

# **ANNUAL MONITORING REPORT YEAR 2 (2007)**

**(Contract Number D05026-1)**

## **CONETOE BUFFER RESTORATION SITE PITT COUNTY, NORTH CAROLINA**

**Prepared for:**

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



**Prepared by:**



Natural Resources  
Restoration & Conservation

**Restoration Systems, L.L.C.  
1101 Haynes Street, Suite 107  
Raleigh, North Carolina 27604**

**And**



**ARCADIS G&M of North Carolina Inc.  
801 Corporate Center Drive, Suite 300  
Raleigh, North Carolina 27607**

**October 2007**

## EXECUTIVE SUMMARY

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Conetoe Buffer Restoration Site (hereinafter 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 Site encompasses 10.19 acres immediately adjacent to unnamed tributaries to Conetoe Creek. A total of 10.19 Buffer Mitigation Units, resulting from 10.19 acres of buffer restoration, were completed in February 2006.

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 4 vegetation plots across the Site were above the required 320 stems per acre with an average of 1,547 tree stems per acre in the Second Monitoring Year (Year 2007). In addition, each individual plot met success criteria and had decent species diversity with 4 to 7 planted species present within each plot. Average stems per acre increased across the Site compared to 2006 monitoring data; however, species diversity remained relatively similar.

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**CONETOE BUFFER RESTORATION SITE  
ANNUAL MONITORING REPORT  
YEAR 2 (2007)  
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 (hereinafter 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 sub-basin 03-03-03 of the Tar-Pamlico River Basin. The Site is part of United States Geological Survey Catalogue 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).

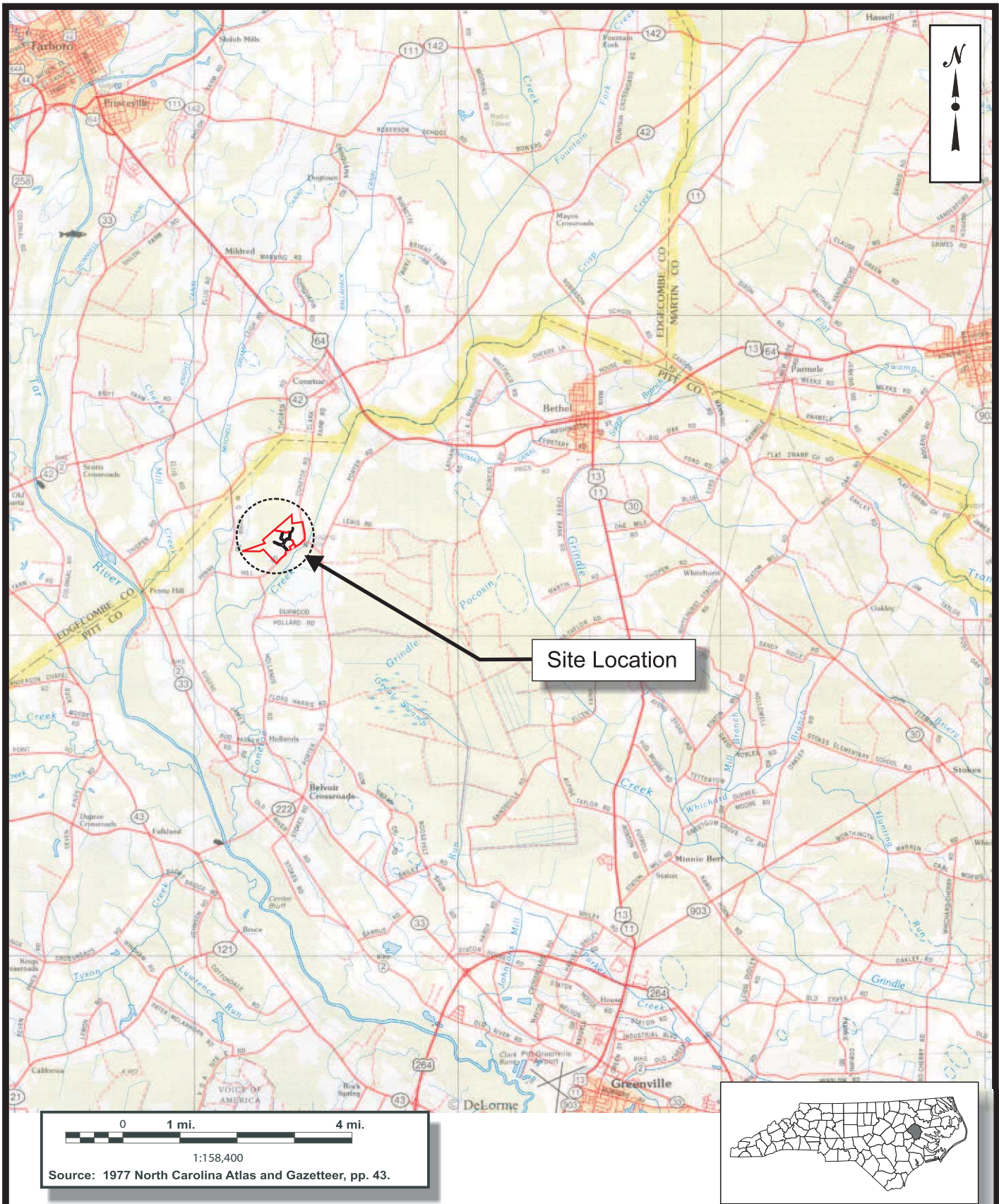
A Detailed Buffer Restoration Plan was completed for the Site in July 2005. The plan outlined methods designed to reforest the entire 10.19-acre Site with native species. Prior to implementation, the entire Site was composed of sewage sludge spray fields. The following objectives provide 10.19 Buffer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

- Restoration of approximately 10.19 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) 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.




801 Corporate Center Dr  
Suite 300  
Raleigh, NC 27607  
Tel. 919.854.1282  
Fax. 919.854.5448

**SITE LOCATION**  
**CONETOE BUFFER RESTORATION SITE**  
 Pitt County, North Carolina

**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 10.19 acres of riparian buffer restoration (10.19 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 107  
Raleigh, North Carolina 27604  
(919) 755-9490

Designer and Monitoring Performer Information

Axiom Environmental, Inc.  
W. Grant Lewis  
2126 Rowland Pond Drive  
Willow Spring, North Carolina 27592  
(919) 215-1693

Planting Contractor Information

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

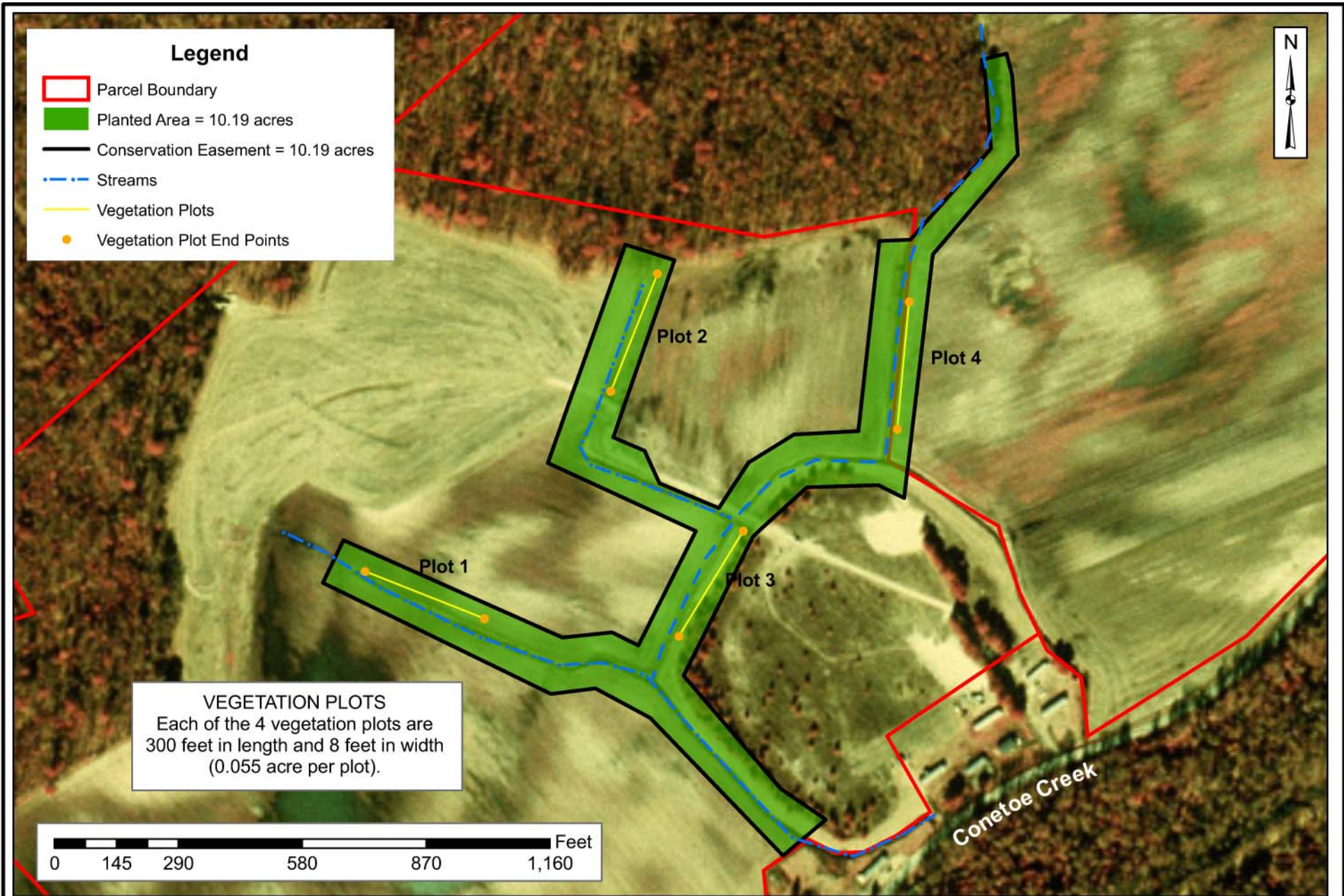
Year Two Monitoring Firm Information

ARCADIS G&M of North Carolina, Inc.  
Ben Furr and Keven Duerr  
801 Corporate Center Drive, Suite 300  
Raleigh, North Carolina 27607  
(919) 854-1282

## 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 will be performed for a minimum of 5 years or until success criteria are 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. Quantitative second year sampling was conducted on September 20, 2007. Subsequently, quantitative sampling of vegetation will be



performed between June 1 and September 30 of each monitoring year for 5 years or until the vegetation success criteria are achieved.

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 noted. Photographs of the four vegetation plots are included in Appendix A.

## 2.1 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**

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

\* 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 5 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.

## 2.2 Vegetation Sampling Results and Comparison to Success Criteria

Quantitative sampling of vegetation was conducted in September 2007. Results are provided in Table 2. Vegetation success criteria for year 2 (320 stems per acre) were exceeded for the 2007 annual monitoring year with 1,547 tree stems per acre across the Site. In addition, each individual plot met success criteria and had decent species diversity with 4 to 7 planted species present within each plot.

## 3.0 CONCLUSIONS

As a whole, vegetation plots across the Site were above the required 320 stems per acre with an average of 1,547 tree stems per acre in the Second Monitoring Year (Year 2007). In addition, each individual plot met success criteria and had decent species diversity with 4 to 7 planted species present within each plot. Average stems per acre increased across the Site compared to 2006 monitoring data; however, species diversity remained relatively similar.

**TABLE 2.**  
**2007 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 1-6B	Total Stems/Acre	Total Stems/Acre Counting Towards Success Criteria**
<b>Character Tree Species (count toward success)</b>							
<i>Acer rubrum</i> (red maple)	1	2			3	14	14
<b><i>Betula nigra</i></b> (river birch)	23	2	17	11	53	241	241
<i>Carya</i> sp. (hickory)	1				1	5	5
<i>Liquidambar styraciflua</i> (sweetgum)	1	56			57	259	259
<b><i>Pinus taeda</i></b> (loblolly pine)	15	7		7	29	132	132
<i>Prunus serotina</i> (black cherry)		3			3	14	14
<b><i>Quercus alba</i></b> (white oak)			26	29	55	250	250
<b><i>Quercus falcata</i></b> (southern red oak)		15	1	1	17	77	77
<b><i>Quercus michauxii</i></b> (swamp chestnut oak)	6	10	8	10	34	155	155
<b><i>Quercus nigra</i></b> (water oak)		2	1		3	14	14
<b><i>Quercus pagoda</i></b> (cherrybark oak)		6	3	7	16	73	73
<b><i>Quercus rubra</i></b> (northern red oak)	5	25	16	26	72	328	328
<b>Species that Don't Count Toward Success</b>							
<i>Baccharis halimifolia</i> (eastern baccharis)	3	4		2	9	41	0
<b>TOTAL STEMS/PLOT</b>	<b>55</b>	<b>132</b>	<b>72</b>	<b>93</b>	<b>349</b>	<b>1588</b>	<b>1547</b>
<b>TOTAL STEMS/PLOT COUNTING TOWARDS SUCCESS CRITERIA</b>	<b>52</b>	<b>128</b>	<b>72</b>	<b>91</b>			
<b>TOTAL STEMS/ACRE COUNTING TOWARDS SUCCESS CRITERIA</b>	<b>945</b>	<b>2327</b>	<b>1309</b>	<b>1655</b>			

\* 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.

**APPENDIX A**  
**VEGETATION PLOT PHOTOGRAPHS**

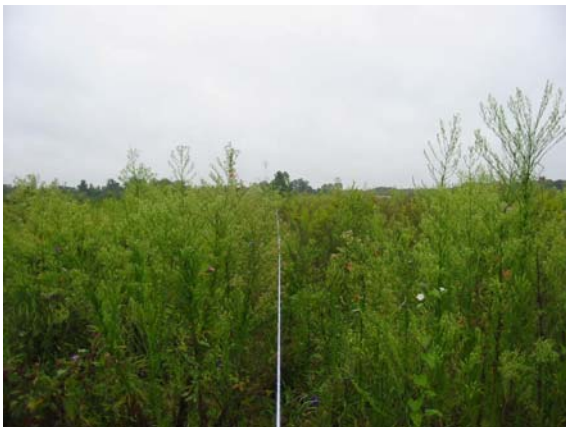
**Conetoe Buffer Restoration Site  
Year 2 (2007) Annual Monitoring Report  
Vegetation Photographs Taken September 2007**



**Plot 1**



**Plot 2**



**Plot 3**



**Plot 4**