

**YEAR 2 (2010)**  
**ANNUAL MONITORING REPORT**  
**THREE MILE CREEK RESTORATION SITE**  
**AVERY COUNTY, NORTH CAROLINA**  
**(Contract #16-D06125-A)**

**FULL DELIVERY PROJECT**  
**TO PROVIDE STREAM AND WETLAND MITIGATION**  
**IN THE FRENCH BROAD RIVER BASIN**  
**CATALOGING UNIT 06010108**



**Prepared for:**

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## EXECUTIVE SUMMARY

Restoration Systems, L.L.C. has completed restoration of streams and wetlands at the Three Mile Creek Restoration Site (hereafter referred to as the “Site”) to assist the North Carolina Ecosystem Enhancement Program in fulfilling stream and wetland mitigation goals. The Site, located in southwestern Avery County approximately 5.2 miles northeast of Spruce Pine, North Carolina, provides 8103 stream mitigation units and 3.7 riparian wetland mitigation units as described in the As-Built Mitigation Plan dated April 2009. The Site is located in United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 06010108010020 (North Carolina Division of Water Quality Subbasin 04-03-06) of the French Broad River Basin. This report serves as the Year 2 (2010) annual monitoring report.

Primary activities at the Site included 1) stream restoration, 2) stream enhancement, 3) stream preservation, 4) wetland restoration and enhancement, 5) soil scarification, and 6) plant community restoration. Project restoration efforts provide 8103 Stream Mitigation Units and 3.7 riverine Wetland Mitigation Units.

Eight vegetation plots (10-meter by 10-meter in size) were established and permanently monumented. These plots were surveyed in July 2010 for the Year 2 (2010) monitoring season. Vegetation sampling across the Site was above the required average density with 637 planted stems per acre surviving. In addition, each individual plot was above success criteria.

Eleven cross-sections and 3600 linear feet of longitudinal profiles were measured for the Year 2 (2010) monitoring. As a whole, monitoring measurements indicate that there have been minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The as-built channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and construction plans. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. The only stream problem area noted within the Site during the Year 2 (2010) monitoring year includes aggradation within a portion of Tributary 1. Aggradation has resulted from the installation of a dirt driveway on the neighboring property. Proactive measures are not recommended at this time to restore channel dimension; however, this reach should be watched over time to ascertain any instability.

All three of the monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 12.5 percent of the growing season, which extends from May 1 to October 11 (163 days).

In summary, Site vegetation, streams, and wetland hydrology met success criteria for Year 2 (2010) monitoring.

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## **1.0 PROJECT BACKGROUND**

### **1.1 Location and Setting**

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of streams and wetlands at the Three Mile Creek Restoration Site (hereafter referred to as the “Site”) to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in fulfilling stream and wetland mitigation goals. The Site, located in southwestern Avery County approximately 5.2 miles northeast of Spruce Pine, North Carolina, provides 8103 stream mitigation units and 3.7 riparian wetland mitigation units as described in the April 2009 As-Built Mitigation Plan (Figures 1 and 2, Appendix A). The Site is located in United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 06010108010020 (North Carolina Division of Water Quality Subbasin 04-03-06) of the French Broad River Basin.

Directions to the Site:

- From Asheville or Raleigh, take I-40 to Marion; take NC 226 north through Linville Falls; go left on NC 194; site is ~4.5 miles on left
- Or, From Asheville take 19/23 North to 19E through Spruce Pine to NC 194
- Take a right on NC 194 and travel approximately 1.5 miles
- The Site is on the right
- Latitude, Longitude of Site: 35.9827°N, 81.9843°W (NAD83/WGS84)

### **1.2 Project Objectives**

The primary components of the restoration project included 1) construction of a stable, riffle-pool stream channel; 2) enhancement of water quality functions within and downstream of the Site; 3) creation of a natural vegetated buffer along restored stream channels; 4) restoration of jurisdictional riverine wetlands in the Site; 5) improvement of aquatic habitat and species diversity by enhancing stream bed variability; and 6) restoration of wildlife functions associated with a riparian corridor/stable stream.

### **1.3 Project Structure, Restoration Type, and Approach**

A 26.68-acre conservation easement was placed on the Site to incorporate all restoration activities. The Site contains 4.8 acres of hydric soil, Three Mile Creek, 12 unnamed tributaries (UTs) to Three Mile Creek, Fork Creek, and adjacent floodplains, which represent the primary hydrologic features of the Site. Prior to construction, the project was characterized by agricultural land utilized for Christmas tree and ornamental landscape nursery plant production, timber harvest, and livestock grazing. Agricultural practices included the maintenance and removal of riparian vegetation and relocation, dredging, and straightening of onsite streams. In addition, hydric soils were disturbed due to regular plowing and vegetation maintenance, hoof shear from livestock, and the removal of groundwater hydrology inputs from the rerouting and straightening of Site tributaries.

Restoration of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Three Mile Creek watershed. Targeted mitigation efforts at the Site were accomplished by:

1. Removing nonpoint and point sources of pollution associated with agricultural practices including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to the Site and b) provide a forested riparian buffer to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and plowing adjacent to Site streams and wetlands and b) planting a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.

4. Promoting floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; c) restoration of depressional floodplain wetlands and floodwater storage capacity within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters.
5. Improving aquatic habitat with bed variability and the use of in-stream structures upstream of a reach identified by the North Carolina Wildlife Resources Commission as supporting naturally reproducing rainbow trout populations.
6. Providing a terrestrial wildlife corridor and refuge in an area that is developed for agricultural production.

As constructed, the Site restored historic stream and wetland functions, which existed onsite prior to channel straightening and dredging, agricultural impacts, and vegetation removal. Stream construction of meandering, E/C stream channel resulted in 6057 linear feet of stream restoration, 618 linear feet of stream enhancement (Level I), 875 linear feet of stream enhancement (Level II), 6421 linear feet of stream preservation, 2.5 acres of riverine wetland restoration, and 2.3 acres of riverine wetland enhancement (Table 1).

**Table 1. Site Restoration Structures and Objectives**

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Existing Linear Footage/ Acreage	Designed Linear Footage/ Acreage**	SMU/ WMU	Comment
Three Mile Creek	1+25-37+30	Restoration	1	3552	3495	3495	Restoration of a straightened channel on new location.
	37+30-42+15	Enhancement I	2	485	485	323.3	Restoration of dimension and profile in place.
Fork Creek	0+00-1+58	Enhancement II	NA	158	158	63.2	Removal of invasive species and supplemental planting.
Tributary 1	0+00-3+84	Restoration	1	172	384	384	Restoration of a straightened channel on new location.
Tributary 2	0+00-1+33	Enhancement I	2	133	133	88.7	Restoration of dimension and profile in place.
	NA	Enhancement II	NA	351	351	140.4	Removal of invasive species and supplemental planting.
Tributary 3	0+00-3+40	Restoration	1	252	340	340	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	1808	1808	361.6	Preservation of existing reach
Tributary 4	0+00-2+28	Restoration	1	136	198	198	Restoration of a ditched and disturbed channel on new location.
	NA	Enhancement II	NA	366	366	146.4	Removal of invasive species and supplemental planting.
Tributary 5	0+00-2+44	Restoration	1	150	214	214	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	931	931	186.2	Preservation of stable, forested stream reaches.
Tributary 6a	0+00-2+44	Restoration	1	124	214	214	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	681	681	136.2	Preservation of stable, forested stream reaches.

**Table 1. Site Restoration Structures and Objectives (continued)**

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Existing Linear Footage/ Acreage	Designed Linear Footage/ Acreage**	SMU/ WMU	Comment
Tributary 7	0+00-2+75	Restoration	1	146	245	245	Restoration of a ditched and disturbed channel on new location.
Tributary 8	0+00-3+43	Restoration	1	519	343	343	Restoration of a ditched and disturbed channel on new location.
	242	Restoration	1	242	242	242	Filling a ditched springhead systems and braiding restoration channel.
Tributary 9	0+00-0+43	NA	NA	0	43	0	Tie spring head to design channel.
Tributary 11a	0+00-0+92	Restoration	1	72	92	92	Restoration of a ditched and disturbed channel on new location.
	228	Restoration	1	228	228	228	Braiding surface flow of restoration channel.
	NA	Preservation	NA	49	49	9.8	Preservation of stable, forested stream reaches.
Tributary 11b	0+00-0+62	Restoration	1	51	62	62	Restoration of a ditched and disturbed channel on new location.
Preservation Tributaries	NA	Preservation	NA	2952	2952	590.4	Preservation of stable, forested stream reaches.
<b>TOTAL SMUs</b>						<b>8103</b>	
Riparian/ Riverine Wetlands	--	Restoration	--	--	2.5	2.5	Reconstructing site tributaries, filling ditched channels and ditches, rehydrating floodplain soils, and planting with native forest vegetation.
	--	Enhancement	--	--	2.3	1.2	Planting with native forest vegetation.
<b>TOTAL WMUs</b>						<b>3.7</b>	

\* Locations of each tributary and restoration type are depicted on Sheets 1-23 in Appendix A (As-built Survey)

\*\* Constructed linear footage excludes crossings or areas outside of easement; therefore, is slightly shorter than stationing depicts.

Priority Approach 1 – Convert incised stream to stable stream at historic floodplain elevation.

Priority Approach 2 – Convert incised stream to stable stream and reestablish floodplain at present location.

#### 1.4 Project History and Background

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

**Table 2. Project Activity and Reporting History**

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	August 2007	September 2007
Construction Completion	NA	January 2009
Site Planting	NA	February 2009
Mitigation Plan/As-builts	March 2009	April 2009
Year 1 Monitoring (2009)	September 2009	September 2009
Year 2 Monitoring (2010)	September 2010	September 2010

**Table 3. Project Contacts**

<b>Full Delivery Provider</b>	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer (919) 755-9490
<b>Designer and Monitoring Performer</b>	Axiom Environmental, Inc. 20 Enterprise Street, Suite 7 Raleigh, NC 27607 Grant Lewis (919) 215-1693
<b>Construction Contractor</b>	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, North Carolina 27592 Lloyd Glover (919) 422-3392
<b>Planting Contractor</b>	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (252) 482-8491
<b>Surveying Contractor</b>	K2 Design Group, PA 5758 US Highway 70 East Goldsboro, North Carolina 27534 John Rudolph (919) 751-0075

**Table 4. Project Background**

Project County	Avery County, North Carolina
Drainage Area	Three Mile Creek: 5.1 square miles Fork Creek: 1.8 square miles Tributaries: 0.02-0.2 square mile
Drainage impervious cover estimate (%)	< 1
Stream Order	Three Mile Creek: Second and Third Fork Creek: Second Tributaries: First and Second
Physiographic Region	Blue Ridge
Ecoregion	Southern Crystalline Ridges and Mountains
Rosgen Classification of As-built	C/E-type
Dominant Soil Types	Chandler, Cullowhee, Nikwasi, Micaville, Saunook, Thunder
Reference Site ID	Stone Mountain and Cranberry Creek
USGS HUC	06010108010020
NCDWQ Subbasin	04-03-06
NCDWQ Classification	WS-IV Tr (Stream Index # 7-2-25-(0.7))
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	Yes, the receiving water of the North Toe River (Stream Index Number 7-2-[27.7]b) is listed for impaired biological integrity and turbidity
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	+/- 8%



## 1.5 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in the monitoring plan view in Figure 2 of Appendix A. Site features including vegetation, stream dimension (cross-sections), stream profile and pattern, wetland hydrology, and photographic documentation were monitored in Year 2 (2010).

## 2.0 PROJECT CONDITION AND MONITORING RESULTS

### 2.1 Vegetation Assessment

Following Site construction, eight plots (10-meter by 10-meter in size) were established and monumented with metal fence posts at all plot corners and PVC at each plot origin. Sampling was conducted as outlined in the *CVS-EPP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (<http://cvs.bio.unc.edu/methods.htm>); results are included in Appendix B. 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 monitoring plan view in Appendix A.

#### 2.1.1 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 density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species, species identified through inventory of a reference (relatively undisturbed) forest community used to orient the planting plan, and appropriate Schafale and Weakley (1990) community descriptions. All species planted and identified in the reference forest will be utilized to define "Characteristic Tree Species" as termed in the success criteria (Table 5).

**Table 5. Characteristic Tree Species**

Planted Species	Reference Species
Pawpaw ( <i>Asimina triloba</i> )	Red maple ( <i>Acer rubrum</i> )
Sugarberry ( <i>Celtis laevigata</i> )	Ironwood ( <i>Carpinus caroliniana</i> )
Redbud ( <i>Cercis canadensis</i> )	Dogwood ( <i>Cornus florida</i> )
Buttonbush ( <i>Cephalanthus occidentalis</i> )	Strawberry bush ( <i>Euonymus americana</i> )
Silky dogwood ( <i>Cornus amomum</i> )	Spice bush ( <i>Lindera benzoin</i> )
Persimmon ( <i>Diospyros virginiana</i> )	Tulip poplar ( <i>Liriodendron tulipifera</i> )
Green ash ( <i>Fraxinus pennsylvanica</i> )	Sycamore ( <i>Platanus occidentalis</i> )
Sycamore ( <i>Platanus occidentalis</i> )	White pine ( <i>Pinus strobes</i> )
Black cherry ( <i>Prunus serotina</i> )	Black cherry ( <i>Prunus serotina</i> )
White oak ( <i>Quercus alba</i> )	White oak ( <i>Quercus alba</i> )
Swamp chestnut oak ( <i>Quercus michauxii</i> )	Red oak ( <i>Quercus</i> sp.)
Cherrybark oak ( <i>Quercus pagoda</i> )	Rhododendron ( <i>Rhododendron</i> sp.)
Northern red oak ( <i>Quercus rubra</i> )	Wild azalea ( <i>Rhododendron periclymenoides</i> )
Elderberry ( <i>Sambucus canadensis</i> )	Black locust ( <i>Robinia pseudoacacia</i> )
	Hemlock ( <i>Tsuga</i> sp.)

An average density of 320 stems per acre of Characteristic Tree Species must be surviving at the end of the third monitoring year. Subsequently, 290 Characteristic Tree Species per acre must be surviving at the end of year 4 and 260 Characteristic Tree Species per acre at the end of year 5.

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.

**2.1.2 Vegetative Problem Areas**

No vegetation problem areas were identified within the Site during Year 2 (2010) Monitoring.

**2.2 Stream Assessment**

Eleven permanent cross-sections were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Rosgen stream classification system. Longitudinal profile measurements of 3600 linear feet of stream include thalweg, water surface, and bankfull; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth.

**2.2.1 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. Annual monitoring will continue until success criteria are met and no less than two bankfull events have occurred, as determined by in situ crest gauge, otherwise monitoring will continue until the second bankfull event has occurred.

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.

**2.2.2 Bankfull Events**

No bankfull events were documented during the Year 2 (2010) monitoring period.

**Table 6. Verification of Bankfull Events**

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
No bankfull events were documented during the monitoring period.			

**2.2.3 Stream Problem Areas**

One stream problem area noted within the Site during the Year 2 (2010) monitoring year includes aggradation within a portion of Tributary 1. Aggradation has resulted from the installation of a dirt driveway on the neighboring property. Proactive measures are not recommended at this time to restore channel dimension; however, this reach should be watched over time to ascertain any instability.

**2.2.4 Categorical Stream Feature Visual Stability Assessment**

The stream was visually inspected during the Year 2 (2010) monitoring period using eight feature categories and various metrics within each category. Assessment features included riffles, pools, thalweg, meanders, channel bed, structures, and root wads/boulders. A table for semi-quantitative assessments of the stream is included in Appendix C (Table C1). The mean percentage of performance for features is summarized in the table below.

**Table 7. Categorical Stream Feature Visual Stability Assessment**

<b>Feature</b>	<b>Year 1 (2009)</b>	<b>Year 2 (2010)</b>	<b>Year 3 (2011)</b>	<b>Year 4 (2012)</b>	<b>Year 5 (2013)</b>
A. Riffles	99%	99%			
B. Pools	100%	100%			
C. Thalweg	100%	100%			
D. Meanders	100%	100%			
E. Bed General	100%	100%			
F. Banks	100%	100%			
G. Vanes / J. Hooks, Etc.	100%	100%			
H. Wads and Boulders	NA	NA			

### **2.2.5 Quantitative Stream Measurements**

During the Year 2 (2010) monitoring period 11 cross-sections and 3600 linear feet of longitudinal profile were measured. Permanent cross-sections and longitudinal profiles are included in Appendix C; each is graphically depicted for as-built through Year 2 (2010) for analysis. As a whole, monitoring measurements indicate minimal changes in both the longitudinal profile and cross-sections as compared to as-built data. The channel geometry compares favorably with the emulated, stable E/C type stream reach as set forth in the detailed mitigation plan and as constructed. Current monitoring has demonstrated dimension, pattern, and profile were stable over the course of the monitoring period. Table for baseline data and annual quantitative assessments are included below.

### **2.3 Wetland Assessment**

Three groundwater gauges were installed in wetland restoration and enhancement areas to provide representative coverage of the Site. One additional gauge was placed in a reference wetland area. Graphs of groundwater hydrology and precipitation from a nearby rain station (Weather Underground 2010) are included in Appendix D.

#### **2.3.1 Wetland Success Criteria**

Target hydrological characteristics include saturation or inundation for 5 to 12.5 percent of the growing season, during average climatic conditions. During growing seasons with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

#### **2.3.2 Wetland Problem Areas**

No wetland problem areas were identified within the Site during Year 2 (2010) monitoring.

**Table 8. Baseline Morphology and Hydraulic Summary  
Threemile Creek**

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built				
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med		
Dimension	USGS gage data is unavailable for this project			17.4	23	20.7	27.2	33	30.1	21	29	25	23.1	27.8	26.1		
BF Width (ft)				32	250	100			100	50	350	250					250
Floodprone Width (ft)				36.5	53	43			46	36	53	45	46.5	55.3	53.1		
BF Cross Sectional Area (ft <sup>2</sup> )				1.5	2.8	2.2	1.4	1.7	1.6	1.5	2.1	1.8	1.8	2.2	2.1		
BF Mean Depth (ft)				1.9	3.3	2.8	2.2	2.6	2.4	2	2.7	2.3	2.2	2.7	2.5		
BF Max Depth (ft)				6.6	14.5	10	16.1	23.8	20	12	16	14	12	15	12		
Width/Depth Ratio				1.5	8	6.5	3	3.7	3.4	2.2	7.4	4.4	9	11	10		
Entrenchment Ratio				1.9	2.5	1.8	1	1.6	1.3	1	1.3	1.1					1
Bank Height Ratio						===			===			===	25	29	28		
Wetted Perimeter (ft)						===			===			===	1.8	2	2		
Hydraulic radius (ft)																	
Pattern																	
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activities			40	55	46.8	27	76	47	27	76	47		
Radius of Curvature (ft)							62.4	312.1	94.5	45	252	52	45	252	52		
Meander Wavelength (ft)							101.7	273.2	199.4	136	252	200	136	252	200		
Meander Width ratio							1.3	1.8	1.6	1.2	3	2	1.2	3	2		
Profile																	
Riffle length (ft)				No pattern of riffles and pools due to straightening activities					===			===	17	111	51		
Riffle slope (ft/ft)							0.26%	1.83%	1.18%	1.94%	2.91%	2.43%	0.43%	4.80%	1.54%		
Pool length (ft)									===			===	26	78	46		
Pool spacing (ft)							65.2	166.7	104.3	67	176	115	76	176	126		
Substrate																	
d50 (mm)									===			===			===		
d84 (mm)									===			===			===		
Additional Reach Parameters																	
Valley Length (ft)									===			===			4057		
Channel Length (ft)									===			===			3528		
Sinuosity									1.1			1.15			1.15		
Water Surface Slope (ft/ft)									1.03%			1.21%			0.98%		
BF slope (ft/ft)									===			===			===		
Rosgen Classification									C/E4			Ce4			C/E 3/4		

**Table 9A. Morphology and Hydraulic Monitoring Summary  
Threemile Creek - Stream and Wetland Restoration Site**

Parameter	Cross Section 1 Riffle (UT 8)						Cross Section 2 Pool (UT 8)						Cross Section 3 Riffle						Cross Section 4 Pool					
	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5
<b>Dimension</b>																								
BF Width (ft)	4.8	4.8	4.4				6.3	7.5	7.6				27.8	30.3	28.5				27.9	27.8	27.9			
Floodprone Width (ft)	250	250	250				----	----	----				250	250	250				----	----	----			
BF Cross Sectional Area (ft <sup>2</sup> )	1.8	2.3	1.7				4.8	5.4	5.9				51.1	51.9	49.9				63.4	62.8	58.9			
BF Mean Depth (ft)	0.4	0.5	0.4				0.8	0.7	0.8				1.8	1.7	1.7				2.3	2.3	2.1			
BF Max Depth (ft)	0.6	0.8	0.7				1.3	1.2	1.3				2.2	2.3	2.2				3.7	3.6	3.4			
Width/Depth Ratio	12.8	10.2	11.3				----	----	----				15.1	17.7	16.3				----	----	----			
Entrenchment Ratio	52.1	51.6	56.6				----	----	----				9.0	8.2	8.8				----	----	----			
Bank Height Ratio	1.0	1.0	1.0				----	----	----				1.0	1.0	1.0				----	----	----			
Wetted Perimeter (ft)	5.1	5.1	4.7				6.9	8.0	8.2				29.0	31.2	29.3				29.6	29.6	29.9			
Hydraulic Radius (ft)	0.4	0.4	0.4				0.7	0.7	0.7				1.8	1.7	1.7				2.1	2.1	2			
<b>Substrate</b>																								
d50 (mm)	----	12.9	17.5				----	NA	0.2				----	23.4	35.4				----	2.4	1.3			
d84 (mm)	----	22	25				----	12	14				----	54	70				----	16	25			
<b>Parameter</b>	<b>MY-00 (2008)</b>			<b>MY-01 (2009)</b>			<b>MY-02 (2010)</b>			<b>MY-03 (2011)</b>			<b>MY-04 (2012)</b>			<b>MY-05 (2013)</b>								
	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>						
<b>Pattern</b>																								
Channel Beltwidth (ft)	30	76	50	30	76	50	30	76	50															
Radius of Curvature (ft)	50	252	101	50	252	101	50	252	101															
Meander Wavelength (ft)	151	252	214	151	252	214	151	252	214															
Meander Width Ratio	1.2	3	2	1.2	3	2	1.2	3	2															
<b>Profile</b>																								
Riffle Length (ft)	17	111	51	21	121	53	23	117	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%	0.15%	3.08%	1.43%	0.65%	2.74%	1.42%															
Pool Length (ft)	26	78	46	24	69	39	27	95	44															
Pool Spacing (ft)	76	176	126	76	176	126	76	176	126															
<b>Additional Reach Parameters</b>																								
Valley Length (ft)	4057			4080			4080																	
Channel Length (ft)	3,528			3,548			3547																	
Sinuosity	1.15			1.15			1.15																	
Water Surface Slope (ft/ft)	0.0098			0.0097			0.0098																	
BF Slope (ft/ft)	-----			-----			-----																	
Rosgen Classification	C/E 3/4			C/E 3/4			C/E 3/4																	

**Table 9B. Morphology and Hydraulic Monitoring Summary  
Threemile Creek - Stream and Wetland Restoration Site**

Parameter	Cross Section 5 Riffle						Cross Section 6 Pool						Cross Section 7 Riffle						Cross Section 8 Pool					
	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5
<b>Dimension</b>																								
BF Width (ft)	26.4	28.6	29.6				21.6	21.2	21.5				23.1	23.6	23.6				25.7	27.2	26.7			
Floodprone Width (ft)	250	250	250				----	----	----				250	250	250				----	----	----			
BF Cross Sectional Area (ft <sup>2</sup> )	55	60.6	61.3				49.9	48.1	54.6				46.5	49.9	48.7				52.1	52.4	51.2			
BF Mean Depth (ft)	2.1	2.1	2.1				2.3	2.3	2.5				2.0	2.1	2.1				2.0	1.9	1.9			
BF Max Depth (ft)	2.6	2.8	2.8				3.5	3.6	4.3				2.4	2.6	2.6				3.4	3.5	3.6			
Width/Depth Ratio	12.7	13.5	14.3				----	----	----				11.5	11.2	11.4				----	----	----			
Entrenchment Ratio	9.5	8.7	8.4				----	----	----				10.8	10.6	10.6				----	----	----			
Bank Height Ratio	1.0	1.0	1.0				----	----	----				1.0	1.0	1.0				----	----	----			
Wetted Perimeter (ft)	27.9	30	31				23.5	23.4	24.7				24.7	25.5	25.1				27.1	28.7	28.9			
Hydraulic Radius (ft)	2.0	2.0	2.0				2.1	2.1	2.2				1.9	2.0	1.9				1.9	1.8	1.8			
<b>Substrate</b>																								
d50 (mm)	----	----	29.1				----	----	11.5				----	----	48.5				----	8.7	1.7			
d84 (mm)	----	----	51				----	----	45				----	----	90				----	64	22			
<b>Parameter</b>	<b>MY-00 (2008)</b>			<b>MY-01 (2009)</b>			<b>MY-02 (2010)</b>			<b>MY-03 (2011)</b>			<b>MY-04 (2012)</b>			<b>MY-05 (2013)</b>								
	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>	<b>Min</b>	<b>Max</b>	<b>Med</b>						
<b>Pattern</b>																								
Channel Beltwidth (ft)	30	76	50	30	76	50	30	76	50															
Radius of Curvature (ft)	50	252	101	50	252	101	50	252	101															
Meander Wavelength (ft)	151	252	214	151	252	214	151	252	214															
Meander Width Ratio	1.2	3	2	1.2	3	2	1.2	3	2															
<b>Profile</b>																								
Riffle Length (ft)	17	111	51	21	121	53	23	117	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%	0.15%	3.08%	1.43%	0.65%	2.74%	1.42%															
Pool Length (ft)	26	78	46	24	69	39	27	95	44															
Pool Spacing (ft)	76	176	126	76	176	126	76	176	126															
<b>Additional Reach Parameters</b>																								
Valley Length (ft)	4057			4080			4080																	
Channel Length (ft)	3,528			3,548			3547																	
Sinuosity	1.15			1.15			1.15																	
Water Surface Slope (ft/ft)	0.0098			0.0097			0.0098																	
BF Slope (ft/ft)	-----			-----			-----																	
Rosgen Classification	C/E 3/4			C/E 3/4			C/E 3/4																	



### 2.3.3 Wetland Criteria Attainment

All three of the monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 12.5 percent of the growing season, which extends from May 1 to October 11 (163 days). Groundwater data presented in this document was collected through July 30, 2010; data will continue to be collected throughout the growing season and will be available upon request. Hydrographs containing groundwater and precipitation data for each gauge can be found in Appendix D.

**Table 10. Wetland Criteria Attainment for Year 2 (2010)**

Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met? /Max Consecutive Days During Growing Season (Percentage)	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	Yes/64 days (39 percent)	100 %	1	Yes	100 %
2	Yes	Yes/91 days (100 percent)		2	Yes	
3	Yes	Yes/55 days (34 percent)		3	Yes	
				4	Yes	
				5	Yes	
				6	Yes	
				7	Yes	
				8	Yes	

### 3.0 CONCLUSIONS

All three of the monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 12.5 percent of the growing season, which extends from May 1 to October 11 (163 days). A summary of groundwater gauge data is included in Table 11.

**Table 11. Summary of Groundwater Gauge Results**

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2009)	Year 2 (2010)*	Year 3 (2010)	Year 4 (2012)	Year 5 (2013)
1	Yes/101 days (62.0 percent)	Yes/64 days (39 percent)			
2	Yes/163 days (100 percent)	Yes/91 days (100 percent)			
3	Yes/163 days (100 percent)	Yes/55 days (34 percent)			
Ref	53 days (32.5 percent)	49 days (30 percent)			

\*Data has been collected through July 30, 2010 for the Year 2 (2010) monitoring season; data will continue to be collected throughout the remainder of the growing season and will be available upon request.



Vegetation sampling across the Site was above the required average density with 637 planted stems per acre surviving. In addition, each individual plot was above success criteria (Table 12).

**Table 12. Summary of Planted Vegetation Plot Results**

Plot	Planted Stems/Acre Counting Towards Success Criteria				
	Year 1 (2009)	Year 2 (2010)	Year 3 (2011)	Year 4 (2012)	Year 5 (2013)
1	405	445			
2	648	445			
3	567	364			
4	931	469			
5	526	526			
6	364	405			
7	1012	971			
8	1214	1214			
<b>Average of All Plots (1-8)</b>	<b>708</b>	<b>637</b>			

#### 4.0 REFERENCES

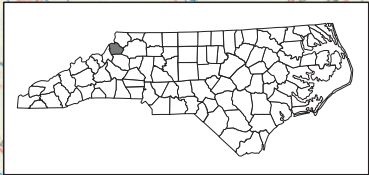
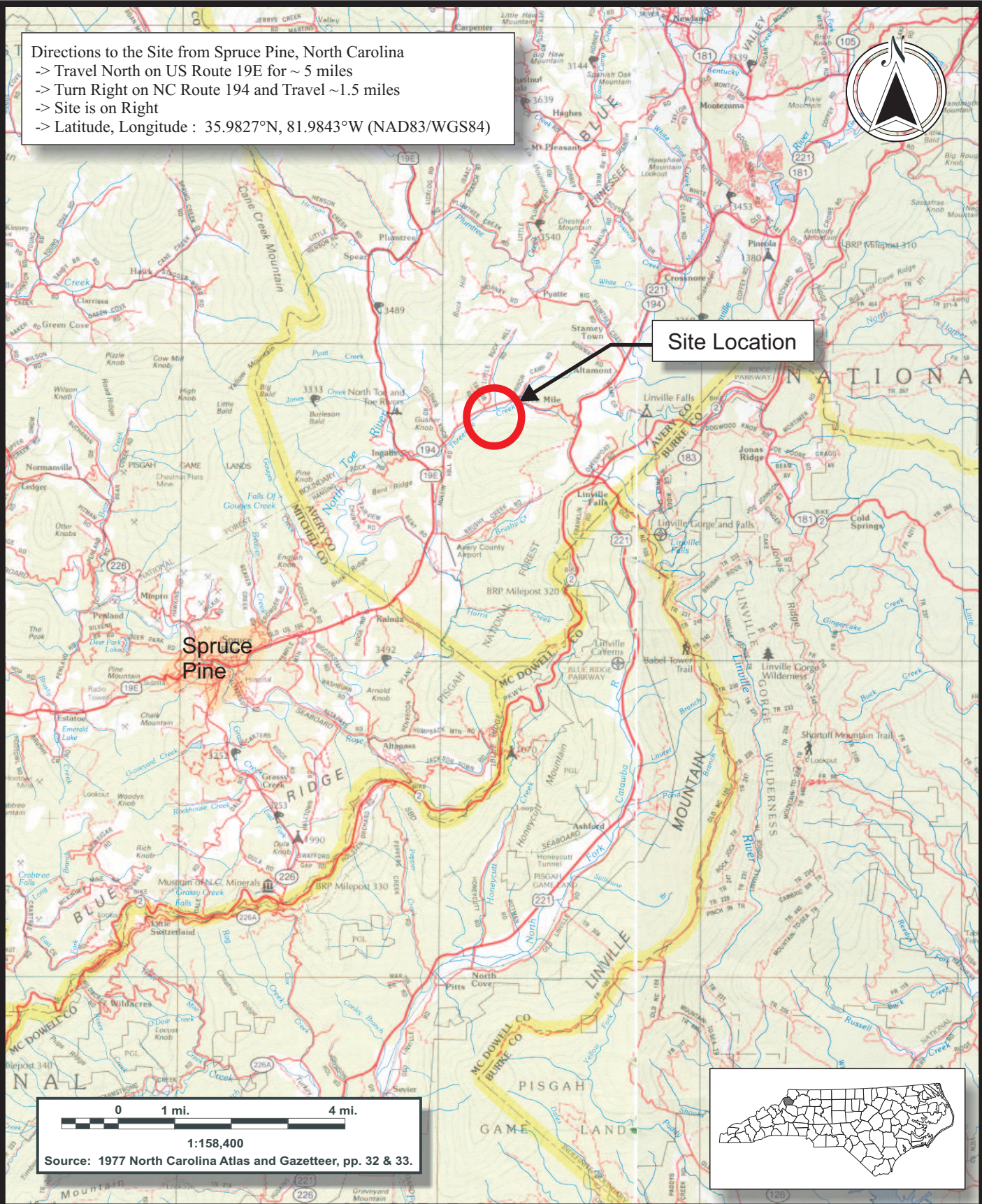
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- Weather Underground. 2010. Station in Boone, North Carolina. (online). Available: [http://www.wunderground.com/US/NC/Spruce\\_Pine/KTNB.html](http://www.wunderground.com/US/NC/Spruce_Pine/KTNB.html) [August 5, 2010]. Weather Underground.

**APPENDIX A  
FIGURES**

**Figure 1. Site Location**

**Figure 2. Monitoring Plan View**

Directions to the Site from Spruce Pine, North Carolina  
 -> Travel North on US Route 19E for ~ 5 miles  
 -> Turn Right on NC Route 194 and Travel ~1.5 miles  
 -> Site is on Right  
 -> Latitude, Longitude : 35.9827°N, 81.9843°W (NAD83/WGS84)



2126 Rowland Pond Dr  
 Willow Spring, NC 27592  
 (919) 215-1693  
 (919) 341-3839 fax

**SITE LOCATION**  
**THREE MILE CREEK RESTORATION SITE**  
 Avery County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	Nov 2008
Project:	07-004

**FIGURE**  
**1**

**Legend**

- Easement Boundary
- Groundwater Gauge Locations
- Vegetation Plot Locations
- Structure Photo Points
- In-stream Structures
- Cross-section Locations
- Stream Restoration
- Stream Enhancement (Level 1)
- Stream Enhancement (Level 2)
- Streams
- Stream Monitoring Reach
- Wetland Restoration Areas
- Wetland Enhancement Areas
- Marsh Treatment Areas



Project:

**THREE MILE CREEK RESTORATION SITE**

Avery County, NC

Title:

**MONITORING PLAN VIEW**

Drawn by: CLF

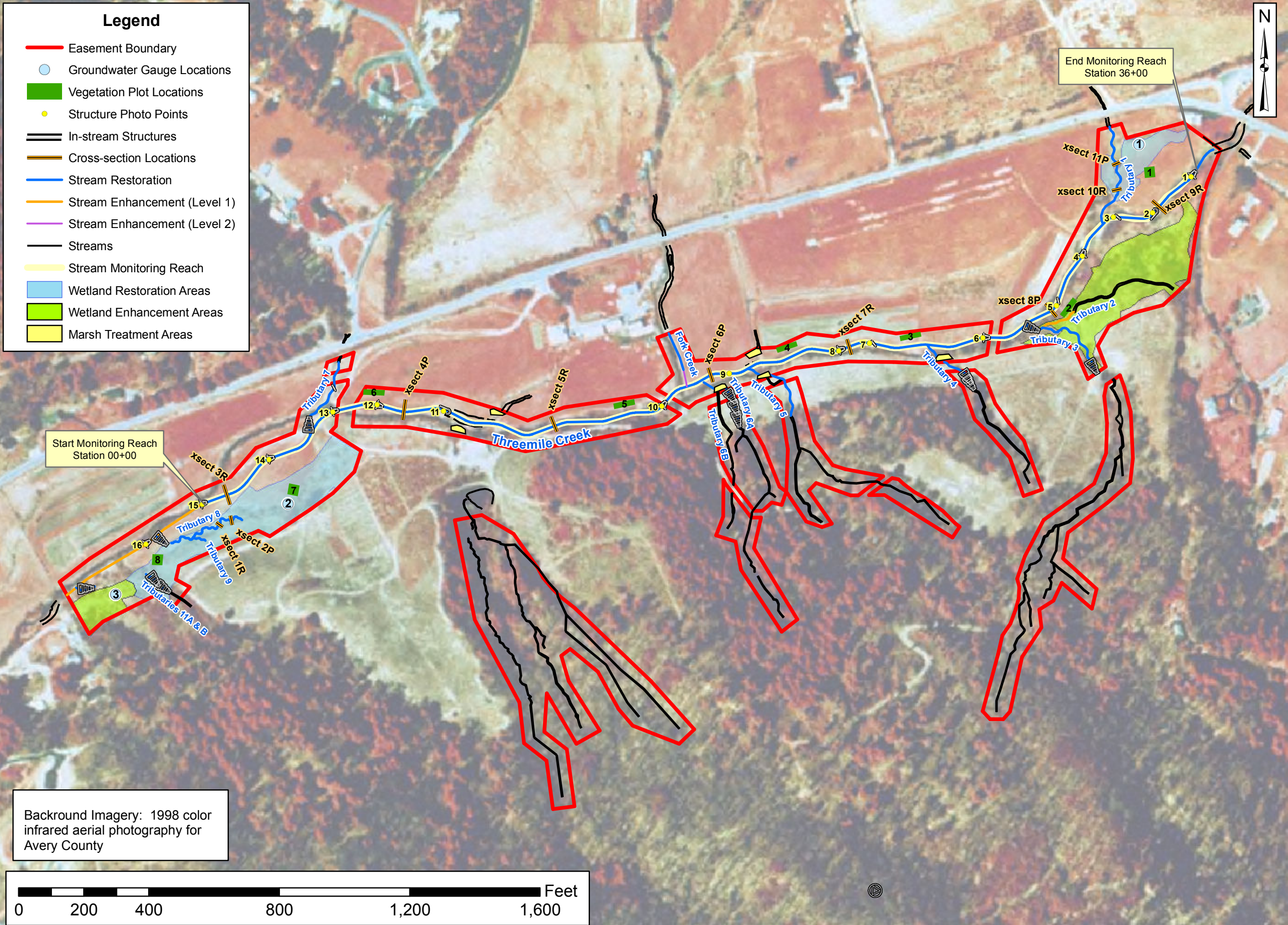
Date: SEPT 2010

Scale: 1:3400

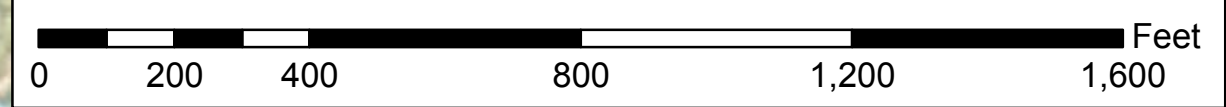
Project No.: 10-001

FIGURE

**2**



Background Imagery: 1998 color infrared aerial photography for Avery County



**APPENDIX B  
VEGETATION DATA**

- 1. Vegetation Survey Data Tables**
- 2. Vegetation Monitoring Plot Photos**

**Report Prepared**

**By** Corri Faquin  
**Date Prepared** 8/24/2010 15:10  
**database name** RestorationSystems-2010-A.mdb  
**database location** C:\Axiom\Business\CVS Database\2010  
**computer name** CORRI  
**file size** 55959552

**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.  
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.  
**Proj, total stems**  
**Plots** List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).  
**Vigor** Frequency distribution of vigor classes for stems for all plots.  
**Vigor by Spp** Frequency distribution of vigor classes listed by species.  
**Damage** List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.  
**Damage by Spp** Damage values tallied by type for each species.  
**Damage by Plot** Damage values tallied by type for each plot.  
**Planted Stems by Plot and Spp** A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.  
**ALL Stems by Plot and spp** A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

**PROJECT SUMMARY-----**

**Project Code** Threemile  
**project Name** Threemile Stream and Wetland Restoration Site  
**Sampled Plots** 8

**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 2
Threemile	Threemile Stream and Wetland Restoration Site	French Broad	637.38

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

Project Code	Project Name	River Basin	Year 2
Threemile	Threemile Stream and Wetland Restoration Site	French Broad	652.5555993

**Plot Data**

plot	Plot Level	Year	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
1	2	1	7/14/2010	11	11	0	0	11	11	445	445	0	445	445	3
2	2	1	7/14/2010	11	11	6	0	11	11	445	445	0	445	445	4
3	2	1	7/14/2010	9	9	5	0	9	9	364	364	0	364	364	4
4	2	1	7/14/2010	19	19	4	0	19	19	769	769	0	769	769	4
5	2	1	7/14/2010	13	13	1	1	14	14	526	526	40	567	567	3
6	2	1	7/14/2010	10	10	1	1	11	11	405	405	40	445	445	3
7	2	1	7/14/2010	24	24	6	0	24	24	971	971	0	971	971	4
8	2	1	7/14/2010	30	29	1	0	30	29	1214	1174	0	1214	1174	6



## Vigor

vigor	Count	Percent
0	12	7.9
1	7	4.6
2	39	25.8
3	47	31.1
4	33	21.9
Missing	12	7.9
Unknown	1	0.7

## Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown	
Alnus serrulata	hazel alder	1							
Asimina triloba	pawpaw			1					
Celtis laevigata	sugarberry			1					
Cephalanthus occidentalis	common buttonbush			3		1			
Diospyros virginiana	common persimmon	3	4	14	4	4	6		
Fraxinus pennsylvanica	green ash	1	5	1					
Quercus alba	white oak	2	9	1					
Quercus falcata	southern red oak	2	5				1		
Quercus michauxii	swamp chestnut oak	4	8	5			2	1	
Quercus pagoda	cherrybark oak		1						
Salix sericea	silky willow	1							
Cercis canadensis	eastern redbud		1	7	1	4	2		
Quercus rubra	northern red oak	12	8	2	2		1		
Platanus occidentalis	American sycamore	7	6	4		3			
<b>TOT:</b>		<b>14</b>	<b>14</b>	<b>33</b>	<b>47</b>	<b>39</b>	<b>7</b>	<b>12</b>	<b>1</b>

## Damage

Damage	Count	Percent Of Stems
(no damage)	103	68.2
Unknown	26	17.2
Diseased	14	9.3
Insects	4	2.6
Deer	3	2
Site Too Wet	1	0.7

### Damage by Species

	Species	CommonName	Count of Damage Categories	(no damage)	Deer	Diseased	Insects	Site too Wet	Unknown
	Alnus serrulata	hazel alder	0	1					
	Asimina triloba	pawpaw	1						1
	Celtis laevigata	sugarberry	1		1				
	Cephalanthus occidentalis	common buttonbush	3	1					3
	Cercis canadensis	eastern redbud	3	12					3
	Diospyros virginiana	common persimmon	18	17	1	11			6
	Fraxinus pennsylvanica	green ash	5	2	1	3			1
	Platanus occidentalis	American sycamore	7	13			3		4
	Quercus alba	white oak	1	11				1	
	Quercus falcata	southern red oak	0	8					
	Quercus michauxii	swamp chestnut oak	4	16					4
	Quercus pagoda	cherrybark oak	0	1					
	Quercus rubra	northern red oak	5	20			1		4
	Salix sericea	silky willow	0	1					
<b>TOT:</b>	<b>14</b>	<b>14</b>	<b>48</b>	<b>103</b>	<b>3</b>	<b>14</b>	<b>4</b>	<b>1</b>	<b>26</b>

### Damage by Plot

	plot	Count of Damage Categories	(no damage)	Deer	Diseased	Insects	Site too Wet	Unknown
	1	2	9					2
	2	3	14	1				2
	3	5	9					5
	4	8	15					8
	5	4	10			2		2
	6	3	8			2		1
	7	22	8	2	14			6
	8	1	30				1	
<b>TOT:</b>	<b>8</b>	<b>48</b>	<b>103</b>	<b>3</b>	<b>14</b>	<b>4</b>	<b>1</b>	<b>26</b>

### Planted Stems by Plot and Species

	Species	CommonName	Total Planted Stems	# plots	avg# stems	1	2	3	4	5	6	7	8
	Alnus serrulata	hazel alder	1	1	1		1						
	Asimina triloba	pawpaw	1	1	1			1					
	Celtis laevigata	sugarberry	1	1	1							1	
	Cephalanthus occidentalis	common buttonbush	3	2	1.5			1	2				
	Cercis canadensis	eastern redbud	9	3	3						4	3	2
	Diospyros virginiana	common persimmon	25	4	6.25	1	3	4				17	
	Fraxinus pennsylvanica	green ash	7	2	3.5		4					3	
	Platanus occidentalis	American sycamore	17	5	3.4		3	3	5	4	2		
	Quercus alba	white oak	12	1	12								12
	Quercus falcata	southern red oak	7	1	7								7
	Quercus michauxii	swamp chestnut oak	18	3	6	2			8	8			
	Quercus pagoda	cherrybark oak	1	1	1								1
	Quercus rubra	northern red oak	24	5	4.8	8			4	1	4		7
	Salix sericea	silky willow	1	1	1								1
<b>TOT:</b>	<b>14</b>	<b>14</b>	<b>127</b>	<b>14</b>		<b>11</b>	<b>11</b>	<b>9</b>	<b>19</b>	<b>13</b>	<b>10</b>	<b>24</b>	<b>30</b>

### All Stems by Plot and Species

	Species	CommonName	Total Stems	# plots	avg# stems	1	2	3	4	5	6	7	8
	Alnus serrulata	hazel alder	2	2	1		1			1			
	Asimina triloba	pawpaw	1	1	1			1					
	Celtis laevigata	sugarberry	1	1	1							1	
	Cephalanthus occidentalis	common buttonbush	4	2	2			1	3				
	Cercis canadensis	eastern redbud	13	4	3.25		2				4	5	2
	Diospyros virginiana	common persimmon	30	5	6	1	5	5			2	17	
	Fraxinus pennsylvanica	green ash	7	2	3.5		4					3	
	Platanus occidentalis	American sycamore	20	5	4		3	4	7	4	2		
	Quercus alba	white oak	12	1	12								12
	Quercus falcata	southern red oak	7	1	7								7
	Quercus michauxii	swamp chestnut oak	18	3	6	2			8	8			
	Quercus pagoda	cherrybark oak	1	1	1								1
	Quercus rubra	northern red oak	24	5	4.8	8			4	1	4		7
	Salix sericea	silky willow	1	1	1								1
<b>TOT:</b>	<b>14</b>	<b>14</b>	<b>141</b>	<b>14</b>		<b>11</b>	<b>15</b>	<b>11</b>	<b>22</b>	<b>14</b>	<b>12</b>	<b>26</b>	<b>30</b>

Threemile Stream and Wetland Restoration Site  
Year 2 (2010) Annual Monitoring  
Vegetation Plot Photos  
Taken July 2010



**APPENDIX C  
GEOMORPHOLOGIC DATA**

- 1. Table C1. Qualitative Visual Stability Assessment**
- 2. Cross-section Plots and Tables**
- 3. Longitudinal Profile Plots**
- 4. Representative Structure Photographs**

**Table C1. Visual Morphological Stability Assessment  
Threemile Creek**

Feature Category	Metric (per As-built and reference baselines)	(# Stable Number Performing as Intended)	Total number	Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
<b>A. Riffles</b>	1. Present	37	37	NA	100%	99%
	2. Armor stable (e.g. no displacement)?	37	37	NA	100%	
	3. Facet grade appears stable?	36	3737	NA	97%	
	4. Minimal evidence of embedding / fining?	37	37	NA	100%	
	5. Length appropriate?	36	37	NA	97%	
<b>B. Pools</b>	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	38	38	NA	100%	100%
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	38	38	NA	100%	
	3. Length appropriate?	38	37	NA	100%	
<b>C. Thalweg</b>	1. Upstream of meander bend (run/inflection) centering?	37	37	NA	100%	100%
	2. Downstream of meander (glide/inflection) centering?	37	37	NA	100%	
<b>D. Meanders</b>	1. Outer bend in state of limited/controlled erosion?	38	38	NA	100%	100%
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	0	100%	
	3. Apparent Rc within spec?	38	38	NA	100%	
	4. Sufficient floodplain access and relief?	38	38	NA	100%	
<b>E. Bed General</b>	1. General channel bed aggradation areas (bar formation)	NA	NA	0	100%	100%
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	0	100%	
<b>F. Bank</b>	1. Actively eroding, wasting, or slumping bank	37	37	100	100%	100%
<b>G. Vanes</b>	1. Free of back or arm scour?	14	14	NA	NA	100%
	2. Height appropriate?	14	14	NA	NA	
	3. Angle and geometry appear appropriate?	14	14	NA	NA	
	4. Free of piping or other structural failures?	14	14	NA	NA	
<b>H. Wads / Boulders</b>	1. Free of scour?	NA	NA	NA	NA	NA
	2. Footing stable?	NA	NA	NA	NA	

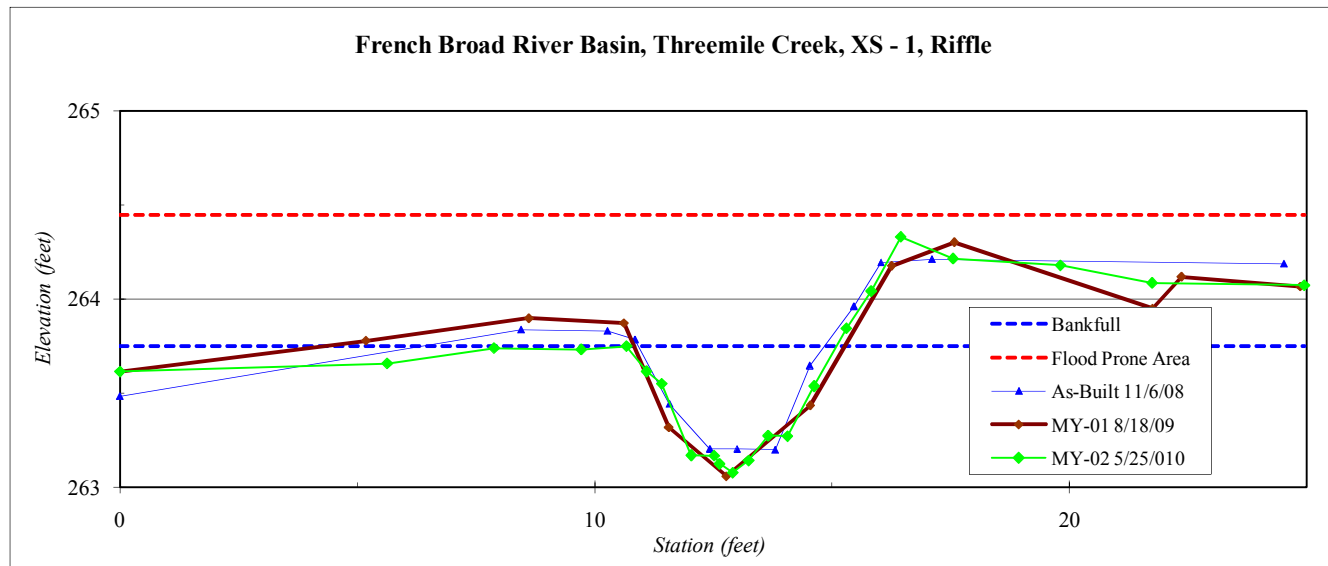
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 1, Riffle
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.00	263.62
5.63	263.66
7.88	263.74
9.72	263.73
10.67	263.75
11.09	263.62
11.41	263.55
12.03	263.17
12.52	263.17
12.63	263.12
12.91	263.08
13.24	263.14
13.66	263.27
14.06	263.27
14.62	263.54
15.30	263.85
15.83	264.04
16.45	264.33
17.55	264.22
19.81	264.18
21.75	264.09
24.95	264.07

SUMMARY DATA	
<b>Bankfull Elevation:</b>	263.8
<b>Bankfull Cross-Sectional Area:</b>	1.7
<b>Bankfull Width:</b>	4.4
<b>Flood Prone Area Elevation:</b>	264.5
<b>Flood Prone Width:</b>	>80
<b>Max Depth at Bankfull:</b>	0.7
<b>Mean Depth at Bankfull:</b>	0.4
<b>W / D Ratio:</b>	11.4
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0



<b>Stream Type</b>	E
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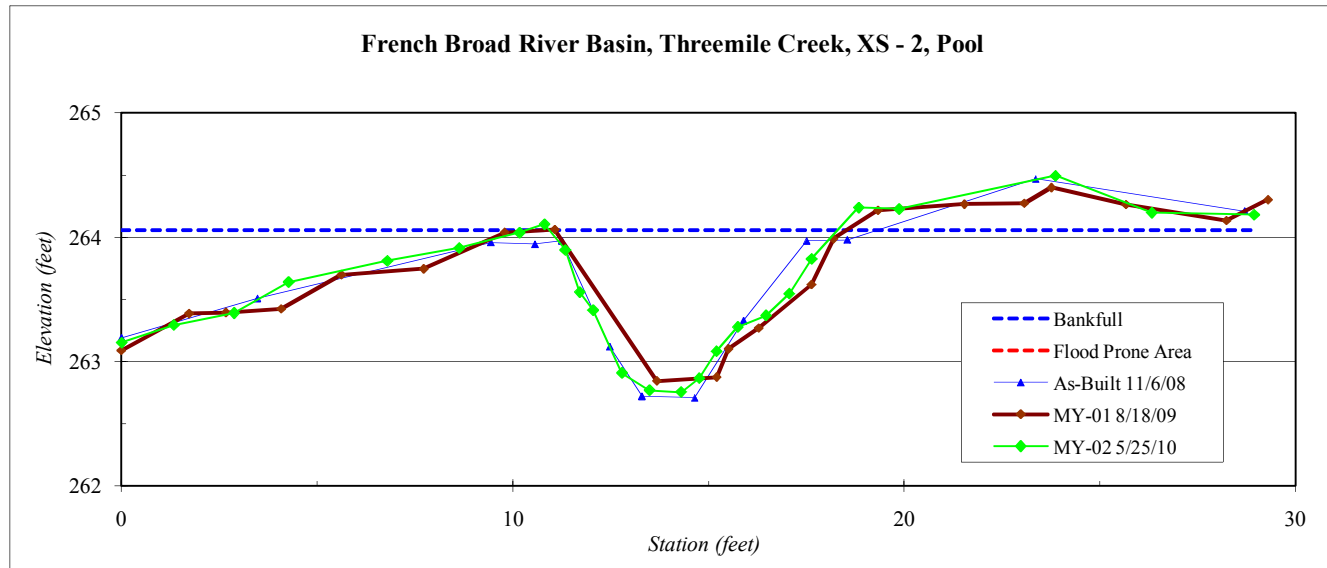
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 2, Pool
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson



Station	Elevation
0.00	263.15
1.33	263.29
2.87	263.39
4.27	263.64
6.79	263.81
8.63	263.92
10.17	264.04
10.81	264.11
11.34	263.90
11.71	263.56
12.05	263.41
12.79	262.91
13.49	262.77
14.30	262.75
14.76	262.87
15.20	263.08
15.75	263.28
16.47	263.37
17.06	263.55
17.64	263.83
18.84	264.24
19.87	264.23
23.87	264.50
26.33	264.20
28.94	264.18

SUMMARY DATA	
<b>Bankfull Elevation:</b>	264.1
<b>Bankfull Cross-Sectional Area:</b>	5.9
<b>Bankfull Width:</b>	7.6
<b>Flood Prone Area Elevation:</b>	-
<b>Flood Prone Width:</b>	-
<b>Max Depth at Bankfull:</b>	1.3
<b>Mean Depth at Bankfull:</b>	0.8
<b>W / D Ratio:</b>	-
<b>Entrenchment Ratio:</b>	-
<b>Bank Height Ratio:</b>	-

<b>Stream Type</b>	E
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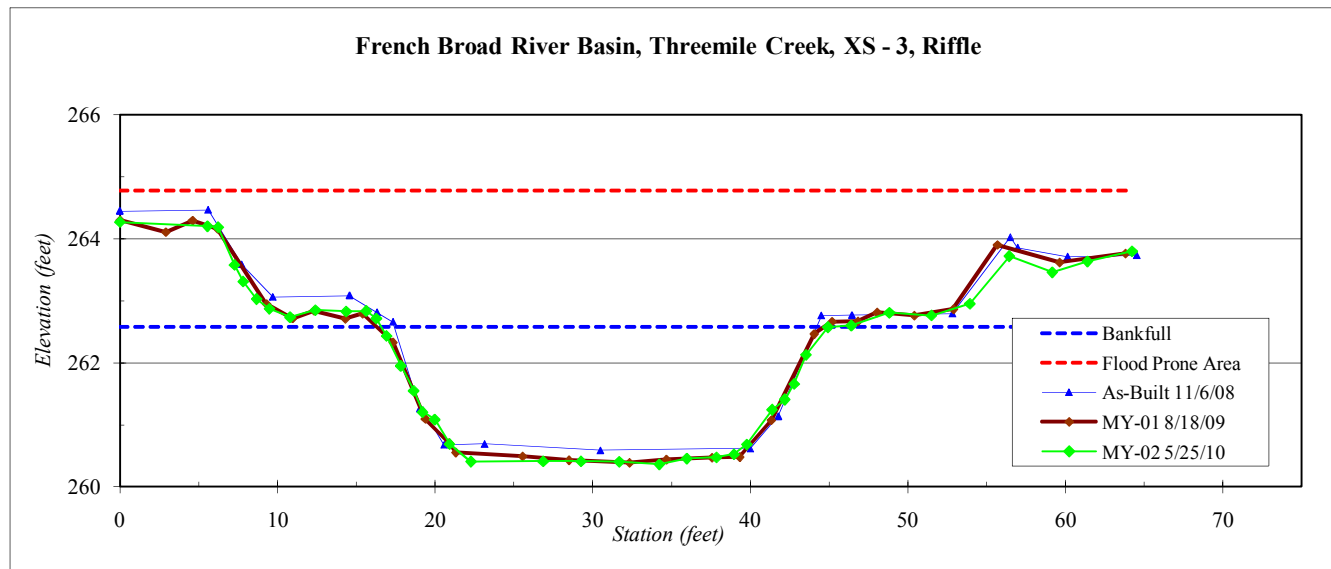
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 3, Riffle
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson



Station	Elevation
0.00	264.27
5.56	264.21
6.23	264.19
7.27	263.58
7.82	263.31
8.66	263.03
9.48	262.87
10.80	262.74
12.40	262.85
14.35	262.83
15.64	262.84
16.26	262.72
16.92	262.43
17.82	261.95
18.65	261.55
19.21	261.21
19.97	261.09
20.92	260.69
22.28	260.41
26.86	260.41
29.26	260.41
31.70	260.41
34.25	260.37
35.98	260.46
37.87	260.48
38.97	260.53
39.78	260.69
41.40	261.25
42.19	261.41
42.79	261.66
43.55	262.13
44.94	262.58
46.42	262.61
48.84	262.81
51.52	262.76
53.95	262.95

SUMMARY DATA	
<b>Bankfull Elevation:</b>	262.6
<b>Bankfull Cross-Sectional Area:</b>	49.9
<b>Bankfull Width:</b>	28.5
<b>Flood Prone Area Elevation:</b>	264.8
<b>Flood Prone Width:</b>	>65
<b>Max Depth at Bankfull:</b>	2.2
<b>Mean Depth at Bankfull:</b>	1.8
<b>W / D Ratio:</b>	16.3
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0

<b>Stream Type</b>	E/C
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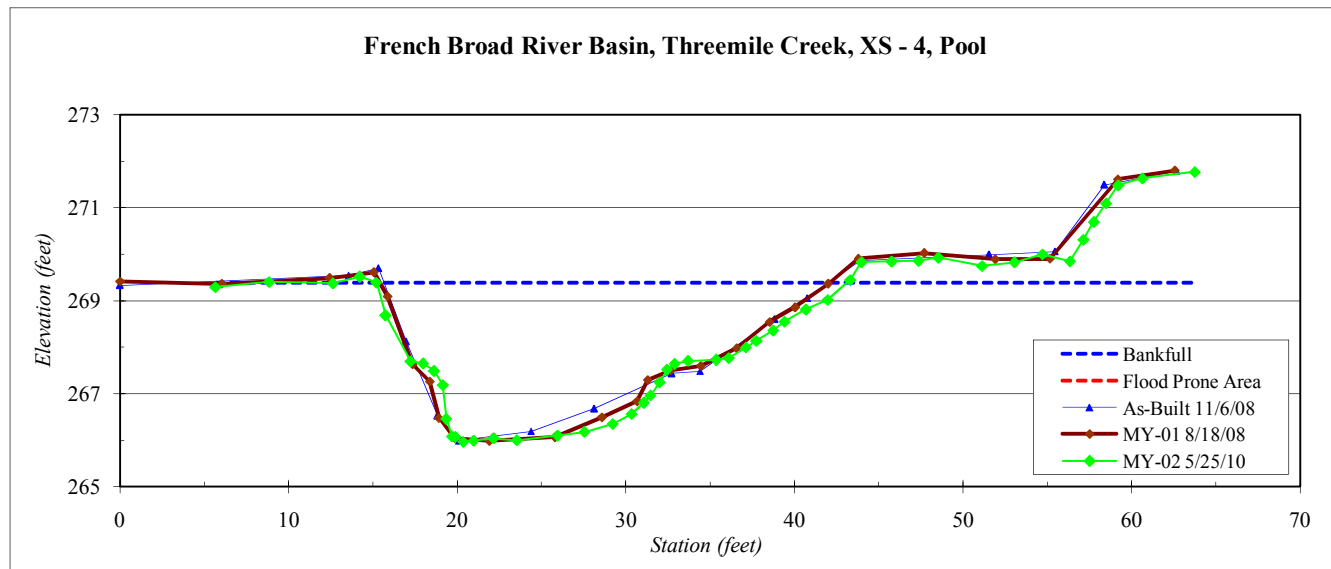
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 4, Pool
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson



Station	Elevation
5.7	269.3
8.9	269.4
12.6	269.4
14.2	269.5
15.2	269.4
15.7	268.7
17.2	267.7
18.0	267.7
18.6	267.5
19.2	267.2
19.4	266.5
19.7	266.1
19.9	266.1
20.4	266.0
21.0	266.0
22.2	266.0
23.5	266.0
26.0	266.1
27.6	266.2
29.2	266.4
30.4	266.6
31.1	266.8
31.5	267.0
32.0	267.2
32.4	267.5
32.9	267.6
33.7	267.7
35.4	267.7
36.1	267.8
37.1	268.0
37.7	268.1
38.7	268.4
39.4	268.6
40.7	268.8
42.0	269.0
43.3	269.4

SUMMARY DATA	
<b>Bankfull Elevation:</b>	269.4
<b>Bankfull Cross-Sectional Area:</b>	58.9
<b>Bankfull Width:</b>	27.9
<b>Flood Prone Area Elevation:</b>	-
<b>Flood Prone Width:</b>	-
<b>Max Depth at Bankfull:</b>	3.4
<b>Mean Depth at Bankfull:</b>	2.1
<b>W / D Ratio:</b>	-
<b>Entrenchment Ratio:</b>	-
<b>Bank Height Ratio:</b>	-

<b>Stream Type</b>	E
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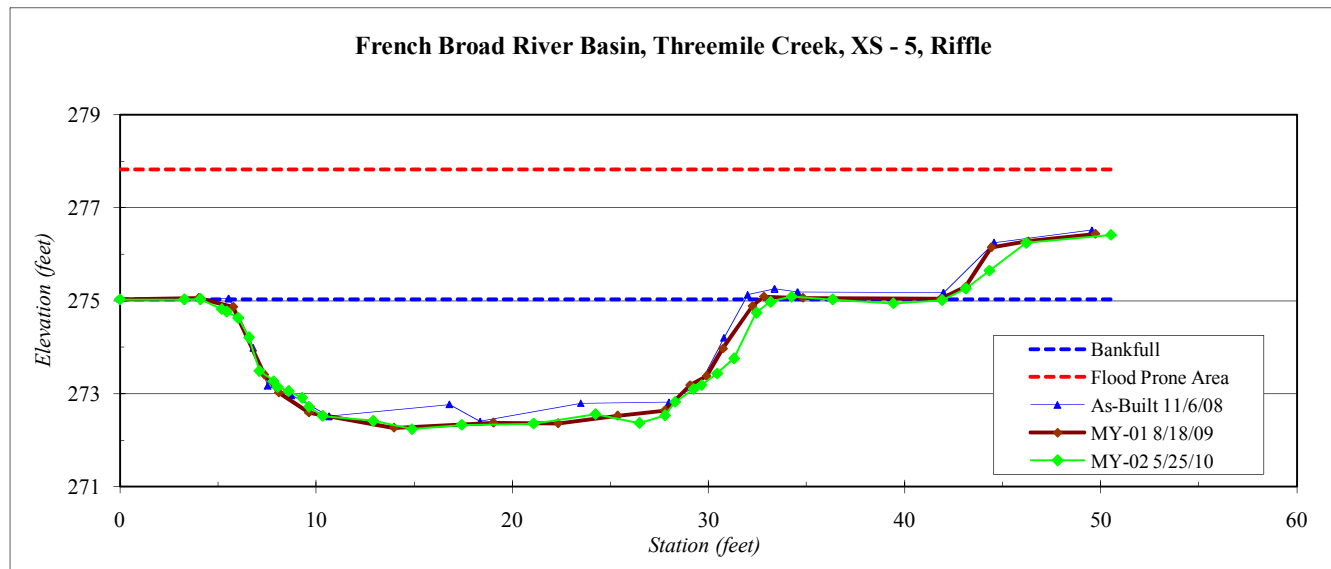
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 5, Riffle
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson



Station	Elevation
0.0	275.0
3.3	275.0
4.1	275.0
5.2	274.8
5.4	274.8
6.0	274.6
6.6	274.2
7.1	273.5
7.8	273.3
8.0	273.1
8.6	273.1
9.3	272.9
9.6	272.7
10.3	272.5
12.9	272.4
14.9	272.2
17.4	272.3
21.1	272.4
24.2	272.6
26.5	272.4
27.8	272.5
28.3	272.8
29.2	273.1
29.7	273.2
30.4	273.4
31.3	273.8
32.5	274.7
33.2	275.0
34.2	275.1
36.3	275.0
39.4	274.9
41.9	275.0
43.1	275.3
44.3	275.6
46.2	276.2
50.5	276.4

SUMMARY DATA	
<b>Bankfull Elevation:</b>	275.0
<b>Bankfull Cross-Sectional Area:</b>	61.3
<b>Bankfull Width:</b>	29.6
<b>Flood Prone Area Elevation:</b>	277.8
<b>Flood Prone Width:</b>	>65
<b>Max Depth at Bankfull:</b>	2.8
<b>Mean Depth at Bankfull:</b>	2.1
<b>W / D Ratio:</b>	14.3
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0

<b>Stream Type</b>	E/C
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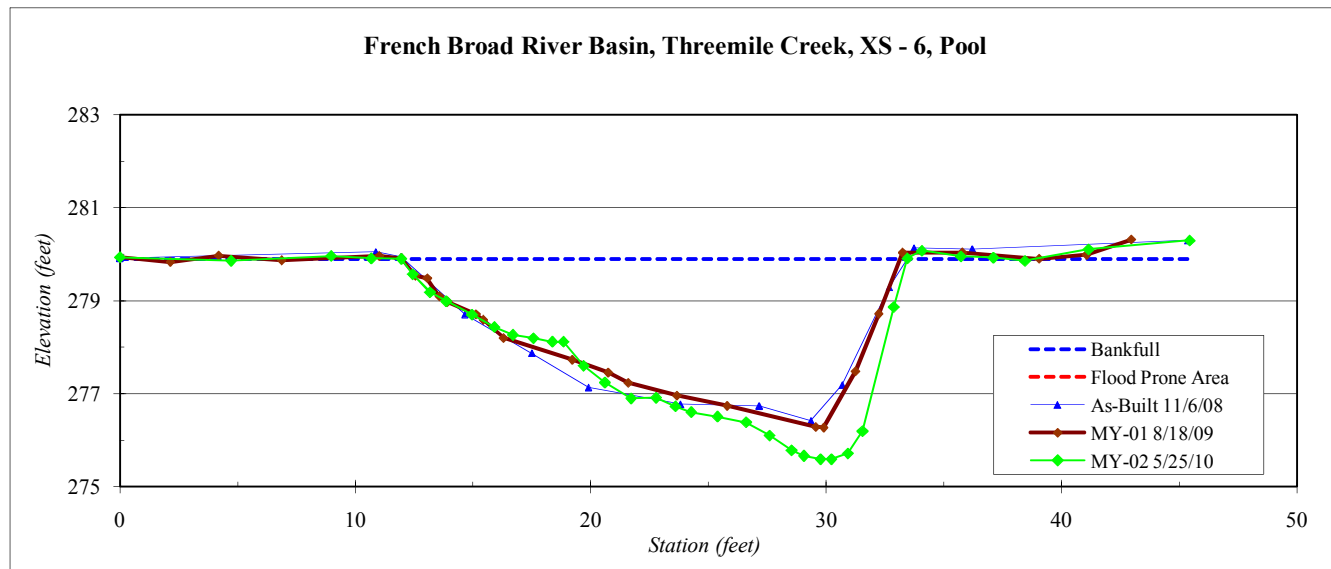
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 6, Pool
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.0	279.9
4.7	279.9
9.0	280.0
10.7	279.9
11.9	279.9
12.4	279.6
13.2	279.2
13.9	279.0
15.0	278.7
15.9	278.4
16.7	278.3
17.6	278.2
18.4	278.1
18.8	278.1
19.7	277.6
20.6	277.2
21.7	276.9
22.8	276.9
23.6	276.7
24.3	276.6
25.4	276.5
26.6	276.4
27.6	276.1
28.5	275.8
29.1	275.7
29.8	275.6
30.2	275.6
30.9	275.7
31.5	276.2
32.9	278.9
33.4	279.9
34.1	280.1
35.7	280.0
37.1	279.9
38.4	279.9
41.1	280.1

SUMMARY DATA	
<b>Bankfull Elevation:</b>	279.9
<b>Bankfull Cross-Sectional Area:</b>	54.6
<b>Bankfull Width:</b>	21.5
<b>Flood Prone Area Elevation:</b>	-
<b>Flood Prone Width:</b>	-
<b>Max Depth at Bankfull:</b>	4.3
<b>Mean Depth at Bankfull:</b>	2.5
<b>W / D Ratio:</b>	-
<b>Entrenchment Ratio:</b>	-
<b>Bank Height Ratio:</b>	-



Stream Type	E/C
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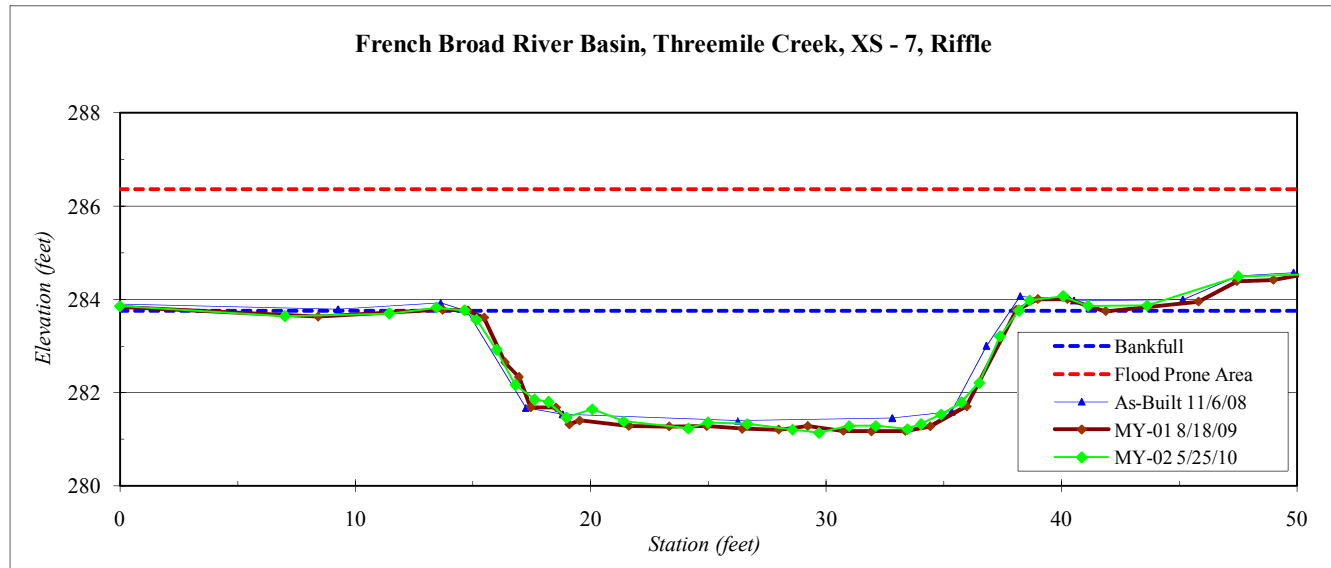
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 7, Riffle
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.0	283.9
7.0	283.6
11.4	283.7
13.4	283.8
14.6	283.8
15.1	283.6
16.0	282.9
16.8	282.2
17.6	281.9
18.2	281.8
19.0	281.5
20.1	281.6
21.4	281.4
24.1	281.2
25.0	281.4
26.7	281.3
28.6	281.2
29.7	281.1
31.0	281.3
32.1	281.3
33.4	281.2
34.0	281.3
34.9	281.5
35.7	281.8
36.5	282.2
37.4	283.2
38.2	283.8
38.6	284.0
40.1	284.1
41.1	283.9
43.6	283.9
47.5	284.5
50.1	284.5

SUMMARY DATA	
<b>Bankfull Elevation:</b>	283.8
<b>Bankfull Cross-Sectional Area:</b>	48.7
<b>Bankfull Width:</b>	23.6
<b>Flood Prone Area Elevation:</b>	286.4
<b>Flood Prone Width:</b>	>65
<b>Max Depth at Bankfull:</b>	2.6
<b>Mean Depth at Bankfull:</b>	2.1
<b>W / D Ratio:</b>	11.4
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0



<b>Stream Type</b>	E/C
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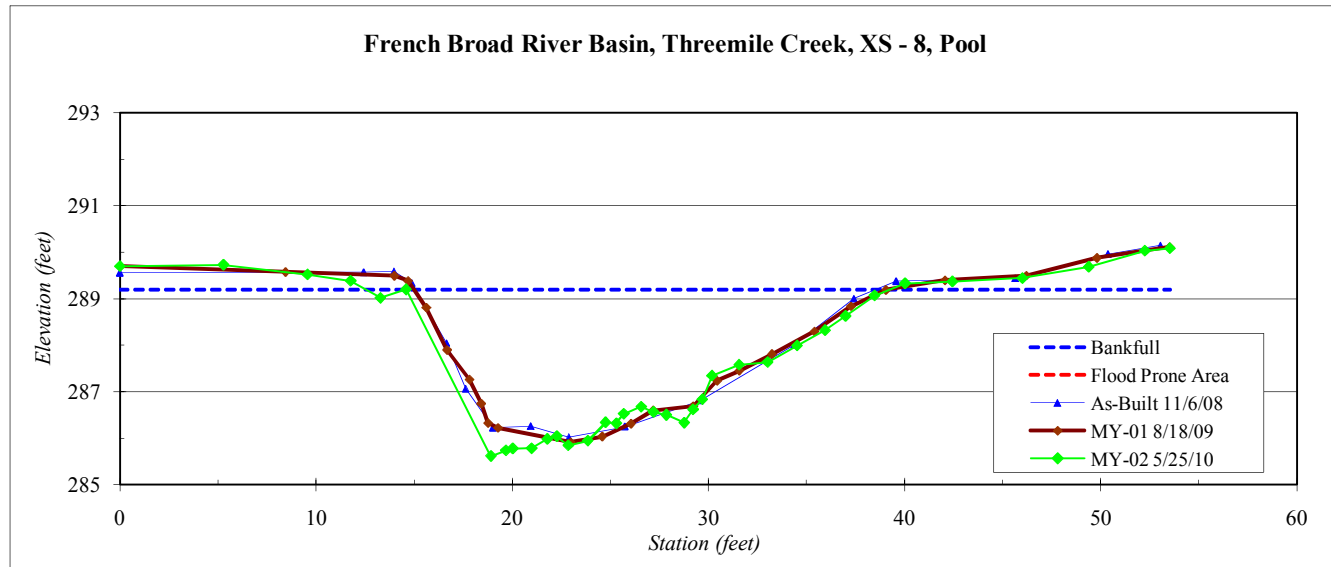
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 8, Pool
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson



Station	Elevation
0.0	289.70
5.3	289.73
9.6	289.52
11.8	289.39
13.3	289.02
14.6	289.20
18.9	285.62
19.7	285.74
20.0	285.78
21.0	285.78
21.8	285.98
22.3	286.05
22.9	285.85
23.8	285.95
24.8	286.34
25.3	286.32
25.7	286.53
26.6	286.68
27.2	286.56
27.9	286.50
28.8	286.33
29.2	286.62
29.7	286.83
30.2	287.35
31.6	287.58
33.0	287.64
34.5	287.99
35.9	288.32
37.0	288.63
38.5	289.07
40.0	289.33
42.4	289.37
46.0	289.44
49.4	289.68
52.2	290.03
53.5	290.08

SUMMARY DATA	
<b>Bankfull Elevation:</b>	289.2
<b>Bankfull Cross-Sectional Area:</b>	51.2
<b>Bankfull Width:</b>	26.7
<b>Flood Prone Area Elevation:</b>	-
<b>Flood Prone Width:</b>	-
<b>Max Depth at Bankfull:</b>	3.6
<b>Mean Depth at Bankfull:</b>	1.9
<b>W / D Ratio:</b>	-
<b>Entrenchment Ratio:</b>	-
<b>Bank Height Ratio:</b>	-

<b>Stream Type</b>	E/C
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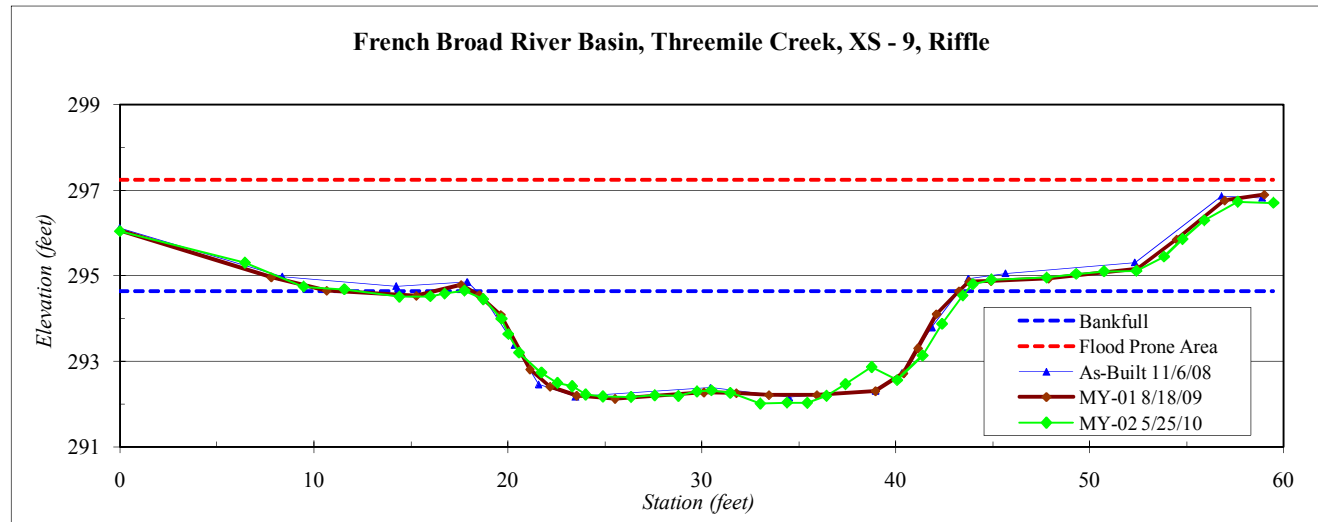
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 9, Riffle
<b>Drainage Area (sq mi):</b>	4.7
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.0	296.0
6.4	295.3
9.5	294.7
11.6	294.7
14.4	294.5
16.0	294.5
16.7	294.6
17.8	294.6
18.7	294.4
19.7	294.0
20.0	293.6
20.6	293.2
21.7	292.7
22.6	292.5
23.3	292.4
24.0	292.2
24.9	292.2
26.3	292.2
27.6	292.2
28.8	292.2
29.7	292.3
30.5	292.3
31.5	292.3
33.0	292.0
34.4	292.0
35.4	292.0
36.4	292.2
37.4	292.5
38.8	292.9
40.1	292.6
41.4	293.1
42.4	293.9
43.4	294.5
44.0	294.8
44.9	294.9
47.8	295.0

SUMMARY DATA	
<b>Bankfull Elevation:</b>	294.6
<b>Bankfull Cross-Sectional Area:</b>	50.4
<b>Bankfull Width:</b>	25.8
<b>Flood Prone Area Elevation:</b>	297.2
<b>Flood Prone Width:</b>	>65
<b>Max Depth at Bankfull:</b>	2.6
<b>Mean Depth at Bankfull:</b>	2.0
<b>W / D Ratio:</b>	13.2
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0



<b>Stream Type</b>	E/C
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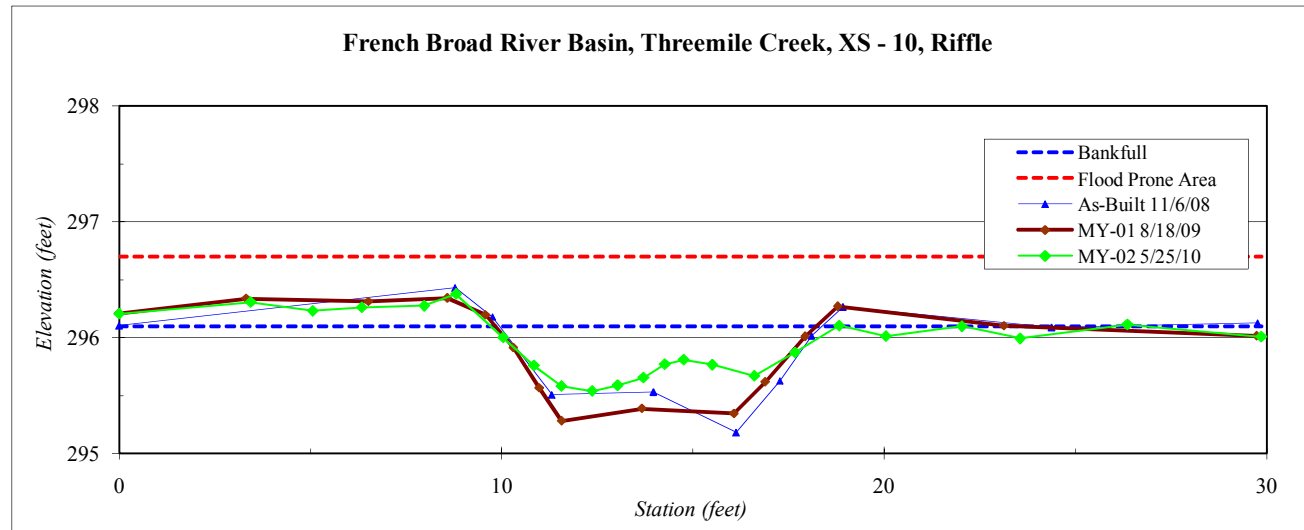
<b>River Basin:</b>	French Broad
<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 10, Riffle
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.0	296.21
3.4	296.31
5.1	296.23
6.3	296.26
8.0	296.28
8.8	296.38
10.0	296.00
10.8	295.76
11.6	295.58
12.4	295.54
13.0	295.59
13.7	295.65
14.3	295.77
14.8	295.81
15.5	295.77
16.6	295.7
17.7	295.9
18.8	296.1
20.0	296.0
22.0	296.1
23.6	296.0
26.4	296.1
29.8	296.0

SUMMARY DATA	
<b>Bankfull Elevation:</b>	296.1
<b>Bankfull Cross-Sectional Area:</b>	3.1
<b>Bankfull Width:</b>	9.1
<b>Flood Prone Area Elevation:</b>	296.7
<b>Flood Prone Width:</b>	>35
<b>Max Depth at Bankfull:</b>	0.6
<b>Mean Depth at Bankfull:</b>	0.3
<b>W / D Ratio:</b>	26.7
<b>Entrenchment Ratio:</b>	>5
<b>Bank Height Ratio:</b>	1.0



<b>Stream Type</b>	E/C
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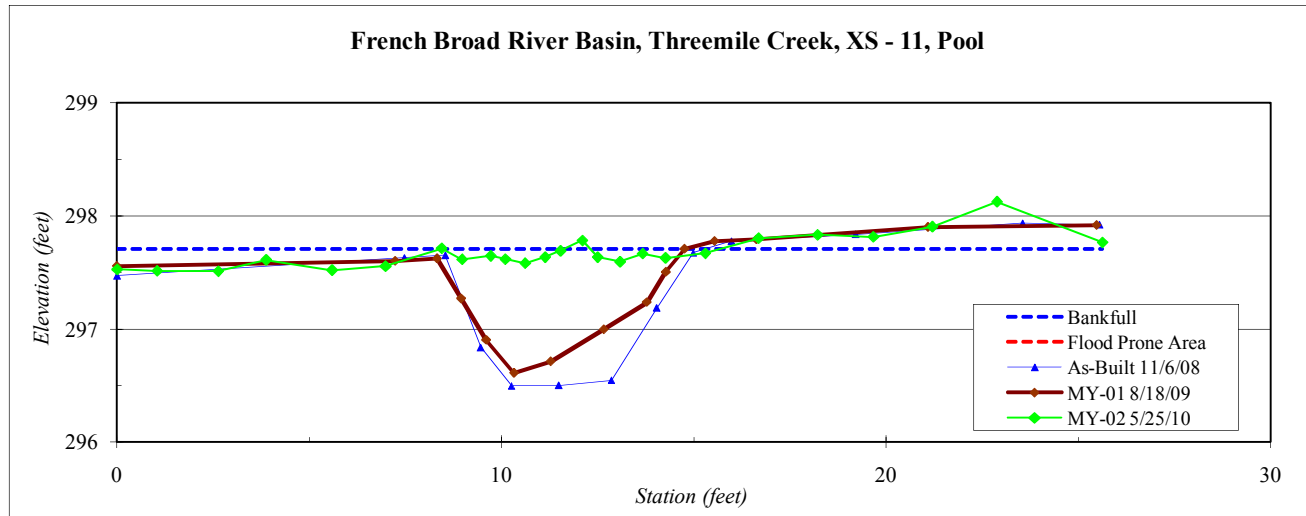
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<b>Watershed:</b>	Threemile Creek
<b>XS ID</b>	XS - 11, Pool
<b>Drainage Area (sq mi):</b>	0.05
<b>Date:</b>	5/25/2010
<b>Field Crew:</b>	Dean, Perkinson

Station	Elevation
0.0	297.5
1.0	297.5
2.6	297.5
3.9	297.6
5.6	297.5
7.0	297.6
8.4	297.7
9.0	297.6
9.7	297.6
10.1	297.6
10.6	297.6
11.1	297.6
11.5	297.7
12.1	297.8
12.5	297.6
13.1	297.6
13.7	297.7
14.3	297.6
15.3	297.7
16.7	297.8
18.2	297.8
19.7	297.8
21.2	297.9
22.9	298.1
25.6	297.8

SUMMARY DATA	
<b>Bankfull Elevation:</b>	297.7
<b>Bankfull Cross-Sectional Area:</b>	0.5
<b>Bankfull Width:</b>	6.6
<b>Flood Prone Area Elevation:</b>	-
<b>Flood Prone Width:</b>	-
<b>Max Depth at Bankfull:</b>	0.2
<b>Mean Depth at Bankfull:</b>	0.1
<b>W / D Ratio:</b>	-
<b>Entrenchment Ratio:</b>	-
<b>Bank Height Ratio:</b>	-



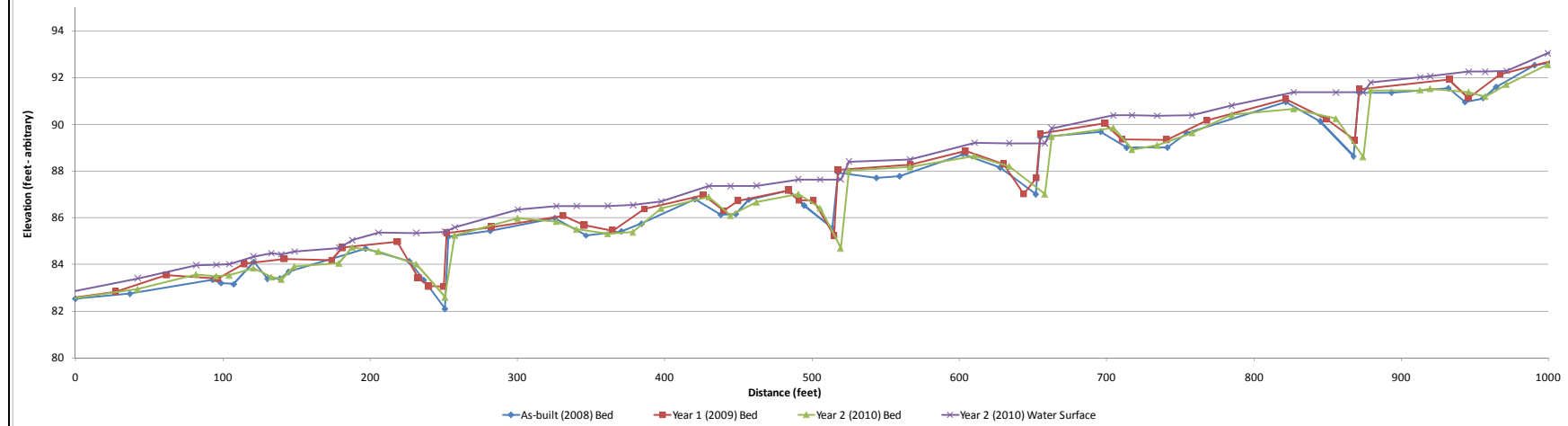
<b>Stream Type</b>	E/C
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Project Name: Threemile Creek - Year 1 (2009) Profile											
Reach: 00+00 - 10+00											
Feature: Profile											
Date: 5/20/10											
Crew: Lewis, Jerginson											
2008 As-built Survey			2009 Year 1 Monitoring /Survey			2010 Year 2 Monitoring /Survey			2011 Year 3 Monitoring /Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6	-3.3	82.5	82.8	-3.0	82.5	82.8			
37.1	82.8	83.2	27.2	82.8	83.1	42.3	82.9	83.4			
93.1	83.4	83.9	61.6	83.5	83.8	81.9	83.6	84.0			
98.8	83.2	83.9	96.5	83.4	84.0	95.6	83.5	84.0			
107.4	83.2	83.9	114.5	84.0	84.3	104.5	83.5	84.0			
121.0	84.1	84.1	141.7	84.2	84.5	120.8	83.8	84.3			
130.4	83.4	84.3	173.8	84.2	84.9	133.0	83.5	84.5			
138.8	83.4	84.3	181.2	84.7	85.0	139.8	83.4	84.4			
144.7	83.7	84.3	218.5	85.0	85.3	148.7	83.9	84.6			
197.0	84.7	85.1	232.7	83.4	85.3	178.9	84.1	84.7			
226.7	84.1	85.1	239.7	83.1	85.3	188.0	84.7	85.0			
236.5	83.3	85.2	249.8	83.0	85.3	205.8	84.6	85.4			
250.9	82.1	85.2	251.9	85.4	85.7	231.4	84.0	85.4			
253.2	85.2	85.2	282.1	85.6	86.0	250.9	82.6	85.4			
281.5	85.4	85.9	331.2	86.1	86.5	257.5	85.3	85.6			
325.5	86.0	86.4	345.4	85.7	86.6	300.3	86.0	86.3			
346.6	85.2		364.7	85.5	86.5	326.5	85.8	86.5			
370.6	85.4	86.4	386.1	86.4	86.6	340.3	85.5	86.5			
384.2	85.7	86.3	426.2	87.0	87.4	361.3	85.3	86.5			
420.6	86.8	87.0	439.9	86.3	87.3	378.5	85.4	86.5			
438.2	86.1	87.2	449.9	86.7	87.3	397.6	86.4	86.7			
448.3	86.2	87.2	483.8	87.2	87.7	430.0	86.9	87.4			
457.1	86.8	87.2	491.2	86.8	87.7	444.7	86.1	87.4			
484.0	87.2	87.6	500.9	86.7	87.7	462.4	86.7	87.4			
494.7	86.5	87.6	514.9	85.2	87.7	490.8	87.0	87.6			
513.8	85.6	87.6	517.6	88.1	88.4	505.6	86.4	87.6			
517.6	87.9	88.2	566.8	88.3	88.5	519.5	84.7	87.6			

	As-built	2009	2010	2011
Avg. Water Surface Slope	0.0098	0.0097	0.0098	
Riffle Length	51	53	51	
Avg. Riffle Slope	0.0154	0.0143	0.0148	
Pool Length	46	38	44	
Pool to Pool Spacing	-----	0.0008	0.0	

Threemile Creek Year 2 (2010) Profile - Reach 00+00 to 10+00

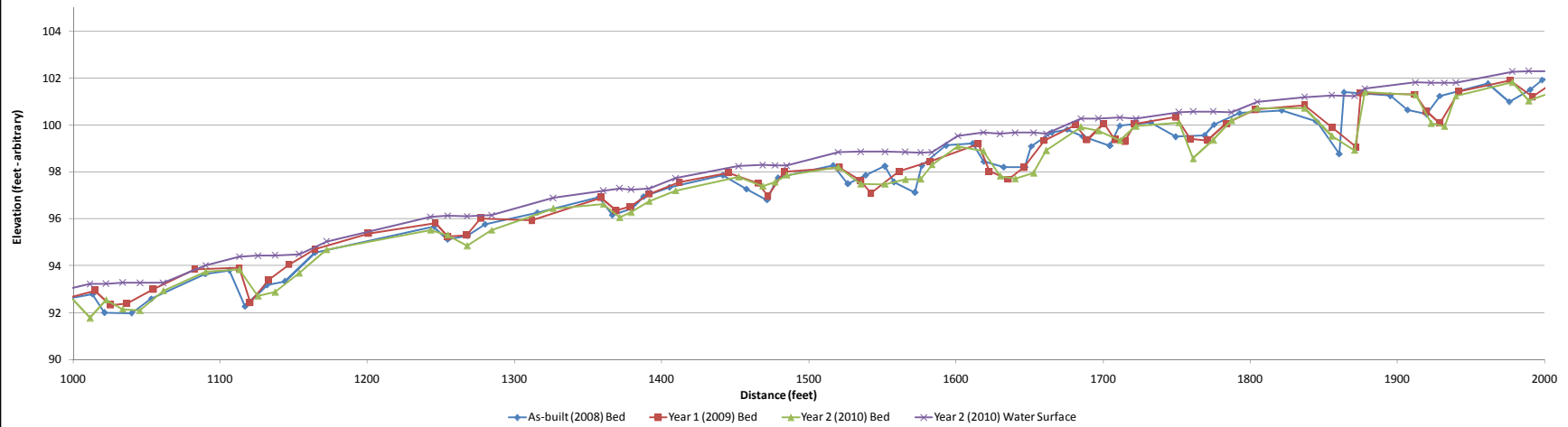


1387.8      96.9      97.3

Project Name Threemile Creek - Year 1 (2009) Profile											
Reach 10+00 - 20+00											
Feature Profile											
Date 5/20/10											
Crew Lewis, Jerginson											
2008 As-built Survey			2009 Year 1 Monitoring /Survey			2010 Year 2 Monitoring /Survey			2011 Year 3 Monitoring /Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6	967.1	92.1	92.5	999.7	92.6	93.0			
37.1	82.8	83.2	1015.0	92.9	93.2	1011.6	91.8	93.2			
93.1	83.4	83.9	1025.6	92.3	93.3	1022.5	92.5	93.2			
98.8	83.2	83.9	1036.6	92.4	93.3	1033.7	92.1	93.3			
107.4	83.2	83.9	1054.6	93.0	93.3	1045.5	92.1	93.3			
121.0	84.1	84.1	1082.7	93.8	94.2	1061.4	92.9	93.3			
130.4	83.4	84.3	1113.0	93.9	94.4	1090.2	93.7	94.0			
138.8	83.4	84.3	1120.3	92.4	94.4	1113.1	93.8	94.4			
144.7	83.7	84.3	1132.9	93.4	94.4	1125.7	92.7	94.4			
197.0	84.7	85.1	1146.8	94.0	94.4	1137.4	92.9	94.4			
226.7	84.1	85.1	1164.5	94.7	94.9	1153.8	93.7	94.5			
236.5	83.3	85.2	1201.0	95.4	95.5	1172.3	94.7	95.0			
250.9	82.1	85.2	1246.3	95.8	96.1	1243.0	95.5	96.1			
253.2	85.2	85.2	1254.6	95.2	96.2	1254.6	95.3	96.1			
281.5	85.4	85.9	1267.6	95.3	96.2	1267.9	94.8	96.1			
325.5	86.0	86.4	1277.0	96.0	96.1	1284.4	95.5	96.1			
346.6	85.2		1311.8	95.9	96.6	1326.3	96.4	96.9			
370.6	85.4	86.4	1358.9	96.9	97.3	1360.3	96.6	97.2			
384.2	85.7	86.3	1369.2	96.3	97.3	1371.5	96.0	97.3			
420.6	86.8	87.0	1378.7	96.5	97.3	1379.2	96.3	97.2			
438.2	86.1	87.2	1391.4	97.0	97.4	1391.6	96.7	97.3			
448.3	86.2	87.2	1412.1	97.6	97.8	1409.4	97.2	97.7			
457.1	86.8	87.2	1445.4	98.0	98.2	1452.3	97.8	98.2			
484.0	87.2	87.6	1465.7	97.5	98.2	1468.7	97.4	98.3			
494.7	86.5	87.6	1472.2	97.0	98.2	1477.1	97.6	98.3			
513.8	85.6	87.6	1483.4	98.0	98.3	1485.0	97.9	98.3			
517.6	87.9	88.2	1520.9	98.2	98.8	1520.0	98.2	98.8			

	As-built	2009	2010	2011
Avg. Water Surface Slope	0.0098	0.0097	0.0098	
Riffle Length	51.0	52.9	51	
Avg. Riffle Slope	0.0154	0.0143	0.0148	
Pool Length	46.0	38.0	44	
Avg. Pool Slope	110.0	0.0008	0.0	

Threemile Creek Year 2 (2010) Profile - Reach 10+00 to 20+00

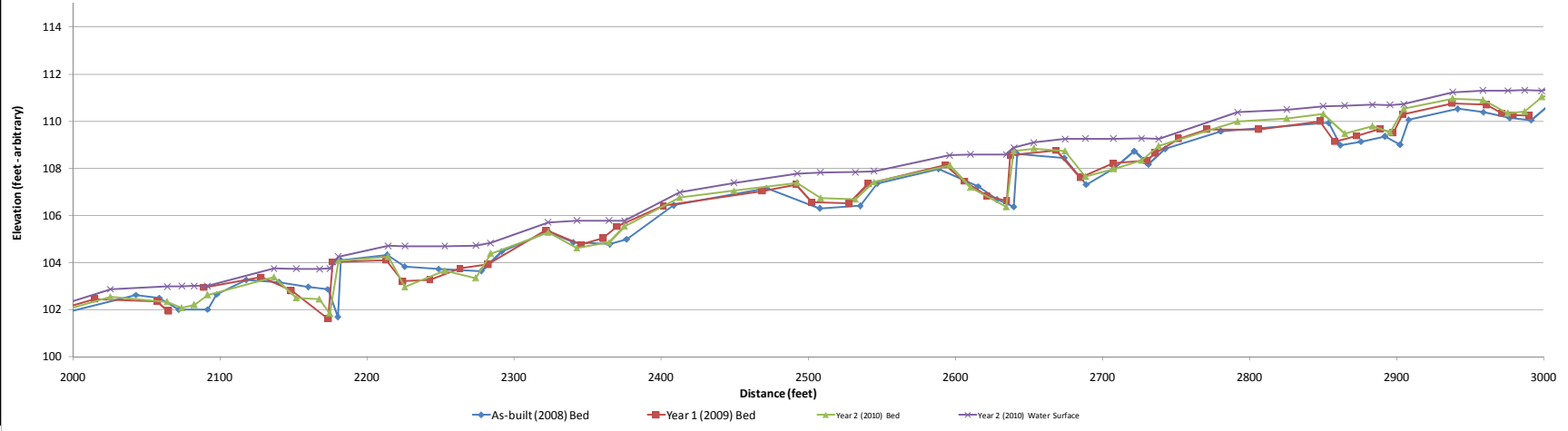


1387.8      96.9      97.3

Project Name Threemile Creek - Year 1 (2009) Profile											
Reach 20+00 - 30+00											
Feature Profile											
Date 5/20/10											
Crew Lewis, Jerginson											
2008			2009			2010			2011		
As-built Survey			Year 1 Monitoring /Survey			Year 2 Monitoring /Survey			Year 3 Monitoring /Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6	1971.8	101.2	102.2	1974.2	101.0	102.3			
37.1	82.8	83.2	1990.1	102.0	102.2	1985.1	101.3	102.3			
93.1	83.4	83.9	2014.8	102.5	102.5	1996.8	102.0	102.3			
98.8	83.2	83.9	2057.5	102.4	102.9	2025.6	102.5	102.9			
107.4	83.2	83.9	2064.9	101.9	102.9	2064.2	102.3	103.0			
121.0	84.1	84.1	2077.4		102.9	2074.1	102.1	103.0			
130.4	83.4	84.3	2089.1	102.9	103.0	2082.5	102.2	103.0			
138.8	83.4	84.3	2127.9	103.4	103.6	2091.6	102.6	103.0			
144.7	83.7	84.3	2148.5	102.8	103.6	2136.7	103.4	103.7			
197.0	84.7	85.1	2173.6	101.6	103.6	2152.0	102.5	103.7			
226.7	84.1	85.1	2176.6	104.0	104.1	2167.6	102.4	103.7			
236.5	83.3	85.2	2212.9	104.1	104.4	2174.7	101.8	103.7			
250.9	82.1	85.2	2224.2	103.2	104.5	2180.4	104.1	104.3			
253.2	85.2	85.2	2242.6	103.3	104.4	2214.4	104.2	104.7			
281.5	85.4	85.9	2263.2	103.7	104.4	2225.7	103.0	104.7			
325.5	86.0	86.4	2282.2	103.9	104.5	2252.9	103.6	104.7			
346.6	85.2		2321.8	105.4	105.7	2274.0	103.3	104.7			
370.6	85.4	86.4	2345.4	104.8	105.6	2284.0	104.4	104.8			
384.2	85.7	86.3	2360.4	105.0	105.7	2323.1	105.3	105.7			
420.6	86.8	87.0	2369.9	105.5	105.6	2342.6	104.6	105.8			
438.2	86.1	87.2	2401.4	106.4	106.6	2364.6	104.9	105.8			
448.3	86.2	87.2	2468.9	107.0	107.5	2375.0	105.5	105.8			
457.1	86.8	87.2	2491.5	107.3	107.6	2412.6	106.8	107.0			
484.0	87.2	87.6	2502.3	106.6	107.6	2449.5	107.1	107.4			
494.7	86.5	87.6	2527.6	106.5	107.6	2492.4	107.4	107.8			
513.8	85.6	87.6	2540.7	107.4	107.6	2508.4	106.7	107.8			
517.6	87.9	88.2	2593.2	108.1	108.4	2532.1	106.7	107.8			
542.8	87.7	88.7	2606.2	107.6	108.4	2644.7	107.4	107.8			

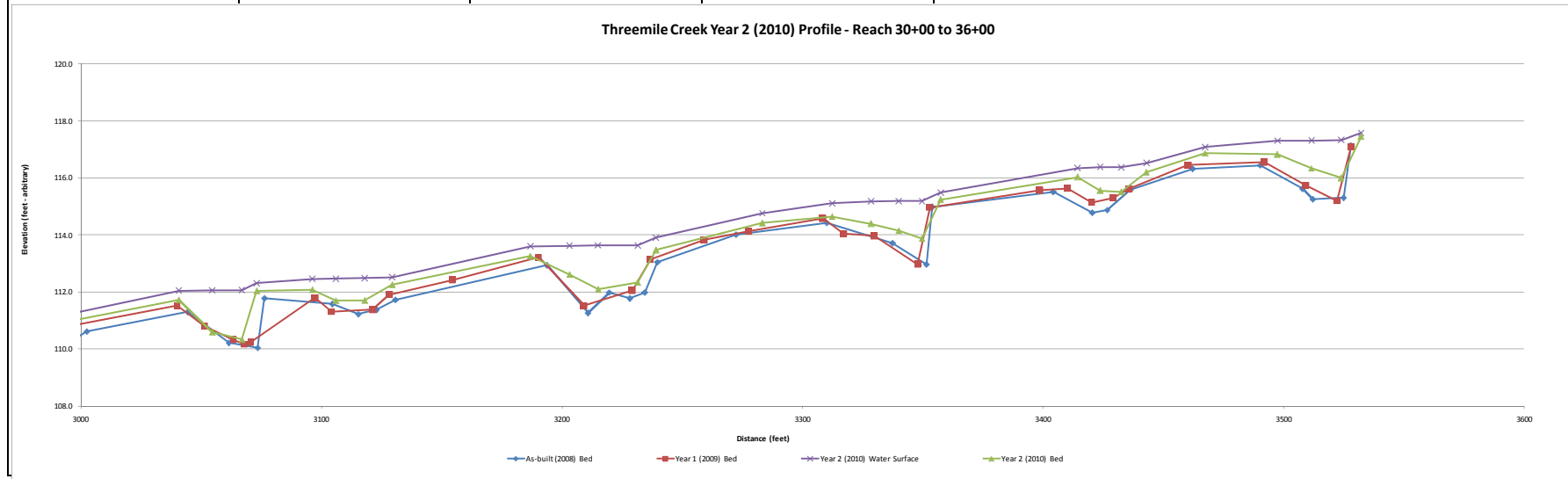
	As-built	2009	2010	2011
Avg. Water Surface Slope	0.0098	0.0097	0.0098	
Riffle Length	51.0	52.9	51	
Avg. Riffle Slope	0.0154	0.0143	0.0148	
Pool Length	46.0	38.0	44	
Avg. Pool Slope	110.0	0.0008	0.0	

Threemile Creek Year 2 (2010) Profile - Reach 20+00 to 30+00



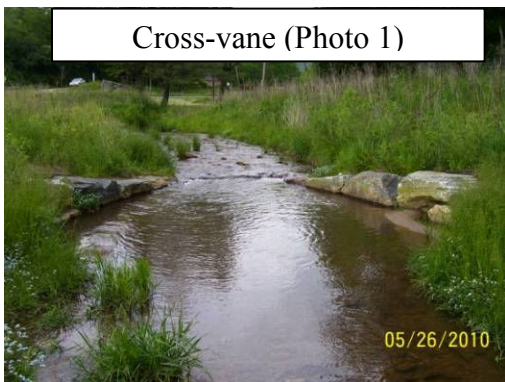
Project Name Threemile Creek - Year 1 (2009) Profile											
Reach 30+00 - 36+00											
Feature Profile											
Date 5/20/10											
Crew Lewis, Jerginson											
2008 As-built Survey			2009 Year 1 Monitoring /Survey			2010 Year 2 Monitoring /Survey			2011 Year 3 Monitoring /Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6	2971.4	110.3	111.0	2975.5	110.3	111.3			
37.1	82.8	83.2	2979.2	110.3	111.0	2987.0	110.4	111.3			
93.1	83.4	83.9	2989.8	110.2	111.0	2998.6	111.0	111.3			
98.8	83.2	83.9	2994.6	110.8	111.1	3040.7	111.7	112.0			
107.4	83.2	83.9	3040.0	111.5	111.8	3054.6	110.6	112.1			
121.0	84.1	84.1	3051.5	110.8	111.8	3066.9	110.3	112.1			
130.4	83.4	84.3	3063.4	110.3	111.8	3073.0	112.0	112.3			
138.8	83.4	84.3	3068.0	110.2	111.8	3096.2	112.1	112.5			
144.7	83.7	84.3	3070.6	110.2	112.1	3105.9	111.7	112.5			
197.0	84.7	85.1	3097.3	111.8	112.1	3117.9	111.7	112.5			
226.7	84.1	85.1	3104.2	111.3	112.1	3129.4	112.3	112.5			
236.5	83.3	85.2	3121.4	111.4	112.1	3186.8	113.2	113.6			
250.9	82.1	85.2	3128.2	111.9	112.1	3203.1	112.6	113.6			
253.2	85.2	85.2	3154.3	112.4	112.7	3215.0	112.1	113.6			
281.5	85.4	85.9	3190.3	113.2	113.3	3231.5	112.3	113.6			
325.5	86.0	86.4	3209.2	111.5	113.3	3239.1	113.5	113.9			
346.6	85.2		3229.2	112.1	113.3	3283.3	114.4	114.8			
370.6	85.4	86.4	3236.7	113.1	113.5	3312.3	114.6	115.1			
384.2	85.7	86.3	3259.2	113.8	114.1	3328.5	114.4	115.2			
420.6	86.8	87.0	3277.5	114.1	114.5	3340.0	114.1	115.2			
438.2	86.1	87.2	3308.5	114.6	114.8	3349.7	113.9	115.2			
448.3	86.2	87.2	3317.1	114.0	114.8	3357.4	115.2	115.5			
457.1	86.8	87.2	3329.7	114.0	114.8	3414.4	116.0	116.3			
484.0	87.2	87.6	3347.9	113.0	114.8	3423.7	115.6	116.4			
494.7	86.5	87.6	3352.9	115.0	115.1	3432.5	115.5	116.4			
513.8	85.6	87.6	3398.6	115.6	115.9	3443.0	116.2	116.5			
517.6	87.9	88.2	3410.1	115.6	116.0	3467.4	116.9	117.1			

	As-built	2009	2010	2011
Avg. Water Surface Slope	0.0098	0.0097		
Rifle Length	51.0	52.9	51	
Avg. Rifle Slope	0.0154	0.0143	0.0148	
Pool Length	46.0	38.0	44	
Avg. Pool Slope	110.0	0.0008	0.0	

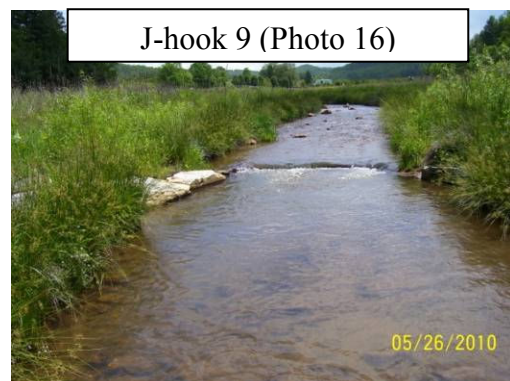
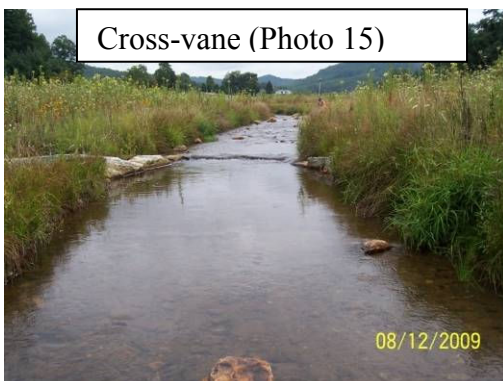
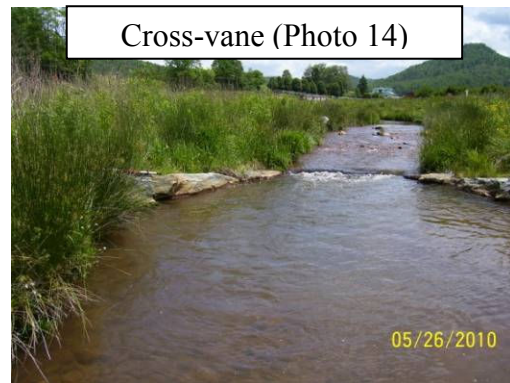
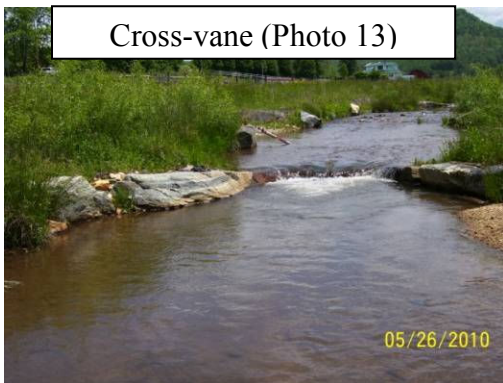
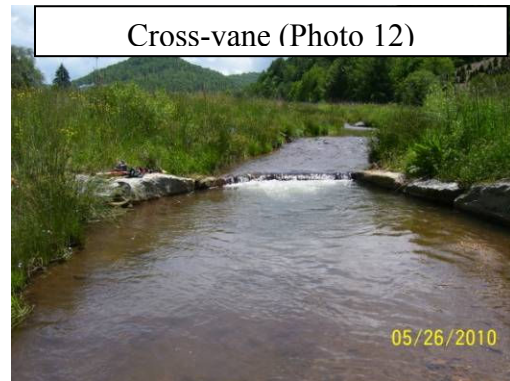
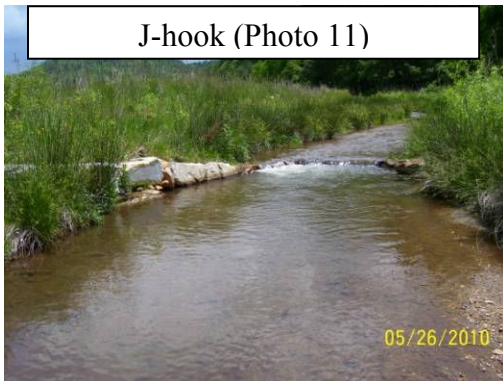
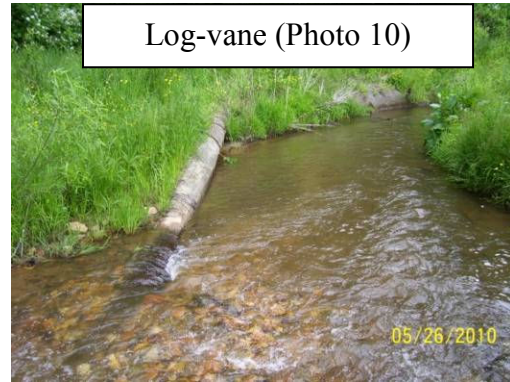


1387.8     96.9     97.3

**Three Mile  
Year 2 (2010) Annual Monitoring  
Structure Photographs taken May 2010**



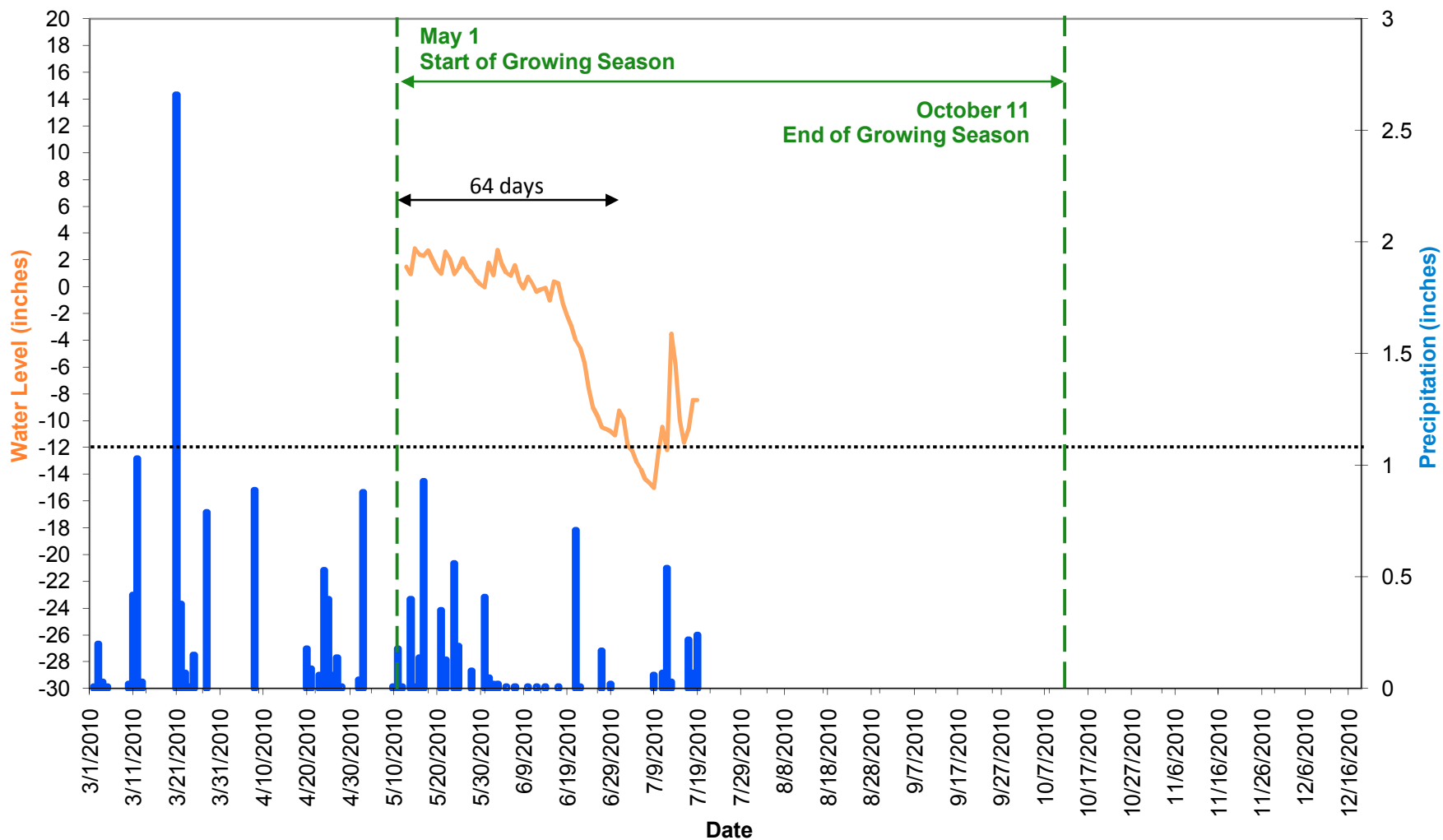
**Three Mile  
Year 2 (2010) Annual Monitoring  
Structure Photographs taken May 2010  
(continued)**



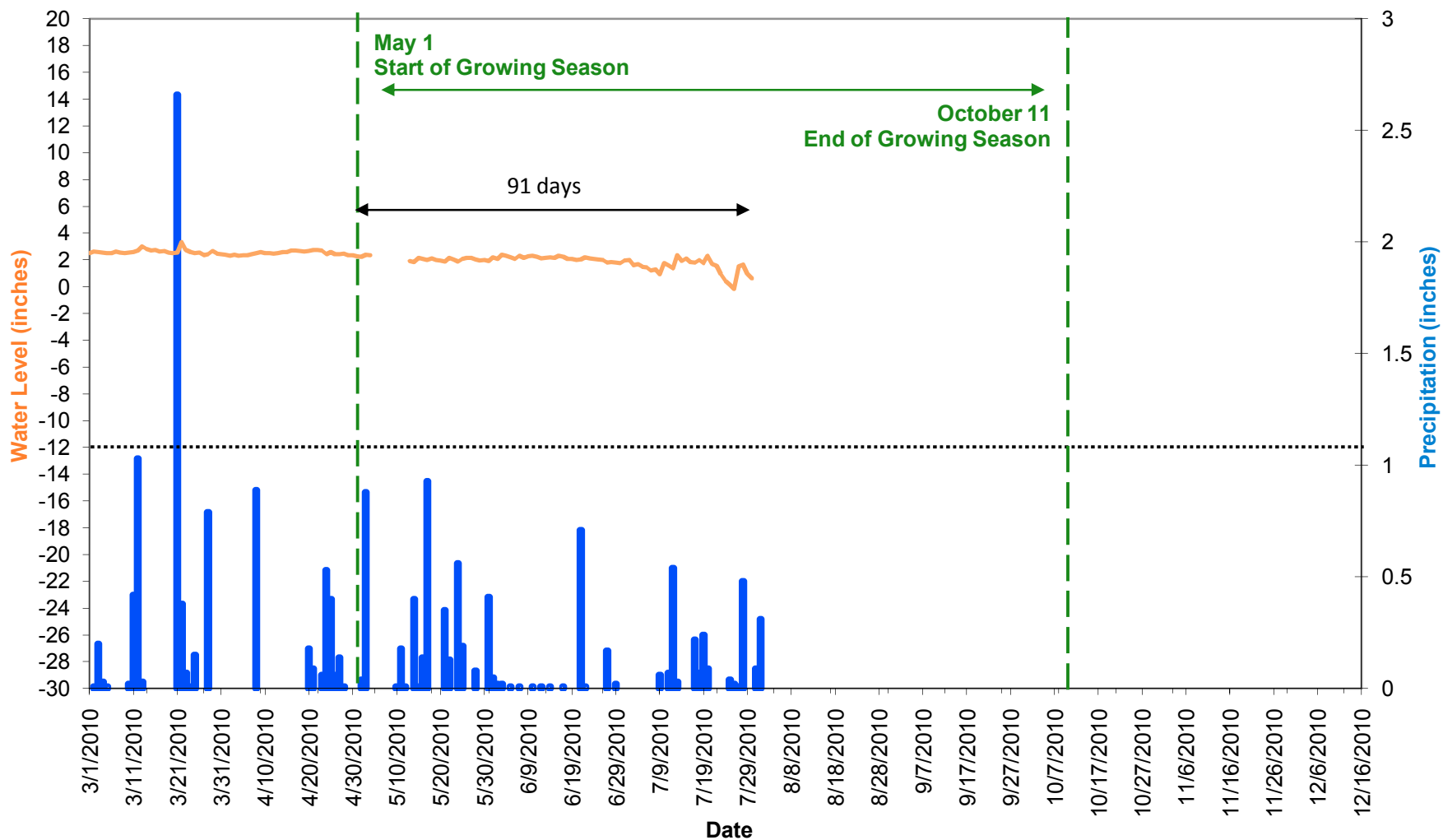
**APPENDIX D  
HYDROLOGY DATA  
2010 Groundwater Gauge Graphs**



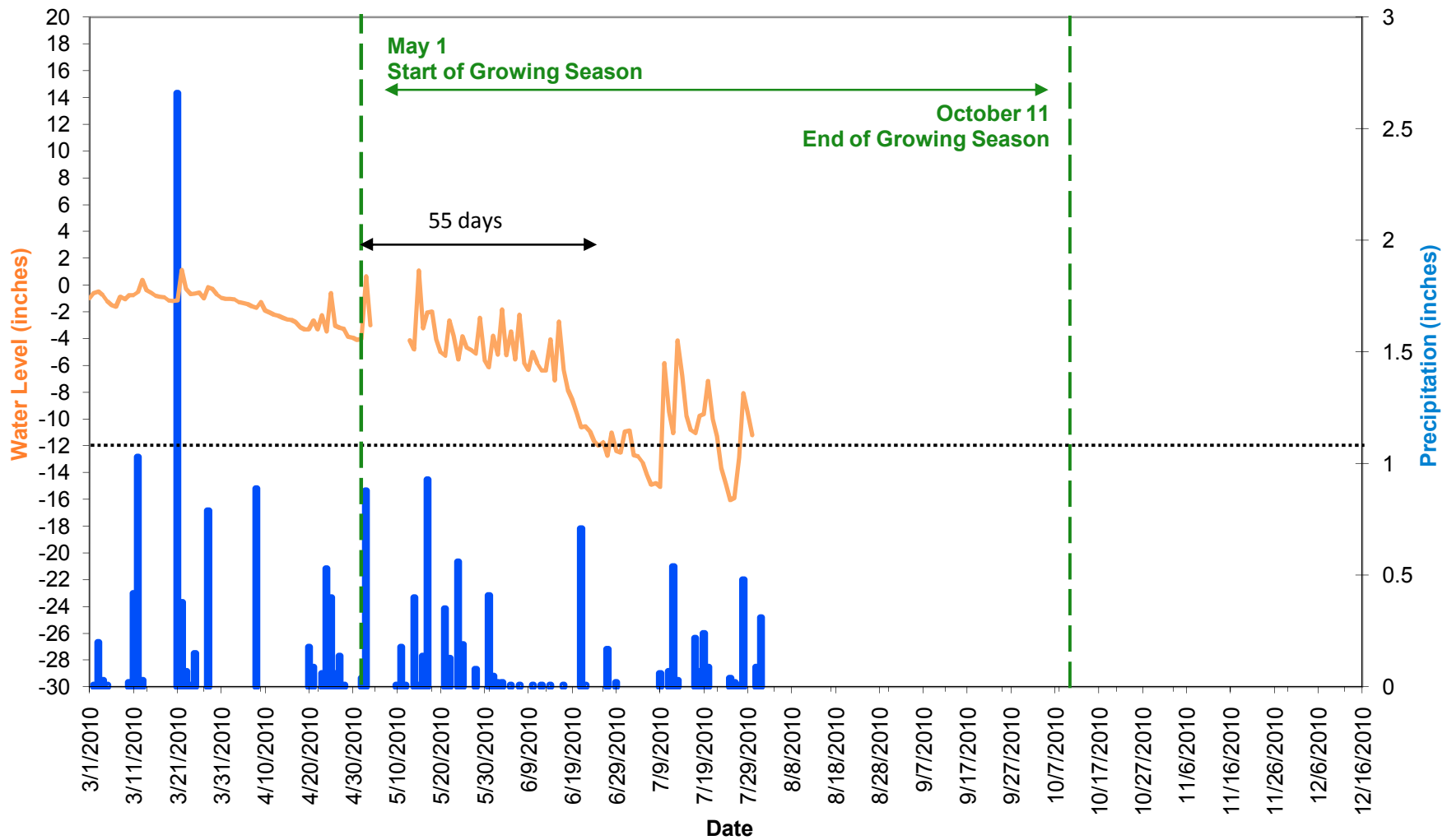
### Threemile- Groundwater Gauge 1 Year 2 (2010 Data)



### Threemile- Groundwater Gauge 2 Year 2 (2010 Data)



### Threemile- Groundwater Gauge 3 Year 2 (2010 Data)



### Threemile- Groundwater Gauge Reference Year 2 (2010 Data)

