ANNUAL MONITORING REPORT
YEAR 1 (2005)

(Contract Number D04009-2)

WALNUT CREEK BUFFER RESTORATION SITE
WAYNE COUNTY, NORTH CAROLINA

Prepared for:

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

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EXECUTIVE SUMMARY

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Walnut Creek Mitigation 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 one mile east of Goldsboro, in Wayne County. This portion of Wayne County is located in the western portion of Neuse River Basin Cataloging Unit 03020202. The Site encompasses 25 acres of buffer restoration immediately adjacent to Walnut Creek and one of its unnamed tributaries and was completed in June, 2005.

Prior to restoration, Site land use consisted primarily of agricultural fields utilized for row crop production in addition to a small area of abandoned pasture. Site ditch banks were characterized by little or no vegetation and tilling took place within one to two feet of the top of bank. Excessive runoff during storms contributed to nutrient, pesticide and sediment runoff.

Site reforestation, consisting of a Nonriverine Wet Hardwood Forest community, was implemented within the entire 25-acre Site. The primary goals of this buffer restoration project focused on reforestation of the Site with native tree and shrub species to:

1. Intercept and assimilate nutrient, pesticide, and sediment runoff from agricultural activities into the headwaters of Walnut Creek and ultimately into the Neuse River.
2. To convert cropland within the project area into riparian forest to reestablish forest functions.
3. To improve wildlife habitat quantity and quality.
4. To augment efforts by Wayne County and the City of Goldsboro to establish buffer areas around Seymour Johnson Air Force Base.

Year 1 monitoring was conducted during October, 2005 to determine the density of surviving trees and shrubs in eight sampling transects. The mean density of vegetation in the eight plots at the Site was 1357 stems/acre, well above the required 320 stems/acre. All individual vegetation plots met success criteria and all exhibited good species diversity with nine to 16 planted species present within each plot.

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WALNUT CREEK MITIGATION SITE
ANNUAL MONITORING REPORT
YEAR 1 (2005)
WAYNE COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Walnut Creek Mitigation 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 situated within the western portion of Cataloging Unit 03020202 (Hydrologic Unit 03020202010040) of the Neuse River Basin (Figure 1) and is located approximately one mile east of Goldsboro, in Wayne County (Figure 2). The Site conservation easement encompasses 27.9 acres immediately adjacent to Walnut Creek and an unnamed tributary to it within sub-basin 03-04-02 of the Neuse River Basin. All streams within or adjacent to the Site are depicted by blue lines on the USGS Southeast Goldsboro (1:24,000) topographic map (Figure 3). The soils of the Site are mostly poorly drained wet flats comprised of the Rains, Torhunta, and Weston series (Figure 4).

A Restoration Plan was completed for the Site in December, 2006. The plan outlined methods designed to reforest the entire Site with native species. Prior to implementation, Part 1 of the Site (approximately 23.5 acres) was composed of row-crop agriculture. Part 2, approximately one mile to the east, consisted of about 1.5 acre of abandoned pasture. The following implemented activities provide 25 Buffer Mitigation Units as requested under the EEP Request for Proposal (RFP) 16-D04009 dated December 31, 2003:

1. Restoration of 25 acres of riparian buffer through planting with native forest species.
2. 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 Site with native tree and shrub species to:

1. Intercept and assimilate nutrient, pesticide, and sediment runoff from agricultural activities into the headwaters of Walnut Creek and ultimately into the Neuse River.
2. To convert cropland within the project area into riparian forest to reestablish forest functions.
3. To improve wildlife habitat quantity and quality.
4. To augment efforts by Wayne County and the City of Goldsboro to establish buffer areas around Seymour Johnson Air Force Base.

The primary goals were accomplished by removing non-point sources of pollution associated with agricultural production including a) the cessation of broadcasting fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams and b) providing a vegetative buffer adjacent to streams to treat surface runoff.

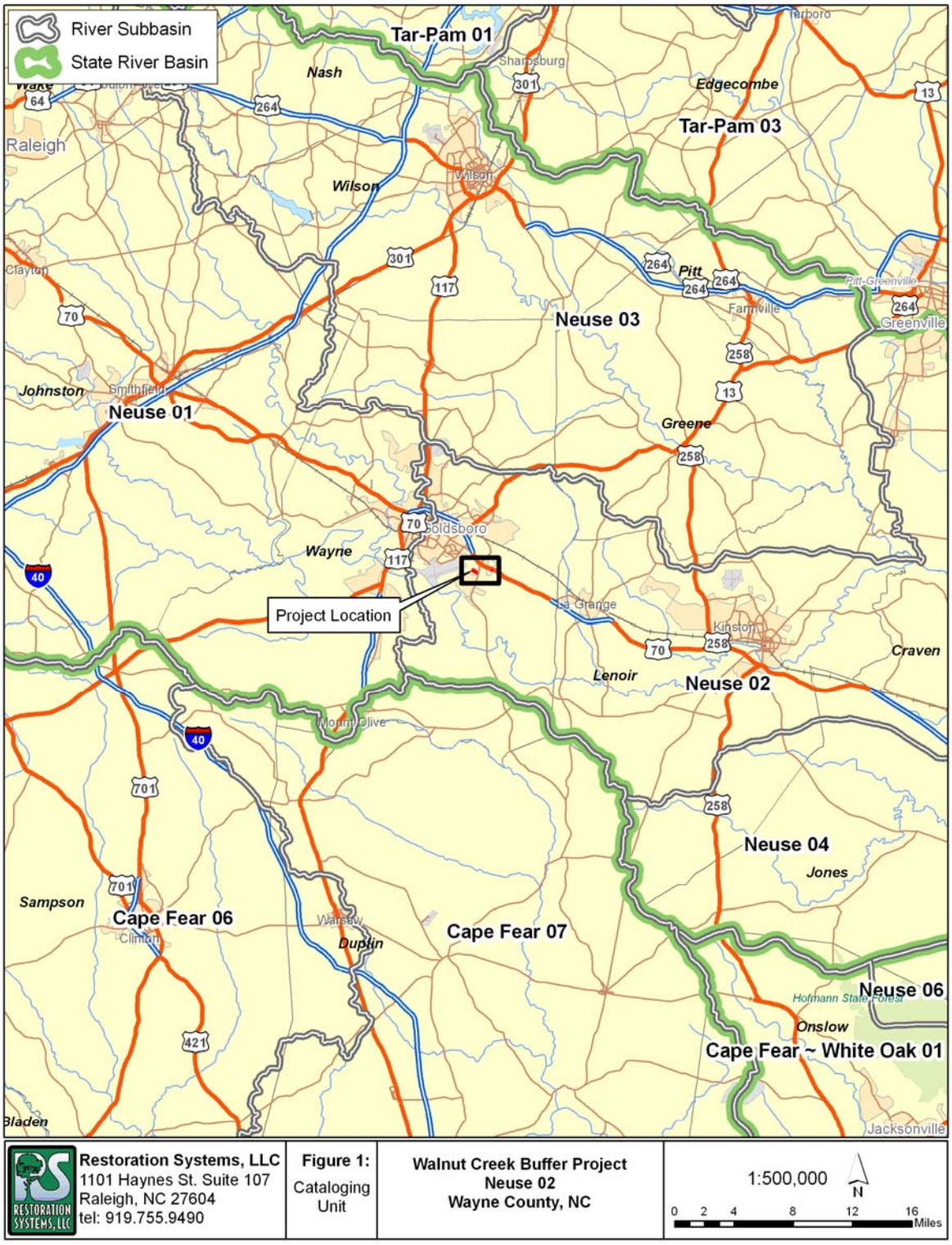

Figure 1. Cataloging Unit 02030202

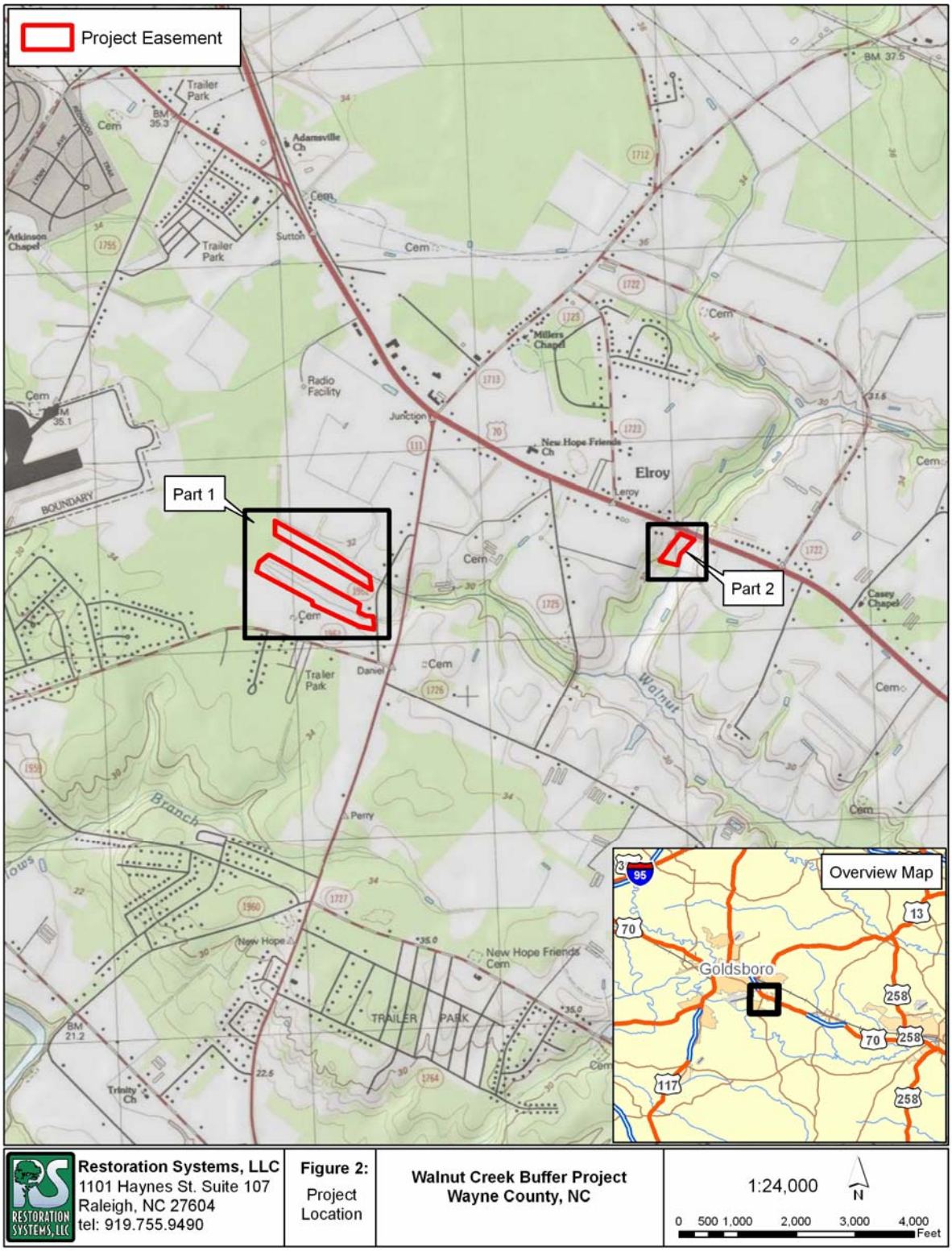

Figure 2. Location of Walnut Creek Mitigation Site

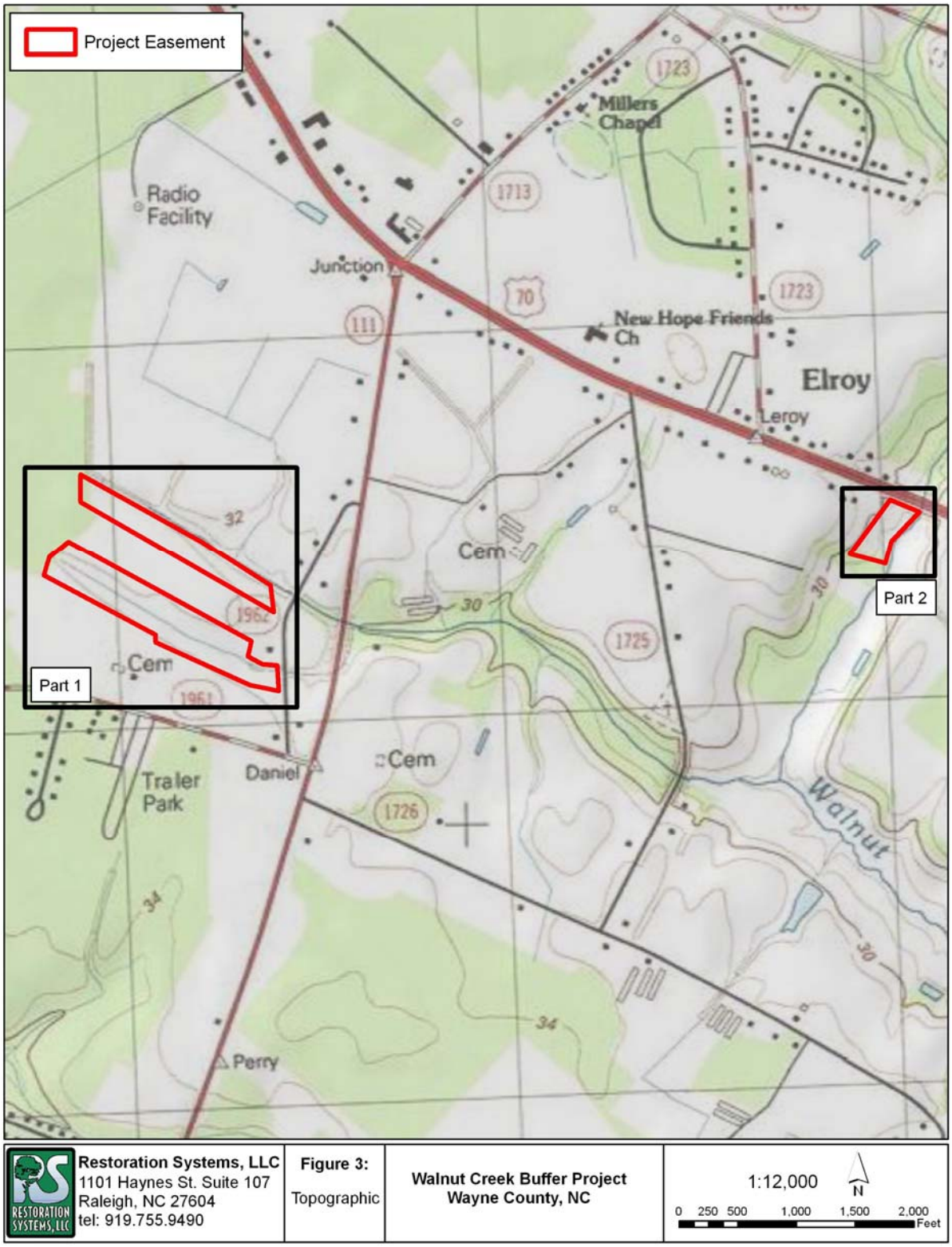

Figure 3. Topographic Map of Walnut Creek Mitigation Site

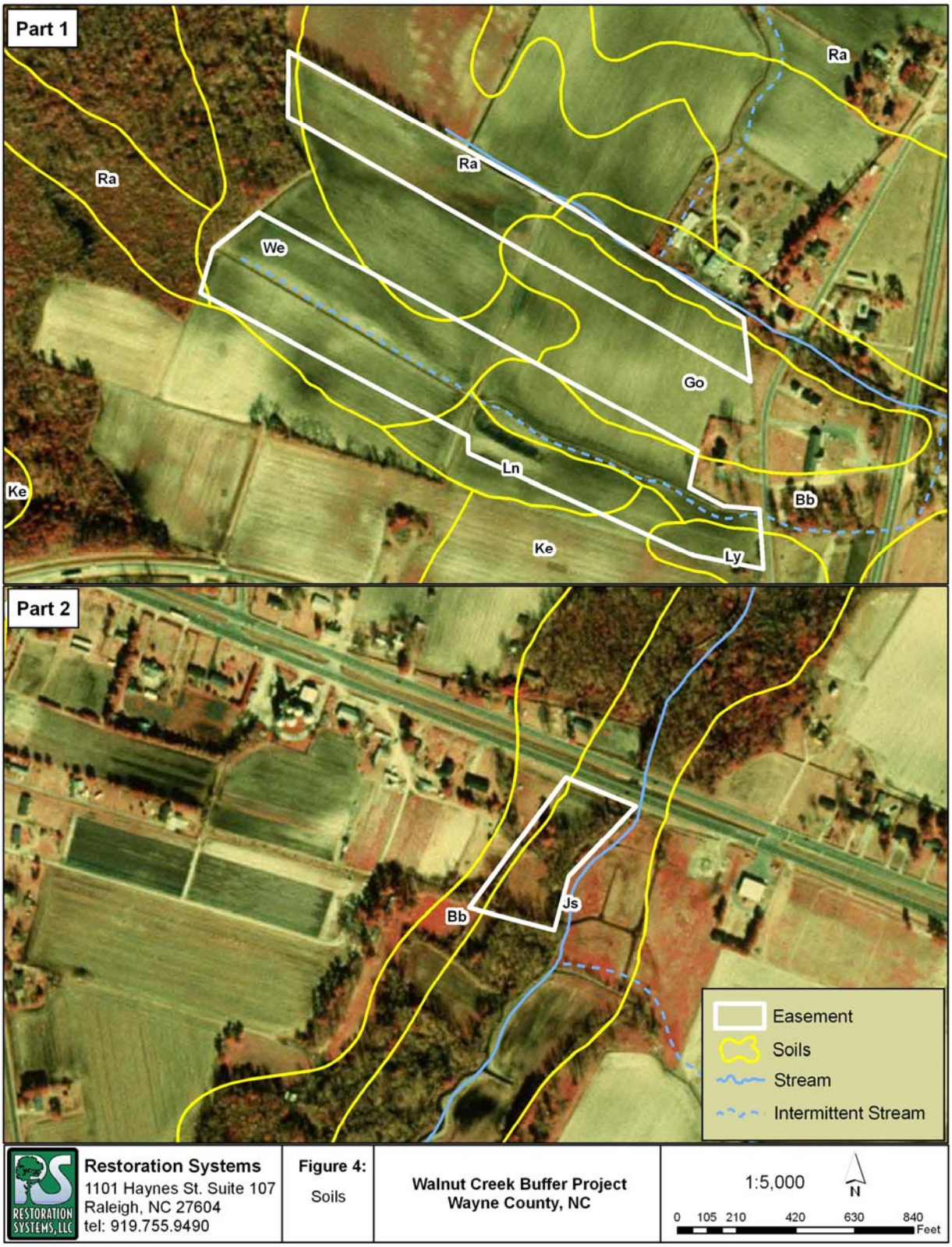

Figure 4. Soils Map of Walnut Creek Mitigation Site

As implemented, the Site provides 25 acres of riparian buffer restoration (25 Buffer Mitigation Units). Information on project owners and contractors follows:

Owner, Designer, and Monitoring Performer
Restoration Systems, L.L.C.
1101 Haynes Street, Suite 107
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(919) 755-9490

Planting Contractor
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2.0 VEGETATION MONITORING PROGRAM

Monitoring procedures for vegetation were designed in accordance with *Guidelines for Riparian Buffer Restoration* (EEP 2004) and the *North Carolina Administrative Code* (NCAC 2000). A general discussion of the plant community restoration monitoring program is provided. Monitoring of restoration efforts will be performed for a minimum of five years or until success criteria are fulfilled. The locations of monitoring plots are depicted in Figures 5 and 6.

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 sampling was conducted in the fall. Subsequently, quantitative sampling of vegetation will be performed between June 1 and December 30 of each monitoring year.

Figure 5. Location of Sampling Transects in Part 1

Figure 6. Location of Sampling Transects in Part 2

Eight sample transects were established within planted areas of the Site shortly after planting. Transects 1-7 (Part 1) are 200 feet in length and 12 feet in width (0.055 acre). Transect 8 is 160 feet long and 7.5 feet wide (0.055 acre). The shorter length of Transect 8 is due to size constraints in Part 2 of the Site. In each sample plot, vegetation parameters monitored include species composition and species density. Visual estimates of the abundance of herbaceous species were also noted. Photographs of the vegetation plots are included in Appendix A.

2.1 Vegetation Success Criteria

Rules published in the North Carolina Administrative Code (NCAC 2000) have been established to determine success criteria. All planted tree and shrub species and all native colonizing hardwood tree and shrub species are counted in establishing success criteria.

Table 1. Planted Tree and Shrub Species

Canopy Trees	Shrubs And Understory Trees
American elm (*Ulmus americana*)	Red Bay (Persea palustris)
Cherrybark Oak (*Quercus pagoda*)	Sweet Bay (Magnolia virginiana)
Green Ash (*Fraxinus pennsylvanica*)	American Beautyberry (*Callicarpa americana*)
Laurel Oak (*Quercus laurifolia*)	Buttonbush (*Cephalanthus occidentalis*)
Persimmon (*Diospyros virginiana*)	Silky Dogwood (*Cornus amomum*)
River birch (*Betula nigra*)	
Swamp Black Gum (*Nyssa biflora var.*	
Swamp Chestnut Oak (*Quercus michauxii*)	
Sugarberry (*Celtis laevigata*)	
Sycamore (*Platanus occidentalis*)	
Water Hickory (*Carya aquatica*)	
Water Oak (*Quercus nigra*)	
Willow Oak (*Quercus phellos*)	
Yellow Poplar (*Liriodendron tulipifera*)	

Vegetation success criteria for the Site will be the existence of an overall density of at least 320 hardwood tree and shrub 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 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 native 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. Photographs of the vegetation plots are included in Appendix A.

2.2 Vegetation Sampling Results and Comparison to Success Criteria

2.2.1 Woody Trees and Shrubs

Quantitative sampling of vegetation was conducted in October 2005 and results are provided in Table 2. Vegetation success criteria for Year 1 (320 stems per acre) were exceeded for the 2005 annual monitoring year with an average of 1357 stems per acre over all transects. All individual vegetation transects met success criteria and had good species diversity with nine to 16 planted species present within each.

Although nine planted species were noted at Transect 8, there was a significant amount of Sweet-gum present at this location. This portion of the Site (Part 2) had been used by the previous owner as a pasture for a pony. An adjacent stand of mature Sweet-gums had apparently produced enough seed over the years to establish a dense population of small (appx. one foot tall) seedlings in the portion that was planted with trees from Table 1. Sometime prior to selling the property to Restoration Systems, the area had been mowed, but by the end of the first growing season numerous stems of Sweet-gum were noted. Most appeared to be from stump sprouting.

Transects 1-7 supported only limited numbers of non-planted stems. The most numerous colonizing species was Groundsel tree, with a maximum of 12 small (< one foot tall) stems noted in Transect 6.

Table 2. 2005 Woody Vegetation Monitoring Data and Results

		Plot Number							
Species*	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Acer rubrum	**Red maple**								**6**
Baccharis halimifolia	Groundsel tree	0	1	2	4	1	12	5	9
Betula nigra	**River birch**	**6**	**9**	**2**	**18**	**3**	**7**	**10**	**8**
Callicarpa americana	**Beauty-berry**	**2**	**2**	**3**		**4**	**1**	**2**	**2**
Carya aquatica	**Water hickory**	**2**		**2**		**1**	**3**		
Celtis leavigata	**Sugarberry**								**3**
Cephalanthus occidentalis	**Button bush**	**12**	**3**	**2**	**5**			**2**	
Cornus amomum	**Silky dogwood**	**11**	**6**	**9**	**6**	**6**	**1**	**6**	
Diospyros virginiana	**Persimmon**	**4**	**4**	**2**	**5**			**2**	
Fraxinus pennsylvanica	**Green ash**	**1**	**6**	**2**		**3**		**1**	**3**
Ligustrum sinense	Privet		1						1
Liquidambar styraciflua	Sweet-gum	12	3		1				85
Liriodendron tulipifera	**Yellow poplar**	**3**	**3**	**3**		**1**			
Magnolia virginiana	**Sweet bay**	**3**	**2**	**3**	**7**		**5**	**11**	
Myrica cerifera	Wax myrtle		1						
Persea palustris	**Red bay**	**12**	**12**	**6**	**2**	**9**	**4**		
Platanus occidentalis	**Sycamore**	**3**	**12**	**6**	**3**	**1**	**2**	**8**	**1**
Prunus serotina	Black cherry	1		1				1	
Quercus michauxii	**Swamp chestnut oak**	**4**	**2**		**2**		**4**		
Quercus nigra	**Water oak**	**3**	**9**	**5**	**5**	**1**	**2**		**5**
Quercus pagoda	**Cherrybark oak**	**2**	**3**	**1**	**2**		**5**	**1**	
Quercus phellos	**Willow oak**	**3**	**18**	**3**	**2**	**9**	**6**	**6**	**9**
Rhus copallina	Winged sumac	1							3
Salix nigra	Black willow					2			
Ulmus americana	**American elm**	**7**	**5**	**2**	**1**				**4**
	Total Stems in Plot	**92**	**102**	**54**	**63**	**41**	**52**	**55**	**139**
	Total Stems per Acre	**1670**	**1851**	**980**	**1143**	**744**	**944**	**998**	**2523**
	Average Stems per Acre		**1357**						

*** Planted species are in bold**

2.2.2 Herbaceous Vegetation

Herbaceous vegetation colonizing Part 1 of the Site during 2005 included species typically referred to as agricultural weeds. Species colonizing Part 2 were fewer in number and consisted of those typically found in wetter habitats. Table 3 includes the dominant species observed during monitoring.

Table 3. 2005 Herbaceous Vegetation Monitoring Data and Results

Species	Common Name	Part 1	Part 2
Elusine indica	Goosegrass	Common	
Digitaria sanguinalis	Crabgrass	Common	
Chenopodium album	Lambsquarters	Abundant	
Amaranthus sp.	Amaranth	Abundant	
Cassia obtusifolius	Sickle pod	Present	
Phytolacca americana	Pokeweed	Present	
Stellaria media	Common chickweed	Present	
Eupatorium capillifolium	Dog fennel	Present	
Ipomoea pandurata	Morning glory	Present	
Rubus sp.	Blackberry	Rare	Common
Juncus effusus	Common rush		Present
Festuca sp.	Meadow fescue		Abundant
Asplenium platyneuron	Ebony spleenwort		Rare
Polygonum pensylvanicum	Smartweed		Present
Lonicera japonica	Honeysuckle		Present

Part 1 of the Site supported thin to dense populations of common "agricultural weeds' after the cessation of tilling and herbicide applications. Residual fertilizer from previous applications promoted herbaceous plant growth and overtopping of planted species was common. However, there was no significant mortality of the planted species; all are broadleaf plants adapted to germination and growth in a relatively shaded environment.

Part 2 of the Site supported numerous sprouting Sweet-gum stems as well as residual grass from when the area was a pasture.

Observations of the effect of competition on the planted by colonizing species will be continued to determine if future herbicide applications will be necessary. No herbicide application is recommended at this time.

3.0 CONCLUSIONS

In summary, all vegetation plots across the Site were above the required 320 stems/acre with an average of 1357 stems/acre in the First Monitoring Year (Year 2005). All individual vegetation plots met success criteria and exhibited good species diversity with nine to 16 planted species present within each plot. Herbaceous vegetation typical of abandoned agricultural fields was observed, but there was no evidence of any effect (significant mortality) on the planted species.

4.0 REFERENCES

EEP. 2004. Ecosystem Enhancement Program Guidelines for Riparian Buffer Restoration, October 2004.

NCAC. 2000. North Carolina Administrative Code. 15A NCAC 02B .0242.

APPPENDIX A
VEGETATION PLOT PHOTOGRAPHS

Transect 1

Transect 2

Transect 3

Transect 4

Transect 5

Transect 6

Transect 7

Transect 8