

**ANNUAL MONITORING REPORT**

**YEAR 4 (2009)**

**Contract D05015-1**

**LITTLE BUFFALO BUFFER MITIGATION SITE  
JOHNSTON COUNTY, NORTH CAROLINA**

**Prepared for:**

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



**Prepared by:**



Natural Resource  
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## **Executive Summary**

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Little Buffalo 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 in the southeastern portion of the Neuse River Basin Cataloging Unit 03020201 and within Johnston County, one of the fastest growing counties in the state of North Carolina.

The Site consists of a total of approximately 23 acres located on the west side of Bay Valley Road (SR 2159). On-site ditches drain to Little Buffalo Creek which connects with the Little River approximately 2 miles downstream of the Site near the town of Kenly. A total of 18.5 Buffer Mitigation Units, resulting from 19.5 acres of buffer restoration, were completed in April 2006.

Prior to restoration, Site land use consisted of agricultural fields utilized for row crop production. On-Site agricultural ditches were characterized by little or no vegetation and unstable banks.

Site reforestation encompasses 18.5 acres of riparian buffer. The primary goals of this buffer restoration project focused on reforestation with native species in order to 1) convert active cropland into riparian forest to reestablish forest functions; 2) intercept and assimilate nutrient, pesticide, and sediment runoff from agricultural and development operations before reaching the UT of Little Buffalo Creek and ultimately the Neuse River; 3) improve wildlife quantity and quality; and 4) reduce residential development in an area where existing water, sewer, and electric utilities make the Site a likely candidate for development.

Overall, the densities of the five vegetation plots across the Site were above the required 320 stems/acre with an average of 1066 tree stems per acre in the Fourth Monitoring Year (2009). All individual vegetation plots met success criteria and had good species diversity with 5 to 11 Character Tree Species present within each plot.

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## 1.0 INTRODUCTION

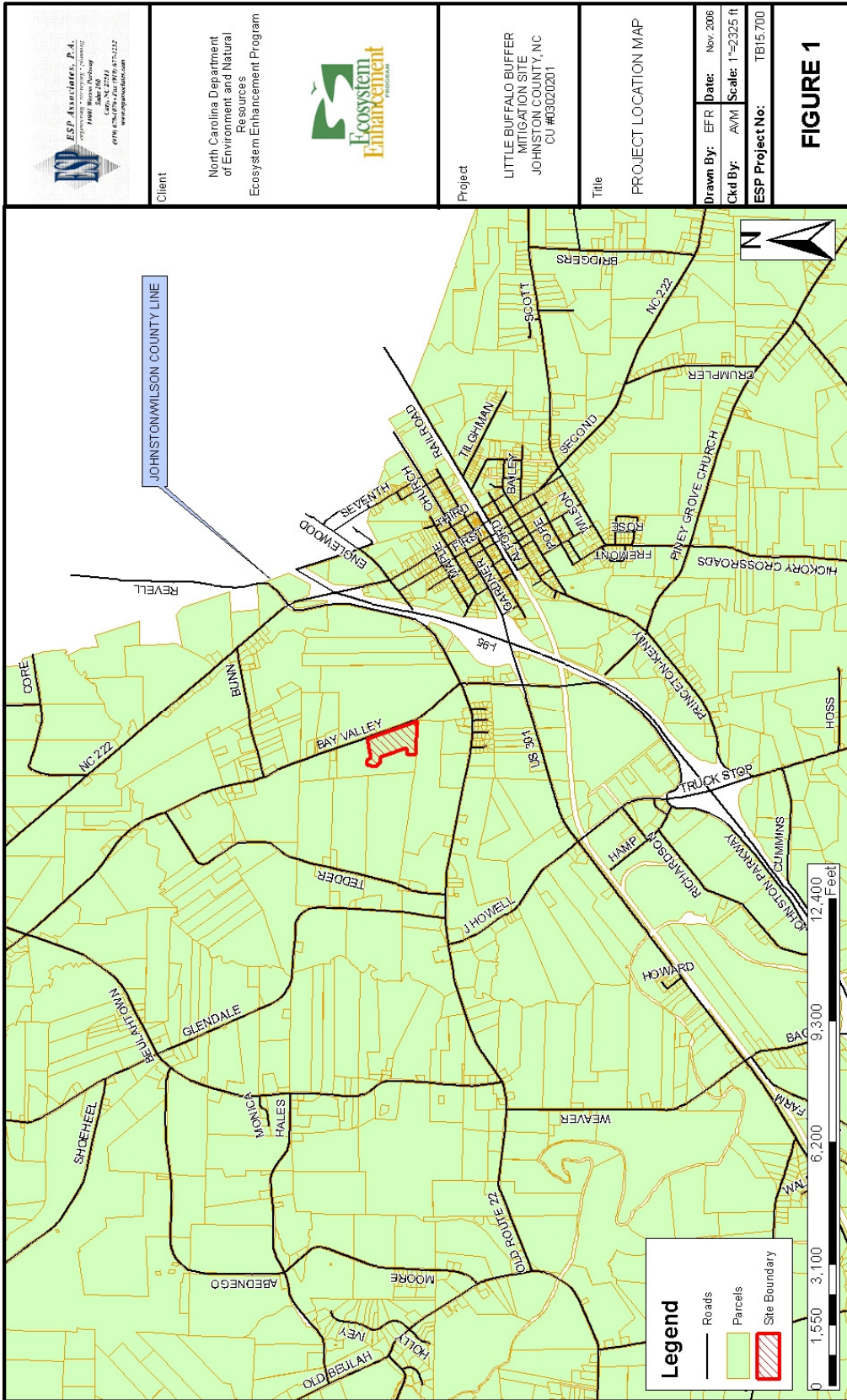
Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Little Buffalo Buffer Restoration Site (hereafter referred to as the Site) to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located in Johnston County, approximately one mile northwest of downtown Kenly and Exit 107 of I-95, north of U.S. Hwy 301, and west of N.C. Hwy 222 (Figure 1).

The Site conservation easement encompasses 18.5 acres within NCDWQ sub-basin 03-04-06 and Hydrologic Unit #03020201180070, which includes Buffalo Creek, Little Buffalo Creek, and the Little River, a drainage area that encompasses a total of 317 square miles. On-site ditches drain to Little Buffalo Creek which connects with the Little River approximately 2 miles downstream of the Site near the town of Kenly.

A Buffer Restoration Plan was completed for the Site in July 2006. The plan outlined methods designed to reforest the entire 19.5-acre Site with native species in order to help improve water quality within the Neuse River Basin. Prior to implementation of the Restoration Plan, the entire Site was utilized for agricultural practices. The following activities provide 18.5 Buffer Mitigation Units:

- Restoration of approximately 18.5 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 with native species in order to 1) convert active cropland into riparian forest to reestablish forest functions; 2) intercept and assimilate nutrient, pesticide, and sediment runoff from agricultural and development operations before reaching the UT of Little Buffalo Creek and ultimately the Neuse River; 3) improve wildlife quantity and quality; and 4) reduce residential development in an area where existing water, sewer, and electric utilities make the Site a likely candidate for development.



The primary goals were accomplished by:

1. Establishing a forested system between the agricultural fields and the receiving waters. By doing this, nutrient (primarily nitrogen), pesticide and sediment input into surface waters of the Neuse River Basin was drastically reduced.
2. Eliminating non-point sources of pollution, such as fertilizers, pesticides, and other agricultural materials and providing a vegetated buffer adjacent to on-Site ditches to treat any surface runoff.
3. Improving wildlife habitat by creating a forested riparian corridor.

A Buffer Restoration Plan was completed for the project in March 2006 (submitted in July 2006). Upon completion of the detailed plan, Bruton Nurseries and Landscapes planted the Site in April 2006. ESP Associates, P.A. completed an as-built Mitigation Report in August 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 Information

ESP Associates, P.A.  
Adam McIntyre  
14001 Weston Parkway  
Suite 100  
Cary, North Carolina 27513  
(919) 678-1070

Planting Contractor and Monitoring Performer Information

Bruton Natural Systems, Inc.  
(Previously Bruton Nurseries & Landscapes)  
Charlie Bruton  
P.O. Box 1197  
Fremont, North Carolina 27830

## 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 shown in Figure 2.

During the first, second, third, and fourth years, vegetation received visual evaluation on a periodic basis to determine the degree of overtopping of planted species by nuisance species. Quantitative sampling was conducted in early fall of the first year, and again in early fall of consecutive years. Subsequently, quantitative sampling of vegetation will be performed between September 15 and November 1 of each monitoring year for five years or until the vegetation success criteria are achieved.

Five sample transects were installed within planted areas of the Site shortly after replanting to equally represent the Site (Figure 2). Each transect is 200 feet in length and 12 feet in width (0.055 acre). In each sample plot, vegetation parameters that were monitored include species composition and species density. Photographs of the 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” (Table 1), as well as recruited seedlings from adjacent forested communities. Character tree species include planted species as well as those observed in forest stands near the Site.

**Table 1. Character Tree Species**

Character Tree Species	
American elm ( <i>Ulmus americana</i> )	Willow oak ( <i>Quercus phellos</i> )
Cherrybark oak ( <i>Quercus falcata</i> )	Chickasaw plum ( <i>Prunus angustifolia</i> )
Green ash ( <i>Fraxinus pennsylvanica</i> )	Paw paw ( <i>Asimina triloba</i> )
River birch ( <i>Betula nigra</i> )	Red twig dogwood ( <i>Cornus sericea</i> )
Swamp black gum ( <i>Nyssa sylvatica</i> )	Silky dogwood ( <i>Cornus amomum</i> )
Swamp chestnut oak ( <i>Quercus michauxii</i> )	Southern crabapple ( <i>Malus angustifolia</i> )
Sycamore ( <i>Platanus occidentalis</i> )	Sweetbay ( <i>Magnolia virginiana</i> )
Water hickory ( <i>Carya aquatica</i> )	

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 vegetation success criteria are achieved.

No quantitative sampling requirements are proposed for herb assemblages as part of the vegetation success criteria. 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 2009. Results are provided in Table 2. Vegetation success criteria for Year 4 (320 stems per acre) were exceeded for the 2009 annual monitoring year with 1066 tree stems per acre across the Site. All individual vegetation plots met success criteria and had good species diversity with 5 to 11 Character Tree Species present within each plot.

## **3.0 CONCLUSIONS**

In summary, vegetation plots across the Site were above the required 320 stems per acre with an average of 1066 tree stems per acre in the Fourth Monitoring Year (Year 2009). All individual vegetation plots met success criteria and had good species diversity with 5 to 11 Character Tree Species present within each plot.





**TABLE 2**  
**2009 VEGETATION MONITORING DATA AND RESULTS**

Note: Each plot totals 0.055 acre in size

Species*	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Total Stems for Plots 1-5	Total Stems/Acre
<b>Character Tree Species (count toward success)</b>							
<i>Quercus falcata</i> (cherrybark oak)	4	1	4	2	0	11	200
<i>Fraxinus pennsylvanica</i> (green ash)	1	3	2	4	0	10	182
<i>Betula nigra</i> (river birch)	0	0	0	2	0	2	36
<i>Nyssa sylvatica</i> (swamp blackgum)	1	0	0	0	0	1	18
<i>Quercus michauxii</i> (swamp chestnut oak)	1	0	0	2	0	3	55
<i>Carya aquatica</i> (water hickory)	0	2	0	0	0	2	36
<i>Quercus phellos</i> (willow oak)	10	6	6	1	3	26	473
<i>Cornus sericea</i> (red twig dogwood)	0	3	0	1	0	4	73
<i>Prunus angustifolia</i> (chickasaw plum)	1	2	0	0	1	4	73
<i>Cornus amomum</i> (silky dogwood)	0	1	0	1	0	2	36
<i>Ulmus americana</i> (American elm)	3	0	2	1	1	7	127
<i>Celtis laevigata</i> (sugarberry)	2	0	1	0	0	3	55
<i>Platanus occidentalis</i> (sycamore)	7	5	2	0	2	16	291
<i>Liriodendron tulipifera</i> (yellow poplar)	2	3	7	2	3	17	309
<i>Asimina triloba</i> (paw paw)	2	0	3	0	0	5	91
<i>Malus angustiflora</i> (southern crabapple)	1	2	0	1	0	4	73
<i>Magnolia virginiana</i> (sweetbay)	6	3	8	1	5	23	419
<i>Acer rubrum</i> (red maple)	0	0	0	0	0	0	0
<i>Liquidambar styraciflua</i> (sweetgum)	44	25	36	22	26	153	2785
<b>TOTAL STEMS/PLOT</b>	85	56	71	40	41	293	
<b>TOTAL STEMS/ACRE</b>	1547	1019	1292	728	746		5332
<b>AVERAGE TOTAL STEMS/ACRE (PLOTS 1-5)</b>							1066

\*Planted species are in bold

**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	1238	1401	1329	1547	
2	801	801	910	1019	
3	1055	1092	1292	1292	
4	1074	710	673	728	
5	637	874	673	746	
<b>Average (Plots 1-5)</b>	<b>961</b>	<b>976</b>	<b>975</b>	<b>1066</b>	

#### **4.0 LITERATURE CITED**

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.

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**

**Little Buffalo Buffer Restoration Site  
Year 4 (2009) Annual Monitoring Report  
Vegetation Plot Photographs Taken September 2009**

**Plot 1**



**Plot 2**



**Plot 3**



**Plot 4**



**Plot 5**

