ANNUAL MONITORING REPORT
YEAR 5 (2010)
CONETOE BUFFER RESTORATION SITE
PITT COUNTY, NORTH CAROLINA
(Contract Number D05026-1)

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ECOSYSTEM ENHANCEMENT PROGRAM
RALEIGH, NORTH CAROLINA

Prepared by:

Restoration Systems, L.L.C.
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

And

Axiom Environmental, Inc.
20 Enterprise Street, Suite 7
Raleigh, North Carolina 27607

July 2010

EXECUTIVE SUMMARY

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Conetoe Buffer Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located approximately 10 miles northwest of Greenville, in Pitt County. This portion of Pitt County is located centrally within Tar-Pamlico River Basin 14-digit Targeted Local Watershed 03020103050050**.**

The Conservation Easement for the Site encompasses 10.19 acres immediately adjacent to unnamed tributaries to Conetoe Creek. A total of 10.02 Buffer Mitigation Units (BMU) within the Conservation Easement were completed in February 2006. Measurements made in 2009 revealed that 0.49 acres (0.49 BMU) of the original 10.02 BMUs were less that 50 feet wide; thus the Site actually generates 9.53 BMUs.

Prior to restoration, Site land use was characterized by spray fields utilized for sewage sludge application. The Site was cleared of native forest vegetation, ditched to reduce the impacts of groundwater on land use, and planted with herbaceous ground cover. Site streams were ditched and received periodic vegetative maintenance, resulting in eroding banks.

Site reforestation, consisting of a Mesic Pine Flatwoods community, was implemented within the entire 10.19-acre Site. The primary goals of this buffer restoration project focused on reforestation of the Site with native species to 1) improve water quality; 2) enhance flood attenuation; 3) reduce sedimentation/siltation; 4) increase channel bank stability; 5) filter and reduce pollutants prior to entering Conetoe Creek; 6) serve as a wildlife corridor by providing connectivity to forested areas adjacent to the Site; 7) provide increased habitat for aquatic and terrestrial wildlife; 8) increase organic matter, carbon export, and woody debris in the stream corridor; 9) restore shade to open waters of the Site; 10) increase potential for appropriate mussel habitat; and 11) enhance macroinvertebrate species populations in the channel.

As a whole, the densities of four vegetation plots across the Site were above the required 320 stems per acre with an average of 1541 tree stems per acre in the Fifth Monitoring Year (Year 2010). In addition, each individual plot met success criteria and had increasing species diversity with 7 to 8 species present within each plot.

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CONETOE BUFFER RESTORATION SITE
ANNUAL MONITORING REPORT
YEAR 5 (2010)
PITT COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

Restoration Systems, LLC (Restoration Systems) has completed the restoration of riparian buffer at the Conetoe Buffer Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located approximately 10 miles northwest of Greenville, in Pitt County (Figure 1).

The Site Conservation Easement encompasses 10.19 acres immediately adjacent to unnamed tributaries to Conetoe Creek within subbasin 03-03-03 of the Tar-Pamlico River Basin. The Site is part of United States Geological Survey Catalog Unit 03020203 of the South Atlantic/Gulf Region and is encompassed within a Hydrologic Unit that has been targeted for restoration needs (Targeted Local Watershed 03020103050050) (EEP 2004).

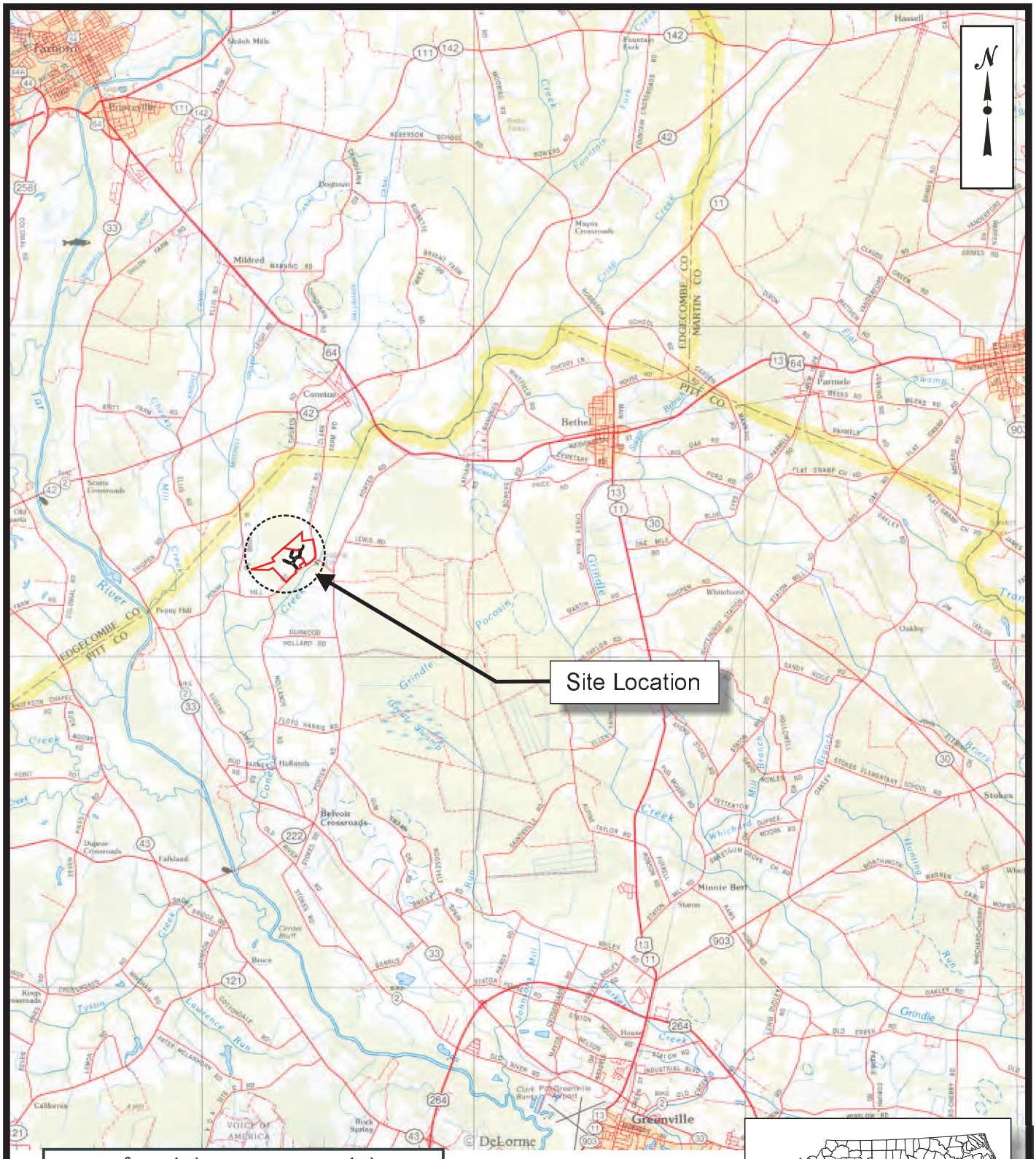
A Detailed Buffer Restoration Plan was completed for the Site in July 2005. The plan outlined methods designed to reforest the entire 10.19-acre Site with native species. Prior to implementation, the entire Site was composed of sewage sludge spray fields. The following objectives provide 9.53 Buffer Mitigation Units as requested under the EEP Request for Proposal (RFP) 16-D05026 dated October 22, 2004:

- Restoration of 9.53 acres of riparian buffer through planting with native forest species.
- Protection of the Site in perpetuity with a conservation easement which is held by the State of North Carolina.

The primary goals of this buffer restoration project focused on reforestation of the entire 10.19-acre Site with native species to 1) improve water quality; 2) enhance flood attenuation; 3) reduce sedimentation/siltation; 4) increase channel bank stability; 5) filter and reduce pollutants prior to entering Conetoe Creek; 6) serve as a wildlife corridor by providing connectivity to forested areas adjacent to the Site; 7) provide increased habitat for aquatic and terrestrial wildlife; 8) increase organic matter, carbon export, and woody debris in the stream corridor; 9) restore shade to open waters of the Site; 10) increase potential for appropriate mussel habitat; and 11) enhance macroinvertebrate species populations in the channel.

The primary goals were accomplished by:

1. Removing nonpoint sources of pollution associated with land use practices including a) removal of spray field application of sewage sludge into and adjacent to Site streams and b) cessation of broadcasting fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams.
2. Reducing sedimentation within onsite and downstream receiving waters through a) a reduction of bank erosion associated with ditch vegetation maintenance, b) filtering and reducing surface runoff from adjacent spray fields, and c) planting a forest buffer adjacent to Site streams.



Axiom Environmental, Inc.
2126 Rowland Pond Dr
Willow Springs, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE LOCATION
CONETOE BUFFER RESTORATION SITE
Pitt County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	June 2008
Project:	08-007

FIGURE 1

3. Increasing floodwater attenuation by revegetating Site streams thereby promoting increased frictional resistance on floodwaters crossing the Site.
4. Providing wildlife habitat including a forested riparian corridor.

As constructed, the Site provides 9.53 acres of riparian buffer restoration (9.53 Buffer Mitigation Units).

On June 27, 2005, EEP contracted with Restoration Systems to complete restoration of the Site. A Detailed Buffer Restoration Plan was completed for the project in July 2005. Upon completion of the detailed plan, Carolina Silvics planted the Site during the first week of February 2006. An As-built Mitigation Plan was completed by Axiom Environmental, Inc. in May 2006.

Information on project managers, owners, and contractors follows:

Owner Information
Restoration Systems, L.L.C.
George Howard and John Preyer
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
(919) 755-9490

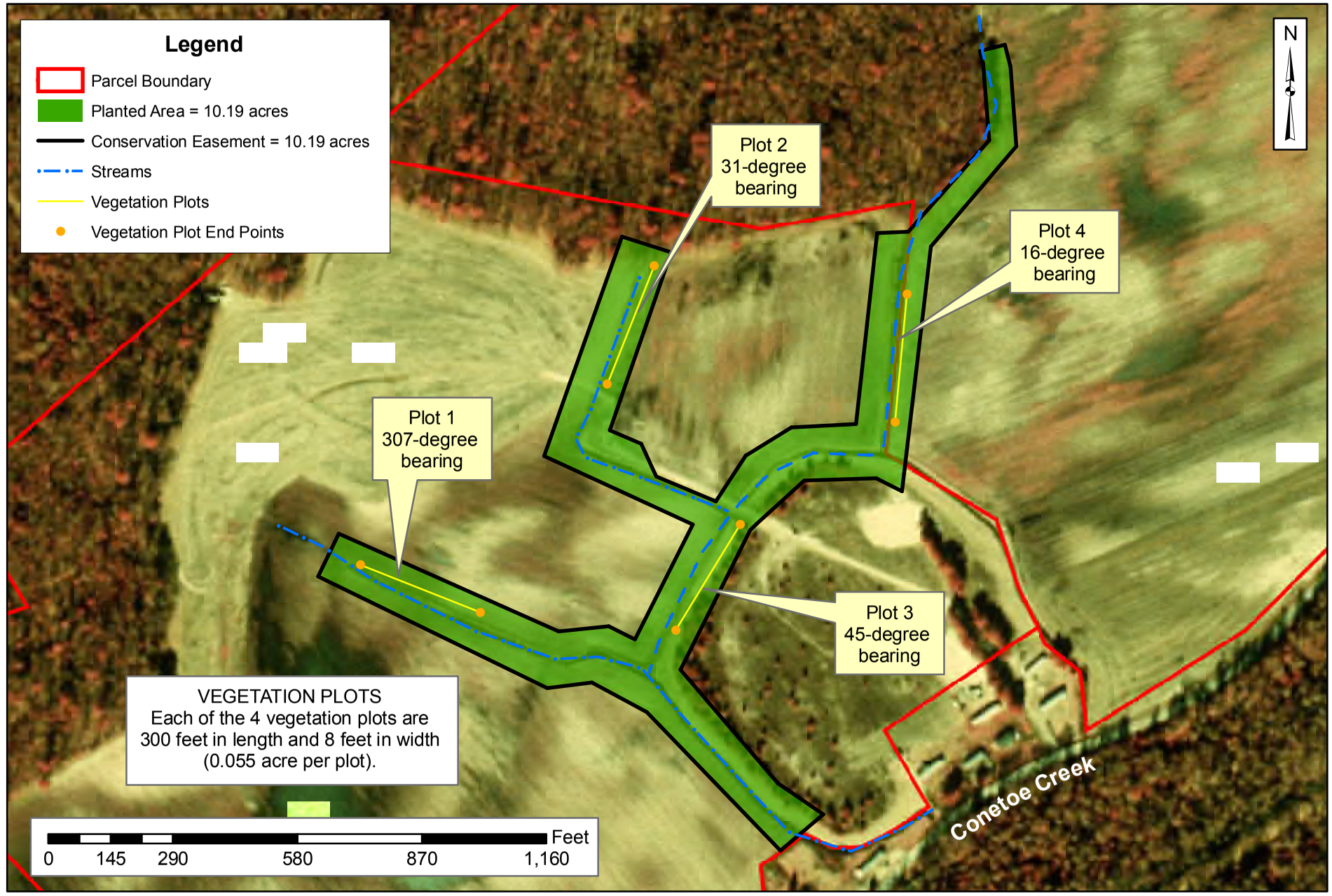
Designer and Monitoring Performer Information
Axiom Environmental, Inc.
W. Grant Lewis
20 Enterprise St., Suite 7
Raleigh, North Carolina 27607
(919) 215-1693

Planting Contractor Information
Carolina Silvics
Dwight McKinney
908 Indian Trail Road
Edenton, North Carolina 27932
(919) 523-4375

2.0 VEGETATION MONITORING PROGRAM

Monitoring procedures for vegetation were designed in accordance with *Stream Mitigation Guidelines* (USACE et al. 2003) and the *Draft Internal Guidance for Vegetation Monitoring Plans for NCWRP Riparian Buffer and Wetland Restoration Projects* (undated). A general discussion of the plant community restoration monitoring program is provided. Monitoring of restoration efforts was performed for 5 years when success criteria were fulfilled. The locations of monitoring plots are depicted in Figure 2.

During the first year, vegetation received visual evaluation on a periodic basis to ascertain the degree of overtopping of planted species by nuisance species. Subsequently, quantitative sampling of vegetation will be performed between June 1 and September 30 of each monitoring year for five years until the vegetation success criteria were achieved.



20 Enterprise St, Suite 7
Raleigh, NC 27607
(919) 215-1693
Axiom Environmental, Inc.

MONITORING PLAN
CONETOE BUFFER RESTORATION SITE
Pitt County, North Carolina

Dwn. by: CLF
Date: June 2009
Project: 09-005

FIGURE
2

Four sample transects were installed within planted areas of the Site shortly after replanting to equally represent the Site (Figure 2). Each transect is 300 feet in length and 8 feet in width (0.055 acre). In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species were also documented in photographs of the vegetation plots included in Appendix A.

2.1.1 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component is dependent upon density and growth of "Character Tree Species." Character Tree Species include planted species, those observed in forest stands near the Site, and those listed in the Mesic Pine Flatwood community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990). All planted canopy tree species and those identified in Schafale and Weakley (1990) will be utilized to define "Characteristic Tree Species" as termed in the success criteria.

Table 1. Character Tree Species

Planted Species	**Examples of Mesic Pine Flatwood Species***
River Birch (*Betula nigra*)	Mockernut Hickory (*Carya alba*)
Loblolly Pine (*Pinus taeda*)	Sand Hickory (*Carya pallida*)
White Oak (*Quercus alba*)	Sweetgum (*Liquidambar styraciflua*)
Southern Red Oak (*Quercus falcata*)	Longleaf Pine (*Pinus palustris*)
Swamp Chestnut Oak (*Quercus michauxii*)	Bluejack Oak (*Quercus incana*)
Water Oak (*Quercus nigra*)	Post Oak (*Quercus stellata*)
Cherrybark Oak (*Quercus pagoda*)	Blackjack Oak (*Quercus marilandica*)
Willow Oak (*Quercus phellos*)	Black Cherry (*Prunus serotina*)
Northern Red Oak (*Quercus rubra*)	

* Species described in Schafale and Weakley (1990) and observed within adjacent sites; this is not a comprehensive list.

Vegetation success criteria for the Site will be the existence of an overall density of at least 320 stems per acre five years after the initial planting. Additional seedlings are expected to be recruited to the Site from adjacent forested communities. These individuals may also be counted in the overall success rate for the Site provided they are native hardwood tree species.

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with Character Tree Species. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

No quantitative sampling requirements are proposed for herb assemblages as part of the vegetation success criteria. Development of floodplain forests over several decades will dictate the success in recruitment and establishment of desired understory and groundcover populations. Visual

estimates of the percent cover of herbaceous species will be noted and documented through periodic photographs. Photographs of the vegetation plots are included in Appendix A.

2.1.2 Vegetation Sampling Results and Comparison to Success Criteria

Quantitative sampling of vegetation was conducted in June 2010. Results are provided in Table 2. Vegetation success criteria for year 5 (320 stems per acre) were exceeded for the 2010 annual monitoring year with 1541 tree stems per acre across the Site. In addition, each individual plot met success criteria and had increasing species diversity with 7 to 8 species present within each plot.

3.0 CONCLUSIONS

As a whole, the densities of four vegetation plots across the Site were above the required 320 stems per acre with an average of 1541 tree stems per acre in the Fifth Monitoring Year (Year 2010). In addition, each individual plot met success criteria and had increasing species diversity with 7 to 8 species present within each plot.

Table 3. Summary of Vegetation Plot Results

Plot	Stems/Acre Counting Towards Success Criteria				
	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
1	764	945	1091	1764	1418
2	1473	2327	1345	2455	2309
3	655	1309	1236	1127	1200
4	1673	1655	2055	1782	1236
Average Plots 1-4	**1141**	**1547**	**1432**	**1782**	**1541**

TABLE 2
2010 VEGETATION MONITORING DATA AND RESULTS

Note: Each plot totals 0.055 acre in size.

Community	**Mesic Pine Flatwoods**						
Species*	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Total Stems for Plots 1-4**	**Total Stems/ Acre**	**Total Stems/Acre Counting Towards Success Criteria**
Character Tree Species (count toward success)							
***Betula nigra* (river birch)**	16	2	14	14	46	209	209
Carya illinoinensis (pecan)	1		2		3	14	14
Diospyros virginiana (sourwood)			1		1	5	5
Liquidambar styraciflua (sweetgum)	2	47			49	223	223
***Pinus taeda* (loblolly pine)**	17	14		9	40	182	182
Prunus serotina (black cherry)		11			11	50	50
***Quercus alba* (white oak)**			23	3	26	118	118
***Quercus falcata* (southern red oak)**	1	1	6	1	9	41	41
***Quercus michauxii* (swamp chestnut oak)**	11	7	11	2	31	141	141
***Quercus nigra* (water oak)**	2	11			13	59	59
***Quercus pagoda* (cherrybark oak)**	28	34	9	29	100	455	455
***Quercus rubra* (northern red oak)**				10	10	45	45
Species that Don't Count Toward Success							
Baccharis halimifolia (eastern baccharis)	11	4			15	68	0
Rhus copallina (smooth sumac)		3	1		4	18	0
TOTAL STEMS/PLOT	**89**	**134**	**67**	**68**	**358**	**1627**	**1541**
TOTAL STEMS/PLOT COUNTING TOWARDS SUCCESS CRITERIA	**78**	**127**	**66**	**68**			
TOTAL STEMS/ACRE COUNTING TOWARDS SUCCESS CRITERIA	**1418**	**2309**	**1200**	**1236**			

* Planted species are in bold.

4.0 REFERENCES

Ecosystem Enhancement Program (EEP). 2004. Tar-Pamlico River Basin Watershed Restoration Plan. North Carolina Department of Environment and Natural Resources, Raleigh.

North Carolina Wetlands Restoration Program (NCWRP). Undated. Draft Internal Guidance for Vegetation Monitoring Plans for NCWRP Riparian Buffer and Wetland Restoration Projects. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

Schafale, M. P., A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation, NC Natural Heritage Program, Division of Parks and Recreation, NC DEM, Raleigh NC.

United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), North Carolina Wildlife Resources Commission (NCWRC), Natural Resources Conservation Service (NRCS), and North Carolina Division of Water Quality (NCDWQ). 2003. Stream Mitigation Guidelines. State of North Carolina.

APPPENDIX A
VEGETATION PLOT PHOTOGRAPHS

Conetoe Buffer Restoration Site
Year 5 (2010) Annual Monitoring
Vegetation Plot Photos Taken June 2010