

FINAL
YEAR 2 (2015) ANNUAL MONITORING REPORT
MARTIN'S CREEK II MITIGATION PROJECT

Cherokee County, North Carolina
DMS Project No. 92633 (Contract No. 005717)
USACE Action ID No. SAW – 2009-00209/DWR Project No. 10-0952
SCO No. 08-07251-01

Data Collection – March-November 2015

Hiwassee River Basin
Cataloging Unit 06020002170010



SUBMITTED TO/PREPARED FOR:

North Carolina Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street, Suite 3000A
Raleigh, North Carolina 27603

December 2015

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SUBMITTED BY:



Axiom Environmental, Inc.

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218 Snow Avenue
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1.0 PROJECT SUMMARY

The North Carolina Department of Environmental Quality - Division of Mitigation Services (DMS) has established the Martin's Creek II Mitigation Project (Site) located in Cherokee County, just south of the town of Murphy. The Site includes a 93.87-acre easement encompassed within 14-digit Cataloging Unit 06020002170010 of the Hiwassee River Basin (Figure 1, Appendix B and Table 4, Appendix A). Land use at the Site, prior to mitigation activities, was composed of livestock pasture, open land, a residence, and forested areas. Martin's Creek and its tributaries were impaired by historical and current land management practices, which included timber harvesting, pasture, channelization, and livestock grazing. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A).

The Site is located along Martin's Creek and several unnamed tributaries, which have been assigned Stream Index Number 1-49 and Best Usage Classification of C. Site streams are listed on the NCDWQ draft 2014 and final 2012 Section 303(d) list of impaired streams due to a fair bioclassification for reduced ecological/biological integrity and fish communities, and elevated levels of fecal coliform bacteria. The Site is located within a Targeted Local Watershed that has been identified for stream and buffer restoration opportunities (NCDMS 2008).

The Site lies within the focus area of the *Peachtree-Martins Creek Local Watershed Plan (LWP)* and roughly corresponds to Restoration site #1 & Preservation site #1 of the LWP project atlas (NCDMS 2007). Goals of the LWP include implementation of wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffers, stabilizing stream banks, and restoring natural channel geomorphology, particularly in headwater streams.

The project goals will directly address stressors identified in the *Peachtree-Martins Creek LWP*, namely lack of riparian vegetation, channel modification, excess sediment inputs, excess nutrient inputs, and bacterial contamination as follows.

- Restore geomorphically stable stream channels within the Site;
- Restore or enhance wetlands;
- Exclude livestock from accessing project streams, wetlands, and riparian zones;
- Improve and restore hydrologic connections and achieve uplift of ecosystem functions;
- Improve water quality within the Site by reducing bank erosion, improving nutrient and sediment removal, and stabilizing stream banks;
- Restore and preserve headwater tributaries to the *Peachtree-Martins Creek Watershed* and the Hiwassee River; and
- Improve aquatic and terrestrial habitat by improving substrate and in-stream cover, adding woody debris, reducing water temperatures, and restoring riparian habitat.

The Site mitigation plan was completed in March 2010 with the final design and construction plans completed in November 2010 (Table 2, Appendix A). Project construction was completed between October 2012 and July 2013. The implemented mitigation is as follows (Figure 2, Appendix B and Table 1, Appendix A).

- 8817 Stream Mitigation Units
 - Restoring approximately 3486 linear feet of stream channel through construction of stable channel at the historic floodplain elevation.
 - Enhancing (level I) approximately 832 linear feet of stream channel through cessation of current land use practices, installing grade control structures, repairing bank erosion, restoring proper channel dimension, and planting with native forest vegetation.
 - Enhancing (level II) approximately 1903 linear feet of stream channel through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
 - Preserving 21,327 linear feet of stream channel.
- 5.97 Riparian Wetland Mitigation Units
 - Restoring approximately 5.20 acres of riparian wetland by removing spoil castings, restoring stream inverts to historic elevations rehydrating stream-side wetlands, removing drain tile, eliminating land use practices, and planting with native forest vegetation.
 - Enhancing approximately 1.61 acres of riparian wetland by fencing livestock and supplemental planting.
- Planting a native woody riparian buffer (at least 30 feet in width) adjacent to restored/enhanced streams and wetlands within the Site.
- Protecting the Site in perpetuity with a conservation easement.

Stream Success Criteria

Stream restoration success criteria for the Site are based on the *Stream Mitigation Guidelines* issued in April 2003 by the USACE and NCDWQ. Success criteria for stream restoration will include 1) documentation of two bankfull events, 2) little change in the channel cross-section from as-built conditions, 3) stable longitudinal profile, 4) substrate consistency, and 5) photographic evidence of stability.

Bankfull Events

Two bankfull flow events in separate years must be documented within the 5-year monitoring period. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years.

Cross-sections

Riffle cross-sections on restoration and enhancement reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Riffle cross-sections should generally fall within the parameters defined for channels of the appropriate Rosgen stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth.

Longitudinal Profile

Longitudinal profile data for the stream reach should show that bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools should be deep with flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters.

Bed Material Analysis

Substrate materials in restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

Photo Reference Sites

Photographs will be used to evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Lateral photos should not indicate excessive erosion or continuing degradation of the banks. A series of photos over time should indicate successive maturation of riparian vegetation.

Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria for this project includes an average density of 320 planted stems per acre 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.

Wetland Success Criteria

Hydrologic success will be based on conditions of on-site reference wetlands. Success will be determined by the following criteria.

Years One Through Three

Hydrologic success criteria will be met if the Site demonstrates groundwater table levels within 12 inches of the soil surface for a minimum of 13% of the growing season (this criterion reflects a deviation of 50% from the duration of saturation expected for this type of wetland system (~25%). Success for monitoring years one through three will be determined based on this 50% tolerance of deviation from the duration of wetland hydrology at the reference sites.

Years Four and Five

Success for monitoring years four and five will be determined based on a 20% tolerance of deviation from the duration of wetland hydrology at the reference sites. Therefore, it is expected that in years four and five the site will achieve a minimum of 20% saturation. Based on reference conditions and the criterion stated above, it is expected that reference soil saturation for years one through five will continue to exceed the regulatory 12.5% minimum requirement of the growing season for Cherokee County. In order to attain conditions suitable for the formation of wetland vegetation and hydric soils, the Site should be saturated within 12 inches of the surface or inundated for consecutive period equal to 24 days. However, to meet hydrologic success criteria and mimic the reference wetland hydrology, the site should demonstrate wetland hydrology for a minimum of 25 days in years one through three. In years four and five, this will increase to a minimum of 38 days. Overbank flooding from the adjacent channel will also be noted during monitoring.

Reference areas will be monitored for a minimum of five years.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on the Division of Mitigation Services (DMS) website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 METHODOLOGY

Monitoring of the Site's restoration efforts will be performed until agreed upon success criteria are fulfilled. Monitoring is proposed for the stream channel, riparian vegetation, and hydrology for a period of five years (Figures 2 & 2A-2C, Appendix A). Monitoring reports of collected data will be submitted no later than December of each monitoring year.

2.1 Streams

Post-restoration monitoring will be conducted for five years following the completion of construction to evaluate the effectiveness of the restoration practices. Measurements were taken using a Topcon GTS 303 total station and Recon data collector. The raw total station file was processed using Carlson Survey Software into a Computer Aided Design (CAD) file. Coordinates were exported as a text/ASCII file to Microsoft Excel for processing and presentation of data, and are not georeferenced. Pebble counts were completed using the modified Wolman method (Rosgen 1993). Monitored stream parameters include stream dimension (cross-sections), pattern (longitudinal survey), profile (profile survey), and photographic documentation. Stream data can be found in Appendix D.

Bankfull Events

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. One crest gauge was installed to record the highest watermark between site visits; the gauge will be checked each Site visit to determine if a bankfull event has occurred (Figure 2A, Appendix B). Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Five bankfull events have been documented to date during monitoring year 2 (2015) for a total of eleven bankfull events during years 1 (2014) and 2 (2015).

Cross-sections

A total of 19 permanent cross-sections, 12 riffle and 7 pool, were established and will be used to evaluate stream dimension; locations are depicted on Figures 2, 2A, and 2B (Appendix B). Because riffle cross-sections are critical in determining bankfull design parameters, the number of riffle cross-sections established will generally outnumber pool cross-sections. Each cross-section will be marked on both banks with permanent pins to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. The annual cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections will be classified using the Rosgen Stream Classification System.

No areas of concern or indicators of instability were observed during year 2 (2015) monitoring; therefore, stream dimension measurements are currently meeting success criteria.

Longitudinal Profile

After Site construction, approximately 4493 linear feet of longitudinal profile was completed to document baseline conditions. Longitudinal profile will be resurveyed annually for the duration of the five-year monitoring period. Measurements include thalweg, water surface, bankfull, and top of low bank. Each of these measurements will be taken at the head of each channel unit (e.g., riffle, pool) and at the maximum pool depth. The survey will be tied to a permanent benchmark.

No areas of concern or indicators of bedform instability were observed during year 2 (2015) monitoring; therefore, stream longitudinal profile measurements are currently meeting success criteria.

Bed Material Analysis

Pebble counts will be conducted annually on one permanent riffle cross-section (100-counts) at the time cross-section and longitudinal surveys are performed during the five year monitoring period. These samples will reveal changes in sediment gradation over time as the stream adjusts to upstream sediment loads.

Year 2 (2015) pebble counts indicate the maintenance of coarser materials in the measured riffle feature; therefore, bed material is currently meeting success criteria.

Photo Reference Sites

A total of 26 photographs will be used to visually document restoration success for at least five years following construction. Photographs will be taken from a height of approximately five to six feet. Photo locations will be recorded using sub-meter GPS to ensure that the same locations (and view directions) on the Site are monitored in each monitoring period.

Year 2 (2015) photo reference sites show no channel aggradation or degradation, or bank erosion. In addition, riparian vegetation is meeting success criteria based on stem counts across the Site; however, it is too early in the monitoring period to show successive maturation of riparian vegetation.

2.2 Vegetation

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Fifteen sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). Vegetation plots are permanently monumented with 6-foot metal t-posts at each corner. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph. Vegetation plot data can be found in Appendix C.

Supplemental planting occurred at the Site in early 2015 with 3000 bare root stems as follows (Figures 2A-2C (Appendix A)).

500 river birch (*Betula nigra*)
500 sycamore (*Platanus occidentalis*)
500 tulip poplar (*Liriodendron tulipifera*)
500 black gum (*Nyssa sylvatica*)
500 northern red oak (*Quercus rubra*)
500 Shumard's oak (*Quercus shumardii*)
3000

Year 2 stem count measurements indicate an average of 459 planted stems per acre (excluding livestock) across the Site; therefore, the Site is currently meeting vegetation success criteria. In addition, all fifteen individual vegetation plots met success criteria based on planted stems alone.

2.3 Wetland Hydrology

Thirteen RDS Ecotone WM groundwater monitoring gauges were installed within Site wetland restoration areas to monitor groundwater hydrology (Figure 2A, Appendix A). Hydrological sampling will continue for five years with gauges recording daily and downloaded at a minimum of quarterly throughout the growing season (April 14-October 21). In addition, an on-site rain gauge will document rainfall data for comparison of groundwater conditions with extended drought conditions. Finally, groundwater gauges located within riverine wetlands adjacent to restored stream reaches will supplement crest gauge measurements to confirm overbank flooding events.

Twelve of the thirteen groundwater gauges met or exceeded wetland success criteria for the Year 2 (2015) monitoring year. Although it is too early in the monitoring period to determine the extent of wetland that is currently meeting wetland hydrology success criteria, Year 2 (2015) data indicates that the majority of the Site wetland area is successful.

3.0 REFERENCES

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APPENDIX A

PROJECT BACKGROUND DATA AND MAPS

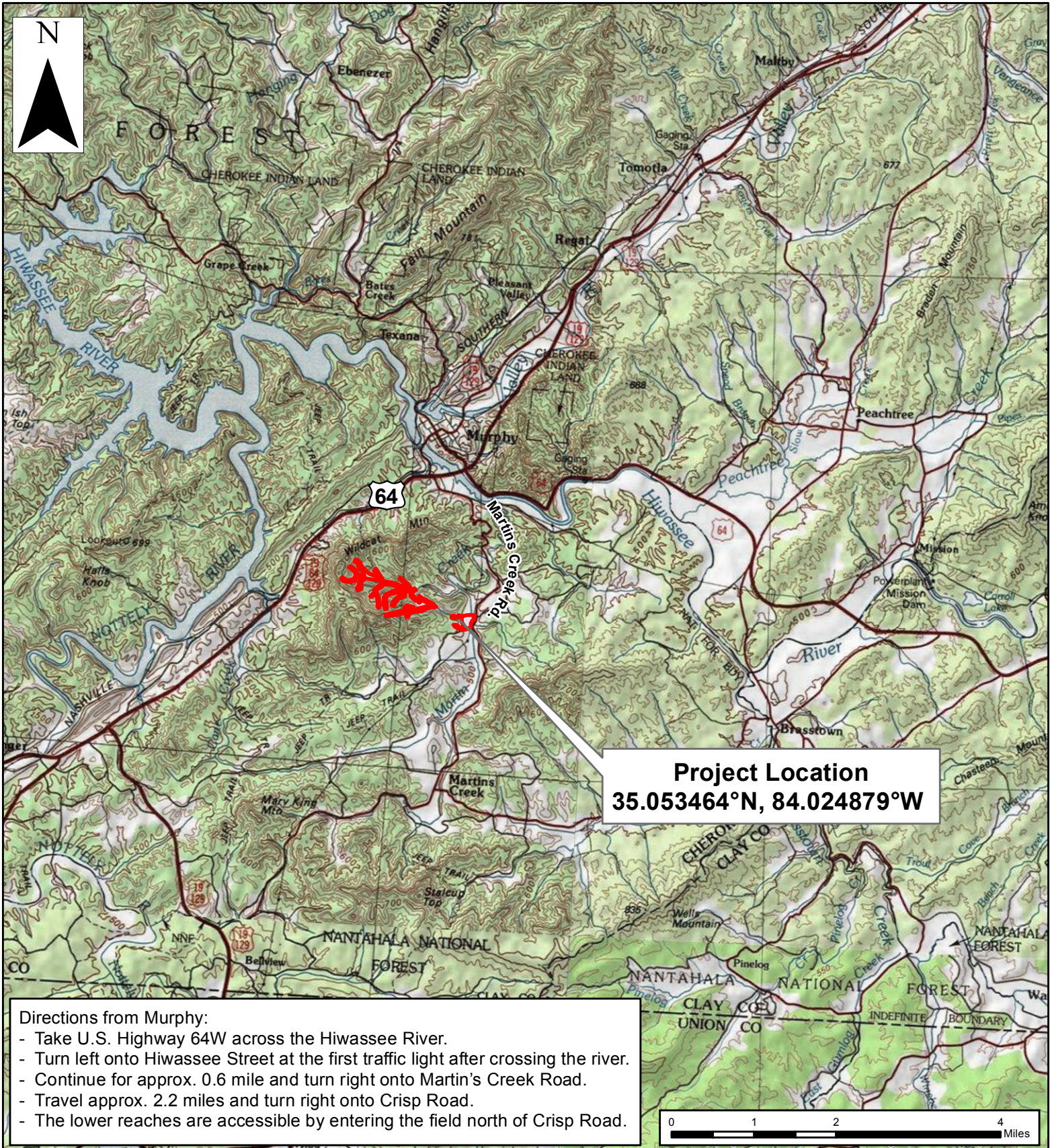
Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

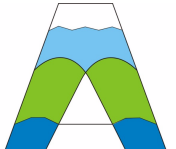
Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Directions from Murphy:

- Take U.S. Highway 64W across the Hiwassee River.
- Turn left onto Hiwassee Street at the first traffic light after crossing the river.
- Continue for approx. 0.6 mile and turn right onto Martin's Creek Road.
- Travel approx. 2.2 miles and turn right onto Crisp Road.
- The lower reaches are accessible by entering the field north of Crisp Road.

Prepared by:	Prepared for:
 <p>Axiom Environmental, Inc.</p>	<p>North Carolina Department of Environmental Quality</p>
	<p>Division of Mitigation Services</p>

**VICINITY MAP
MARTINS CREEK II
DMS PROJECT NUMBER 92633
Cherokee County, North Carolina**

Dwn. by: KRJ	FIGURE 1
Date: Nov 2015	
Project: 12.004.16	

**Table 1. Project Components and Mitigation Credits
Martin's Creek II Mitigation Site**

Mitigation Credit Summations							
Stream		Riparian Wetland			Nonriparian Wetland		
8817		5.97			---		
Projects Components							
Station Range	Existing Linear Footage/Acreage	Priority Approach	Restoration/Restoration Equivalent	Restoration Linear Footage/Acreage	Mitigation Ratio	Mitigation Credits	Comment
Right Prong Martin's Creek and UTs	17,234	---	Preservation	17,234-203= 17,031	5:1	3406.2	Three short reaches in upstream portion of RP UT1 do not have adequate buffer to claim credit and therefore have been removed from the total linear footage and calculated mitigation credits.
Right Prong Martin 's Creek and UTs	971	---	Enhance II	971	2.5:1	388.4	Enhancement Level II - invasive species controls and localized erosion stabilization.
Martin's Creek UTs	4296	---	Preservation	4296	5:1	859.2	
Martin's Creek*	857	---	Enhance II	857	5:1*	171.4	Enhancement Level II - invasive species controls and localized erosion stabilization.
UT-2 to Martin's Creek	75	---	Enhance II	75	2.5:1	30.0	
UT 1 (Reach 3) to Martin's Creek Station 00+00 to 03+37	337	---	Enhance I	337	1.5:1	224.7	Level I stream enhancement - grade control structures, repair bank erosion, and restore proper dimension.
UT 1-3 (Reach 1) to Martin's Creek Station 00+00 to 04+95	495	---	Enhance I	495	1.5:1	330.0	Level I stream enhancement - grade control structures, repair bank erosion, and restore proper dimension.
UT 1 (Reach 2) to Martin's Creek Station 00+00 to 10+52	1052	I	Restoration	1052	1:1	1052	Construction of a new channel on the existing floodplain.
UT 1 (Reach 4) to Martin's Creek	05+46 to 05+91	II	Restoration	51	1:1	51.0	Construction of a new channel in a low slope valley.
	05+91 to 06+35**			37	2:1**	18.5	
	06+35 to 15+75			941	1:1	941.0	
	15+75 to 16+75**			100	2:1**	50.0	
UT 1-3 (Reach 2) to Martin's Creek	05+54 to 05+90	II	Restoration	35	1:1	35.0	Construction of a new channel in a low slope valley.
	05+90 to 06+10***			20	2:1***	10.0	
	06+10 to 18+59			1250	1:1	1250.0	
Wetland Restoration	---	---	Restoration	5.14	1:1	5.14	Restoration of riparian wetlands through stream restoration activities, filling abandoned channels and drain tiles, removing spoil castings, and planting.
				0.06	2:1^	0.03	
Wetland Enhancement	1.61	---	Enhancement	1.604	2:1	0.802	Enhancement of existing riparian wetlands by fencing livestock and planting.
				0.006	4:1+	0.002	
Component Summation							
Restoration Level	Stream (linear footage)	Riparian Wetland (acreage)		Nonriparian Wetland (acreage)			
Restoration	3486	5.20		--			
Enhancement (Level I)	832	--		--			
Enhancement (Level II)	1903	1.61		--			
Preservation	21,327	--		--			
Totals	27,548	6.81		--			
Mitigation Units	8817 SMUs	5.97 Riparian WMUs		0.00 Nonriparian WMUs			

* Martin's Creek proper is located beneath a power line; therefore, a credit ratio of 5:1 has been used to calculate mitigation units.

** UT1 (Reach 4) stations 05+91 to 06+35 and 15+75 to 16+75 are located beneath a power line; therefore, a credit ratio of 2:1 has been used to calculate mitigation units.

*** UT1-3 (Reach 2) station 05+90 to 06+10 is located beneath a power line; therefore, a credit ratio of 2:1 has been used to calculate mitigation units.

^0.06 acres of wetland restoration is located beneath a power line; therefore, a credit ratio of 2:1 has been used to calculate mitigation units.

+0.006 acres of wetland enhancement is located beneath a power line; therefore, a credit ratio of 4:1 has been used to calculate mitigation units.

**Table 2. Project Activity and Reporting History
Martin's Creek II Mitigation Site**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan	January 2010-July 2010	September 2010
Final Design – Construction Plans	September 2010-March 2011	March 2011
Construction	--	October 2012-July 2013
Temporary S&E Mix applied to Entire Project Site	--	October 2012-July 2013
Permanent Seed Mix applied to the Entire Project Site	--	October 2012-July 2013
Bare Root; Containerized; and B&B Plantings for the Entire Project Site	--	March 2014
Mitigation Plan/ As-Built (Year 0 Monitoring Baseline)	April 2014	April 2014
Year 1 Monitoring	October 2014	December 2014
Warranty Supplemental Planting	--	March 2015
Year 2 Monitoring	November 2015	December 2015
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3. Project Contacts Table
Martin's Creek II Mitigation Site**

Designer	Michael Baker Engineering, Inc. 797 Haywood Road, Suite 201 Asheville, NC 28806 Micky Clemmons 828-350-1408
Construction Plans and Sediment and Erosion Control Plans	Michael Baker Engineering, Inc. 797 Haywood Road, Suite 201 Asheville, NC 28806 Micky Clemmons 828-350-1408
Construction Contractor	River Works, Inc. 6105 Chapel Hill Rd. Raleigh, NC 27607 919-582-3574
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932 (252) 482-8491
As-built Surveyor	Turner Land Surveying, PLLC 3201 Glenridge Drive Raleigh, NC 27604 919-875-1378
Baseline Data Collection	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

**Table 4. Project Attribute Table
Martin's Creek II Mitigation Site**

Project County	Cherokee County, North Carolina							
Physiographic Region	Blue Ridge							
Ecoregion	Broad Basins							
Project River Basin	Hiwassee							
USGS HUC for Project (14 digit)	06020002170010							
NCDWQ Sub-basin for Project	04-05-02							
Planning Area	Yes – Peachtree-Martins Creek LWP							
WRC Class (Warm, Cool, Cold)	Cold							
% of project easement fenced or demarcated	100							
Beaver activity observed during design phase?	No							
	Right Prong Martin's Creek		Martin's Creek					
	RP UT1	RP Mainstem	MC UT1		MC UT1-3		MC UT2	MC Mainstem
			LII Enh	PI Rest	LI Enh	PI Rest		
Drainage Area	.17	0.6	0.02 – 0.18		0.07 – 0.08		0.39	6.81
Stream Order (USGS topo)	1st	3rd	2nd		1st		1st	3rd
Restored Length (feet)								
Perennial or Intermittent	I/P	I/P	P	P	P	P	P	P
Watershed Type	Rural							
Watershed impervious cover	<10%							
NCDWQ AU/Index number	1-49 (Martin's Creek), 1-49-3 (Right Prong Martins Creek)							
NCDWQ Classification	C		C		C		C	C
303d listed?	No							
Upstream of a 303d listed	No							
Reasons for 303d listed segment	NA							
Total acreage of easement	93.87							
Total existing vegetated acreage of easement	-							
Total planted restoration acreage	17 acres							
Rosgen Classification of preexisting	B	B	Eb/Fb/B /G	Cb/G	Eb/B	C/F	B	C
Rosgen Classification of As-built	B	B	B/C	B/C	B	C	B	C
Valley type	II		II		VIII		VIII	VIII
Valley slope	N/A		0.015 - 0.05		0.007 – 0.04		N/A	N/A
Cowardin classification of proposed	N/A		N/A		N/A		N/A	N/A
Trout waters designation	No							
Species of concern, endangered etc.	No							
Dominant Soil Series	Cullowhee fine sandy loam		Thurmont-Dillard Complex Arkaqua loam		Dillard loam Arkaqua loam		Arkaqua loam	Arkaqua loam

APPENDIX B

VISUAL ASSESSMENT DATA

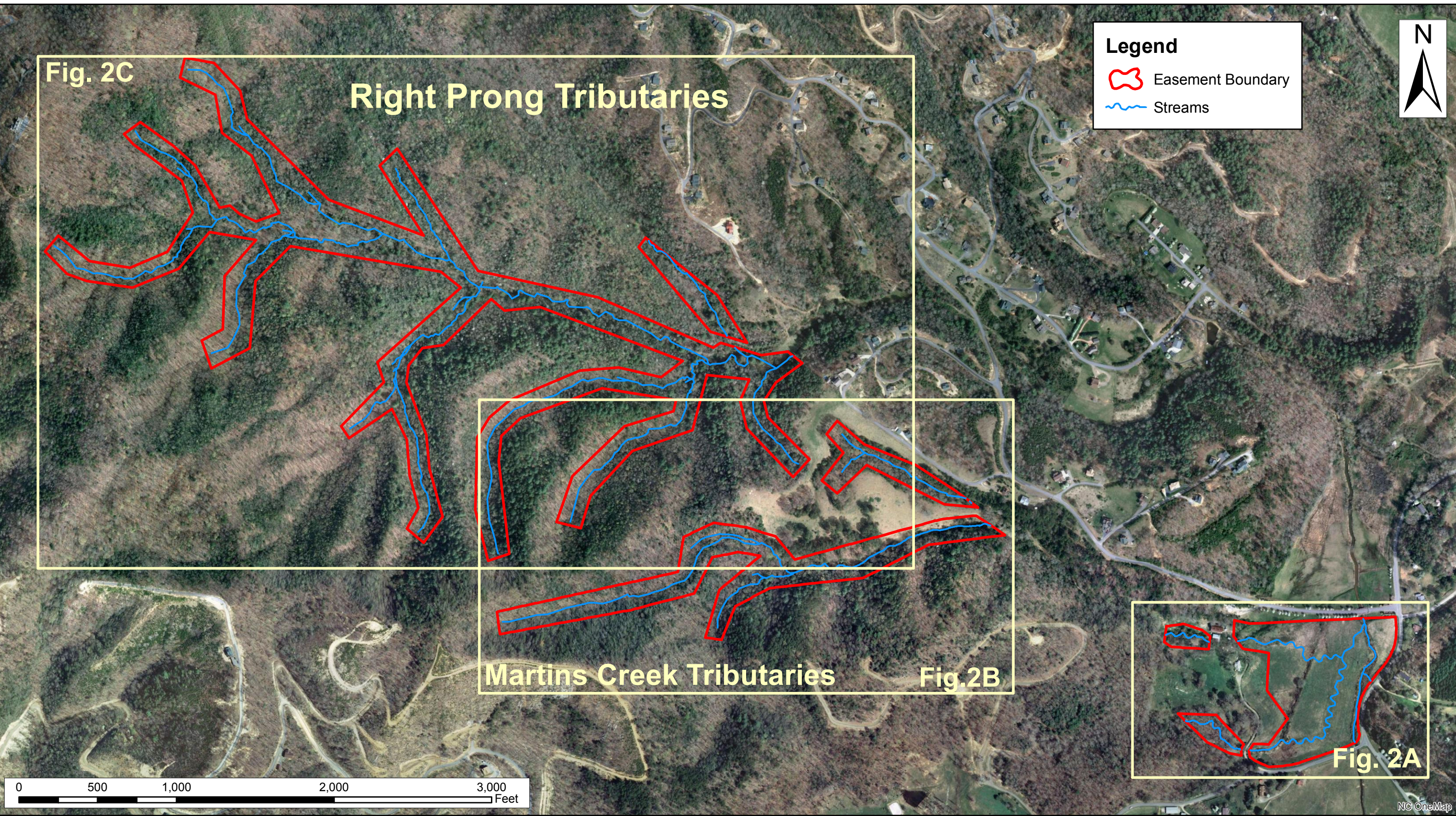
Figures 2 and 2A-2C. Current Conditions Plan View (CCPV)

Tables 5A-5E. Visual Stream Morphology Stability Assessment

Table 6. Vegetation Condition Assessment

Stream Station Photographs

Vegetation Plot Photographs



Legend



-  Easement Boundary
-  Streams



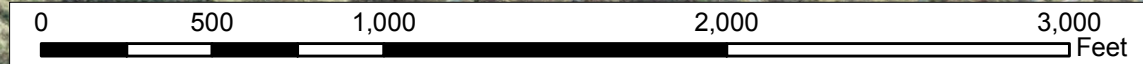
Fig. 2C

Right Prong Tributaries

Martins Creek Tributaries

Fig.2B

Fig. 2A



NC OneMap



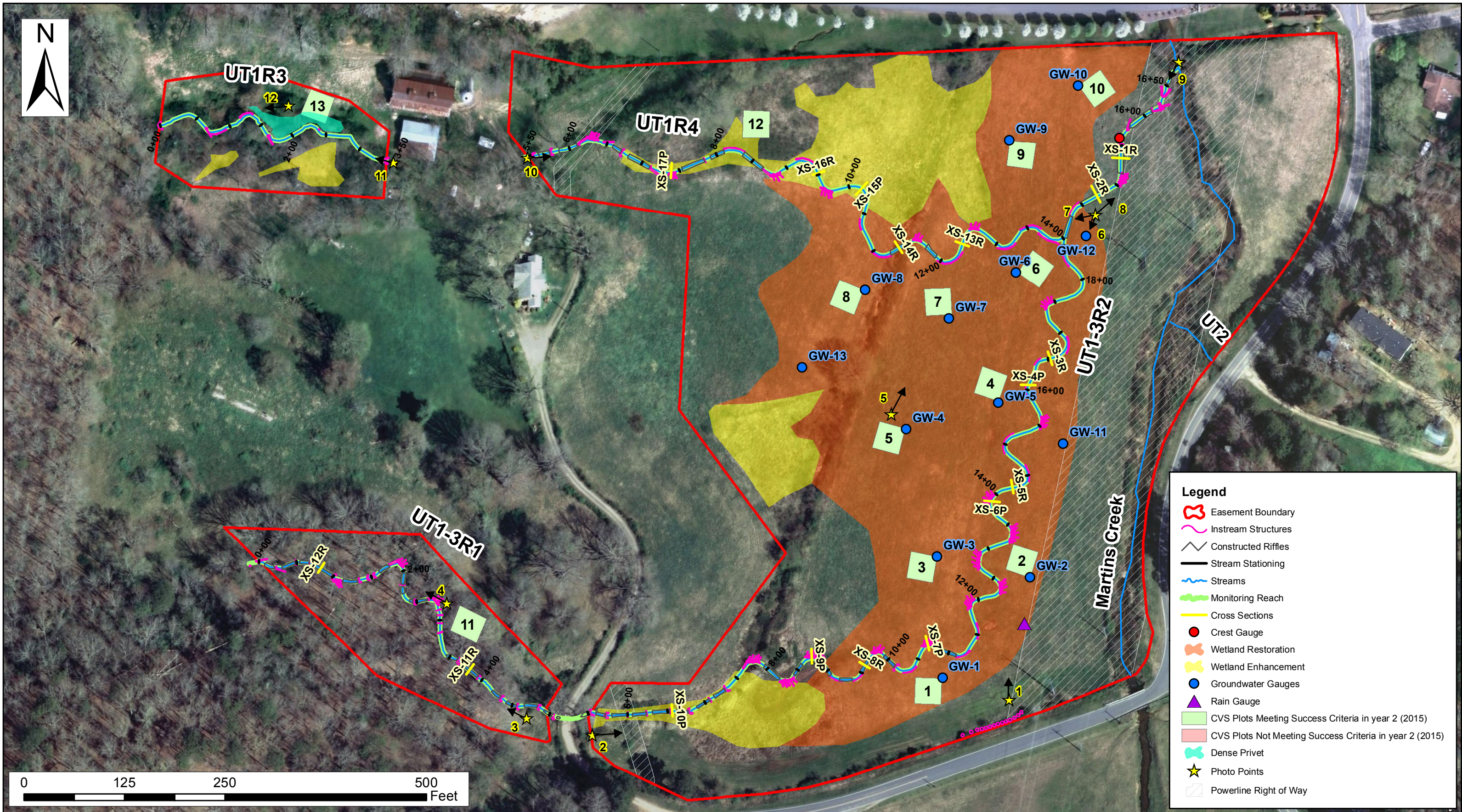
Axiom Environmental
 218 Snow Avenue
 Raleigh, NC 27603
 (919) 215-1693

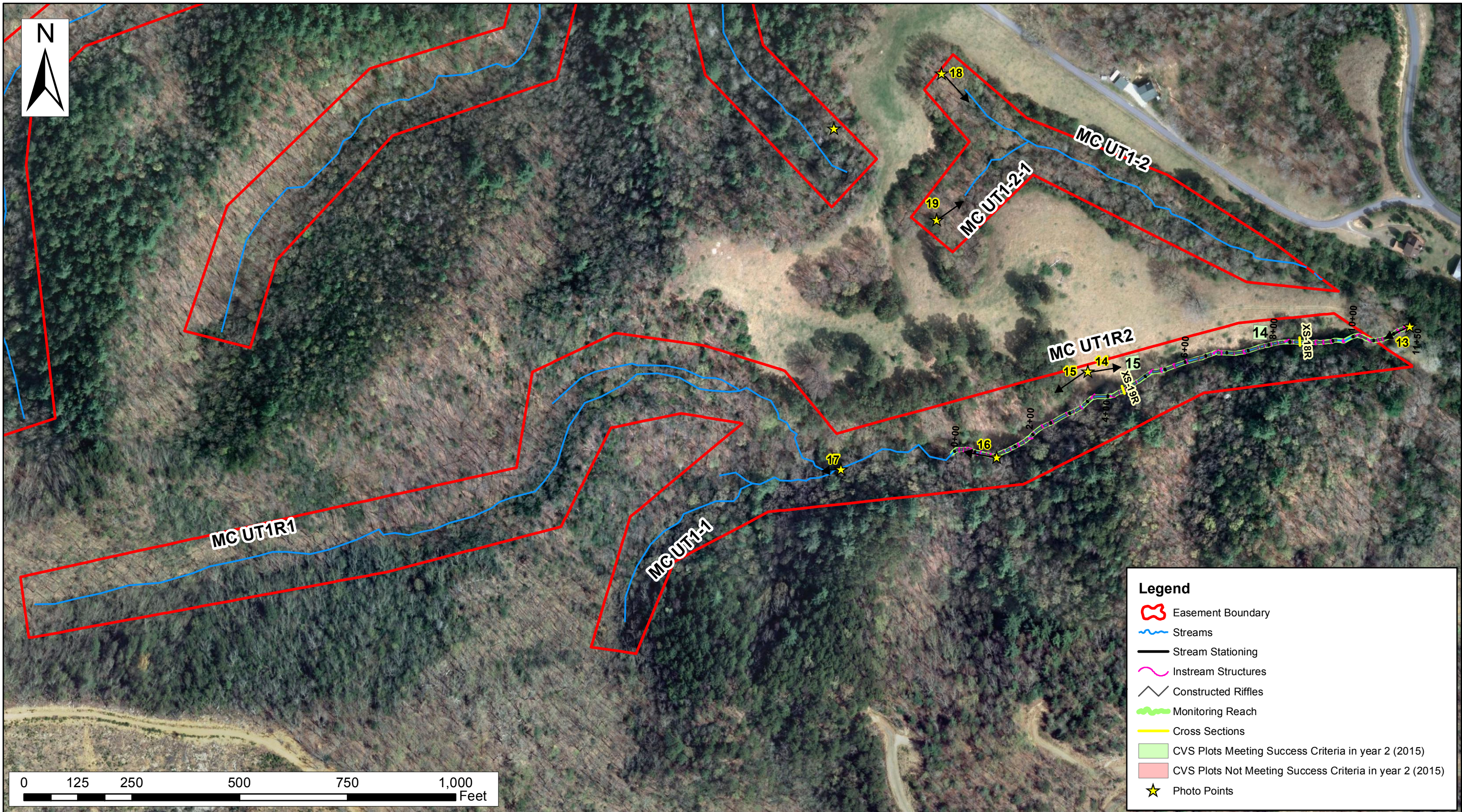
Axiom Environmental, Inc.

**CURRENT CONDITIONS PLAN VIEW
 MARTINS CREEK II
 DMS PROJECT # 92633
 Cherokee County, North Carolina**

Dwn. by:	KRJ
Date:	Nov 2015
Project:	12-004.16

FIGURE
2





CURRENT CONDITIONS PLAN VIEW
MARTINS CREEK II (MARTINS CREEK TRIBUTARIES)
DMS PROJECT # 92633
 Cherokee County, North Carolina

Dwn. by:	KRJ
Date:	Nov 2015
Project:	12-004.16

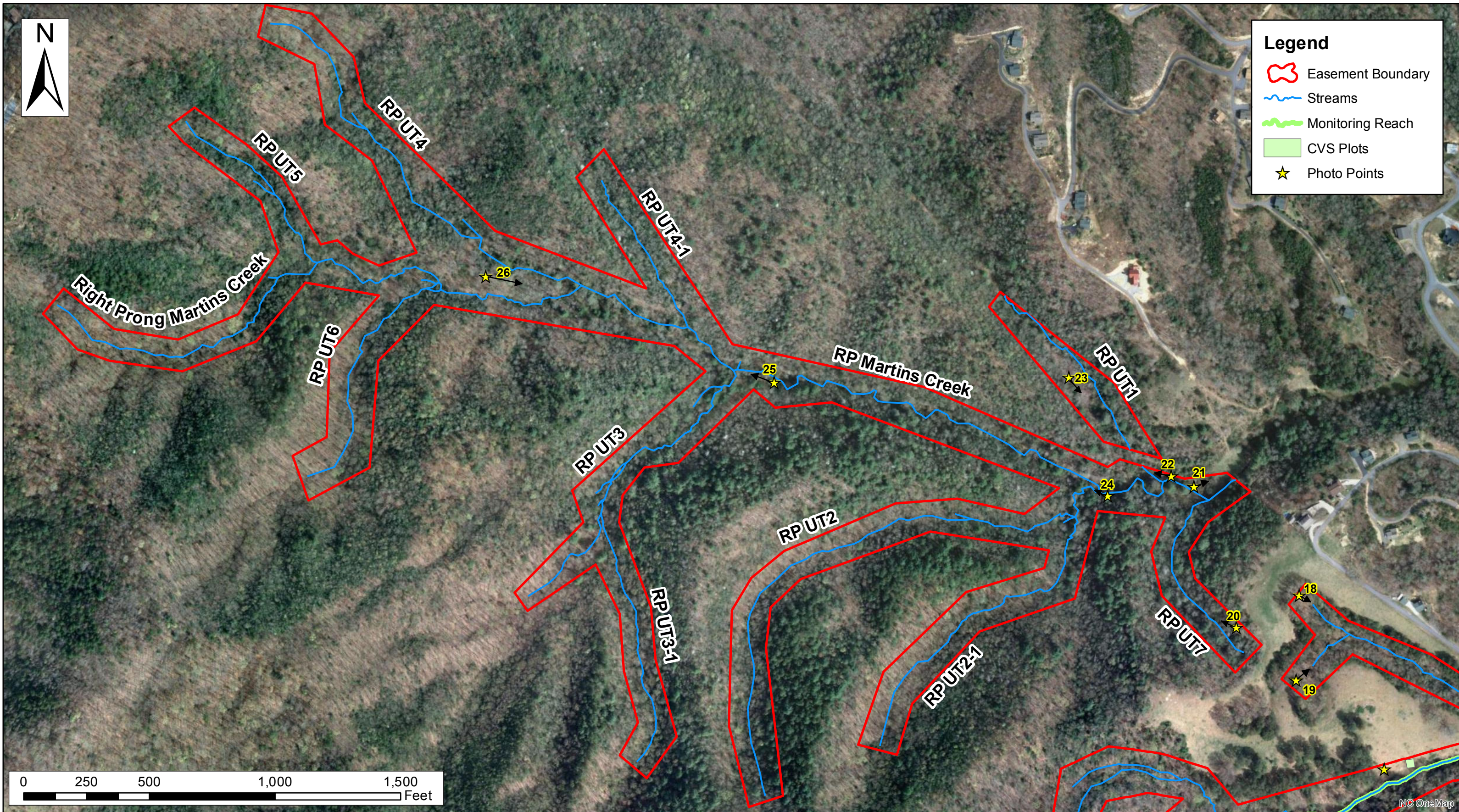


Table 5A
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 UT1 Reach 4
 1129

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	23	23			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	25	25			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	25	25			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		2. Thalweg centering at downstream of meander (Glide)	25	25			100%			
	Totals									
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

Table 5B
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 UT1 Reach 3
 337

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	10	10		100%				
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	10	10		100%				
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	10	10		100%				
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	10	10		100%				
2. Thalweg centering at downstream of meander (Glide)		10	10	100%						
Totals										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	4	4			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	4	4			100%			

Table 5C
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 UT1-3 Reach 2
 1305

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	32	32			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	32	32			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	32	32			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	32	32			100%			
2. Thalweg centering at downstream of meander (Glide)		32	32			100%				
Totals										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	10	10			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	10	10			100%			

Table 5D
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 UT1-3 Reach 1
 495

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	16	16			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	22	22			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	22	22			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%			
2. Thalweg centering at downstream of meander (Glide)		22	22			100%				
Totals										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	21	21			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	21			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	21			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	21	21			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	21	21			100%			

Table 5E
 Reach ID
 Assessed Length

Visual Stream Morphology Stability Assessment
 UT1 Reach 2
 1051

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	55	55			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	55	55			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	55	55			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	55	55			100%			
2. Thalweg centering at downstream of meander (Glide)		55	55			100%				
Totals										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	57	57			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	57	57			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	57	57			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	57	57			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	57	57			100%			

Table 6

Vegetation Condition Assessment

Martins Creek II Mitigation Project

Planted Acreage¹

17

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	None	0.1 acres	none	0	0.00	0.0%
2. Low Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%
2B. Low Planted Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%
Total				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	None	0.25 acres	N/A	0	0.00	0.0%
Cumulative Total				0	0.00	0.0%

Easement Acreage²

93.87

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern ⁴	Dense Chinese privet adjacent to UT1R3.	1000 SF	Blue Polygon	1	0.04	0.0%
5. Easement Encroachment Areas ³	None	none	none	0	0.00	0.0%

¹ = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

² = The acreage within the easement boundaries.

³ = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

⁴ = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likely trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly early in a projects monitoring history. However, areas of discrete, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolizing invasives polygons, particularly for situations where the condition for an area is somewhere between isolated specimens and dense, discrete patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

**Martin's Creek II
Year 2 Fixed Station Photographs
Taken July 2015**

Photo Point 1



Photo Point 2



Photo Point 3



Photo Point 4



Photo Point 5

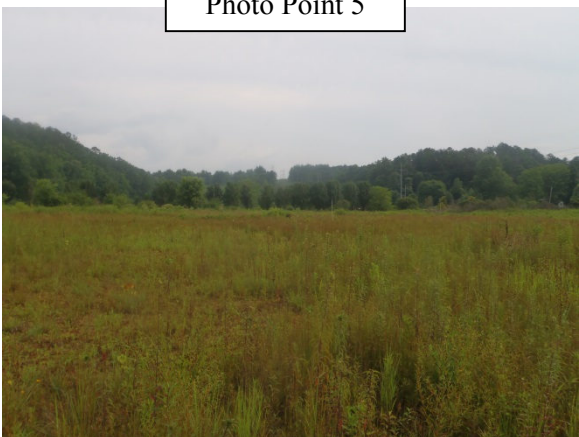
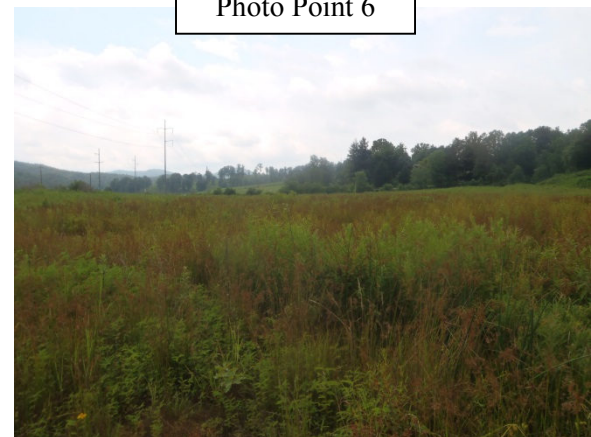


Photo Point 6



Martin's Creek II
Year 2 Fixed Station Photographs (continued)
Taken July 2015

Photo Point 7



Photo Point 8



Photo Point 9



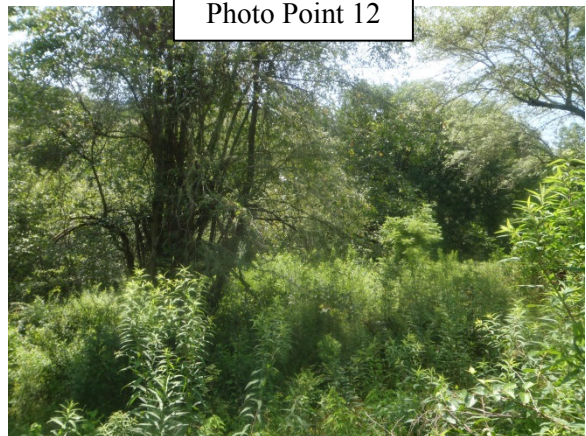
Photo Point 10



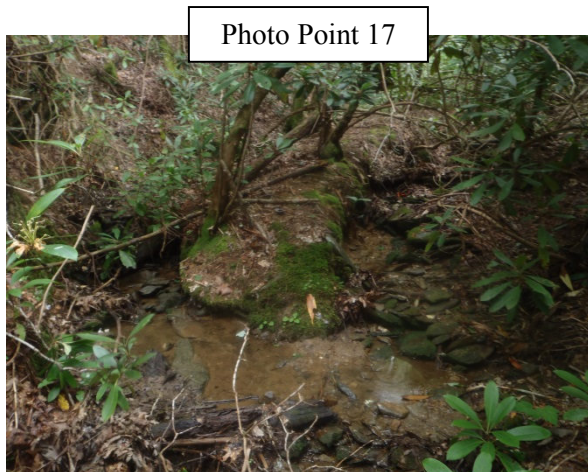
Photo Point 11



Photo Point 12



Martin's Creek II
Year 2 Fixed Station Photographs (continued)
Taken July 2015



Martin's Creek II
Year 2 Fixed Station Photographs (continued)
Taken July 2015

Photo Point 19



Photo Point 20



Photo Point 21



Photo Point 22



Photo Point 23



Photo Point 24

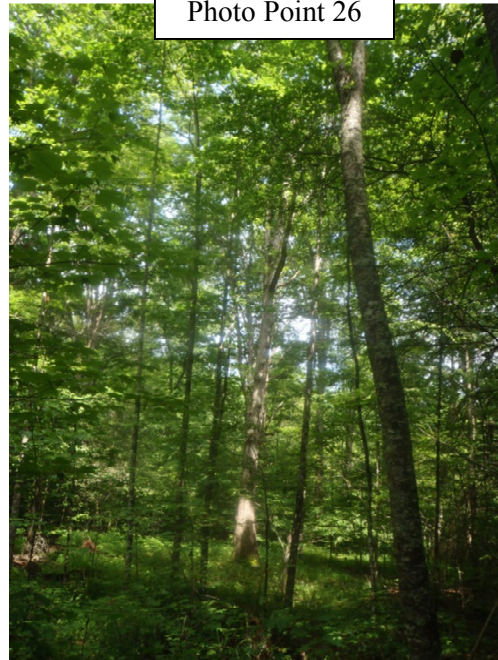


Martin's Creek II
Year 2 Fixed Station Photographs (continued)
Taken July 2015

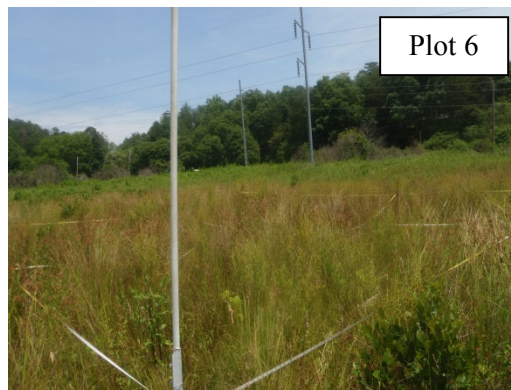
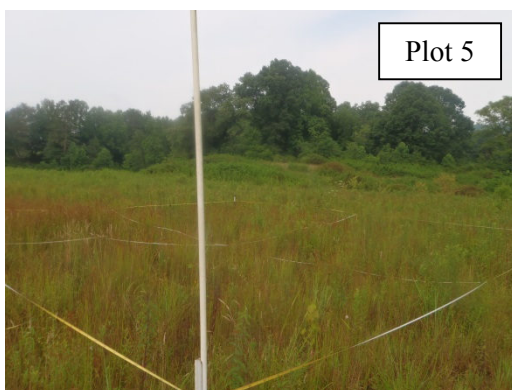
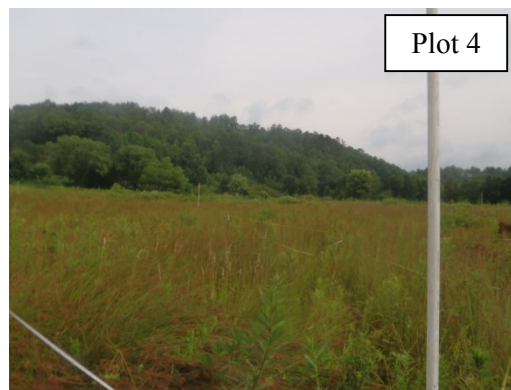
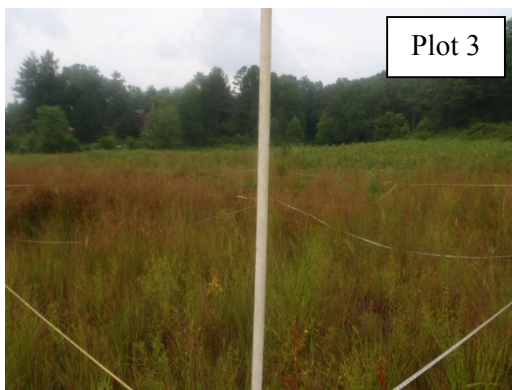
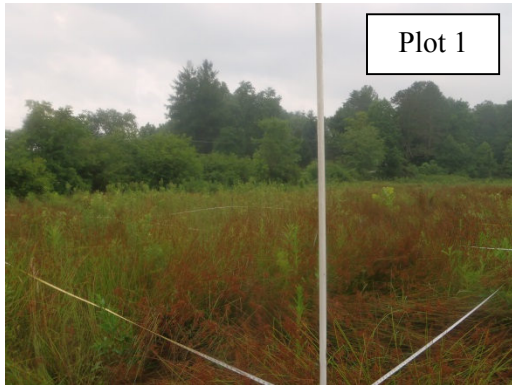
Photo Point 25



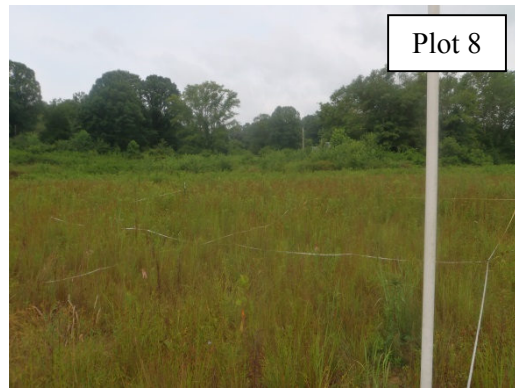
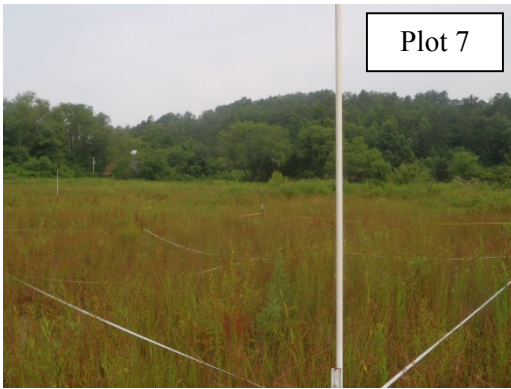
Photo Point 26



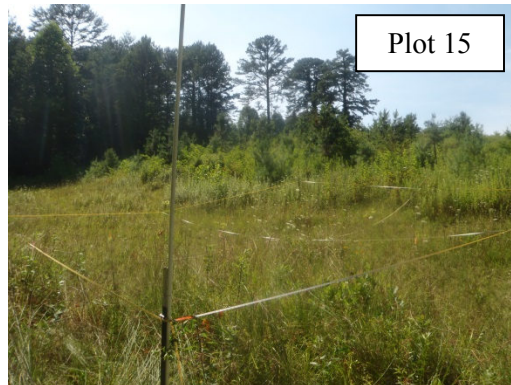
Martin's Creek II
Year 2 Vegetation Monitoring Photographs
Taken July 12-13, 2015



Martin's Creek II
Year 2 Vegetation Monitoring Photographs
Taken July 12-13, 2015
(continued)



Martin's Creek II
Year 2 Vegetation Monitoring Photographs
Taken July 12-13, 2015
(continued)



APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

**Table 7. Vegetation Plot Criteria Attainment Based on Planted Stems
Martin's Creek II Mitigation Site (DMS Project Number 92633)**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	
9	Yes	
10	Yes	
11	Yes	
12	Yes	
13	Yes	
14	Yes	
15	Yes	

**Table 8. CVS Vegetation Plot Metadata
Martin's Creek II Mitigation Site (DMS Project Number 92633)**

Report Prepared By	Corri Faquin
Date Prepared	7/29/2015 12:41
database name	Axiom-EEP-2015-A-v2.3.1.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	50962432
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	92633
project Name	Martin's Creek II
Description	Stream and Wetland Restoration
River Basin	Hiwassee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	15

Table 9. Total and Planted Stems by Plot and Species (continued)

DMS Project Code 92633. Project Name: Martin's Creek II

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2015)									Annual Means								
			92633-01-0013			92633-01-0014			92633-01-0015			MY2 (2015)			MY1 (2014)			MY0 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree												18			4			1
Alnus serrulata	hazel alder	Shrub						40			17			71			25			
Betula nigra	river birch	Tree	2	2	2	1	1	1				19	19	19	9	9	9	9	9	9
Carpinus caroliniana	American hornbeam	Tree												7			1			
Carya	hickory	Tree									1	1	1	1	1	1	2	2	2	2
Carya alba	mockernut hickory	Tree													3	3	3	3	3	3
Carya glabra	pignut hickory	Tree										2	2	2	3	3	3			
Diospyros virginiana	common persimmon	Tree										3	3	3						
Fagus grandifolia	American beech	Tree															5			5
Fraxinus pennsylvanica	green ash	Tree															1			
Juglans nigra	black walnut	Tree			4									4						2
Liriodendron tulipifera	tuliptree	Tree							1	1	2	20	20	23	20	20	20	24	24	24
Malus	apple	Tree						1						1						
Nyssa	tupelo	Tree										9	9	9	4	4	4			
Pinus strobus	eastern white pine	Tree						1			2			3						
Platanus occidentalis	American sycamore	Tree	2	2	2	4	4	4				39	39	40	27	27	27	27	27	27
Quercus	oak	Tree										6	6	6	8	8	8	40	40	40
Quercus alba	white oak	Tree															1			
Quercus coccinea	scarlet oak	Tree				3	3	3				7	7	7	7	7	7	3	3	3
Quercus michauxii	swamp chestnut oak	Tree	1	1	1							1	1	1	1	1	1	4	4	4
Quercus nigra	water oak	Tree										10	10	10	14	14	14	17	17	17
Quercus pagoda	cherrybark oak	Tree							1	1	1	2	2	2	2	2	2	1	1	1
Quercus rubra	northern red oak	Tree	5	5	5	3	3	3	10	10	10	50	50	50	25	25	25	2	2	2
Quercus shumardii	Shumard's oak	Tree	1	1	1							1	1	1						
Salix nigra	black willow	Tree												3						
Unknown		Shrub or Tree																2	2	2
Stem count			11	11	15	11	11	53	13	13	33	170	170	281	124	124	162	134	134	142
size (ares)			1			1			1			15			15			15		
size (ACRES)			0.02			0.02			0.02			0.37			0.37			0.37		
Species count			5	5	6	4	4	7	4	4	6	14	14	21	13	13	19	12	12	15
Stems per ACRE			445.2	445.2	607	445.2	445.2	2145	526.1	526.1	1335	458.6	458.6	758.1	334.5	334.5	437.1	361.5	361.5	383.1

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes

P-all = Planting including livestakes

T = All planted and natural recruits including livestakes

T includes natural recruits

APPENDIX D
STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-f. Baseline Stream Data Summary

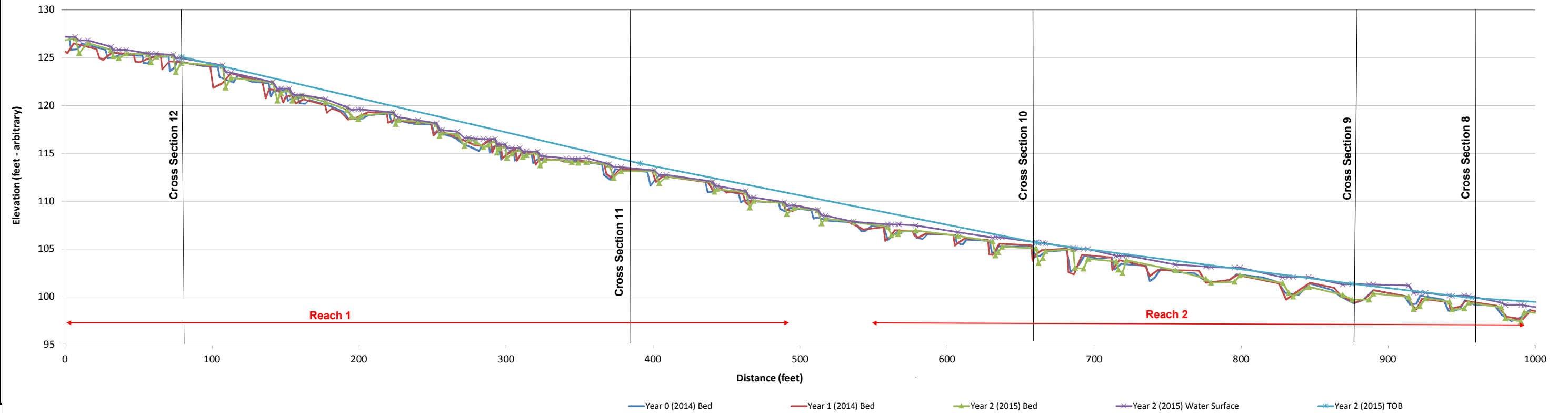
Tables 11a-f. Monitoring Data

Project Name Martins Creek II
Reach UT 1 - 3 Reach 1 and 2, Station 00+00 - 10+00
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
996.5	98.7	99.1	1016.0	98.2	98.3	1016.9	98.2	98.5						
990.2	97.9	99.1	996.9	98.6	99.0	992.6	98.4	99.1						
983.6	97.5	99.1	991.3	97.7	99.0	990.2	97.4	99.2						
977.2	98.1	99.1	980.6	97.9	99.0	979.8	97.7	99.2						
972.7	99.1	99.4	973.8	99.1	99.4	976.9	98.9	99.4						
958.7	99.2	99.7	952.9	99.6	100.0	954.7	99.4	100.1						
952.1	99.6	100.0	949.0	99.0	100.0	951.8	98.8	100.1						
948.5	98.7	100.0	942.2	98.7	100.0	943.5	98.7	100.1						
944.4	98.6	100.0	941.0	99.5	100.0	941.6	99.5	100.1						
941.0	98.6	100.0	922.8	99.8	100.4	925.3	99.9	100.4						
937.6	99.7	100.0	919.3	98.7	100.3	921.4	99.0	100.5						
921.8	100.2	100.4	917.1	98.9	100.3	917.1	98.7	100.4						
919.2	99.3	100.4	913.2	100.0	100.3	914.0	100.0	101.2						
914.8	99.2	100.3	890.4	100.7	101.1	889.8	100.4	101.3						
911.0	100.1	100.5	884.2	99.8	101.1	886.8	99.7	101.3						
889.7	100.7	101.1	877.4	99.4	101.2	875.5	99.7	101.3						
882.6	99.7	101.2	867.7	100.2	101.1	869.0	100.2	101.3						
876.7	99.3	101.2	863.0	101.0	101.2	845.9	101.1	102.1						
867.3	100.1	101.2	846.9	101.5	101.9	835.2	100.0	102.1						
861.5	100.7	101.3	839.9	100.8	101.9	832.5	100.4	102.1						
846.0	101.4	101.8	830.6	99.7	102.0	828.3	101.4	102.1						
839.0	100.2	101.8	825.8	101.4	102.0	799.1	102.3	103.1						
829.8	100.4	101.8	797.2	102.3	102.8	795.5	101.6	103.1						
824.9	101.5	101.9	791.6	101.8	102.9	779.4	101.5	103.1						
814.6	102.0	102.4	776.1	101.5	102.9	775.9	101.9	103.2						
796.9	102.4	102.9	771.2	102.7	103.0	755.2	102.8	103.4						
792.1	101.8	102.9	743.5	102.8	103.5	722.0	103.8	104.3						

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0161	0.0162	0.0174		
Riffle Length	20	20	22		
Avg. Riffle Slope	0.0185	0.0209	0.0163		
Pool Length	14	16	13		
Pool to Pool Spacing	34	34	35		

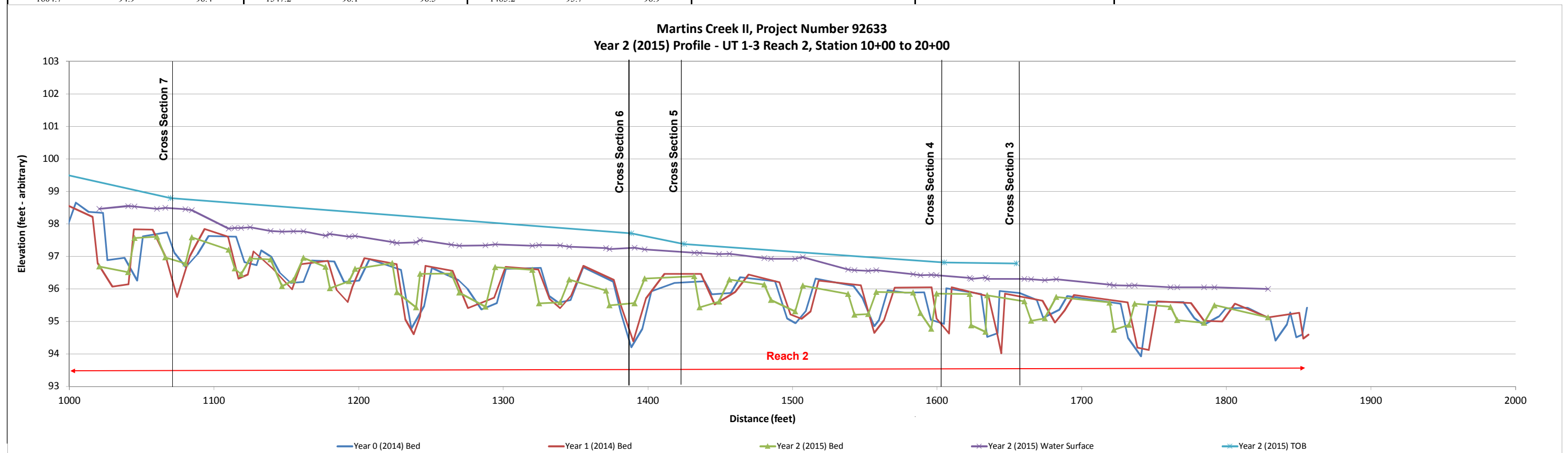
Martins Creek II, Project Number 92633
Year 2 (2015) Profile - UT 1-3 Reach 1 and 2, Station 00+00 to 10+00



Project Name Martins Creek II
Reach UT 1 - 3 Reach 2, Station 10+00 - 20+00
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
1855.8	95.4	95.9	1856.9	94.6	95.7	1829.0	95.1	96.0						
1852.5	94.6	95.8	1853.2	94.5	95.7	1791.8	95.5	96.0						
1848.3	94.5	95.9	1850.5	95.3	95.8	1784.6	95.0	96.0						
1844.3	95.3	95.9	1828.7	95.1	95.7	1766.2	95.0	96.1						
1841.9	94.9	95.9	1806.0	95.5	95.8	1761.4	95.4	96.1						
1834.0	94.4	95.8	1797.1	95.0	95.8	1736.6	95.5	96.1						
1830.6	95.1	95.9	1784.6	95.0	95.8	1732.7	94.9	96.1						
1814.5	95.4	96.0	1775.5	95.6	95.8	1722.3	94.7	96.1						
1799.6	95.4	95.9	1752.2	95.6	95.9	1719.2	95.6	96.1						
1794.8	95.2	96.0	1746.3	94.1	95.9	1682.4	95.8	96.3						
1784.4	94.9	96.0	1738.4	94.2	95.9	1674.4	95.1	96.3						
1777.9	95.1	96.0	1731.8	95.6	95.9	1665.0	95.0	96.3						
1770.2	95.6	96.0	1694.6	95.8	96.1	1660.4	95.6	96.3						
1746.1	95.6	96.0	1688.2	95.3	96.1	1634.7	95.8	96.3						
1741.1	93.9	96.0	1681.4	95.0	96.2	1633.5	94.7	96.4						
1732.1	94.5	96.1	1673.0	95.6	96.1	1623.5	94.9	96.3						
1726.8	95.5	96.0	1646.9	95.9	96.1	1622.6	95.8	96.3						
1690.1	95.8	96.2	1644.5	94.0	96.2	1599.6	95.9	96.4						
1684.6	95.4	96.2	1641.4	94.7	96.1	1595.8	94.8	96.4						
1673.3	95.1	96.2	1635.7	95.8	96.1	1588.4	95.3	96.4						
1669.0	95.7	96.2	1610.2	96.0	96.3	1583.4	95.9	96.4						
1656.8	95.9	96.2	1608.3	94.6	96.4	1557.9	95.9	96.6						
1643.3	95.9	96.3	1599.6	95.1	96.3	1552.4	95.2	96.6						
1641.8	94.6	96.3	1596.1	96.0	96.3	1542.8	95.2	96.6						
1634.6	94.5	96.3	1570.6	96.0	96.5	1538.4	95.8	96.6						
1630.6	95.8	96.3	1563.3	95.0	96.5	1507.0	96.1	97.0						
1606.4	96.0	96.4	1556.6	94.7	96.5	1501.9	95.3	96.9						
1604.7	94.9	96.4	1547.2	96.1	96.5	1485.2	95.7	96.9						

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0161	0.0162	0.0174		
Riffle Length	20	20	22		
Avg. Riffle Slope	0.0185	0.0209	0.0163		
Pool Length	14	16	13		
Pool to Pool Spacing	34	34	35		

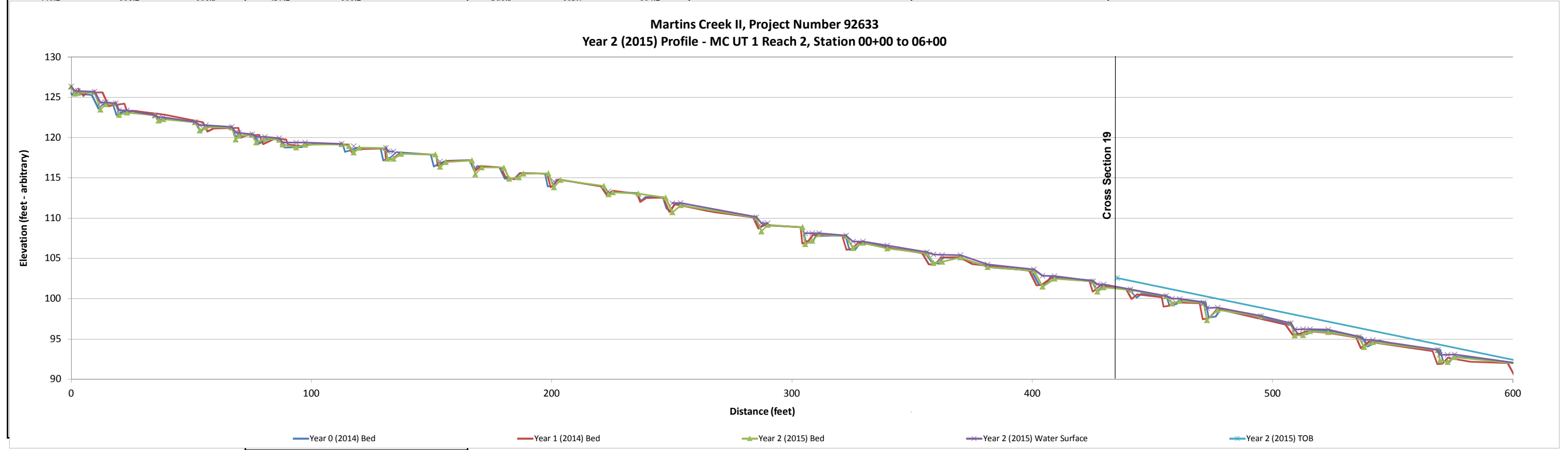


Project Name Martins Creek II
Reach MC UT 1 Reach 2, Station 00+00 - 06+00
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
603.4	90.7	91.5	603.8	91.2		600.5	92.0	92.0						
601.2	92.0	92.2	600.7	90.5		575.8	92.7	93.1						
583.1	92.7	92.9	597.8	92.0		572.8	92.1	93.1						
575.4	92.8	93.0	582.4	92.2		569.7	92.3	93.0						
573.4	92.1	93.0	572.9	92.7		568.7	93.6	93.7						
570.9	92.3	93.0	570.7	91.9		541.7	94.6	94.9						
569.9	93.7	93.8	568.5	91.9		538.1	94.0	94.9						
556.2	94.0	94.3	566.6	93.5		536.0	95.2	95.3						
544.5	94.8	95.0	540.0	94.7		523.2	95.9	96.2						
539.5	94.1	95.0	536.8	93.9		515.5	96.0	96.2						
537.3	95.2	95.3	534.7	95.2		512.6	95.5	96.2						
525.6	95.9	96.2	523.2	95.8		509.3	95.4	96.2						
517.2	96.1	96.3	514.2	96.0		507.6	97.0	96.9						
514.1	95.6	96.3	511.5	95.7	96.1	495.3	97.8	97.9						
510.6	95.6	96.3	508.4	95.5	96.1	477.2	98.6	98.9						
507.6	96.7	97.1	505.3	96.8		472.7	97.3	98.9						
495.4	97.8	98.0	493.9	97.6	97.7	471.3	99.5	99.5						
478.4	98.7	99.0	477.0	98.7		461.4	99.7	100.0						
476.3	97.8	99.0	473.3	97.6	98.8	458.2	99.4	100.0						
473.4	97.7	99.0	470.9	97.5	98.8	455.7	100.3	100.3						
472.2	99.6	99.7	469.7	99.4		440.9	101.1	101.2						
462.6	99.9	100.1	459.3	99.6		429.7	101.4	101.8						
460.0	99.4	100.1	456.5	99.1	99.6	427.0	100.9	101.8						
457.1	99.2	100.1	454.5	99.0	99.6	425.3	102.2	102.2						
455.9	100.3	100.4	453.8	100.2		409.3	102.5	102.8						
445.4	100.6	100.9	443.5	100.6		404.3	101.5	102.8						
443.4	100.1	100.9	441.4	100.0	100.7	400.6	103.5	103.6						
440.2	101.2	101.3	439.2	101.2		381.5	103.9	104.2						

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0577	NA*	0.0582		
Riffle Length	19	16	17		
Avg. Riffle Slope	0.0457	NA*	0.0447		
Pool Length	6	6	6		
Pool to Pool Spacing	25	22	24		

NA* No water in channel during field surveys

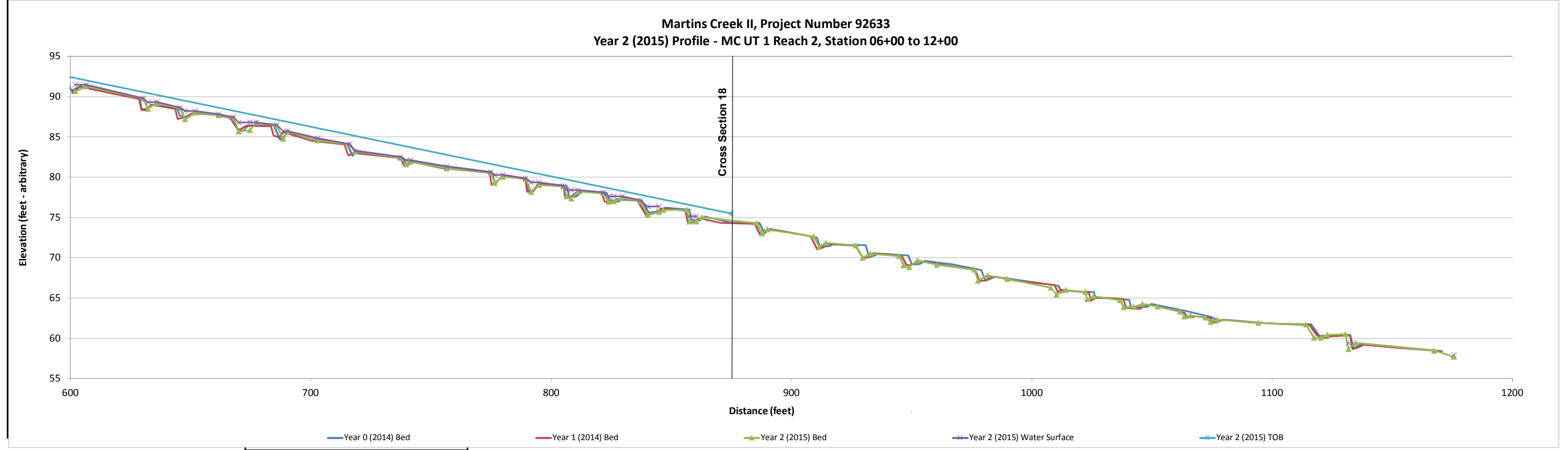


Project Name Martins Creek II
Reach MC UT 1 Reach 2, Station 06+00 - 12+00
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
1170.7	58.4	58.5	1169.9	58.4	58.4	1175.6	57.7	58.0						
1137.5	59.4	59.6	1153.8	58.8	58.9	1167.4	58.5							
1134.1	58.7	59.5	1138.0	59.2	59.3	1134.6	59.5							
1132.5	60.4	60.5	1135.4	58.8	59.3	1131.7	58.7	59.4						
1119.6	60.3	60.6	1133.5	58.7	59.3	1130.6	60.5							
1116.2	61.8	61.8	1132.4	60.4		1122.9	60.4							
1099.7	61.8	62.1	1124.3	60.2		1120.3	60.1							
1081.3	62.3	62.4	1122.3	60.0		1117.4	60.1							
1077.3	62.2	62.5	1118.7	60.3		1114.0	61.7							
1074.5	62.7	62.9	1115.6	61.7		1094.3	61.9							
1064.6	63.4	63.3	1091.2	62.0		1077.2	62.3							
1049.9	64.3	64.5	1079.4	62.3		1074.4	62.1							
1047.7	63.9	64.5	1077.1	62.0		1072.2	62.6							
1041.2	63.9	64.5	1075.5	61.9		1066.1	62.8							
1040.6	64.8	64.9	1074.1	62.6		1063.5	62.7							
1031.8	65.0	65.4	1068.2	62.8		1061.7	63.3							
1030.0	65.0	65.4	1066.6	62.6		1052.3	63.9							
1026.5	65.0	65.4	1064.6	62.6		1046.0	64.3							
1025.8	65.8	65.8	1063.6	63.2		1042.4	63.9							
1017.7	65.8	66.0	1053.6	63.9		1038.1	63.9							
1013.8	66.0	66.2	1048.0	64.2		1036.8	64.7							
1012.6	65.7	66.2	1044.7	63.7		1025.7	65.2							
1011.0	66.5	66.7	1039.2	63.8		1022.9	64.8							
984.7	67.6	67.9	1038.1	64.9		1022.3	65.8							
980.6	67.2	67.9	1027.3	65.1		1014.1	66.0							
978.9	68.5	68.7	1024.5	64.7		1010.2	65.4							
967.1	69.2	69.4	1023.8	65.7		1007.8	66.3							
955.4	69.6	69.9	1012.0	66.1		989.8	67.4							

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0577	NA*	0.0582		
Riffle Length	19	16	17		
Avg. Riffle Slope	0.0457	NA*	0.0447		
Pool Length	6	6	6		
Pool to Pool Spacing	25.0	22	24		

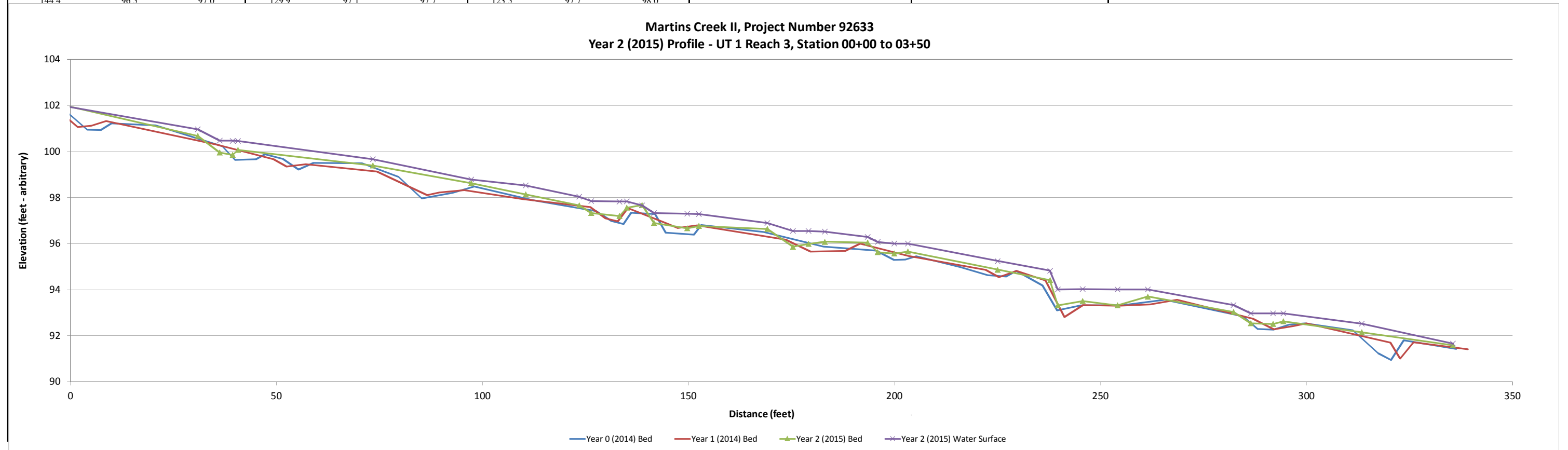
NA* No water in channel during field surveys



Project Name Martins Creek II
Reach UT 1 Reach 3, Station 00+00 - 03+50
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
336.4	91.4	91.5	339.1	91.4	91.5	335.5	91.6	91.7						
323.6	91.8	92.1	326.0	91.7	92.0	313.4	92.1	92.5						
320.5	90.9	92.1	322.7	91.0	92.0	294.4	92.6	93.0						
317.3	91.2	92.0	320.3	91.7	92.0	291.9	92.5	93.0						
311.2	92.2	92.6	299.9	92.5	92.8	286.5	92.5	93.0						
299.7	92.5	92.8	296.9	92.4	92.8	282.3	93.0	93.3						
295.8	92.5	92.9	292.0	92.3	92.8	261.5	93.7	94.0						
292.0	92.3	92.8	286.9	92.7	93.0	254.1	93.3	94.0						
288.2	92.3	92.8	268.6	93.6	93.8	245.7	93.5	94.0						
284.7	92.8	93.1	262.1	93.4	93.8	239.6	93.3	94.0						
265.6	93.6	93.8	254.3	93.3	93.8	237.7	94.4	94.8						
255.6	93.3	93.8	245.8	93.3	93.8	225.0	94.9	95.2						
245.2	93.3	93.8	241.3	92.8	93.8	203.2	95.7	96.0						
239.5	93.1	93.8	236.7	94.4	94.7	200.0	95.6	96.0						
235.9	94.2	94.9	229.6	94.8	95.0	195.9	95.6	96.1						
229.6	94.8	95.3	225.4	94.5	95.1	193.5	96.0	96.3						
227.0	94.6	95.3	222.1	94.9	95.1	183.1	96.1	96.5						
222.6	94.6	95.3	203.3	95.5	95.7	179.2	96.0	96.5						
216.1	95.0	95.3	191.6	96.0	96.2	175.3	95.9	96.5						
205.3	95.4	95.8	188.0	95.7	96.3	169.2	96.6	96.9						
202.6	95.3	95.8	179.6	95.7	96.3	152.5	96.8	97.3						
199.9	95.3	95.8	173.6	96.2	96.4	149.7	96.7	97.3						
195.5	95.7	96.0	152.1	96.8	97.1	141.6	96.9	97.3						
182.7	95.9	96.3	147.3	96.7	97.1	138.7	97.7	97.7						
168.2	96.5	96.8	144.2	96.9	97.1	135.0	97.6	97.8						
153.0	96.8	97.0	135.3	97.5	97.8	133.2	97.2	97.8						
151.3	96.4	97.0	132.9	97.0	97.8	126.4	97.3	97.8						
144.4	96.5	97.0	129.9	97.1	97.7	123.5	97.7	98.0						

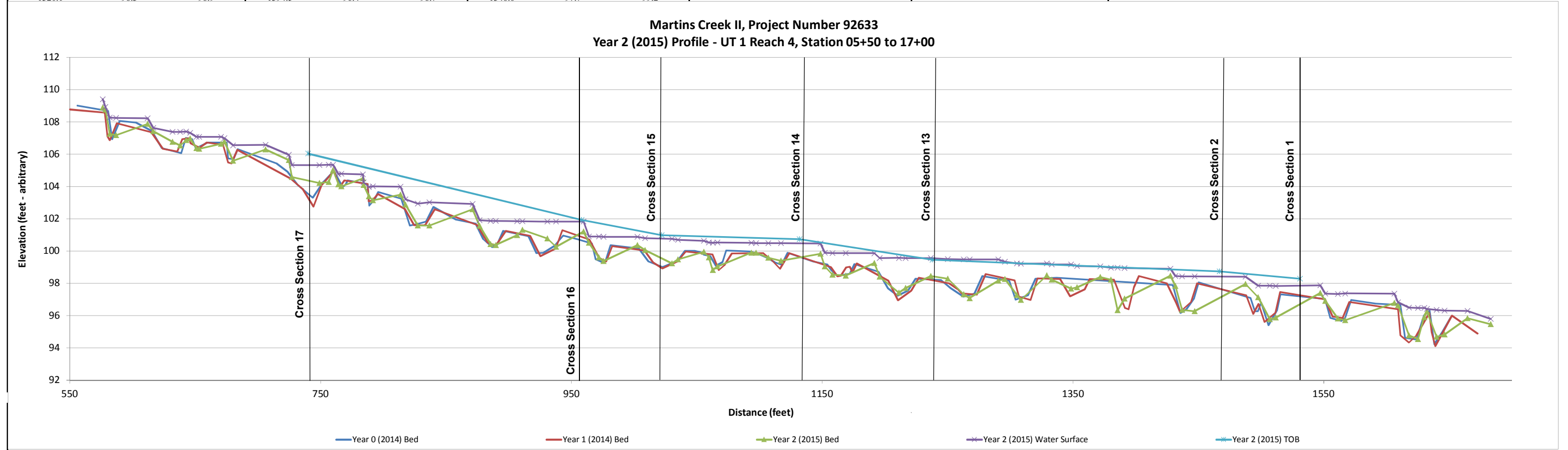
	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0305	0.0304	0.0305		
Riffle Length	17	21	21		
Avg. Riffle Slope	0.0388	0.0395	0.0310		
Pool Length	13	13	14		
Pool to Pool Spacing	31	34	44		



Project Name Martins Creek II
Reach UT 1 Reach 4, Station 05+50 - 17+00
Project Number 92633
Date 7/22/15
Crew Perkinson, Jernigan

2014 Year 0 Monitoring \Survey			2014 Year 1 Monitoring \Survey			2015 Year 2 Monitoring \Survey			2016 Year 3 Monitoring \Survey			2017 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
1651.4	95.9	96.3	1672.7	94.9	95.6	1683.1	95.5	95.8						
1644.5	95.0	96.3	1652.2	96.0	96.1	1664.7	95.8	96.3						
1638.0	94.2	96.4	1643.3	94.7	96.2	1646.4	94.8	96.3						
1634.4	96.3	96.4	1638.9	94.1	96.2	1640.1	94.7	96.3						
1630.0	96.0	96.4	1636.1	95.0	96.2	1632.3	96.2	96.4						
1624.0	94.5	96.4	1634.1	96.2	96.3	1630.1	95.9	96.5						
1614.7	94.6	96.4	1623.8	94.8	96.3	1625.2	94.5	96.5						
1611.1	96.7	96.8	1617.9	94.3	96.3	1618.0	94.8	96.5						
1591.5	96.7	97.0	1611.2	94.8	96.3	1609.3	96.6	96.8						
1571.8	97.0	97.2	1609.1	96.4	96.6	1606.4	96.8	97.4						
1567.2	95.9	97.3	1570.4	96.9	97.1	1567.1	95.7	97.4						
1563.9	95.7	97.3	1564.9	95.9	97.1	1561.2	95.8	97.3						
1555.3	95.9	97.3	1557.1	95.9	97.1	1551.2	96.9	97.4						
1551.1	97.0	97.2	1551.1	97.0	97.2	1547.3	97.4	97.9						
1515.5	97.3	97.8	1515.2	97.5	97.6	1511.8	95.9	97.8						
1512.7	96.4	97.8	1511.4	96.2	97.6	1506.9	95.8	97.9						
1505.9	95.4	97.8	1502.7	95.6	97.6	1497.8	97.1	97.8						
1500.0	96.8	97.7	1498.0	96.7	97.6	1487.5	98.0	98.4						
1497.4	96.3	97.7	1493.6	96.1	97.6	1446.9	96.3	98.4						
1495.0	96.3	97.8	1488.2	97.3	97.6	1436.9	96.4	98.4						
1491.6	97.1	97.7	1448.8	98.0	98.2	1431.6	97.8	98.4						
1450.2	98.1	98.3	1444.2	96.8	98.3	1427.8	98.5	98.9						
1446.5	97.1	98.4	1435.5	96.2	98.2	1391.2	97.1	99.0						
1440.5	96.4	98.3	1432.4	96.8	98.3	1385.5	96.3	99.0						
1435.8	96.2	98.4	1424.8	98.0	98.2	1380.2	98.2	99.0						
1429.6	97.9	98.3	1402.7	98.5	98.6	1371.8	98.4	99.1						
1336.8	98.3	98.8	1398.5	97.8	98.7	1353.1	97.8	99.1						
1320.1	98.3	98.9	1394.5	96.4	98.7	1348.6	97.7	99.2						

	2014	2014	2015	2016	2017
Avg. Water Surface Slope	0.0135	0.0123	0.0116		
Riffle Length	21	23	6		
Avg. Riffle Slope	0.0166	0.0161	0.1220		
Pool Length	22	19	40		
Pool to Pool Spacing	42	40	46		



Project Name: UT to Martins Creek (Contreras)					
Cross-Section: 5					
Feature: Riffle					
			2015		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	11%	11%
Sand	very fine sand	0.125	2	4%	14%
	fine sand	0.250		0%	14%
	medium sand	0.50	1	2%	16%
	coarse sand	1.00		0%	16%
	very coarse sand	2.0	2	4%	19%
Gravel	very fine gravel	4.0		0%	19%
	fine gravel	5.7		0%	19%
	fine gravel	8.0	3	5%	25%
	medium gravel	11.3	5	9%	33%
	medium gravel	16.0	3	5%	39%
	course gravel	22.3	7	12%	51%
	course gravel	32.0	12	21%	72%
	very coarse gravel	45	8	14%	86%
	very coarse gravel	64	3	5%	91%
Cobble	small cobble	90	2	4%	95%
	medium cobble	128	2	4%	98%
	large cobble	180	1	2%	100%
	very large cobble	256		0%	100%
Boulder	small boulder	362		0%	100%
	small boulder	512		0%	100%
	medium boulder	1024		0%	100%
	large boulder	2048		0%	100%
Bedrock	bedrock	40096		0%	100%
TOTAL % of whole count			57	100%	100%
Summary Data					
D16	1.042				
D35	12.39				
D50	21.5				
D84	43				
D95	92				

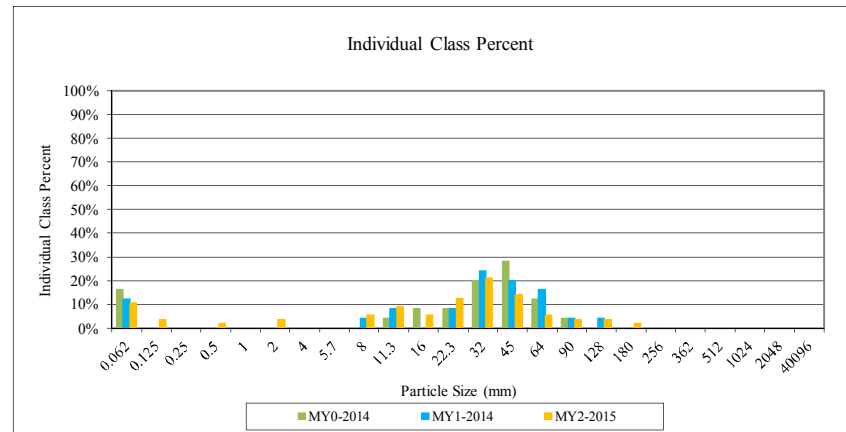
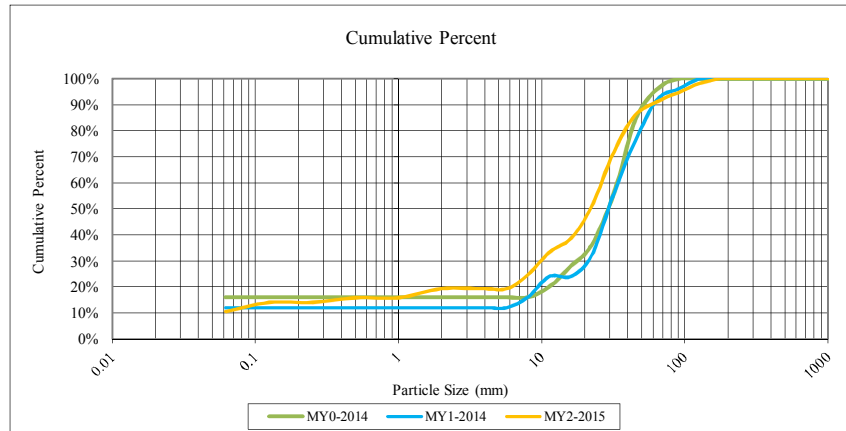


Table 10a. Baseline Stream Data Summary (UT -1 to Martin's Creek)
Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Gauge	Regional Curve			Pre-Existing Condition (UT-1)					Reference Reach(es) Data					Design (UT-1)			Monitoring Baseline (UT-1 Reach 4)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Max	Med	Min	Mean	Med	Max	SD	
Dimension and Substrate - Rifle Only																							
BF Width (ft)					5.9	8.5	7.6	14.0	3.0	11.7				21.7		7.7	8.5		6.4	7.1	6.6	8.4	1.1
Floodprone Width (ft)					9.0	17.0	16.2	30.8	8.2	20				410		16	100		25	25	25	25	0
BF Mean Depth (ft)					0.3	0.6	0.6	0.8	0.2	0.6				1.0		0.5	0.7		0.5	0.6	0.6	0.8	0.2
BF Max Depth (ft)					0.6	0.9	1.0	1.1	0.2	0.9				2.5		0.7	0.9		0.8	1.0	0.9	1.2	0.2
BF Cross Sectional Area (ft ²)					3.6	4.7	4.3	6.2	1.2	10.2				13.1		4.1	6.0		3.2	4.5	3.8	6.4	1.7
Width/Depth Ratio					7.6	18.8	12.6	55.0	18.0	10.7				17.0		12.0	14.3		10.5	11.4	11.0	12.8	1.2
Entrenchment Ratio					1.2	2.0	2.0	2.9	0.6	1.7				32.0		2.0	11.8		1.5	1.5	1.5	1.6	0.1
Bank Height Ratio					1.0	2.0	1.8	4.1	1.1	1.0				1.0		1.0	1.0		1.0	1.0	1.0	1.0	0.0
Profile																							
Rifle length (ft)																		5	21	20	40	8	
Rifle slope (ft/ft)					0.025			0.170		0.2000				1.9000		0.0100	0.1600		0.0009	0.0166	0.0148	0.0337	0.0111
Pool length (ft)																		8.0	22.0	22.0	37.0	9.5	
Pool Max depth (ft)										2.2				2.5		1.6	2.0		2.1	2.3	2.3	2.4	0.2
Pool spacing (ft)					30.0			85.0		48.0				231.0		12.0	45.0		27.0	42.0	40.0	61.0	11.0
Pattern																							
Channel Beltwidth (ft)										16				55			40				40		
Radius of Curvature (ft)										28				47		30	40		30			40	
Rc:Bankfull width (ft/ft)										2				3		3.8	4.7		3.8			4.7	
Meander Wavelength (ft)										70				260		15	30		15			30	
Meander Width ratio										1.1				4.1				4.7			4.7		
Transport parameters																							
Reach Shear Stress (competency) lbs/ft ²																							
Max part size (mm) mobilized at bankfull																							
Stream Power (transport capacity) W/m ²																							
Additional Reach Parameters																							
Rosgen Classification					Eb/Fb/B/G/Cb					Aa/Bc					B/C			B/C					
Bankfull Velocity (fps)					4.2-4.4										3.9-4.3								
Bankfull Discharge (cfs)					16 - 25																		
Valley Length (ft)					1565					----													
Channel Thalweg Length (ft)					1747													781					
Sinuosity					1.06 - 1.18					1.19					1.05-1.4			1.05-1.4					
Water Surface Slope (ft/ft)					0.015 - 0.05					0.0333					.01-.057			0.0135					
BF slope (ft/ft)					----					----					----			----					
Bankfull Floodplain Area (acres)					----					----					----			----					
% of Reach with Eroding Banks					----					----					----			----					
Channel Stability or Habitat Metric					----					----					----			----					
Biological or Other					----					----					----			----					

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design					Monitoring Baseline									
R1%/RU%P%G%/S%																									
SC%/SA%/G%/C%/B%BE%																									
d16/d35/d50/d84/d95	6- 8	2-4.4	3.6-8.7	15.9-28	66.8-																				
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																									
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																									

Table 10c. Baseline Stream Data Summary (UT -1 to Martin's Creek)
Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Gauge	Regional Curve			Pre-Existing Condition (UT-1)					Reference Reach(es) Data					Design (UT-1)			Monitoring Baseline (UT-1 Reach 2)					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Max	Med	Min	Mean	Med	Max	SD	
Dimension and Substrate - Riffle Only																							
BF Width (ft)					5.9	8.5	7.6	14.0	3.0	11.7				21.7		7.7	8.5		8.0			8.7	
Floodprone Width (ft)					9.0	17.0	16.2	30.8	8.2	20				410		16	100			25			
BF Mean Depth (ft)					0.3	0.6	0.6	0.8	0.2	0.6				1.0		0.5	0.7			0.7			
BF Max Depth (ft)					0.6	0.9	1.0	1.1	0.2	0.9				2.5		0.7	0.9		1.1				
BF Cross Sectional Area (ft ²)					3.6	4.7	4.3	6.2	1.2	10.2				13.1		4.1	6.0		5.2			5.9	
Width/Depth Ratio					7.6	18.8	12.6	55.0	18.0	10.7				17.0		12.0	14.3		12.3			12.8	
Entrenchment Ratio					1.2	2.0	2.0	2.9	0.6	1.7				32.0		2.0	11.8		2.9			3.1	
Bank Height Ratio					1.0	2.0	1.8	4.1	1.1	1.0				1.0		1.0	1.0			1.0			
Profile																							
Riffle length (ft)																		5	21	20	40	8	
Riffle slope (ft/ft)					0.025			0.170		0.2000				1.9000		0.0100	0.1600		0.0009	0.0166	0.0148	0.0337	0.0111
Pool length (ft)																		8.0	22.0	22.0	37.0	9.5	
Pool Max depth (ft)										2.2				2.5		1.6	2.0		2.1	2.3	2.3	2.4	0.2
Pool spacing (ft)					30.0			85.0		48.0				231.0		12.0	45.0		27.0	42.0	40.0	61.0	11.0
Pattern																							
Channel Beltwidth (ft)										16				55			40				40		
Radius of Curvature (ft)										28				47		30	40		30			40	
Rc:Bankfull width (ft/ft)										2				3		3.8	4.7		3.8			4.7	
Meander Wavelength (ft)										70				260		15	30		15			30	
Meander Width ratio										1.1				4.1				4.7			4.7		
Transport parameters																							
Reach Shear Stress (competency) lbs/ft ²																							
Max part size (mm) mobilized at bankfull																							
Stream Power (transport capacity) W/m ²																							
Additional Reach Parameters																							
Rosgen Classification					Eb/Fb/B/G/Cb					Aa/Bc					B/C			C					
Bankfull Velocity (fps)					4.2-4.4										3.9-4.3								
Bankfull Discharge (cfs)					16 - 25																		
Valley Length (ft)					1565					----					----								
Channel Thalweg Length (ft)					1747										----			1176					
Sinuosity					1.06 - 1.18					1.19					1.05-1.4			1.05-1.4					
Water Surface Slope (ft/ft)					0.015 - 0.05					0.0333					.01-.057			0.0577					
BF slope (ft/ft)					----					----					----			----					
Bankfull Floodplain Area (acres)					----					----					----			----					
% of Reach with Eroding Banks					----					----					----			----					
Channel Stability or Habitat Metric					----					----					----			----					
Biological or Other					----					----					----			----					

Table 10d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design					Monitoring Baseline									
R1%/RU%P%G%/S%																									
SC%/SA%/G%/C%/B%BE%																									
d16/d35/d50/d84/d95	6- 8	2-4.4	3.6-8.7	15.9-28	66.8-																				
Entrainment Class <1.5/1.5-1.99/2.0-4.9/5.0-																									
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0																									

Table 11e. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Cross Section 18 (UT 1 Reach 2)							Cross Section 19 (UT 1 Reach 2)						
	Riffle							Riffle						
Dimension	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	8.0	7.9	8.2					8.7	8.0	8.6				
Floodprone Width (ft) (approx)	25.0	25.0	25.0					25.0	25.0	25.0				
BF Mean Depth (ft)	0.7	0.7	0.6					0.7	0.6	0.7				
BF Max Depth (ft)	1.1	1.1	0.9					1.1	1.0	1.0				
BF Cross Sectional Area (ft ²)	5.2	5.5	4.7					5.9	5.0	5.8				
Width/Depth Ratio	12.3	11.3	14.3					12.8	12.8	12.8				
Entrenchment Ratio	3.1	3.2	3.0					2.9	3.1	2.9				
Bank Height Ratio	1.0	1.0	1.0					1.0	1.0	1.0				
d50 (mm)	----	----	----					----	----	----				

Table 11f. Monitoring Data - Stream Reach Data Summary

Martin's Creek II Mitigation Project - DMS Project Number 92633

Parameter	Baseline (UT 1 Reach 2)					MY-1 (UT 1 Reach 2)					MY-2 (UT 1 Reach 2)					MY-3 (UT 1 Reach 2)					MY-4 (UT 1 Reach 2)					MY-5 (UT 1 Reach 2)														
	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD	Min	Mean	Med	Max	SD										
Dimension and Substrate - Riffle Only																																								
BF Width (ft)	8.0			8.7		7.9			8		8.2			8.6																										
Floodprone Width (ft)		25					25					25																												
BF Mean Depth (ft)		0.7					0.6				0.7			0.7																										
BF Max Depth (ft)		1.1					1.0				1.1			1.0																										
BF Cross Sectional Area (ft ²)	5.2			5.9		5.0			5.5		4.7			5.8																										
Width/Depth Ratio	12.3			12.8		11.4			12.5		12.7			14.3																										
Entrenchment Ratio	2.9			3.1		3.1			3.2		2.9			3.1																										
Bank Height Ratio		1.0					1.0					1.0																												
Profile																																								
Riffle length (ft)	7	19	18	51	10	4	16	12	37	9	4.3	16.5	12.8	46.7	9.4																									
Riffle slope (ft/ft)	0.0215	0.0457	0.0445	0.0667	0.0125	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*																									
Pool length (ft)	3	6	6	10	2	3	6	5	12	2	3	6	6	14	2																									
Pool Max depth (ft)																																								
Pool spacing (ft)	15	25	23	58	10	9	22	19	45	9	9	24	19	55	11																									
Pattern																																								
Channel Beltwidth (ft)			40																																					
Radius of Curvature (ft)	30			40																																				
Rc:Bankfull width (ft/ft)	3.8			4.7																																				
Meander Wavelength (ft)	15			30																																				
Meander Width ratio			4.7																																					
Additional Reach Parameters																																								
Rosgen Classification	C - Type					C - Type					C - Type																													
Channel Thalweg Length (ft)	1176					1167					1176																													
Sinuosity	1.2					1.2					1.2																													
Water Surface Slope (Channel) (ft/ft)	0.0577					NA*					0.0582																													
BF slope (ft/ft)	----					----					----																													
Ri%/RU%P%G%/S%																																								
SC%/SA%/G%/C%/B%BE%																																								
d16/d35/d50/d84/d95																																								
% of Reach with Eroding Banks																																								
Channel Stability or Habitat Metric																																								
Biological or Other																																								

NA* No water in channel during field surveys.

APPENDIX E
HYDROLOGY DATA

Table 12. Verification of Bankfull Events

Table 13. Wetland Hydrology Criteria Attainment Summary

Figure E1. Martin's Creek II 30-70 Percentile Graph for Rainfall
Groundwater Gauge Graphs

**Table 12. Verification of Bankfull Events
Martin's Creek II Mitigation Site (DMS Project Number 92633)**

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
August 25, 2014	April 7, 2014	Crest gauge data indicates a bankfull event after approximately 2.4 inches of rain documented in one day at an onsite rain gauge.	---
August 25, 2014	July 1, 2014	Crest gauge data indicates a bankfull event after approximately 2.02 inches of rain was documented over two days at an onsite rain gauge.	---
August 25, 2014	August 24, 2014	Crest gauge data indicates a bankfull event after approximately 1.39 inches of rain documented over two days at an onsite rain gauge.	---
October 27, 2014	September 3, 2014	Crest gauge data indicates a bankfull event after approximately 1.67 inches of rain documented in one day at an onsite rain gauge.	---
October 27, 2014	October 14, 2014	Crest gauge data and laid back vegetation indicate a bankfull event after approximately 2.5 inches of rain documented in one day at an onsite rain gauge.	1
April 12, 2015	November 17, 2014	Crest gauge data indicates a bankfull event after approximately 1.44 inches of rain documented in one day at an onsite rain gauge.	---
July 13, 2015	June 11, 2015	Crest gauge data indicates a bankfull event after approximately 1.68 inches of rain documented in one day at an onsite rain gauge.	---
July 13, 2015	June 26, 2015	Crest gauge data indicates a bankfull event after approximately 1.57 inches of rain was documented in one day at an onsite rain gauge.	---
September 11, 2015	August 19, 2015	Crest gauge data indicates a bankfull event after approximately 2.94 inches of rain was documented over three days at an onsite rain gauge.	---
November 18, 2015	September 26, 2015	Crest gauge data indicates a bankfull event after approximately 2.65 inches of rain was documented over two days at an onsite rain gauge.	---
November 18, 2015	October 3, 2015	Crest gauge data indicates a bankfull event after approximately 4.50 inches of rain was documented over three days at an onsite rain gauge.	---



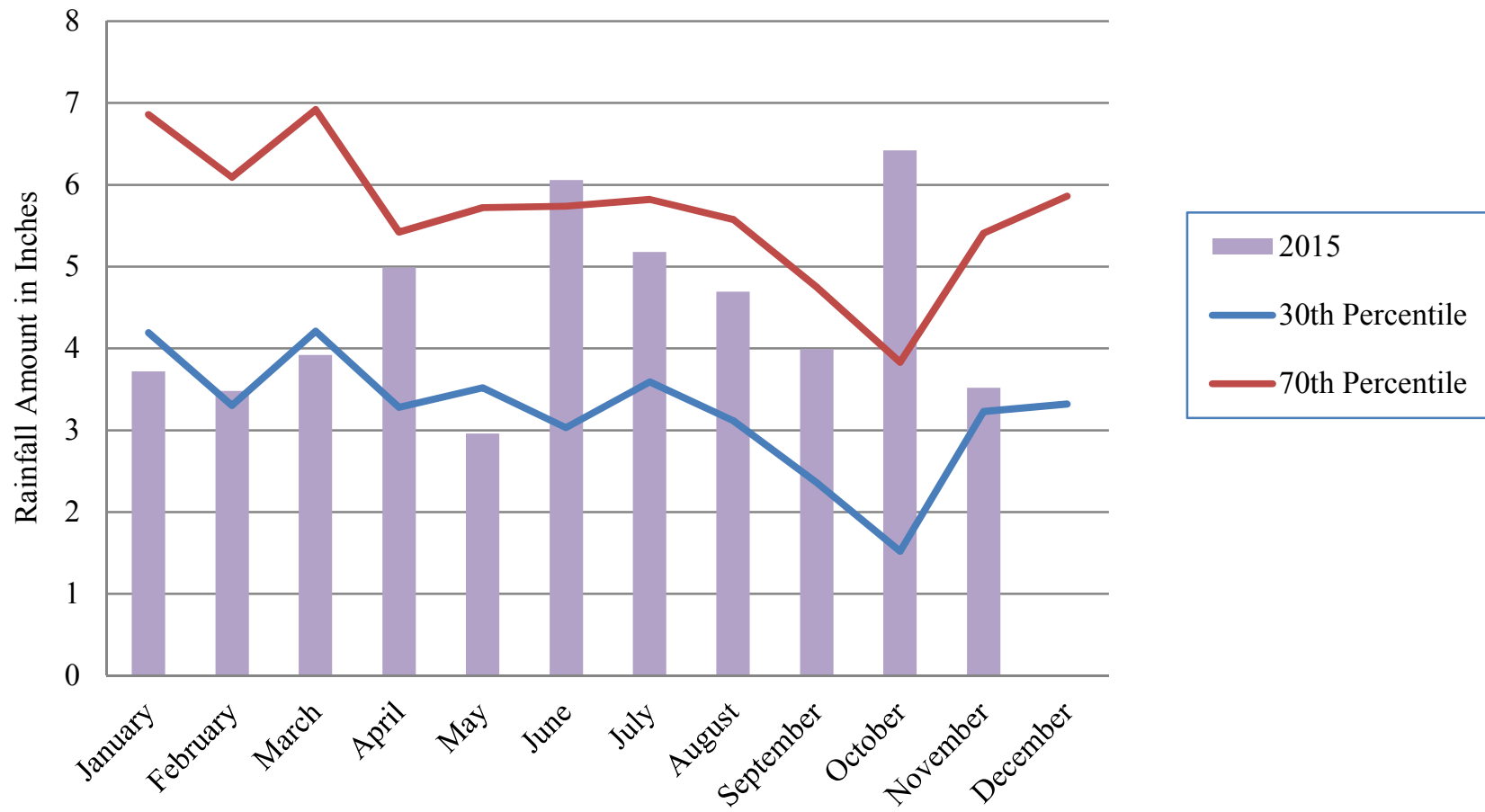
Photo 1: Laid back vegetation after a bankfull event

**Table 13. Wetland Hydrology Criteria Attainment Summary
Martin's Creek II Mitigation Site (DMS Project Number 92633)**

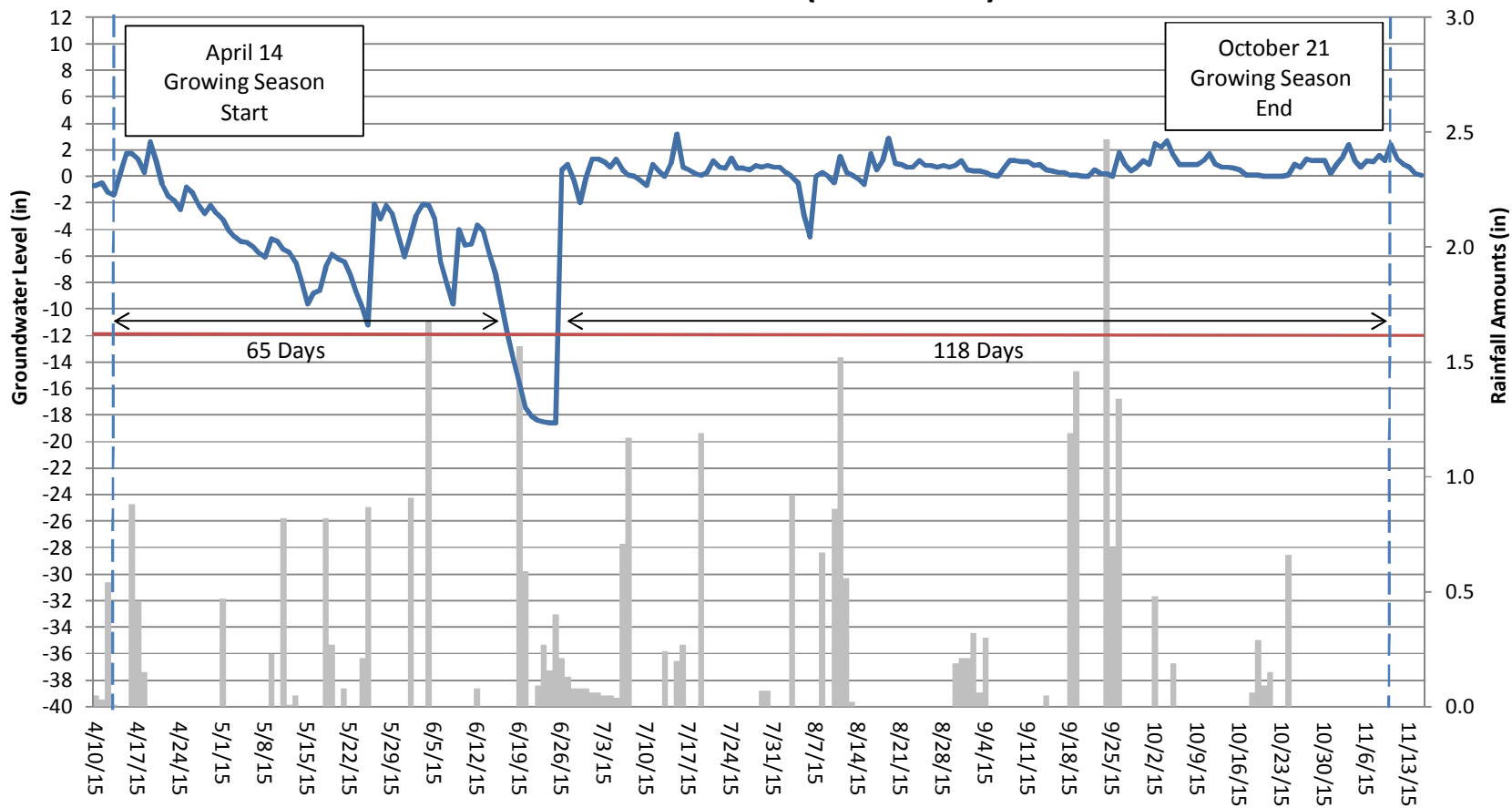
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
1	Yes/75 Days (39%)	Yes/118 Days (61.8%)			
2	No/21 Days (11%)	Yes/36 Days (18.8%)			
3	Yes/52 Days (27%)	Yes/72 Days (37.7%)			
4	No/21 Days (11%)	Yes/27 Days (14.1%)			
5	No/15 Days (7.8%)	Yes/25 Days (13.1%)			
6	Yes/58 Days (30%)	Yes/69 Days (36.1%)			
7	Yes/85 Days (44%)	Yes/69 Days (36.1%)			
8	Yes/65Days (34%)	Yes/72 Days (37.7%)			
9	No/22 Days (11.5%)	Yes/27 Days (14.1%)			
10	No/24 Days (12.5%)	Yes/28 Days (14.7%)			
11	No/18 Days (9%)	No/22 Days (11.5%)			
12	No/20 Days (10%)	Yes/27 Days (14.1%)			
13	Yes/116 Days (61%)	Yes/117 Days (61.2%)			

Figure E1: Martin's Creek II 30-70 Percentile Graph for Rainfall

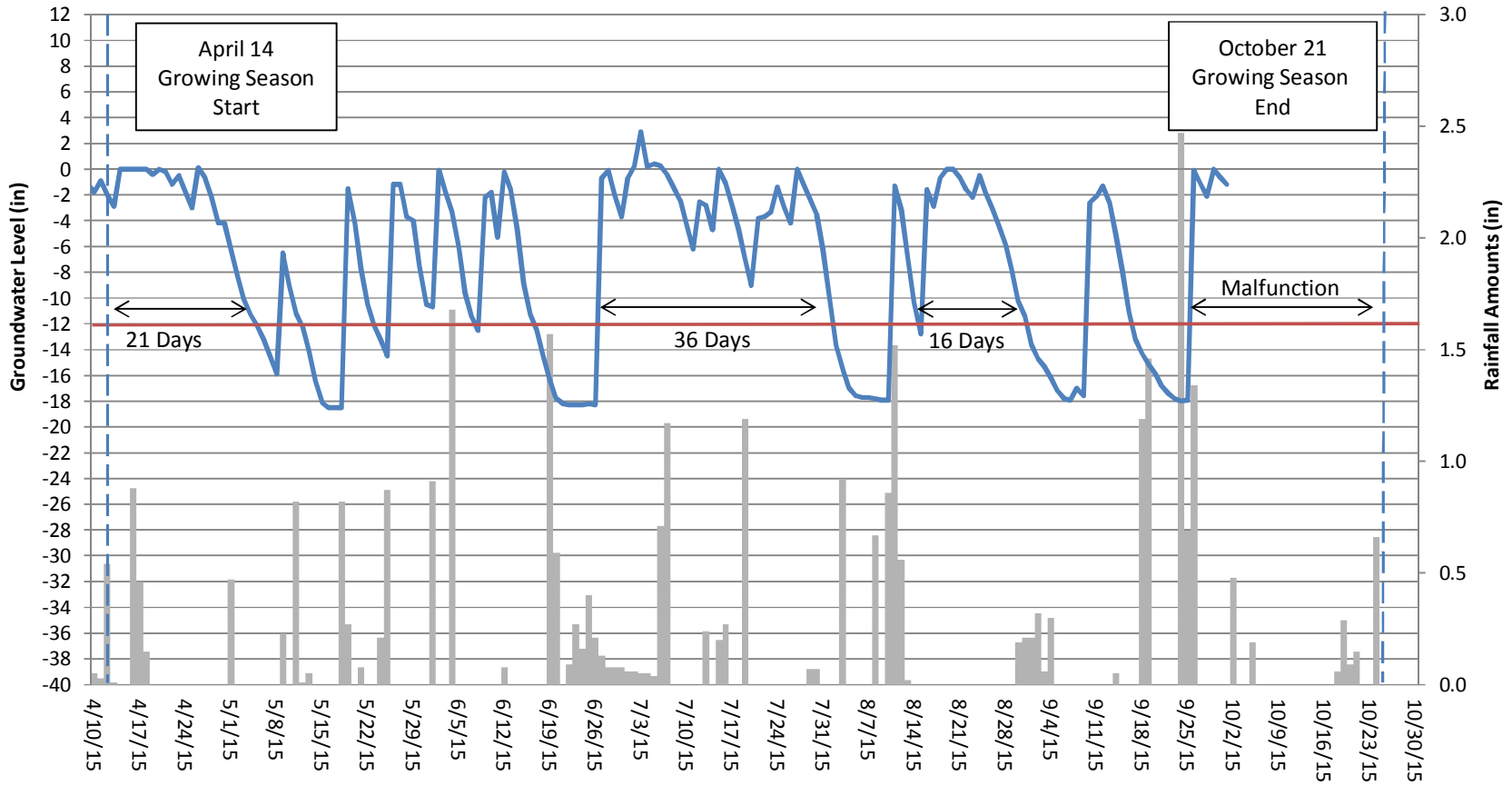
Data from WETS Station : MURPHY, NC 6001



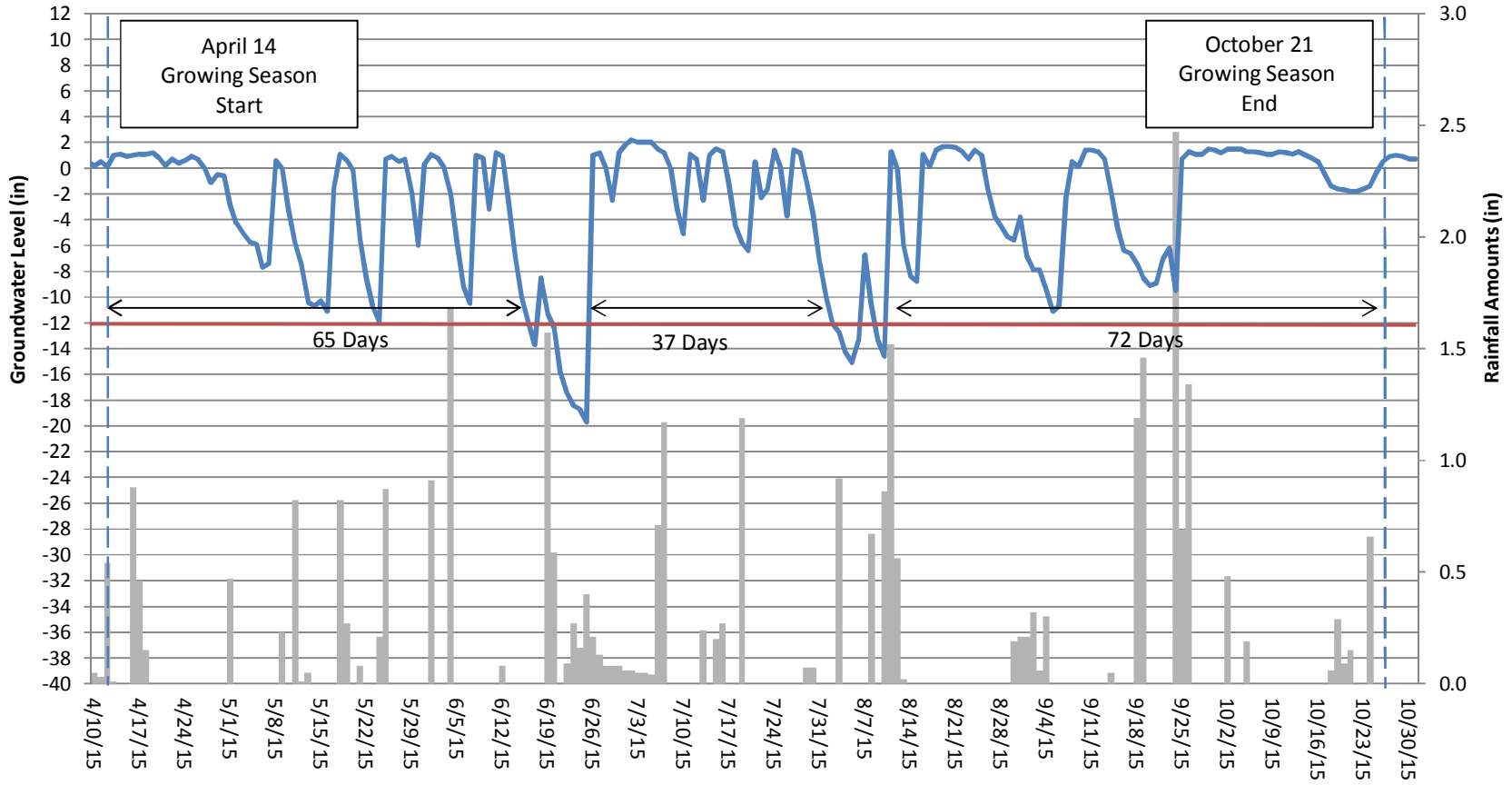
Martins Creek II Groundwater Gauge 1 Year 2 (2015 Data)



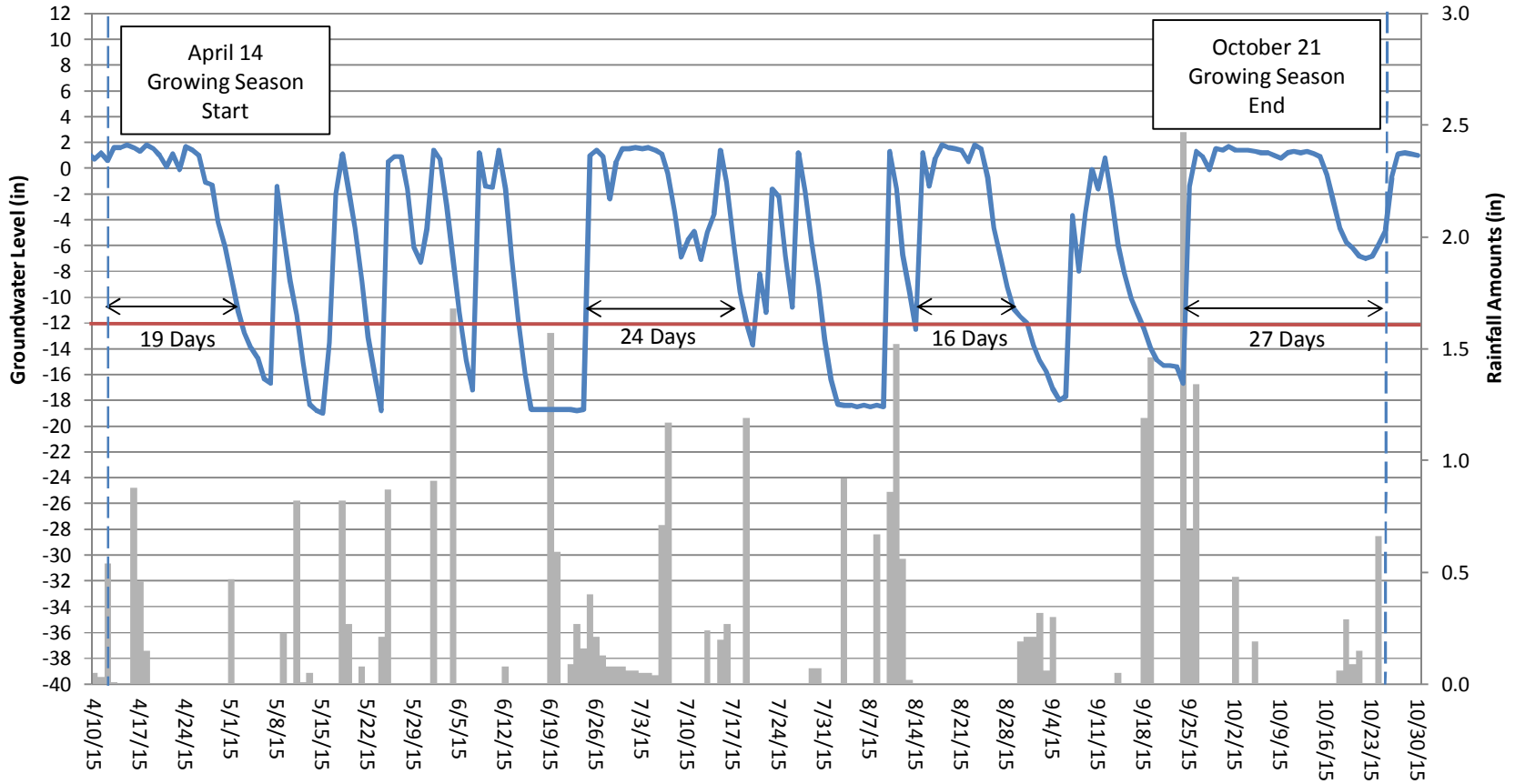
Martins Creek II Groundwater Gauge 2 Year 2 (2015 Data)



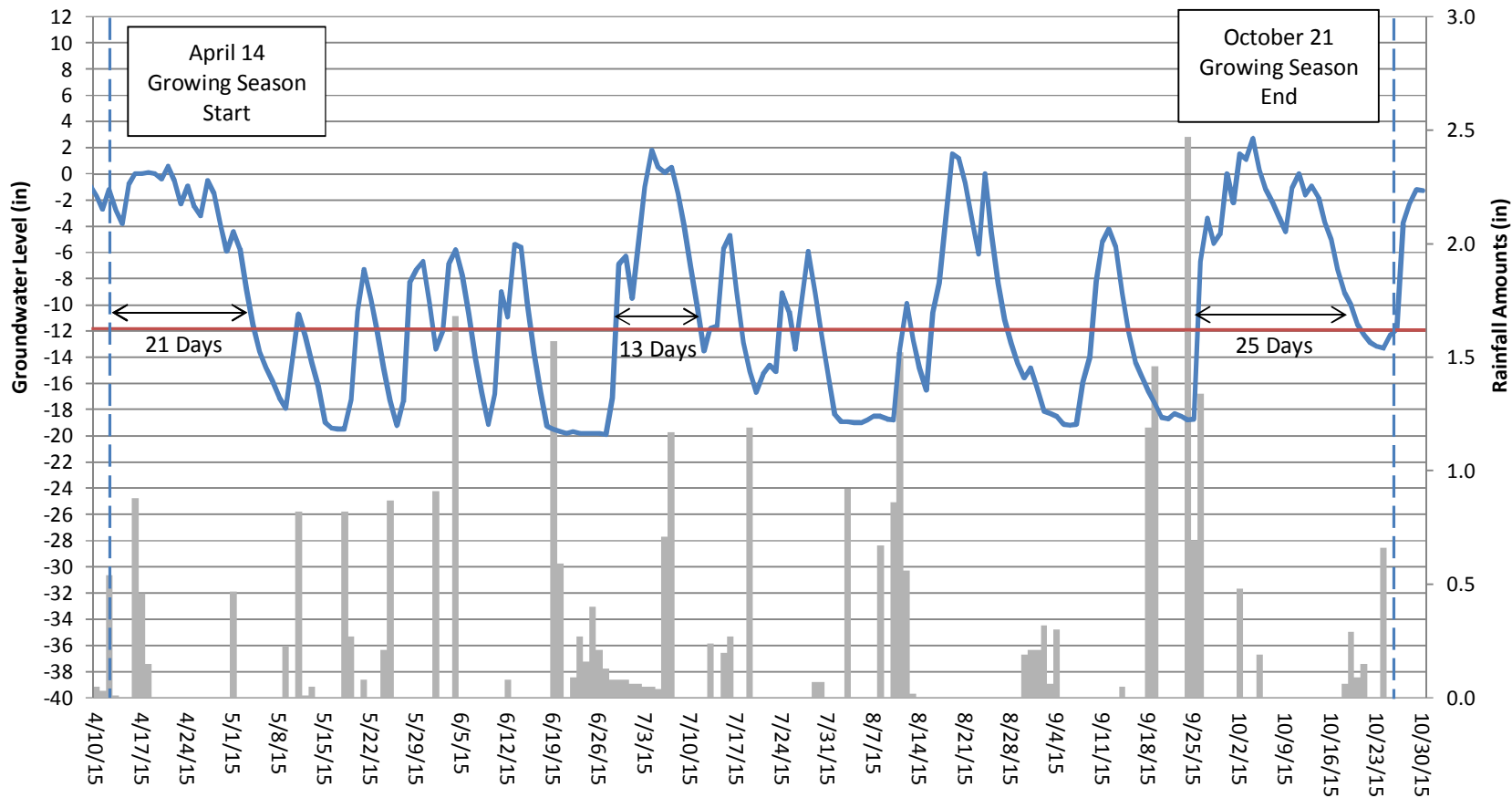
Martins Creek II Groundwater Gauge 3 Year 2 (2015 Data)



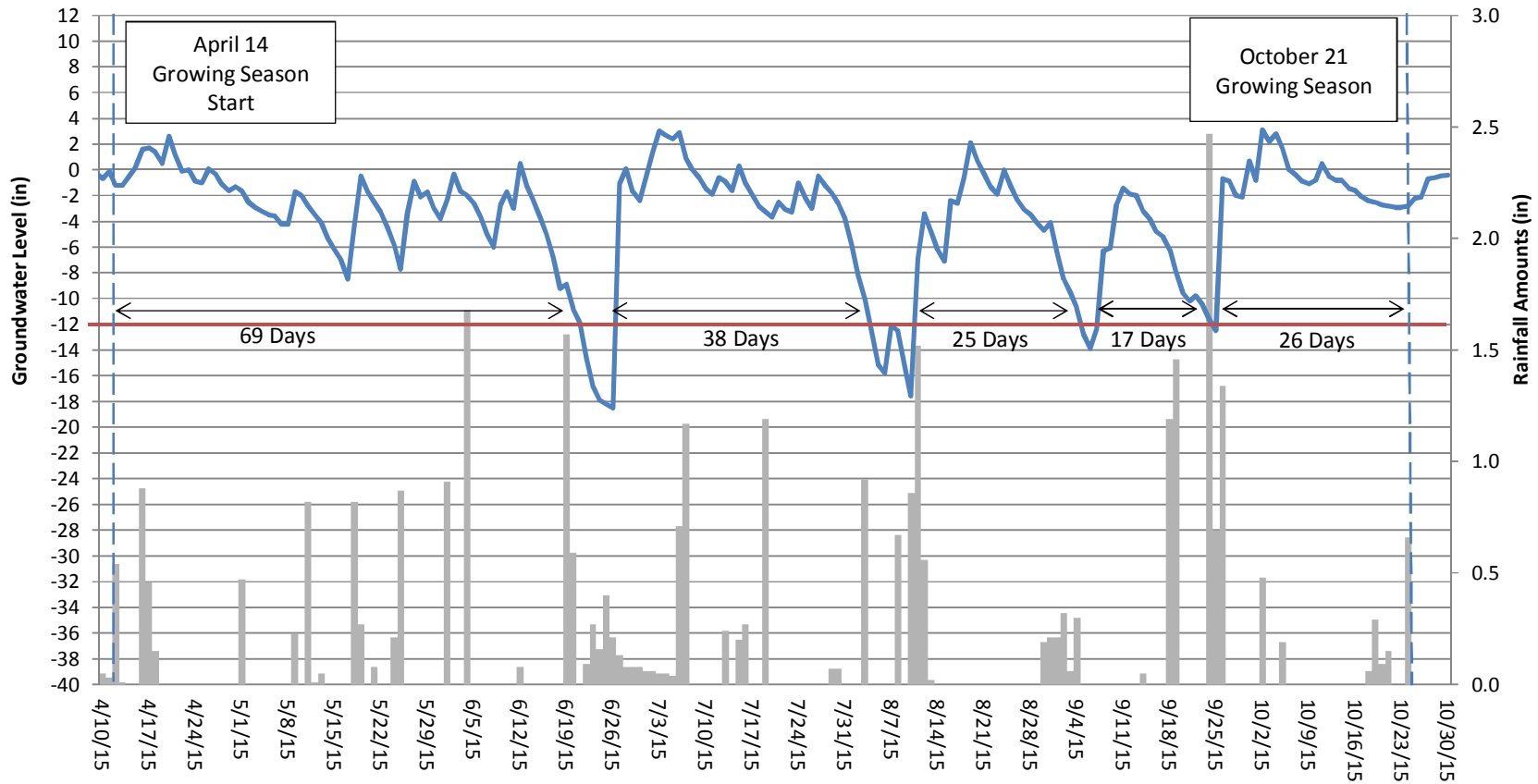
Martins Creek II Groundwater Gauge 4 Year 2 (2015 Data)



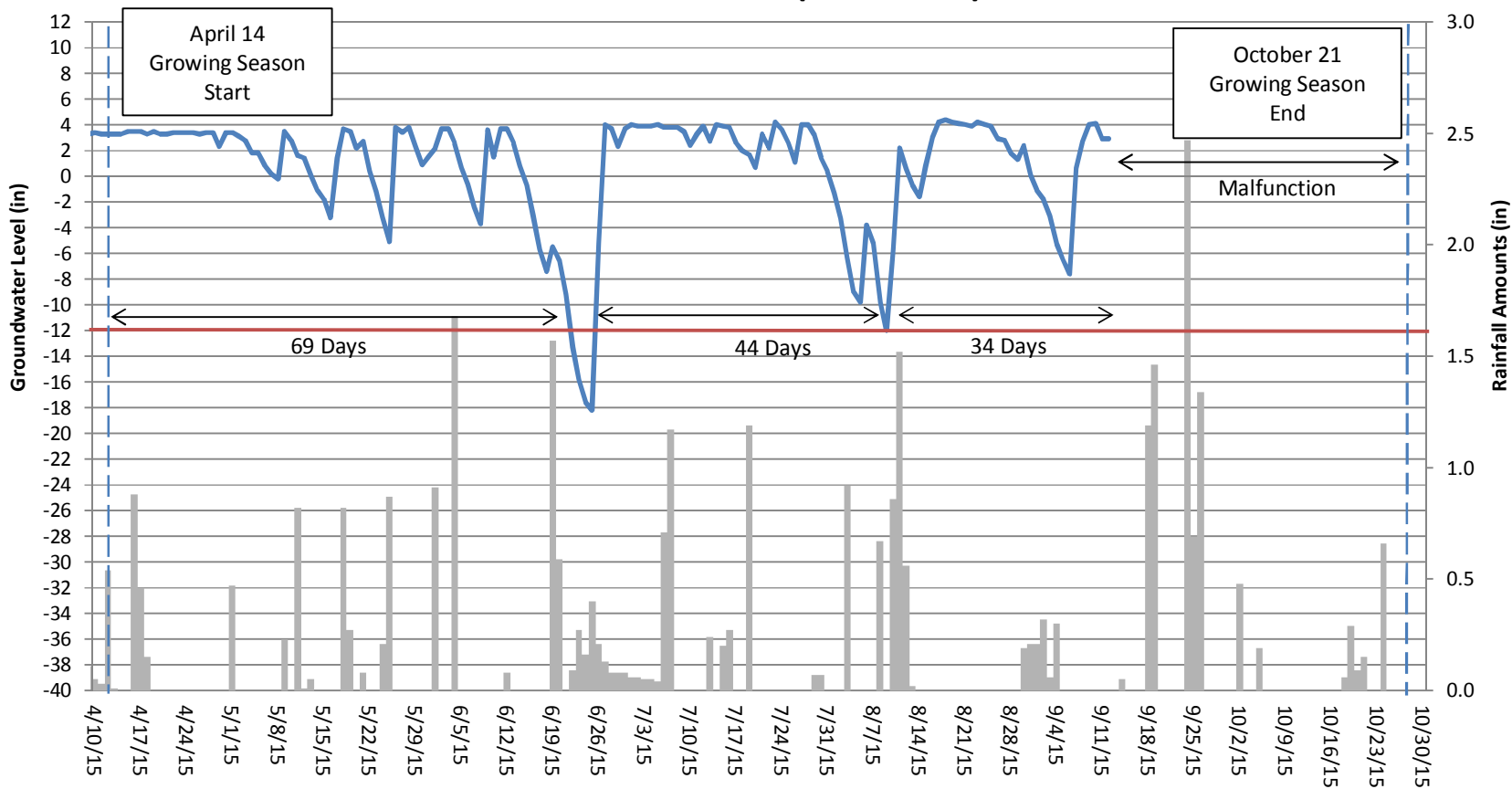
Martins Creek II Groundwater Gauge 5 Year 2 (2015 Data)



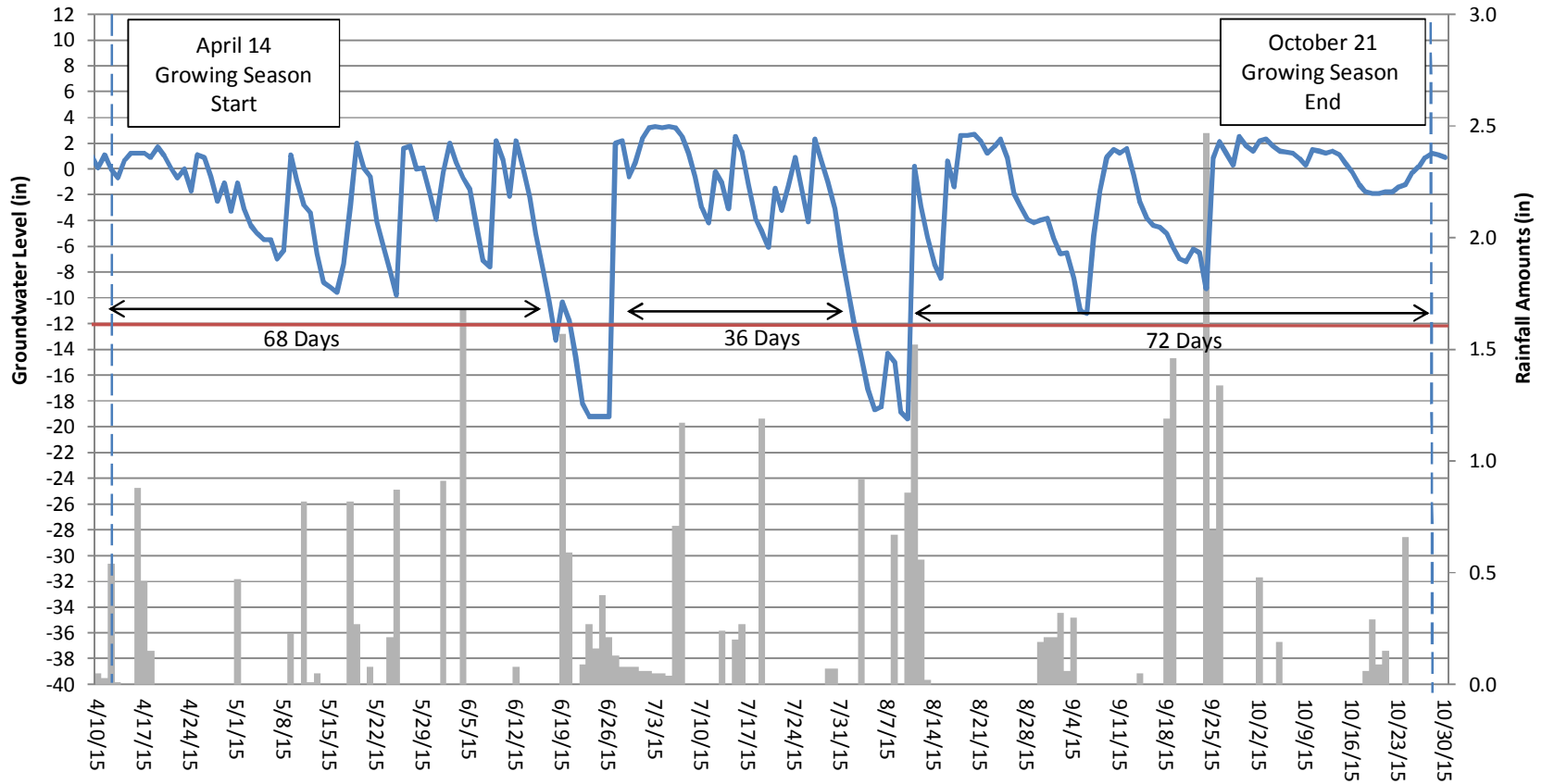
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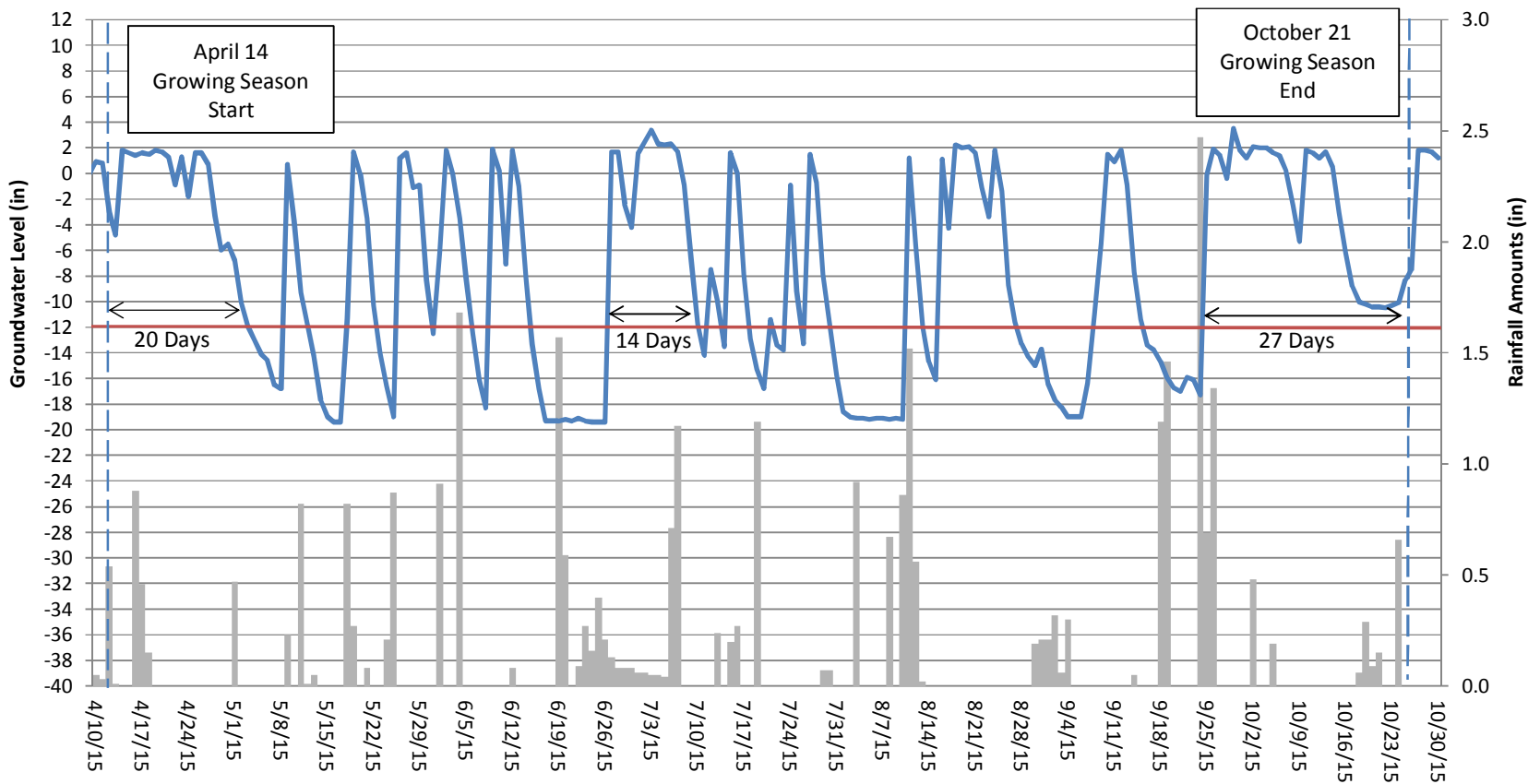
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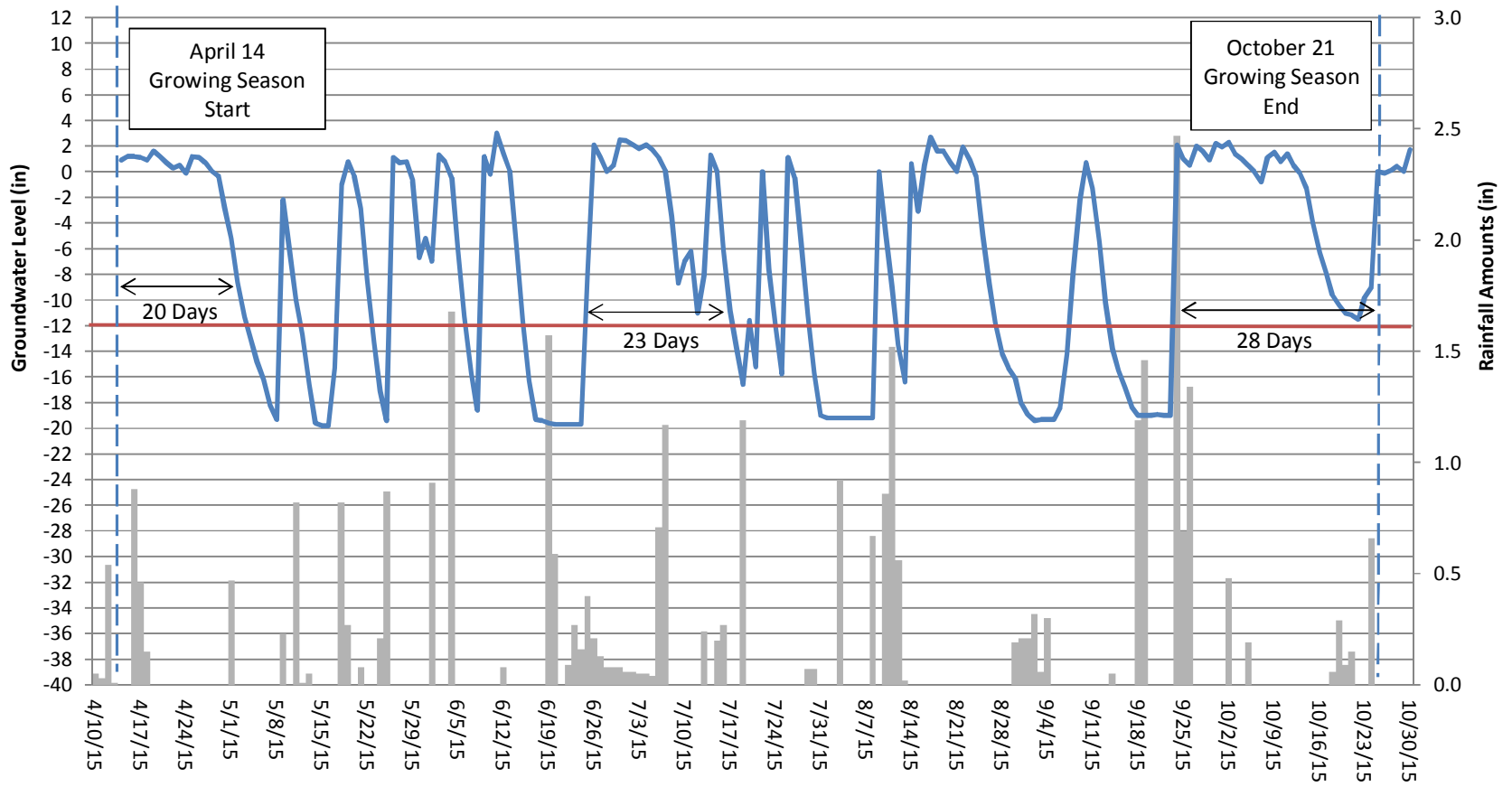
Martins Creek II Groundwater Gauge 8 Year 2 (2015 Data)



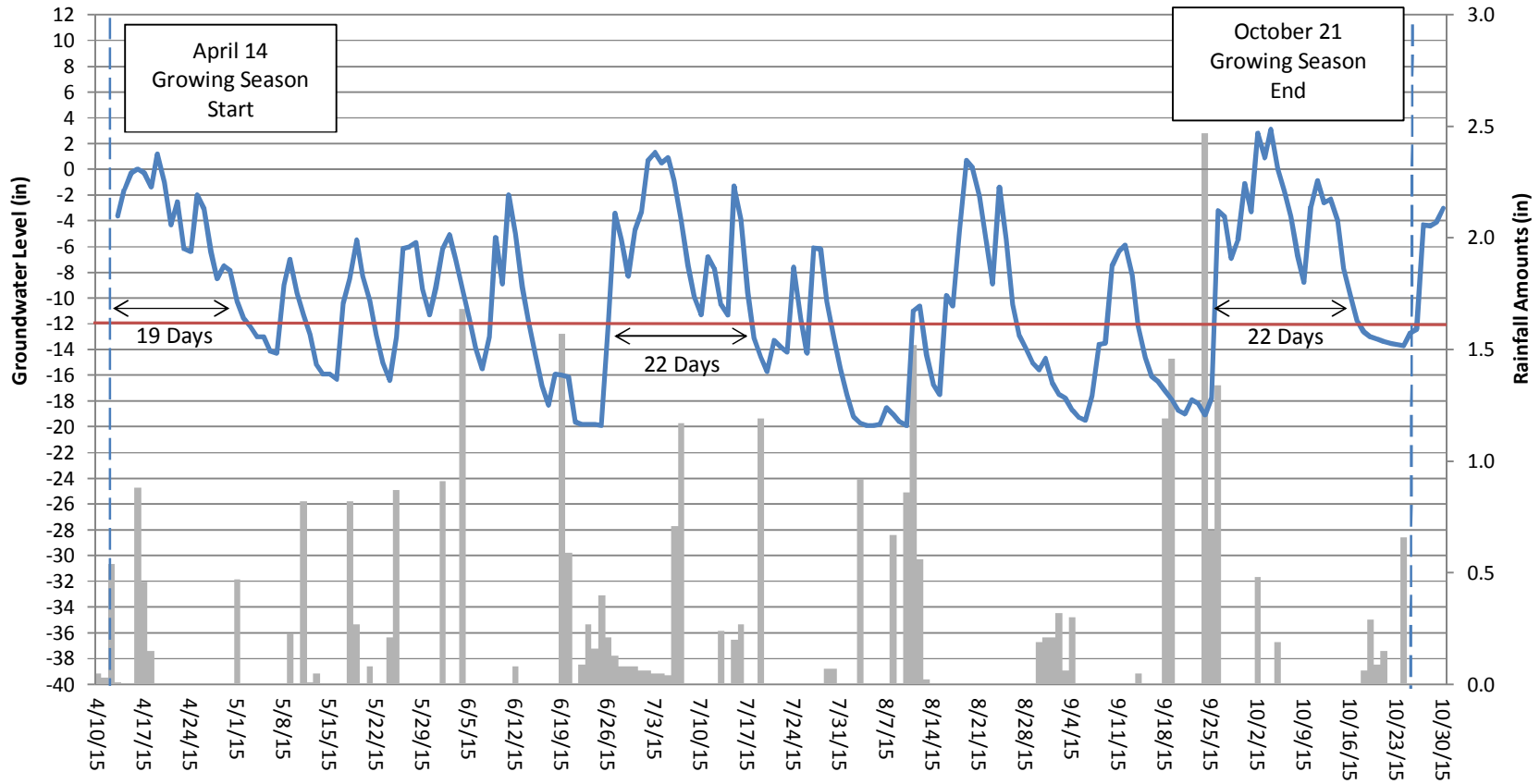
Martins Creek II Groundwater Gauge 9 Year 2 (2015 Data)



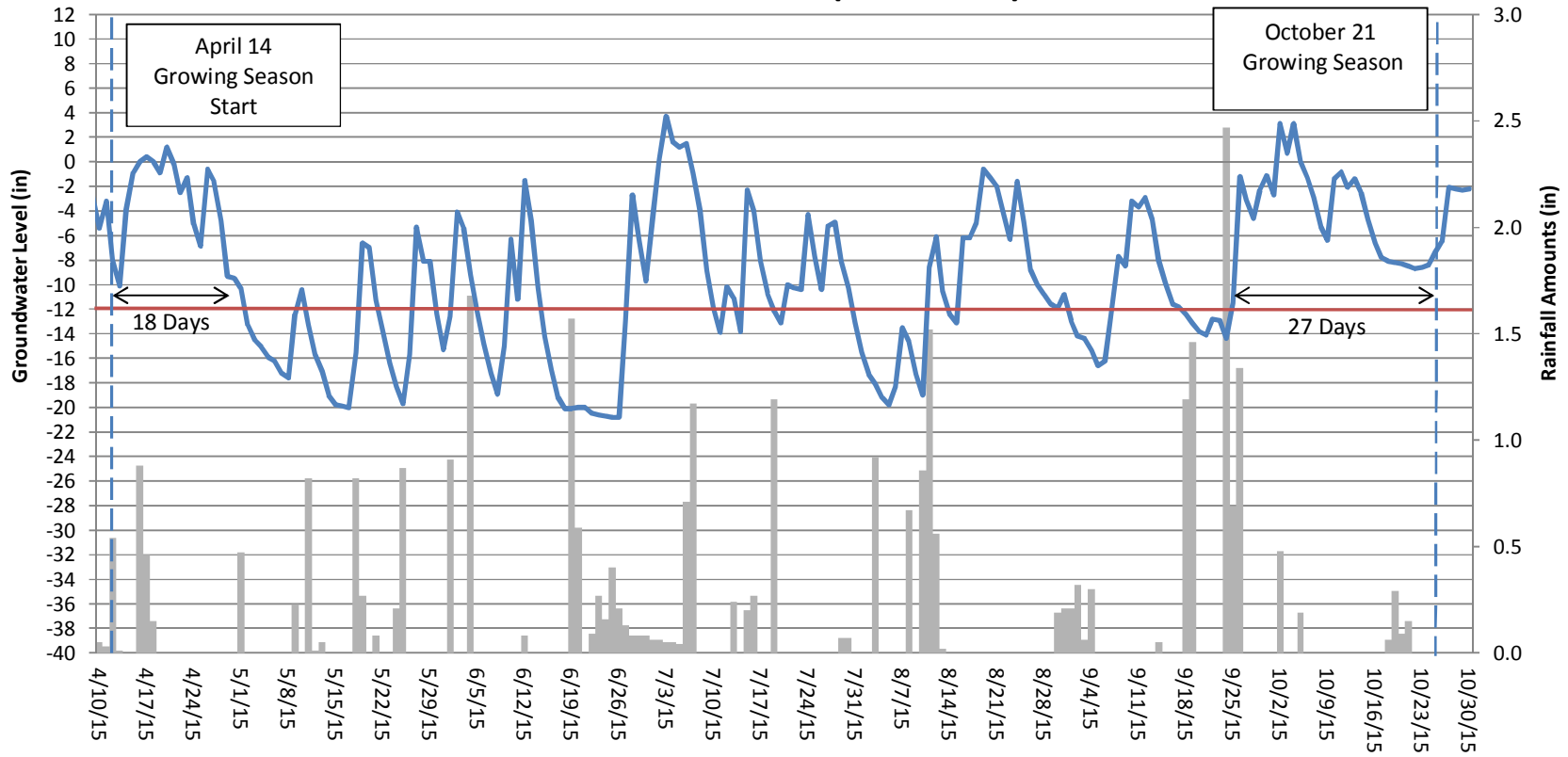
Martins Creek II Groundwater Gauge 10 Year 2 (2015 Data)



Martins Creek II Groundwater Gauge 11 Year 2 (2015 Data)



Martins Creek II Groundwater Gauge 12 Year 2 (2015 Data)



Martins Creek II Groundwater Gauge 13 Year 2 (2015 Data)

