

**YEAR 1 (2014) ANNUAL MONITORING REPORT**

**PEPPERWOOD FARM RIPARIAN BUFFER MITIGATION SITE**

Wake County, North Carolina

EEP Project ID: 95713

Contract No. 004946, DWR Project No. 2013-1262

Data Collected August-October 2014



Prepared for:



NC Department of Environment and Natural Resources  
Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652

December 2014

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## 1.0 Executive Summary

This **Year 1 (2014) Annual Monitoring Report** describes the **Pepperwood Farm Riparian Buffer Mitigation Site** (Site) and is designed specifically to assist in fulfilling the North Carolina Ecosystem Enhancement Program riparian buffer mitigation goals within the Neuse 03020201 Watershed. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A). This report (compiled based on the NC Ecosystem Enhancement Program (NCEEP) *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.5 dated 6/8/12) summarizes data for Year 1 (2014) monitoring.

The Site is located approximately 1 mile northeast of Willow Springs and 4 miles northeast of Fuquay-Varina, in Wake County, North Carolina, (Figure 1, Appendix A). The project is situated within the Middle Creek watershed (United States Geological Society (USGS) 14-digit Hydrologic Cataloging Unit (HUC) 03020201120010 of the Neuse River Basin and North Carolina Division of Water Resource (NC DWR) Sub-basin 03-04-03). This sub-basin was identified by the 2010 Neuse River Basin Restoration Priorities (NC DENR) as a Targeted Local Watershed (TLW).

The Site encompasses 12.66 acres and is protected in perpetuity by three conservation easements recorded at the Wake County Register of Deeds on 11/25/2013. The Site protects five unnamed tributaries with direct hydrologic connection to Terrible Creek, DWR Stream Index Number 27-43-15-8-(2) and a Best Usage Classification of C, NSW (NC DWR 2009). Prior to restoration activities, riparian areas were cleared of native forest vegetation, heavily degraded by livestock grazing and hoof shear, maintained for hay production, and subject to raw manure fertilization. Streams were straightened, routinely cleared and subject to storm water runoff from boarding facilities.

The primary goal of this riparian buffer restoration project is to provide **10.70 Neuse River Riparian Buffer Units** (RBMU). The success of this goal is based on the following.

1. Removing nonpoint sources of pollution associated with agricultural activities including a) removal of horses from riparian areas; b) eliminating the application of fertilizer, pesticides, and other agricultural materials into and adjacent to streams; and c) establishing a vegetative buffer adjacent to streams to treat surface runoff, which may contain pollutants such as sediment and/or agricultural pollutants from the adjacent landscape.
2. Reducing sedimentation onsite and downstream by a) reducing bank erosion associated with vegetation maintenance and b) planting a diverse hardwood vegetative buffer adjacent to Site tributaries.
3. Stabilizing stream banks where necessary by sloping channel banks, and installing erosion control matting and livestock stakes.
4. Improving aquatic habitat by enhancing stream bed shading and natural detritus input.
5. Providing a terrestrial wildlife corridor and refuge in an area continually being developed for commercial and residential use.
6. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
7. Protecting the Site's full potential of stream and riparian buffer functions and values in perpetuity.

Accomplishing this criterion is a multi-year process. Restoration activities outlined in the Pepperwood Farm Mitigation Plan were implemented during February and March of 2014. Activities included the installation of a shallow marsh treatment area, stabilization of stream banks, planting of riparian areas with bare root hardwood seedlings, removal of livestock from riparian areas and protecting the Site in

perpetuity with a conservation easement. Additionally, the Site has been surveyed and marked per NC EEP guidelines by a licensed NC surveyor.

### **Vegetation Success Criteria**

Success of vegetation criteria at the Site indicates successful restoration of riparian area adjacent to subject streams as well as improvement of overall water quality resulting from the treatment of runoff from agriculture fields. Success criteria are dependent upon the density and growth of planted tree species.

An average density of 320 stems per acre of planted species must be surviving after five monitoring years in accordance with NC Division of Water Resources Administrative Code 15A NCAC 02B.0242 (*Neuse River Basin: Nutrient Sensitive Waters Management Strategy*).

## **2.0 Methodology**

Monitoring of vegetation restoration efforts will follow Level 2 *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) and will be conducted between June 1 and October 30. Site monitoring will be conducted at thirteen (13) vegetation monitoring plots representing 3.6% of the 10.7 acres of restored buffer. Monitoring reports will be reported to the NC EEP annually for a minimum of 5 years or until success criteria are fulfilled. Monitoring parameters will include species composition and density. Visual observations to ascertain the degree of shrub and herbaceous species, including overtopping of seedlings during year 1 will be documented with photos and included in the annual monitoring report (Appendix C).

Year 1 (2014) monitoring data was collected August 22, 2014 by Axiom Environmental, and established an average density of 511 planted stems per acre on Site with all 13 CVS monitoring plots exceeding success criteria (Appendix C). The dominant tree species identified from year 1 (2014) data collection at the Site was *Betula nigra*, *Celtis laevigata*, *Fraxinus pennsylvanica*, *Liriodendron tulipifera*, *Quercus michauxii*, and *Quercus pagoda*. In summary, the Site is in compliance with success criteria for vegetation in Monitoring Year 1 (2014).

### 3.0 References

- Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Schafale, W.H. McNab, D.R. Lenat, T.F. MacPherson, J.B. Glover, and V.B. Shelbourne. 2002. Ecoregions of North Carolina and South Carolina. U.S. Geological Survey, Reston, Virginia.
- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
- North Carolina Division of Water Resources (NCDWR). 2004. Final North Carolina Water Quality Assessment and Impaired Waters List (2004 303(d) Report) (online). Available: <http://portal.ncdenr.org/web/wq/ps/mtu/assessment> [March 2014]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- North Carolina Division of Water Resources (NCDWR). 2010. Final North Carolina Water Quality Assessment and Impaired Waters List (2010 Integrated 305(b) and 303(d) Report) (online). Available: [http://h2o.enr.state.nc.us/tmdl/documents/draft\\_2010\\_Cat\\_5.pdf](http://h2o.enr.state.nc.us/tmdl/documents/draft_2010_Cat_5.pdf) [February 1, 2011]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- North Carolina Division of Water Resources (NCDWR). 2010. River Restoration Priorities Executive Summary (online). Available: [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=665be84c-cf93-477b-918c-1993778ef11f&groupId=60329](http://portal.ncdenr.org/c/document_library/get_file?uuid=665be84c-cf93-477b-918c-1993778ef11f&groupId=60329) [March 2014]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

## **Appendix A: Vicinity Map and Background Tables**

Figure 1. Vicinity Map

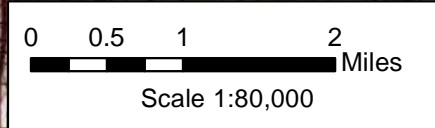
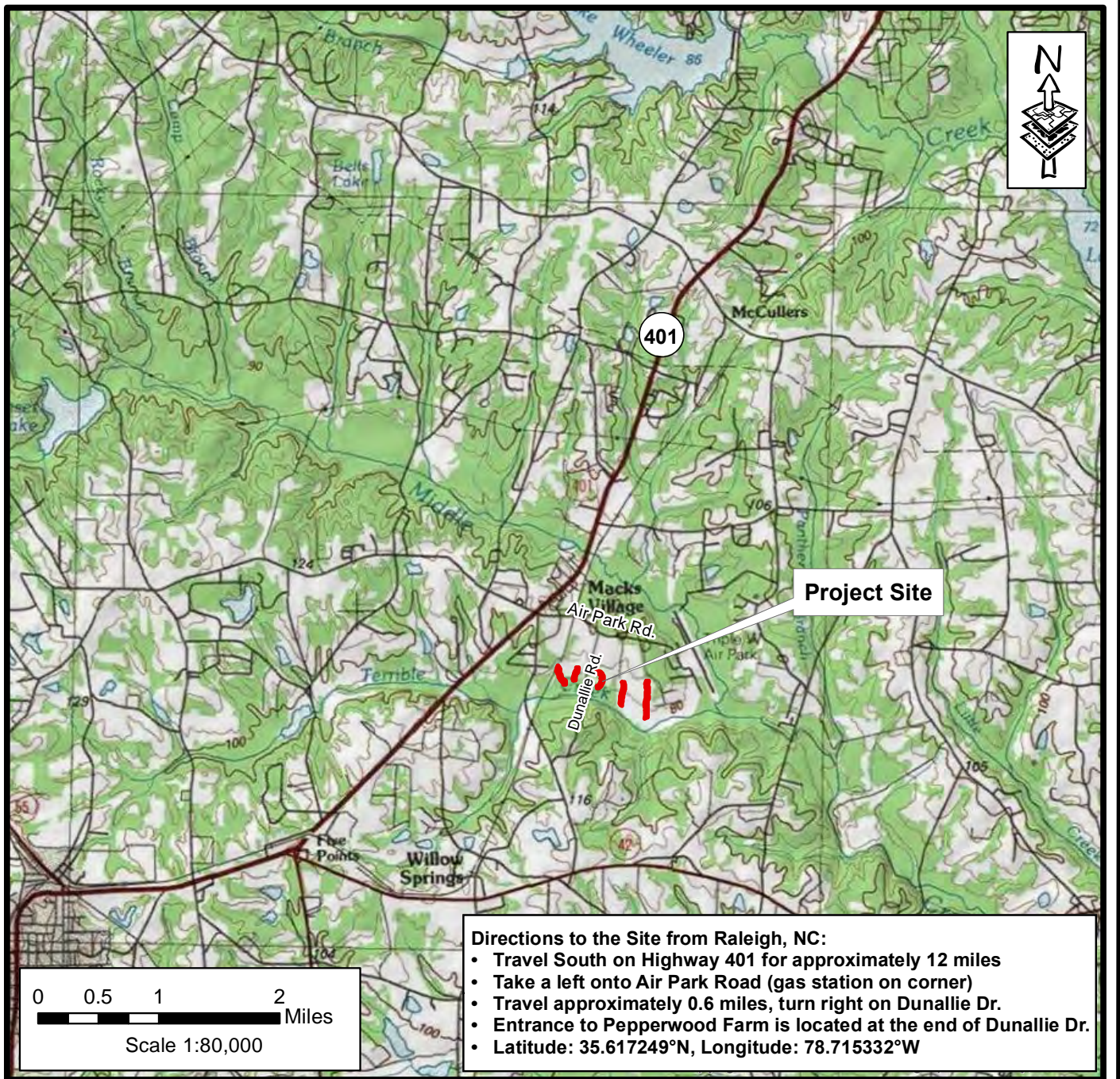
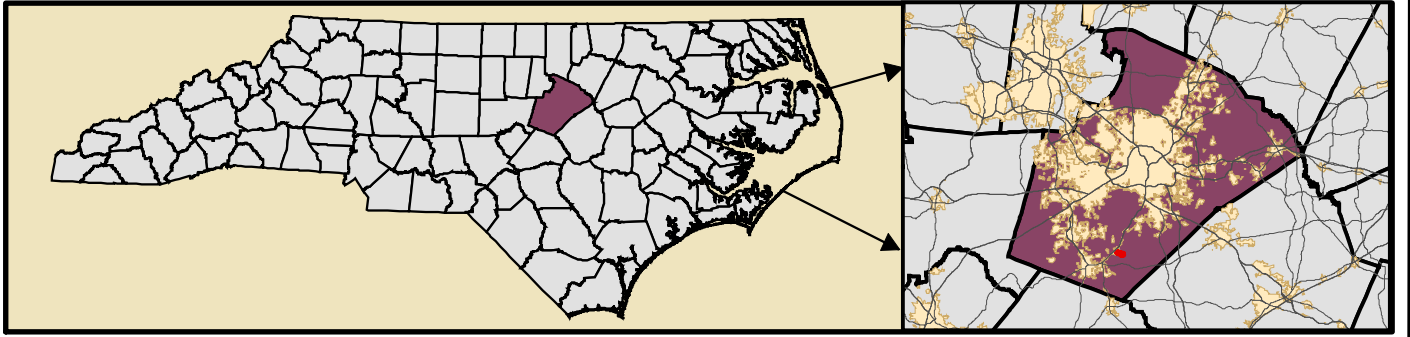
Table 1. Project Components and Mitigation Credits Table

Table 2. Project Activity and Reporting History Table

Table 3. Project Contact Table

Table 4. Project Baseline Information and Attributes Table





**Directions to the Site from Raleigh, NC:**

- Travel South on Highway 401 for approximately 12 miles
- Take a left onto Air Park Road (gas station on corner)
- Travel approximately 0.6 miles, turn right on Dunallie Dr.
- Entrance to Pepperwood Farm is located at the end of Dunallie Dr.
- Latitude: 35.617249°N, Longitude: 78.715332°W

Prepared by:	Prepared for:
	

VICINITY MAP  
 PEPPERWOOD FARM  
 RIPARIAN BUFFER MITIGATION SITE  
 Wake County, North Carolina

Dwn. By:	KRJ
Date:	Oct 2014
Project:	10-001

FIGURE  
 1

**Table 1: Project Components and Mitigation Credits**

Pepperwood Farm Riparian Buffer Mitigation Site, Wake County NC EEP Project ID 95713

<b>Mitigation Credits</b>				
<b>Neuse Riparian Buffer</b>				
<b>Existing Acreage</b>	<b>Restoration/ Mit. Ratio</b>	<b>Restoration Acreage</b>	<b>Mitigation / Acre</b>	<b>Comment</b>
.30	n/a	n/a	n/a	Existing forested area – excluded from credit determination
10.70	Restoration (1:1)	10.70	43,560 sq. ft. / acre	Cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
<b>Component Summation</b>				
<b>Restoration Level</b>		<b>Neuse Riparian Buffer Credits (sq. ft.)</b>		
Restoration		10.70 acres = 466,092 sq. ft.		
<b>Totals</b>		10.70 acres = 466,092 sq. ft.		

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

Pepperwood Farm Riparian Buffer Mitigation Site, Wake County NC EEP Project ID 95713

<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
CE Document	NA	August 13 <sup>th</sup> , 2013
Conservation Easement	NA	November 25 <sup>th</sup> , 2013
Mitigation Plan	NA	January 30 <sup>th</sup> , 2014
Earthwork	NA	March 5 <sup>th</sup> , 2014
Bare Root Planting	NA	March 13 <sup>th</sup> , 2014
Baseline Monitoring Document	March 2014	May 5 <sup>th</sup> , 2014
Year 1 (2014) Annual Monitoring Report	October 2014	October 20 <sup>th</sup> , 2014



**Table 3: Project Contact Table**

Pepperwood Farm Riparian Buffer Mitigation Site, Wake County NC EEP Project ID 95713

	<b>Firm</b>	<b>POC &amp; Address</b>
<b>Full Delivery Provider</b>	Restoration Systems, LLC	1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer 919-755-9490
<b>Designer:</b>	Restoration Systems, LLC	Raymond Holz: 919-755-9490 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604
<b>Earthwork Contractor:</b>	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
<b>Planting Contractor:</b>	Carolina Silvics	Mary-Margaret McKinney 252.333.9852 908 Indian Trail Road Edenton, NC 27932
<b>Seeding Contractor:</b>	Land Mechanics, Inc.	Lloyd Glover; 919.422.3392 780 Landmark Road Willow Spring, NC 27592-7756
<b>Nursery Stock Suppliers:</b>	ArborGen	1.888.888.7158
<b>Baseline Data Collection</b>	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603
<b>Vegetation Monitoring:</b>	Axiom Environmental, Inc.	Grant Lewis; 919.215.1693 218 Snow Ave. Raleigh, NC 27603

**Table 4: Project Baseline Information & Attributes Table**

Pepperwood Farm Riparian Buffer Mitigation Site, Wake County NC EEP Project ID 95713

Project Information			
Project Name		Pepperwood Farm	
County		Wake	
Project Area (acres)		12.66	
Project Coordinates (latitude and longitude)		35.617249°N, -78.715332°W (NAD83/WGS84)	
Project Watershed Summary Information			
Physiographic Province		Northern Outer Piedmont	
River Basin		Neuse	
USGS Hydrologic Unit 8-digit	3020201	USGS Hydrologic Unit 14-digit	3020201120010
DWR Sub-basin		3/4/2003	
Project Drainage Area, Total Outfall (acres)		285.45	
Project Drainage Area Percentage of Impervious Area		> 5%	
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	No		
Waters of the United States – Section 401	No		
Endangered Species Act	No		
Historic Preservation Act	No		
Coastal Zone Management Act [CZMA/Coastal Area Management Act (CAMA)]	No		
FEMA Floodplain Compliance	No		
Essential Fisheries Habitat	No		

## **Appendix B: Visual Assessment Data**

Figure 2. Current Conditions Plan View  
Vegetation Plot Photos  
Fixed Photo Points





Prepared for:



Project:

**PEPPERWOOD FARM  
RIPARIAN BUFFER  
MITIGATION SITE**

Wake County, NC

Title:

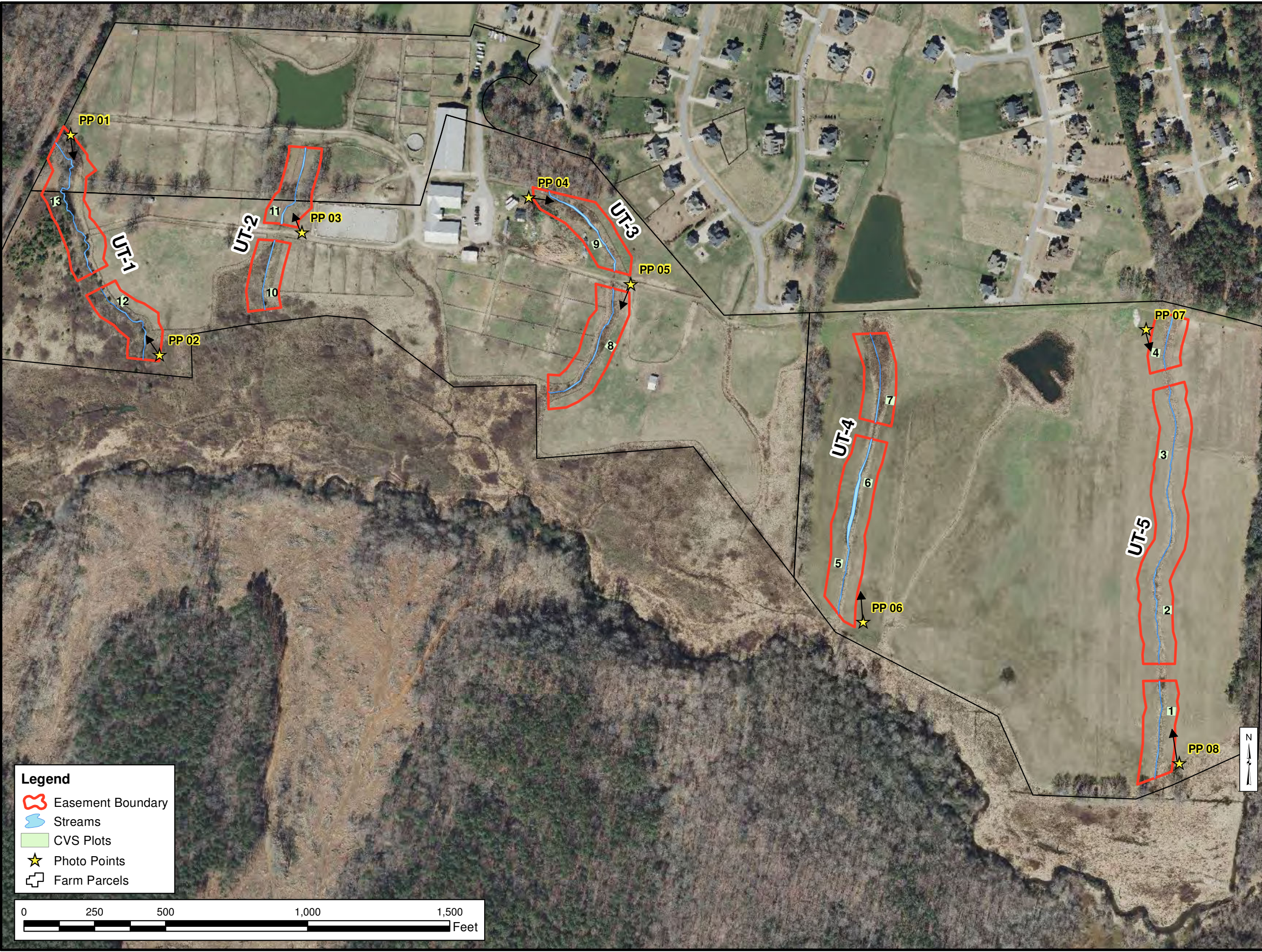
**CURRENT CONDITIONS  
PLAN VIEW**

Notes:

1. Background imagery source:  
2010 CGIA orthoimagery

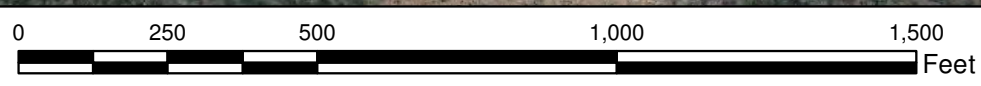
Drawn by:	KRJ
Date:	Oct 2014
Scale:	As shown
Project No.:	10-001

**FIGURE  
2**



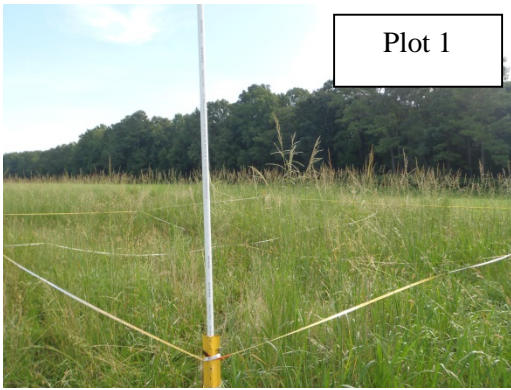
**Legend**

- Easement Boundary
- Streams
- CVS Plots
- Photo Points
- Farm Parcels

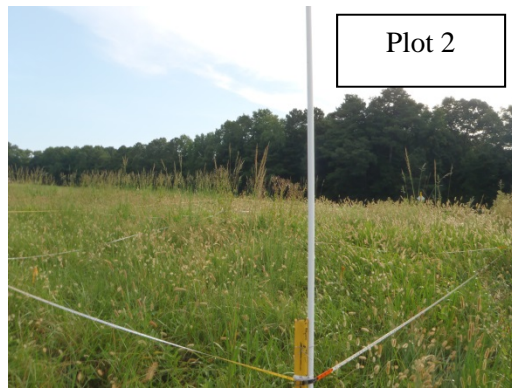




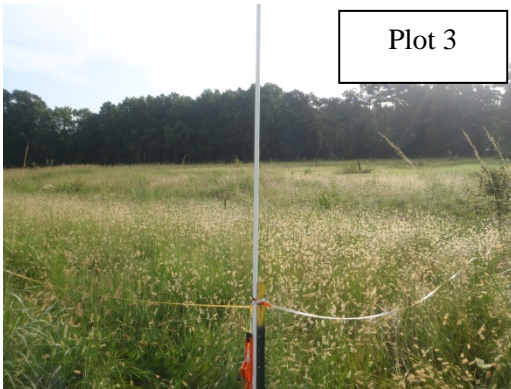
**Pepperwood Farm  
Vegetation Monitoring Photographs  
Taken August 22, 2014**



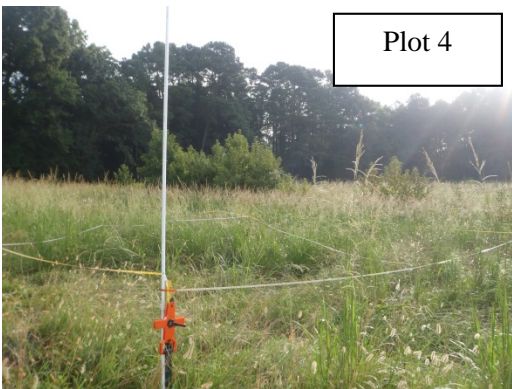
Plot 1



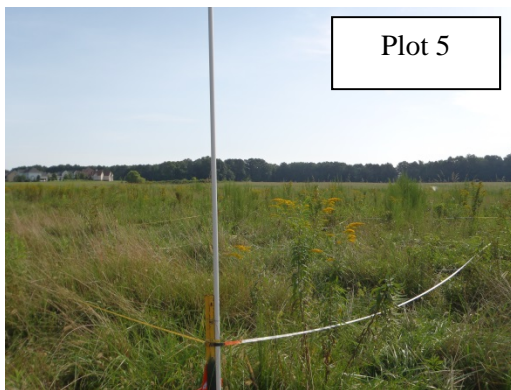
Plot 2



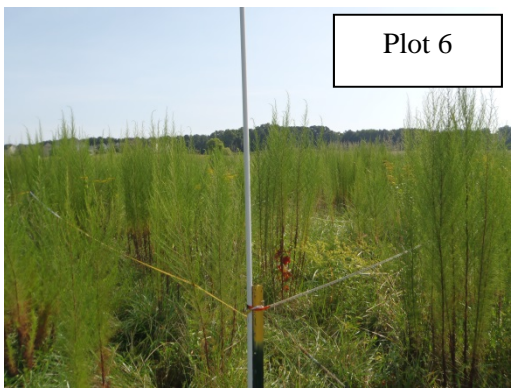
Plot 3



Plot 4



Plot 5



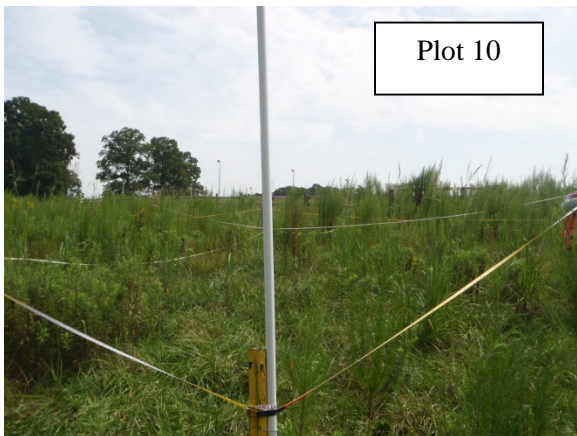
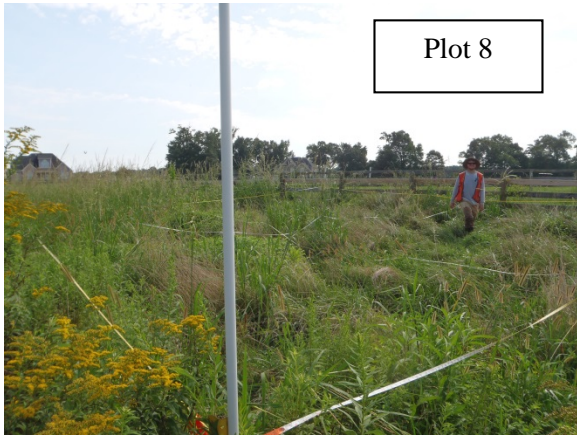
Plot 6



Plot 7



**Pepperwood Farm  
Vegetation Monitoring Photographs  
Taken August 22, 2014  
(continued)**





**Pepperwood Farm  
Fixed Photo Points  
Taken October 17, 2014**



## **Appendix C: Vegetation Plot Data**

Table 5. Vegetation Plot Success by Project Asset Type

Table 6. Total and Planted Stems by Plot and Species

**Table 5. Vegetation Plot Success by Plot Type**

Plot #	Riparian Buffer Stems <sup>1</sup>	Stream/ Wetland Stems <sup>2</sup>	Live Stakes	Invasives	Volunteers <sup>3</sup>	Total <sup>4</sup>	Unknown Growth Form
1	16	n/a	0	0	0	16	0
2	13	n/a	0	0	0	13	0
3	15	n/a	0	0	1	16	0
4	8	n/a	0	0	0	8	0
5	10	n/a	0	0	0	10	0
6	13	n/a	0	0	4	17	0
7	9	n/a	0	0	3	13	1
8	10	n/a	0	0	0	10	0
9	10	n/a	0	0	0	10	0
10	18	n/a	0	0	5	23	0
11	17	n/a	0	0	0	17	0
12	12	n/a	0	0	2	14	0
13	12	n/a	0	0	115	127	0

**Stem Class**

<sup>1</sup>Buffer Stems

<sup>2</sup>Stream/ Wetland Stems

<sup>3</sup>Volunteers

<sup>4</sup>Total

**characteristics**

Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.

Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines

Native woody stems. Not planted. No vines.

Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Table 6. Total and Planted Stems by Plot and Species

Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2014)																				
			123-01-0001			123-01-0002			123-01-0003			123-01-0004			123-01-0005			123-01-0006			123-01-0007		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																				1	
Baccharis halimifolia	eastern baccharis	Shrub								1													
Betula nigra	river birch	Tree	1	1	1	1	1	1									1	1	1				
Carpinus caroliniana	American hornbeam	Tree				1	1	1	1	1	1				3	3	3	1	1	1			
Carya	hickory	Tree																					
Carya cordiformis	bitternut hickory	Tree							1	1	1	2	2	2									
Carya ovata	shagbark hickory	Tree																					
Celtis	hackberry	Tree																					
Celtis laevigata	sugarberry	Tree	4	4	4															1	1	1	
Diospyros virginiana	common persimmon	Tree																					
DONTKNOW: unsure record*																				1	1	1	
Fraxinus pennsylvanica	green ash	Tree	3	3	3	1	1	1	4	4	4	1	1	1	2	2	2	2	2	2			
Liquidambar styraciflua	sweetgum	Tree																	1			2	
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	1	6	6	6	3	3	3	1	1	1						
Morella cerifera	wax myrtle	shrub																					
Platanus occidentalis	American sycamore	Tree																					
Prunus serotina	black cherry	Tree																					
Quercus	oak	Tree							1	1	1	2	2	2									
Quercus michauxii	swamp chestnut oak	Tree	2	2	2	4	4	4	2	2	2						1	1	1				
Quercus pagoda	cherrybark oak	Tree	1	1	1										1	1	1	3	3	3	3	3	
Quercus phellos	willow oak	Tree																					
Ulmus alata	winged elm	Tree																		3			
Ulmus americana	American elm	Tree	3	3	3	5	5	5							3	3	3	5	5	5	5	5	
<b>Stem count</b>			16	16	16	13	13	13	15	15	16	8	8	8	10	10	10	13	13	17	10	10	13
<b>size (ares)</b>			1			1			1			1			1			1			1		
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
<b>Species count</b>			7	7	7	6	6	6	6	6	7	4	4	4	5	5	5	6	6	8	4	4	6
<b>Stems per ACRE</b>			647.5	647.5	647.5	526.1	526.1	526.1	607	607	647.5	323.7	323.7	323.7	404.7	404.7	404.7	526.1	526.1	688	404.7	404.7	526

Exceeds requirements, but by less than 10% P-all = Planting including livestakes  
 Fails to meet requirements, by less than 10% T = All planted and natural recruits including livestakes  
 Fails to meet requirements by more than 10% T includes natural recruits

\* As-built counts were completed 1 week after Site planting; therefore, this is a known planted stem. It was not easily identified at asbuilt or Year 1 monitoring and will be identified in Year 2 (2015).



Table 6. Total and Planted Stems by Plot and Species (continued)

Scientific Name	Common Name	Species Type	Current Plot Data (MY1 2014)																		Annual Means										
			123-01-0008			123-01-0009			123-01-0010			123-01-0011			123-01-0012			123-01-0013			MY1 (2014)			MY0 (2014)							
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T					
Acer rubrum	red maple	Tree																							1						
Baccharis halimifolia	eastern baccharis	Shrub									2														3						
Betula nigra	river birch	Tree																1	1	1	4	4	4	42	42	42					
Carpinus caroliniana	American hornbeam	Tree				2	2	2	1	1	1	4	4	4							13	13	13	8	8	8					
Carya	hickory	Tree																							5	5	5				
Carya cordiformis	bitternut hickory	Tree							2	2	2														5	5	5				
Carya ovata	shagbark hickory	Tree																							3	3	3				
Celtis	hackberry	Tree																							1	1	1				
Celtis laevigata	sugarberry	Tree				1	1	1				1	1	1	5	5	5	2	2	2	14	14	14	25	25	25					
Diospyros virginiana	common persimmon	Tree																								3					
DONTKNOW: unsure record*																										1	1	1	3	3	3
Fraxinus pennsylvanica	green ash	Tree							2	2	2				3	3	3	1	1	1	19	19	19	23	23	23					
Liquidambar styraciflua	sweetgum	Tree																													
Liriodendron tulipifera	tuliptree	Tree							2	2	2	1	1	1																	
Morella cerifera	wax myrtle	shrub																													
Platanus occidentalis	American sycamore	Tree																													
Prunus serotina	black cherry	Tree																													
Quercus	oak	Tree	1	1	1	1	1	1	3	3	3	1	1	1							9	9	9	24	24	24					
Quercus michauxii	swamp chestnut oak	Tree							1	1	1	1	1	1	3	3	3	1	1	1	15	15	15	9	9	9					
Quercus pagoda	cherrybark oak	Tree	6	6	6	1	1	1				2	2	2				4	4	4	21	21	21	16	16	16					
Quercus phellos	willow oak	Tree	2	2	2																2	2	2	4	4	4					
Ulmus alata	winged elm	Tree																													
Ulmus americana	American elm	Tree	1	1	1	5	5	5	7	7	7	7	7	7	1	1	1	3	3	3	45	45	45	17	17	17					
<b>Stem count</b>			10	10	10	10	10	10	18	18	23	17	17	17	12	12	14	12	12	127	164	164	294	207	207	207					
<b>size (ares)</b>			1			1			1			1			1			1			13			13							
<b>size (ACRES)</b>			0.02			0.02			0.02			0.02			0.02			0.02			0.32			0.32							
<b>Species count</b>			4	4	4	5	5	5	7	7	11	7	7	7	4	4	5	6	6	11	12	12	19	17	17	17					
<b>Stems per ACRE</b>			404.7	404.7	404.7	404.7	404.7	404.7	728.4	728.4	930.8	688	688	688	485.6	485.6	566.6	485.6	485.6	5140	510.5	510.5	915.2	644.4	644.4	644.4					

Exceeds requirements, but by less than 10% P-all = Planting including livestakes  
 Fails to meet requirements, by less than 10% T = All planted and natural recruits including livestakes  
 Fails to meet requirements by more than 10% T includes natural recruits

\* As-built counts were completed 1 week after Site planting; therefore, this is a known planted stem. It was not easily identified at asbuilt or Year 1 monitoring and will be identified in Year 2 (2015).