

**Harrell Stream and Wetland Restoration Site
Monitoring Report – MY04
Edgecombe County, NC**



Submitted to:



NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

January 2012



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EXECUTIVE SUMMARY

The Harrell Stream and Wetland Restoration Site is a full-delivery project that was developed for the North Carolina Ecosystem Enhancement Program (EEP). Construction was completed in September 2007 on an Unnamed Tributary to Swift Creek and 15.0 acres of Coastal Plain Small Stream Swamp wetland community. The 441-acre watershed at the downstream limits of the project stream and the 57-acre watershed draining into the project wetland are located within the USGS 14-digit HUC 03020101130090 and the NCDWQ Sub-basin 03-03-02 in the Tar-Pamlico River Basin. The project restored 6,808 linear feet of channel using a combination of Priority 2 and 3 approaches, and 15.0 acres of Coastal Plain Small Stream Swamp wetland community, generating 6,808 stream mitigation units and 15.0 wetland mitigation units. The stream design addressed vertical instability problems and a lack of bed variability by stabilizing stream banks, installing in-stream structures, adjusting stream planform, and replanting the riparian areas with native vegetation. The wetland was restored by filling ditches, creating microtopography, and planting native trees and shrubs. This report describes the results from the findings of the fourth year of monitoring that took place in 2011.

The riparian buffer was planted with twelve different species of bare root trees and shrubs and three different species of live stakes. The restored wetland was planted with eleven different species of bare root trees and shrubs. Vegetation monitoring plots were established during the as-built survey and included 18 monitoring plots placed throughout the stream buffer and 12 monitoring plots installed in the restored wetland. Vegetation must meet a minimum survival success rate of 260 stems/acre after five years. Between the second and third monitoring years supplemental planting was conducted on isolated sections of the stream restoration. The fourth-year monitoring counted an average of 573 stems/acre in the stream plots and 517 stems/acre in the wetland plots. The fourth-year monitoring found the vegetation component of the project to be on track to meeting the success criteria.

The stream assessment completed during fourth-year monitoring found the stream to be stable and functioning properly. Channel dimensions have not changed significantly from the first-year monitoring. The small portions of localized bed erosion, aggradation, and degradation that were noted during previous monitoring years have not become problematic or caused any instability in the stream. Any problem areas noted during the fourth-year monitoring have been documented in the Current Condition Plan View. The on-site stream gauges have recorded multiple bankfull events since the project was constructed in September 2007.

During the 2011 monitoring year, wetland hydrology was achieved at all four wells in the restoration area. In 2011 groundwater was within 12 inches of the soil surface for at least 16 consecutive days (7% of the growing season) at each well, which exceeds the 5% success criteria.

The daily rainfall data depicted on the gauge data graphs were obtained from the on-site precipitation gauge. The precipitation gauge was installed on the site prior to project implementation. The daily rainfall data obtained from a local weather station shows that the area had average to below average rainfall during the 2011 growing season and correlated to the precipitation data recorded on-site.

1.0 PROJECT BACKGROUND

Project Goals and Objectives

The goals and objectives of the restoration project are as follows:

Restoration Goals:

- Protect aquatic resources from excess nutrients, sediment, and other pollutants coming from the agricultural watershed.
- Reestablish terrestrial and aquatic habitat and connect the site to the existing floodplain corridor along Swift Creek.

Restoration Objectives:

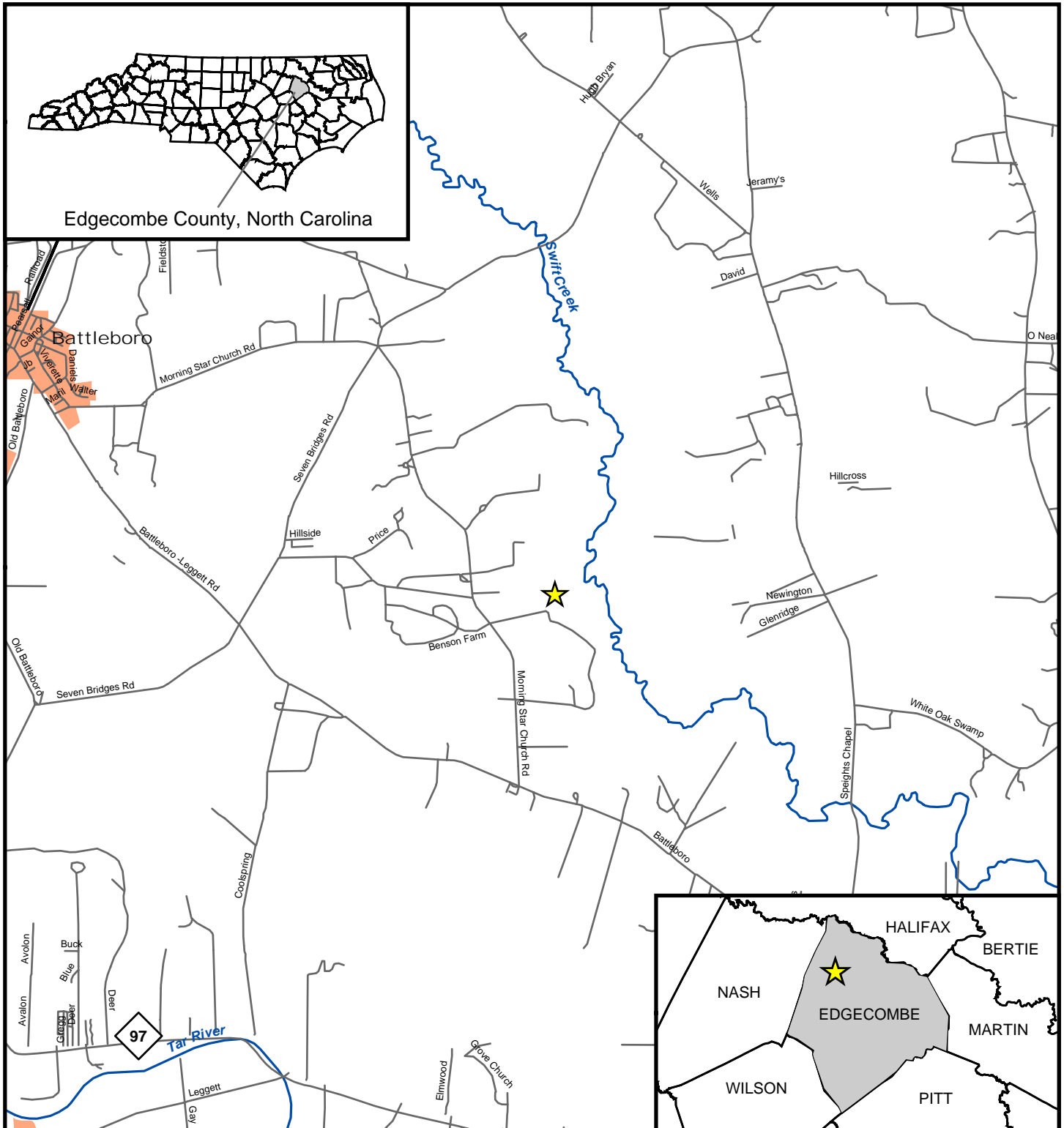
- Restore 6,808 linear feet of stable stream channel with the appropriate pattern, profile, and dimension that can support a sand transport system.
- Connect the stream to a functioning floodplain.
- Fill and plug ditches in the drained hydric soils to restore saturated hydrologic conditions for 5% of the growing season.
- Plant tree species typical of a Coastal Plain Small Swamp Stream along the stream riparian corridor and floodplain as well as in the restored wetland.

1.1 Project Structure, Restoration Type, and Approach

Prior to restoration, UT to Swift Creek had been channelized and straightened since at least 1948. The entire site, including where the wetland was restored, was under agricultural production. There were fields adjacent to the stream and the wetland that had been drained by a network of ditches. There were no remaining vegetated buffers or in-stream features in the channel and the banks were nearly vertical. The channel was characterized as having poor streambed variability and habitat diversity. Restoration of 6,808 linear feet of channel was accomplished utilizing a combination of Priority Levels 2 and 3 (Table 1). Reach 1 (Station 10+00 to 22+26) was restored using a Priority Level 3 approach. The restoration of a B5c channel with a sinuosity of 1.06 was accomplished by building a bankfull channel with a higher width/depth ratio than the existing stream, creating distinct bed features by adding pools and riffles to the profile, and grading back the upper slopes to create an appropriate valley for the stream. Reaches 2, 3, and 4 (Stations 22+26 to 36+91, 36+91 to 51+82, and 51+82 to 78+80, respectively) were restored to a C5 channel with a Priority Level 2 restoration. The restoration established a bankfull channel with a new floodplain where the designed bankfull stage equals the new floodplain elevation (bank height ratio=1.0). Reaches 2, 3, and 4 have sinuosity values of 1.07, 1.23, and 1.10, respectively. The four different reaches are shown in Figure 2.





1.2 Location and Setting

The Harrell Stream and Wetland Restoration Site is located approximately six miles northeast of Rocky Mount, North Carolina in Edgecombe County (Figure 1). The latitude and longitude of the project site are 36.0201 North and 77.6807 West (WGS1984). To reach the site from Raleigh, proceed east on U.S. Route 264-East/64-East (US 264E/64E) for approximately 17 miles. Continue on US 64E for another 30 miles. Take the U.S. Route 301 Bypass and then U.S. Route 301 (US 301) north into Battleboro. Make a right onto Battleboro-Leggett Road and then turn left onto Morning Star Church Road just outside of town. Proceed through Cherry Crossroads and continue for 2.25 miles. The project site is on the left side of Morning Star Church Road and is directly opposite the junction with Benson Farm Road.



Edgemcombe County, North Carolina

Figure 1. Vicinity Map

-  Project Site Location
-  Major Streams and Rivers
-  Municipalities
-  Roads



1:63,360

1 inch equals 1 miles

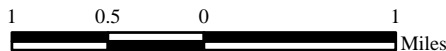




Figure 2. Project Reaches

- Reach 1
- Reach 2
- Reach 3
- Reach 4
- Easement Exception
- Project Site Boundary



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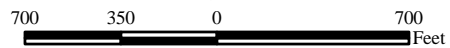


Image Source: NC Statewide Orthoimagery, 2010.

1.3 Project History and Background

Table I. Project Restoration Components Harrell Stream and Wetland Restoration						
Project Segment / Reach ID	Pre- Restoration Feet/Acres	Type	Approach	As - Built Footage or Acreage	Stationing	Stream or Wetland Mitigation Units (SMU/WMU)*
Reach 1	1,224 lf	R	P3	1,226 lf	10+00 - 22+26	1,226 SMU
Reach 2	1,389 lf	R	P2	1,465 lf	22+59 - 36+91	1,432 SMU
Reach 3	1,231 lf	R	P2	1,491 lf	36+91 - 51+82	1,491 SMU
Reach 4	2,494 lf	R	P2	2,698 lf	52+12 - 78+80	2,659 SMU
Wetland	15.0 ac	R	-	15.0 ac	-	15 WMU

R = Restoration

P2 = Priority 2

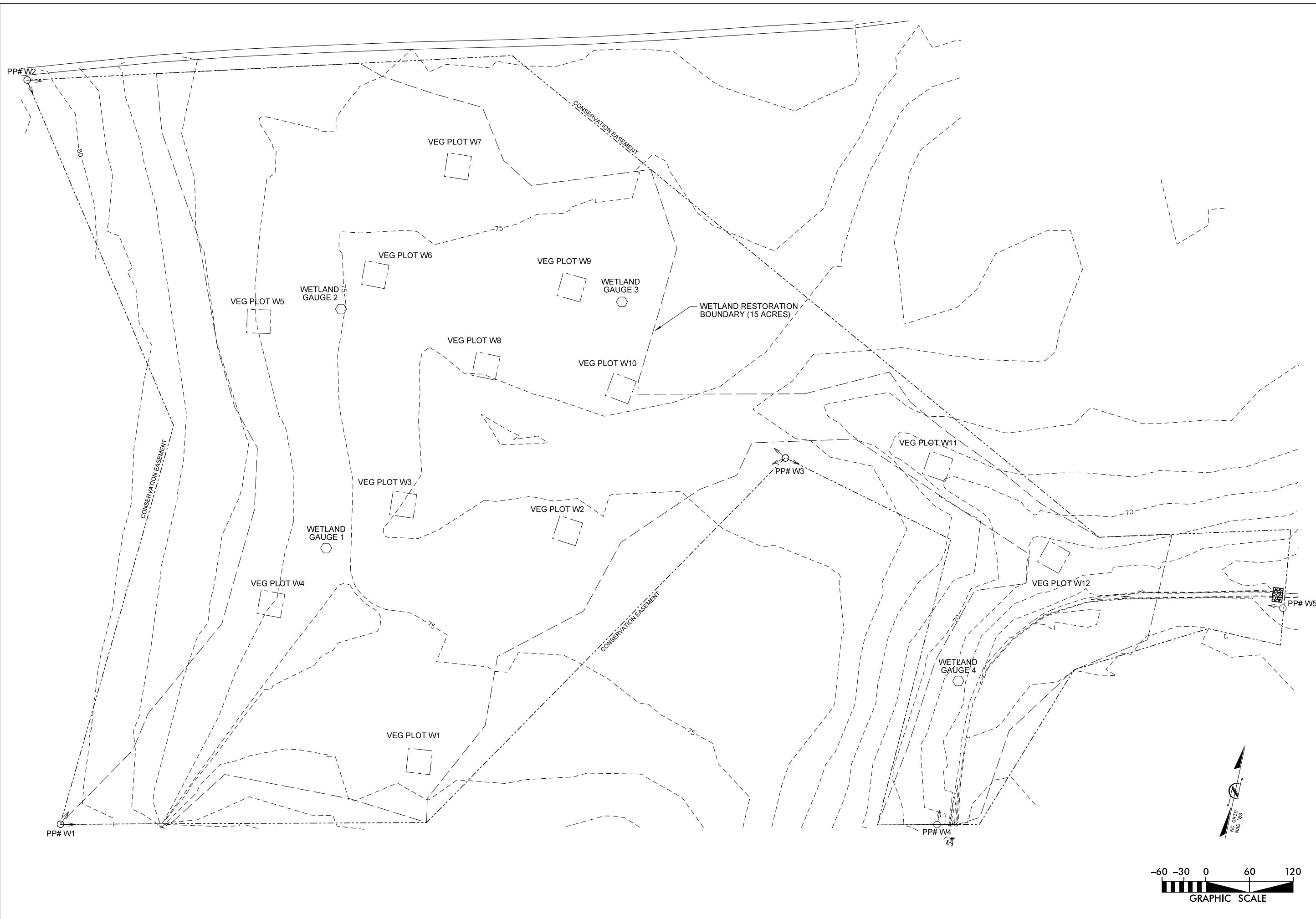
P3 = Priority 3

* Two 30' farm crossings and one 10' irrigation crossing are excluded from the mitigation unit calculations.

Table II. Project Activity and Reporting History Harrell Stream and Wetland Restoration		
Activity or Report	Data Collection Complete	Completion or Delivery
Final Design - Wetland	2005 - 2006	Aug 06
Construction - Wetland	N/A	Oct 06
Planting - Wetland	N/A	Feb 07
Restoration Plan	2005 - 2006	Apr 07
Final Design - Stream	2005 - 2006	Apr 07
Construction - Stream	N/A	Sep 07
Planting - Stream	N/A	Jan 08
Mitigation Plan / As-Built (Year 0 Monitoring - Baseline)	Oct 07 / Jan 08*	Feb 08
Year 1 Monitoring	Oct 08	Nov 08
Year 2 Monitoring	Nov 09	Dec 09
Supplemental Planting	N/A	Feb 10
Year 3 Monitoring	Nov 10	Dec 10
Additional Easement Acquired and Supplemental Planting	N/A	Feb 11
Year 4 Monitoring	Nov 11	Jan 12

Table III. Project Contact Table	
Harrell Stream and Wetland Restoration	
Design Firm	KCI Technologies, Inc. Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Gary Mrynca Phone: (919) 783-9214 Fax: (919) 783-9266
Construction Contractor	Environmental Technologies and Construction Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Ryan McDavitt Phone: (919) 783-9214 Fax: (919) 783-9266
Planting Contractor	H & J Forest Services PO Box 458 Holly Ridge, NC 28445 Phone: (910) 512-6754
Monitoring Performers	
MY-00 - MY-05	KCI Technologies, Inc. Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table IV. Project Background Table	
Harrell Stream and Wetland Restoration	
Project County	Edgecombe County
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terraces
Project River Basin	Tar-Pamlico
USGS HUC for Project and Reference	03020101130090 (UT to Swift Creek)
	03040101080010 (Mitchell River)
	03030002060140 (North Prong Creek)
NCDWQ Sub-basin for Project and Reference	03-03-02 (UT to Swift Creek)
	03-07-02 (Mitchell River)
	03-06-05 (North Prong Creek)
Drainage Area	Wetland
	Stream
	0.09 sq. mi.
	0.60 sq. mi.
Stream Order	Second Order
Watershed Type (Rural, Urban, Developing, etc.)	Rural
Watershed LULC Distribution	Urban
	Ag-Row Crop
	Ag-Livestock
	Forested
	Water/Wetlands
	<1%
	95%
	1%
	4%
	<1%
Watershed impervious cover (%)	<1%
Rosgen Classification of As-built (Stream)	B5c / C5
Cowardin Classification (Wetland)	Palustrine - forested wetland
NCDWQ Classification for Project	NSW, Class C
Within EEP Watershed Plan?	No
Any portion of the project segment upstream of a 303d listed segment?	No
Reasons for 303d Listing or Stressor	N/A
Total project acreage of easement	44.5 Acres
Total planted acreage	43.0 Acres
WRC Class (Warm, Cool, Cold)	warm
Species of concern, endangered etc.	none
Pre-construction Beaver activity?	Historically, according to landowner
Dominant Soil Types	Wetland
	Stream
	Roanoke loam series
	Roanoke loam and Wagram loamy sand series
% of Project Easement Fenced	0%



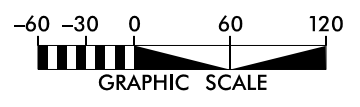
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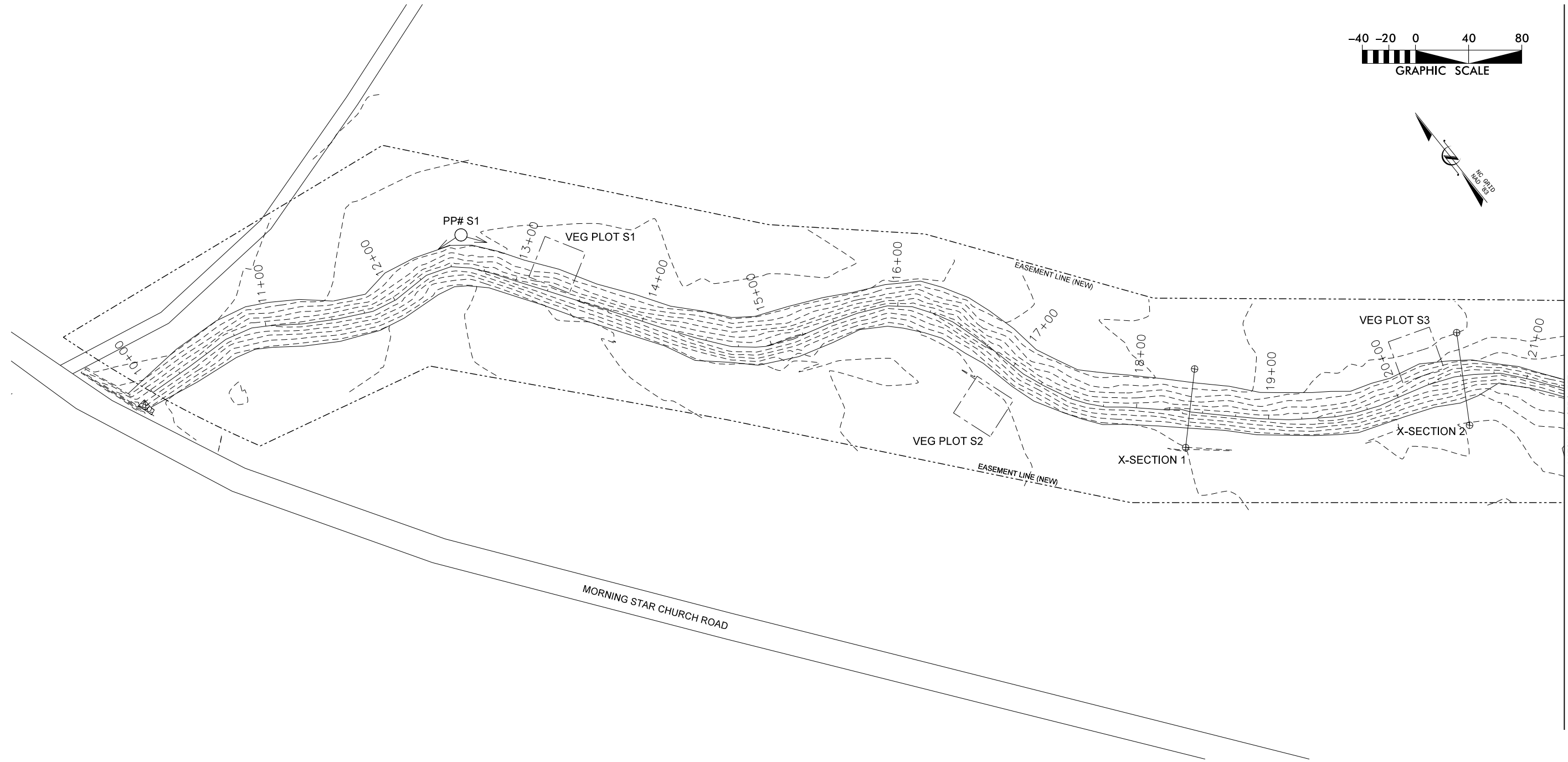


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**HARRELL SITE
 STREAM AND WETLAND RESTORATION**
 EDGEcombe CO., NORTH CAROLINA

DATE: JAN 2012
 SCALE: 1"=120'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 1 OF 7





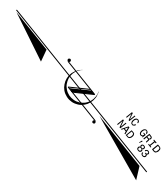
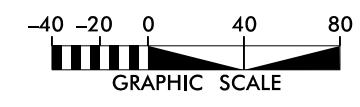
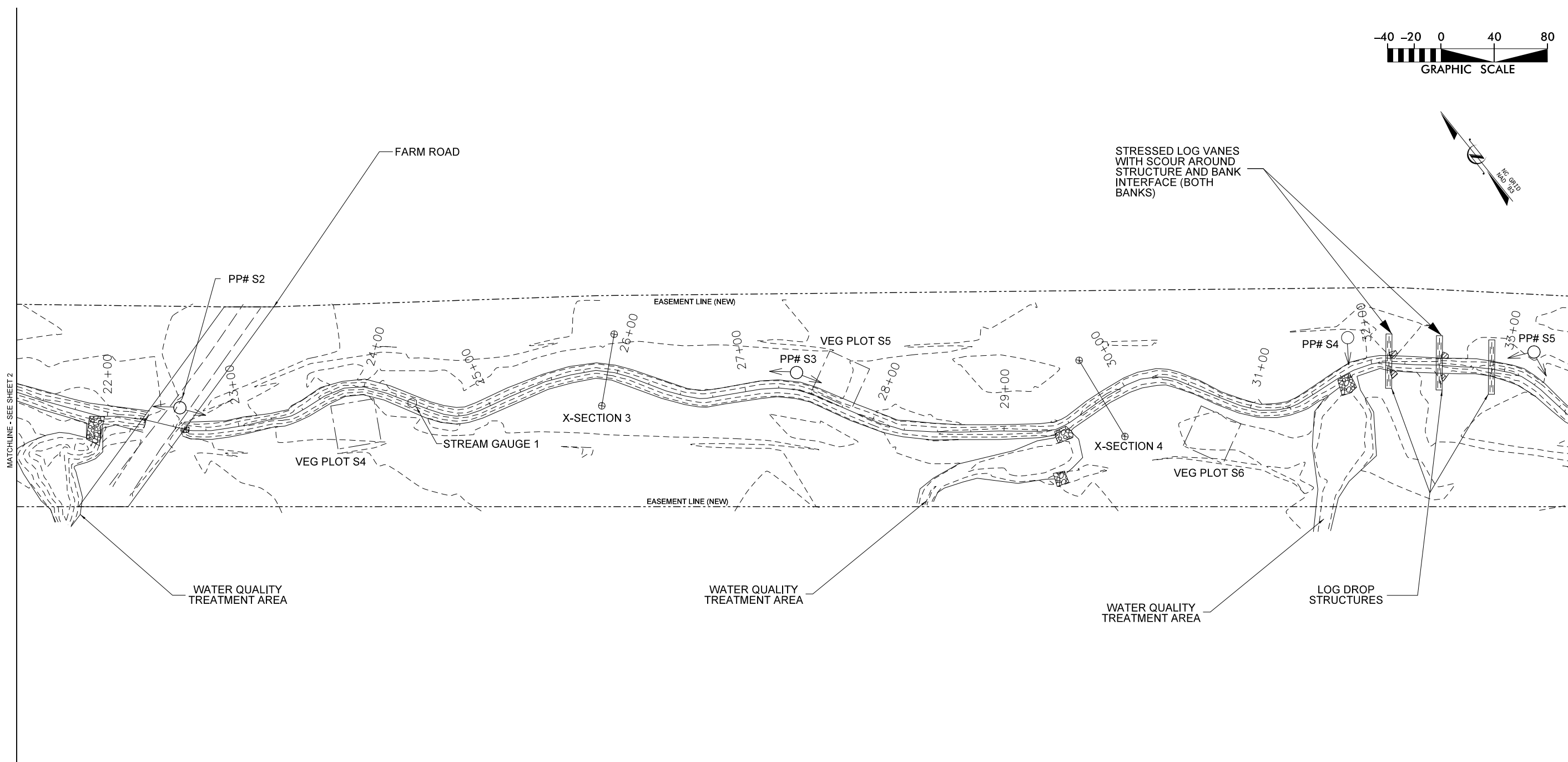
SYMBOL	DESCRIPTION	DATE	APPROVED



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**HARRELL SITE
 STREAM AND WETLAND RESTORATION**
 EDGECOMBE CO., NORTH CAROLINA
 STATION 10+00 TO STATION 21+29

DATE: JAN 2012
 SCALE: 1"=80'
**CURRENT
 CONDITION
 PLAN VIEW**
 SHEET 2 OF 7



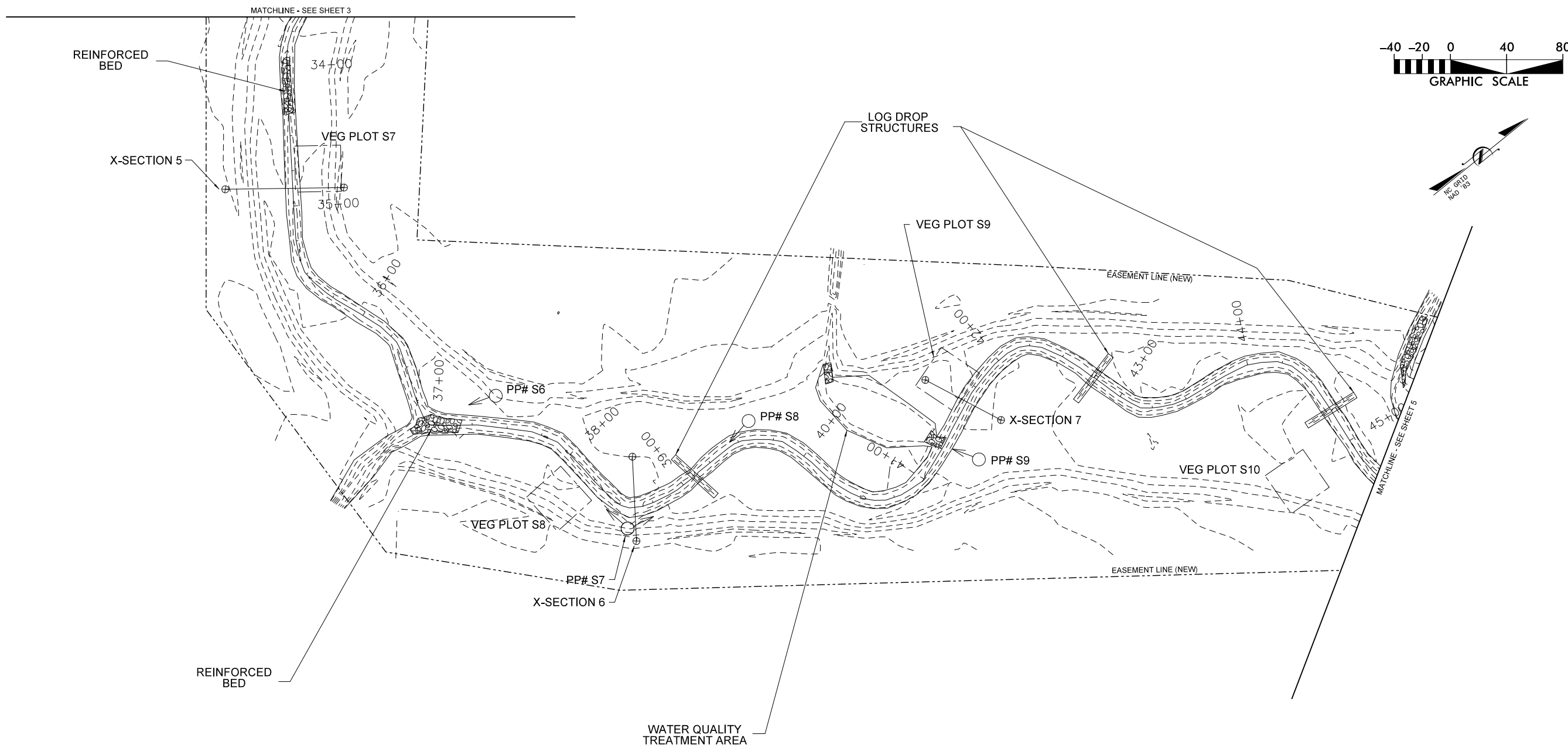
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**HARRELL SITE
STREAM AND WETLAND RESTORATION**
EDGECOMBE CO., NORTH CAROLINA
STATION 21+29 TO STATION 33+64

DATE: JAN 2012
SCALE: 1"=80'
**CURRENT
CONDITION
PLAN VIEW**
SHEET 3 OF 7



SYMBOL	DESCRIPTION	DATE	APPROVED



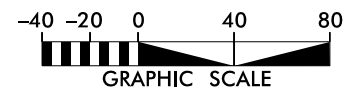
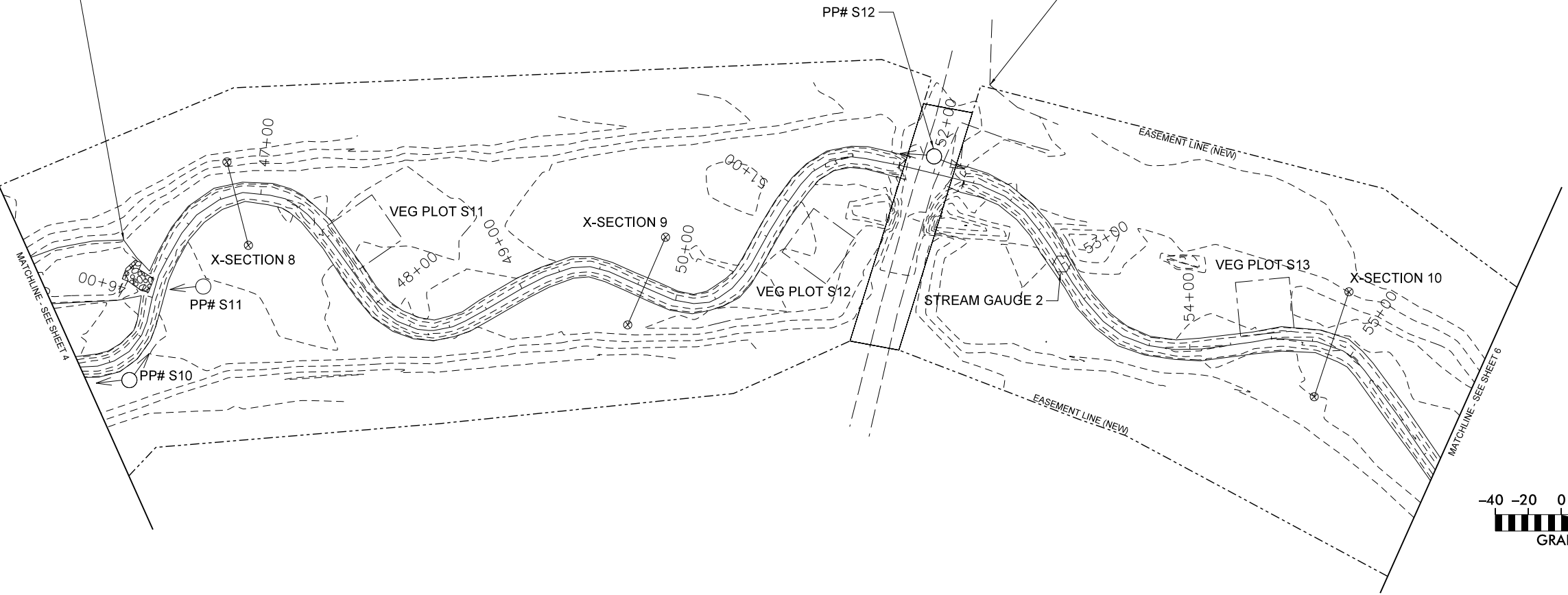
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**HARRELL SITE
 STREAM AND WETLAND RESTORATION**
 EDGECOMBE CO., NORTH CAROLINA
 STATION 33+64 TO STATION 45+31

DATE: JAN 2012
 SCALE: 1"=80'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 4 OF 7

WATER QUALITY TREATMENT AREA

FARM ROAD



SYMBOL	DESCRIPTION	DATE	APPROVED



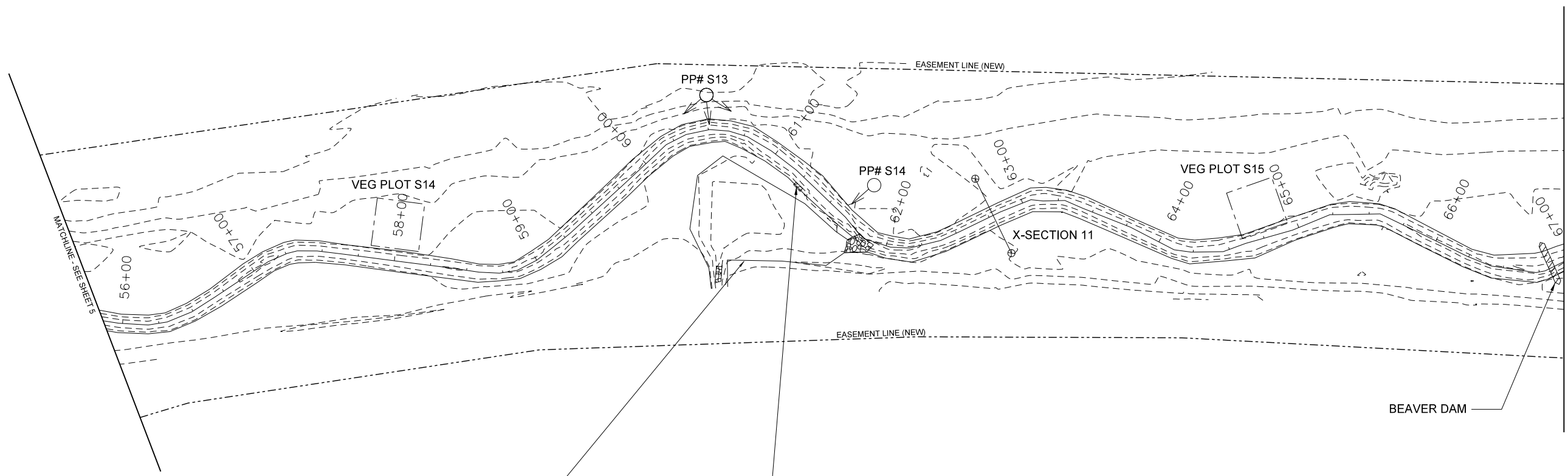
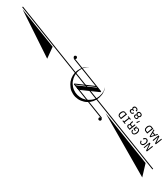
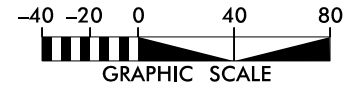
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HARRELL SITE
STREAM AND WETLAND RESTORATION
EDGEcombe CO., NORTH CAROLINA
STATION 45+31 TO STATION 55+86

DATE: JAN 2012
SCALE: 1"=80'

CURRENT
CONDITION
PLAN VIEW

SHEET 5 OF 7



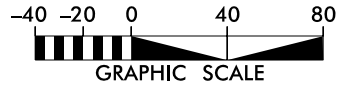
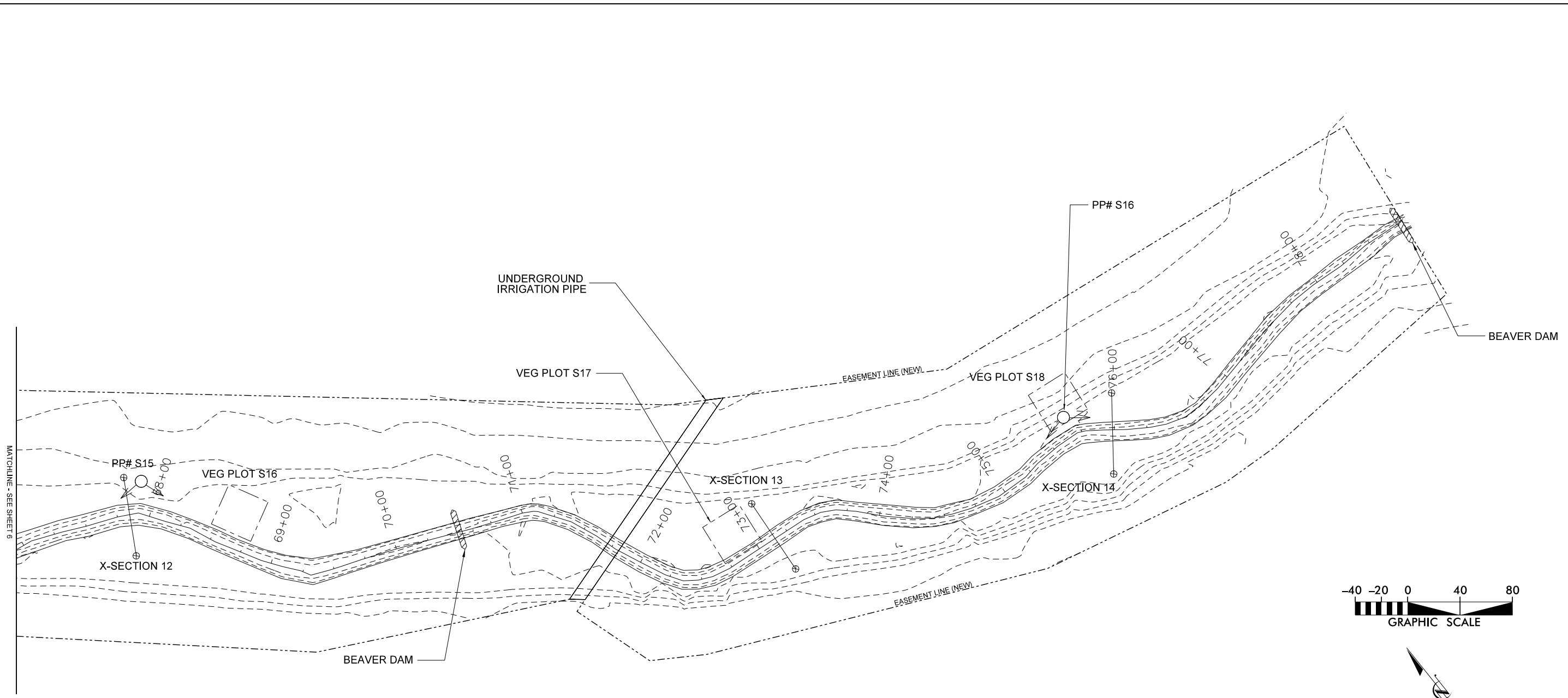
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HARRELL SITE
STREAM AND WETLAND RESTORATION
EDGECOMBE CO., NORTH CAROLINA
STATION 55+86 TO STATION 66+94

DATE: JAN 2012
SCALE: 1"=80'
CURRENT CONDITION PLAN VIEW
SHEET 6 OF 7



MATCHLINE - SEE SHEET 6

SYMBOL	DESCRIPTION	DATE	APPROVED



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**HARRELL SITE
STREAM AND WETLAND RESTORATION**
EDGECOMBE CO., NORTH CAROLINA
STATION 66+94 TO STATION 76+80

DATE: JAN 2012
SCALE: 1"=80'
**CURRENT
CONDITION
PLAN VIEW**
SHEET 7 OF 7

2.0 PROJECT CONDITIONS AND MONITORING RESULTS

2.1 Vegetation Assessment

The planted vegetation on the site is growing well. There are isolated spots of sparse vegetation throughout the stream site due to poor soil being exposed in the floodplain during the Priority 2 restoration. Also, due to backwater from Swift Creek, the downstream portion of the stream buffer floods frequently, drowning out trees planted in this area. Supplemental planting was conducted in the winter of 2009/2010 and 2010/2011.

The low stream flow throughout the summer allows vegetation to become established in the stream channel. This vegetation includes grasses, rushes, cattails, and Asian dayflower (*Murdannia keisak*). During the past four years of monitoring, the vegetation in the channel has not caused any problems such as redirecting flows into streambanks and causing erosion. Overall the channel vegetation has increased the stability of the system and is typical of small stream swamp vegetative communities, which is the target vegetative community for the site.

The wetland continues to show high survivability and vigorous growth of the planted trees.

Some scattered populations of invasive species have been identified in the floodplain area, which include: Chinese lespedeza (*Lespedeza cuneata*) and tropical soda apple (*Solanum viarium*). Asian dayflower was present within the channel in isolated areas. Japanese honeysuckle (*Lonicera japonica*) was observed on the outer edges of the project. Although they are not a problem at this time, these populations will continue to be monitored to determine if invasive control is required in the future.

The monitored vegetation plots within the stream buffer and wetland revealed that the planted vegetation is growing well with 573 and 517 stems/acre, respectively. Only a few monitoring plots have low stem counts. The overall vegetation assessment found the site to be on track to meeting the vegetative success criteria.

The vegetative monitoring results are displayed in Appendix A and in the Current Condition Plan View.

2.2 Stream Assessment

During the 2011 growing season, the stream experienced low flows, which is typical of the summer months. The on-site stream gauge recorded seven bankfull events in June, July, August, and November 2011.

The stream assessment found the stream to be generally stable, with no significant changes from the previous monitoring year. Periodic storm events caused isolated bed degradation in reaches 1 and 2. Some of these areas are visible on the longitudinal profile and cross-section plots. These patterns are typical for a stream like UT to Swift Creek. Its sand bed system is much more mobile than a gravel stream. Because of this, it is expected that patterns of aggradation and degradation are more dynamic within these systems. These dune/anti-dune streams will experience bed variation over time. The stream banks and floodplain experienced little to no erosion throughout the project. The in-stream structures are performing as designed. The water quality treatment areas are stable and retaining water. All of these stream features will continue to be monitored to make sure that any observed changes are within the range of variability found in stable stream systems.

The stream assessment monitoring is described in Appendix B and the Current Conditions Plan View.

2.2.1 Bankfull Events

Table V. Hydrological (Bankfull) Verifications Harrell Stream and Wetland Restoration Site			
Date of Data Collection	Date of Occurrence	Method	Photo Number
10/10/2007	10/10/2007	Stream Gauge	N/A
10/27/2007	10/27/2007	Stream Gauge	N/A
7/6/2008	7/6/2008	Stream Gauge	N/A
6/9/2009	6/9/2009	Stream Gauge	N/A
1/25/2010	1/25/2010	Stream Gauge	N/A
3/29/2010	3/29/2010	Stream Gauge	N/A
9/30/2010	9/30/2010	Stream Gauge	N/A
7/27/2011	6/27/2011	Stream Gauge	N/A
7/27/2011	7/5/2011	Stream Gauge	N/A
7/27/2011	7/6/2011	Stream Gauge	N/A
10/17/2011	7/31/2011	Stream Gauge	N/A
10/17/2011	8/6/2011	Stream Gauge	N/A
10/17/2011	8/27/2011	Stream Gauge	N/A
12/13/2011	11/4/2011	Stream Gauge	N/A

2.2.2 Quantitative Measures Summary Tables

Table VI a. Reach 1 Baseline Stream Summary																	
Harrell Stream and Wetland Restoration																	
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built				
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n	
Bankfull Width (ft)		5.4			1	29.2			35.0		10.0			10.2		1	
Floodprone Width (ft)		>70			1	44			64		>18			22		1	
Bankfull Mean Depth (ft)		1.3			1	2.0			2.1		0.9			1.2		1	
Bankfull Max Depth (ft)		2.0			1	2.7			2.8		1.4			2.1		1	
Bankfull Cross-Sectional Area (ft ²)		7.3			1	62.5			68.8		9.1			12.6		1	
Width/Depth Ratio		4.1			1	13.9			17.5		11.1			8.3		1	
Entrenchment Ratio		13			1	1.3			2.2		>1.8			2.7		1	
Bank Height Ratio		1.8			1						1.0			1.0		1	
Pattern																	
Channel Beltwidth (ft)						100			400		45	65	47	66	85	5	
Radius of Curvature (ft)						70			220		30	80	31	55	65	8	
Rc:Bankfull width (ft/ft)						2.2			12.5		3.0	8.0	3.0	5.4	6.4		
Meander Wavelength (ft)						140			500		50	200	166	260	420	7	
Meander Width Ratio						3			14		4	10	4.6	6.5	8.3		
Profile																	
Riffle Length (ft)																	
Riffle Slope (ft/ft)						0.007			0.027								
Pool Length (ft)																	
Pool Spacing (ft)						115			400								
Substrate and Transport Parameters																	
SC% / Sa% / G% / C% / B% / Be%	100% / - / - / - / - / -					- / 11% / 89% / - / - / -							7% / 85% / 8% / - / - / -				
d16 / d35 / d50 / d84 / d95 (mm)	0.062 / 0.062 / 0.1 / 0.1 / 0.1					2.6 / 5.7 / 7.1 / - / 15.0							0.15 / 0.36 / 0.54 / 1.1 / 6.0				
Additional Reach Parameters																	
Channel length (ft)	1,224										1,265		1,226				
Drainage Area (SM)	0.20										6.00		0.20		0.20		
Rosgen Classification	E5										B4c		B5c		B5c		
Sinuosity	1.00										1.10		1.03		1.06		
Water Surface Slope (ft/ft)	0.0067										0.0084		0.0067		0.0067		
BF slope (ft/ft)													0.0067		0.0068		

Table VI b. Reach 2 Baseline Stream Summary																
Harrell Stream and Wetland Restoration																
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-Built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	5.7	6.1		6.5	2	13.6	15.7		17.8	2	10.0		9.2	10.2	11.5	3
Floodprone Width (ft)	>65			>70	2	325	463		600	2	>30		56	>59	>67	3
Bankfull Mean Depth (ft)	1.2	1.25		1.3	2	1.5	1.6		1.7	2	1.1		1.0	1.1	1.1	3
Bankfull Max Depth (ft)	1.9	1.9		1.9	2	2.6	2.8		3.0	2	1.4		1.6	1.7	1.9	3
Bankfull Cross-Sectional Area (ft ²)	7.5	7.75		8	2	22.6	24.4		26.2	2	11.2		8.8	10.5	12.5	3
Width/Depth Ratio	4.3	4.8		5.3	2	8.2	10.1		11.9	2	9.1		9.3	9.8	10.6	3
Entrenchment Ratio	10.8	11.1		11.4	2	23.8	28.8		33.7	2	>3.0		4.8	5.9	6.8	3
Bank Height Ratio	1.4	1.6		1.8	2	1.0	1.0		1.0	2	1.0		1.0	1.0	1.0	3
Pattern																
Channel Beltwidth (ft)							158				45	60	24	32	41	8
Radius of Curvature (ft)						37	158		40		30	50	30	36	43	14
Rc:Bankfull width (ft/ft)						2.1			2.3		3.0	5.0	2.9	3.5	4.2	
Meander Wavelength (ft)						94			143		100	200	125	157	186	8
Meander Width Ratio							8.9				4.0	10.0	2.4	3.1	4.0	
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)																
Pool Length (ft)																
Pool Spacing (ft)																
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	88% / 12% / - / - / - / -					11% / 89% / - / - / - / -							3% / 81% / 16% / - / - / -			
d16 / d35 / d50 / d84 / d95 (mm)	0.062 / 0.062 / 0.1 / - / -					0.075 / 0.14 / 0.2 / 0.4 / 0.6							0.3 / 0.7 / 0.9 / 3.5 / 9.8			
Additional Reach Parameters																
Channel length (ft)	1,400										1,465		1,465			
Drainage Area (SM)	0.23					3.04					0.23		0.23			
Rosgen Classification	E5					C5					C5		C5			
Sinuosity	1.00					1.28					1.05		1.07			
Water Surface Slope (ft/ft)	0.0023					0.0024					0.0023		0.0021			
BF slope (ft/ft)											0.0023		0.0022			

Table VI c. Reach 3 Baseline Stream Summary

Harrell Stream and Wetland Restoration

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	6.4	7.6	7.7	8.6	4	13.6	15.7		17.8	2	12.0		11.8	12.8	14.1	4
Floodprone Width (ft)	>65			>80	4	325	463		600	2	>30		>50	>57	>61	4
Bankfull Mean Depth (ft)	1.4	1.6	1.5	1.9	4	1.5	1.6		1.7	2	1.4		1.2	1.3	1.4	4
Bankfull Max Depth (ft)	2.4	2.7	2.7	2.8	4	2.6	2.8		3.0	2	2.0		1.9	2.1	2.5	4
Bankfull Cross-Sectional Area (ft ²)	10.4	11.6	12.0	12.1	4	22.6	24.4		26.2	2	16.8		14.4	16.2	19.1	4
Width/Depth Ratio	3.3	5.0	5.3	6.2	4	8.2	10.1		11.9	2	8.6		8.9	10.1	10.8	4
Entrenchment Ratio	7.6	9.5	9.8	10.9	4	23.8	28.8		33.7	2	>2.5		3.8	4.5	5.0	4
Bank Height Ratio	1.5	1.6	1.6	1.7	4	1.0	1.0		1.0	2	1.0		1.0	1.0	1.0	4
Pattern																
Channel Beltwidth (ft)							158				60	100	41	70	107	11
Radius of Curvature (ft)						37	158		40		40	60	21	35	46	13
Rc:Bankfull width (ft/ft)						2.1			2.3		3.0	5.0	1.6	2.7	3.6	
Meander Wavelength (ft)						94			143		120	240	158	183	225	11
Meander Width Ratio							8.9				4.0	10.0	3.2	5.5	8.4	
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)																
Pool Length (ft)																
Pool Spacing (ft)																
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	65% / 35% / - / - / - / -					11% / 89% / - / - / - / -							7% / 81% / 12% / - / - / -			
d16 / d35 / d50 / d84 / d95	0.062 / 0.062 / 0.1 / - / -					0.075 / 0.14 / 0.2 / 0.4 / 0.6							0.2 / 0.5 / 0.8 / 1.9 / 5.9			
Additional Reach Parameters																
Channel length (ft)	1,225										1,560		1,491			
Drainage Area (SM)	0.42					3.04					0.42		0.42			
Rosgen Classification	E5					C5					C5		C5			
Sinuosity	1.00					1.28					1.27		1.23			
Water Surface Slope (ft/ft)	0.0023					0.0024					0.0023		0.0042			
BF slope (ft/ft)											0.0023		0.0042			

Table VI d. Reach 4 Baseline Stream Summary																
Harrell Stream and Wetland Restoration																
Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design		As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Mean	Max	n
Bankfull Width (ft)	8.4	9.5	9.6	10.4	3	13.6	15.7		17.8	2	13.4		13.1	14.2	16.5	5
Floodprone Width (ft)	>65			>70	3	325	463		600	2	>30		>57	>61	>67	5
Bankfull Mean Depth (ft)	1.1	1.5	1.2	2.2	3	1.5	1.6		1.7	2	1.6		1.3	1.4	1.7	5
Bankfull Max Depth (ft)	1.7	2.5	2.7	3.0	3	2.6	2.8		3.0	2	2.3		2.0	2.2	2.5	5
Bankfull Cross-Sectional Area (ft ²)	10.4	13.8	12.7	18.4	3	22.6	24.4		26.2	2	21.6		17.9	20.5	28.2	5
Width/Depth Ratio	3.8	7.0	8.5	8.8	3	8.2	10.1		11.9	2	8.4		8.8	9.9	10.8	5
Entrenchment Ratio	7.1	7.2	7.2	7.3	3	23.8	28.8		33.7	2	>2.2		3.6	4.4	5.0	5
Bank Height Ratio	0.9	1.0	1.0	1.2	3	1.0	1.0		1.0	2	1.0		1.0	1.0	1.0	5
Pattern																
Channel Beltwidth (ft)							158				50	90	32	59	101	18
Radius of Curvature (ft)						37	158		40		40	70	30	50	63	17
Rc:Bankfull width (ft/ft)						2.1			2.3		3.0	5.0	2.1	3.5	4.0	
Meander Wavelength (ft)						94			143		130	260	196	233	300	18
Meander Width Ratio							8.9				4.0	10.0	2.3	4.2	7.1	
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)																
Pool Length (ft)																
Pool Spacing (ft)																
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / B% / Be%	50% / 16% / 34% / - / - / -					11% / 89% / - / - / - / -							7.8% / 77.2% / 15% / - / -			
d16 / d35 / d50 / d84 / d95	0.062 / 0.062 / 0.062 / 3.1 / 4.3					0.075 / 0.14 / 0.2 / 0.4 / 0.6							0.6 / 1.1 / 1.3 / 2.4 / 5.0			
Additional Reach Parameters																
Channel length (ft)	2,500										2,697		2,696			
Drainage Area (SM)	0.61					3.04					0.605		0.605			
Rosgen Classification	E5					C5					C5		C5			
Sinuosity	1.00					1.28					1.08		1.10			
Water Surface Slope (ft/ft)	0.0023					0.0024					0.0023		0.0025			
BF slope (ft/ft)											0.0023		0.0021			

Table VII. Morphology and Hydraulic Monitoring Summary

Harrell Stream and Wetland Restoration

Parameter	Cross-Section 1 Reach 1						Cross-Section 2 Reach 1						Cross-Section 3 Reach 2					
	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	10.2	10.4	10.5	10.8	11.2		12.4	12.7	13.4	13.4	12.8		11.5	13.1	12.4	12.8	13.3	
Floodprone Width (ft)	22	27	30	31	32		25	25	24	20	21		>55	>55	>55	>55	>55	
Bankfull Cross-Sectional Area (ft ²)	12.6	13.4	14.3	14.0	14.7		17.1	12.9	14.3	12.3	13.1		12.5	12.6	11.9	12.6	13.2	
Bankfull Mean Depth (ft)	1.2	1.3	1.4	1.3	1.3		1.4	1.0	1.1	0.9	1.0		1.1	1.0	1.0	1.0	1.0	
Bankfull Maximum Depth (ft)	2.1	2.1	2.1	2.1	2.2		2.2	1.7	1.8	1.3	1.5		1.9	1.9	1.9	1.9	1.9	
Width/Depth Ratio	8.3	8.1	7.7	8.3	8.5		9.0	12.5	12.6	14.5	12.5		10.6	13.7	12.9	13.5	13.3	
Entrenchment Ratio	2.7	2.6	2.9	2.9	2.8		2.8	2.0	1.9	1.5	1.7		>4.4	>4.3	>4.6	>4.3	>4.1	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	11.2	11.5	11.6	11.9	12.3		13.3	13.6	14.2	13.9	13.5		12.2	13.9	13.0	13.5	14.0	
Hydraulic Radius (ft)	1.1	1.2	1.2	1.2	1.2		1.3	0.9	1.0	0.9	1.0		1.0	0.9	0.9	0.9	0.9	
Substrate																		
d50 (mm)	0.5	1.8	0.1	0.8	4.4		1.1	1.8	0.1	1.4	2.1		0.6	2.3	0.4	0.8	0.6	
d84 (mm)	1.1	14.0	1.8	6.4	9.8		1.8	5.3	0.9	1.8	5.0		1.4	4.3	1.3	1.3	4.9	

Table VII. cont. Morphology and Hydraulic Monitoring Summary

Harrell Stream and Wetland Restoration

Parameter	Cross-Section 4 Reach 2						Cross-Section 5 Reach 2						Cross-Section 6 Reach 3					
	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	9.8	11.5	8.8	9.3	9.6		9.2	9.9	8.2	9.2	11.4		14.1	15.0	13.4	12.9	13.4	
Floodprone Width (ft)	>67	>67	>67	>67	>67		56	56	57	60	60		>56	>56	>56	>56	>56	
Bankfull Cross-Sectional Area (ft ²)	10.3	10.8	8.1	8.8	9.2		8.8	10.2	8.8	10.7	10.8		19.1	20.8	18.6	19.5	20.8	
Bankfull Mean Depth (ft)	1.1	0.9	0.9	0.9	1.0		1.0	1.0	1.1	1.2	0.9		1.4	1.4	1.4	1.5	1.5	
Bankfull Maximum Depth (ft)	1.7	1.7	1.5	1.6	1.6		1.6	2.0	1.8	2.1	2.1		2.5	2.7	2.6	2.7	2.8	
Width/Depth Ratio	9.3	12.2	9.6	9.9	10.0		9.6	9.7	7.6	7.8	12.1		10.4	10.8	9.7	8.5	8.7	
Entrenchment Ratio	>7.0	>7.0	>7.0	>7.0	>7.0		6.1	5.7	7.0	6.6	5.2		>4.0	>3.7	>4.2	>4.3	>4.2	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	10.7	12.2	9.4	9.9	10.3		10.0	10.9	9.3	10.3	12.5		15.2	16.3	14.7	14.4	15.0	
Hydraulic Radius (ft)	1.0	0.9	0.9	0.9	0.9		0.9	0.9	0.9	1.0	0.9		1.3	1.3	1.3	1.4	1.4	
Substrate																		
d50 (mm)	1.3	3.4	0.1	0.1	0.2		0.9	0.8	0.1	0.1	0.1		0.6	0.2	0.1	0.1	0.6	
d84 (mm)	4.4	6.2	1.2	0.2	2.4		4.6	3.8	0.3	0.1	0.3		2.0	7.7	1.0	0.1	8.9	

**Table VII. cont. Morphology and Hydraulic Monitoring Summary
Harrell Stream and Wetland Restoration**

Parameter	Cross-Section 7 Reach 3						Cross-Section 8 Reach 3						Cross-Section 9 Reach 3					
	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	12.1	12.0	13.0	12.4	12.7		13.0	11.9	11.0	11.2	12.1		11.8	12.4	11.9	11.6	12.1	
Floodprone Width (ft)	>61	>61	>61	>61	>61		>50	>50	>50	>50	>50		>58	>58	>58	>58	>58	
Bankfull Cross-Sectional Area (ft ²)	14.4	16.2	18.5	18.2	18.2		15.6	15.8	13.2	11.2	14.2		15.6	15.2	14.3	14.4	15.0	
Bankfull Mean Depth (ft)	1.2	1.4	1.4	1.5	1.4		1.2	1.3	1.2	1	1.2		1.3	1.2	1.2	1.2	1.2	
Bankfull Maximum Depth (ft)	1.9	2.6	2.8	2.8	2.8		1.9	2.0	1.8	1.5	1.9		2.0	2.0	1.9	1.9	2.0	
Width/Depth Ratio	10.2	8.8	9.1	8.4	8.9		10.8	8.9	9.2	10.4	10.3		8.9	10.1	9.9	9.3	9.8	
Entrenchment Ratio	>5.0	>5.0	>5.0	>4.9	>4.8		>4.0	>5.0	>5.0	>4.6	>4.4		>5.0	>5.0	>5.0	>5.0	>4.8	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	12.8	13.2	14.3	14.0	14.2		14.0	12.8	11.9	11.5	13.0		12.8	13.2	12.7	12.4	12.9	
Hydraulic Radius (ft)	1.1	1.2	1.3	1.3	1.3		1.1	1.2	1.1	1.0	1.1		1.2	1.2	1.1	1.2	1.2	
Substrate																		
d50 (mm)	0.8	0.7	0.1	0.1	0.2		1.0	1.0	1.1	0.1	0.1		0.9	0.8	0.6	0.1	0.1	
d84 (mm)	2.0	7.3	0.7	0.1	7.2		1.9	5.5	3.2	0.1	0.1		1.7	1.7	1.0	0.1	0.1	

**Table VII. cont. Morphology and Hydraulic Monitoring Summary
Harrell Stream and Wetland Restoration**

Parameter	Cross-Section 10 Reach 4						Cross-Section 11 Reach 4						Cross-Section 12 Reach 4					
	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	13.5	13.9	12.7	13.1	12.9		14.0	13.3	12.8	12.7	13.3		16.8	17.6	16.1	16.9	17.0	
Floodprone Width (ft)	>67	>67	>67	>67	>67		>57	>57	>57	>57	>57		>61	>61	>61	>61	>61	
Bankfull Cross-Sectional Area (ft ²)	17.9	16.9	14.2	14.0	14.2		18.2	18.7	18.0	17.1	17.8		28.2	27.2	23.4	24.7	25.8	
Bankfull Mean Depth (ft)	1.3	1.2	1.1	1.1	1.1		1.3	1.4	1.4	1.3	1.3		1.7	1.5	1.5	1.5	1.5	
Bankfull Maximum Depth (ft)	2.0	2.0	1.8	1.7	1.8		2.1	2.3	2.2	2.1	2.2		2.5	2.5	2.2	2.3	2.3	
Width/Depth Ratio	10.2	11.5	11.4	12.3	11.7		10.8	9.5	9.1	9.4	9.9		10.0	11.4	11.1	11.6	11.2	
Entrenchment Ratio	>5.0	>5.0	>5.0	>5.0	>4.8		>4.0	>4.0	>4.0	>4.0	>4.0		>4.0	>4.0	>4.0	>4.0	>3.6	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	14.3	14.7	13.3	13.7	13.5		15.0	14.4	13.9	13.6	14.3		17.8	18.7	17.1	18.0	18.0	
Hydraulic Radius (ft)	1.2	1.2	1.1	1.0	1.0		1.2	1.3	1.3	1.3	1.3		1.6	1.5	1.4	1.4	1.4	
Substrate																		
d50 (mm)	1.0	2.0	0.1	0.1	0.1		1.4	1.6	0.1	0.3	0.3		1.4	0.9	1.3	0.1	0.4	
d84 (mm)	2.6	4.2	3.0	0.1	0.9		2.0	5.9	1.6	0.6	1.1		3.0	2.7	2.8	0.1	0.9	

Table VII. cont. Morphology and Hydraulic Monitoring Summary												
Harrell Stream and Wetland Restoration												
Parameter	Cross-Section 13 Reach 4						Cross-Section 14 Reach 4					
	MY0	MY1	MY2	MY3	MY4	MY5	MY0	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	13.1	13.4	13.3	13.3	13.4		13.6	14.0	13.8	14.2	15.0	
Floodprone Width (ft)	>60	>60	>60	>60	>60		>62	>62	>62	>62	>62	
Bankfull Cross-Sectional Area (ft ²)	19.4	20.0	18.4	18.5	19.5		19.0	20.5	19.1	20.3	21.0	
Bankfull Mean Depth (ft)	1.5	1.5	1.4	1.4	1.5		1.4	1.5	1.4	1.4	1.4	
Bankfull Maximum Depth (ft)	2.4	2.3	2.3	2.1	2.2		2.1	2.3	2.2	2.2	2.3	
Width/Depth Ratio	8.8	8.9	9.6	9.6	9.2		9.7	9.6	10.0	9.9	10.7	
Entrenchment Ratio	>4.0	>4.0	>4.0	>4.0	>4.0		>4.0	>4.0	>4.0	>4.0	>3.9	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Wetted Perimeter (ft)	14.1	14.3	14.4	14.3	14.4		14.5	15.1	15.6	15.2	16.0	
Hydraulic Radius (ft)	1.4	1.4	1.3	1.3	1.4		1.3	1.4	1.2	1.3	1.3	
Substrate												
d50 (mm)	1.5	1.6	1.1	0.7	0.4		1.3	0.1	0.1	0.6	0.2	
d84 (mm)	2.6	4.7	1.8	0.9	5.8		1.8	0.4	0.1	0.9	0.5	

2.3 Wetland Assessment

The maximum number of consecutive days that the groundwater was within 12 inches of the surface was determined for each groundwater gauge. This number was converted into a percentage of the 223-day growing season. Table 5 presents the hydrological monitoring results for 2011. The wetland wells used to monitor site hydrology were installed in the spring of 2007. During the fourth year of monitoring wetland hydrology was achieved at all of the wells on the site (Table 5). Based on these data, the site has exceeded the minimum duration of 12 consecutive days with the water table within 12 inches of the soil surface for the 2011 growing season (Appendix B). Climatic data for the 2011 growing season were analyzed in comparison to historical data to determine whether 2011 was a normal year in terms of climatic conditions. The historical data were collected from the NRCS, Water and Climate Center, "Climate Analysis for Wetlands by County" website. This evaluation concluded that 2011 was an average to below average year for rainfall during the growing season. Rainfall was within the 30th to 70th percentiles for the months of March, May, July, September, and October. Rainfall was less than the 30th percentile threshold in January, February, April, June and November, and was greater than the 70th percentile threshold in August. (Appendix B).

2.3.1 Wetland Criteria Attainment Tables

Well #	Hydroperiod					Max. No. of Consecutive Days	Dates Meeting Success
	<5%	5% - 8%	8% - 12.5%	>12.5%	Actual %		
1			X		9.4%	21	3/30-4/20
2				X	18.8%	42	3/20-5/1
3		X			7.2%	16	8/27-9/11
4		X			7.2%	16	3/30-4/15

Well #	Pre-Restoration	Year 1	Year 2	Year 3	Year 4	Year 5
1	<5%	6.8%	9.8%	8.1%	9.4%	
2	<5%	16.5%	12.4%	9.4%	18.8%	
3	<5%	6.8%	9.8%	8.5%	7.2%	
4	<5%	13.7%	12.0%	8.5%	7.2%	

3.0 SUCCESS CRITERIA

The stream is functioning as designed and has not developed any significant problems. The changes that are visible in the monitored cross-sections and profiles indicate adjustment of the stream due to its sand bed. Any feature changes will be tracked to see if the stream is moving beyond its expected variability. With multiple bankfull events since construction, the stream is on track to meeting the success criterion of at least two bankfull events occurring in separate years over the course of the monitoring period.

The hydrology data in Section 2.3 indicates that the wetland is on track to meeting the success criterion of having the groundwater continuously within 12" of the ground surface for 5% of the growing season.

The planted vegetation has been doing well, with some plots experiencing more mortality than others. This mortality can be attributed to normal losses after the initial planting as well as to the effects of a drought soon after planting. The low planted stem density areas on the stream floodplain are mostly caused by the poor soil quality in these areas and periods of flooding in the lower stream reaches. The

supplemental planting over the past years has increased the number of woody stems in these areas. Some invasive species have been identified on the site, which include Chinese lespedeza (*Lespedeza cuneata*), Japanese honeysuckle (*Lonicera japonica*), tropical soda apple (*Solanum viarium*) and Asian dayflower (*Murdannia keisak*). The exotic vegetation is not widespread across the project, but these populations will continue to be monitored to determine if control measures will be required in the future. The vegetation is on track to meeting the success criteria in the stream and wetland for the fourth year of monitoring.

Appendix A

Vegetation Data

**Table A1. Riparian Buffer Stem Density and Species Count by Plot
Harrell Stream and Wetland Restoration**

Plot Number	River Birch <i>Betula nigra</i>	American Beautyberry <i>Callicarpa americana</i>	Shagbark Hickory <i>Carya ovata</i>	Sugarberry <i>Celtis laevigata</i>	Silky Dogwood <i>Cornus amomum</i>	Persimmon <i>Diospyros virginiana</i>	Green Ash <i>Fraxinus pennsylvanica</i>	Sycamore <i>Platanus occidentalis</i>	Southern Red Oak <i>Quercus falcata</i>	Swamp Chestnut Oak <i>Quercus michauxii</i>	Willow Oak <i>Quercus phellos</i>	Black Willow <i>Salix nigra</i>	Elderberry <i>Sambucus canadensis</i>	Bald Cypress <i>Taxodium distichum</i>	Cherrybark Oak <i>Quercus pagoda</i>	Total (Year 4)	Density-Year 4 (Stems/Acre)
S1					6	1			3		2				1	13	520
S2		4	3						1						1	9	360
S3		2	1		4	6					1		5		1	20	800
S4		2		4						3	3					12	480
S5	4			1	8					4	2		1			20	800
S6	2	2								4						8	320
S7		7		3	7				1	3	4		2			27	1,080
S8		5									1					6	240
S9	4				4	5				2	3	3				21	840
S10				1		1		4			2					8	320
S11		3		2	6	2			1	3	1	1				19	760
S12	5	1		1				1								8	320
S13		4		2	2		1	1		4						14	560
S14	2	2				7				2						13	520
S15	4	4		2	9			3		1						23	920
S16	1	2				1		1		4						9	360
S17				1		1	3			3			2			10	400
S18	4			4			8				2					18	720
Average Density																573	

**Table A2. Wetland Stem Density and Species Count by Plot
Harrell Stream and Wetland Restoration**

Plot Number	Green Ash <i>Fraxinus pennsylvanica</i>	American Beautyberry <i>Callicarpa americana</i>	Water Hickory <i>Carya aquatica</i>	Buttonbush <i>Cephalanthus occidentalis</i>	Cherrybark Oak <i>Quercus pagoda</i>	Swamp Chestnut Oak <i>Quercus michauxii</i>	Willow Oak <i>Quercus phellos</i>	Laurel Oak <i>Quercus laurifolia</i>	Bald Cypress <i>Taxodium distichum</i>	Total (Year 4)	Density- Year 4 (Stems/Acre)
W1	4			1	1	1		2		9	360
W2				2	5		2	1		10	400
W3				1	1	1			6	9	360
W4	2			4	5	1	2	1		15	600
W5	4				1	4			4	13	520
W6				5	3		5		3	16	640
W7					2	3	4			9	360
W8			9	3	1				3	16	640
W9	2			1	4	1	1	3		12	480
W10	3			4	2			4	1	14	560
W11		1	4	2					6	13	520
W12			5	4		1			9	19	760
										Average Density	517

Table A3. Riparian Buffer Vegetation History (stems/acre)								
Harrell Stream and Wetland Restoration								
Plot Number	MY-00	MY-01	MY-02	MY-03	MY-04		MY-05	
	Planted	Planted	Planted	Planted	Planted	Total	Planted	Total
S1	1,120	640	560	440	520	560		
S2	720	360	400*	360	360	360		
S3	1,120	880	880	840	800	800		
S4	480	560*	560	520	480	640		
S5	1,200	840	800	800	800	840		
S6	480	280	280	280	320	680		
S7	1,120	1,120	1,120	1,080	1,080	1,920		
S8	480	320	240	240	240	960		
S9	1,240	920	920	880	840	1,440		
S10	600	360	360	360	320	1,000		
S11	880	760	800*	800	760	1,160		
S12	600	440	360	360	320	760		
S13	1,160	840	800	720	560	1,200		
S14	640	520	520	520	520	840		
S15	1,120	1,000	960	960	920	1,200		
S16	600	480	480	480	360	800		
S17	880	200	200	400**	400**	440		
S18	680	320	280	720**	720**	760		

*Uncounted plants during baseline and MY01 were added to total

** Includes plants from supplemental planting

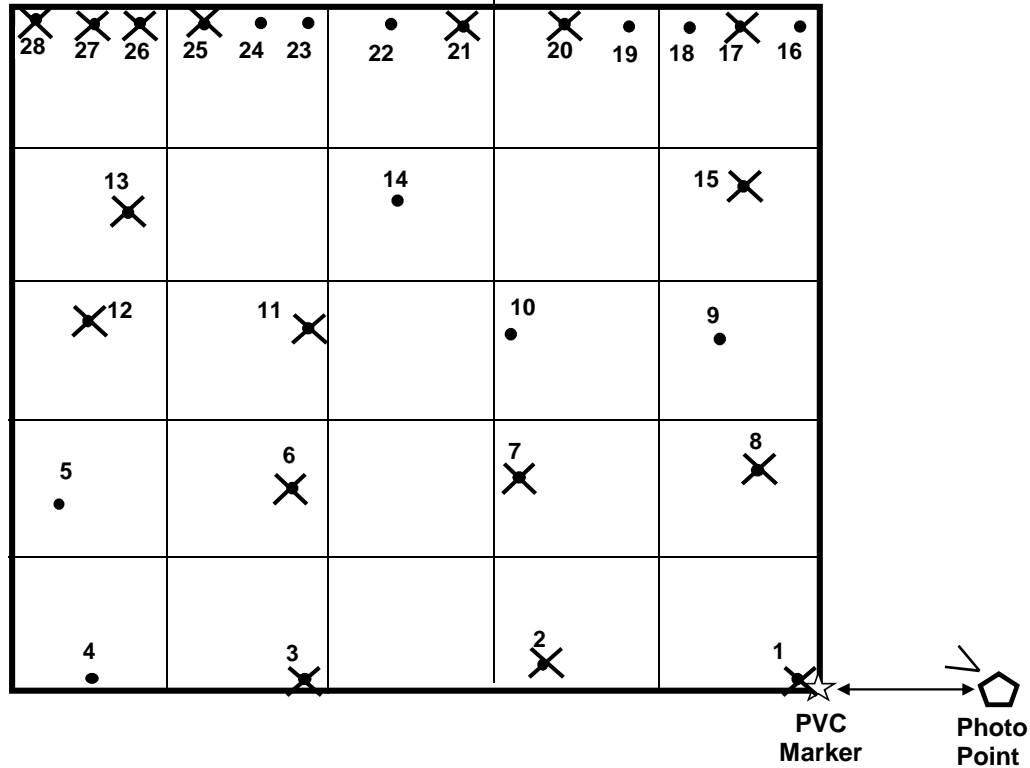
Plot Number	MY-00	MY-01	MY-02	MY-03	MY-04		MY-05	
	Planted	Planted	Planted	Planted	Planted	Total	Planted	Total
W1	520	400	400	400	360	400		
W2	640	360	360	360	400	400		
W3	600	400	400	360	360	440		
W4	800	640	640	640	600	680		
W5	600	560	560	520	520	680		
W6	720	600	600	600	640	680		
W7	680	240	240	320	360	520		
W8	760	680	680	640	640	680		
W9	640	560	560	520	480	520		
W10	600	600	600	560	560	1,240		
W11	680	560	560	560	520	760		
W12	1,080	800	800	760	760	1,120		

Vegetation Monitoring Data Sheets

Vegetation Monitoring Worksheet

Site: Harrell Plot: S1 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	<i>Quercus sp.</i>			Dead
2	Cherrybark Oak (<i>Quercus pagoda</i>)	0.42	3	Insect damage
3	Southern Red Oak (<i>Quercus falcata</i>)			Dead
4	Southern Red Oak (<i>Quercus falcata</i>)	2.17	4	
5	Southern Red Oak (<i>Quercus falcata</i>)	1.01	3	
6	Persimmon (<i>Diospyros virginiana</i>)			Missing
7	Unknown			Dead
8	Persimmon (<i>Diospyros virginiana</i>)	2.15	4	Insect damage
9	Willow Oak (<i>Quercus phellos</i>)	2.56	4	
10	Willow Oak (<i>Quercus phellos</i>)	2.27	4	Rodent damage
11	Willow Oak (<i>Quercus phellos</i>)			Dead
12	Unknown			Dead
13	Southern Red Oak (<i>Quercus falcata</i>)			Dead
14	Southern Red Oak (<i>Quercus falcata</i>)	0.61	2	Rodent damage
15	Southern Red Oak (<i>Quercus falcata</i>)			Dead
16	Silky Dogwood (<i>Cornus amomum</i>)	0.39	3	Live Stake, deer browse
17	Silky Dogwood (<i>Cornus amomum</i>)			Live Stake, missing
18	Silky Dogwood (<i>Cornus amomum</i>)	0.71	3	Live stake, deer browse
19	Silky Dogwood (<i>Cornus amomum</i>)	0.49	3	Live stake, deer browse
20	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, missing
21	Elderberry (<i>Sambucus canadensis</i>)			Dead
22	Silky Dogwood (<i>Cornus amomum</i>)	1.51	3	Live stake, deer browse, resprout
23	Silky Dogwood (<i>Cornus amomum</i>)	0.66	3	Live stake, deer browse
24	Silky Dogwood (<i>Cornus amomum</i>)	0.36	2	Live stake, deer browse, resprout
25	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
26	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
27	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
28	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	46.2%
Southern Red Oak (<i>Quercus falcata</i>)	23.1%
Willow Oak (<i>Quercus phellos</i>)	15.4%
Cherrybark Oak (<i>Quercus pagoda</i>)	7.7%
Persimmon (<i>Diospyros virginiana</i>)	7.7%

Density:

Total Number of Trees 13 / 0.025 acres = 520 stems / acre

Total Number of Desirable Stems* 14 / 0.025 acres = 560 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 13 / 28 trees x 100 = 46 % survivability



3rd Year Monitoring



4th Year Monitoring

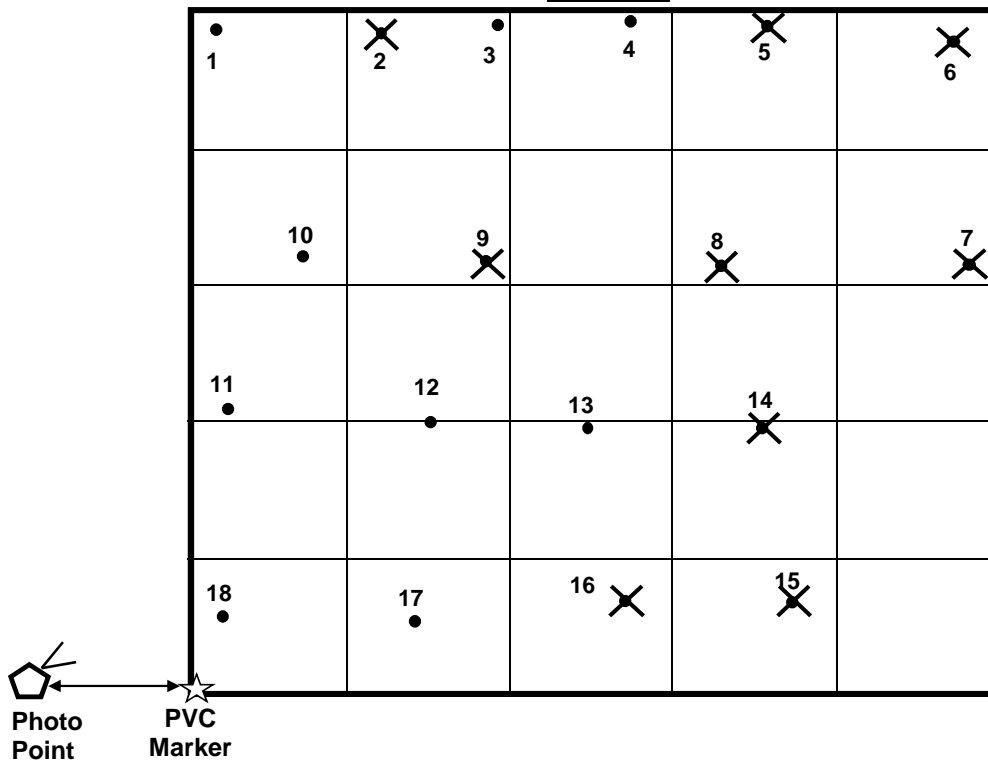
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Persimmon (<i>Diospyros virginiana</i>)	1			
Total	1			

Vegetation Monitoring Worksheet

Site: Harrell Plot: S2 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	American Beautyberry (<i>Callicarpa americana</i>)	0.51	4	Resprout
2	American Beautyberry (<i>Callicarpa americana</i>)			Dead
3	Cherrybark Oak (<i>Quercus pagoda</i>)	0.15	2	Resprout
4	Southern Red Oak (<i>Quercus falcata</i>)	0.23	2	Deer browse
5	American Beautyberry (<i>Callicarpa americana</i>)			Dead
6	American Beautyberry (<i>Callicarpa americana</i>)			Dead
7	Willow Oak (<i>Quercus phellos</i>)			Dead
8	American Beautyberry (<i>Callicarpa americana</i>)			Dead
9	<i>Quercus sp.</i>			Dead
10	American Beautyberry (<i>Callicarpa americana</i>)	1.15	4	
11	Shagbark Hickory (<i>Carya ovata</i>)	0.33	3	Resprout
12	Shagbark Hickory (<i>Carya ovata</i>)	0.39	2	
13	Shagbark Hickory (<i>Carya ovata</i>)	0.10	3	Resprout
14	Southern Red Oak (<i>Quercus falcata</i>)			Dead
15	<i>Quercus sp.</i>			Dead
16	Willow Oak (<i>Quercus phellos</i>)			Dead
17	American Beautyberry (<i>Callicarpa americana</i>)	1.35	4	
18	American Beautyberry (<i>Callicarpa americana</i>)	1.27	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Southern Red Oak (<i>Quercus falcata</i>)	11.1%
Shagbark Hickory (<i>Carya ovata</i>)	33.3%
American Beautyberry (<i>Callicarpa americana</i>)	44.4%
Cherrybark Oak (<i>Quercus pagoda</i>)	11.1%

Density:

Total Number of Trees 9 / 0.025 acres = 360 stems / acre

Total Number of Desirable Stems* 9 / 0.025 acres = 360 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 9 / 18 trees x 100 = 50 % survivability



3rd Year Monitoring



4th Year Monitoring

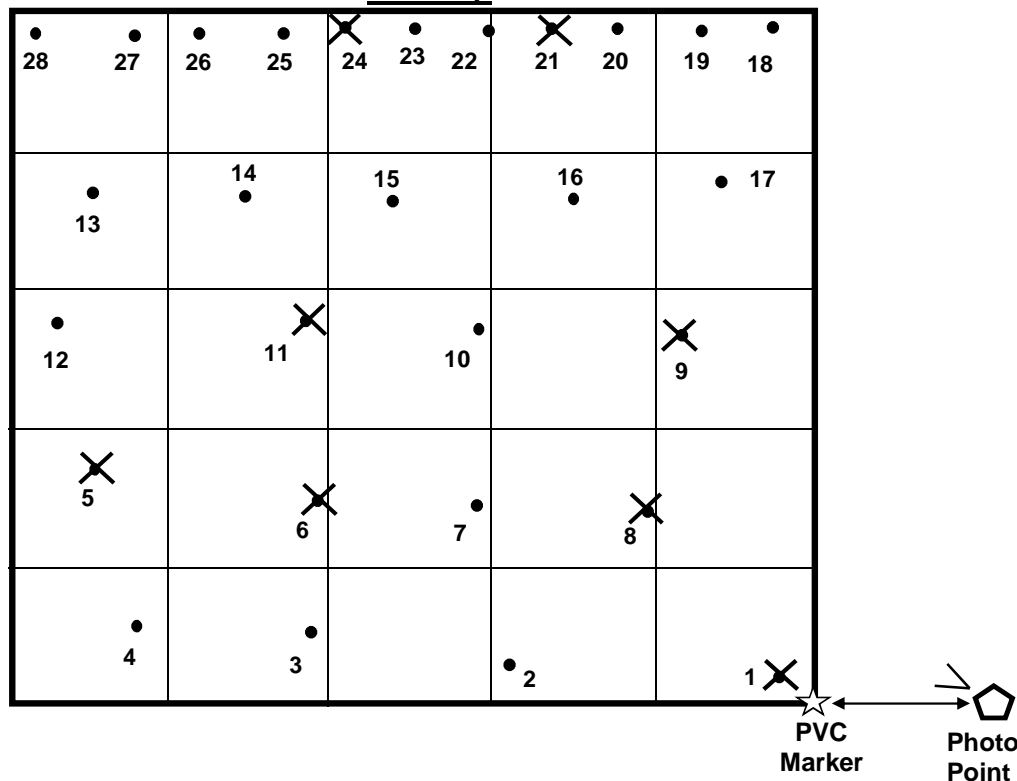
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Total				

Vegetation Monitoring Worksheet

Site: Harrell Plot: S3 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Willow Oak (<i>Quercus phellos</i>)			Dead
2	American Beautyberry (<i>Callicarpa americana</i>)	1.51	4	Insect
3	Persimmon (<i>Diospyros virginiana</i>)	1.90	3	Insect
4	American Beautyberry (<i>Callicarpa americana</i>)	1.15	4	Insect
5	Persimmon (<i>Diospyros virginiana</i>)			Dead
6	Shagbark Hickory (<i>Carya ovata</i>)			Dead
7	Shagbark Hickory (<i>Carya ovata</i>)	0.37	4	Insect
8	Shagbark Hickory (<i>Carya ovata</i>)			Dead
9	Unknown			Dead
10	Willow Oak (<i>Quercus phellos</i>)	3.30	4	
11	Unknown			Dead
12	Persimmon (<i>Diospyros virginiana</i>)	3.30	4	
13	Persimmon (<i>Diospyros virginiana</i>)	1.87	4	
14	Persimmon (<i>Diospyros virginiana</i>)	0.52	3	Resprout
15	Persimmon (<i>Diospyros virginiana</i>)	2.47	4	
16	Persimmon (<i>Diospyros virginiana</i>)	2.50	4	
17	Cherrybark Oak (<i>Quercus pagoda</i>)	1.90	3	
18	Elderberry (<i>Sambucus canadensis</i>)	2.18	4	Live stake
19	Elderberry (<i>Sambucus canadensis</i>)	2.30	4	Live stake
20	Silky Dogwood (<i>Cornus amomum</i>)	1.78	3	Live stake, deer browse
21	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
22	Elderberry (<i>Sambucus canadensis</i>)	1.72	3	Live stake, deer browse
23	Silky Dogwood (<i>Cornus amomum</i>)	1.61	3	Live stake, deer browse
24	Elderberry (<i>Sambucus canadensis</i>)			Dead
25	Elderberry (<i>Sambucus canadensis</i>)	1.72	4	Live stake
26	Elderberry (<i>Sambucus canadensis</i>)	1.96	3	Live stake, leaf wilt
27	Silky Dogwood (<i>Cornus amomum</i>)	0.96	2	Live stake, deer browse, insect
28	Silky Dogwood (<i>Cornus amomum</i>)	0.93	3	Live stake, deer browse, insect

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Elderberry (<i>Sambucus canadensis</i>)	25.0%
Silky Dogwood (<i>Cornus amomum</i>)	20.0%
American Beautyberry (<i>Callicarpa americana</i>)	10.0%
Willow Oak (<i>Quercus phellos</i>)	5.0%
Persimmon (<i>Diospyros virginiana</i>)	30.0%
Cherrybark Oak (<i>Quercus pagoda</i>)	5.0%
Shagbark Hickory (<i>Carya ovata</i>)	5.0%

Density:

Total Number of Trees 20 / 0.025 acres = 800 stems / acre

Total Number of Desirable Stems* 20 / 0.025 acres = 800 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 20 / 28 trees x 100 = 71 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

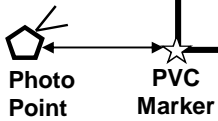
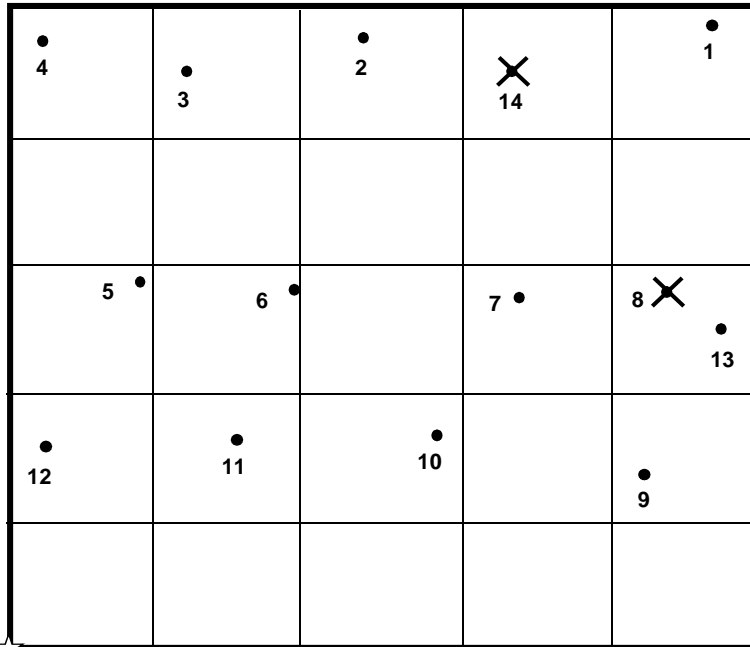
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Total				

Vegetation Monitoring Worksheet

Site: Harrell Plot: S4 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	American Beautyberry (<i>Callicarpa americana</i>)	0.57	4	
2	Willow Oak (<i>Quercus phellos</i>)	0.87	4	
3	Willow Oak (<i>Quercus phellos</i>)	1.34	4	
4	Willow Oak (<i>Quercus phellos</i>)	2.77	4	
5	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	3.50	4	
6	Sugarberry (<i>Celtis laevigata</i>)	2.17	3	Insect
7	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.70	3	Insect
8	River Birch (<i>Betula nigra</i>)			Dead
9	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.39	4	
10	Sugarberry (<i>Celtis laevigata</i>)	0.16	2	Resprout
11	Sugarberry (<i>Celtis laevigata</i>)	0.23	1	Deer, main stem died back
12	American Beautyberry (<i>Callicarpa americana</i>)	0.99	3	
13	Sugarberry (<i>Celtis laevigata</i>)	1.61	4	Not counted during baseline monitoring
14	Sugarberry (<i>Celtis laevigata</i>)			Not counted during baseline monitoring.

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
American Beautyberry (<i>Callicarpa americana</i>)	16.7%
Willow Oak (<i>Quercus phellos</i>)	25.0%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	25.0%
Sugarberry (<i>Celtis laevigata</i>)	33.3%

Density:

Total Number of Trees 12 / 0.025 acres = 480 stems / acre

Total Number of Desirable Stems* 16 / 0.025 acres = 640 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 12 / 14 trees x 100 = 86 % survivability*



3rd Year Monitoring



4th Year Monitoring

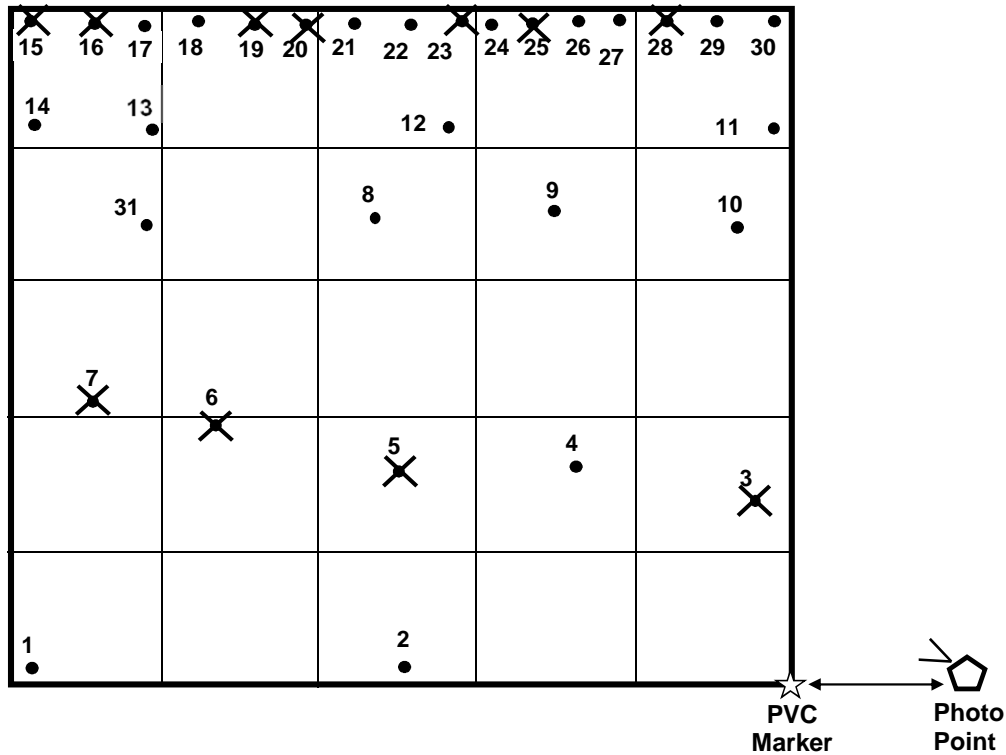
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Cherrybark Oak (<i>Quercus pagoda</i>)	1			
Red Maple (<i>Acer rubrum</i>)			1	
Sweetgum (<i>Liquidambar styraciflua</i>)				1
Black Willow (<i>Salix nigra</i>)		1		1
Loblolly Pine (<i>Pinus taeda</i>)		2		
Total	1	3	1	1

Vegetation Monitoring Worksheet

Site: Harrell Plot: S5 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	River Birch (<i>Betula nigra</i>)	1.20	4	
2	River Birch (<i>Betula nigra</i>)	1.77	4	
3	<i>Quercus</i> sp.			Dead
4	Willow Oak (<i>Quercus phellos</i>)	0.85	3	
5	<i>Quercus</i> sp.			Dead
6	Sugarberry (<i>Celtis laevigata</i>)			Dead
7	<i>Quercus</i> sp.			Dead
8	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.41	4	Top died back
9	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.34	3	Top died back, insect
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.58	3	
11	Willow Oak (<i>Quercus phellos</i>)	1.56	4	
12	River Birch (<i>Betula nigra</i>)	2.35	4	
13	River Birch (<i>Betula nigra</i>)	2.07	4	
14	Sugarberry (<i>Celtis laevigata</i>)	0.92	4	
15	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
16	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
17	Silky Dogwood (<i>Cornus amomum</i>)	0.31	2	Live stake, deer browse
18	Silky Dogwood (<i>Cornus amomum</i>)	0.44	3	Live stake, deer browse
19	Black Willow (<i>Salix nigra</i>)			Live stake, dead
20	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
21	Silky Dogwood (<i>Cornus amomum</i>)	0.72	3	Live stake, deer browse
22	Silky Dogwood (<i>Cornus amomum</i>)	0.23	3	Live stake, resprout
23	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
24	Silky Dogwood (<i>Cornus amomum</i>)	0.30	2	Live stake, top died back
25	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
26	Silky Dogwood (<i>Cornus amomum</i>)	0.62	3	Live stake
27	Silky Dogwood (<i>Cornus amomum</i>)	0.55	3	Live stake, deer browse
28	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
29	Silky Dogwood (<i>Cornus amomum</i>)	0.63	3	Live stake
30	Elderberry (<i>Sambucus canadensis</i>)	0.60	3	Live stake, deer browse
31	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.61	4	Resprout, insect

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	40.0%
Elderberry (<i>Sambucus canadensis</i>)	5.0%
River Birch (<i>Betula nigra</i>)	20.0%
Willow Oak (<i>Quercus phellos</i>)	10.0%
Sugarberry (<i>Celtis laevigata</i>)	5.0%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	20.0%

Density:

Total Number of Trees 20 / 0.025 acres = 800 stems / acre

Total Number of Desirable Stems* 21 / 0.025 acres = 840 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 20 / 31 trees x 100 = 65 % survivability



3rd Year Monitoring



4th Year Monitoring

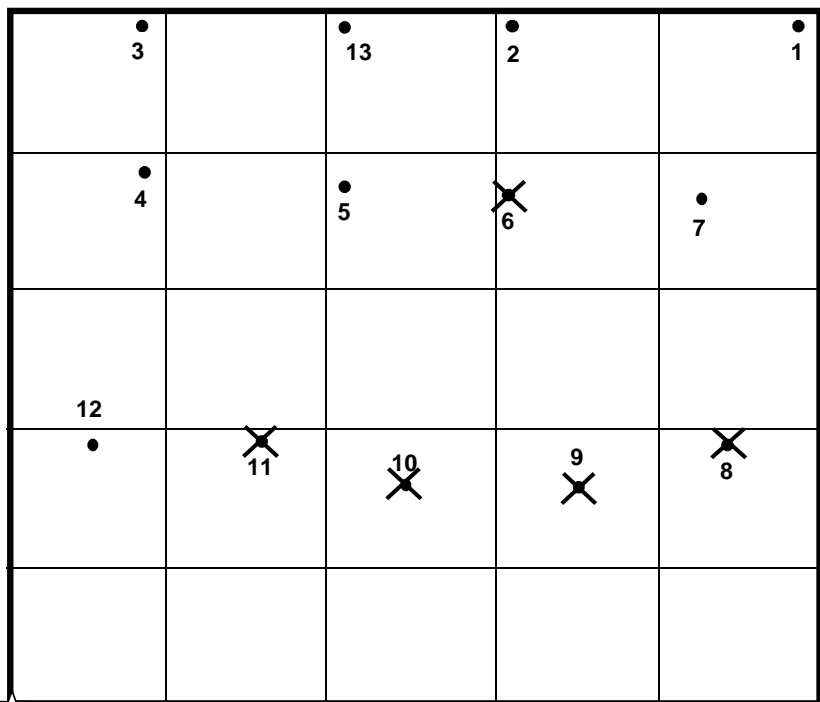
Volunteers:



Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Loblolly Pine (<i>Pinus taeda</i>)	1			
Total	1			

Vegetation Monitoring Worksheet

Site: Harrell Plot: S6 Date: 7/29/2011

Plot Map



 Photo Point
 PVC Marker

ID	Species	Height (m)	Vigor	Comment
1	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.98	4	Deer browse, main top died back
2	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.32	3	Insect damage
3	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.83	4	
4	American Beautyberry (<i>Callicarpa americana</i>)	0.92	3	Deer browse
5	American Beautyberry (<i>Callicarpa americana</i>)	1.06	4	
6	Swamp Chestnut Oak (<i>Quercus michauxii</i>)			Dead
7	River Birch (<i>Betula nigra</i>)	2.54	4	
8	Sugarberry (<i>Celtis laevigata</i>)			Dead
9	Sugarberry (<i>Celtis laevigata</i>)			Dead
10	<i>Quercus sp.</i>			Dead
11	<i>Quercus sp.</i>			Dead
12	River Birch (<i>Betula nigra</i>)	4.20	4	
13	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.75	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
River Birch (<i>Betula nigra</i>)	25.0%
American Beautyberry (<i>Callicarpa americana</i>)	25.0%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	50.0%

Density:

Total Number of Trees 8 / 0.025 acres = 320 stems / acre

Total Number of Desirable Stems* 17 / 0.025 acres = 680 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 8 / 12 trees x 100 = 67 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

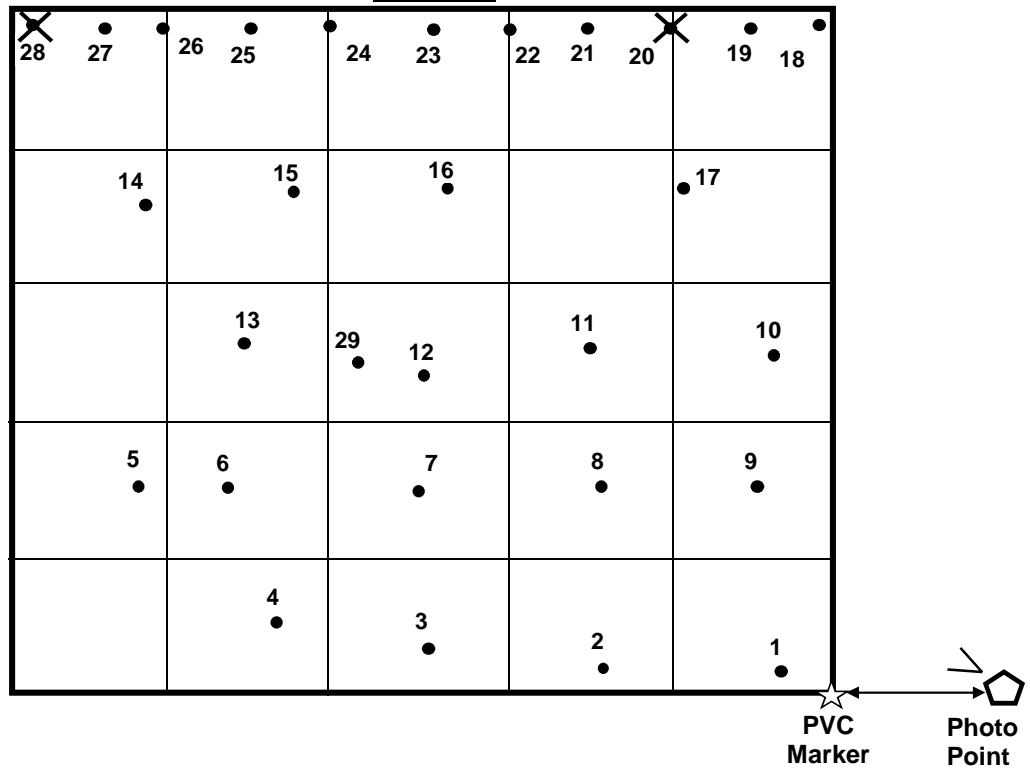
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Black Willow (<i>Salix nigra</i>)	7	1	1	
Total	7	1	2	

Vegetation Monitoring Worksheet

Site: Harrell Plot: S7 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.05	2	Resprout
2	Sugarberry (<i>Celtis laevigata</i>)	0.70	3	Deer browse
3	Sugarberry (<i>Celtis laevigata</i>)	1.49	4	
4	Sugarberry (<i>Celtis laevigata</i>)	1.77	4	
5	Southern Red Oak (<i>Quercus falcata</i>)	1.81	4	
6	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.29	4	
7	American Beautyberry (<i>Callicarpa americana</i>)	0.83	4	
8	American Beautyberry (<i>Callicarpa americana</i>)	0.98	4	
9	American Beautyberry (<i>Callicarpa americana</i>)	1.24	4	
10	Willow Oak (<i>Quercus phellos</i>)	1.41	4	
11	Willow Oak (<i>Quercus phellos</i>)	1.23	4	
12	Willow Oak (<i>Quercus phellos</i>)	0.83	4	
13	Willow Oak (<i>Quercus phellos</i>)	1.31	4	
14	American Beautyberry (<i>Callicarpa americana</i>)	1.81	4	
15	American Beautyberry (<i>Callicarpa americana</i>)	1.37	4	
16	American Beautyberry (<i>Callicarpa americana</i>)	1.41	4	
17	American Beautyberry (<i>Callicarpa americana</i>)	1.33	4	
18	Silky Dogwood (<i>Cornus amomum</i>)	0.79	3	Live stake, deer browse
19	Silky Dogwood (<i>Cornus amomum</i>)	1.24	3	Live stake, deer browse
20	Silky Dogwood (<i>Cornus amomum</i>)			Dead
21	Silky Dogwood (<i>Cornus amomum</i>)	0.61	3	Live stake, deer browse
22	Silky Dogwood (<i>Cornus amomum</i>)	0.78	4	Live stake, deer browse
23	Silky Dogwood (<i>Cornus amomum</i>)	1.17	3	Live stake, deer browse
24	Silky Dogwood (<i>Cornus amomum</i>)	1.26	4	Live stake, deer browse
25	Silky Dogwood (<i>Cornus amomum</i>)	1.25	3	Live stake, deer browse
26	Elderberry (<i>Sambucus canadensis</i>)	0.61	2	Live stake, resprout, deer browse
27	Elderberry (<i>Sambucus canadensis</i>)	1.06	3	Live stake, top died back
28	Elderberry (<i>Sambucus canadensis</i>)			Live stake, missing
29	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.49	3	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	25.9%
Elderberry (<i>Sambucus canadensis</i>)	7.4%
American Beautyberry (<i>Callicarpa americana</i>)	25.9%
Sugarberry (<i>Celtis laevigata</i>)	11.1%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	11.1%
Southern Red Oak (<i>Quercus falcata</i>)	3.7%
Willow Oak (<i>Quercus phellos</i>)	14.8%

Density:

Total Number of Trees 27 / 0.025 acres = 1080 stems / acre

Total Number of Desirable Stems* 48 / 0.025 acres = 1920 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 27 / 29 trees x 100 = 93 % survivability



3rd Year Monitoring



4th Year Monitoring

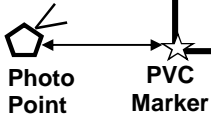
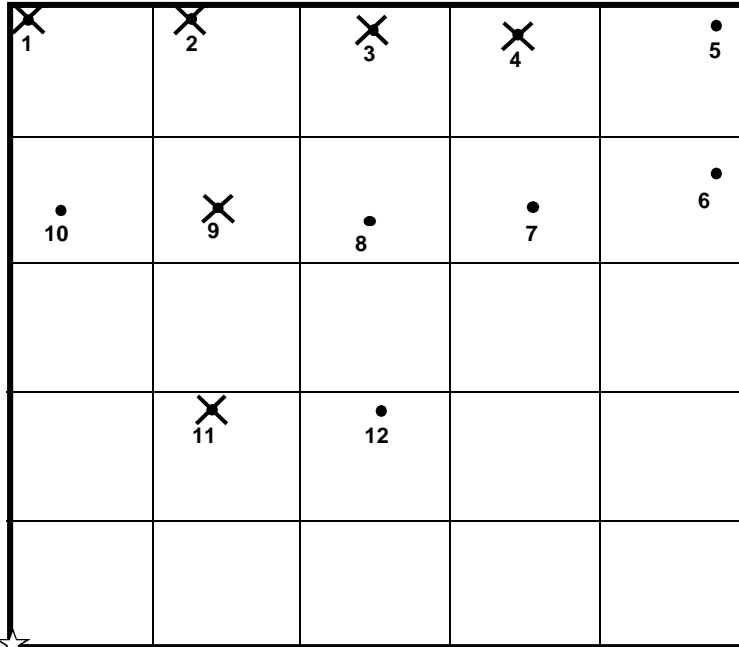
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Elderberry (<i>Sambucus canadensis</i>)	1			
Winged Sumac (<i>Rhus copallinum</i>)	5	7	8	
Total	6	7	8	

Vegetation Monitoring Worksheet

Site: Harrell Plot: S8 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Unknown			Dead
2	Unknown			Dead
3	Unknown			Dead
4	Sugarberry (<i>Celtis laevigata</i>)			Dead
5	Willow Oak (<i>Quercus phellos</i>)	0.49	2	Deer browse
6	American Beautyberry (<i>Callicarpa americana</i>)	0.20	3	Resprout
7	American Beautyberry (<i>Callicarpa americana</i>)	0.20	3	Resprout
8	American Beautyberry (<i>Callicarpa americana</i>)	0.32	3	
9	American Beautyberry (<i>Callicarpa americana</i>)			Dead
10	American Beautyberry (<i>Callicarpa americana</i>)	0.54	3	
11	Unknown			Missing
12	American Beautyberry (<i>Callicarpa americana</i>)	0.55	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
American Beautyberry (<i>Callicarpa americana</i>)	83.3%
Willow Oak (<i>Quercus phellos</i>)	16.7%

Density:

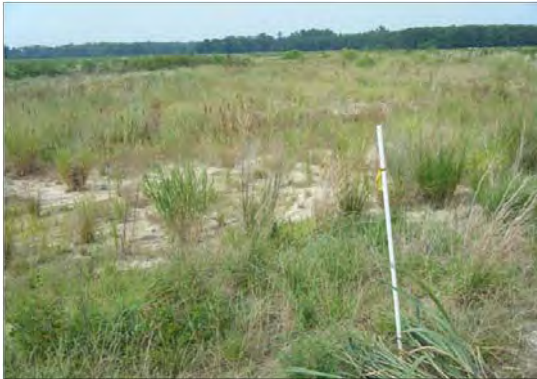
Total Number of Trees 6 / 0.025 acres = 240 stems / acre

Total Number of Desirable Stems* 24 / 0.025 acres = 960 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 6 / 12 trees x 100 = 50 % survivability



3rd Year Monitoring



4th Year Monitoring

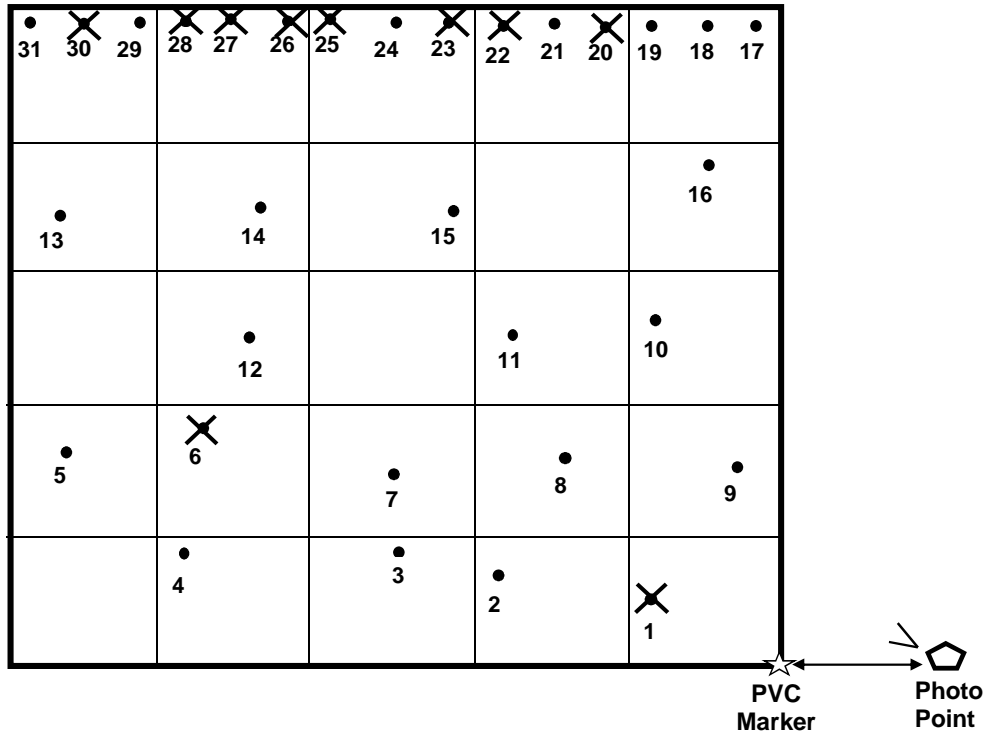
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
American Beautyberry (<i>Callicarpa americana</i>)	1			
Loblolly Pine (<i>Pinus taeda</i>)	2	4		
Red Maple (<i>Acer rubrum</i>)	1			
Sweetgum (<i>Liquidambar styraciflua</i>)			1	
Southern Red Oak (<i>Quercus falcata</i>)	1			
Bald Cypress (<i>Taxodium distichum</i>)	2	1		
Baccharis (<i>Baccharis halimifolia</i>)	1	2	3	1
Total	8	7	4	1

Vegetation Monitoring Worksheet

Site: Harrell Plot: S9 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Sugarberry (<i>Celtis laevigata</i>)			Dead
2	Persimmon (<i>Diospyros virginiana</i>)	0.41	3	Top died back
3	Persimmon (<i>Diospyros virginiana</i>)	0.42	3	Top died back
4	Persimmon (<i>Diospyros virginiana</i>)	1.04	4	
5	Willow Oak (<i>Quercus phellos</i>)	0.44	2	Deer browse
6	Willow Oak (<i>Quercus phellos</i>)			Missing
7	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.22	2	Top died back
8	River Birch (<i>Betula nigra</i>)	1.53	4	
9	River Birch (<i>Betula nigra</i>)	2.69	4	
10	Persimmon (<i>Diospyros virginiana</i>)	0.37	1	Top died back
11	Willow Oak (<i>Quercus phellos</i>)	0.33	4	Resprout
12	Persimmon (<i>Diospyros virginiana</i>)	0.77	2	Resprout
13	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.77	4	
14	Willow Oak (<i>Quercus phellos</i>)	0.40	3	
15	River Birch (<i>Betula nigra</i>)	1.05	4	
16	River Birch (<i>Betula nigra</i>)	1.98	4	
17	Silky Dogwood (<i>Cornus amomum</i>)	1.12	4	Deer browse
18	Silky Dogwood (<i>Cornus amomum</i>)	0.78	3	Deer browse
19	Silky Dogwood (<i>Cornus amomum</i>)	0.24	2	Deer browse
20	Elderberry (<i>Sambucus canadensis</i>)			Dead, live stake
21	Black Willow (<i>Salix nigra</i>)	0.79	4	Live stake
22	Silky Dogwood (<i>Cornus amomum</i>)			Dead, live stake
23	Silky Dogwood (<i>Cornus amomum</i>)			Dead, live stake
24	Silky Dogwood (<i>Cornus amomum</i>)	0.31	2	Live stake, resprout
25	Silky Dogwood (<i>Cornus amomum</i>)			Dead, live stake
26	Silky Dogwood (<i>Cornus amomum</i>)			Dead, live stake
27	Silky Dogwood (<i>Cornus amomum</i>)			Dead, live stake
28	Black Willow (<i>Salix nigra</i>)			Dead, live stake
29	Black Willow (<i>Salix nigra</i>)	4.00	4	Live stake
30	Black Willow (<i>Salix nigra</i>)			Dead, live stake
31	Black Willow (<i>Salix nigra</i>)	5.00	4	Live stake

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	19.0%
Black Willow (<i>Salix nigra</i>)	9.5%
River Birch (<i>Betula nigra</i>)	19.0%
Willow Oak (<i>Quercus phellos</i>)	14.3%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	9.5%
Persimmon (<i>Diospyros virginiana</i>)	23.8%
Sugarberry (<i>Celtis laevigata</i>)	0.0%

Density:

Total Number of Trees 21 / 0.025 acres = 840 stems / acre

Total Number of Desirable Stems* 36 / 0.025 acres = 1440 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 21 / 31 trees x 100 = 68 % survivability



3rd Year Monitoring



4th Year Monitoring

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Bald Cypress (<i>Taxodium distichum</i>)	2	2		
Loblolly Pine (<i>Pinus taeda</i>)		1	1	
Baccharis (<i>Baccharis halimifolia</i>)	1	1		
Willow Oak (<i>Quercus phellos</i>)		1		
Winged Sumac (<i>Rhus copallinum</i>)	6			
Total	9	5	1	

Species	Percent of Total
Sycamore (<i>Platanus occidentalis</i>)	50.0%
Willow Oak (<i>Quercus phellos</i>)	25.0%
Sugarberry (<i>Celtis laevigata</i>)	12.5%
Persimmon (<i>Diospyros virginiana</i>)	12.5%

Density:

Total Number of Trees 8 / 0.025 acres = 320 stems / acre

Total Number of Desirable Stems* 25 / 0.025 acres = 1000 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 8 / 15 trees x 100 = 53 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

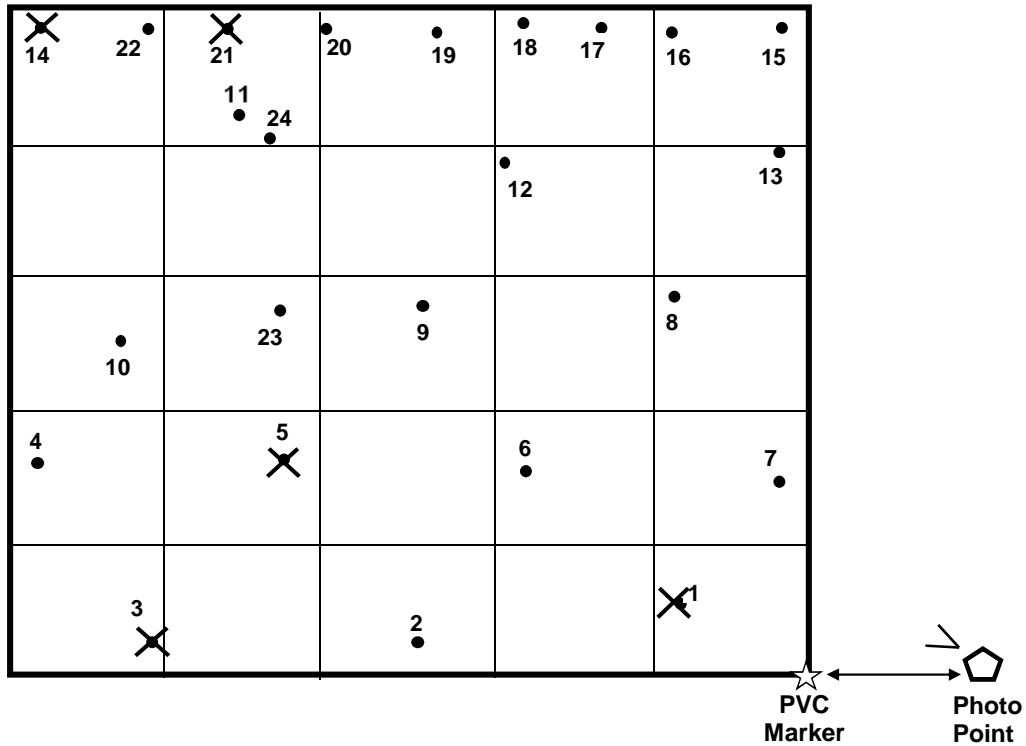
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Black Willow (<i>Salix nigra</i>)		2	2	2
Baccharis (<i>Baccharis halimifolia</i>)	1	5	1	
Willow Oak (<i>Quercus phellos</i>)		1		
Bald Cypress (<i>Taxodium distichum</i>)	2			
Black Oak (<i>Quercus velutina</i>)	1			
Total	4	8	3	2

Vegetation Monitoring Worksheet

Site: Harrell Plot: S11 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	American Beautyberry (<i>Callicarpa americana</i>)			Dead
2	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.63	4	
3	American Beautyberry (<i>Callicarpa americana</i>)			Dead
4	Willow Oak (<i>Quercus phellos</i>)	0.99	4	
5	American Beautyberry (<i>Callicarpa americana</i>)			Dead
6	Southern Red Oak (<i>Quercus falcata</i>)	0.63	4	
7	American Beautyberry (<i>Callicarpa americana</i>)	0.11	2	Resprout
8	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.09	3	
9	American Beautyberry (<i>Callicarpa americana</i>)	0.30	3	
10	Persimmon (<i>Diospyros virginiana</i>)	1.78	4	
11	Persimmon (<i>Diospyros virginiana</i>)	1.02	4	
12	American Beautyberry (<i>Callicarpa americana</i>)	0.85	4	
13	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.49	4	Deer browse
14	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
15	Silky Dogwood (<i>Cornus amomum</i>)	0.80	4	Live stake, deer browse
16	Silky Dogwood (<i>Cornus amomum</i>)	0.67	3	Live stake, deer browse
17	Silky Dogwood (<i>Cornus amomum</i>)	0.87	4	Live stake, deer browse
18	Silky Dogwood (<i>Cornus amomum</i>)	1.19	4	Live stake, deer browse
19	Silky Dogwood (<i>Cornus amomum</i>)	0.90	4	Live stake, deer browse
20	Silky Dogwood (<i>Cornus amomum</i>)	0.70	4	Live stake, deer browse
21	Elderberry (<i>Sambucus canadensis</i>)			Missing
22	Black Willow (<i>Salix nigra</i>)	2.43	4	Live stake
23	Sugarberry (<i>Celtis laevigata</i>)	0.34	2	Deer browse
24	Sugarberry (<i>Celtis laevigata</i>)	0.31	2	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	31.6%
Black Willow (<i>Salix nigra</i>)	5.3%
American Beautyberry (<i>Callicarpa americana</i>)	15.8%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	15.8%
Willow Oak (<i>Quercus phellos</i>)	5.3%
Persimmon (<i>Diospyros virginiana</i>)	10.5%
Sugarberry (<i>Celtis laevigata</i>)	10.5%
Southern Red Oak (<i>Quercus falcata</i>)	5.3%

Density:

Total Number of Trees 19 / 0.025 acres = 760 stems / acre

Total Number of Desirable Stems* 29 / 0.025 acres = 1160 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 19 / 23 trees x 100 = 83 % survivability



3rd Year Monitoring



4th Year Monitoring

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)	2	3	3	
Black Willow (<i>Salix nigra</i>)			2	
Total	2	3	5	

Species	Percent of Total
River Birch (<i>Betula nigra</i>)	62.5%
Sycamore (<i>Platanus occidentalis</i>)	12.5%
American Beautyberry (<i>Callicarpa americana</i>)	12.5%
Sugarberry (<i>Celtis laevigata</i>)	12.5%

Density:

Total Number of Trees 8 / 0.025 acres = 320 stems / acre

Total Number of Desirable Stems* 19 / 0.025 acres = 760 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 8 / 15 x 100 = 53 % survivability



3rd Year Monitoring



4th Year Monitoring

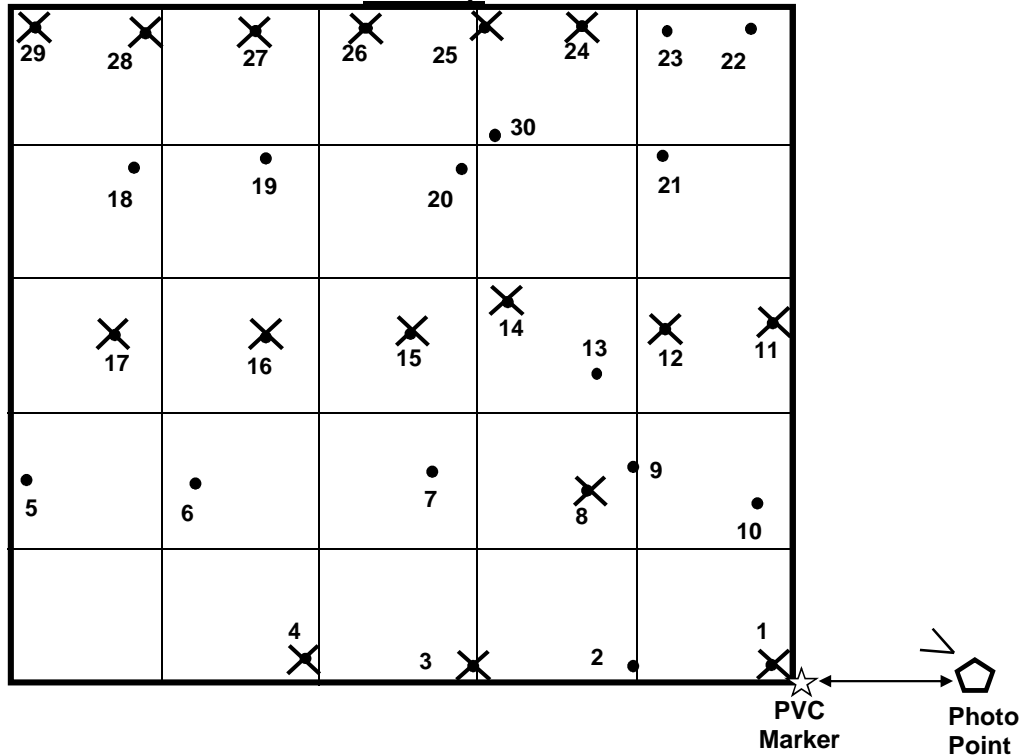
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Sugarberry (<i>Celtis laevigata</i>)	1	1		
Baccharis (<i>Baccharis halimifolia</i>)	1	2	1	
Bald Cypress (<i>Taxodium distichum</i>)		2		
Green Ash (<i>Fraxinus pennsylvanica</i>)	1			
Buttonbush (<i>Cephalanthus occidentalis</i>)		2		
Total	3	7	1	

Vegetation Monitoring Worksheet

Site: Harrell Plot: S13 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Sugarberry (<i>Celtis laevigata</i>)			Dead
2	Sugarberry (<i>Celtis laevigata</i>)	1.03	4	
3	Unknown			Dead
4	American Beautyberry (<i>Callicarpa americana</i>)			Dead
5	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.92	4	
6	Sycamore (<i>Platanus occidentalis</i>)	3.00	4	
7	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.17	4	
8	Possumhaw (<i>Viburnum nudum</i>)			Dead
9	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.35	3	Main stem died back
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.48	3	
11	Sugarberry (<i>Celtis laevigata</i>)			Dead
12	Possumhaw (<i>Viburnum nudum</i>)			Dead
13	Sugarberry (<i>Celtis laevigata</i>)	0.40	4	
14	Sugarberry (<i>Celtis laevigata</i>)			Missing
15	Possumhaw (<i>Viburnum nudum</i>)			Dead
16	Sugarberry (<i>Celtis laevigata</i>)			Missing
17	Sugarberry (<i>Celtis laevigata</i>)			Missing
18	American Beautyberry (<i>Callicarpa americana</i>)	0.77	4	
19	American Beautyberry (<i>Callicarpa americana</i>)	0.29	3	
20	American Beautyberry (<i>Callicarpa americana</i>)	0.46	3	Resprout
21	American Beautyberry (<i>Callicarpa americana</i>)	0.28	3	
22	Silky Dogwood (<i>Cornus amomum</i>)	0.47	3	Live stake, deer browse
23	Silky Dogwood (<i>Cornus amomum</i>)	0.81	4	Live stake, deer browse
24	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
25	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
26	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
27	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
28	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
29	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
30	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.52	3	Not counted during baseline monitoring

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	13.3%
Sycamore (<i>Platanus occidentalis</i>)	6.7%
American Beautyberry (<i>Callicarpa americana</i>)	26.7%
Sugarberry (<i>Celtis laevigata</i>)	13.3%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	26.7%
Green Ash (<i>Fraxinus pennsylvanica</i>)	6.7%

Density:

Total Number of Trees 14 / 0.025 acres = 560 stems / acre

Total Number of Desirable Stems* 30 / 0.025 acres = 1200 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 14 / 30 x 100 = 47 % survivability



3rd Year Monitoring



4th Year Monitoring

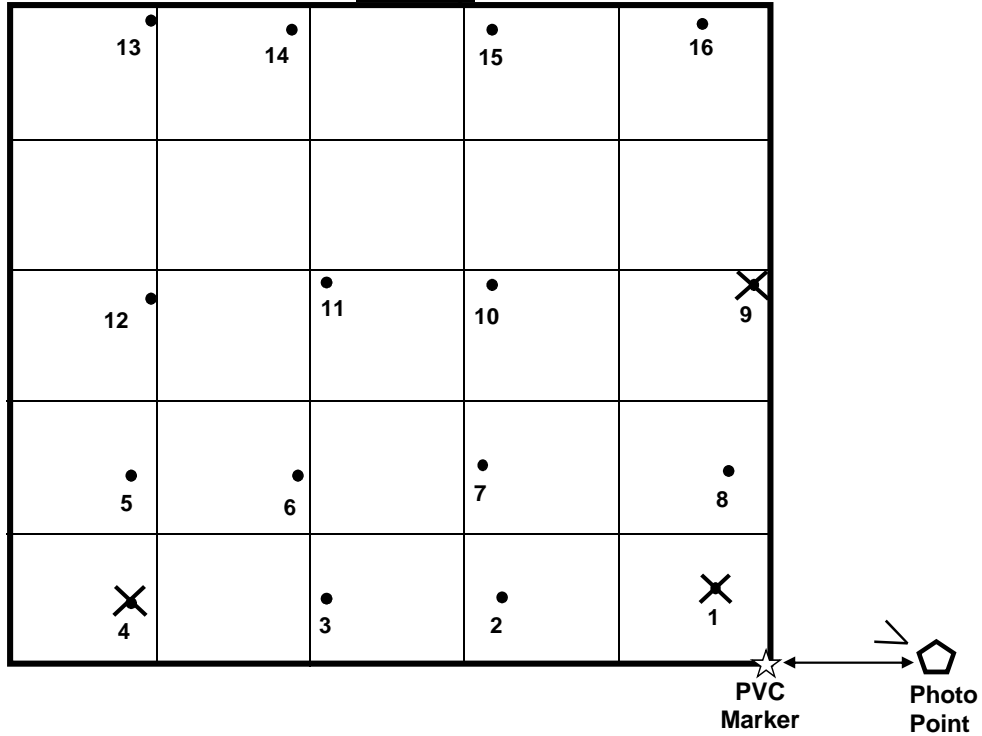
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)		2		
Loblolly Pine (<i>Pinus taeda</i>)	1	1		
Southern Red Oak (<i>Quercus falcata</i>)	6	5		
Total	7	8		

Vegetation Monitoring Worksheet

Site: Harrell Plot: S14 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	American Beautyberry (<i>Callicarpa americana</i>)			Dead
2	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.69	4	
3	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.29	4	
4	<i>Quercus sp.</i>			Dead
5	Persimmon (<i>Diospyros virginiana</i>)	1.47	4	
6	River Birch (<i>Betula nigra</i>)	1.66	4	
7	American Beautyberry (<i>Callicarpa americana</i>)	0.61	3	
8	Persimmon (<i>Diospyros virginiana</i>)	3.50	4	
9	Willow Oak (<i>Quercus phellos</i>)			Dead
10	Persimmon (<i>Diospyros virginiana</i>)	1.21	4	
11	Persimmon (<i>Diospyros virginiana</i>)	0.83	4	
12	Persimmon (<i>Diospyros virginiana</i>)	0.88	4	
13	River Birch (<i>Betula nigra</i>)	0.85	4	
14	Persimmon (<i>Diospyros virginiana</i>)	0.28	3	
15	Persimmon (<i>Diospyros virginiana</i>)	0.20	3	Resprout
16	American Beautyberry (<i>Callicarpa americana</i>)	0.90	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
River Birch (<i>Betula nigra</i>)	15.4%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	15.4%
Persimmon (<i>Diospyros virginiana</i>)	53.8%
American Beautyberry (<i>Callicarpa americana</i>)	15.4%

Density:

Total Number of Trees 13 / 0.025 acres = 520 stems / acre

Total Number of Desirable Stems* 21 / 0.025 acres = 840 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 13 / 16 x 100 = 81 % survivability



3rd Year Monitoring



4th Year Monitoring

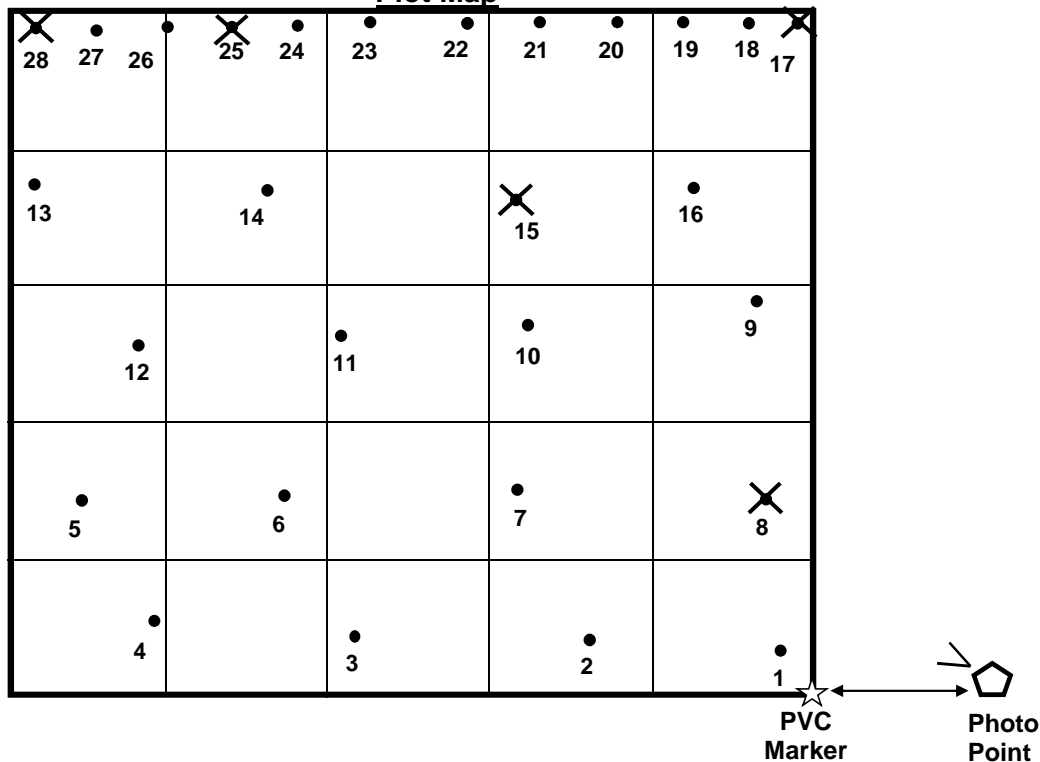
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)		1	2	
Southern Red Oak (<i>Quercus falcata</i>)	1	2		
River Birch (<i>Betula nigra</i>)		1		
Black Willow (<i>Salix nigra</i>)				1
Red Maple (<i>Acer rubrum</i>)		1		
Total	1	5	2	1

Vegetation Monitoring Worksheet

Site: Harrell Plot: S15 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	River Birch (<i>Betula nigra</i>)	2.58	4	
2	River Birch (<i>Betula nigra</i>)	3.00	4	
3	River Birch (<i>Betula nigra</i>)	2.71	4	
4	River Birch (<i>Betula nigra</i>)	2.68	4	
5	Sugarberry (<i>Celtis laevigata</i>)	0.27	3	Top died back
6	Sugarberry (<i>Celtis laevigata</i>)	0.62	4	
7	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.16	4	
8	Sugarberry (<i>Celtis laevigata</i>)			Dead
9	American Beautyberry (<i>Callicarpa americana</i>)	0.50	4	
10	Sycamore (<i>Platanus occidentalis</i>)	1.49	4	
11	Sycamore (<i>Platanus occidentalis</i>)	1.31	4	Main stem died back
12	Sycamore (<i>Platanus occidentalis</i>)	1.15	4	
13	American Beautyberry (<i>Callicarpa americana</i>)	0.33	3	Top died back
14	American Beautyberry (<i>Callicarpa americana</i>)	0.27	2	
15	American Beautyberry (<i>Callicarpa americana</i>)			Dead
16	American Beautyberry (<i>Callicarpa americana</i>)	0.55	4	
17	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
18	Silky Dogwood (<i>Cornus amomum</i>)	0.44	3	Live stake
19	Silky Dogwood (<i>Cornus amomum</i>)	0.48	2	Live stake
20	Silky Dogwood (<i>Cornus amomum</i>)	0.40	3	Live stake
21	Silky Dogwood (<i>Cornus amomum</i>)	2.13	4	Live stake
22	Silky Dogwood (<i>Cornus amomum</i>)	1.08	4	Live stake, deer browse
23	Silky Dogwood (<i>Cornus amomum</i>)	0.67	3	Live stake, deer browse
24	Silky Dogwood (<i>Cornus amomum</i>)	0.85	3	Live stake, deer browse
25	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
26	Silky Dogwood (<i>Cornus amomum</i>)	0.64	3	Live stake
27	Silky Dogwood (<i>Cornus amomum</i>)	0.45	3	Live stake, deer browse
28	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Silky Dogwood (<i>Cornus amomum</i>)	39.1%
River Birch (<i>Betula nigra</i>)	17.4%
Sycamore (<i>Platanus occidentalis</i>)	13.0%
Sugarberry (<i>Celtis laevigata</i>)	8.7%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	4.3%
American Beautyberry (<i>Callicarpa americana</i>)	17.4%

Density:

Total Number of Trees 23 / 0.025 acres = 920 stems / acre

Total Number of Desirable Stems* 30 / 0.025 acres = 1200 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 23 / 28 x 100 = 82 % survivability



3rd Year Monitoring



4th Year Monitoring

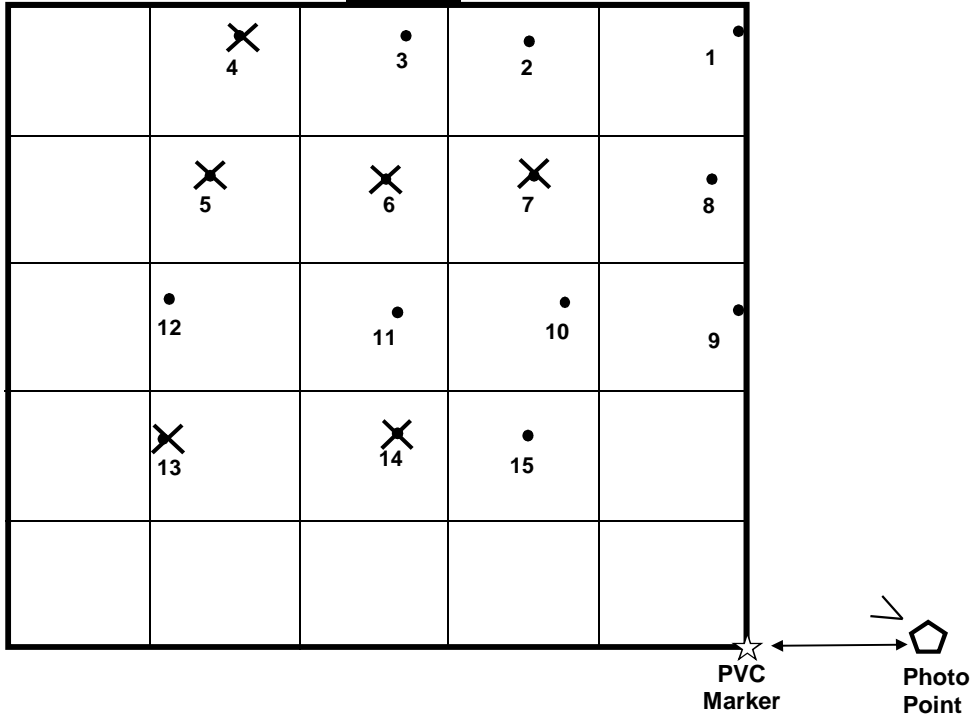
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)		2	14	
Red Maple (<i>Acer rubrum</i>)	1	1		
Bald Cypress (<i>Taxodium distichum</i>)		1		
Total	1	4	14	

Vegetation Monitoring Worksheet

Site: Harrell Plot: S16 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	American Beautyberry (<i>Callicarpa americana</i>)	0.74	3	
2	Persimmon (<i>Diospyros virginiana</i>)	0.25	2	
3	American Beautyberry (<i>Callicarpa americana</i>)	1.04	4	
4	Willow Oak (<i>Quercus phellos</i>)			Dead
5	American Beautyberry (<i>Callicarpa americana</i>)			Dead
6	American Beautyberry (<i>Callicarpa americana</i>)			Dead
7	Swamp Chestnut Oak (<i>Quercus michauxii</i>)			Dead
8	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.73	4	
9	Sycamore (<i>Platanus occidentalis</i>)	4.00	4	
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.18	2	Resprout
11	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.56	3	Deer browse
12	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.55	3	
13	River Birch (<i>Betula nigra</i>)			Dead
14	Unknown			Dead
15	River Birch (<i>Betula nigra</i>)	3.50	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
American Beautyberry (<i>Callicarpa americana</i>)	22.2%
Sycamore (<i>Platanus occidentalis</i>)	11.1%
River Birch (<i>Betula nigra</i>)	11.1%
Persimmon (<i>Diospyros virginiana</i>)	11.1%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	44.4%

Density:

Total Number of Trees 9 / 0.025 acres = 360 stems / acre

Total Number of Desirable Stems* 20 / 0.025 acres = 800 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 9 / 15 x 100 = 60 % survivability



3rd Year Monitoring



4th Year Monitoring

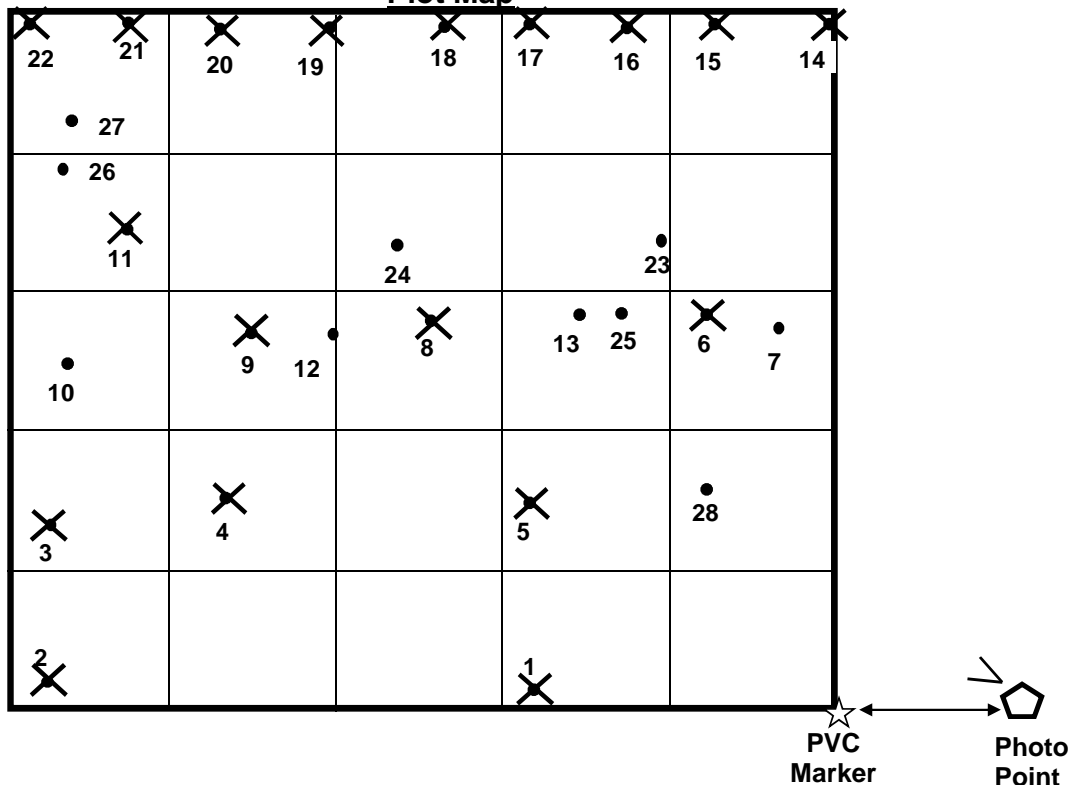
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)		7		
Bald Cypress (<i>Taxodium distichum</i>)		1		
Red Maple (<i>Acer rubrum</i>)		1		
Green Ash (<i>Fraxinus pennsylvanica</i>)	1			
Buttonbush (<i>Cephalanthus occidentalis</i>)	1			
Sweetgum (<i>Liquidambar styraciflua</i>)		1		
Silver Maple (<i>Acer saccharinum</i>)		1		
Total	2	11		

Vegetation Monitoring Worksheet

Site: Harrell Plot: S17 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp Chestnut Oak (<i>Quercus michauxii</i>)			Dead
2	Sugarberry (<i>Celtis laevigata</i>)			Dead
3	Unknown			Dead
4	Willow Oak (<i>Quercus phellos</i>)			Dead
5	Sugarberry (<i>Celtis laevigata</i>)			Dead
6	Persimmon (<i>Diospyros virginiana</i>)			Dead
7	Persimmon (<i>Diospyros virginiana</i>)	1.24	3	Top died back
8	Persimmon (<i>Diospyros virginiana</i>)			Dead
9	Swamp Chestnut Oak (<i>Quercus michauxii</i>)			Dead
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.50	4	
11	Willow Oak (<i>Quercus phellos</i>)			Dead
12	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	0.31	3	
13	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.33	4	
14	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
15	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
16	Black Willow (<i>Salix nigra</i>)			Live stake, dead
17	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
18	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
19	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
20	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
21	Elderberry (<i>Sambucus canadensis</i>)			Live stake, dead
22	Silky Dogwood (<i>Cornus amomum</i>)			Live stake, dead
23	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.69	4	Recently planted; added;
24	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.36	4	Recently planted; added
25	Bald Cypress (<i>Taxodium distichum</i>)	0.75	3	Recently planted; added
26	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.70	3	Recently planted; added
27	Sugarberry (<i>Celtis laevigata</i>)	0.09	2	Recently planted; added, deer browse
28	Bald Cypress (<i>Taxodium distichum</i>)	0.85	2	Recently planted; added

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Persimmon (<i>Diospyros virginiana</i>)	10.0%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	30.0%
Sugarberry (<i>Celtis laevigata</i>)	10.0%
Green Ash (<i>Fraxinus pennsylvanica</i>)	30.0%
Bald Cypress (<i>Taxodium distichum</i>)	20.0%

Density:

Total Number of Trees 10 / 0.025 acres = 400 stems / acre

Total Number of Desirable Stems* 11 / 0.025 acres = 440 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 10 / 28 x 100 = 45 % survivability



3rd Year Monitoring



4th Year Monitoring

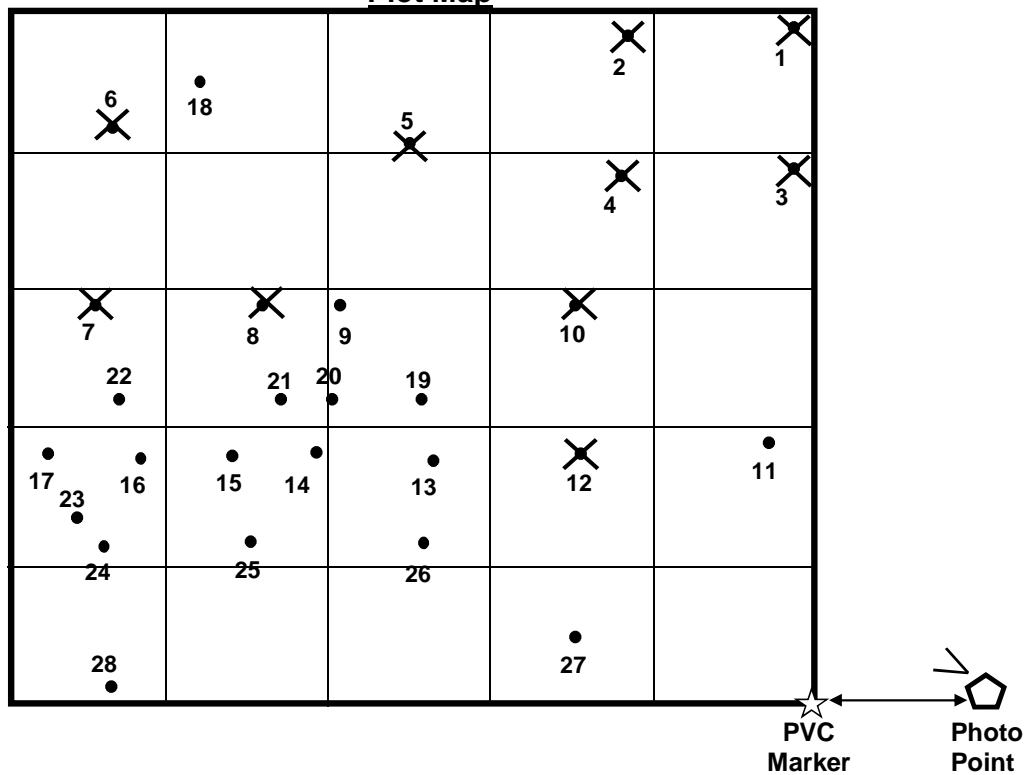
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Green Ash (<i>Fraxinus pennsylvanica</i>)		1		
Total		1		

Vegetation Monitoring Worksheet

Site: Harrell Plot: S18 Date: 7/29/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	River Birch (<i>Betula nigra</i>)			Dead
2	River Birch (<i>Betula nigra</i>)			Dead
3	Unknown			Dead
4	<i>Quercus sp.</i>			Dead
5	American Beautyberry (<i>Callicarpa americana</i>)			Dead
6	Willow Oak (<i>Quercus phellos</i>)			Dead
7	American Beautyberry (<i>Callicarpa americana</i>)			Dead
8	American Beautyberry (<i>Callicarpa americana</i>)			Dead
9	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.99	4	
10	American Beautyberry (<i>Callicarpa americana</i>)			Dead
11	River Birch (<i>Betula nigra</i>)	0.93	4	
12	River Birch (<i>Betula nigra</i>)			Dead
13	River Birch (<i>Betula nigra</i>)	1.19	4	Resprout
14	Willow Oak (<i>Quercus phellos</i>)	0.65	4	
15	River Birch (<i>Betula nigra</i>)	1.62	4	
16	River Birch (<i>Betula nigra</i>)	1.22	3	
17	Willow Oak (<i>Quercus phellos</i>)	0.57	4	Deer browse
18	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.52	3	Recently planted; added
19	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.73	4	Recently planted; added
20	Green Ash (<i>Fraxinus pennsylvanica</i>)	1.00	4	Recently planted; added
21	Green Ash (<i>Fraxinus pennsylvanica</i>)	1.17	4	Recently planted; added
22	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.73	4	Recently planted; added
23	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.38	3	Recently planted; added
24	Sugarberry (<i>Celtis laevigata</i>)	0.62	3	Recently planted; added
25	Sugarberry (<i>Celtis laevigata</i>)	0.65	3	Recently planted; added
26	Sugarberry (<i>Celtis laevigata</i>)	0.68	3	Recently planted; added
27	Sugarberry (<i>Celtis laevigata</i>)	0.75	3	Recently planted; added
28	Green Ash (<i>Fraxinus pennsylvanica</i>)	0.39	4	Recently planted; added

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
River Birch (<i>Betula nigra</i>)	22.2%
Willow Oak (<i>Quercus phellos</i>)	11.1%
Green Ash (<i>Fraxinus pennsylvanica</i>)	44.4%
Sugarberry (<i>Celtis laevigata</i>)	22.2%

Density:

Total Number of Trees 18 / 0.025 acres = 720 stems / acre

Total Number of Desirable Stems* 19 / 0.025 acres = 760 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 18 / 28 x 100 = 64 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Green Ash (<i>Fraxinus pennsylvanica</i>)	1			
Red Maple (<i>Acer rubrum</i>)		1		
Total	1	1		

Species	Percent of Total
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	11.1%
Green Ash (<i>Fraxinus pennsylvanica</i>)	33.3%
Buttonbush (<i>Cephalanthus occidentalis</i>)	11.1%
Laurel Oak (<i>Quercus laurifolia</i>)	11.1%
Cherrybark Oak (<i>Quercus pagoda</i>)	22.2%
American Beautyberry (<i>Callicarpa americana</i>)	11.1%

Density:

Total Number of Trees 9 / 0.025 acres = 360 stems / acre

Total Number of Desirable Stems* 10 / 0.025 acres = 400 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 9 / 13 trees x 100 = 69 % survivability



3rd Year Monitoring



4th Year Monitoring

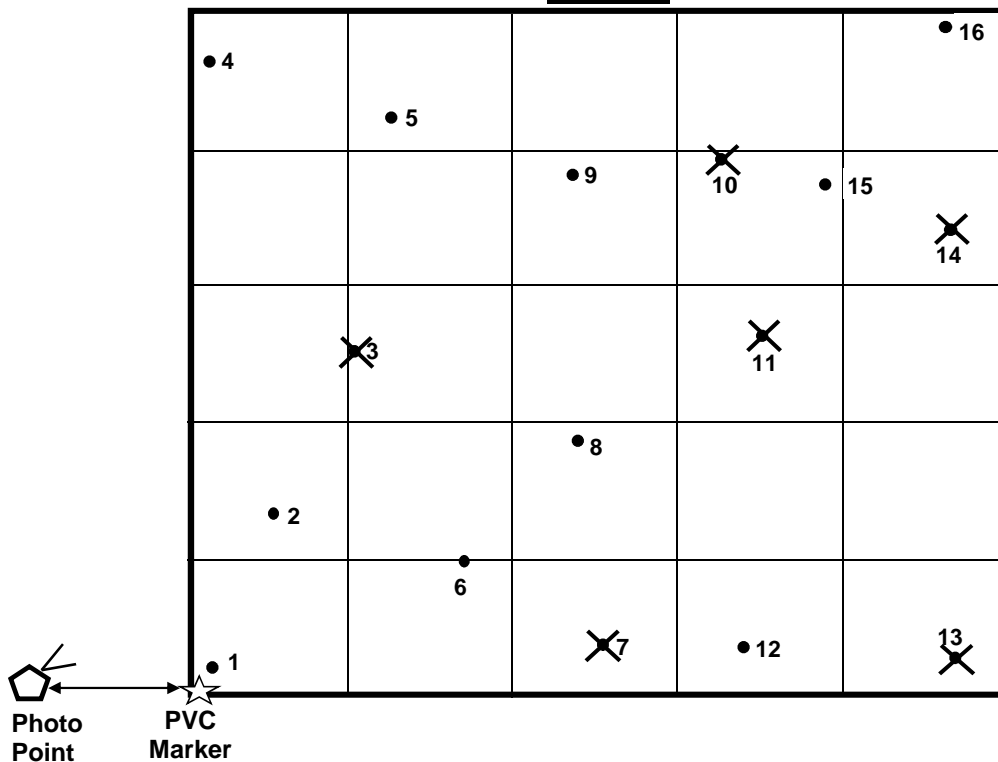
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Laurel Oak (<i>Quercus laurifolia</i>)				1
Total				1

Vegetation Monitoring Worksheet

Site: Harrell Plot: W2 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Willow Oak (<i>Quercus phellos</i>)	0.89	3	
2	Laurel Oak (<i>Quercus laurifolia</i>)	2.24	4	
3	Unknown			Dead
4	Willow Oak (<i>Quercus phellos</i>)	4.00	4	
5	Cherrybark Oak (<i>Quercus pagoda</i>)	1.31	4	
6	Cherrybark Oak (<i>Quercus pagoda</i>)	0.71	3	Deer browse
7	Cherrybark Oak (<i>Quercus pagoda</i>)			Dead
8	Cherrybark Oak (<i>Quercus pagoda</i>)	3.70	4	
9	Cherrybark Oak (<i>Quercus pagoda</i>)	1.39	4	
10	Unknown			Dead
11	Unknown			Dead
12	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.24	4	
13	Unknown			Dead
14	Unknown			Dead
15	Cherrybark Oak (<i>Quercus pagoda</i>)	0.48	3	
16	Buttonbush (<i>Cephalanthus occidentalis</i>)	0.14	1	Resprout

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Willow Oak (<i>Quercus phellos</i>)	20.0%
Cherrybark Oak (<i>Quercus pagoda</i>)	50.0%
Buttonbush (<i>Cephalanthus occidentalis</i>)	20.0%
Laurel Oak (<i>Quercus laurifolia</i>)	10.0%

Density:

Total Number of Trees 10 / 0.025 acres = 400 stems / acre

Total Number of Desirable Stems* 10 / 0.025 acres = 400 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 10 / 16 trees x 100 = 63 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Total				0

Vegetation Monitoring Worksheet

Site: Harrell Plot: W3 Date: 7/28/2011

Plot Map

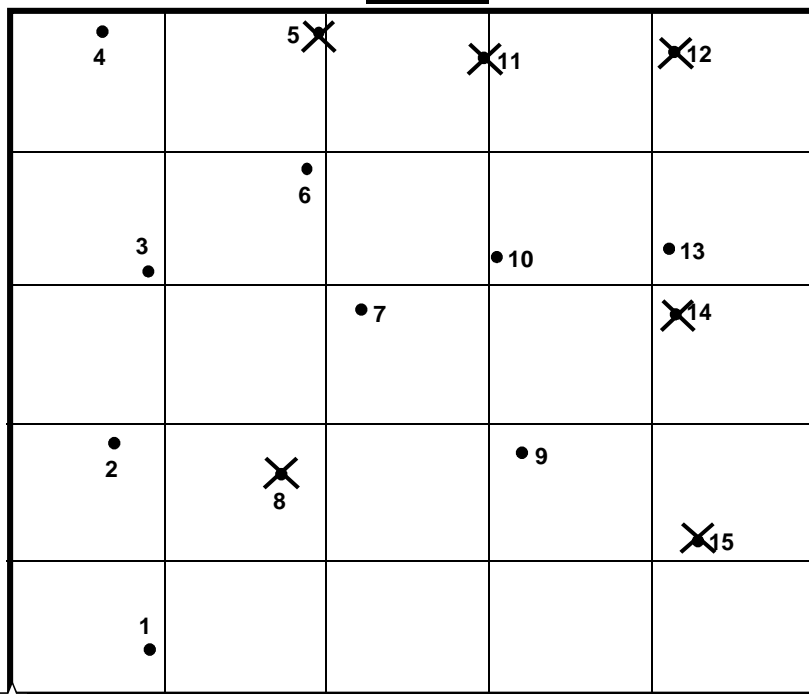


Photo Point



PVC Marker

ID	Species	Height (m)	Vigor	Comment
1	Bald Cypress (<i>Taxodium distichum</i>)	1.39	2	
2	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.74	4	
3	Bald Cypress (<i>Taxodium distichum</i>)	3.50	4	
4	Cherrybark Oak (<i>Quercus pagoda</i>)	1.72	4	
5	<i>Quercus sp.</i>			Dead
6	Bald Cypress (<i>Taxodium distichum</i>)	3.50	4	
7	Bald Cypress (<i>Taxodium distichum</i>)	3.50	4	
8	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
9	Bald Cypress (<i>Taxodium distichum</i>)	3.00	4	
10	Bald Cypress (<i>Taxodium distichum</i>)	3.20	4	
11	Unknown			Dead
12	Unknown			Dead
13	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	3.50	4	
14	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
15	Bald Cypress (<i>Taxodium distichum</i>)			Dead

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Bald Cypress (<i>Taxodium distichum</i>)	66.7%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	11.1%
Buttonbush (<i>Cephalanthus occidentalis</i>)	11.1%
Cherrybark Oak (<i>Quercus pagoda</i>)	11.1%

Density:

Total Number of Trees 9 / 0.025 acres = 360 stems / acre

Total Number of Desirable Stems* 11 / 0.025 acres = 440 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 9 / 15 trees x 100 = 60 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

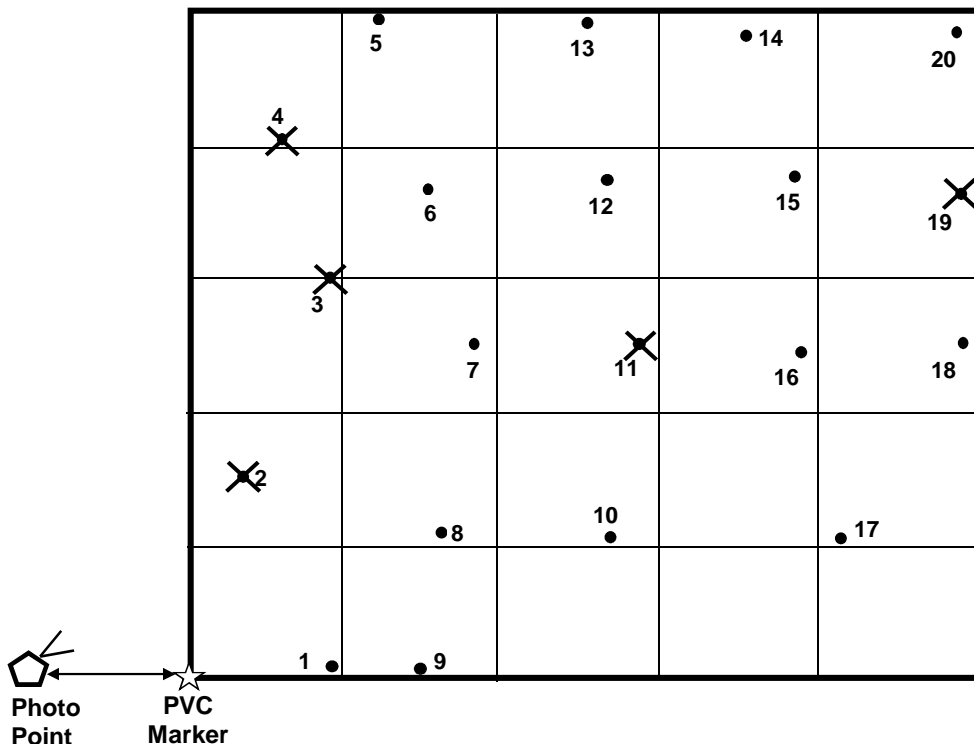
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Black Willow (<i>Salix nigra</i>)				2
Total				2

Vegetation Monitoring Worksheet

Site: Harrell Plot: W4 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Green Ash (<i>Fraxinus pennsylvanica</i>)	2.09	4	Fungus
2	Cherrybark Oak (<i>Quercus pagoda</i>)			Dead
3	Unknown			Dead
4	Unknown			Dead
5	Buttonbush (<i>Cephalanthus occidentalis</i>)	2.23	4	
6	Cherrybark Oak (<i>Quercus pagoda</i>)	2.49	4	
7	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.83	4	
8	Cherrybark Oak (<i>Quercus pagoda</i>)	2.92	4	
9	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.33	3	
10	Cherrybark Oak (<i>Quercus pagoda</i>)	3.37	4	
11	Unknown			Dead
12	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	4.00	4	
13	Laurel Oak (<i>Quercus laurifolia</i>)	4.00	4	
14	Willow Oak (<i>Quercus phellos</i>)	4.20	4	
15	Cherrybark Oak (<i>Quercus pagoda</i>)	3.50	4	
16	Buttonbush (<i>Cephalanthus occidentalis</i>)	2.27	4	
17	Cherrybark Oak (<i>Quercus pagoda</i>)	3.50	4	
18	Green Ash (<i>Fraxinus pennsylvanica</i>)	2.54	4	
19	American Beautyberry (<i>Callicarpa americana</i>)			Dead
20	Willow Oak (<i>Quercus phellos</i>)	3.50	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Green Ash (<i>Fraxinus pennsylvanica</i>)	13.3%
Cherrybark Oak (<i>Quercus pagoda</i>)	33.3%
Buttonbush (<i>Cephalanthus occidentalis</i>)	26.7%
Laurel Oak (<i>Quercus laurifolia</i>)	6.7%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	6.7%
Willow Oak (<i>Quercus phellos</i>)	13.3%
American Beautyberry (<i>Callicarpa americana</i>)	0.0%

Density:

Total Number of Trees 15 / 0.025 acres = 600 stems / acre

Total Number of Desirable Stems* 17 / 0.025 acres = 680 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 15 / 20 trees x 100 = 75 % survivability



3rd Year Monitoring



4th Year Monitoring

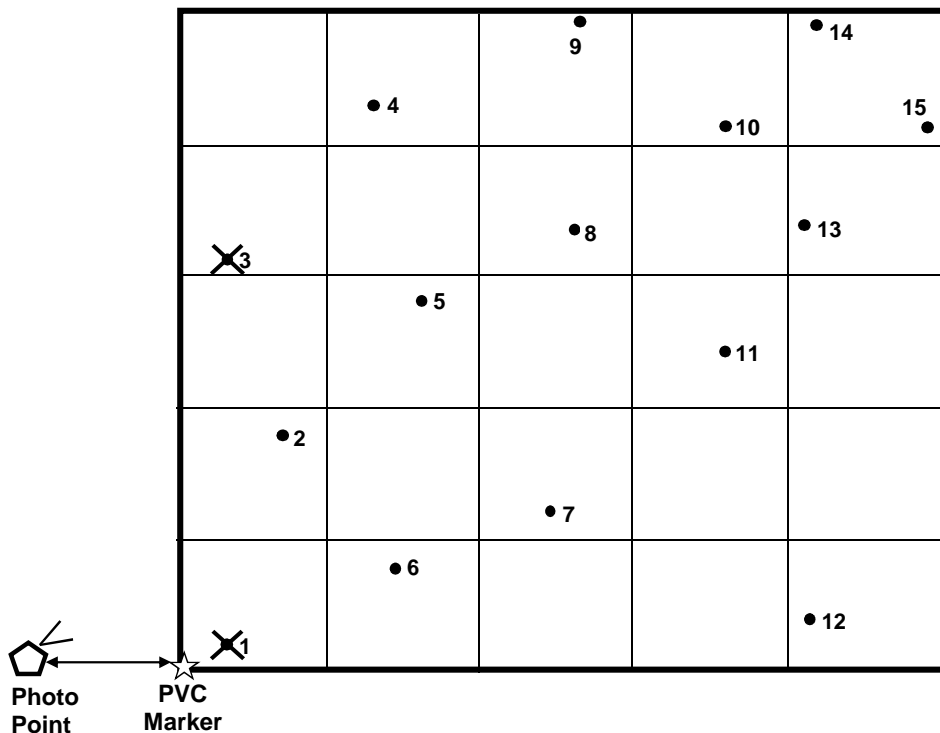
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Red Maple (<i>Acer rubrum</i>)	2			
Cherrybark Oak (<i>Quercus pagoda</i>)		1		
Baccharis (<i>Baccharis halimifolia</i>)		1		
Total	2	2		

Vegetation Monitoring Worksheet

Site: Harrell Plot: W5 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Beautyberry (<i>Callicarpa americana</i>)			Dead
2	Bald Cypress (<i>Taxodium distichum</i>)	1.48	4	
3	Swamp Chestnut Oak (<i>Quercus michauxii</i>)			Dead
4	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.28	4	
5	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.23	4	
6	Green Ash (<i>Fraxinus pennsylvanica</i>)	2.35	4	
7	Green Ash (<i>Fraxinus pennsylvanica</i>)	2.03	4	
8	Bald Cypress (<i>Taxodium distichum</i>)	1.70	4	
9	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.32	4	
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	2.40	4	
11	Bald Cypress (<i>Taxodium distichum</i>)	1.95	4	
12	Green Ash (<i>Fraxinus pennsylvanica</i>)	1.43	3	
13	Cherrybark Oak (<i>Quercus pagoda</i>)	1.83	4	
14	Bald Cypress (<i>Taxodium distichum</i>)	1.51	3	
15	Green Ash (<i>Fraxinus pennsylvanica</i>)	2.15	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Bald Cypress (<i>Taxodium distichum</i>)	30.8%
Green Ash (<i>Fraxinus pennsylvanica</i>)	30.8%
Cherrybark Oak (<i>Quercus pagoda</i>)	7.7%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	30.8%

Density:

Total Number of Trees 13 / 0.025 acres = 520 stems / acre

Total Number of Desirable Stems* 17 / 0.025 acres = 680 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 13 / 15 trees x 100 = 87 % survivability



3rd Year Monitoring



4th Year Monitoring

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Loblolly Pine (<i>Pinus taeda</i>)		1		
Red Maple (<i>Acer rubrum</i>)	1			
Cherrybark Oak (<i>Quercus pagoda</i>)	1	1		
Sweetgum (<i>Liquidambar styraciflua</i>)	1	2		
Green Ash (<i>Fraxinus pennsylvanica</i>)		1		
Total	3	5		

Species	Percent of Total
Bald Cypress (<i>Taxodium distichum</i>)	18.8%
Willow Oak (<i>Quercus phellos</i>)	31.3%
Cherrybark Oak (<i>Quercus pagoda</i>)	18.8%
Buttonbush (<i>Cephalanthus occidentalis</i>)	31.3%

Density:

Total Number of Trees 16 / 0.025 acres = 640 stems / acre

Total Number of Desirable Stems* 17 / 0.025 acres = 680 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 16 / 18 trees x 100 = 89 % survivability



3rd Year Monitoring



4th Year Monitoring

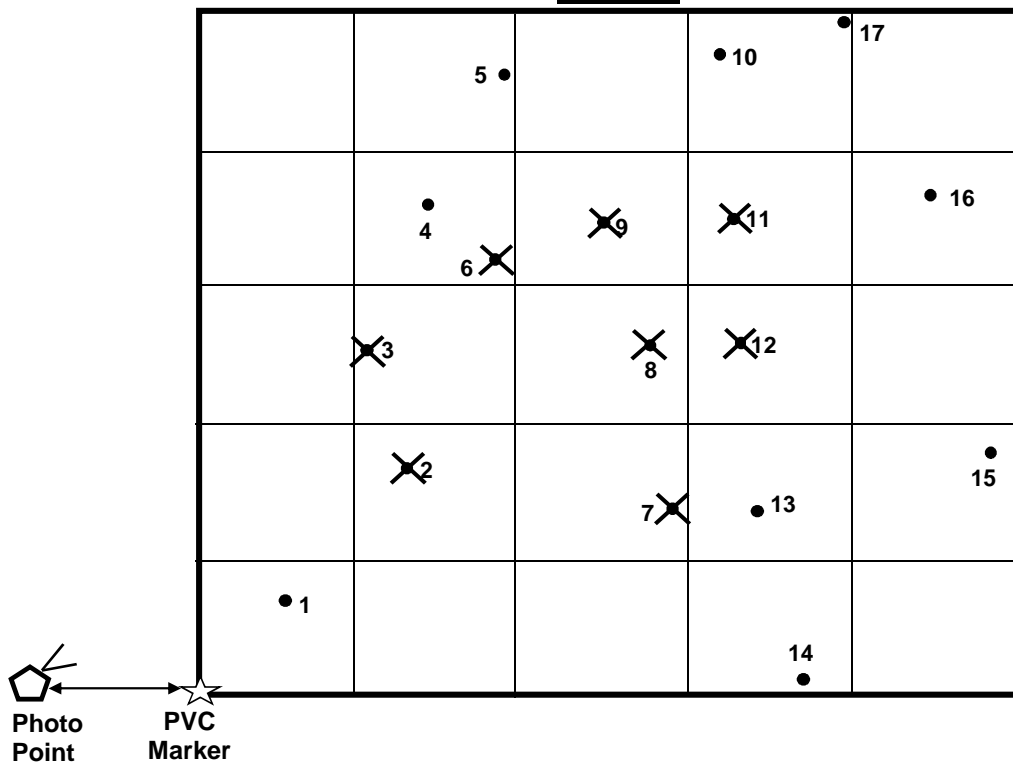
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Black Willow (<i>Salix nigra</i>)		1		
Sweetgum (<i>Liquidambar styraciflua</i>)	2	4	1	
Total	2	5	1	

Vegetation Monitoring Worksheet

Site: Harrell Plot: W7 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	4.00	4	Deer browse
2	Water Hickory (<i>Carya aquatica</i>)			Dead
3	Unknown			Dead
4	Willow Oak (<i>Quercus phellos</i>)	2.16	4	
5	Willow Oak (<i>Quercus phellos</i>)	4.00	4	
6	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
7	Unknown			Dead
8	Unknown			Dead
9	Unknown			Dead
10	Cherrybark Oak (<i>Quercus pagoda</i>)	0.85	4	
11	Unknown			Dead
12	Unknown			Dead
13	Willow Oak (<i>Quercus phellos</i>)	3.50	4	
14	Willow Oak (<i>Quercus phellos</i>)	0.90	4	
15	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	3.50	4	
16	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	4.00	4	
17	Cherrybark Oak (<i>Quercus pagoda</i>)	0.47	3	Deer browse

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Willow Oak (<i>Quercus phellos</i>)	44.4%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	33.3%
Cherrybark Oak (<i>Quercus pagoda</i>)	22.2%

Density:

Total Number of Trees 9 / 0.025 acres = 360 stems / acre

Total Number of Desirable Stems* 13 / 0.025 acres = 520 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 9 / 17 trees x 100 = 53 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

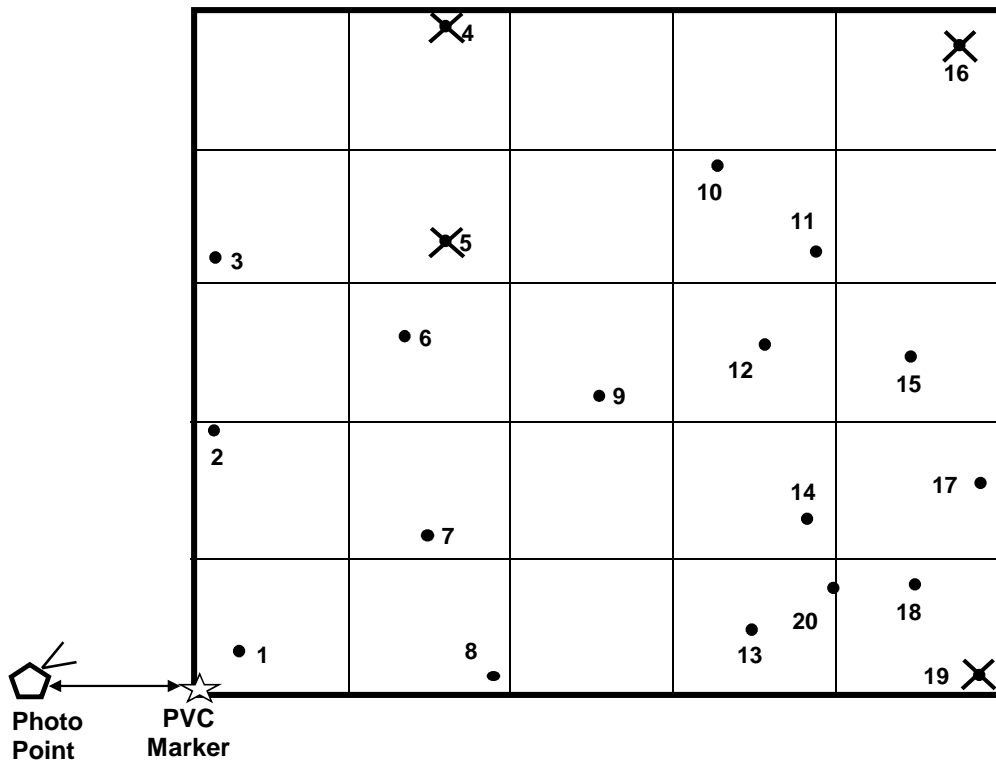
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Sweetgum (<i>Liquidambar styraciflua</i>)	2	4	2	
Green Ash (<i>Fraxinus pennsylvanica</i>)	1			
Loblolly Pine (<i>Pinus taeda</i>)	3			
Total	6	4	2	

Vegetation Monitoring Worksheet

Site: Harrell Plot: W8 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Buttonbush (<i>Cephalanthus occidentalis</i>)	0.65	2	Deer browse
2	Water Hickory (<i>Carya aquatica</i>)	1.20	4	Deer browse
3	Water Hickory (<i>Carya aquatica</i>)	1.88	4	
4	Unknown			Dead
5	Unknown			Dead
6	Water Hickory (<i>Carya aquatica</i>)	1.38	4	
7	Bald Cypress (<i>Taxodium distichum</i>)	1.90	4	
8	Water Hickory (<i>Carya aquatica</i>)	1.33	4	
9	Bald Cypress (<i>Taxodium distichum</i>)	1.62	4	
10	Water Hickory (<i>Carya aquatica</i>)	1.48	4	
11	Water Hickory (<i>Carya aquatica</i>)	1.78	4	
12	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.65	4	
13	Bald Cypress (<i>Taxodium distichum</i>)	1.48	4	
14	Water Hickory (<i>Carya aquatica</i>)	1.18	4	
15	Water Hickory (<i>Carya aquatica</i>)	2.20	4	
16	American Beautyberry (<i>Callicarpa americana</i>)			Dead
17	Water Hickory (<i>Carya aquatica</i>)	1.00	4	
18	Buttonbush (<i>Cephalanthus occidentalis</i>)	2.05	4	
19	Bald Cypress (<i>Taxodium distichum</i>)			Dead
20	Cherrybark Oak (<i>Quercus pagoda</i>)	2.34	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Water Hickory (<i>Carya aquatica</i>)	56.3%
Bald Cypress (<i>Taxodium distichum</i>)	18.8%
Buttonbush (<i>Cephalanthus occidentalis</i>)	18.8%
Cherrybark Oak (<i>Quercus pagoda</i>)	6.3%

Density:

Total Number of Trees 16 / 0.025 acres = 640 stems / acre

Total Number of Desirable Stems* 17 / 0.025 acres = 680 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 16 / 20 trees x 100 = 80 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Cherrybark Oak (<i>Quercus pagoda</i>)	1			
Total	1			

Species	Percent of Total
Green Ash (<i>Fraxinus pennsylvanica</i>)	16.7%
Laurel Oak (<i>Quercus laurifolia</i>)	25.0%
Willow Oak (<i>Quercus phellos</i>)	8.3%
Cherrybark Oak (<i>Quercus pagoda</i>)	33.3%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	8.3%
Buttonbush (<i>Cephalanthus occidentalis</i>)	8.3%

Density:

Total Number of Trees 12 / 0.025 acres = 480 stems / acre

Total Number of Desirable Stems* 13 / 0.025 acres = 520 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 12 / 16 trees x 100 = 75 % survivability



3rd Year Monitoring



4th Year Monitoring

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Sweetgum (<i>Liquidambar styraciflua</i>)			1	
Sugarberry (<i>Celtis laevigata</i>)	1			
Total	1		1	

Species	Percent of Total
Laurel Oak (<i>Quercus laurifolia</i>)	28.6%
Bald Cypress (<i>Taxodium distichum</i>)	7.1%
Green Ash (<i>Fraxinus pennsylvanica</i>)	21.4%
Cherrybark Oak (<i>Quercus pagoda</i>)	14.3%
Buttonbush (<i>Cephalanthus occidentalis</i>)	28.6%

Density:

Total Number of Trees **14** / 0.025 acres = **560** stems / acre

Total Number of Desirable Stems* **31** / 0.025 acres = **1240** stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees **14** / 15 trees x 100 = **93** % survivability



3rd Year Monitoring



4th Year Monitoring

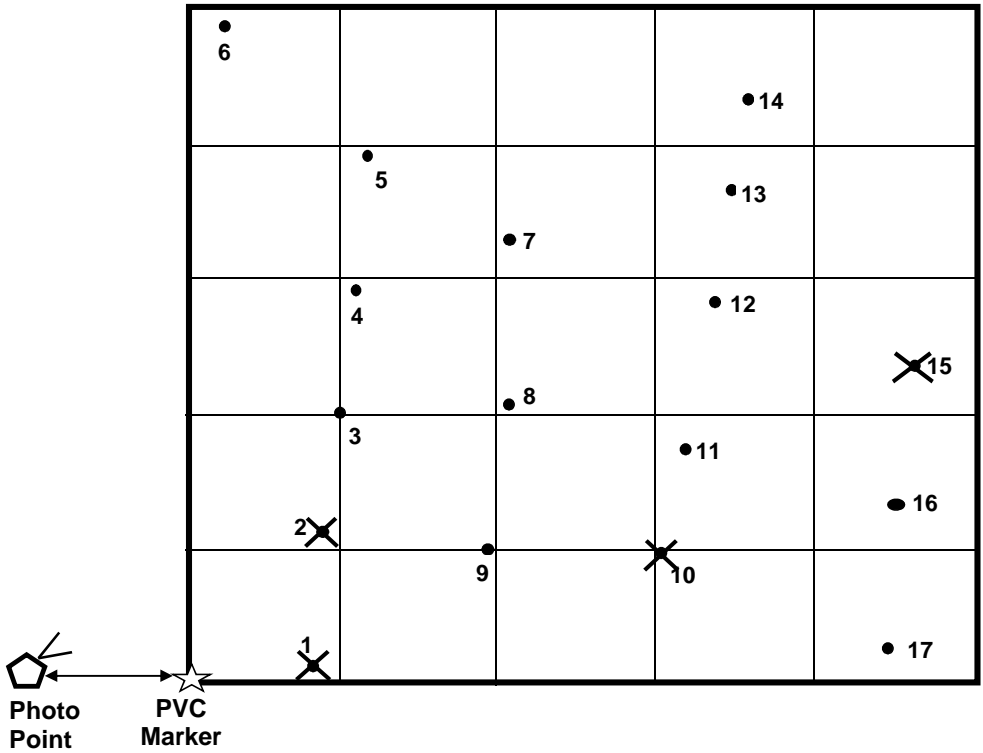
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Baccharis (<i>Baccharis halimifolia</i>)	3	10	3	
Cherrybark Oak (<i>Quercus pagoda</i>)	1			
Total	4	10	3	

Vegetation Monitoring Worksheet

Site: Harrell Plot: W11 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Buttonbush (<i>Cephalanthus occidentalis</i>)			Missing
2	Buttonbush (<i>Cephalanthus occidentalis</i>)			Missing
3	Bald Cypress (<i>Taxodium distichum</i>)	3.50	4	
4	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.68	3	
5	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.35	3	
6	Water Hickory (<i>Carya aquatica</i>)	3.50	4	
7	American Beautyberry (<i>Callicarpa americana</i>)	0.95	4	
8	Water Hickory (<i>Carya aquatica</i>)	2.50	4	
9	Bald Cypress (<i>Taxodium distichum</i>)	1.60	4	
10	Bald Cypress (<i>Taxodium distichum</i>)			Dead
11	Water Hickory (<i>Carya aquatica</i>)	1.43	4	
12	Bald Cypress (<i>Taxodium distichum</i>)	1.51	4	
13	Water Hickory (<i>Carya aquatica</i>)	0.58	3	
14	Bald Cypress (<i>Taxodium distichum</i>)	1.27	3	
15	Bald Cypress (<i>Taxodium distichum</i>)			Dead
16	Bald Cypress (<i>Taxodium distichum</i>)	0.67	4	
17	Bald Cypress (<i>Taxodium distichum</i>)	1.26	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Bald Cypress (<i>Taxodium distichum</i>)	42.9%
Water Hickory (<i>Carya aquatica</i>)	30.8%
Buttonbush (<i>Cephalanthus occidentalis</i>)	15.4%
American Beautyberry (<i>Callicarpa americana</i>)	7.7%

Density:

Total Number of Trees 13 / 0.025 acres = 520 stems / acre

Total Number of Desirable Stems* 19 / 0.025 acres = 760 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 13 / 17 trees x 100 = 76 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

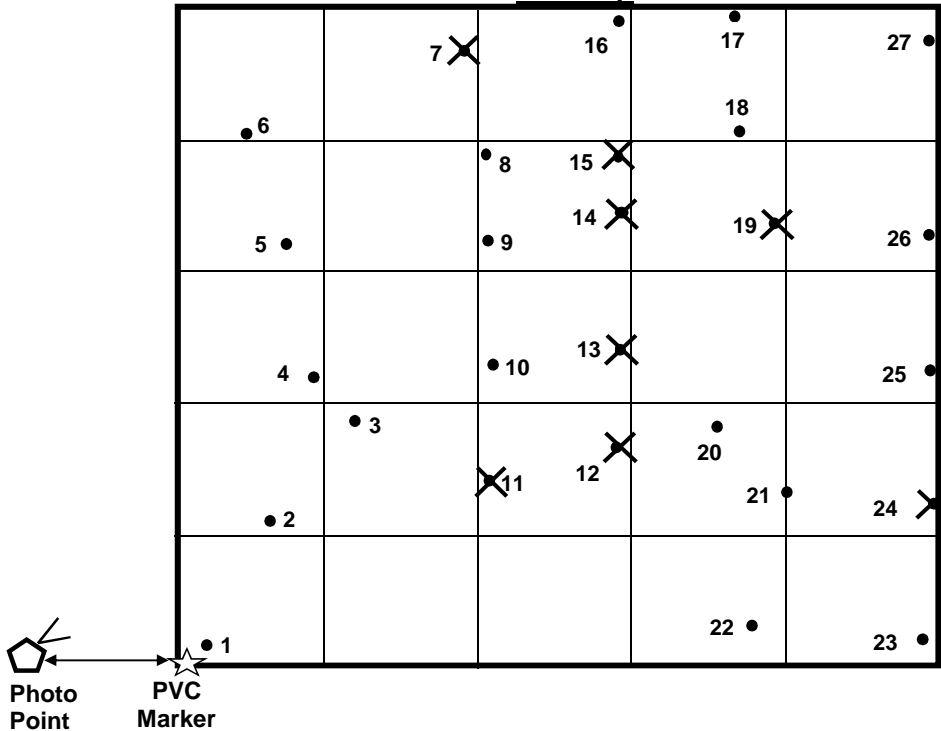
Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Water Hickory (<i>Carya aquatica</i>)		1		
Loblolly Pine (<i>Pinus taeda</i>)		1		
Winged Sumac (<i>Rhus copallinum</i>)	2		2	
Total	2	2	2	

Vegetation Monitoring Worksheet

Site: Harrell Plot: W12 Date: 7/28/2011

Plot Map



ID	Species	Height (m)	Vigor	Comment
1	Water Hickory (<i>Carya aquatica</i>)	4.00	4	
2	Bald Cypress (<i>Taxodium distichum</i>)	1.83	4	
3	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.07	4	
4	Bald Cypress (<i>Taxodium distichum</i>)	1.25	4	
5	Bald Cypress (<i>Taxodium distichum</i>)	1.58	4	
6	Bald Cypress (<i>Taxodium distichum</i>)	2.12	4	
7	American Beautyberry (<i>Callicarpa americana</i>)			Dead
8	Buttonbush (<i>Cephalanthus occidentalis</i>)	0.71	4	Resprout
9	Buttonbush (<i>Cephalanthus occidentalis</i>)	0.78	3	Deer browse
10	Swamp Chestnut Oak (<i>Quercus michauxii</i>)	1.00	4	
11	Buttonbush (<i>Cephalanthus occidentalis</i>)			Missing
12	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
13	Unknown			Dead
14	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
15	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
16	Water Hickory (<i>Carya aquatica</i>)	1.75	4	
17	Water Hickory (<i>Carya aquatica</i>)	2.80	3	
18	Water Hickory (<i>Carya aquatica</i>)	1.77	4	
19	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
20	Water Hickory (<i>Carya aquatica</i>)	1.96	4	
21	Bald Cypress (<i>Taxodium distichum</i>)	3.00	4	
22	Bald Cypress (<i>Taxodium distichum</i>)	2.80	4	
23	Bald Cypress (<i>Taxodium distichum</i>)	1.81	4	
24	Buttonbush (<i>Cephalanthus occidentalis</i>)			Dead
25	Buttonbush (<i>Cephalanthus occidentalis</i>)	1.41	3	Insect damage
26	Bald Cypress (<i>Taxodium distichum</i>)	3.00	4	
27	Bald Cypress (<i>Taxodium distichum</i>)	1.82	4	

Vigor: 4=excellent, 3=good, 2=weak, 1=unlikely to survive year

Species	Percent of Total
Water Hickory (<i>Carya aquatica</i>)	26.3%
Bald Cypress (<i>Taxodium distichum</i>)	47.4%
Buttonbush (<i>Cephalanthus occidentalis</i>)	21.1%
Swamp Chestnut Oak (<i>Quercus michauxii</i>)	5.3%

Density:

Total Number of Trees 19 / 0.025 acres = 760 stems / acre

Total Number of Desirable Stems* 28 / 0.025 acres = 1120 stems / acre

* This includes all volunteers listed below except Red Maple (*Acer rubrum*) and Sweetgum (*Liquidambar styraciflua*)

Survivability:

Total Number of Trees 19 / 27 x 100 = 70 % survivability



**3rd Year
Monitoring**



**4th Year
Monitoring**

Volunteers:

Species	10-50 cm	50-100 cm	100-150 cm	>150 cm
Swamp Chestnut Oak (<i>Quercus michauxii</i>)		1		
Willow Oak (<i>Quercus phellos</i>)		1		
Water Hickory (<i>Carya aquatica</i>)		1		
Cherrybark Oak (<i>Quercus pagoda</i>)		3		
Red Maple (<i>Acer rubrum</i>)		1		
Coralberry (<i>Symphoricarpos orbiculatus</i>)		1		
Laurel Oak (<i>Quercus laurifolia</i>)		1		
Total		9		

Appendix B

Stream and Wetland Photos

Appendix B1 – Stream and Wetland Photo Stations



Photo Point S1: View looking upstream near Station 12+75. 1/12/12 – MY-04



Photo Point S1: View looking downstream near Station 12+75. 1/12/12 – MY-04



Photo Point S2: View looking upstream from farm road near Station 21+30. 1/12/12 – MY-04



Photo Point S2: View looking downstream from farm road near Station 21+30. 1/12/12 – MY-04



Photo Point S3: View looking upstream near Station 27+60. 1/12/12 – MY-04



Photo Point S3: View looking downstream near Station 27+60. 1/12/12 – MY-04



Photo Point S4: View of water quality treatment structure near Station 32+25. 1/12/12 – MY-04



Photo Point S5: View looking at log drop structures, near Station 33+35. 1/12/12 – MY-04



Photo Point S5: View looking downstream near Station 33+35. 1/12/12 – MY-04



Photo Point S6: View of incoming drainage ditch near Station 37+25. 1/12/12 – MY-04



Photo Point S7: View looking upstream near Station 39+00. 1/12/12 – MY-04



Photo Point S7: View looking downstream near Station 39+00. 1/12/12 – MY-04



Photo Point S8: View of log drop structure near Station 39+50. 1/12/12 – MY-04



Photo Point S9: View of water quality treatment structure near Station 41+75. 1/12/12 – MY-04



Photo Point S10: View looking upstream near Station 46+15. 1/12/12 – MY-04



Photo Point S10: View looking downstream near Station 46+15. 1/12/12 – MY-04



Photo Point S11: View of water quality treatment structure near Station 47+00. 1/12/12 – MY-04



Photo Point S12: View looking upstream near Station 52+00. 1/12/12 – MY-04



Photo Point S12: View looking downstream near Station 52+00. 1/12/12 – MY-04



Photo Point S13: View looking upstream near Station 61+50. 1/12/12 – MY-04



Photo Point S13: View of water quality treatment structure near Station 61+50. 1/12/12 – MY-04



Photo Point S13: View looking downstream near Station 61+50. 1/12/12 – MY-04



Photo Point S14: View of stream with water quality treatment structure in the background near Station 62+60. 1/12/12 – MY-04



Photo Point S15: View looking upstream near Station 69+00. 1/12/12 – MY-04



Photo Point S15: View looking downstream near Station 69+00. 1/12/12 – MY-04



Photo Point S16: View looking upstream near Station 76+75. (Photo taken farther away from stream due to water depth) 1/12/12 – MY-04



Photo Point S16: View looking downstream toward project end before the stream joins Swift Creek near Station 76+75. (Photo taken farther away from stream due to water depth) 1/12/12 – MY-04



Photo Point W1: View looking north from southwest corner of wetland. 7/28/11 – MY-04



Photo Point W1: View looking east from southwest corner of wetland. 7/28/11 – MY-04



Photo Point W2: View looking east from northwest corner of wetland. 7/28/11 – MY-04



Photo Point W2: View looking southeast from northwest corner of wetland. 7/28/11 – MY-04



Photo Point W3: View looking east from middle corner of wetland. 7/28/11 – MY-04



Photo Point W3: View looking west from middle corner of wetland. 7/28/11 – MY-04



Photo Point W3: View looking southwest from middle corner of wetland. 7/28/11 – MY-04



Photo Point W4: View looking north toward Wetland Gauge 1. 7/28/11 – MY-04



Photo Point W5: View looking west toward the downstream end of site. 7/28/11 – MY-04

Appendix C

Geomorphologic and Hydrologic Data

Appendix C1 – Cross-Section Plots

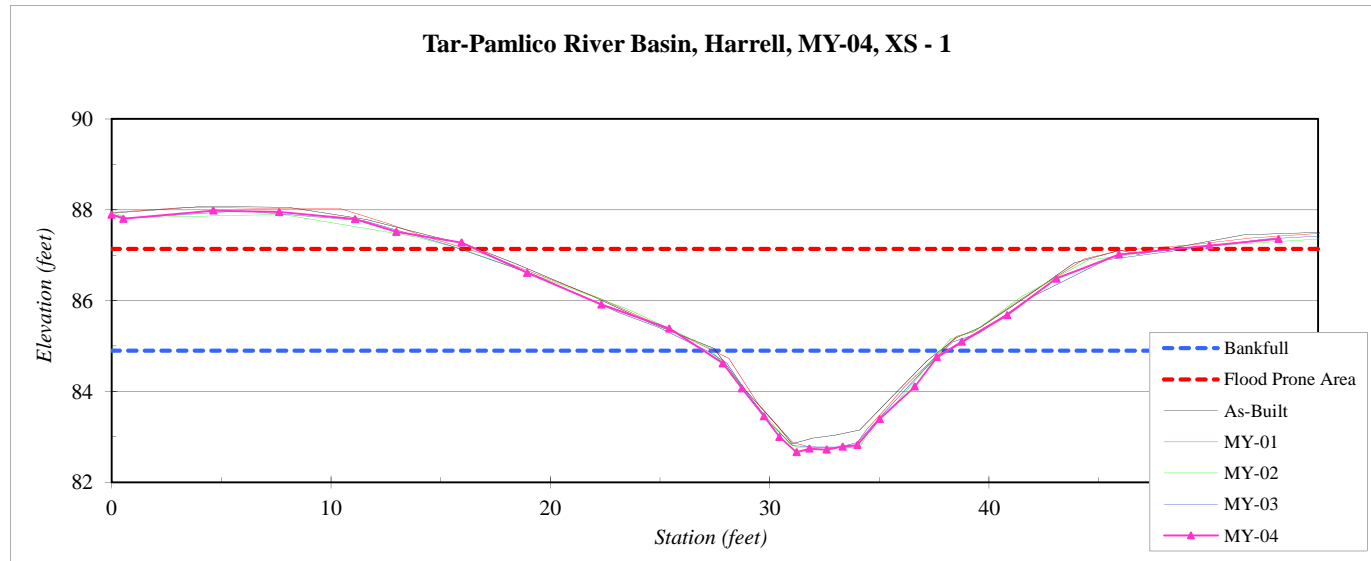
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 1
Drainage Area (sq mi):	0.20
Date:	5/11/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	87.89
0.54	87.80
4.64	87.98
7.65	87.95
11.09	87.80
12.99	87.51
15.96	87.28
18.95	86.61
22.33	85.91
25.42	85.39
27.86	84.62
28.74	84.06
29.75	83.45
30.45	83.00
31.22	82.66
31.82	82.74
32.59	82.72
33.32	82.78
33.99	82.82
35.02	83.39
36.62	84.10
37.62	84.75
38.76	85.09
40.83	85.68
43.07	86.49
45.92	87.02
50.05	87.21
53.19	87.36

SUMMARY DATA	
Bankfull Elevation:	84.9
Bankfull Cross-Sectional Area:	14.7
Bankfull Width:	11.2
Flood Prone Area Elevation:	87.1
Flood Prone Width:	32
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.3
W / D Ratio:	8.5
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

Stream Type	B5c
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River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 2
Drainage Area (sq mi):	0.20
Date:	5/11/2011
Field Crew:	A. French, A. Helms

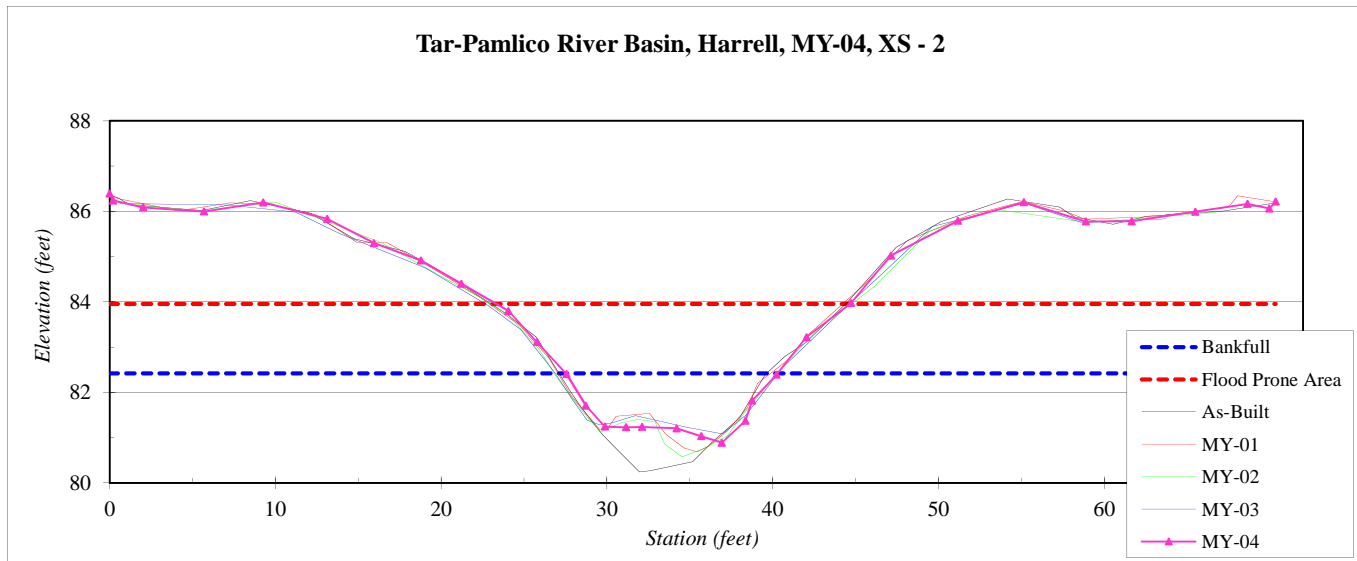


Station	Elevation
0.00	86.39
0.20	86.24
2.02	86.09
5.69	85.99
9.27	86.20
13.13	85.83
15.95	85.30
18.79	84.92
21.22	84.40
24.06	83.80
25.79	83.11
27.56	82.41
28.73	81.71
29.88	81.24
31.15	81.23
32.13	81.24
34.20	81.21
35.69	81.03
36.94	80.89
38.36	81.37
38.77	81.82
40.24	82.39
42.04	83.22
44.72	83.97
47.14	85.02
51.17	85.79
55.15	86.20
58.90	85.78
61.66	85.78
65.50	85.99
68.66	86.16
69.97	86.06
70.36	86.21

SUMMARY DATA	
Bankfull Elevation:	82.4
Bankfull Cross-Sectional Area:	13.1
Bankfull Width:	12.8
Flood Prone Area Elevation:	84.0
Flood Prone Width:	21
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	12.5
Entrenchment Ratio:	1.7
Bank Height Ratio:	1.0

Stream Type	B5c
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Tar-Pamlico River Basin, Harrell, MY-04, XS - 2



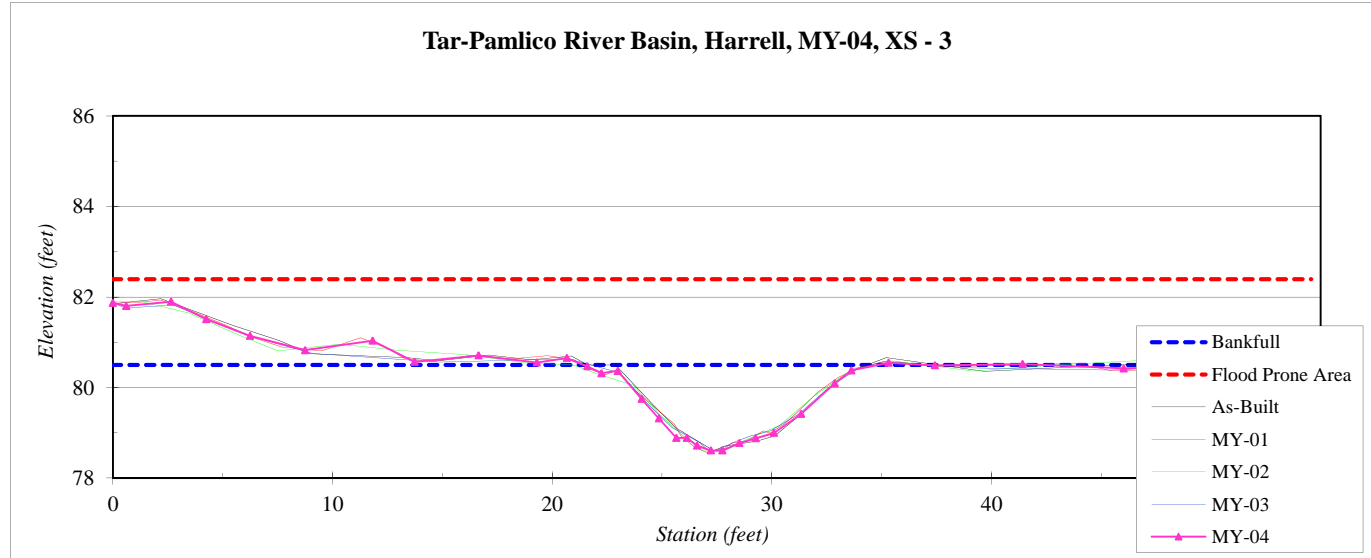
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 3
Drainage Area (sq mi):	0.23
Date:	5/11/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	81.87
0.60	81.80
2.64	81.90
4.25	81.51
6.25	81.14
8.75	80.82
11.83	81.03
13.74	80.57
16.66	80.71
19.31	80.55
20.67	80.65
21.60	80.47
22.25	80.31
22.99	80.37
24.08	79.75
24.87	79.32
25.66	78.88
26.14	78.89
26.61	78.71
27.23	78.61
27.76	78.61
28.52	78.77
29.27	78.88
30.11	79.00
31.33	79.42
32.87	80.09
33.63	80.38
35.32	80.54
37.43	80.49
41.42	80.52
46.03	80.42
50.43	80.45
54.26	80.82
54.56	80.99

SUMMARY DATA	
Bankfull Elevation:	80.5
Bankfull Cross-Sectional Area:	13.2
Bankfull Width:	13.3
Flood Prone Area Elevation:	82.4
Flood Prone Width:	>55
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.0
W / D Ratio:	13.4
Entrenchment Ratio:	>4.1
Bank Height Ratio:	1.0

Stream Type	C5
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River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 4
Drainage Area (sq mi):	0.23
Date:	5/11/2011
Field Crew:	A. French, A. Helms

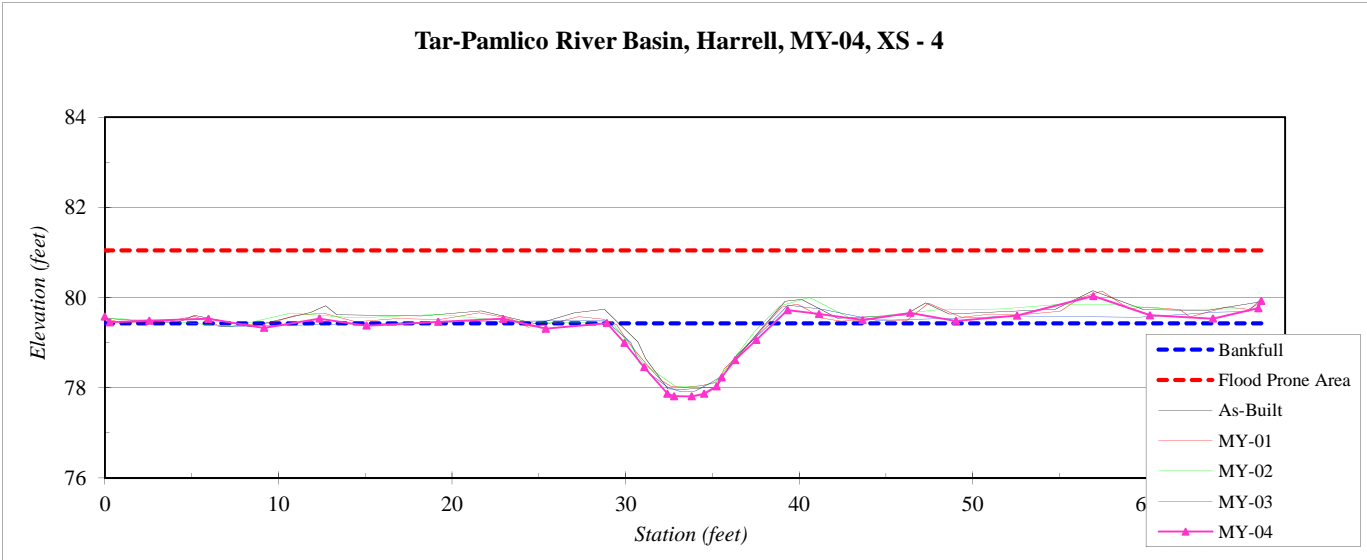


Station	Elevation
0.00	79.58
0.28	79.45
2.56	79.49
5.96	79.53
9.17	79.33
12.36	79.53
15.08	79.38
19.20	79.46
22.95	79.53
25.41	79.31
28.92	79.44
29.94	79.00
31.08	78.45
32.42	77.87
32.79	77.81
33.80	77.81
34.52	77.87
35.25	78.03
35.54	78.23
36.31	78.61
37.53	79.06
39.33	79.72
41.14	79.64
43.66	79.50
46.41	79.66
49.04	79.49
52.57	79.60
56.95	80.03
60.22	79.61
63.84	79.53
66.45	79.76
66.63	79.93

SUMMARY DATA	
Bankfull Elevation:	79.4
Bankfull Cross-Sectional Area:	9.2
Bankfull Width:	9.6
Flood Prone Area Elevation:	81.0
Flood Prone Width:	>67
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
W / D Ratio:	10.0
Entrenchment Ratio:	>7.0
Bank Height Ratio:	1.0

Stream Type	C5
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Tar-Pamlico River Basin, Harrell, MY-04, XS - 4



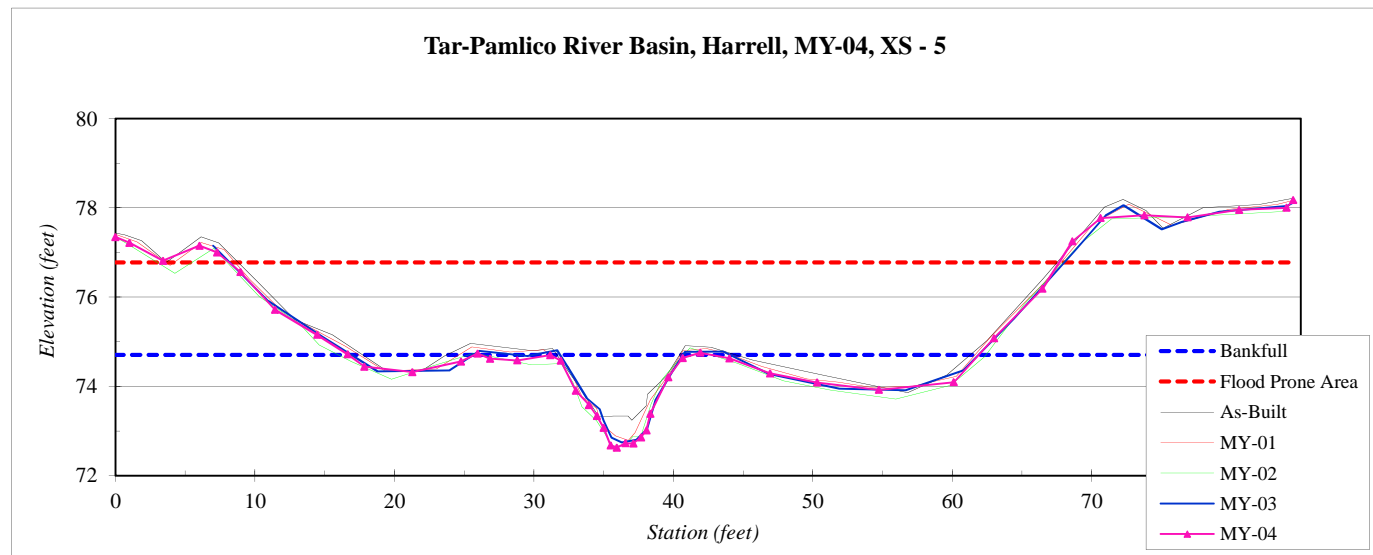
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 5
Drainage Area (sq mi):	0.23
Date:	5/18/2011
Field Crew:	A. French, A. Helms



Stream Type	C5
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Station	Elevation
0.00	77.35
1.01	77.21
3.41	76.81
6.02	77.15
7.28	77.00
8.96	76.56
11.44	75.72
14.46	75.15
16.65	74.72
17.84	74.44
21.29	74.32
24.76	74.55
25.95	74.73
26.86	74.62
28.82	74.58
31.18	74.70
31.92	74.58
33.00	73.90
33.96	73.58
34.52	73.34
35.00	73.07
35.50	72.67
35.95	72.63
36.56	72.72
37.13	72.72
37.69	72.86
38.07	73.01
38.34	73.38
39.63	74.20
40.67	74.64
41.92	74.75
44.02	74.63
46.93	74.29
50.30	74.09
54.74	73.92
60.11	74.09
63.00	75.08
66.46	76.19
68.61	77.25

SUMMARY DATA	
Bankfull Elevation:	74.7
Bankfull Cross-Sectional Area:	10.8
Bankfull Width:	11.4
Flood Prone Area Elevation:	76.8
Flood Prone Width:	60
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	0.9
W / D Ratio:	12.0
Entrenchment Ratio:	5.2
Bank Height Ratio:	1.0



*Other shots not included due to space

River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 6
Drainage Area (sq mi):	0.42
Date:	5/18/2011
Field Crew:	A. French, A. Helms

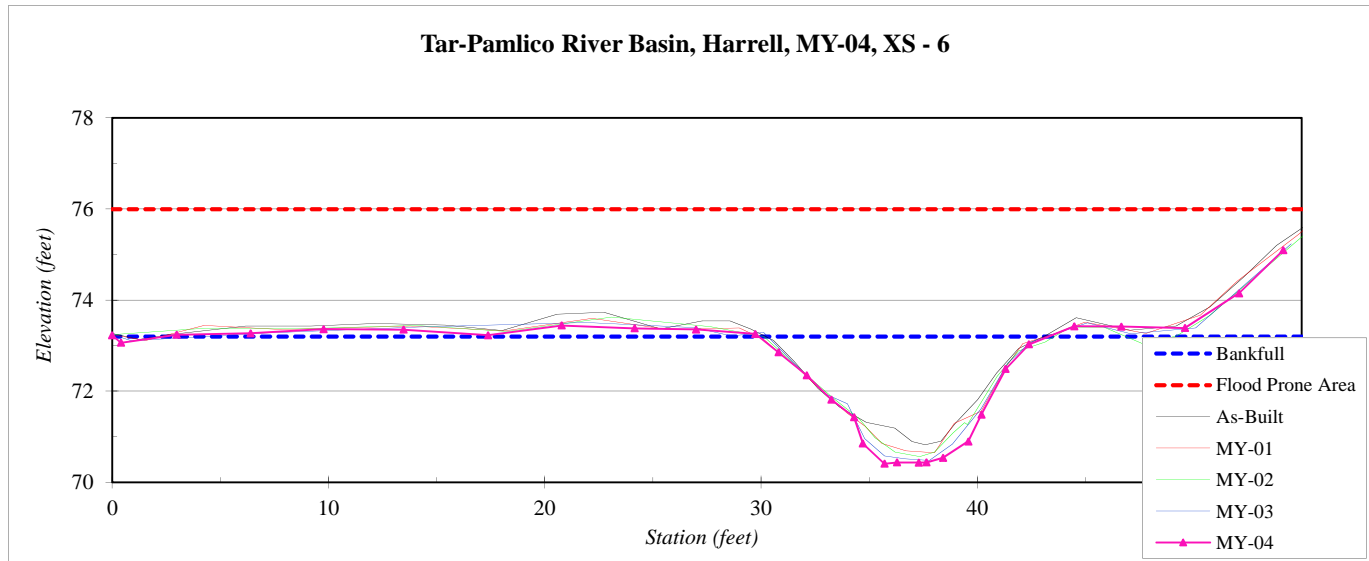


Station	Elevation
0.00	73.23
0.41	73.06
2.98	73.24
6.40	73.27
9.78	73.36
13.47	73.35
17.38	73.23
20.78	73.44
24.16	73.38
27.01	73.35
29.74	73.25
30.81	72.85
32.12	72.34
33.25	71.82
34.31	71.43
34.71	70.85
35.71	70.41
36.29	70.43
37.30	70.43
37.65	70.43
38.43	70.54
39.59	70.90
40.19	71.49
41.31	72.48
42.39	73.03
44.50	73.42
46.66	73.42
49.61	73.38
52.11	74.15
54.15	75.09

SUMMARY DATA	
Bankfull Elevation:	73.2
Bankfull Cross-Sectional Area:	20.8
Bankfull Width:	13.4
Flood Prone Area Elevation:	76.0
Flood Prone Width:	>56
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.6
W / D Ratio:	8.6
Entrenchment Ratio:	>4.2
Bank Height Ratio:	1.0

Stream Type	C5
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Tar-Pamlico River Basin, Harrell, MY-04, XS - 6



River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 7
Drainage Area (sq mi):	0.42
Date:	5/18/2011
Field Crew:	A. French, A. Helms

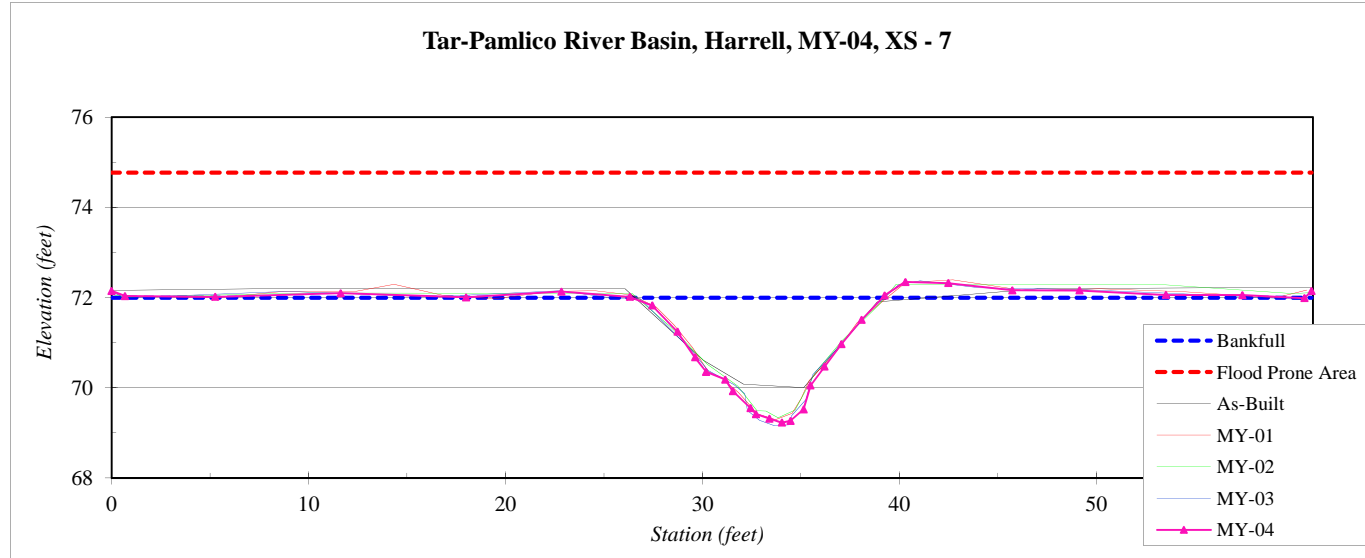


Station	Elevation
0.00	72.15
0.69	72.03
5.26	72.02
11.63	72.10
18.00	72.00
22.84	72.13
26.32	72.01
27.46	71.82
28.74	71.24
29.64	70.67
30.19	70.35
31.17	70.18
31.55	69.93
32.45	69.55
32.73	69.42
33.41	69.31
34.03	69.23
34.47	69.27
35.14	69.52
35.49	70.05
36.21	70.47
37.06	70.97
38.09	71.51
39.26	72.05
40.31	72.35
42.49	72.32
45.74	72.16
49.15	72.16
53.54	72.06
57.43	72.06
60.57	71.99
60.93	72.15

SUMMARY DATA	
Bankfull Elevation:	72.0
Bankfull Cross-Sectional Area:	18.2
Bankfull Width:	12.7
Flood Prone Area Elevation:	74.8
Flood Prone Width:	>61
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.4
W / D Ratio:	8.9
Entrenchment Ratio:	>4.8
Bank Height Ratio:	1.0

Stream Type	C5
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Tar-Pamlico River Basin, Harrell, MY-04, XS - 7



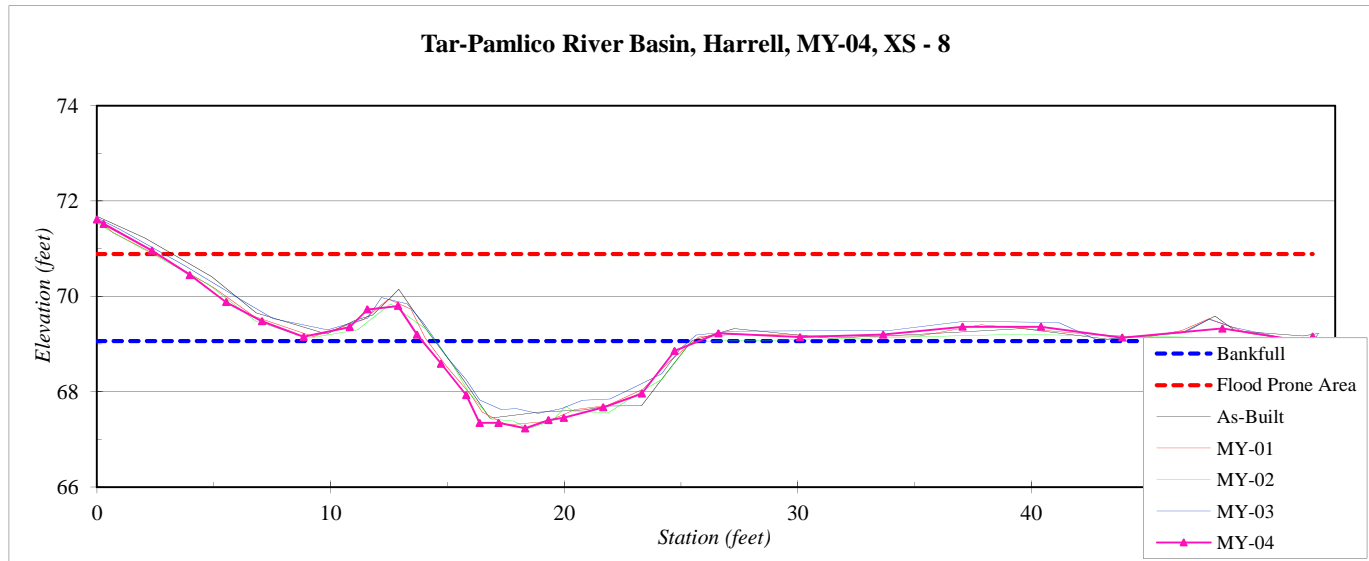
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 8
Drainage Area (sq mi):	0.42
Date:	5/18/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	71.61
0.29	71.52
2.36	70.96
3.98	70.45
5.53	69.88
7.07	69.48
8.85	69.15
10.82	69.36
11.58	69.73
12.89	69.80
13.70	69.20
14.73	68.59
15.81	67.93
16.38	67.34
17.20	67.34
18.33	67.23
19.33	67.40
19.99	67.45
21.67	67.67
23.32	67.96
24.73	68.86
26.60	69.22
30.10	69.15
33.66	69.20
37.06	69.36
40.41	69.36
43.89	69.14
48.18	69.33
51.93	69.04
52.04	69.16

SUMMARY DATA	
Bankfull Elevation:	69.1
Bankfull Cross-Sectional Area:	14.2
Bankfull Width:	12.1
Flood Prone Area Elevation:	70.9
Flood Prone Width:	>50
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.2
W / D Ratio:	10.3
Entrenchment Ratio:	>4.4
Bank Height Ratio:	1.0

Stream Type C5



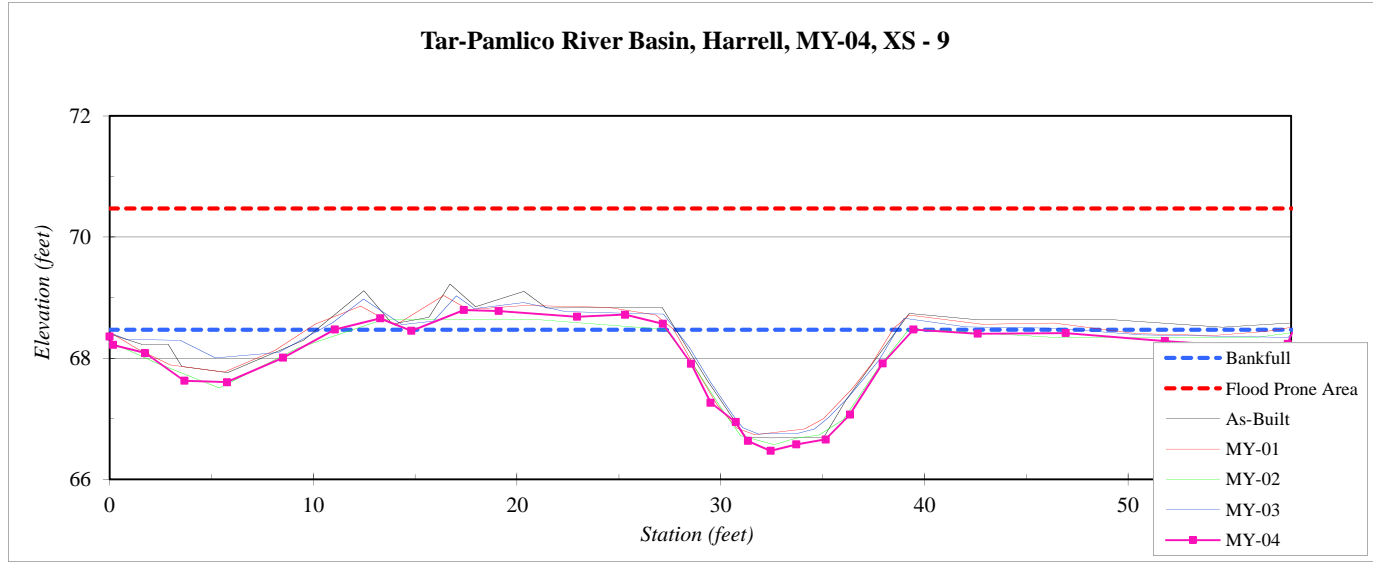
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 9
Drainage Area (sq mi):	0.42
Date:	5/19/2011
Field Crew:	A. French, A. Helms



Stream Type	C5
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Station	Elevation
0.00	68.36
0.17	68.22
1.75	68.09
3.67	67.63
5.76	67.60
8.52	68.01
11.05	68.47
13.28	68.66
14.81	68.45
17.39	68.79
19.10	68.78
22.94	68.68
25.30	68.72
27.16	68.57
28.54	67.91
29.50	67.27
30.73	66.94
31.33	66.63
32.45	66.47
33.72	66.57
35.15	66.66
36.34	67.07
37.95	67.92
39.46	68.47
42.61	68.40
46.93	68.41
51.80	68.28
56.35	68.18
57.83	68.24
58.04	68.42

SUMMARY DATA	
Bankfull Elevation:	68.5
Bankfull Cross-Sectional Area:	15.0
Bankfull Width:	12.1
Flood Prone Area Elevation:	70.5
Flood Prone Width:	>58
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.2
W / D Ratio:	9.8
Entrenchment Ratio:	>4.8
Bank Height Ratio:	1.0



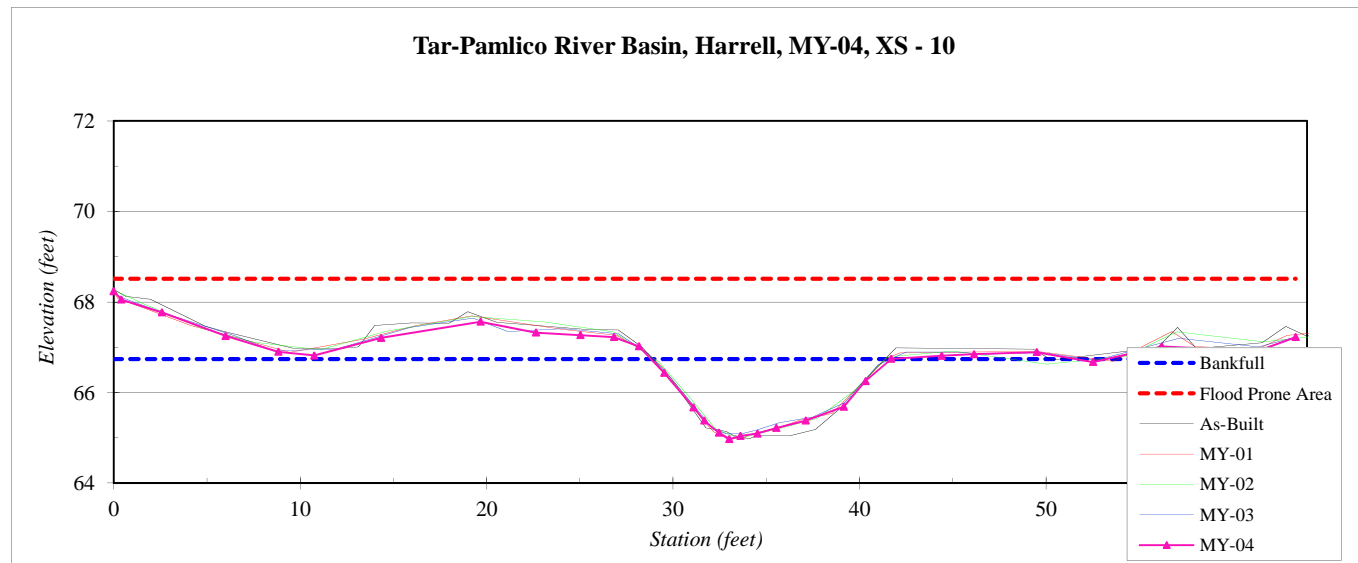
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 10
Drainage Area (sq mi):	0.61
Date:	5/19/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	68.24
0.42	68.05
2.60	67.77
6.01	67.25
8.83	66.90
10.76	66.82
14.35	67.21
19.68	67.57
22.65	67.32
25.04	67.27
26.84	67.22
28.17	67.02
29.52	66.43
31.10	65.67
31.67	65.38
32.46	65.11
33.02	64.97
33.61	65.04
34.53	65.09
35.55	65.22
37.12	65.38
39.16	65.69
40.33	66.25
41.71	66.74
44.42	66.81
46.15	66.85
49.51	66.89
52.53	66.67
56.22	67.02
61.38	66.92
63.39	67.23

SUMMARY DATA	
Bankfull Elevation:	66.7
Bankfull Cross-Sectional Area:	14.2
Bankfull Width:	12.9
Flood Prone Area Elevation:	68.5
Flood Prone Width:	>67
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	11.7
Entrenchment Ratio:	>4.8
Bank Height Ratio:	1.0

Stream Type	C5
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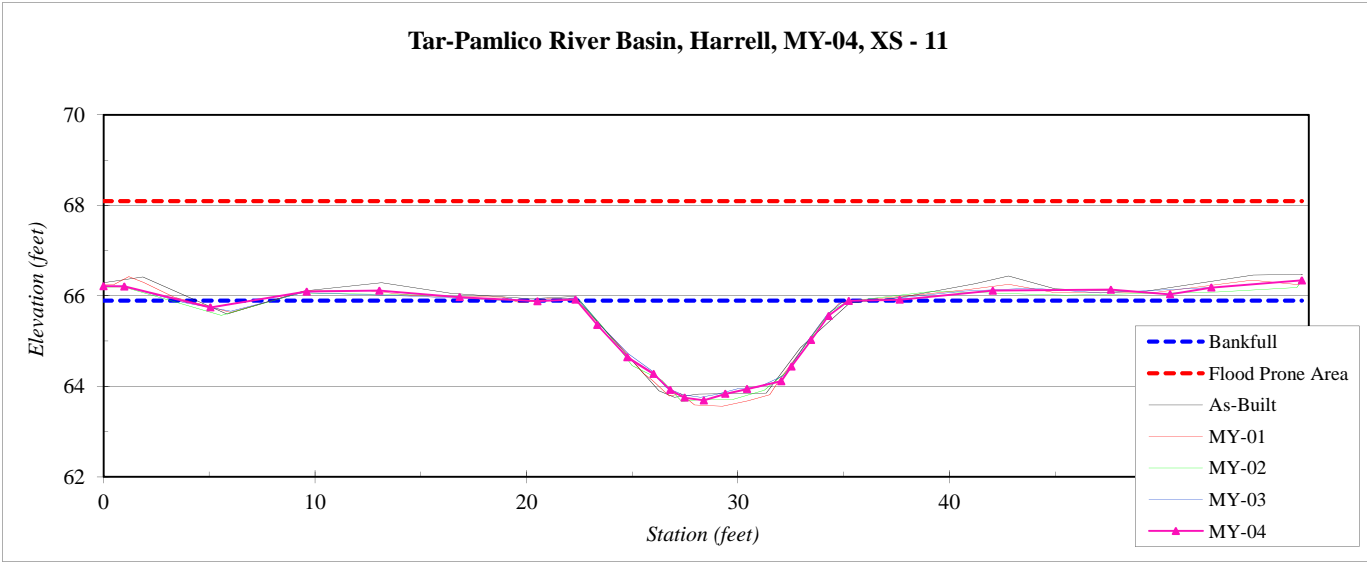
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 11
Drainage Area (sq mi):	0.61
Date:	5/19/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	66.21
0.98	66.20
5.06	65.74
9.60	66.09
13.04	66.11
16.84	65.97
20.51	65.88
22.33	65.92
23.35	65.35
24.77	64.64
26.01	64.27
26.81	63.92
27.48	63.75
28.39	63.69
29.41	63.83
30.44	63.94
32.06	64.11
32.53	64.43
33.46	65.02
34.29	65.56
35.24	65.89
37.65	65.91
42.06	66.11
47.65	66.13
50.44	66.03
52.39	66.18
56.7	66.34

SUMMARY DATA	
Bankfull Elevation:	65.9
Bankfull Cross-Sectional Area:	17.8
Bankfull Width:	13.3
Flood Prone Area Elevation:	68.1
Flood Prone Width:	>57
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.3
W / D Ratio:	9.9
Entrenchment Ratio:	>4.1
Bank Height Ratio:	1.0

Stream Type	C5
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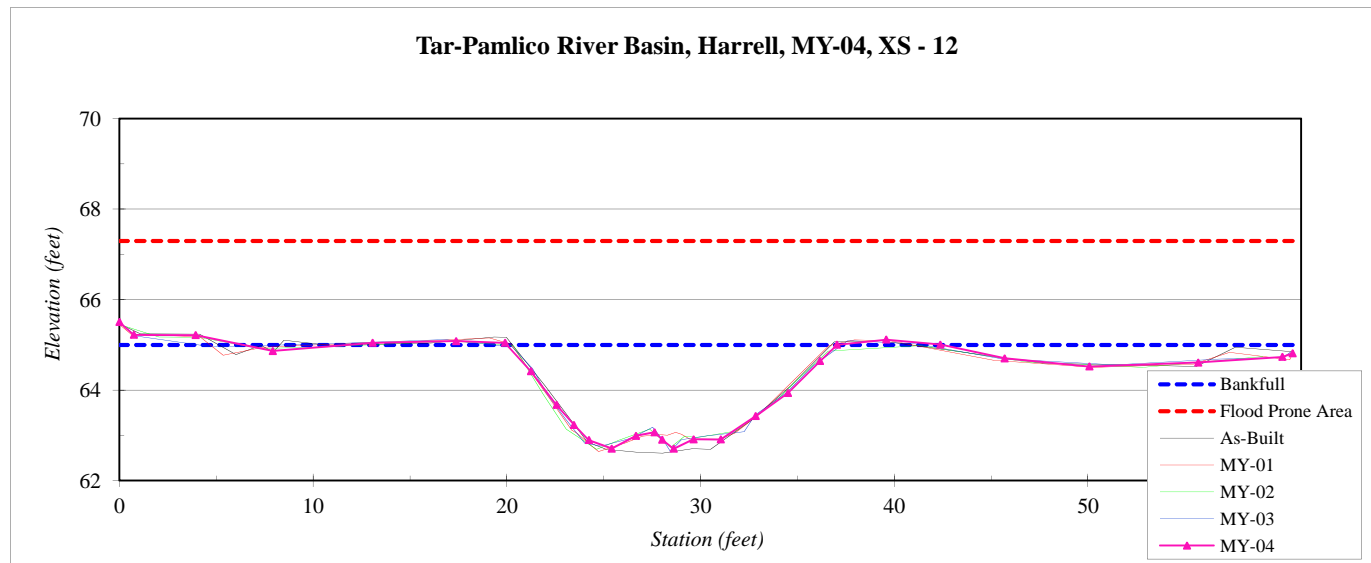
River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 12
Drainage Area (sq mi):	0.61
Date:	5/19/2011
Field Crew:	A. French, A. Helms



Station	Elevation
0.00	65.50
0.74	65.22
3.94	65.22
7.92	64.86
13.07	65.04
17.38	65.08
19.90	65.05
21.25	64.41
22.57	63.67
23.47	63.23
24.23	62.89
25.42	62.71
26.67	62.99
27.63	63.07
28.02	62.90
28.61	62.70
29.64	62.91
31.05	62.91
32.85	63.43
34.51	63.93
36.17	64.64
37.05	65.00
39.59	65.12
42.39	65.00
45.70	64.70
50.07	64.52
55.69	64.61
60.04	64.73
60.57	64.82

SUMMARY DATA	
Bankfull Elevation:	65.0
Bankfull Cross-Sectional Area:	25.8
Bankfull Width:	17.0
Flood Prone Area Elevation:	67.3
Flood Prone Width:	>61
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.5
W / D Ratio:	11.2
Entrenchment Ratio:	>3.6
Bank Height Ratio:	1.0

Stream Type	C5
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River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 13
Drainage Area (sq mi):	0.61
Date:	5/19/2011
Field Crew:	A. French, A. Helms

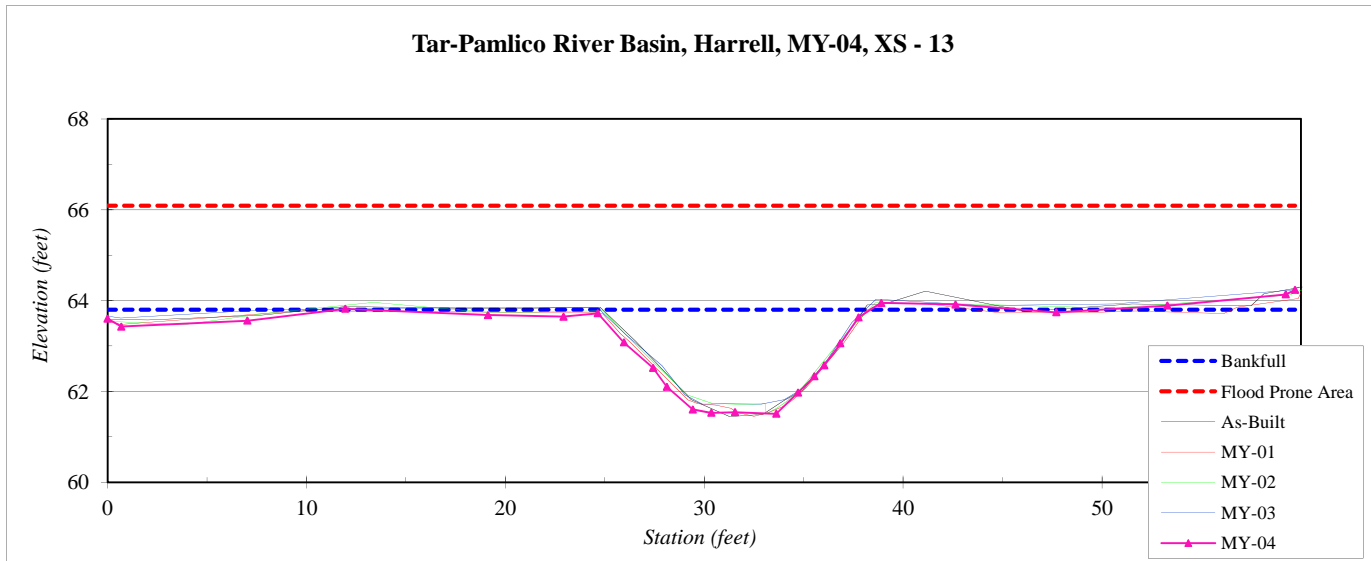


Stream Type	C5
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Station	Elevation
0.00	63.60
0.70	63.43
7.03	63.56
11.95	63.82
19.12	63.68
22.92	63.65
24.65	63.72
25.97	63.08
27.42	62.52
28.12	62.10
29.42	61.60
30.35	61.53
31.55	61.54
33.62	61.51
34.73	61.97
35.54	62.33
36.03	62.57
36.84	63.06
37.75	63.63
38.91	63.95
42.64	63.92
47.70	63.74
53.28	63.89
59.23	64.13
59.70	64.23

SUMMARY DATA	
Bankfull Elevation:	63.8
Bankfull Cross-Sectional Area:	19.5
Bankfull Width:	13.4
Flood Prone Area Elevation:	66.1
Flood Prone Width:	>60
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.5
W / D Ratio:	9.2
Entrenchment Ratio:	>4.4
Bank Height Ratio:	1.0

Tar-Pamlico River Basin, Harrell, MY-04, XS - 13



River Basin:	Tar-Pamlico
Watershed:	Harrell, MY-04
XS ID	XS - 14
Drainage Area (sq mi):	0.61
Date:	5/19/2011
Field Crew:	A. French, A. Helms

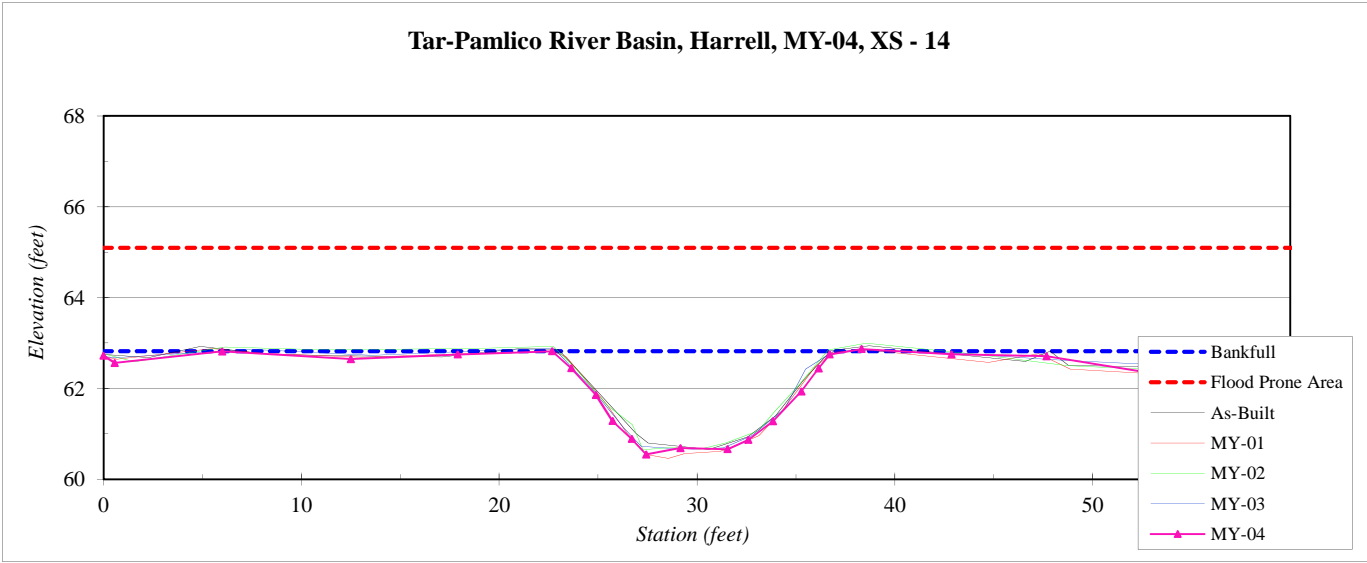


Station	Elevation
0.00	62.72
0.57	62.56
6.00	62.81
12.51	62.65
17.91	62.75
22.68	62.82
23.65	62.44
24.89	61.85
25.73	61.28
26.71	60.89
27.43	60.54
29.16	60.69
31.55	60.66
32.59	60.87
33.85	61.28
35.28	61.93
36.15	62.44
36.71	62.75
38.32	62.87
42.86	62.75
47.67	62.71
52.58	62.37
55.57	62.42
56.68	62.45

SUMMARY DATA	
Bankfull Elevation:	62.8
Bankfull Cross-Sectional Area:	21.0
Bankfull Width:	15.0
Flood Prone Area Elevation:	65.1
Flood Prone Width:	>62
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.4
W / D Ratio:	10.7
Entrenchment Ratio:	>3.9
Bank Height Ratio:	1.0

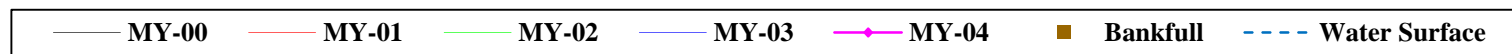
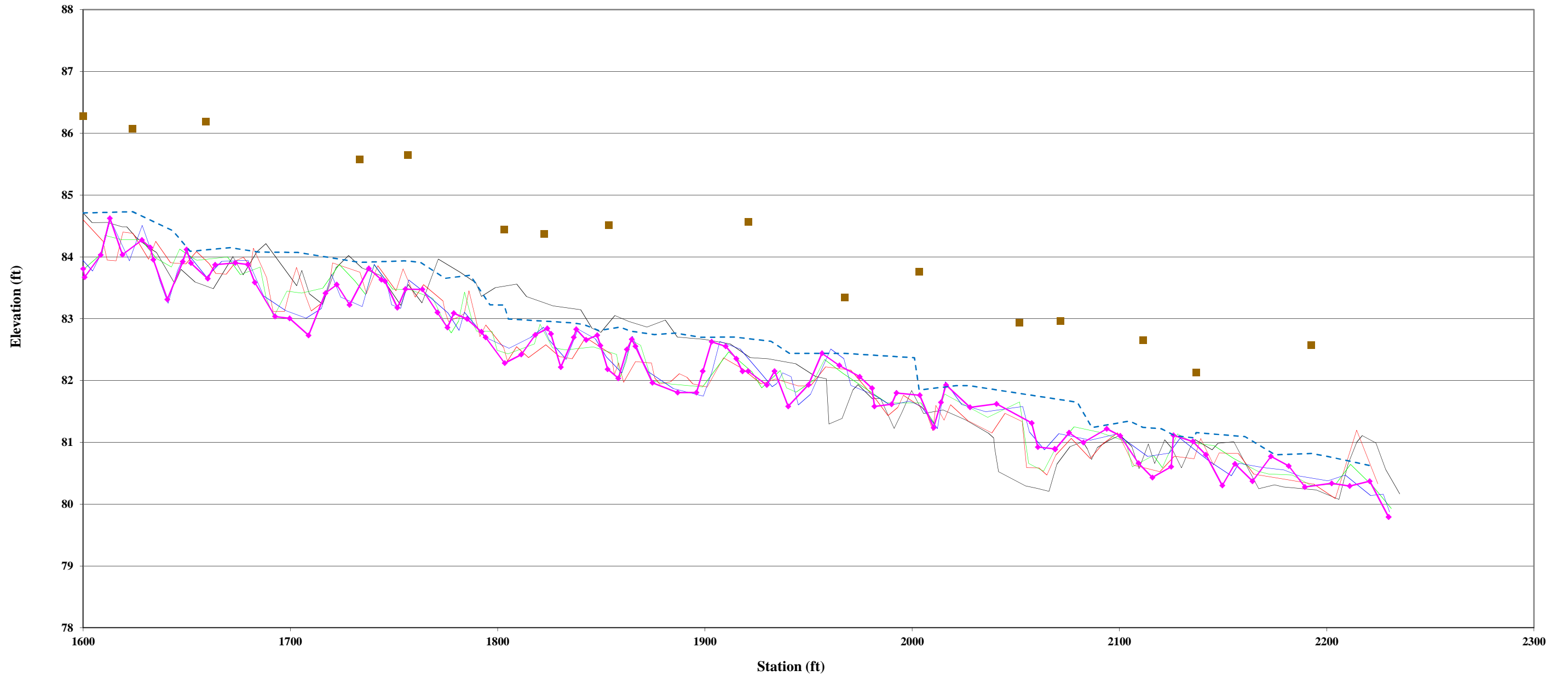
Stream Type	C5
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Tar-Pamlico River Basin, Harrell, MY-04, XS - 14

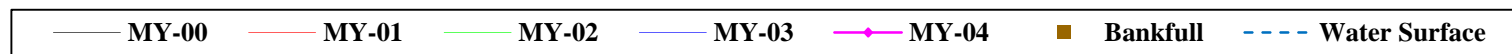
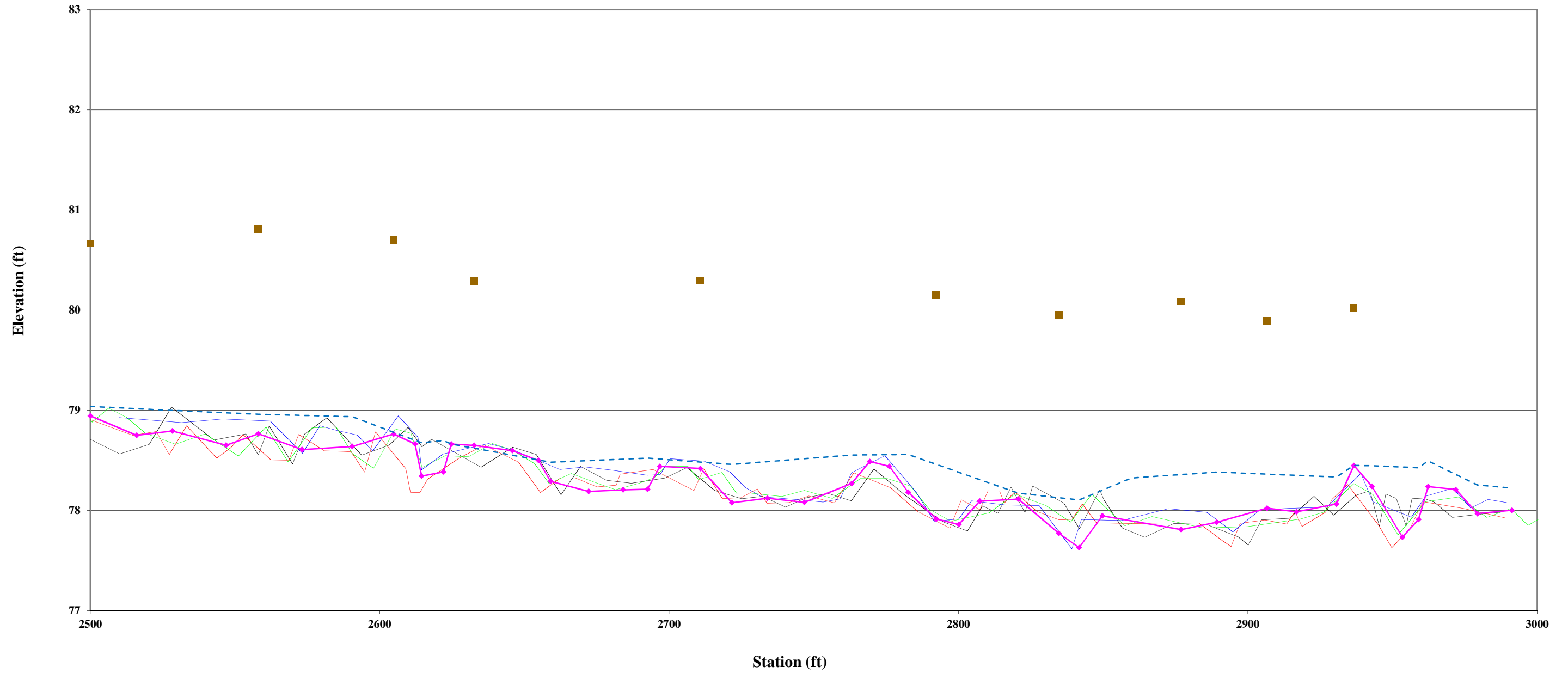


Appendix C2 – Longitudinal Profiles

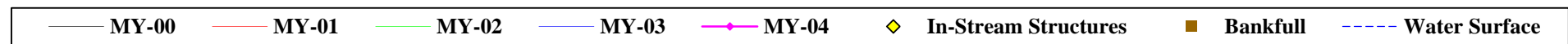
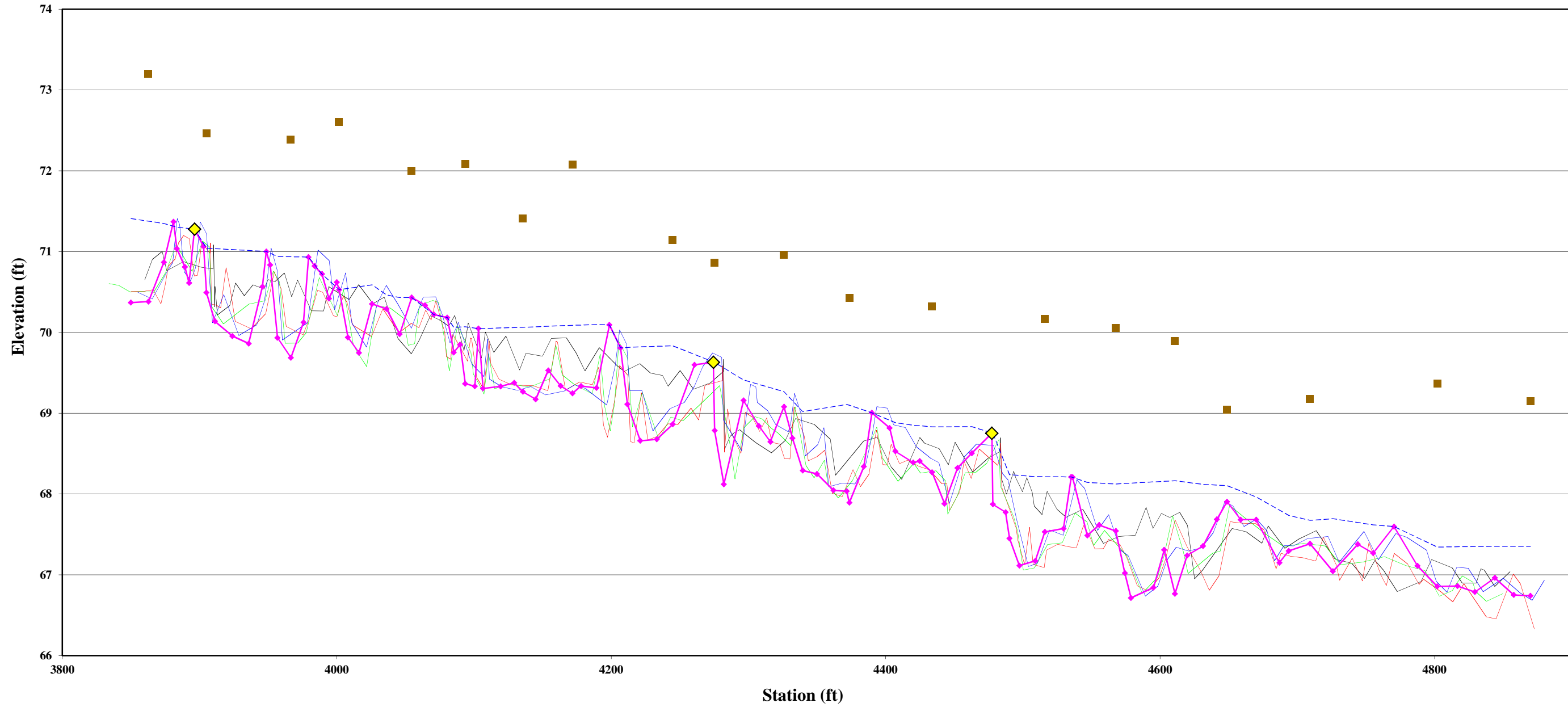
Longitudinal Profile
Harrell Stream Restoration MY-04
Reach 1 - Station 16+00 - 22+40



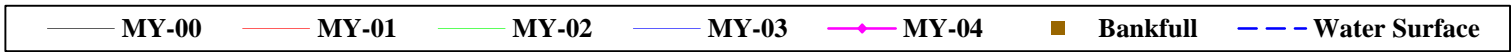
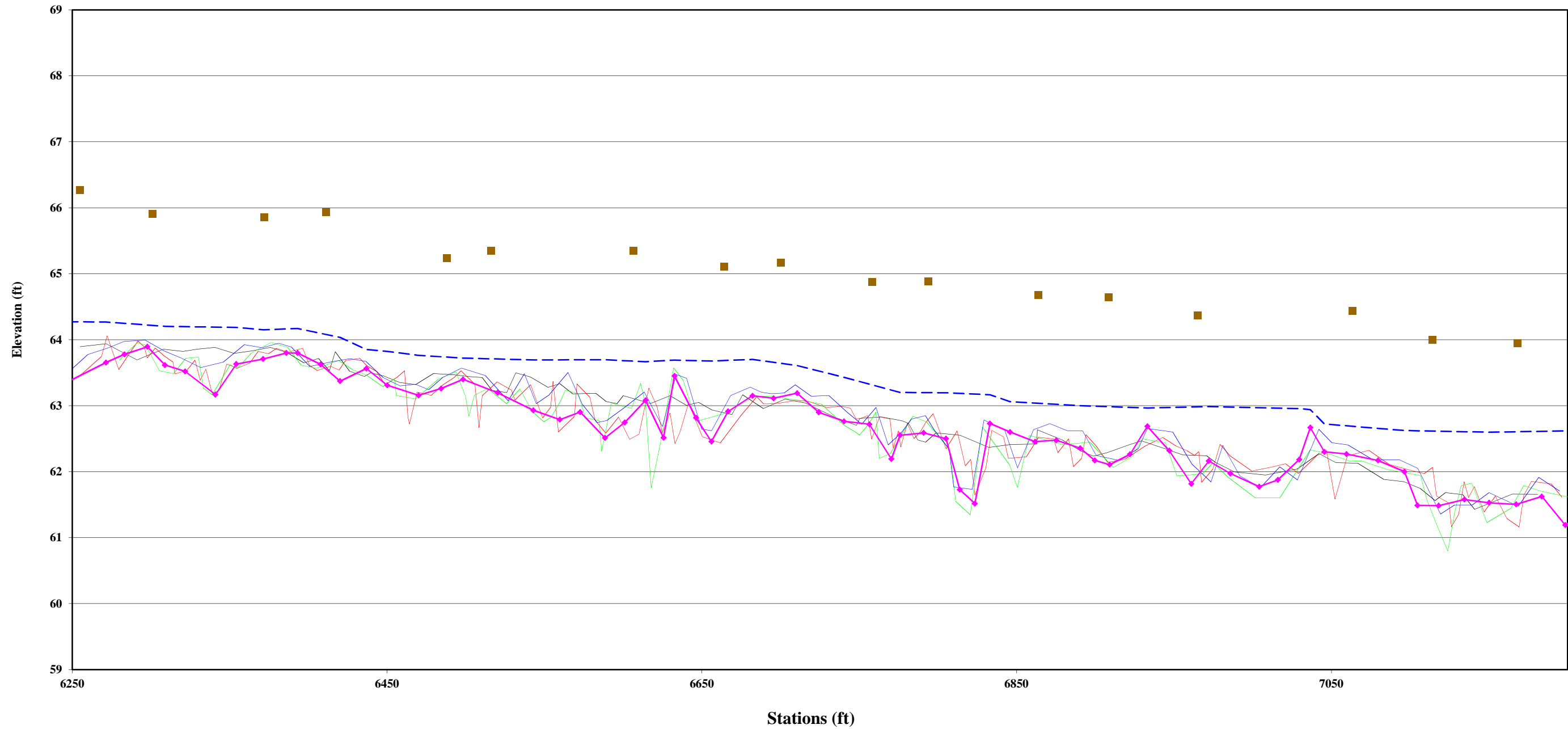
Longitudinal Profile
Harrell Stream Restoration MY-04
Reach 2 - Station 25+00 - 29+90



Longitudinal Profile
Harrell Stream Restoration MY-04
Reach 3 - Station 38+50 - 48+80

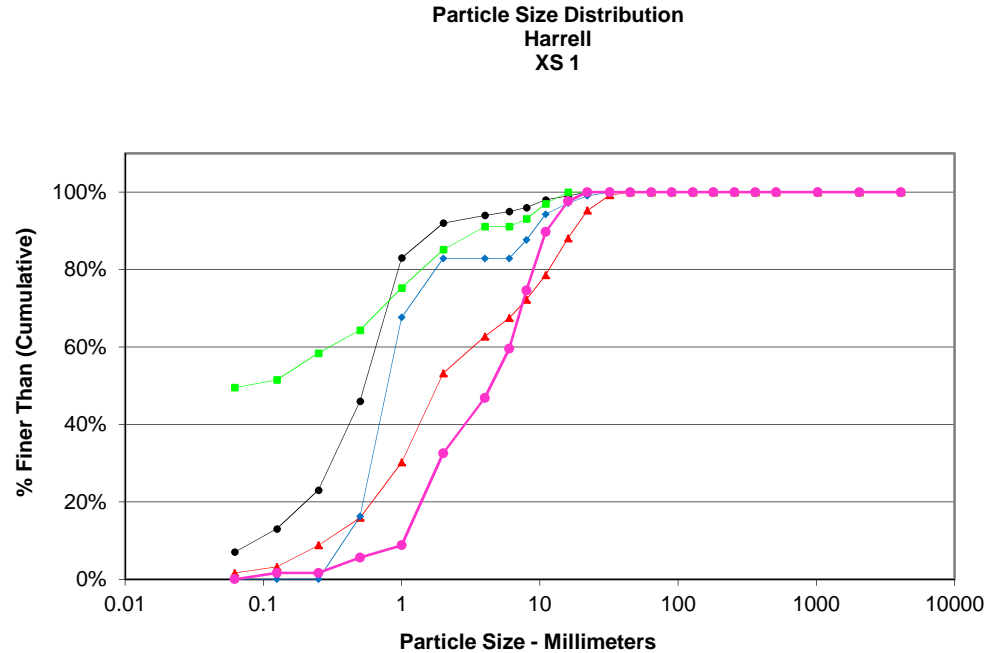


**Longitudinal Profile
Harrell Stream Restoration MY-04
Reach 4 - Station 62+55 - 72+00**



Appendix C3 – Pebble Count Data

Cross-Section 1 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	30
Very Fine	2 - 4		18
Fine	4 - 5.7	G	16
Fine	5.7 - 8	R	19
Medium	8 - 11.3	A	19
Medium	11.3 - 16	V	10
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32		
Very Coarse	32 - 45		
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		126
Note:			

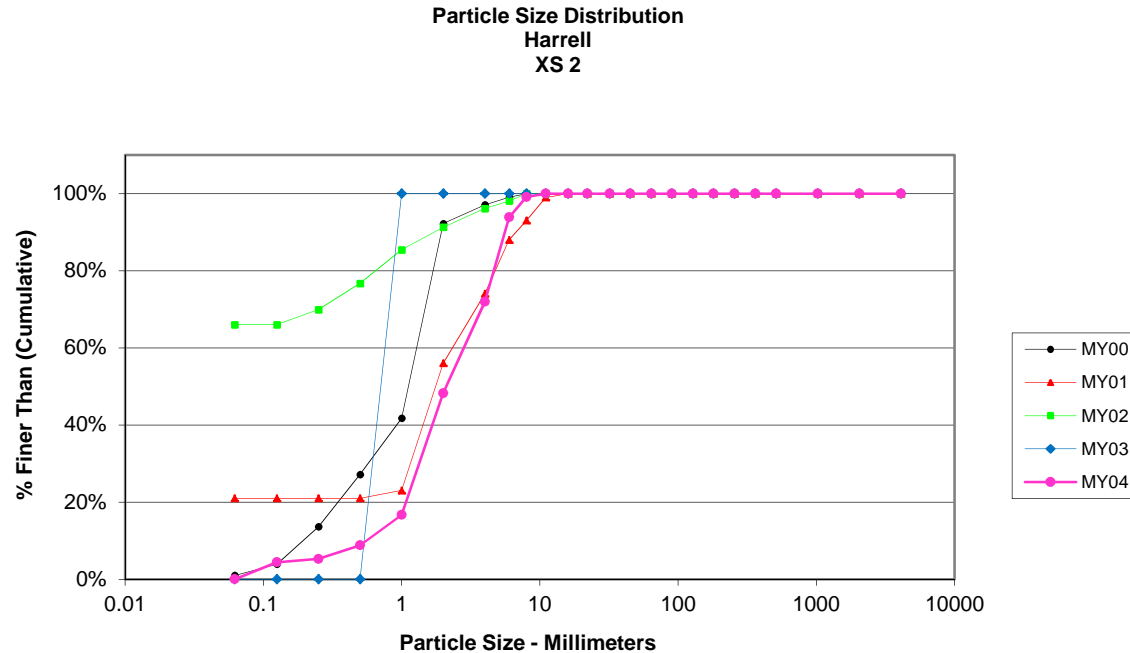


Size (mm)	
D16	1.2
D35	2.3
D50	4.4
D65	6.7
D84	9.8
D95	14

Size Distribution	
mean	3.4
dispersion	2.9
skewness	-0.11

Type	
silt/clay	0%
sand	33%
gravel	67%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	1
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	9
Very Coarse	1 - 2	S	36
Very Fine	2 - 4		27
Fine	4 - 5.7	G	25
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		114
Note:			

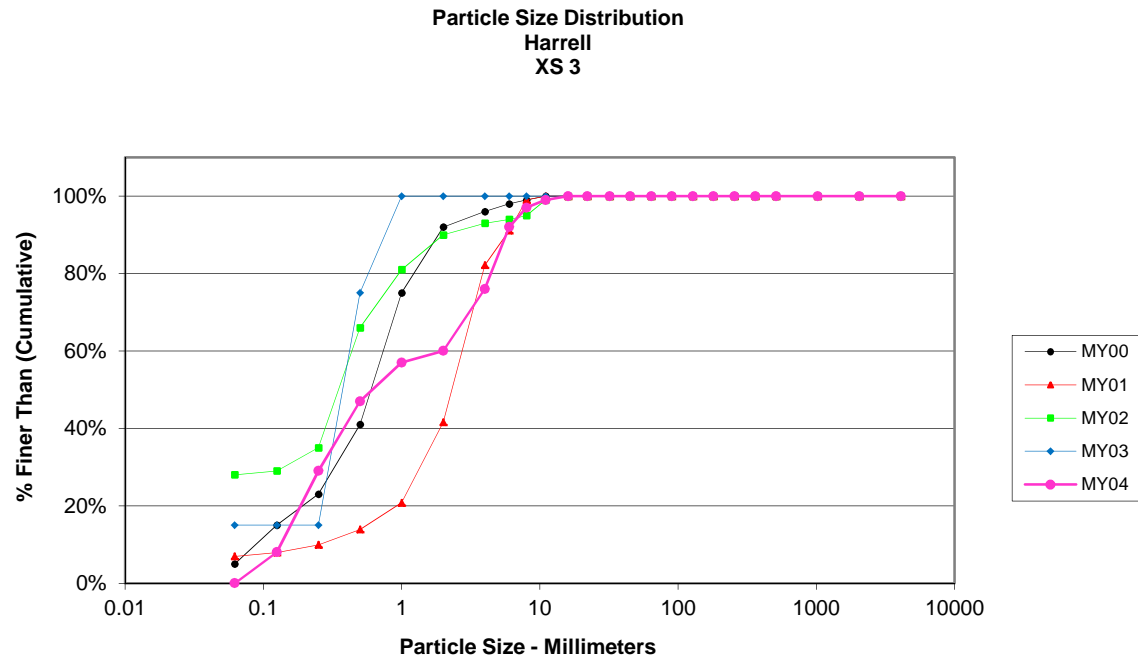


Size (mm)	
D16	0.94
D35	1.5
D50	2.1
D65	3.3
D84	5
D95	6.4

Size Distribution	
mean	2.2
dispersion	2.3
skewness	0.02

Type	
silt/clay	0%
sand	48%
gravel	52%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	8
Fine	.125 - .25	A	21
Medium	.25 - .50	N	18
Coarse	.50 - 1	D	10
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		16
Fine	4 - 5.7	G	16
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			

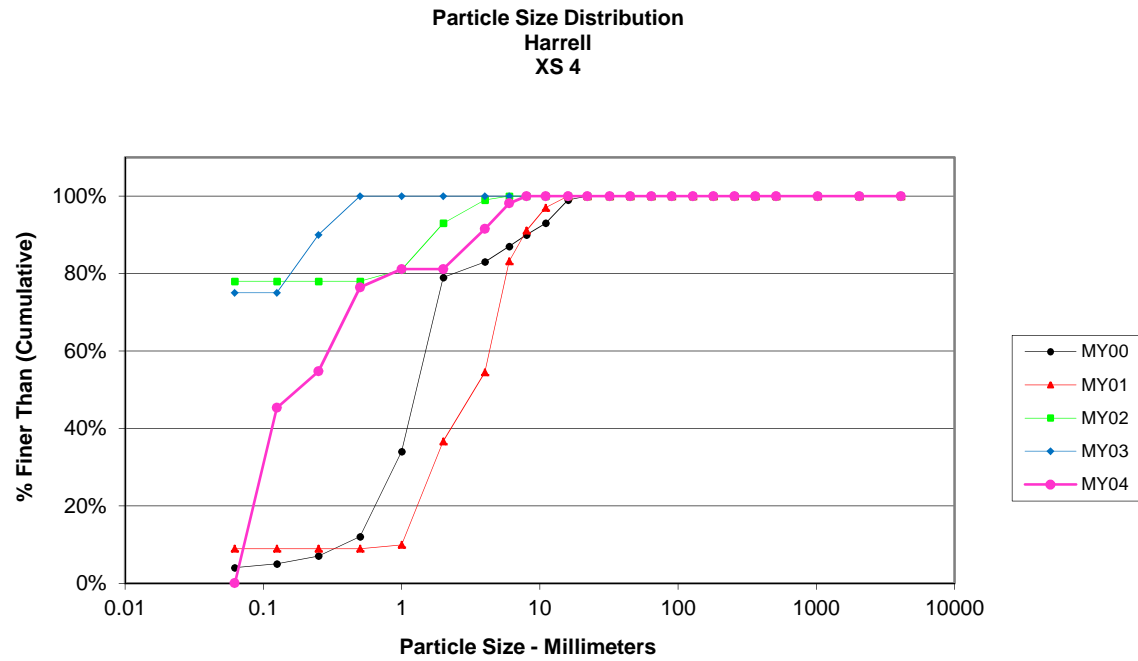


Size (mm)	
D16	0.16
D35	0.31
D50	0.62
D65	2.5
D84	4.9
D95	7.1

Size Distribution	
mean	0.9
dispersion	5.9
skewness	0.13

Type	
silt/clay	0%
sand	60%
gravel	40%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	48
Fine	.125 - .25	A	10
Medium	.25 - .50	N	23
Coarse	.50 - 1	D	5
Very Coarse	1 - 2	S	
Very Fine	2 - 4		11
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		106
Note:			

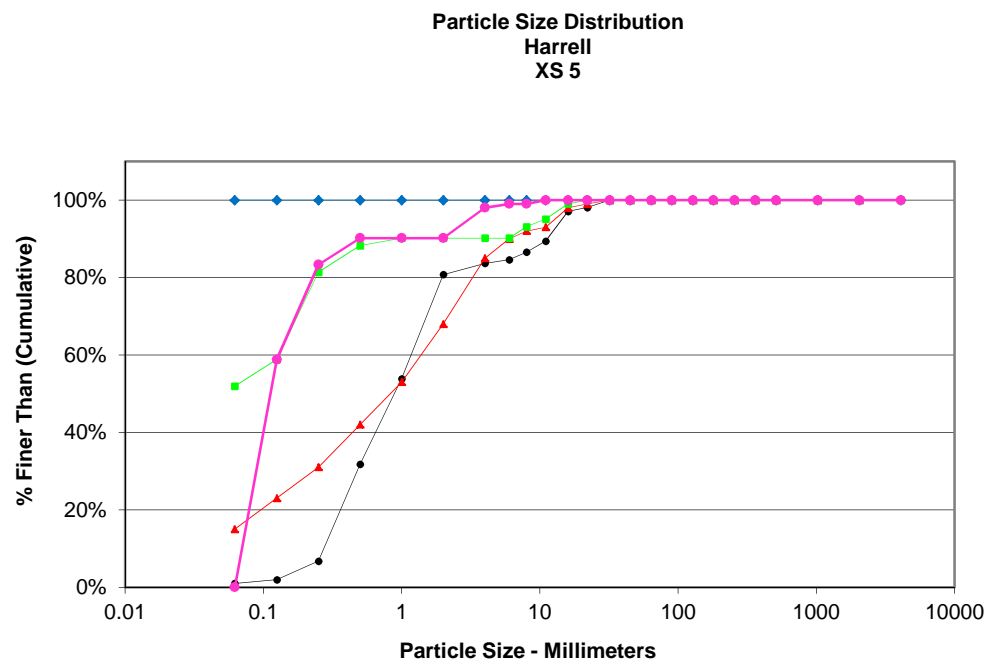


Size (mm)	
D16	0.079
D35	0.11
D50	0.18
D65	0.35
D84	2.4
D95	5

Size Distribution	
mean	0.4
dispersion	7.8
skewness	0.32

Type	
silt/clay	0%
sand	81%
gravel	19%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	60
Fine	.125 - .25	A	25
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		8
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	102
Note:			

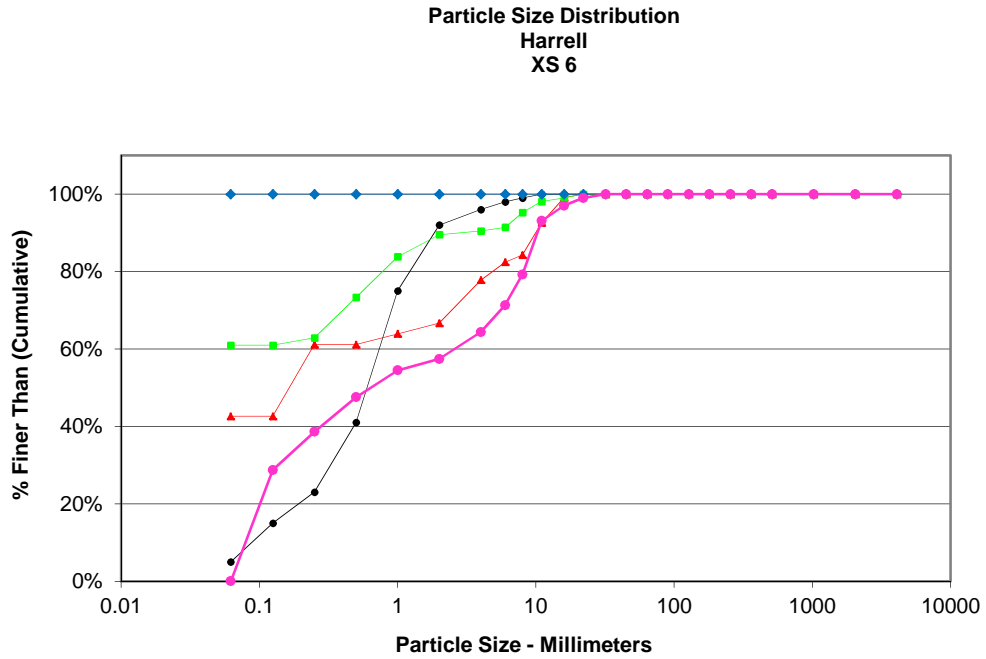


Size (mm)	
D16	0.075
D35	0.094
D50	0.11
D65	0.15
D84	0.27
D95	3.1

Size Distribution	
mean	0.1
dispersion	2.0
skewness	0.15

Type	
silt/clay	0%
sand	90%
gravel	10%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	29
Fine	.125 - .25	A	10
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		7
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	8
Medium	8 - 11.3	A	14
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45		
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101
Note:			

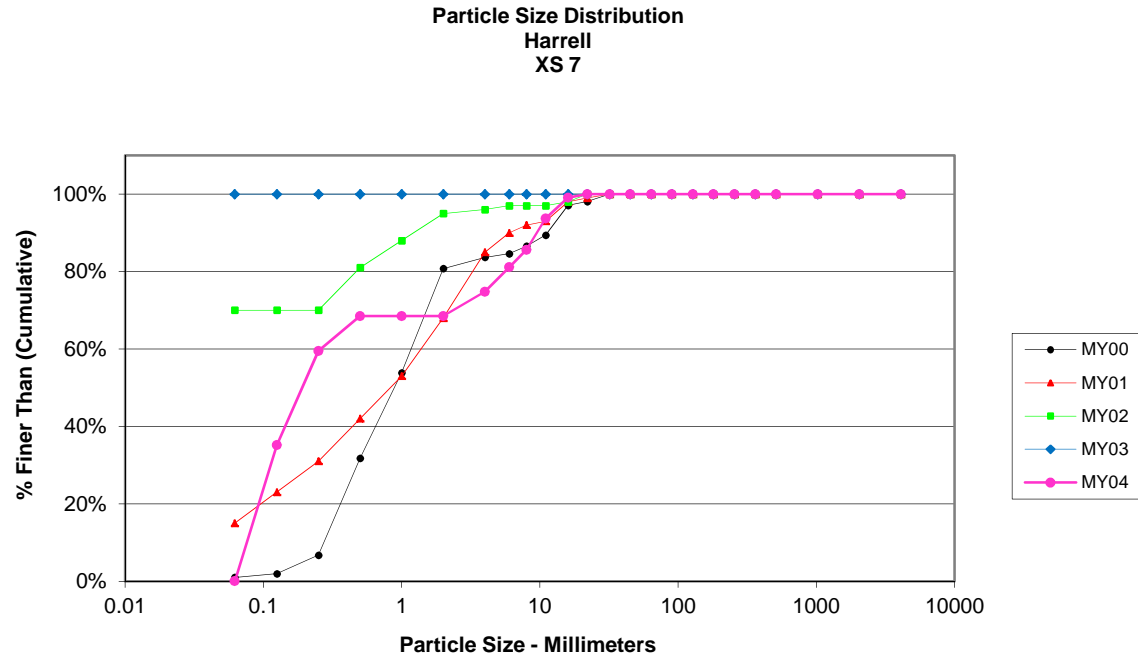


Size (mm)	Count
D16	0.092
D35	0.19
D50	0.64
D65	4.2
D84	8.9
D95	13

Size Distribution	
mean	0.9
dispersion	10.4
skewness	0.11

Type	
silt/clay	0%
sand	57%
gravel	43%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 7 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	39
Fine	.125 - .25	A	27
Medium	.25 - .50	N	10
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		7
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	6
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		111
Note:			

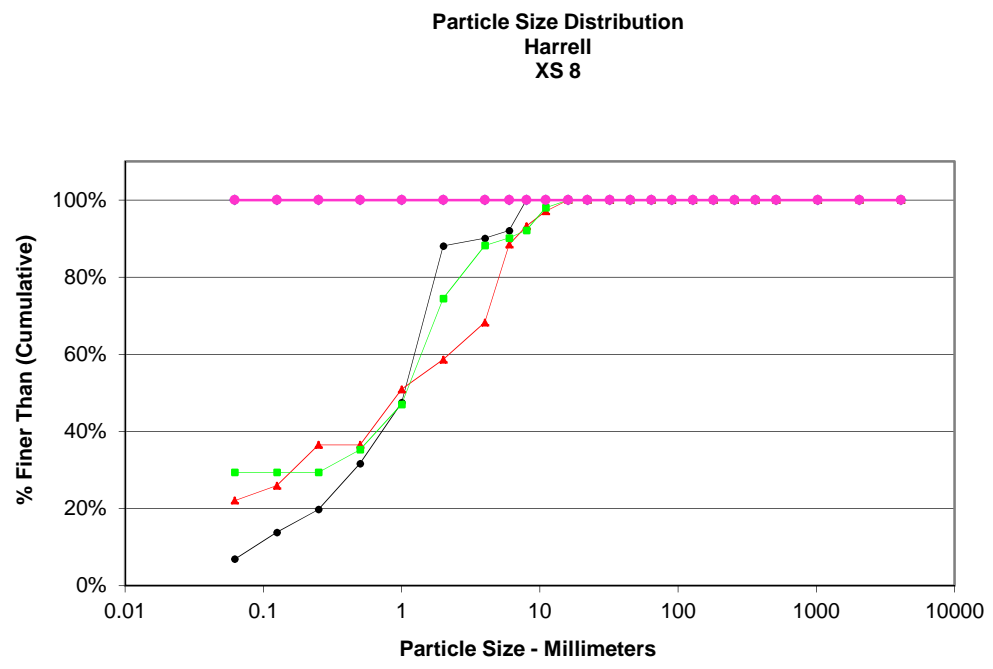


Size (mm)	
D16	0.085
D35	0.12
D50	0.19
D65	0.38
D84	7.2
D95	12

Size Distribution	
mean	0.8
dispersion	20.1
skewness	0.44

Type	
silt/clay	0%
sand	68%
gravel	32%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 8 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	100
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			

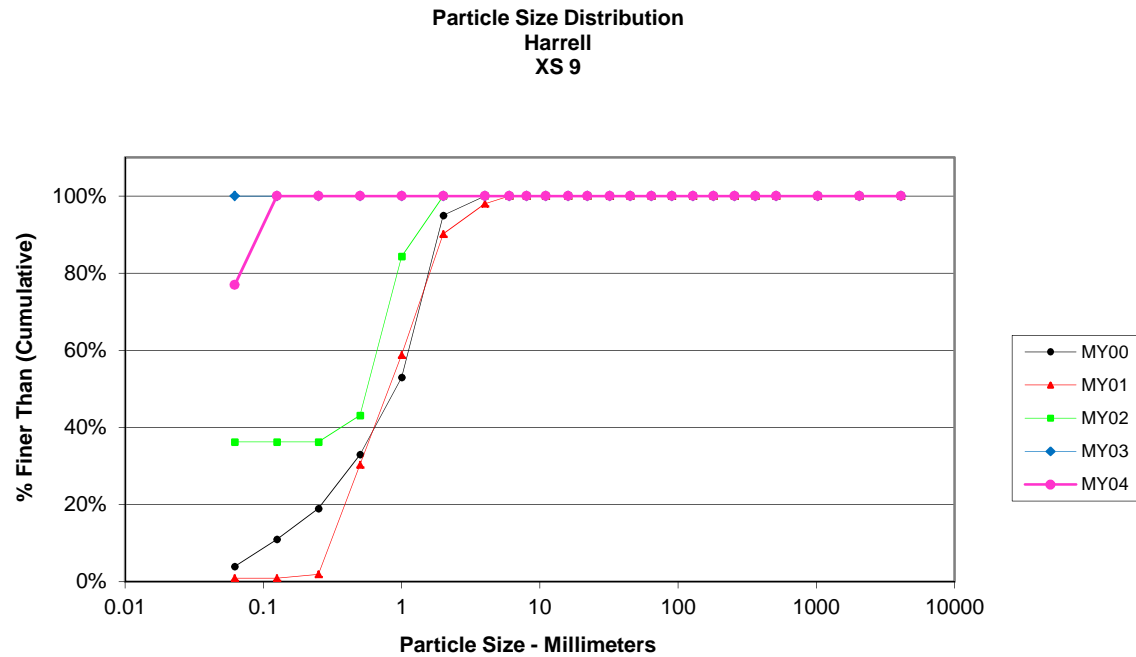


Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.062
D95	0.062

Size Distribution	
mean	0.1
dispersion	1.0
skewness	-

Type	
silt/clay	100%
sand	0%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 9 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	77
Very Fine	.062 - .125	S	23
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			

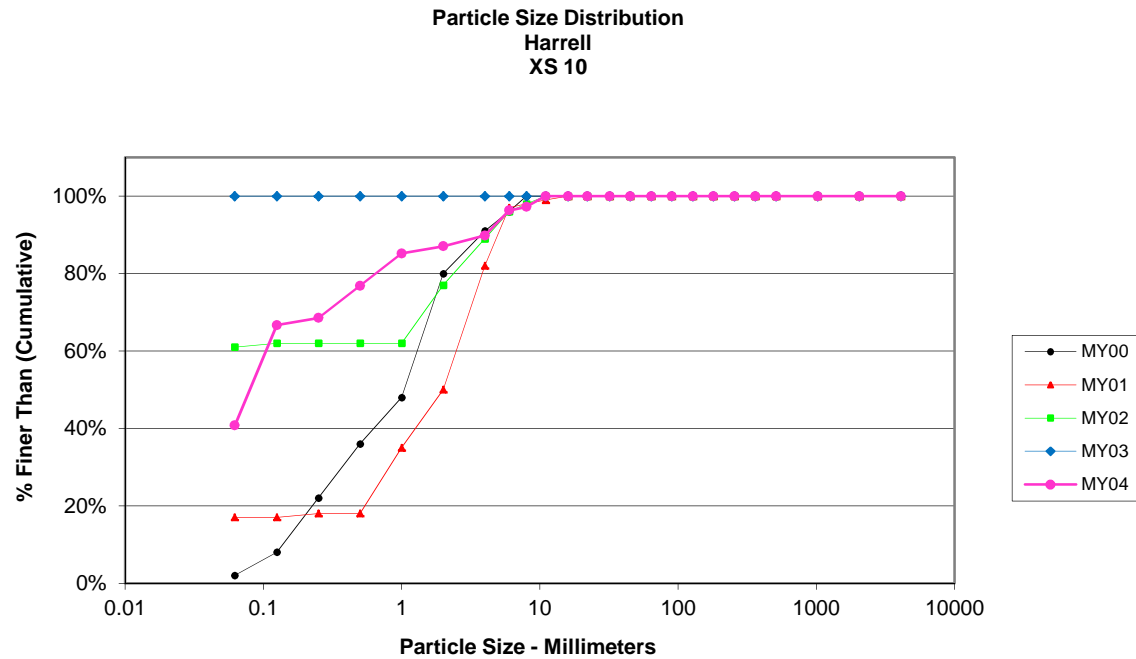


Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.077
D95	0.11

Size Distribution	
mean	0.1
dispersion	1.1
skewness	0.15

Type	
silt/clay	77%
sand	23%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 10 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	44
Very Fine	.062 - .125	S	28
Fine	.125 - .25	A	2
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	9
Very Coarse	1 - 2	S	2
Very Fine	2 - 4		3
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		108
Note:			

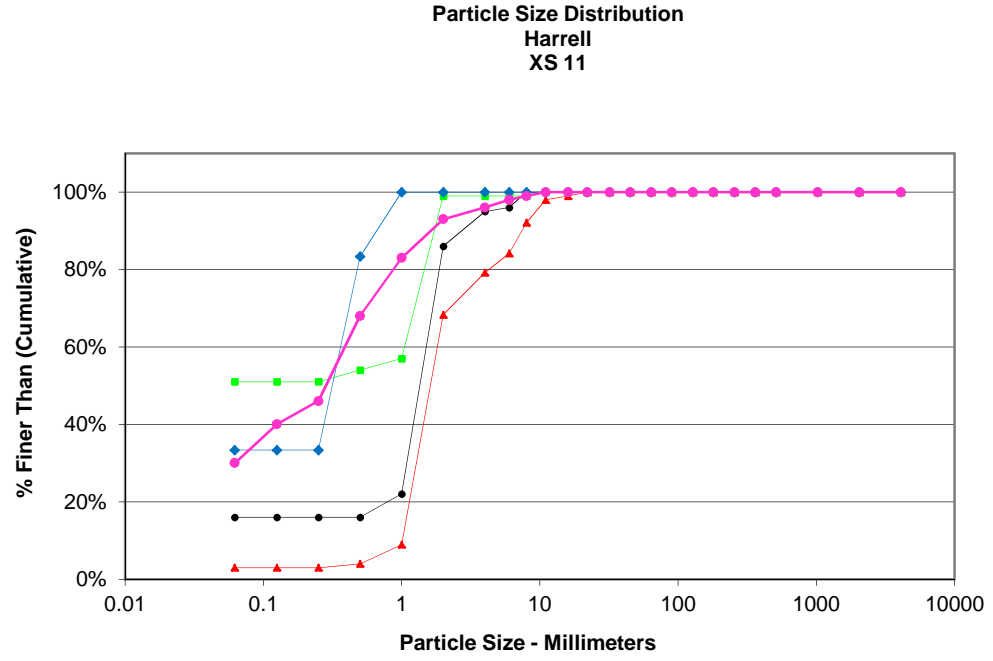


Size (mm)	Count
D16	0.062
D35	0.062
D50	0.080
D65	0.120
D84	0.910
D95	5.500

Size Distribution	
mean	0.2
dispersion	6.3
skewness	0.44

Type	
silt/clay	41%
sand	46%
gravel	13%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 11 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	30
Very Fine	.062 - .125	S	10
Fine	.125 - .25	A	6
Medium	.25 - .50	N	22
Coarse	.50 - 1	D	15
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		3
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			

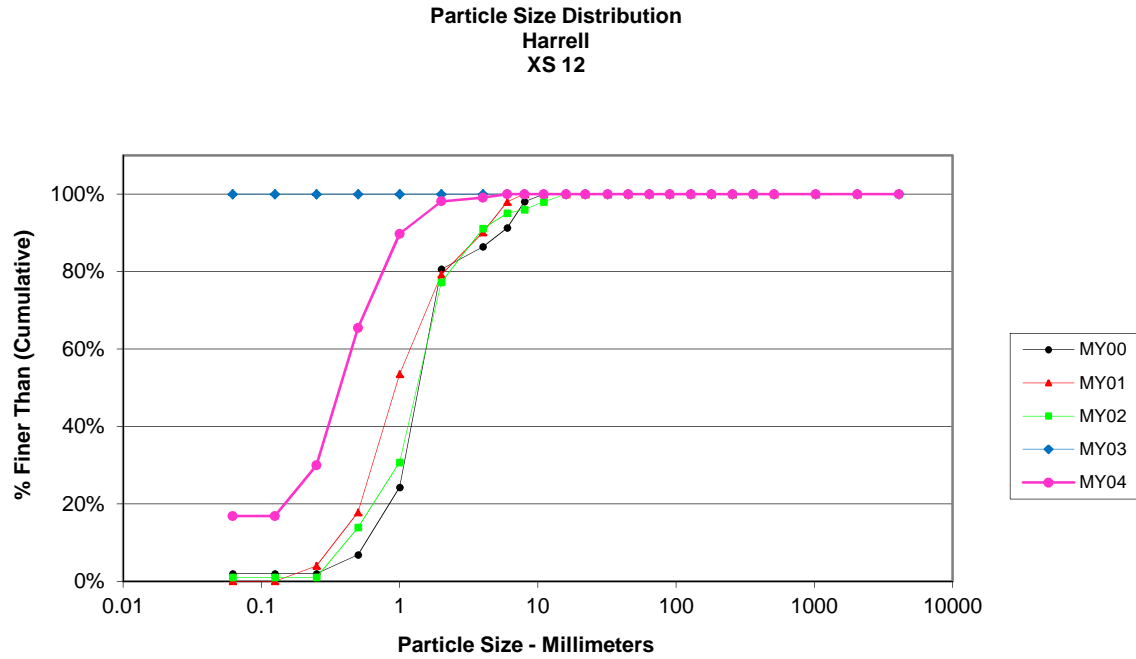


Size (mm)
D16
D35
D50
D65
D84
D95

Size Distribution	
mean	0.3
dispersion	4.2
skewness	-0.03

Type	
silt/clay	30%
sand	63%
gravel	7%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 12 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	18
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	14
Medium	.25 - .50	N	38
Coarse	.50 - 1	D	26
Very Coarse	1 - 2	S	9
Very Fine	2 - 4		1
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		107
Note:			

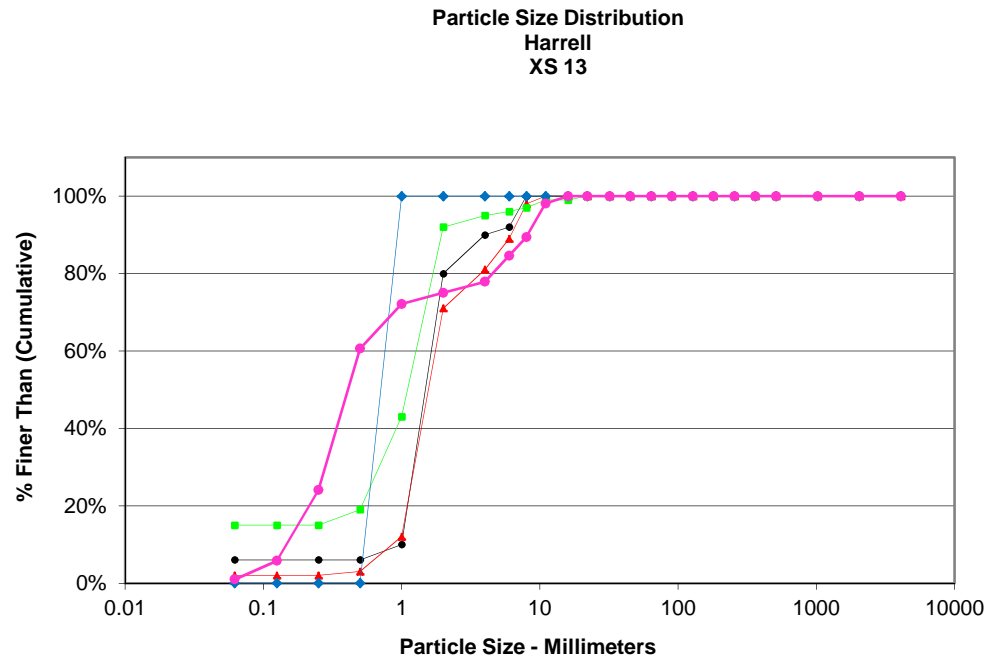


Size (mm)	
D16	0.062
D35	0.28
D50	0.37
D65	0.5
D84	0.85
D95	1.5

Size Distribution	
mean	0.2
dispersion	4.1
skewness	-0.19

Type	
silt/clay	17%
sand	81%
gravel	2%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 13 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	19
Medium	.25 - .50	N	38
Coarse	.50 - 1	D	12
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		3
Fine	4 - 5.7	G	7
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		104
Note:			

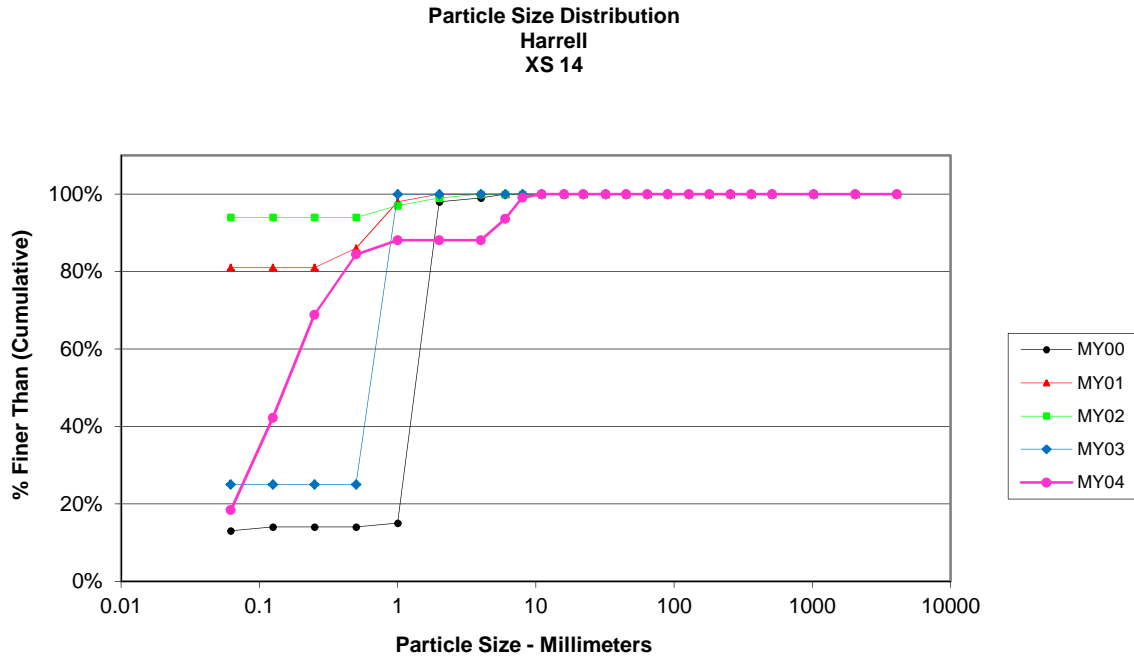


Size (mm)	
D16	0.180
D35	0.31
D50	0.41
D65	0.65
D84	5.8
D95	9.8

Size Distribution	
mean	1.0
dispersion	8.2
skewness	0.32

Type	
silt/clay	1%
sand	74%
gravel	25%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 14 - MY04			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	20
Very Fine	.062 - .125	S	26
Fine	.125 - .25	A	29
Medium	.25 - .50	N	17
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	6
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		109
Note:			



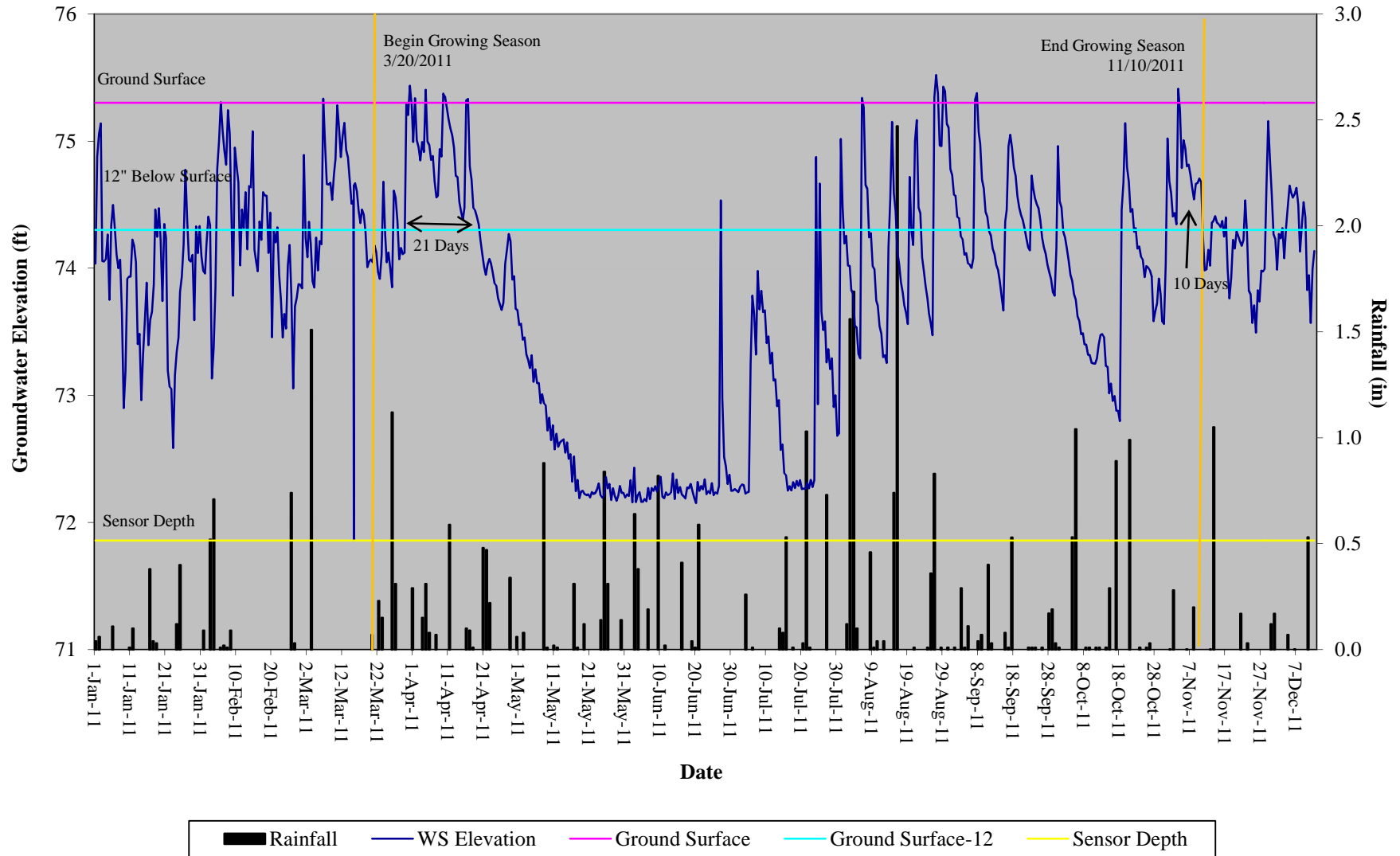
Size (mm)	
D16	0.062
D35	0.1
D50	0.15
D65	0.23
D84	0.49
D95	6.5

Size Distribution	
mean	0.2
dispersion	2.8
skewness	0.07

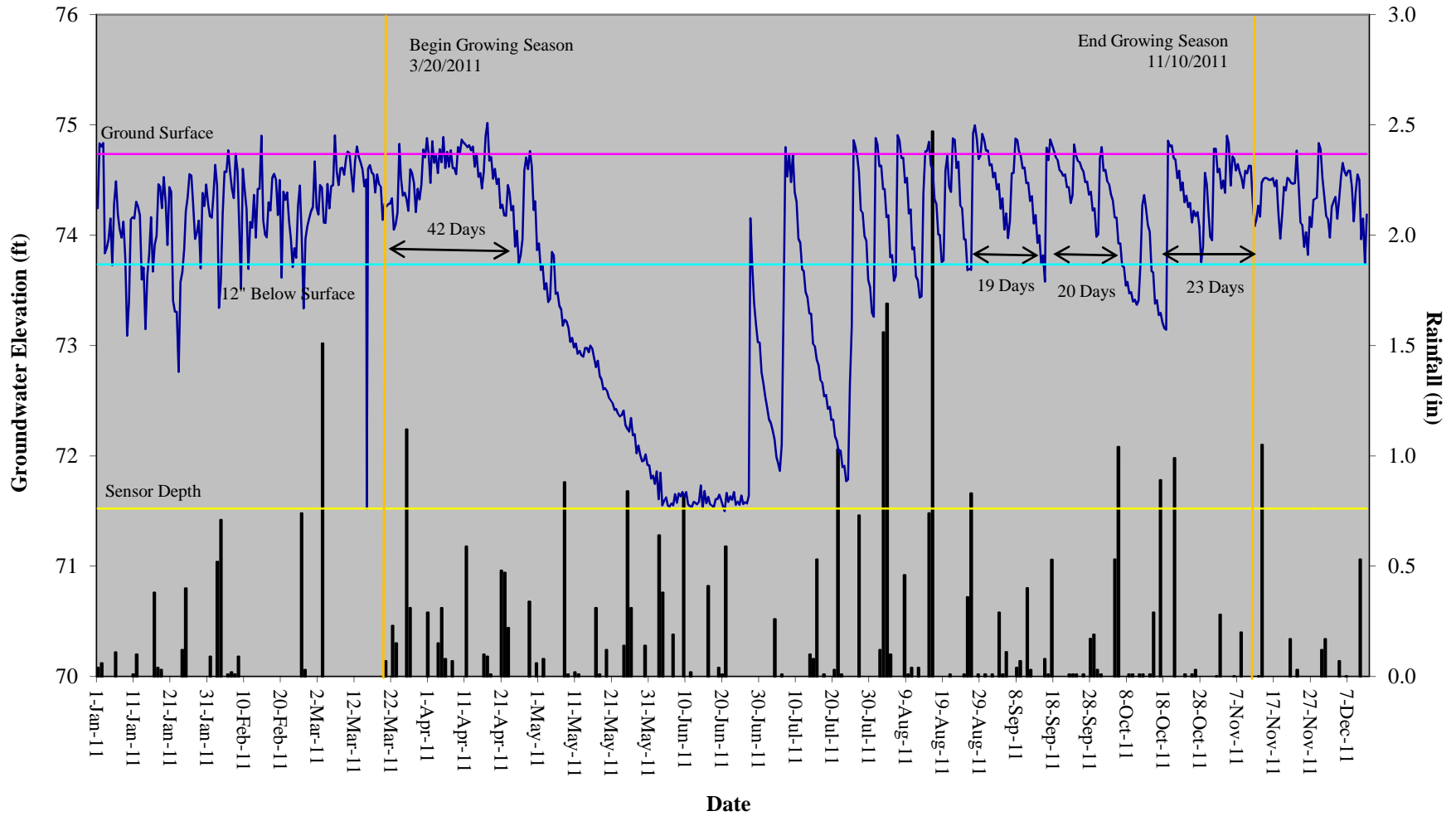
Type	
silt/clay	18%
sand	70%
gravel	12%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Appendix C4 – Stream and Wetland Hydrographs

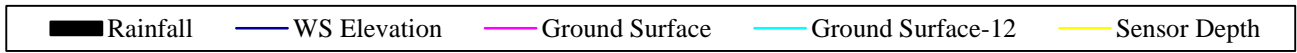
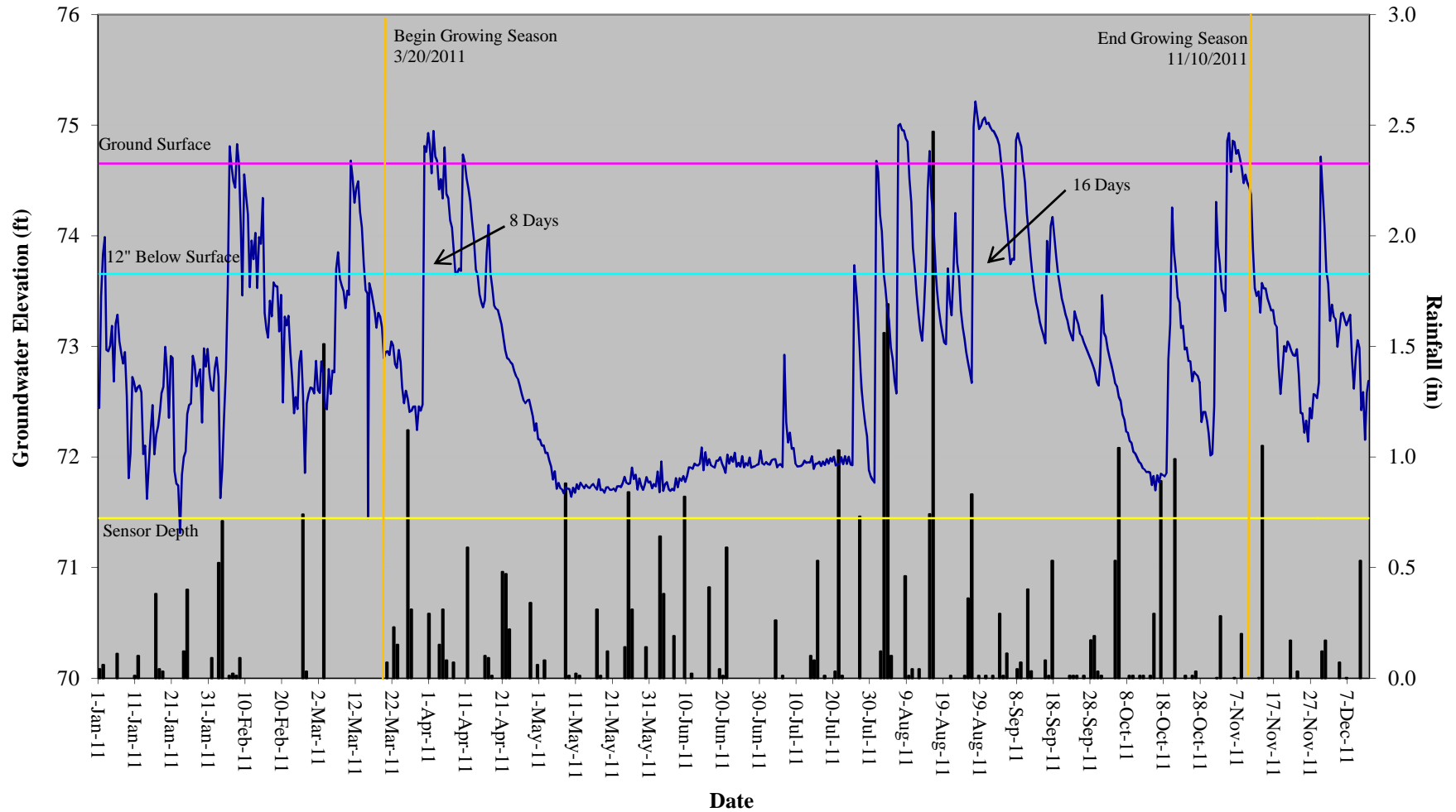
Harrell Farm Gauge 1 Wetland Hydrograph 1/1/11 to 12/13/11



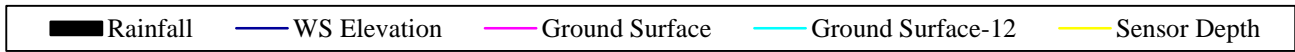
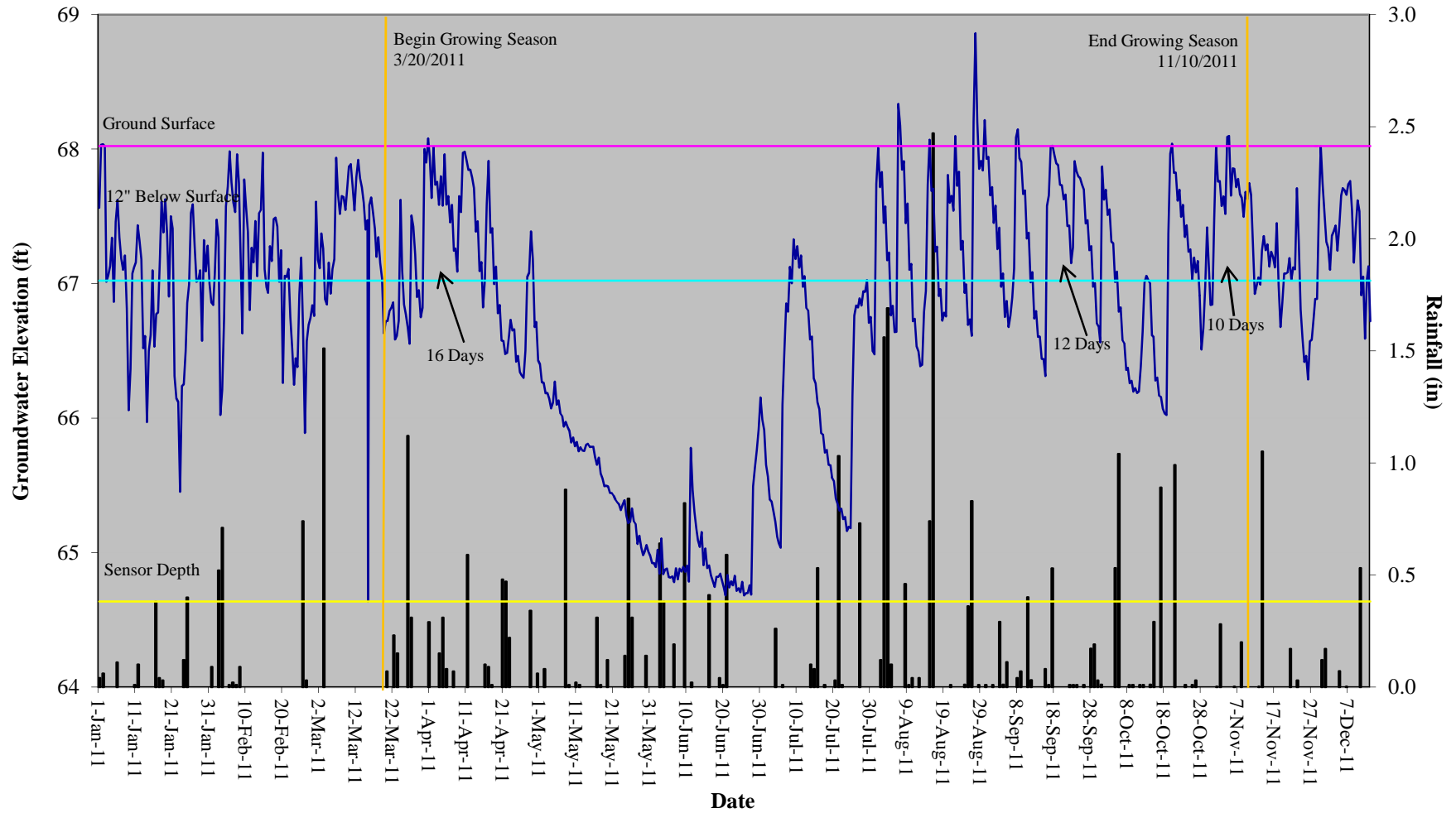
Harrell Farm Gauge 2 Wetland Hydrograph 1/1/11 to 12/13/11



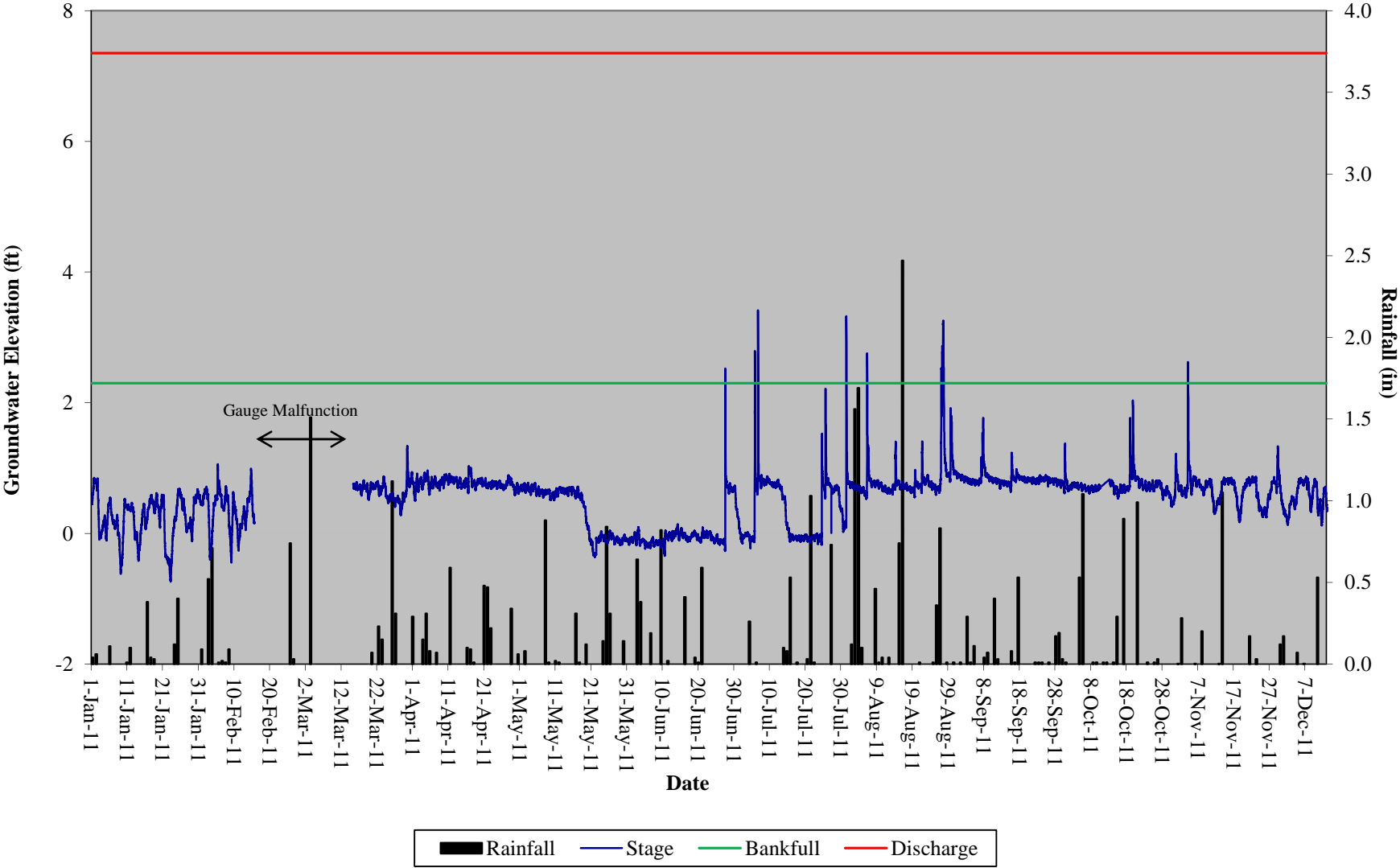
Harrell Farm Gauge 3 Wetland Hydrograph 1/1/11 to 12/13/11



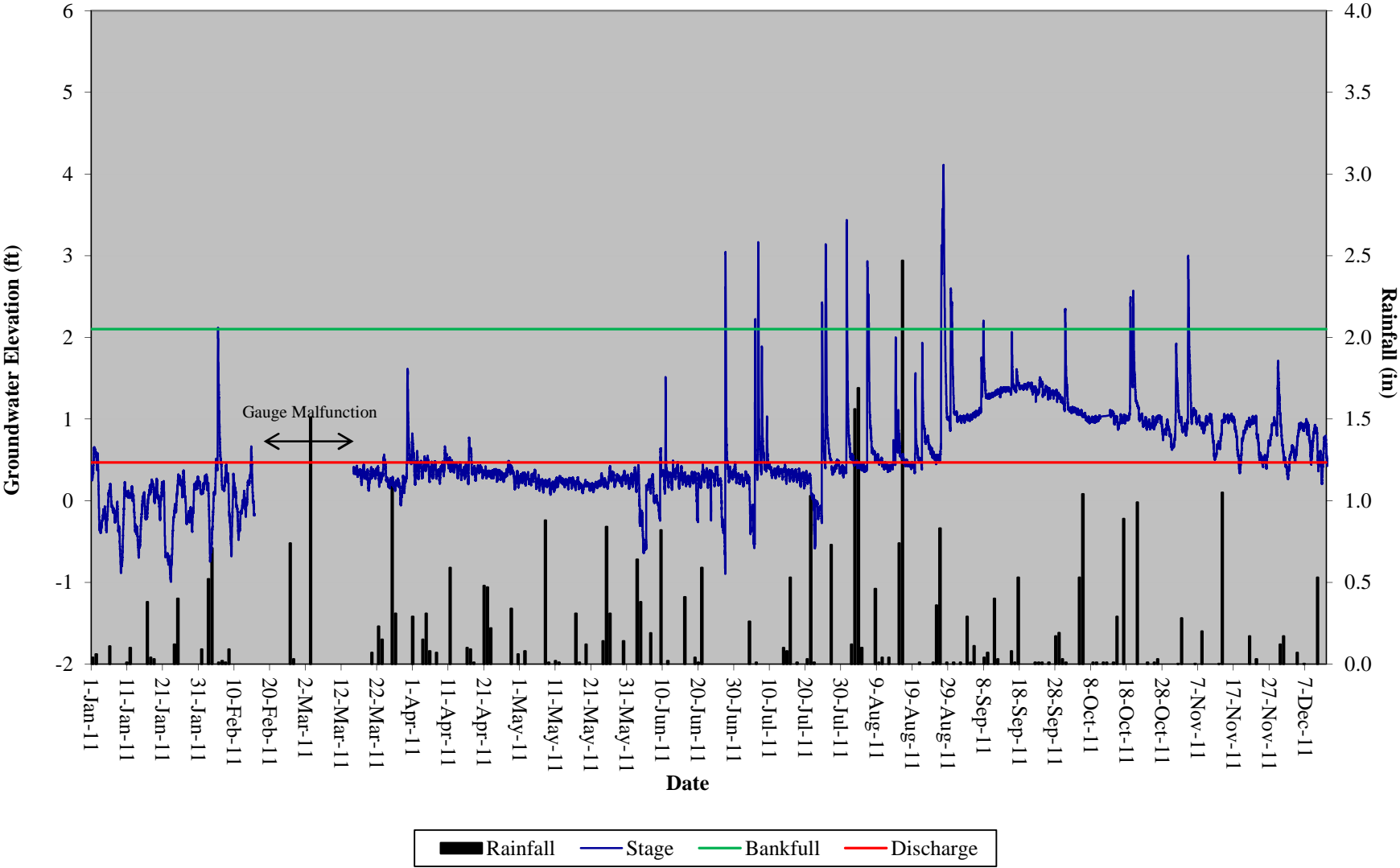
Harrell Farm Gauge 4 Wetland Hydrograph 1/1/11 to 12/13/11



Harrell Stream and Wetland Restoration Stream Gauge 1 Hydrograph 1/1/11 to 12/13/11



**Harrell Stream and Wetland Restoration
Stream Gauge 2 Hydrograph
1/1/11 to 12/13/11**



Appendix C5 – Precipitation 30-70 Percentile Graph

Harrell 30-70 Percentile Graph 2010-2011
Rocky Mount, NC Monthly Rainfall

