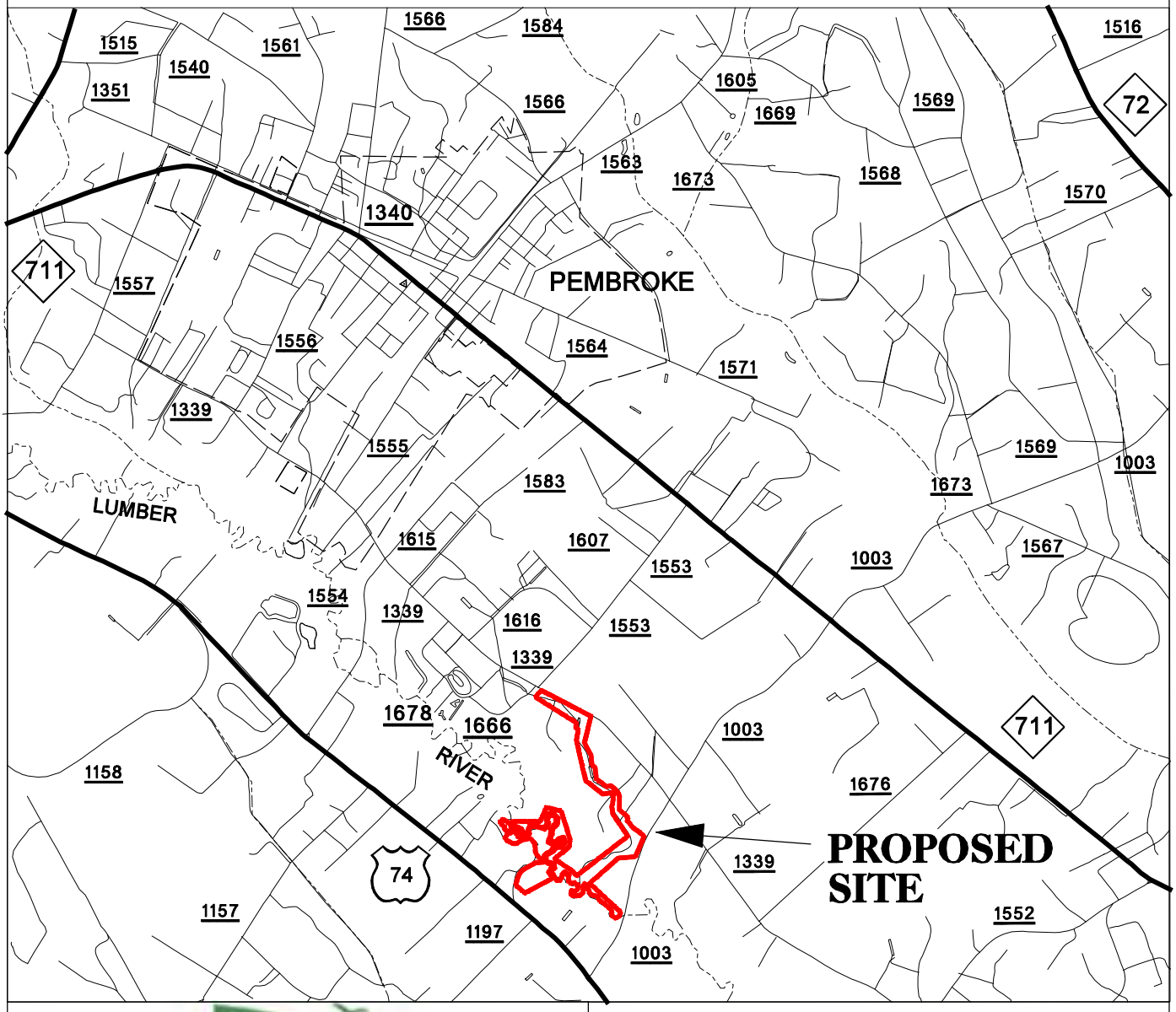
FIGURES

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 INVOLED 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

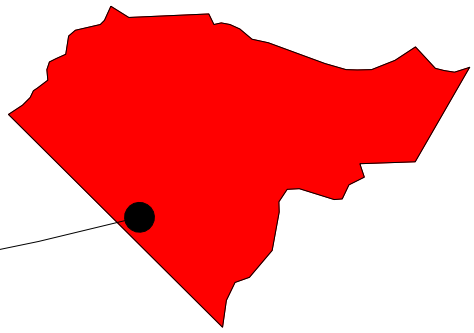
UT to the Lumber River
Stream Restoration Plan
Robeson County, North Carolina

0 2000 4000
FEET

Date: 08/26/10

Figure: 1

Columbus County
North Carolina



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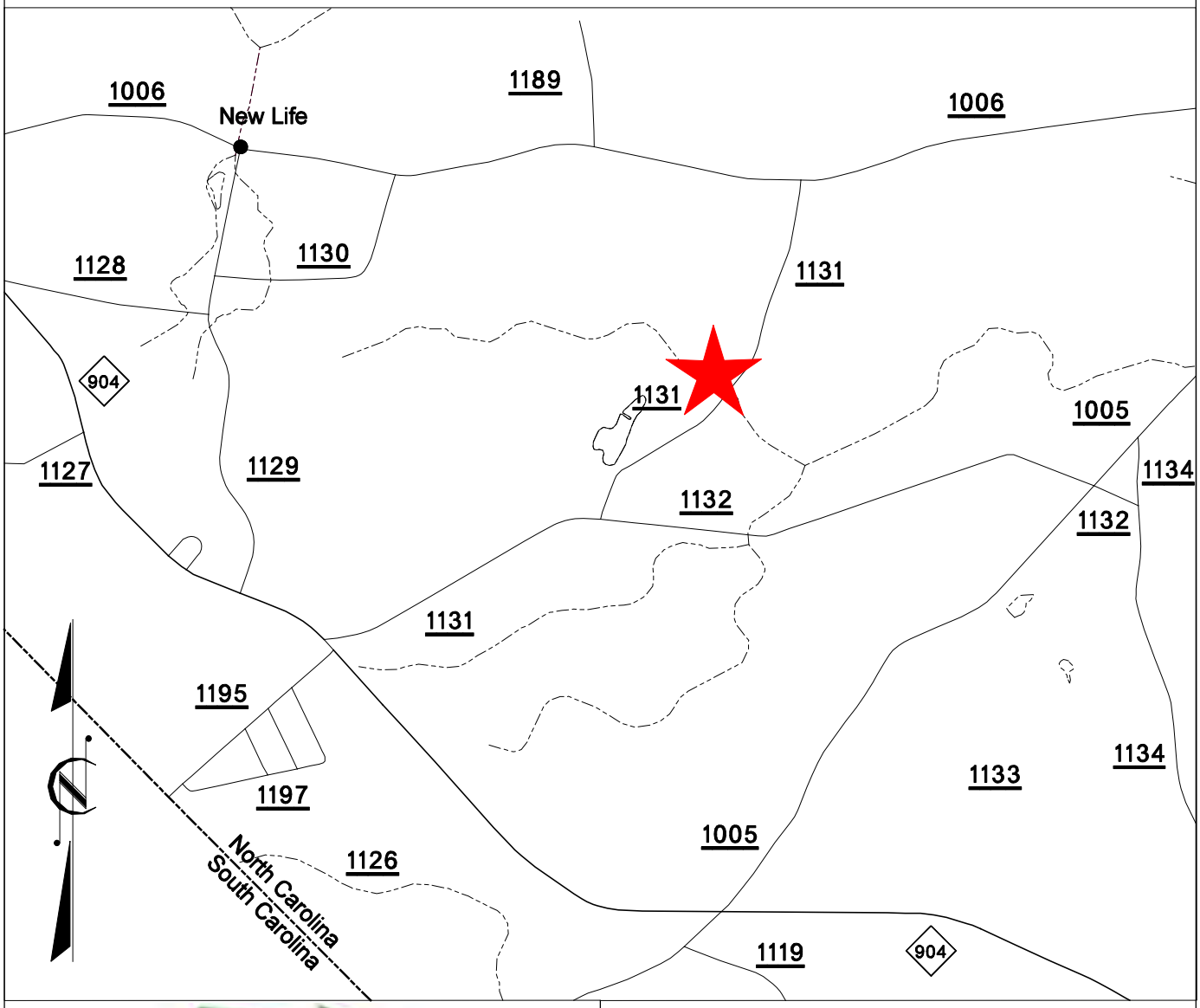

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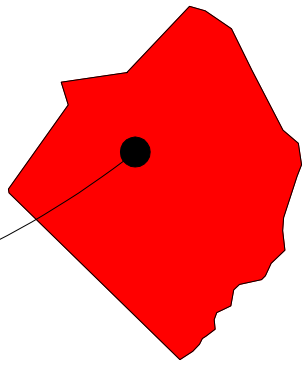
UT Ironhill Branch Reference Site Vicinity Map

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

Date: 08/26/10

Figure: 2

Robeson County
North Carolina



REFERENCE SITE

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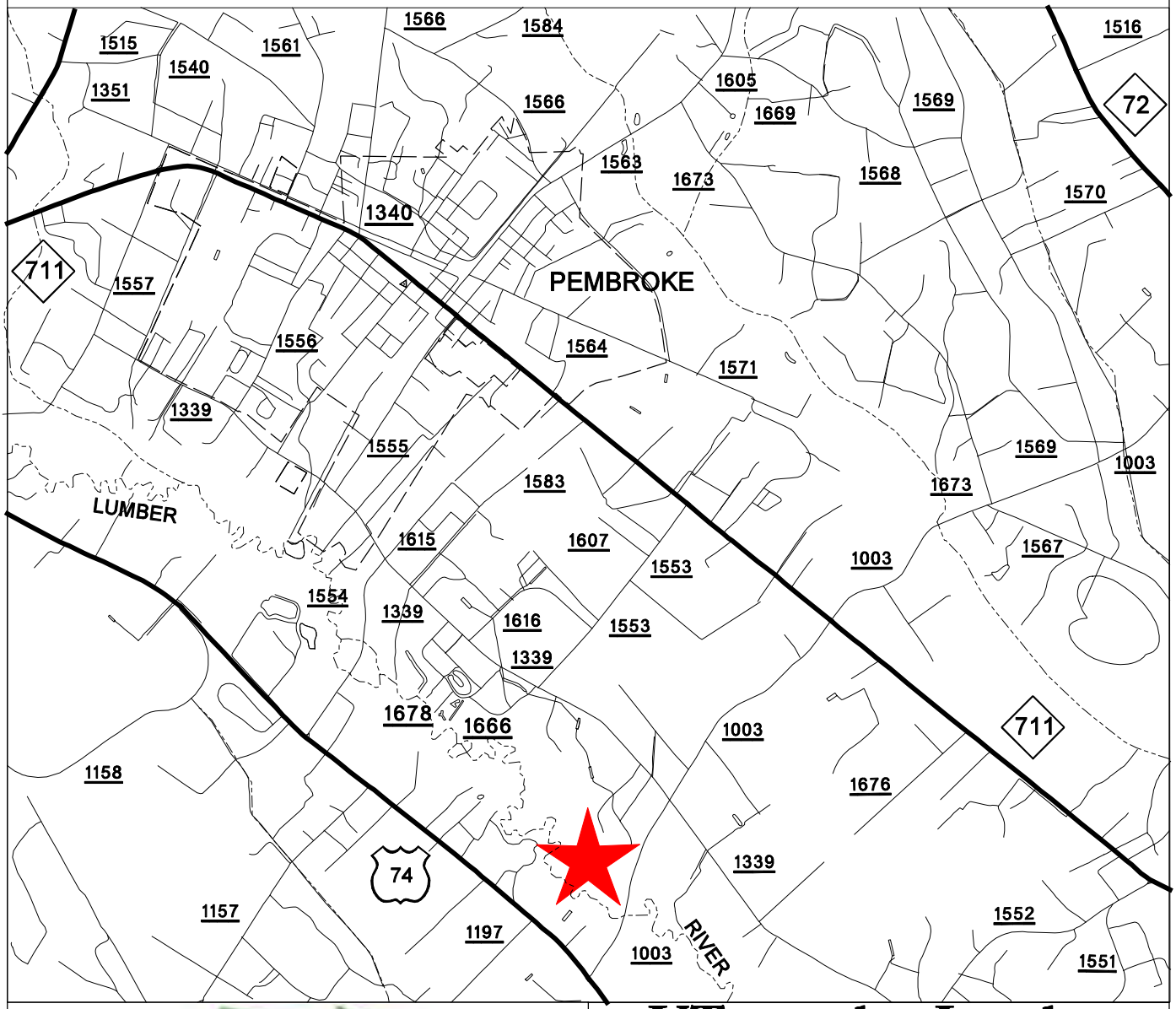

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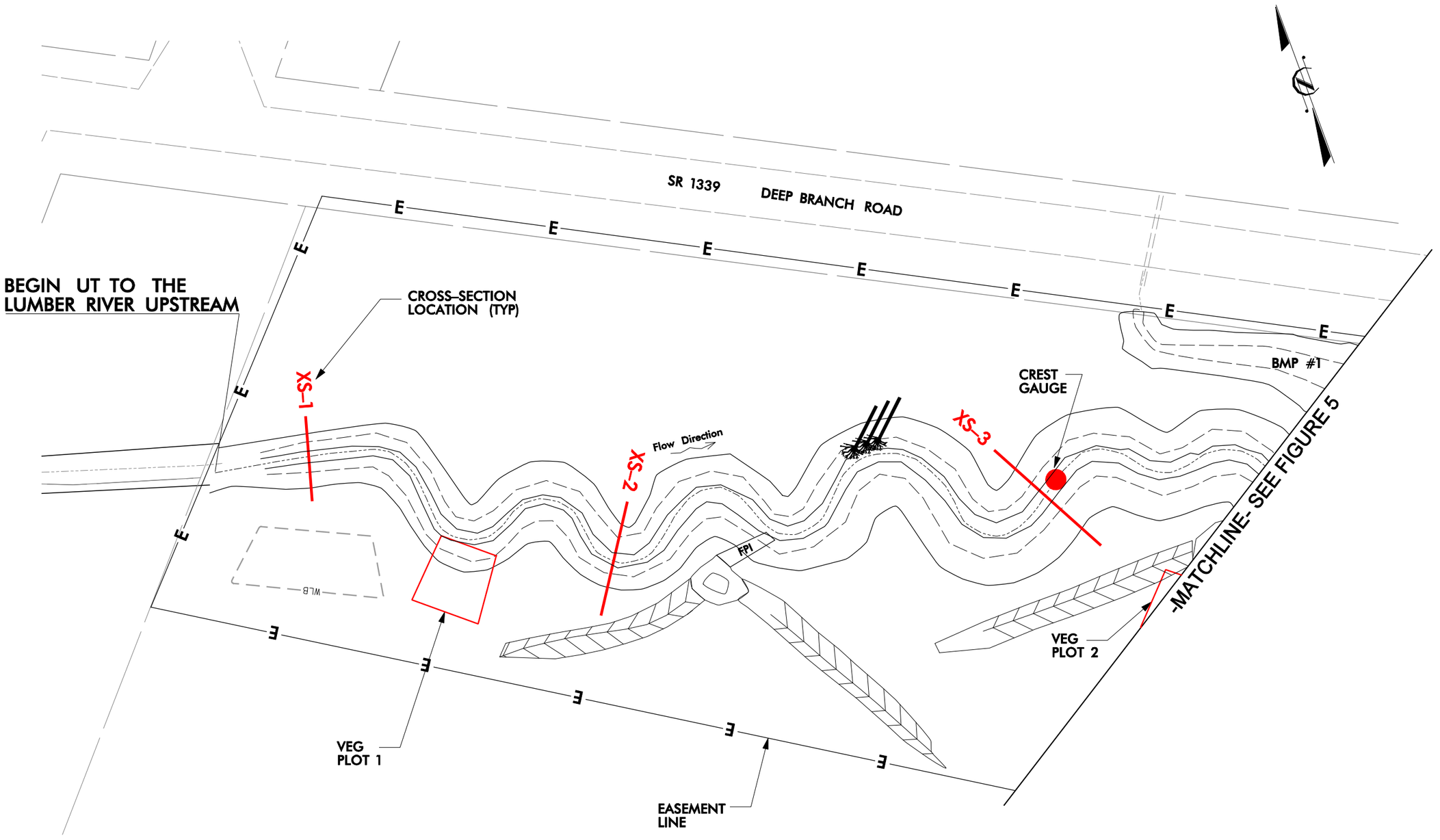
UT to the Lumber River Wooded Reach Reference Site Vicinity Map

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

Date: 08/26/10	Figure: 3

MONITORING LOCATIONS



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STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA

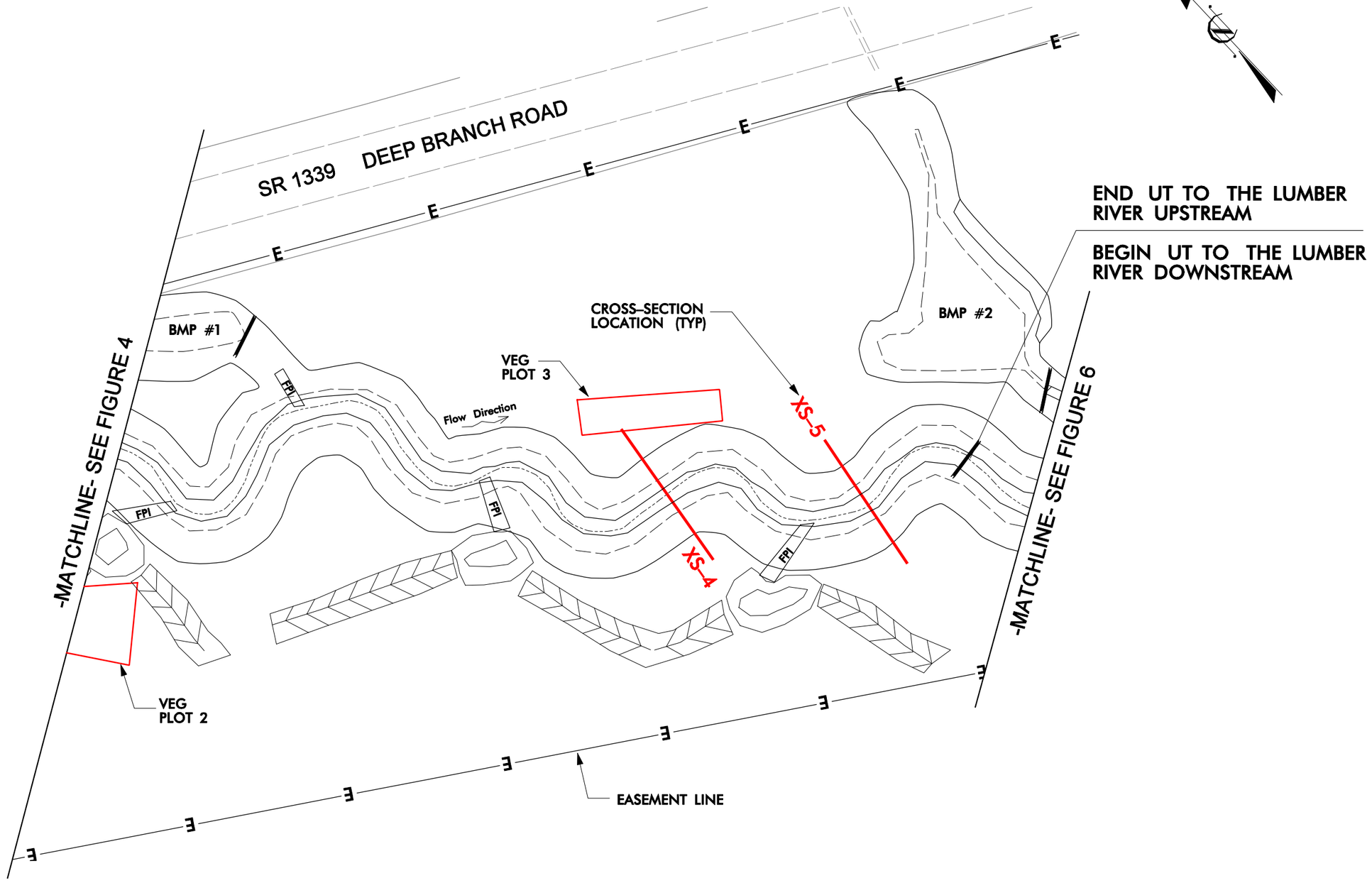
GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 4

MONITORING LOCATIONS



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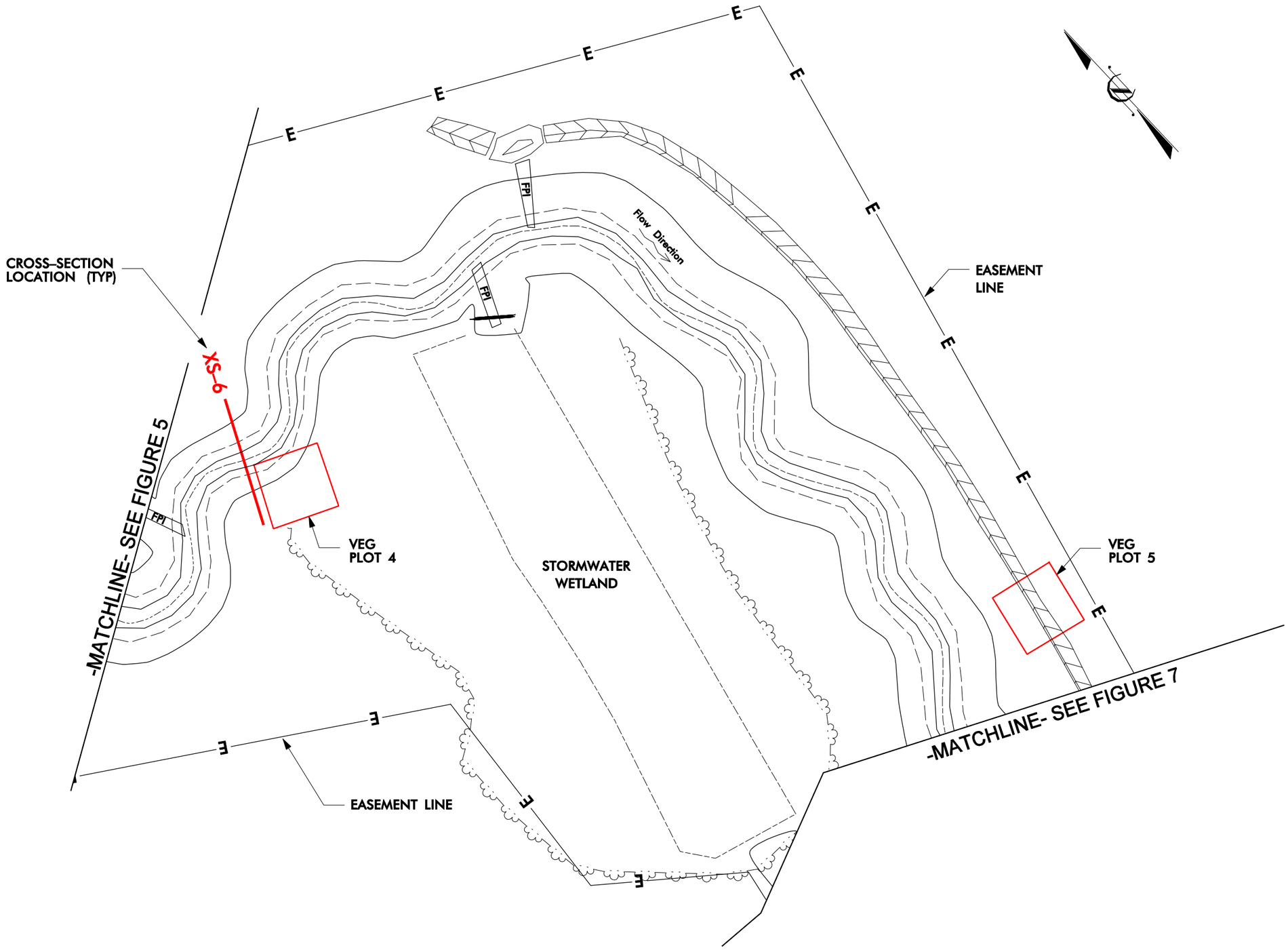
GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 5

MONITORING LOCATIONS



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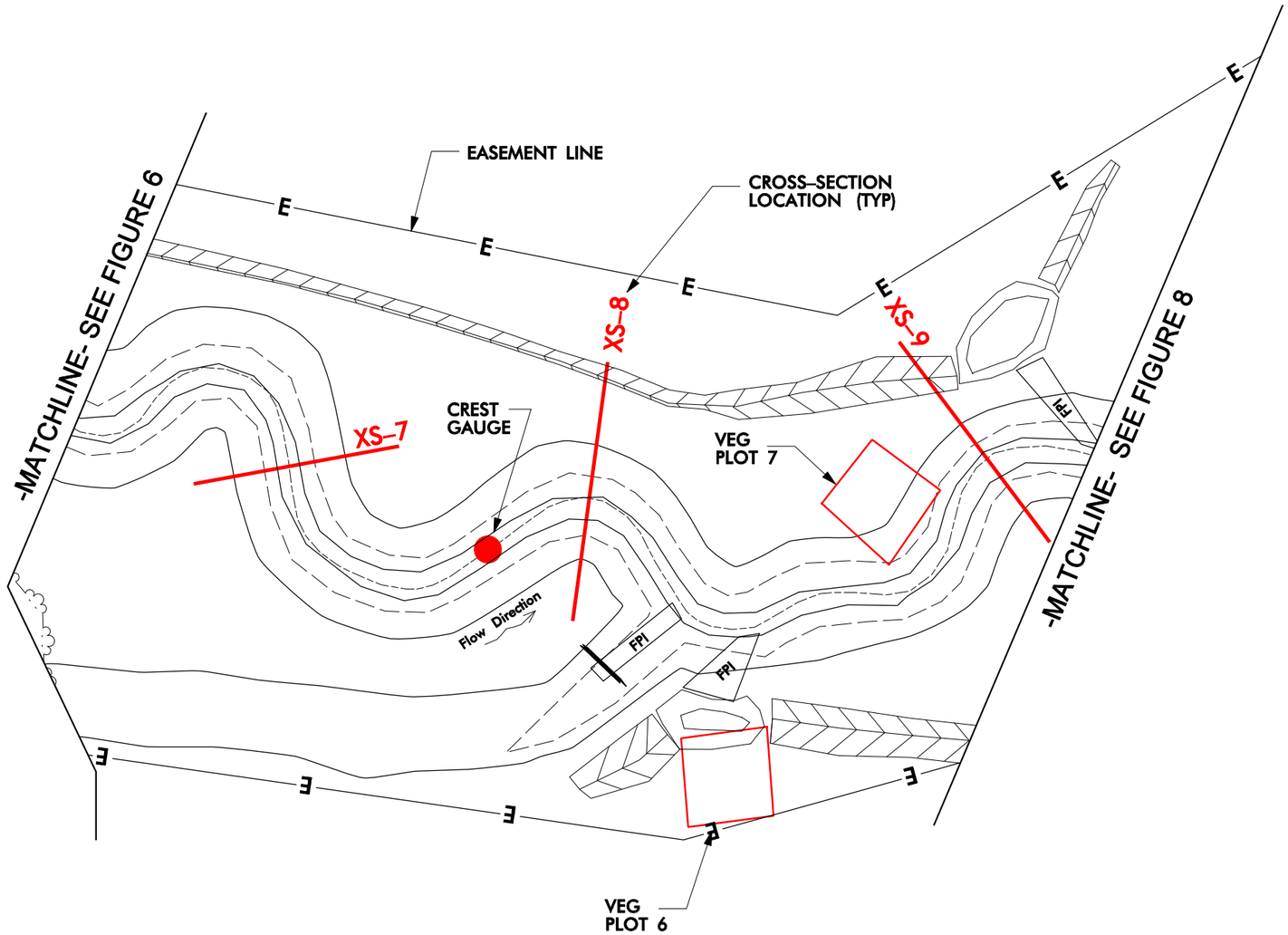
GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 6

MONITORING LOCATIONS



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STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA

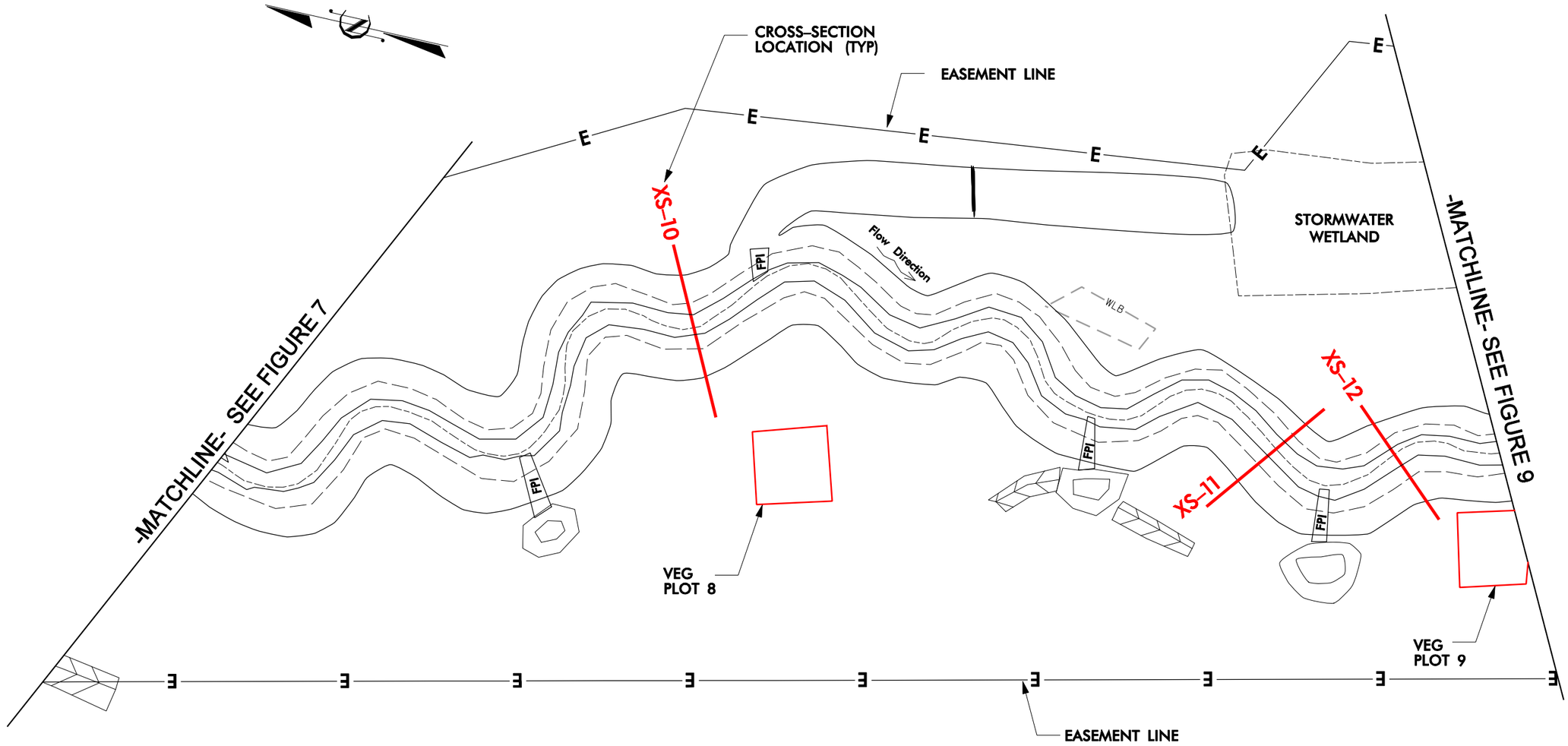
GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 7

MONITORING LOCATIONS



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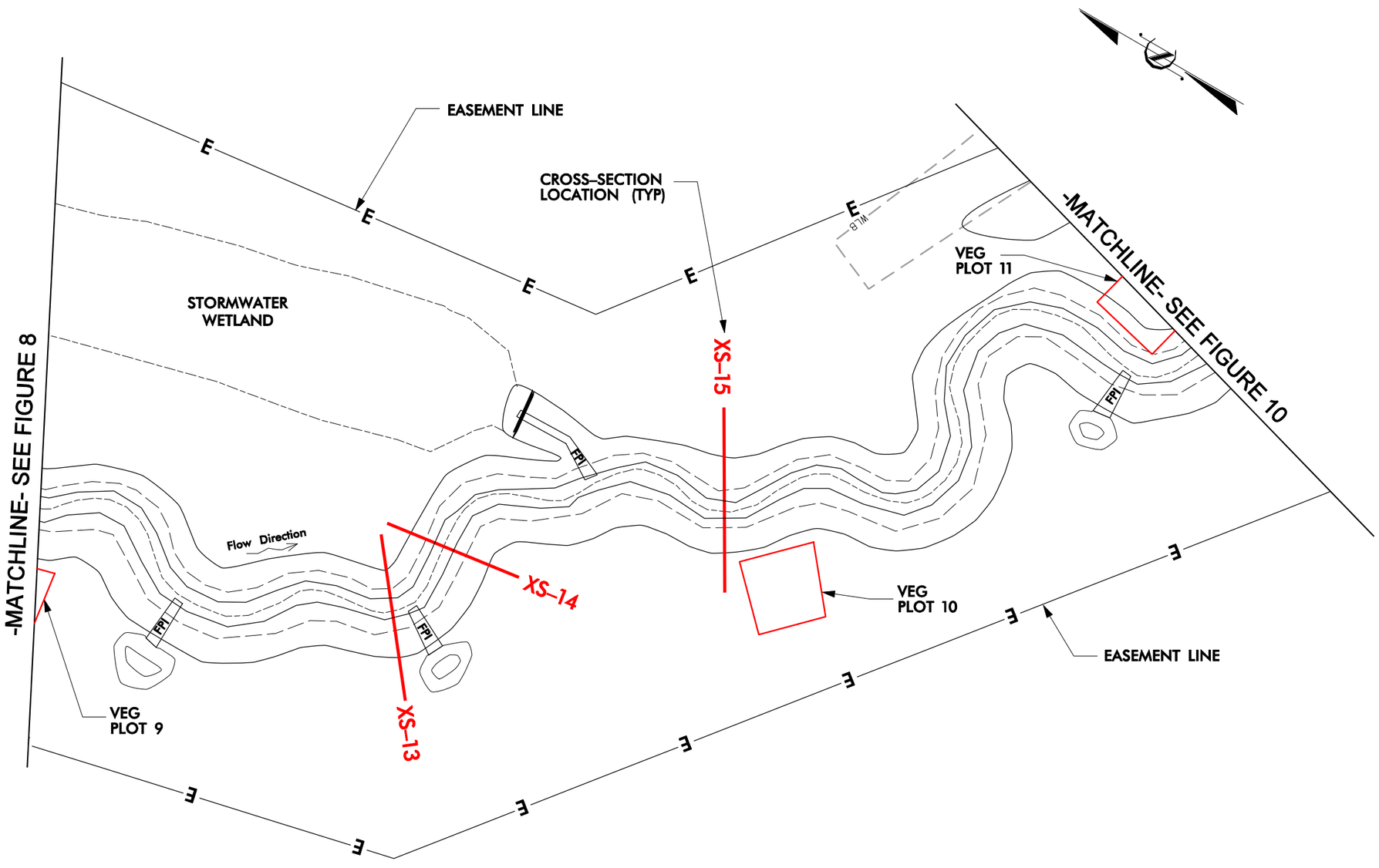
GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 8

MONITORING LOCATIONS



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GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 9

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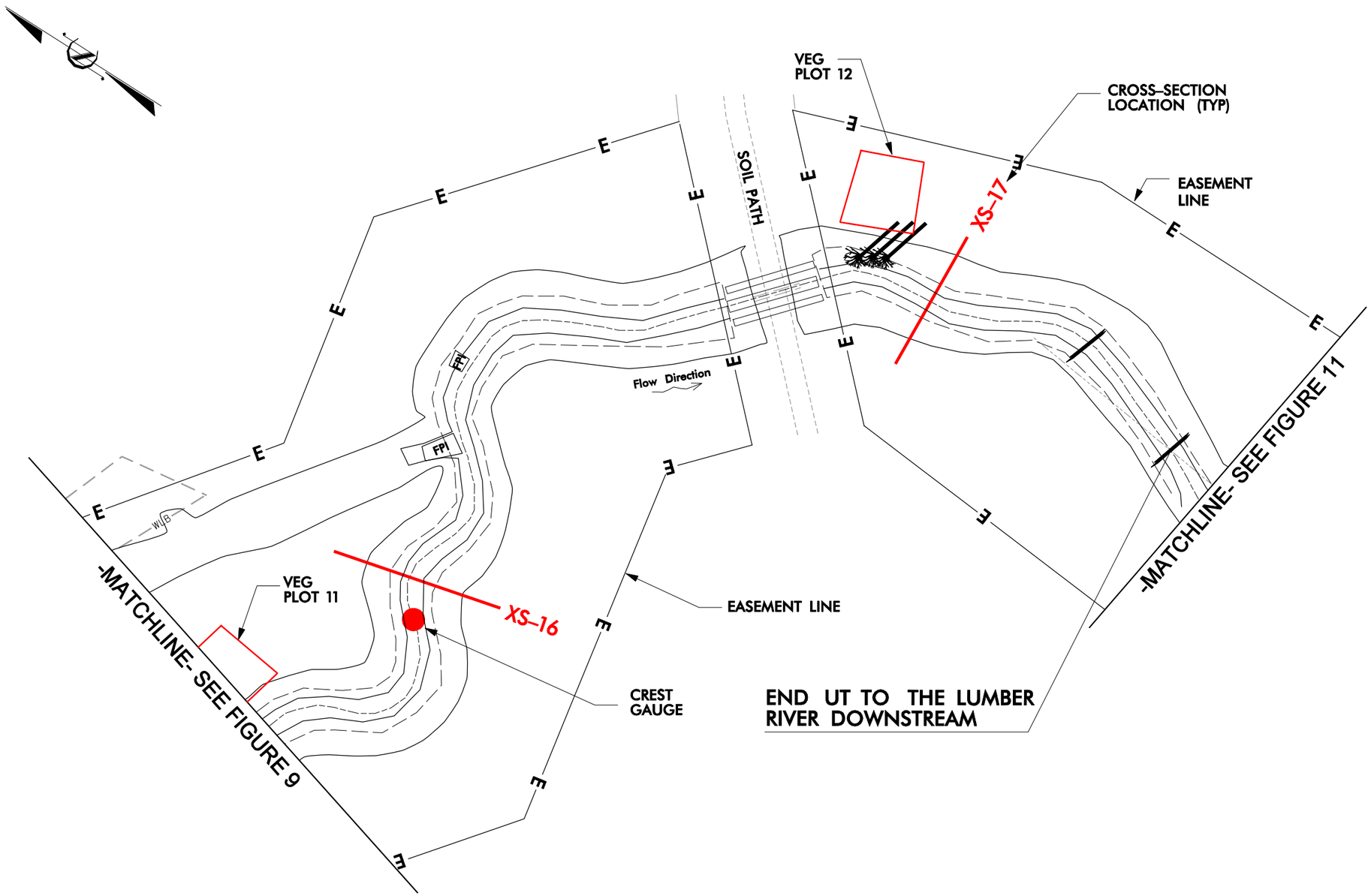
MONITORING LOCATIONS



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STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 08-26-10

MONITORING PLAN VIEW

Figure 10

9/13/2010
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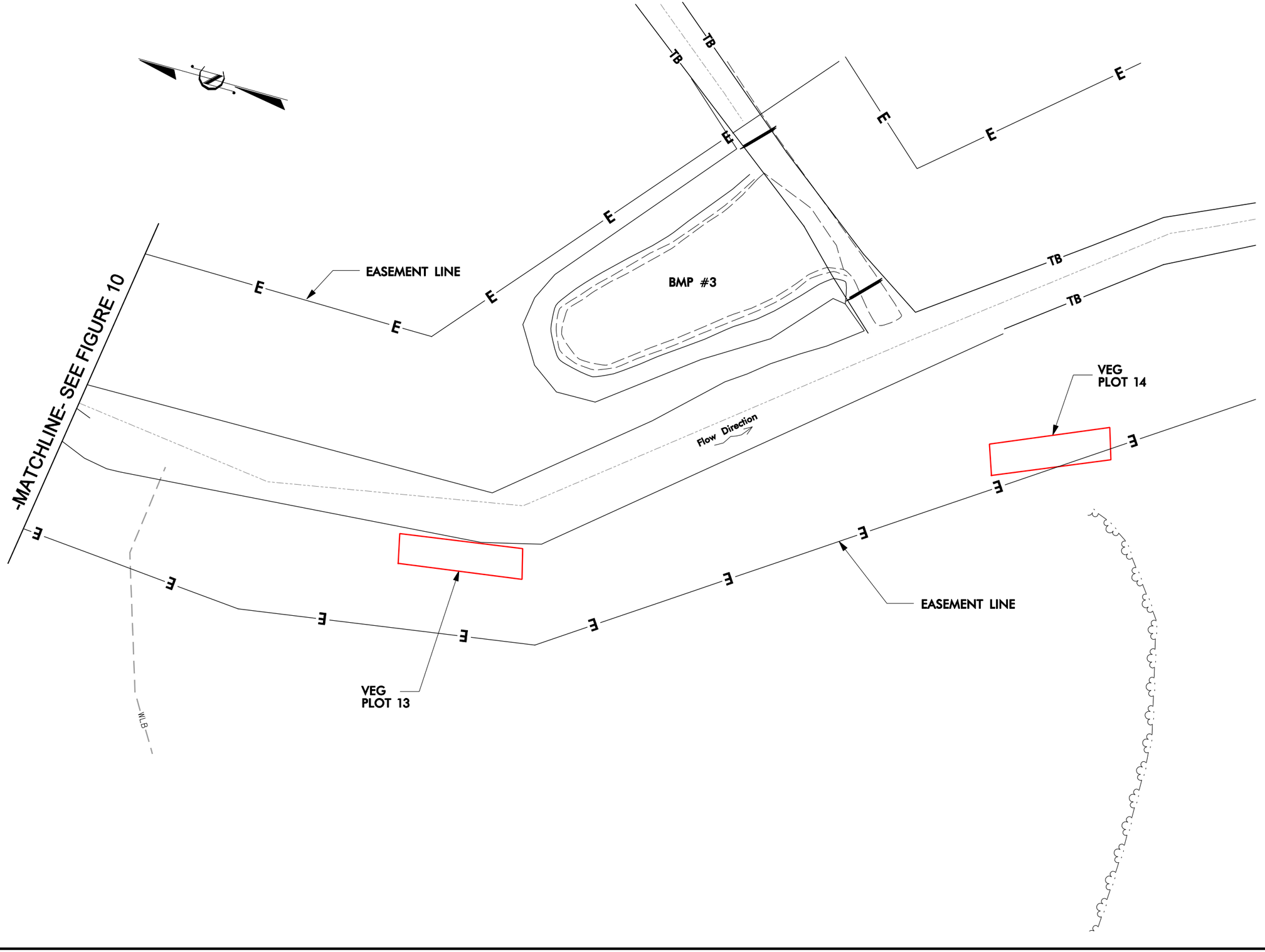
MONITORING LOCATIONS



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STREAM RESTORATION PROJECT
ROBESON COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 0 25 50
PLANS

DATE: 08-26-10

MONITORING
PLAN VIEW

Figure 11

APPENDIX A
CROSS-SECTION PERMANENT PHOTO STATIONS

As-built XSC-1

As-built XSC-2

As-built XSC - 3

Representative Preconstruction Conditions

As-built XSC-4

As-built XSC-5

As-built XSC - 6

Representative Preconstruction Conditions

As-built XSC-7

As-built XSC-8

As-built XSC - 9

Representative Preconstruction Conditions

As-built XSC-10

As-built XSC-11

As-built XSC-12

Representative Preconstruction Conditions

As-built XSC-13

As-built XSC-14

As-built XSC - 15

Representative Preconstruction Conditions

As-built XSC-16

As-built XSC-17

Representative Preconstruction Conditions

APPENDIX B
AS-BUILT BASELINE SURVEYS
1. CROSS-SECTION RAW DATA
2. PROFILE RAW DATA

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 1 (upstream)
Cross Section Name: XS1R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.8 ft
Backsight Rod Reading: 3.95 ft

TAPE	FS	ELEV	NOTE
0	6.8	155.95	
7.1	6.81	155.94	
12	8.98	153.77	
14	9.18	153.57	
16.2	9.12	153.63	BKF
17.7	9.95	152.8	
18.3	10.42	152.33	inv
19.4	9.96	152.79	
20.4	9.69	153.06	
22	9.07	153.68	
25.5	8.95	153.8	
26.9	9.1	153.65	
33.3	6.89	155.86	
40	7.17	155.58	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	154.93	154.93	154.93
Bankfull Elevation (ft)	153.63	153.63	153.63
Floodprone Width (ft)	21.23	-----	-----
Bankfull Width (ft)	5.67	2.5	3.17
Entrenchment Ratio	3.74	-----	-----
Mean Depth (ft)	0.63	0.7	0.57
Maximum Depth (ft)	1.3	1.3	1.13
Width/Depth Ratio	9	3.57	5.56
Bankfull Area (sq ft)	3.56	1.75	1.81
Wetted Perimeter (ft)	6.28	4.04	4.5
Hydraulic Radius (ft)	0.57	0.43	0.4
Begin BKF Station	16.2	16.2	18.7
End BKF Station	21.87	18.7	21.87

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 1 (upstream)
Cross Section Name: XS2P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.8 ft
Backsight Rod Reading: 3.95 ft

TAPE	FS	ELEV	NOTE
0	7.42	155.33	
10.7	7.24	155.51	
17.4	9.08	153.67	
22	9.28	153.47	
24.5	9.42	153.33	
26.8	9.74	153.01	
28.5	10.21	152.54	
29.2	10.21	152.54	inv
30.3	10.25	152.5	
31.2	9.31	153.44	BKF
33.7	9.29	153.46	
36	9.26	153.49	
37.5	9.04	153.71	
42.4	6.78	155.97	
55	6.46	156.29	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	154.38	154.38	154.38
Bankfull Elevation (ft)	153.44	153.44	153.44
Floodprone Width (ft)	24.14	-----	-----
Bankfull Width (ft)	8.66	6.63	2.03
Entrenchment Ratio	2.79	-----	-----
Mean Depth (ft)	0.45	0.37	0.72
Maximum Depth (ft)	0.94	0.9	0.94
Width/Depth Ratio	19.24	17.92	2.82
Bankfull Area (sq ft)	3.92	2.46	1.46
Wetted Perimeter (ft)	9.16	7.62	3.33
Hydraulic Radius (ft)	0.43	0.32	0.44
Begin BKF Station	22.54	22.54	29.17
End BKF Station	31.2	29.17	31.2

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 1 (upstream)
Cross Section Name: XS3R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.8 ft
Backsight Rod Reading: 3.95 ft

TAPE	FS	ELEV	NOTE
0	6.26	156.49	
13	6.29	156.46	
19	8.34	154.41	
22.7	9.58	153.17	
26	9.68	153.07	
28.5	9.64	153.11	BKF
31.5	10.6	152.15	
32.5	10.77	151.98	inv
33	10.73	152.02	
34.2	10.54	152.21	
37	9.67	153.08	BKF
42.5	9.72	153.03	
48.5	8.17	154.58	
58	5.74	157.01	
68	5.59	157.16	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	154.22	154.22	154.22
Bankfull Elevation (ft)	153.1	153.1	153.1
Floodprone Width (ft)	27.54	-----	-----
Bankfull Width (ft)	8.47	3.75	4.72
Entrenchment Ratio	3.25	-----	-----
Mean Depth (ft)	0.64	0.59	0.69
Maximum Depth (ft)	1.12	1.08	1.12
Width/Depth Ratio	13.23	6.36	6.84
Bankfull Area (sq ft)	5.45	2.2	3.25
Wetted Perimeter (ft)	8.8	4.99	5.97
Hydraulic Radius (ft)	0.62	0.44	0.54
Begin BKF Station	28.53	28.53	32.28
End BKF Station	37	32.28	37

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 1 (upstream)
Cross Section Name: XS4R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.2 ft
Backsight Rod Reading: 3.31 ft

TAPE	FS	ELEV	NOTE
0	5.8	155.71	
17.3	6.19	155.32	
24	5.45	156.06	
27	5.48	156.03	
30	6.08	155.43	
35	6.08	155.43	
37	6.33	155.18	
45.7	8.82	152.69	
50.4	9	152.51	BKF
51.4	9.53	151.98	
51.9	10.2	151.31	inv
54	10.04	151.47	
56.8	9.86	151.65	
59.5	9.1	152.41	BKF
65.3	8.93	152.58	
71.7	7.08	154.43	
90	6.38	155.13	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	153.61	153.61	153.61
Bankfull Elevation (ft)	152.46	152.46	152.46
Floodprone Width (ft)	26.38	-----	-----
Bankfull Width (ft)	9.01	2.62	6.39
Entrenchment Ratio	2.93	-----	-----
Mean Depth (ft)	0.73	0.75	0.72
Maximum Depth (ft)	1.15	1.15	1.06
Width/Depth Ratio	12.34	3.49	8.88
Bankfull Area (sq ft)	6.55	1.96	4.59
Wetted Perimeter (ft)	9.63	4.13	7.61
Hydraulic Radius (ft)	0.68	0.47	0.6
Begin BKF Station	50.49	50.49	53.11
End BKF Station	59.5	53.11	59.5

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 1 (upstream)
Cross Section Name: XS5P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.2 ft
Backsight Rod Reading: 3.31 ft

TAPE	FS	ELEV	NOTE
0	6.14	155.37	
3	6.11	155.4	
6	5.75	155.76	
14.2	5.75	155.76	
23.5	9.03	152.48	
26.5	9.35	152.16	
30	9.28	152.23	
33.5	10.11	151.4	
34.8	10.39	151.12	
36	10.66	150.85	inv
36.7	10.56	150.95	
37.1	10.06	151.45	
39.3	9.37	152.14	BKF
42.5	9.12	152.39	
44.8	9.01	152.5	
51	7.3	154.21	
58	5.59	155.92	
62	4.99	156.52	
68	4.73	156.78	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	153.43	153.43	153.43
Bankfull Elevation (ft)	152.14	152.14	152.14
Floodprone Width (ft)	27.37	-----	-----
Bankfull Width (ft)	8.92	5.38	3.54
Entrenchment Ratio	3.07	-----	-----
Mean Depth (ft)	0.64	0.63	0.65
Maximum Depth (ft)	1.29	1.24	1.29
Width/Depth Ratio	13.94	8.54	5.45
Bankfull Area (sq ft)	5.69	3.38	2.31
Wetted Perimeter (ft)	9.42	6.76	5.14
Hydraulic Radius (ft)	0.6	0.5	0.45
Begin BKF Station	30.38	30.38	35.76
End BKF Station	39.3	35.76	39.3

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS6R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 158.2 ft
Backsight Rod Reading: 3.31 ft

TAPE	FS	ELEV	NOTE
0	6.67	154.84	
13	6.76	154.75	
20.8	9.7	151.81	
24	9.79	151.72	
26.8	9.75	151.76	BKF
29.9	10.7	150.81	
30.3	10.96	150.55	inv
31.2	10.84	150.67	
31.5	10.72	150.79	
33.8	9.72	151.79	BKF
37.6	9.6	151.91	
41.6	8.29	153.22	
46.1	7.06	154.45	
63	6.51	155	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	152.99	152.99	152.99
Bankfull Elevation (ft)	151.77	151.77	151.77
Floodprone Width (ft)	23.23	-----	-----
Bankfull Width (ft)	6.95	3.91	3.04
Entrenchment Ratio	3.34	-----	-----
Mean Depth (ft)	0.63	0.62	0.65
Maximum Depth (ft)	1.22	1.22	1.17
Width/Depth Ratio	11.03	6.31	4.68
Bankfull Area (sq ft)	4.4	2.43	1.97
Wetted Perimeter (ft)	7.42	5.31	4.44
Hydraulic Radius (ft)	0.59	0.46	0.44
Begin BKF Station	26.8	26.8	30.71
End BKF Station	33.75	30.71	33.75

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS7R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 156.16 ft
Backsight Rod Reading: 3.24 ft

TAPE	FS	ELEV	NOTE
0	5.15	154.25	
11	5.21	154.19	
20.3	4.91	154.49	
27	7.08	152.32	
31	8.45	150.95	
34	8.51	150.89	
37	8.84	150.56	
39.3	9.65	149.75	
39.8	9.76	149.64	inv
40.6	9.68	149.72	
42	9.34	150.06	
44	8.76	150.64	bkf
45	8.63	150.77	
47.8	8.57	150.83	
51.2	8.37	151.03	
60.5	5.35	154.05	
75	5.35	154.05	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	151.64	151.64	151.64
Bankfull Elevation (ft)	150.64	150.64	150.64
Floodprone Width (ft)	24.09	-----	-----
Bankfull Width (ft)	7.73	3.77	3.96
Entrenchment Ratio	3.12	-----	-----
Mean Depth (ft)	0.52	0.49	0.55
Maximum Depth (ft)	1	1	0.98
Width/Depth Ratio	14.87	7.69	7.2
Bankfull Area (sq ft)	4.02	1.85	2.16
Wetted Perimeter (ft)	8.01	4.9	5.06
Hydraulic Radius (ft)	0.5	0.38	0.43
Begin BKF Station	36.27	36.27	40.04
End BKF Station	44	40.04	44

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS8P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 156.16 ft
Backsight Rod Reading: 3.24 ft

TAPE	FS	ELEV	NOTE
0	5.55	153.85	
6	5.98	153.42	
7	5.66	153.74	
20	5.32	154.08	
27.5	5.02	154.38	
31	5.25	154.15	
39	7.81	151.59	
42.1	8.63	150.77	
46.3	8.74	150.66	
48.5	9.03	150.37	
49	9.93	149.47	
49.4	10.14	149.26	inv
50.1	9.98	149.42	
52.2	9.59	149.81	
57	8.71	150.69	BKF
63.2	8.67	150.73	
74	6.84	152.56	
94	5.54	153.86	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	152.12	152.12	152.12
Bankfull Elevation (ft)	150.69	150.69	150.69
Floodprone Width (ft)	34.06	-----	-----
Bankfull Width (ft)	11.85	5.04	6.81
Entrenchment Ratio	2.88	-----	-----
Mean Depth (ft)	0.56	0.47	0.62
Maximum Depth (ft)	1.43	1.43	1.25
Width/Depth Ratio	21.16	10.72	10.98
Bankfull Area (sq ft)	6.63	2.38	4.26
Wetted Perimeter (ft)	12.58	6.91	8.18
Hydraulic Radius (ft)	0.53	0.34	0.52
Begin BKF Station	45.15	45.15	50.19
End BKF Station	57	50.19	57

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS9P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 156.16 ft
Backsight Rod Reading: 3.24 ft

TAPE	FS	ELEV	NOTE
0	5.8	153.6	
17.3	6.19	153.21	
24	5.45	153.95	
27	5.48	153.92	
30	6.08	153.32	
35	6.08	153.32	
37	6.33	153.07	
45.7	8.82	150.58	
50.4	9	150.4	
51.4	9.53	149.87	
51.9	10.2	149.2	inv
54	10.04	149.36	
56.8	9.86	149.54	
59.5	9.1	150.3	BKF
65.3	8.93	150.47	
71.7	7.08	152.32	
90	6.38	153.02	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	151.4	151.4	151.4
Bankfull Elevation (ft)	150.3	150.3	150.3
Floodprone Width (ft)	25.68	-----	-----
Bankfull Width (ft)	8.91	2.52	6.39
Entrenchment Ratio	2.88	-----	-----
Mean Depth (ft)	0.69	0.73	0.67
Maximum Depth (ft)	1.1	1.1	1.01
Width/Depth Ratio	12.91	3.45	9.54
Bankfull Area (sq ft)	6.1	1.83	4.27
Wetted Perimeter (ft)	9.47	3.98	7.51
Hydraulic Radius (ft)	0.64	0.46	0.57
Begin BKF Station	50.59	50.59	53.11
End BKF Station	59.5	53.11	59.5

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS10P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 155.17 ft
Backsight Rod Reading: 4.31 ft

TAPE	FS	ELEV	NOTE
0	6.4	153.08	
15.6	6.71	152.77	
26	9.64	149.84	
30.3	9.62	149.86	BKF
32.6	10.14	149.34	
34.3	10.65	148.83	
36.2	11.07	148.41	
37.2	11.17	148.31	inv
38	10.64	148.84	
40.3	9.51	149.97	
46.3	9.46	150.02	
59	5.85	153.63	
76	5.87	153.61	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	151.41	151.41	151.41
Bankfull Elevation (ft)	149.86	149.86	149.86
Floodprone Width (ft)	30.76	-----	-----
Bankfull Width (ft)	9.78	5.82	3.96
Entrenchment Ratio	3.15	-----	-----
Mean Depth (ft)	0.8	0.71	0.94
Maximum Depth (ft)	1.55	1.43	1.55
Width/Depth Ratio	12.22	8.2	4.21
Bankfull Area (sq ft)	7.86	4.16	3.7
Wetted Perimeter (ft)	10.36	7.43	5.79
Hydraulic Radius (ft)	0.76	0.56	0.64
Begin BKF Station	30.3	30.3	36.12
End BKF Station	40.08	36.12	40.08

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS11R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 155.17 ft
Backsight Rod Reading: 4.31 ft

TAPE	FS	ELEV	NOTE
0	6.25	153.23	
8.6	6.52	152.96	
17.5	9.83	149.65	
22.6	10.19	149.29	bkf
25.5	11.12	148.36	
26	11.33	148.15	
26.4	11.34	148.14	inv
26.8	11.3	148.18	
27	11.14	148.34	
30.7	10.03	149.45	bkf
35.6	9.93	149.55	
37.1	9.68	149.8	
47.8	6.53	152.95	
65	5.61	153.87	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	150.6	150.6	150.6
Bankfull Elevation (ft)	149.37	149.37	149.37
Floodprone Width (ft)	24.87	-----	-----
Bankfull Width (ft)	8.97	4.8	4.16
Entrenchment Ratio	2.77	-----	-----
Mean Depth (ft)	0.57	0.52	0.63
Maximum Depth (ft)	1.23	1.23	1.23
Width/Depth Ratio	15.74	9.23	6.6
Bankfull Area (sq ft)	5.15	2.51	2.63
Wetted Perimeter (ft)	9.37	6.22	5.6
Hydraulic Radius (ft)	0.55	0.4	0.47
Begin BKF Station	21.47	21.47	26.27
End BKF Station	30.43	26.27	30.43

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS12R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 155.17 ft
Backsight Rod Reading: 4.31 ft

TAPE	FS	ELEV	NOTE
0	5.5	153.98	
9.7	6.49	152.99	
18.2	10.08	149.4	
23.2	10.1	149.38	
24.7	11.26	148.22	
25.4	11.37	148.11	inv
26.4	11.32	148.16	
26.7	11.21	148.27	
31	10.1	149.38	BKF
37.6	10.14	149.34	
41	9.17	150.31	
49	6.67	152.81	
59	6.2	153.28	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	150.65	150.65	150.65
Bankfull Elevation (ft)	149.38	149.38	149.38
Floodprone Width (ft)	26.85	-----	-----
Bankfull Width (ft)	7.8	2.36	5.44
Entrenchment Ratio	3.44	-----	-----
Mean Depth (ft)	0.73	0.81	0.69
Maximum Depth (ft)	1.27	1.27	1.26
Width/Depth Ratio	10.68	2.91	7.88
Bankfull Area (sq ft)	5.7	1.92	3.78
Wetted Perimeter (ft)	8.37	4.03	6.86
Hydraulic Radius (ft)	0.68	0.48	0.55
Begin BKF Station	23.2	23.2	25.56
End BKF Station	31	25.56	31

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS13P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 155.17 ft
Backsight Rod Reading: 4.31 ft

TAPE	FS	ELEV	NOTE
0	5.18	154.3	
9	5.47	154.01	
15	5.95	153.53	
23.8	8.55	150.93	
27.3	8.71	150.77	BKF
31	9.61	149.87	
32	10	149.48	
32.8	10.26	149.22	
33.3	10.03	149.45	
34	9.26	150.22	
35	9.17	150.31	
36.7	8.6	150.88	BKF
43.7	8.64	150.84	
53	5.67	153.81	
60	5.37	154.11	
71	4.95	154.53	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	152.44	152.44	152.44
Bankfull Elevation (ft)	150.83	150.83	150.83
Floodprone Width (ft)	30.02	-----	-----
Bankfull Width (ft)	10.56	5.28	5.28
Entrenchment Ratio	2.84	-----	-----
Mean Depth (ft)	0.63	0.42	0.85
Maximum Depth (ft)	1.61	1.07	1.61
Width/Depth Ratio	16.76	12.57	6.21
Bankfull Area (sq ft)	6.68	2.2	4.48
Wetted Perimeter (ft)	11.27	6.48	6.92
Hydraulic Radius (ft)	0.59	0.34	0.65
Begin BKF Station	25.99	25.99	31.27
End BKF Station	36.55	31.27	36.55

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS14R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 153.42 ft
Backsight Rod Reading: 4.22 ft

TAPE	FS	ELEV	NOTE
0	4.98	152.66	
11	5.73	151.91	
16.7	8.21	149.43	
21.8	8.62	149.02	
22.5	8.77	148.87	
25.2	9.74	147.9	
25.9	9.84	147.8	inv
26.7	9.8	147.84	
27.3	9.51	148.13	
30.5	8.62	149.02	BKF
35.7	8.85	148.79	
48	5.96	151.68	
60	5.79	151.85	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	150.24	150.24	150.24
Bankfull Elevation (ft)	149.02	149.02	149.02
Floodprone Width (ft)	27.03	-----	-----
Bankfull Width (ft)	8.7	4.18	4.52
Entrenchment Ratio	3.11	-----	-----
Mean Depth (ft)	0.64	0.64	0.64
Maximum Depth (ft)	1.22	1.22	1.22
Width/Depth Ratio	13.59	6.53	7.06
Bankfull Area (sq ft)	5.59	2.68	2.91
Wetted Perimeter (ft)	9.08	5.59	5.92
Hydraulic Radius (ft)	0.62	0.48	0.49
Begin BKF Station	21.8	21.8	25.98
End BKF Station	30.5	25.98	30.5

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS15P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 153.42 ft
Backsight Rod Reading: 4.22 ft

TAPE	FS	ELEV	NOTE
0	5.85	151.79	
13	5.35	152.29	
24	5.81	151.83	
26	6.01	151.63	
29.2	7.17	150.47	
33.6	8.06	149.58	
35	8.68	148.96	
40	8.76	148.88	BKF
43	9.93	147.71	
44	10.16	147.48	inv
44.8	10.01	147.63	
45.5	9.5	148.14	
48.6	8.76	148.88	
52	8.81	148.83	
63	5.97	151.67	
78	5.55	152.09	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	150.28	150.28	150.28
Bankfull Elevation (ft)	148.88	148.88	148.88
Floodprone Width (ft)	27.48	-----	-----
Bankfull Width (ft)	8.6	3.73	4.87
Entrenchment Ratio	3.19	-----	-----
Mean Depth (ft)	0.69	0.72	0.67
Maximum Depth (ft)	1.4	1.34	1.4
Width/Depth Ratio	12.46	5.18	7.27
Bankfull Area (sq ft)	5.94	2.67	3.27
Wetted Perimeter (ft)	9.11	5.31	6.48
Hydraulic Radius (ft)	0.65	0.5	0.5
Begin BKF Station	40	40	43.73
End BKF Station	48.6	43.73	48.6

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS16P
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 152.43 ft
Backsight Rod Reading: 3.5 ft

TAPE	FS	ELEV	NOTE
0	4.97	150.96	
7	4.52	151.41	
14.5	4.44	151.49	
20	6.11	149.82	
24.5	7.32	148.61	
31.7	7.67	148.26	BKF
33.5	8.56	147.37	
34	9.34	146.59	inv
35	9.28	146.65	
36.1	8.84	147.09	
37	8.69	147.24	
40.8	7.77	148.16	BKF
42	7.73	148.2	
46.3	7.8	148.13	
57	4.78	151.15	
76	4.74	151.19	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	149.83	149.83	149.83
Bankfull Elevation (ft)	148.21	148.21	148.21
Floodprone Width (ft)	32.36	-----	-----
Bankfull Width (ft)	9	3.72	5.28
Entrenchment Ratio	3.6	-----	-----
Mean Depth (ft)	0.81	0.99	0.68
Maximum Depth (ft)	1.62	1.62	1.35
Width/Depth Ratio	11.11	3.76	7.76
Bankfull Area (sq ft)	7.27	3.68	3.6
Wetted Perimeter (ft)	9.88	5.74	6.85
Hydraulic Radius (ft)	0.74	0.64	0.52
Begin BKF Station	31.8	31.8	35.52
End BKF Station	40.8	35.52	40.8

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

RIVERMORPH CROSS SECTION SUMMARY

River Name: UT Lumber
Reach Name: Reach 2 (downstream)
Cross Section Name: XS17R
Survey Date: 04/14/2010

Cross Section Data Entry

BM Elevation: 152.43 ft
Backsight Rod Reading: 3.5 ft

TAPE	FS	ELEV	NOTE
0	4.74	151.19	
10	4.72	151.21	
15.3	5.54	150.39	
19.8	6.75	149.18	
23.7	8.02	147.91	
28.4	8.14	147.79	BKF
29.5	8.34	147.59	
31.9	9.2	146.73	
32.4	9.4	146.53	
32.9	9.35	146.58	
33.3	9.97	145.96	inv
35	8.59	147.34	
36.9	8.08	147.85	
40.5	8.14	147.79	
42.8	7.03	148.9	
51	5.42	150.51	
63	4.95	150.98	

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	149.62	149.62	149.62
Bankfull Elevation (ft)	147.79	147.79	147.79
Floodprone Width (ft)	28.3	-----	-----
Bankfull Width (ft)	8.28	4.69	3.59
Entrenchment Ratio	3.42	-----	-----
Mean Depth (ft)	0.69	0.66	0.74
Maximum Depth (ft)	1.83	1.5	1.83
Width/Depth Ratio	12	7.11	4.85
Bankfull Area (sq ft)	5.74	3.08	2.67
Wetted Perimeter (ft)	9.37	6.56	5.82
Hydraulic Radius (ft)	0.61	0.47	0.46
Begin BKF Station	28.4	28.4	33.09
End BKF Station	36.68	33.09	36.68

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

UT to Lumber River As-Built Survey - Profile Data

TR = top of riffle, MR = mid riffle, BR = bottom of riffle, P = pool

Design Station	NOTE	Riffle/Pool Lengths	Riffle/Pool WS Slope	Feature Depth	WD	ELEV				
						CP	INV	LTOB	RTOB	WS
Begin Upper Reach										
	#4548					158.8				
1000	P			2.25	1.7		151.78	153.98	154.08	153.48
1030	TR			1.04	0.45		152.58	153.51	153.73	153.03
1077	BR	47	-0.00149	1.07	0.37		152.59	153.73	153.59	152.96
1091	P	25.5	-0.00275	1.215	0.45		152.5	153.77	153.66	152.95
1102.5	TR			0.995	0.2		152.69	153.7	153.67	152.89
1125	BR	22.5	-0.00089	1.25	0.4		152.47	153.74	153.7	152.87
1141	P			1.18	0.48		152.38	153.64	153.48	152.86
1158	P	47	0.00000	1.13	0.43		152.48	153.59	153.63	152.91
1172	TR			0.99	0.3		152.57	153.56	153.56	152.87
1182	BR	10	-0.00500	0.885	0.21		152.61	153.5	153.49	152.82
1188	P			1.05	0.25		152.56	153.63	153.59	152.81
1200	P	32.5	-0.00277	1.105	0.34		152.43	153.51	153.56	152.77
1214.5	TR			0.94	0.15		152.58	153.51	153.53	152.73
1220	BR	5.5	0.00182	0.96	0.25		152.49	153.44	153.46	152.74
1229	P			1.01	0.29		152.44	153.42	153.48	152.73
1244	P	46	-0.00391	1.055	0.3		152.41	153.45	153.48	152.71
1266	TR			1.195	0.25		152.31	153.5	153.51	152.56
1290	BR	24	-0.00125	0.965	0.28		152.25	153.17	153.26	152.53
1299	P			1.285	0.45		152.05	153.38	153.29	152.5
1308	P	24	-0.00042	1.29	0.5		152.02	153.41	153.21	152.52
1314	TR			1.16	0.32		152.2	153.47	153.25	152.52
1330	BR	16	0.00000	1.04	0.35		152.17	153.12	153.3	152.52
1344	P			1.28	0.64		151.85	153.09	153.17	152.49
1357	P	38.5	0.00000	1.47	0.64		151.83	153.33	153.27	152.47
1368.5	TR			1.075	0.36		152.16	153.27	153.2	152.52
1388	BR	19.5	-0.00410	1.13	0.32		152.12	153.26	153.24	152.44
1397	P			1.355	0.44		152.03	153.48	153.29	152.47
1405	P	31	-0.00548	1.425	0.5		151.97	153.52	153.27	152.47
1419	TR			0.95	0.17		152.1	152.96	153.14	152.27
1441	BR	22	-0.00045	1.15	0.35		151.91	153.02	153.1	152.26
1450	P	19	-0.00474	1.55	0.7		151.57	153.11	153.13	152.27
1460	TR			1.165	0.26		151.91	153.11	153.04	152.17
1467	BR	7	0.01286	1.2	0.33		151.93	153.17	153.09	152.26
1476	P			0.98	0.2		152.06	153.07	153.01	152.26
1478	P			1.065	0.3		151.95	153.11	152.92	152.25
1490	P	34	-0.00088	1.3	0.4		151.78	153.09	153.07	152.18
1501	TR			1.055	0.18		152.05	153.13	153.08	152.23
1519	MR			1.115	0.16		152.01	153.07	153.18	152.17
1547	BR	46	-0.00152	0.99	0.19		151.97	152.93	152.99	152.16
1552	P	16	-0.00188	1.005	0.26		151.9	152.8	153.01	152.16
1563	TR			0.97	0.16		151.97	152.93	152.95	152.13
1580	BR	17	0.00059	1.045	0.28		151.86	152.88	152.93	152.14
1593	P	20	-0.00200	1.36	0.54		151.58	152.93	152.95	152.12
1600	TR			1.04	0.17		151.93	152.93	153.01	152.1
1611	BR	11	-0.00091	1.05	0.18		151.91	152.96	152.96	152.09
1618	P			1.52	0.65		151.44	153.02	152.9	152.09
1629	P	19	-0.00053	1.435	0.6		151.46	152.93	152.86	152.06
1630	TR			1.06	0.22		151.86	152.96	152.88	152.08
1643	BR	13	-0.00077	1.185	0.28		151.79	152.97	152.98	152.07
						158.81				
1652	P	18	-0.00222	1.235	0.28		151.73	153.05	152.88	152.01
1661	TR			1.095	0.26		151.77	152.86	152.87	152.03
1674	BR	13	-0.00077	1.035	0.25		151.77	152.8	152.81	152.02
1685	P			1.205	0.4		151.61	152.82	152.81	152.01
1696	P			1.535	0.76		151.33	152.78	152.95	152.09
1709	P	48	-0.00063	1.555	0.76		151.25	152.78	152.83	152.01
1722	TR			1.245	0.39		151.6	152.85	152.84	151.99
1759	BR	37	-0.00324	1.155	0.27		151.6	152.8	152.71	151.87
1761	P	11	-0.00182	1.525	0.65		151.21	152.66	152.81	151.86
1770	TR			1.14	0.21		151.64	152.79	152.77	151.85
1798	BR	28	-0.00071	1.175	0.26		151.57	152.71	152.78	151.83
1805	P			1.58	0.6		151.22	152.79	152.81	151.82
1813	P	20	-0.00350	1.59	0.7		151.13	152.72	152.72	151.83
1818	TR			1.18	0.21		151.55	152.69	152.77	151.76

1835	MR			1.085	0.11		151.68	152.75	152.78	151.79
1854	BR	36	0.00056	1.125	0.18		151.6	152.7	152.75	151.78
1867	P	26	0.00000	1.285	0.42		151.4	152.68	152.69	151.82
1880	TR			1.185	0.26		151.52	152.67	152.74	151.78
1891	BR	11	-0.00545	1.185	0.24		151.48	152.57	152.76	151.72
1903	P	22	-0.00045	1.65	0.75		150.9	152.55	152.55	151.65
1913	TR			1.125	0.22		151.49	152.55	152.68	151.71
1927	BR	14	-0.00071	1.12	0.25		151.45	152.48	152.66	151.7
1938	P			1.385	0.5		151.24	152.64	152.61	151.74
1953	P	37	-0.00297	1.225	0.3		151.39	152.67	152.56	151.69
1964	TR			1.27	0.3		151.29	152.59	152.53	151.59
1985	MR			1.02	0.18		151.4	152.37	152.47	151.58
2007	BR	43	-0.00047	1.16	0.32		151.25	152.37	152.45	151.57
2017	P	20	-0.00100	1.175	0.33		151.24	152.45	152.38	151.57
2027	TR			1.16	0.3		151.25	152.4	152.42	151.55
2049	BR	22	-0.00182	1.19	0.31		151.2	152.43	152.35	151.51
2057	P			1.29	0.42		151.1	152.34	152.44	151.52
2069	P	28	-0.00429	1.24	0.27		151.24	152.38	152.58	151.51
2077	TR			1.16	0.15		151.24	152.33	152.47	151.39
2096	BR	19	-0.00368	1.27	0.22		151.1	152.36	152.38	151.32
2103	P	19	-0.00368	1.45	0.4		150.91	152.36	152.36	151.31
2115	TR			1.145	0.16		151.09	152.17	152.3	151.25
2130	BR	15	-0.00467	1.19	0.15		151.03	152.06	152.38	151.18
2137	P			1.295	0.25		150.93	152.16	152.29	151.18
2149	P	31	-0.00226	1.315	0.26		150.89	152.22	152.19	151.15
2161	sill			1.115	0.09		151.02	152.15	152.12	151.11
End Upper Reach										
Begin Lower Reach										
2161	sill			1.115	0.09		151.02	152.15	152.12	151.11
2165	P	9	-0.00111	1.735	0.7		150.39	152.13	152.12	151.09
2170	TR			1.18	0.22		150.88	152.04	152.08	151.1
2186	BR	16	-0.00125	1.2	0.19		150.89	152.08	152.1	151.08
2197	P			1.565	0.47		150.58	152.19	152.1	151.05
2209	P	30	-0.00033	1.705	0.65		150.39	152.04	152.15	151.04
2216	TR			1.375	0.29		150.78	152.15	152.16	151.07
2234	BR	18	-0.00111	1.335	0.29		150.76	151.99	152.2	151.05
2244	P	17	0.00000	1.68	0.7		150.33	151.95	152.07	151.03
2251	TR			1.17	0.2		150.85	152.05	151.99	151.05
2263	MR			1.195	0.23		150.77	151.83	152.1	151
2277	BR	26	-0.00115	1.245	0.29		150.73	151.91	152.04	151.02
2285	P	14	-0.00571	1.345	0.36		150.62	151.98	151.95	150.98
2291	TR			1.29	0.3		150.64	151.88	151.98	150.94
2296	BR	5	-0.00800	1.285	0.39		150.51	151.78	151.81	150.9
2301	P	10	0.00400	1.355	0.42		150.53	151.98	151.79	150.95
2306	TR			1.13	0.2		150.74	151.95	151.79	150.94
2328	BR	22	-0.00182	1.395	0.29		150.61	152.01	152	150.9
2344	P	27	-0.00185	1.89	0.83		149.95	151.91	151.77	150.78
2355	TR			1.175	0.16		150.69	151.85	151.88	150.85
2369	MR			1.38	0.33		150.47	151.84	151.86	150.8
2381	BR	26	-0.00231	1.355	0.25		150.54	151.87	151.92	150.79
2387	P	15	-0.00133	1.66	0.51		150.3	151.94	151.98	150.81
2396	TR			1.405	0.23		150.54	151.93	151.96	150.77
2417	BR	21	0.00048	1.33	0.24		150.54	151.89	151.85	150.78
2424	P			1.325	0.2		150.56	151.9	151.87	150.76
2430	P	17	-0.00294	1.7	0.65		150.08	151.73	151.83	150.73
2434	TR			1.315	0.22		150.51	151.82	151.83	150.73
2447	BR	13	0.00000	1.38	0.28		150.45	151.8	151.86	150.73
2460	P	24	-0.00208	1.59	0.51		150.18	151.75	151.79	150.69
2471	TR			1.41	0.29		150.39	151.77	151.83	150.68
2489	BR			1.245	0.3		150.37	151.57	151.66	150.67
2506	BR	35	-0.00143	1.175	0.2		150.43	151.57	151.64	150.63
						154.73				
2512	P	14	0.00000	1.455	0.35		150.13	151.57	151.6	150.48
2520	TR			1.14	0.15		150.48	151.68	151.56	150.63
2541	BR	21	-0.00381	1.28	0.22		150.33	151.63	151.59	150.55
2552	P	17	-0.00235	1.54	0.53		150.04	151.56	151.6	150.57
2558	TR			1.295	0.19		150.32	151.66	151.57	150.51
2568	BR	10	0.00400	1.265	0.29		150.26	151.51	151.54	150.55
2570	P	6	-0.00167	1.555	0.52		150.01	151.54	151.59	150.53
2574	TR			1.405	0.38		150.16	151.59	151.54	150.54
2609	BR	35	-0.00086	1.32	0.25		150.26	151.65	151.51	150.51

2613	P	17	-0.00235	1.8225	0.8		149.74	151.61	151.515	150.54
2626	TR			1.275	0.2		150.27	151.57	151.52	150.47
2649	BR	23	-0.00391	1.465	0.25		150.13	151.67	151.52	150.38
2663	P	25	-0.00200	1.375	0.31		150.12	151.545	151.445	150.43
2674	TR			1.255	0.19		150.14	151.42	151.37	150.33
2699	BR	25	-0.00040	1.225	0.19		150.13	151.34	151.37	150.32
2714	P	31	-0.00129	1.3375	0.28		150.02	151.375	151.34	150.3
2730	TR			1.38	0.3		149.98	151.41	151.31	150.28
2766	BR	36	-0.00139	1.26	0.2		150.03	151.36	151.22	150.23
2782	P	27	-0.00296	1.69	0.52		149.6	151.34	151.24	150.12
2793	TR			1.4	0.26		149.89	151.32	151.26	150.15
2806	BR	13	-0.00154	1.285	0.16		149.97	151.35	151.16	150.13
2819	P	24	-0.00125	1.74	0.16		149.51	151.34	151.16	149.67
2830	TR			1.375	0.23		149.87	151.33	151.16	150.1
2849	BR	19	-0.00158	1.41	0.26		149.81	151.2	151.24	150.07
2857	P	17	-0.00235	1.48	0.32		149.72	151.165	151.235	150.04
2866	TR			1.35	0.2		149.83	151.13	151.23	150.03
2888	BR	22	0.00000	1.285	0.2		149.83	151.14	151.09	150.03
2907	P	41	-0.00244	1.3125	0.3		149.68	151.04	150.945	149.98
2929	TR			1.16	0.22		149.71	150.94	150.8	149.93
2944	BR	15	0.00000	1.355	0.3		149.63	150.99	150.98	149.93
2949	P	14	-0.00357	1.845	0.78		149.12	150.97	150.96	149.9
2958	TR			1.435	0.37		149.51	150.95	150.94	149.88
2969	BR	11	0.00636	1.385	0.39		149.56	150.95	150.94	149.95
						155.05				
2981	P	17	-0.00059	1.745	0.7		149.17	150.9	150.93	149.87
2986	TR			1.225	0.25		149.69	150.9	150.93	149.94
3020	BR	34	-0.00118	1.15	0.19		149.71	150.93	150.79	149.9
3041	P	32	-0.00125	1.2875	0.27		149.58	150.91	150.825	149.85
3052	TR			1.225	0.21		149.65	150.89	150.86	149.86
3074	BR	22	-0.00091	1.31	0.29		149.55	150.85	150.87	149.84
3081	P	18	-0.00111	1.75	0.74		149.11	150.89	150.83	149.85
3092	TR			1.2	0.16		149.66	150.93	150.79	149.82
3146	BR	54	-0.00148	1.275	0.27		149.47	150.79	150.7	149.74
3157	P			1.855	0.89		148.88	150.7675	150.7025	149.77
3170	P	36	-0.00083	1.215	0.2		149.51	150.745	150.705	149.71
3182	TR			1.295	0.3		149.41	150.7	150.71	149.71
3214	BR	32	-0.00125	1.345	0.25		149.42	150.68	150.85	149.67
3225	P	32	0.00000	1.855	0.85		148.84	150.685	150.705	149.69
3246	TR			1.195	0.24		149.43	150.69	150.56	149.67
3268	BR	22	-0.00273	1.16	0.18		149.43	150.6	150.58	149.61
3275	P	13	-0.00077	1.205	0.2		149.39	150.605	150.585	149.59
3281	TR			1.155	0.19		149.41	150.52	150.61	149.6
3297	BR	16	0.00125	1.105	0.2		149.42	150.52	150.53	149.62
3309	P	28	-0.00214	1.2475	0.3		149.28	150.52	150.535	149.58
3325	TR			1.12	0.19		149.37	150.52	150.46	149.56
3348	BR	23	-0.00174	1.13	0.15		149.37	150.54	150.46	149.52
3361	P	27	-0.00259	1.16	0.15		149.31	150.53	150.41	149.46
3375	TR			1.19	0.2		149.25	150.52	150.36	149.45
3411	BR	36	-0.00278	1.205	0.16		149.19	150.42	150.37	149.35
3425	P	33	-0.00212	1.28	0.19		149.15	150.44	150.42	149.34
3444	TR			1.435	0.25		149.03	150.46	150.47	149.28
3469	BR	25	-0.00280	1.24	0.15		149.06	150.3	150.3	149.21
3485	P	22	-0.00091	1.7775	0.65		148.5	150.285	150.27	149.15
3491	TR			1.215	0.15		149.04	150.27	150.24	149.19
3529	BR	38	-0.00184	1.3	0.21		148.91	150.23	150.19	149.12
3542	P	27	0.00000	1.68	0.59		148.53	150.23	150.19	149.12
3556	TR			1.245	0.2		148.92	150.19	150.14	149.12
3575	BR	19	-0.00316	1.39	0.26		148.8	150.26	150.12	149.06
3588	P	22	-0.00182	1.4125	0.31		148.74	150.185	150.12	149.05
3597	TR			1.295	0.2		148.82	150.11	150.12	149.02
3613	BR	16	-0.00187	1.31	0.2		148.79	150.1	150.1	148.99
3629	P	25	0.00040	2.0025	0.9		148.06	150.08	150.045	148.96
3638	TR			1.305	0.28		148.72	150.06	149.99	149
3650	BR	12	0.00000	1.4025	0.4		148.6	149.985	150.02	149
3671	P	31	-0.00194	1.67	0.6		148.33	149.98	150.02	148.93
3681	TR			1.31	0.27		148.67	149.91	150.05	148.94
						153.94				
3711	BR	30	-0.00233	1.395	0.25		148.62	150.03	150	148.87
3728	P	35	-0.00343	1.45	0.28		148.52	149.955	149.985	148.8

3746	TR			1.345	0.17		148.58	149.88	149.97	148.75
3768	BR	22	-0.00136	1.425	0.24		148.48	149.89	149.92	148.72
3787	P	33	-0.00364	1.4725	0.27		148.41	149.865	149.9	148.68
3801	TR			1.41	0.15		148.45	149.84	149.88	148.6
3821	BR	20	-0.00050	1.4675	0.29		148.3	149.755	149.78	148.59
3832	P	24	0.00083	1.845	0.8		147.83	149.67	149.68	148.63
3845	TR			1.345	0.25		148.36	149.67	149.74	148.61
3854	BR	9	-0.00667	1.4225	0.26		148.29	149.685	149.74	148.55
3864	P	22	-0.00136	1.76	0.62		147.95	149.68	149.74	148.57
3876	TR			1.36	0.16		148.36	149.7	149.74	148.52
3886	BR	10	-0.00100	1.435	0.29		148.22	149.68	149.63	148.51
3890	P	20	0.00100	1.46	0.41		148.13	149.66	149.52	148.54
3906	TR			1.485	0.4		148.13	149.63	149.6	148.53
3927	BR	21	-0.00190	1.445	0.3		148.19	149.6	149.67	148.49
3936	P			1.375	0.16		148.26	149.6	149.67	148.42
3941	P	26	-0.00192	1.815	0.7		147.75	149.54	149.59	148.45
3953	TR			1.255	0.2		148.24	149.48	149.51	148.44
3997	BR	44	-0.00114	1.345	0.21		148.18	149.53	149.52	148.39
4013	P	36	0.00000	1.6225	0.56		147.85	149.49	149.455	148.41
4033	TR			1.21	0.18		148.21	149.45	149.39	148.39
4050	BR	17	-0.00235	1.3475	0.26		148.09	149.46	149.415	148.35
4059	P			1.455	0.38		148	149.47	149.44	148.38
4074	P	28	-0.00107	1.4525	0.4		147.97	149.435	149.41	148.37
4078	TR			1.26	0.19		148.13	149.4	149.38	148.32
4089	BR	11	0.00000	1.3475	0.3		148.02	149.36	149.375	148.32
4096	P	15	-0.00133	1.905	0.86		147.46	149.36	149.37	148.32
4104	TR			1.335	0.29		148.01	149.32	149.37	148.3
4117	BR	13	0.00000	1.305	0.25		148.05	149.35	149.36	148.3
4124	P			1.725	0.65		147.64	149.38	149.35	148.29
4138	P	30	0.00100	1.825	0.87		147.45	149.305	149.245	148.32
4147	TR			1.235	0.38		147.95	149.23	149.14	148.33
4163	BR	16	-0.00312	1.2575	0.32		147.96	149.225	149.21	148.28
4167	P	17	0.00059	1.385	0.46		147.83	149.22	149.21	148.29
4180	TR			1.3	0.34		147.95	149.22	149.28	148.29
4192	BR	12	-0.00333	1.225	0.24		148.01	149.22	149.25	148.25
4199	P	20	0.00050	1.68	0.7		147.54	149.22	149.22	148.24
4212	TR			1.2	0.28		147.98	149.19	149.17	148.26
4232	BR	20	-0.00200	1.2	0.31		147.91	149.03	149.19	148.22
4240	P	18	-0.00111	1.58	0.71		147.52	149.11	149.09	148.23
4250	TR			1.2	0.31		147.89	149.19	148.99	148.2
4267	BR	17	0.00294	1.305	0.49		147.76	149.12	149.01	148.25
4276	P			1.63	0.8		147.41	149.05	149.03	148.21
4291	P	33	-0.00182	1.385	0.51		147.65	149.015	149.055	148.16
4300	TR			1.19	0.35		147.84	148.98	149.08	148.19
4333	BR	33	0.00000	1.115	0.28		147.91	149.08	148.97	148.19
4342	P			1.3925	0.56		147.62	149.05	148.975	148.18
4354	P	30	-0.00167	1.34	0.49		147.66	149.02	148.98	148.15
4363	TR			1.12	0.22		147.92	149	149.08	148.14
4378	BR	15	-0.01067	1.275	0.3		147.68	148.94	148.97	147.98
4385	P	17	-0.00118	1.2475	0.3		147.69	148.945	148.93	147.99
4395	TR			1.16	0.2		147.76	148.95	148.89	147.96
4409	BR	14	-0.00571	1.285	0.23		147.65	148.965	148.905	147.88
4416	P	12	0.00167	1.33	0.3		147.62	148.98	148.92	147.92
4421	TR			1.25	0.25		147.65	148.92	148.88	147.9
4441	BR	20	-0.00100	1.215	0.26		147.62	148.82	148.85	147.88
4446	P	16	-0.00563	1.4975	0.51		147.38	148.875	148.88	147.89
4457	TR			1.34	0.21		147.58	148.93	148.91	147.79
4477	MR			1.355	0.29		147.51	148.865	148.865	147.8
4497	BR	40	0.00000	1.23	0.21		147.58	148.8	148.82	147.79
4508	P	24	-0.00167	1.36	0.25		147.45	148.8	148.82	147.7
						148.73				
4521	TR			1.265	0.22		147.53	148.8	148.79	147.75
4542	BR	21	0.00095	1.285	0.29		147.48	148.8	148.73	147.77
4552	P			1.295	0.24		147.44	148.8	148.67	147.68
4572	P	46	-0.00283	1.2525	0.24		147.43	148.72	148.645	147.67
4588	TR			1.21	0.22		147.42	148.64	148.62	147.64
4605	BR	17	-0.00235	1.27	0.24		147.36	148.75	148.51	147.6
4616	P	25	-0.00080	1.3775	0.37		147.25	148.73	148.525	147.62
4630	TR			1.285	0.24		147.34	148.71	148.54	147.58
4643	BR	13	-0.00308	1.3025	0.22		147.32	148.73	148.515	147.54
4653	P	23	0.00087	1.54	0.48		147.08	148.75	148.49	147.56

4666	TR			1.355	0.38		147.18	148.62	148.45	147.56
4676	BR	10	-0.00400	1.3025	0.29		147.23	148.6	148.465	147.52
4680	P	11	-0.00182	1.54	0.51		146.99	148.6	148.46	147.5
4687	TR			1.22	0.19		147.31	148.58	148.48	147.5
4708	BR	21	-0.00238	1.225	0.33		147.12	148.45	148.24	147.45
4721	P	33	0.00061	1.3075	0.4		147.08	148.445	148.33	147.48
4741	TR			1.22	0.26		147.21	148.44	148.42	147.47
4756	BR	15	-0.00200	1.3	0.28		147.16	148.445	148.475	147.44
4763	P	19	0.00053	1.63	0.6		146.86	148.45	148.53	147.46
4775	TR			1.415	0.41		147.04	148.47	148.44	147.45
4784	BR	9	-0.00333	1.3475	0.36		147.06	148.395	148.42	147.42
4794	P			1.62	0.7		146.74	148.32	148.4	147.44
4807	P			1.7575	0.85		146.6	148.32	148.395	147.45
4822	P	51	0.00059	1.415	0.52		146.94	148.32	148.39	147.46
4835	TR			1.395	0.49		146.96	148.32	148.39	147.45
4864	BR	29	-0.00034	1.34	0.5		146.94	148.33	148.23	147.44
4873	P	23	-0.00087	1.695	0.8		146.61	148.37	148.24	147.41
4887	TR			1.19	0.34		147.08	148.32	148.22	147.42
4903	BR	16	-0.00062	1.13	0.34		147.07	148.26	148.14	147.41
	#962					152.43				
4917	P	34	-0.00235	1.755	0.9		146.46	148.22	148.21	147.36
4937	TR			1.125	0.26		147.07	148.24	148.15	147.33
4956	BR	19	-0.01000	1.23	0.31		146.83	148.22	147.9	147.14
4965	P	25	0.00200	1.855	0.9		146.21	148.04	148.09	147.11
4981	TR			1.215	0.4		146.79	148	148.01	147.19
4994	BR	13	-0.00308	1.435	0.55		146.6	148.04	148.03	147.15
5007	P	41	0.00024	1.56	0.71		146.45	148	148.02	147.16
5035	TR			1.165	0.34		146.82	147.96	148.01	147.16
5053	BR	18	-0.00389	1.2975	0.4		146.69	147.965	148.01	147.09
5061	P	25	0.00080	1.31	0.46		146.68	147.97	148.01	147.14
5078	TR			1.125	0.26		146.85	147.96	147.99	147.11
5111	Culvert			1.83	1.04		145.99	147.755	147.885	147.03
5151	Culvert			2.015	1.22		145.8	147.75	147.88	147.02
5165	BR	87	-0.00103	1.025	0.38		146.64	147.55	147.78	147.02
5175	P	20	-0.00450	1.2175	0.46		146.53	147.665	147.83	146.99
5185	TR			1.19	0.29		146.64	147.78	147.88	146.93
5211	BR	26	-0.00577	1.155	0.36		146.42	147.44	147.71	146.78
5223	P			1.07	0.45		146.48	147.465	147.635	146.93
5229	P	19	-0.00158	1.255	0.47		146.29	147.46	147.63	146.76
5230	TR			1.125	0.35		146.4	147.49	147.56	146.75
5260	MR			1.2	0.3		146.3	147.54	147.46	146.6
5277	sill	47	-0.00383	1.1825	0.22		146.35	147.555	147.51	146.57
5281	P	8	-0.00625	2.055	0.95		145.51	147.57	147.56	146.46
5285	TR			1.38	0.32		146.2	147.51	147.65	146.52
5311	MR			1.255	0.18		146.29	147.51	147.58	146.47
5335	sill	50	-0.00240	1.24	0.13		146.27	147.51	147.51	146.4
5338	P	7	-0.01286	1.8225	0.69		145.65	147.46	147.485	146.34
5342	TR			1.375	0.25		146.06	147.41	147.46	146.31
5357	BR	15	-0.00333	1.585	0.31		145.95	147.46	147.61	146.26
	pin					147.6				
						152.43				

End Lower Reach

APPENDIX C
VEGETATION PLOT PHOTOGRAPHS

Vegetation Plot #1

Vegetation Plot #2

Vegetation Plot #3

Vegetation Plot #4

Vegetation Plot #5

Vegetation Plot #6

Vegetation Plot #7

Vegetation Plot #8

Vegetation Plot #9 – Photo Missing from Records

Vegetation Plot #10

Vegetation Plot #11

Vegetation Plot #12

Vegetation Plot #13

Vegetation Plot #14

APPENDIX D
CVS VEGETATION DATA

Report Prepared By	Ryan Smith
Date Prepared	8/25/2010 14:38

database name	CVS_entry.mdb
database location	S:\Lumber_River\Docs\Monitoring
computer name	NC10435
file size	37883904

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.

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)	59707.39
Required Plots (calculated)	14
Sampled Plots	14

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 0 (baseline)
94068	UT to the Lumber River	Lumber	806.48

plot	Plot Level	Year	Latitude/Northing	Longitude/Easting	Zone	Datum	Date Sampled	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
UTLR-FH-0001	1	0	329533.7900	1944032.6390	NC	NAD83/WGS84	4/27/2010	19	19	0	0	19	19	768.9027217	768.9027217	0	768.9027217	768.9027217	7
UTLR-FH-0010	1	0	327621.8170	1945196.6450	nc	NAD83/WGS84	4/30/2010	17	17	0	0	17	17	687.9655931	687.9655931	0	687.9655931	687.9655931	8
UTLR-FH-0011	1	0	327536.8000	1945385.0610	nc	NAD83/WGS84	4/30/2010	15	15	0	0	15	15	607.0284645	607.0284645	0	607.0284645	607.0284645	7
UTLR-FH-0012	1	0	327426.9340	1945716.6670	nc	NAD83/WGS84	4/30/2010	18	18	0	0	18	18	728.4341574	728.4341574	0	728.4341574	728.4341574	8
UTLR-FH-0013	1	0	327042.2280	1945670.8650	nc	NAD83/WGS84	4/30/2010	27	27	0	0	27	27	1092.651236	1092.651236	0	1092.651236	1092.651236	4
UTLR-FH-0014	1	0	326753.9350	1945799.3000	nc	NAD83/WGS84	4/30/2010	23	23	0	0	23	23	930.7769789	930.7769789	0	930.7769789	930.7769789	3
UTLR-FH-0002	1	0	329399.9540	1944357.9470	nc	NAD83/WGS84	4/27/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	8
UTLR-FH-0003	1	0	329309.8740	1944602.1840	nc	NAD83/WGS84	4/27/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	8
UTLR-FH-0004	1	0	329123.4490	1944816.8510	nc	NAD83/WGS84	4/27/2010	22	22	0	0	22	22	890.3084146	890.3084146	0	890.3084146	890.3084146	9
UTLR-FH-0005	1	0	328859.5730	1945049.3770	nc	NAD83/WGS84	4/27/2010	18	18	0	0	18	18	728.4341574	728.4341574	0	728.4341574	728.4341574	8
UTLR-FH-0006	1	0	328610.0060	1944832.2890	nc	NAD83/WGS84	4/27/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	6
UTLR-FH-0007	1	0	328532.5300	1944924.3700	nc	NAD83/WGS84	4/27/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	8
UTLR-FH-0008	1	0	328224.5780	1944995.0850	nc	NAD83/WGS84	4/27/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	7
UTLR-FH-0009	1	0	327918.6780	1945027.6840	nc	NAD83/WGS84	4/30/2010	20	20	0	0	20	20	809.371286	809.371286	0	809.371286	809.371286	7

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 0 (baseline)
94068	UT to the Lumber River	Lumber	806.4806743

vigor	Count	Percent
4	279	100

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Fraxinus pennsylvanica	green ash	27						
	Nyssa biflora	swamp tupelo	47						
	Quercus laurifolia	laurel oak	28						
	Quercus lyrata	overcup oak	33						
	Quercus michauxii	swamp chestnut oak	18						
	Quercus nigra	water oak	36						
	Quercus phellos	willow oak	32						
	Taxodium distichum	bald cypress	32						
	Ulmus americana	American elm	26						
TOT:	**9**	**9**	**279**						

Damage	Count	Percent Of Stems
(no damage)	279	100

	Species	CommonName	Count of Damage Categories	(no damage)
	Fraxinus pennsylvanica	green ash	0	27
	Nyssa biflora	swamp tupelo	0	47
	Quercus laurifolia	laurel oak	0	28
	Quercus lyrata	overcup oak	0	33
	Quercus michauxii	swamp chestnut oak	0	18
	Quercus nigra	water oak	0	36
	Quercus phellos	willow oak	0	32
	Taxodium distichum	bald cypress	0	32
	Ulmus americana	American elm	0	26
TOT:	**9**	**9**	**0**	**279**

	plot	Count of Damage Categories	(no damage)
	UTLR-FH-0001	0	19
	UTLR-FH-0002	0	20
	UTLR-FH-0003	0	20
	UTLR-FH-0004	0	22
	UTLR-FH-0005	0	18
	UTLR-FH-0006	0	20
	UTLR-FH-0007	0	20
	UTLR-FH-0008	0	20
	UTLR-FH-0009	0	20
	UTLR-FH-0010	0	17
	UTLR-FH-0011	0	15
	UTLR-FH-0012	0	18
	UTLR-FH-0013	0	27
	UTLR-FH-0014	0	23
TOT:	**14**	**0**	**279**

	Comment	Species	Common Name	Total Planted Stems	# plots	avg# stems	plot UTLR-FH-0001	plot UTLR-FH-0002	plot UTLR-FH-0003	plot UTLR-FH-0004	plot UTLR-FH-0005	plot UTLR-FH-0006	plot UTLR-FH-0007	plot UTLR-FH-0008	plot UTLR-FH-0009	plot UTLR-FH-0010	plot UTLR-FH-0011	plot UTLR-FH-0012	plot UTLR-FH-0013	plot UTLR-FH-0014
		Fraxinus pennsylvanica	green ash	27	11	2.45	3	1	1	2	3		2	3	4	2	2	4		
		Nyssa biflora	swamp tupelo	47	13	3.62	3	2	2	3	3	1	4	3	2		3	4	11	6
		Quercus laurifolia	laurel oak	28	10	2.8	3	3	3	2	2		1	4		4	3	3		
		Quercus lyrata	overcup oak	33	9	3.67				3	1		4	1		1	2	1	9	11
		Quercus michauxii	swamp chestnut oak	18	10	1.8	1	1	1	2	1	1		4	5	1		1		
		Quercus nigra	water oak	36	12	3	2	5	5	3	4	6	2	4	1	2	1	1		
		Quercus phellos	willow oak	32	12	2.67	4	1	1	3	3	6	2	1	4	3	1	3		
		Taxodium distichum	bald cypress	32	11	2.91	3	2	2	2		1	4		1	2	3		6	6
		Ulmus americana	American elm	26	10	2.6		5	5	2	1	5	1		3	2		1	1	
TOT:	**0**	**9**	**9**	**279**	**9**		**19**	**20**	**20**	**22**	**18**	**20**	**20**	**20**	**20**	**17**	**15**	**18**	**27**	**23**