

NORWOOD GAINNEY RIPARIAN BUFFER RESTORATION

Wayne County, NC

2007 Annual Monitoring Report
Year 1 of 5



NCEEP Project Number 628

Project ID# D06058S

Submitted To:

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Executive Summary

The Norwood Gainey Riparian Buffer Restoration (NGRBR) site is located in Wayne County, North Carolina. Historically used for agriculture purposes, the 58.4 acre site is surrounded and dissected by agricultural ditches that flow into Bouge Swamp. The site is managed by the North Carolina Ecosystem Enhancement Program (EEP) with the goal of effectively restoring forested riparian buffers along the onsite agricultural ditches and enhancing 5.4 acres of riparian wetlands through the establishment of native wetland trees and shrubs.

The riparian buffer vegetation success criterion is monitored using 18 (10 m X 10 m) vegetative plots within the 50 ft buffer on each side of the ditches. Species composition and density are noted. The minimum survival rates for vegetative success are as follows: 320 stems/acre of target species at end of Year 3, 290 stems/acre at end of Year 4, and 260 stems/acre at end of Year 5. Zones of herbaceous buffer (grassland) will be incorporated beyond the initial 50-ft adjacent to the ditches. Twenty (10m X 10m) plots were established within the herbaceous zone. The 20 vegetation plots within the herbaceous zone will be monitored concurrently with the riparian buffer zone. The percent coverage of planted and naturally recruited vegetation will be visually estimated. Herbaceous coverage is not tied directly to success criteria, although coverage of at least 80% is desirable.

The wetland enhancement vegetative success criterion is consistent with the riparian buffers and is monitored with seven (10 m X 10 m) vegetative plots. The hydrologic success criterion for the wetland enhancement area requires the soil to be ponded, flooded, or saturated within 12 inches of the surface for a least 12.5% of the growing season during years with normal precipitation. Two monitoring gauges have been installed in the wetland enhancement area to monitor the hydrologic success criterion.

In 2007, 16 of the 18 plots (88.9%) in the riparian buffer and six of the seven plots (85.7%) in the wetland enhancement area met the 320 stems/acre success criterion that would be required for Year 3 monitoring. Drought conditions during the 2007 growing season appear to be the primary cause of sapling mortality in the vegetative plots. Nineteen of the 20 (95.0%) herbaceous plots met the 80% coverage criterion.

During the 2007 monitoring period, the two monitoring gauges in the wetland enhancement area both met the hydrology success criterion, a 100% success rate.

I. Project Background

1.0 Project Objectives

Riparian Buffer Goals and Objectives

The objective of the NGRBR is to effectively restore forested riparian buffers along the onsite agricultural ditches that convey surface runoff toward Bouge Swamp and ultimately into the Neuse River (Figure 1). Approximately 13,660.0 linear ft of riparian buffer encompassing approximately 21.6 acres (based on a 50-ft buffer for each side of the ditches) are being restored along the onsite agricultural ditches. These restored buffers, once mature, will consist of forested communities extending a minimum of 50 ft from the edge of each agriculture ditch. The restored buffers will promote stability and provide excess nutrient and sediment removal. Restoration of the riparian buffer along the ditches also helps to improve aquatic and terrestrial habitats and promote ditch stability by reducing any concentrated flow. The buffers will provide habitat protection as a result of the restoration (e.g., food for foraging wildlife). There will also be removal of nutrient source as a result of elimination of agricultural practices. Zones of herbaceous buffer (grassland) will be incorporated in all areas beyond the initial 50-ft buffers. These grassland buffers will encompass approximately 26.2 acres. The goal of the herbaceous buffer is to provide additional cover and increase the overall effectiveness of the riparian buffer.

Wetland Enhancement Goals and Objectives

Wetland enhancement will be accomplished by establishing native wetland trees and shrubs within a portion of an existing borrow area near the southern border of the site (Figure 2). This borrow area has been determined to be jurisdictional by the U.S. Army Corps of Engineers (USACE). However, a portion of this borrow area currently consists of open water and cannot effectively be used for wetland enhancement under the current project goals and objectives. The open water area will remain in its current condition. Approximately 5.4 acres of riparian wetland enhancement will result from this project once success has been demonstrated.

2.0 Project Structure, Restoration Type, and Approach

The project study area is rural in nature with the surrounding landscape dominated by a mixture of forested communities and agricultural land. The project study area has been historically utilized for crop production. The most recent crops planted were corn. A small borrow pit has been excavated along the southern boundary of the project study area. A portion of this borrow area has become naturalized with the remainder consisting of open water. Adjacent land use consists of timberland, Bouge Swamp, and residential homes. The U.S. Department of Agriculture (USDA) Farm Service does not identify the agricultural land within the project study area as prior converted cropland.

Riparian Buffer

The pre-construction condition of the riparian buffers consisted primarily of agricultural fields surrounded and dissected by agricultural ditches that flow into Bouge Swamp and ultimately into the Neuse River. The condition of the riparian buffers does not allow for diffuse flow into the ditches, nor do they provide adequate filtering capacity as is found in normal vegetated buffers. Buffer restoration techniques will help improve the water quality of Bouge Swamp by reducing the amount of erosion and excess nutrients and stormwater runoff entering the system.

The 50-ft riparian buffers were planted with native bare root tree species on 10-ft centers providing a density of approximately 440 trees per acre. Shrubs were planted on 13-ft centers in Zone 2 providing a density of approximately 260 shrubs per acre. Native shrub species were incorporated into the Zone 2 planting plan in order to provide more diversity and to enhance wildlife habitat. A density of 260 surviving woody stems per acre is necessary for success at the end of the anticipated 5-year monitoring period.

A seed mixture of perennial native grasses was planted in the herbaceous area beyond the 50-ft riparian buffer and throughout Zone 1 and Zone 2. This native grass seed mixture will provide additional cover and increase the overall effectiveness of the riparian buffer.

The buffer restoration efforts have resulted in approximately 13,660.0 linear ft of Zone 1 (30 ft) buffer restoration. This equates to approximately 14.0 acres of Zone 1 buffer restoration. Approximately 11,900.0 linear ft of Zone 2 (20 ft) buffer restoration has also been accomplished through this restoration effort. This equates to approximately 7.6 acres of Zone 2 buffer restoration. In addition to the Zone 1 and Zone 2 restoration efforts, approximately 26.2 acres outside of Zones 1 and 2 were restored with native grasses.

Wetland Enhancement

The 5.4-acre wetland enhancement area was planted with native bare root wetland trees on 10-ft centers providing a density of approximately 440 per acre. Shrubs were planted on 13-ft centers providing a density of approximately 260 shrubs per acre. A density of 260 surviving woody stems per acre is necessary for success at the end of the anticipated 5-year monitoring period. Two monitoring wells were installed in the wetland enhancement area in order to document seasonal hydrologic conditions. The wetland enhancement will improve onsite aquatic and terrestrial habitats.

Table I lists the estimated riparian buffer and wetland acreage to be restored or enhanced with the NGRBR.

| Table I. Project Restoration Components Norwood Gainey Riparian Buffer Restoration Site EEP #628 | | | | |
|---|---------------|-------------------|---------------------------------|---------------------------------|
| Area | Before | After | Credit Ratio¹ | WMU/ BMU¹ |
| EEP Easement Area (acres) | (58.4) | (58.4) | n/a | n/a |
| Existing Wetland Area within EEP Easement (acres) ² | (7.7) | (7.7) | n/a | n/a |
| Wetland Enhancement (acres) | 0.0 | (5.4) | TBD | TBD |
| Zone 1 Buffer Restoration (acres) [linear ft] | 0.0 | (14.0) [13,660.0] | 3:1 | 4.7 |
| Zone 2 Buffer Restoration (acres) [linear ft] | 0.0 | (7.6) [11,900.0] | 1.5:1 | 5.1 |
| Herbaceous Buffer Restoration ³ (acres) | 0.0 | (26.2) | n/a | n/a |

¹ Units are subject to regulatory approval; Wetland Mitigation Units (WMU), Buffer Mitigation Units (BMU);

² 2.3 acres of 7.7 acre total is open water

³ Outside of Zones 1 & 2

In order to demonstrate successful mitigation, vegetation and hydrologic monitoring is to be conducted for a minimum of five years.

Vegetation Monitoring (Riparian Buffer and Wetland Enhancement)

Success criterion for vegetation restoration states there must be a minimum of 320 stems/acre of target species at the end of the third year of monitoring, 290 stems/acre at the end of Year 4, and 260 stems/acre for the end of Year 5. Using CVS-EEP Protocol for Recording Vegetation Version 4.0 (Lee), the vegetation plots will be monitored for success criterion for a minimum of five years. Photographs of the vegetation plots from the same viewpoints annually will provide a visual record of plot growth. Within the wetland enhancement area, vegetative data will be correlated with the appropriate hydrologic data from the groundwater monitoring gauges to determine if success criteria are being met.

Planted seedlings and natural recruitment of the target species are included in the riparian buffer restoration vegetation survival criterion. Survival and density of planted woody stems and natural recruitment will be reported and evaluated relative to the success criterion. At least nine different representative tree species and three shrub species are planted in the buffer restoration area. At least three tree species and two shrub species are planted in the wetland enhancement area. If vegetation success criterion is not met, the reasons for failure will be examined and appropriate corrective action will be taken. No quantitative sampling requirements are proposed for herbaceous and shrub assemblages as part of the vegetation success criteria; however, they will be visually assessed for growth patterns and vigor.

Hydrologic Monitoring (Wetland Enhancement Only)

Successful hydrological criterion requires the soil be ponded, flooded, or saturated within 12 inches of the surface for at least 12.5% of the growing season during a year with normal precipitation levels. The growing season for Wayne County is 243 days; therefore in order to demonstrate success, a gauge must have saturated conditions for a minimum of 31 (12.5%) consecutive days during the growing season.

3.0 Location and Setting

The NGRBR site is located south of Goldsboro in Wayne County, North Carolina. The project study area is rural in nature and with the surrounding landscape dominated by a mixture of forested communities and agricultural land. The project study area has been historically utilized for crop production. A small borrow pit has been excavated along the southern boundary of the project study area. A portion of this borrow area has become naturalized with the remainder consisting of open water. Adjacent land use consists of timberland, Bouge Swamp, and residential homes. The U.S. Department of Agriculture (USDA) Farm Service does not identify the agricultural land within the project study area as prior converted cropland.

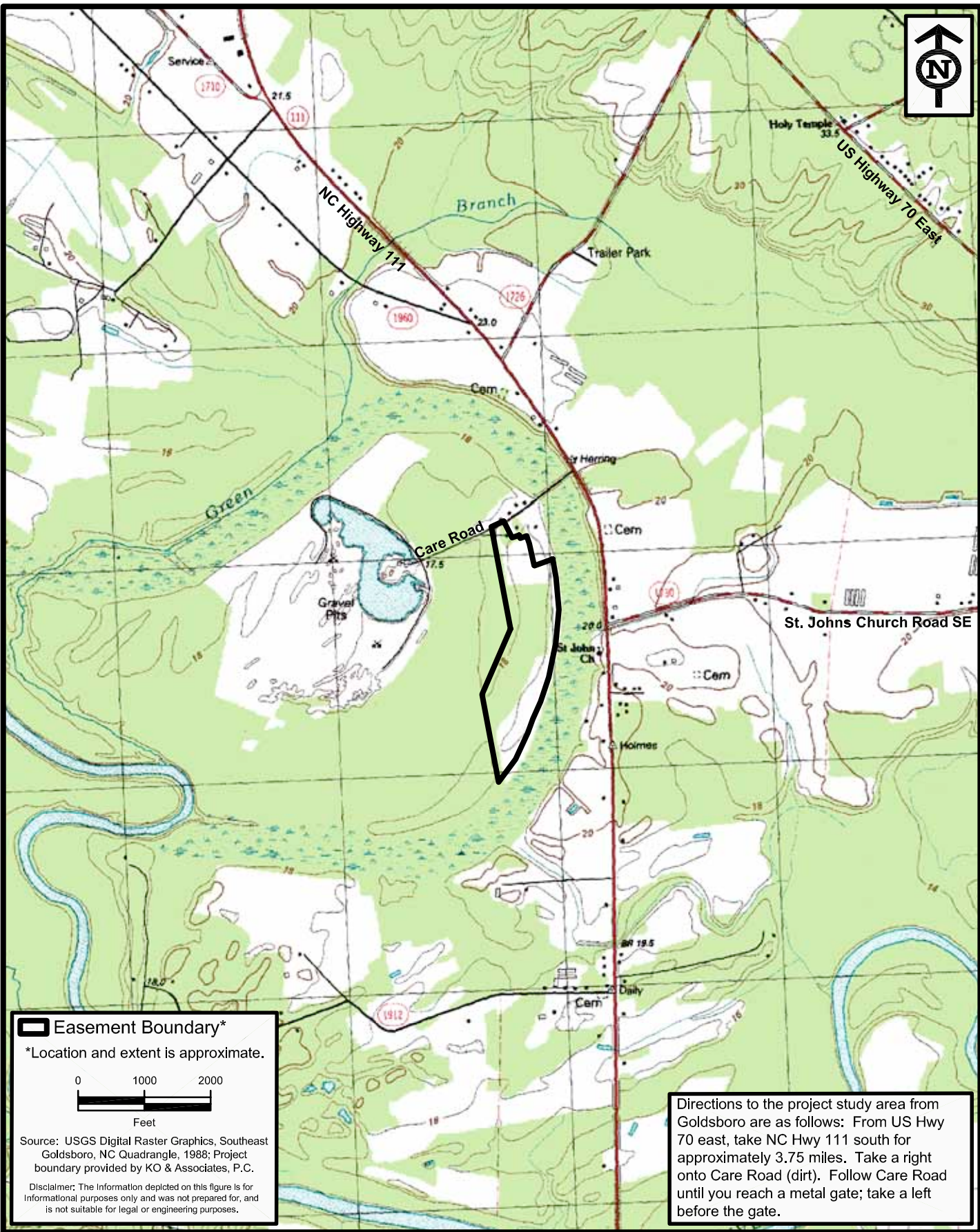
The project study area was subjected to a jurisdictional delineation effort during the planning phase of the design process. The delineation effort, which was accepted by the USACE, indicates the presence of jurisdictional wetlands and surface waters within the project study area.

The project study area is located within United States Geologic Survey (USGS) Hydrologic Unit Code (HUC) 03020202 and is located within the Neuse River Basin (subbasin 03-04-05). The drainage area of the 58.4-acre project study area is approximately 67.0 acres. Man-made

drainage ditches surrounding the project study area intercept much of the water flow before it reaches the areas proposed for riparian buffer restoration.

The project study area is located in the Coastal Plain physiographic province. The topography in the project study area is generally characterized as nearly level to gently sloping. Surface elevations in the project study area range from 55.0 ft to 58.0 ft above mean sea level. The ditch elevations range between 52.0 ft and 54.5 ft above mean sea level.

The project study area is adjacent to Bouge Swamp, which is a historic oxbow swamp system of the Neuse River. Bouge Swamp has not been assigned an individual Stream Index Number (SIN) or a Best Usage Classification (BUC) according to the North Carolina Department of Environment and Natural Resources (DENR). Therefore, it carries the same BUC as the named stream to which it is a tributary. The ditches located in the project study area flow generally in a southerly direction into adjacent Bouge Swamp and then into the Neuse River. This particular section of the Neuse River [SIN 27-(56)] has been assigned a BUC of **C; NSW**. Class **C** waters are freshwaters protected for secondary recreation, fishing, aquatic life (including propagation and survival), and wildlife. Secondary recreation is any activity involving human body contact with water on an infrequent or incidental basis. The supplemental classification **NSW** indicates Nutrient Sensitive Waters, which require limitations on nutrient inputs.



Easement Boundary*
 *Location and extent is approximate.

0 1000 2000
Feet

Source: USGS Digital Raster Graphics, Southeast Goldsboro, NC Quadrangle, 1988; Project boundary provided by KO & Associates, P.C.

Disclaimer: The Information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes.

Directions to the project study area from Goldsboro are as follows: From US Hwy 70 east, take NC Hwy 111 south for approximately 3.75 miles. Take a right onto Care Road (dirt). Follow Care Road until you reach a metal gate; take a left before the gate.

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Ecosystem Enhancement

Composite Vicinity Map
**Norwood Gainey Riparian Buffer
 Restoration Site EEP# 628**
 Wayne County, North Carolina
 Monitoring Report Year 1

| | |
|------------|------------|
| Project: | ER05148.00 |
| Date: | Mar 2008 |
| Drwn/Chkd: | RT/TM |
| Figure: | 1 |

4.0 Project History and Background

Table II provides the timeline for data collection completion and for actual completion of various construction and monitoring milestones. The dates for several of these activities were unavailable at the time of report submission.

| Table II. Project Activity and Reporting History Norwood Gainey Riparian Buffer Restoration Site-EEP # 628 | | |
|---|---------------------------------|--------------------------|
| Activity or Report | Data Collection Complete | Actual Completion |
| Restoration Plan | N/A | March 2006 |
| Final Design-90% | N/A | N/A |
| Construction | N/A | N/A |
| Temporary S&E mix applied to entire site | N/A | Nov 2006 |
| Permanent Seed mix applied | N/A | Nov 2006 |
| Mitigation Plan/ As-built (Year 0 Monitoring- baseline) | N/A | Feb 2007 |
| Year 1 Monitoring | Oct 2007 | Nov 2007 |
| Year 2 Monitoring | N/A | N/A |
| Year 3 Monitoring | N/A | N/A |
| Year 4 Monitoring | N/A | N/A |
| Year 5 Monitoring | N/A | N/A |

The points of contact for various phases and for the monitoring of the site are provided in Table III.

| Table III. Project Contacts Norwood Gainey Riparian Buffer Restoration Site-EEP # 628 | | |
|--|--|--|
| Designer Primary project design POC | K O & Associates, P.C. R. Kevin Williams, PE email: ko@koassociates.com | 5121 Kingdom Way., Suite 100 Raleigh, North Carolina 27607 Phone: (919) 851-6066 |
| Construction Contractor Construction contractor POC | N/A | |
| Planting Contractor Planting contractor POC | Carolina Silvics J. Dwight Mckinney, Jr., RF Email: info@carolinasilvics.com | 908 Indian Trail Road Edenton, North Carolina 27932 Phone: (252) 482-8491 |
| Seeding Contractor Seeding contractor POC | Seal Brothers Contracting Brian Seal | PO Box 86 Dobson, NC 27017 Phone: (336)786-2263 |
| Nursery Stock Suppliers | NC Division of Forest Resources and International Paper | |
| Monitoring Performers Wetland and Vegetation POC | Environmental Services, Inc. Jeff Harbour Email: jharbour@esinc.cc | 524 S. New Hope Road Raleigh, North Carolina 27610 Phone: (919) 212-1760 |

Relevant project background information for the NGRBR is provided in Table IV. There are two Cowardin Classifications for the wetland enhancement area; the open water area (PUB) and the partially excavated area (PEM).

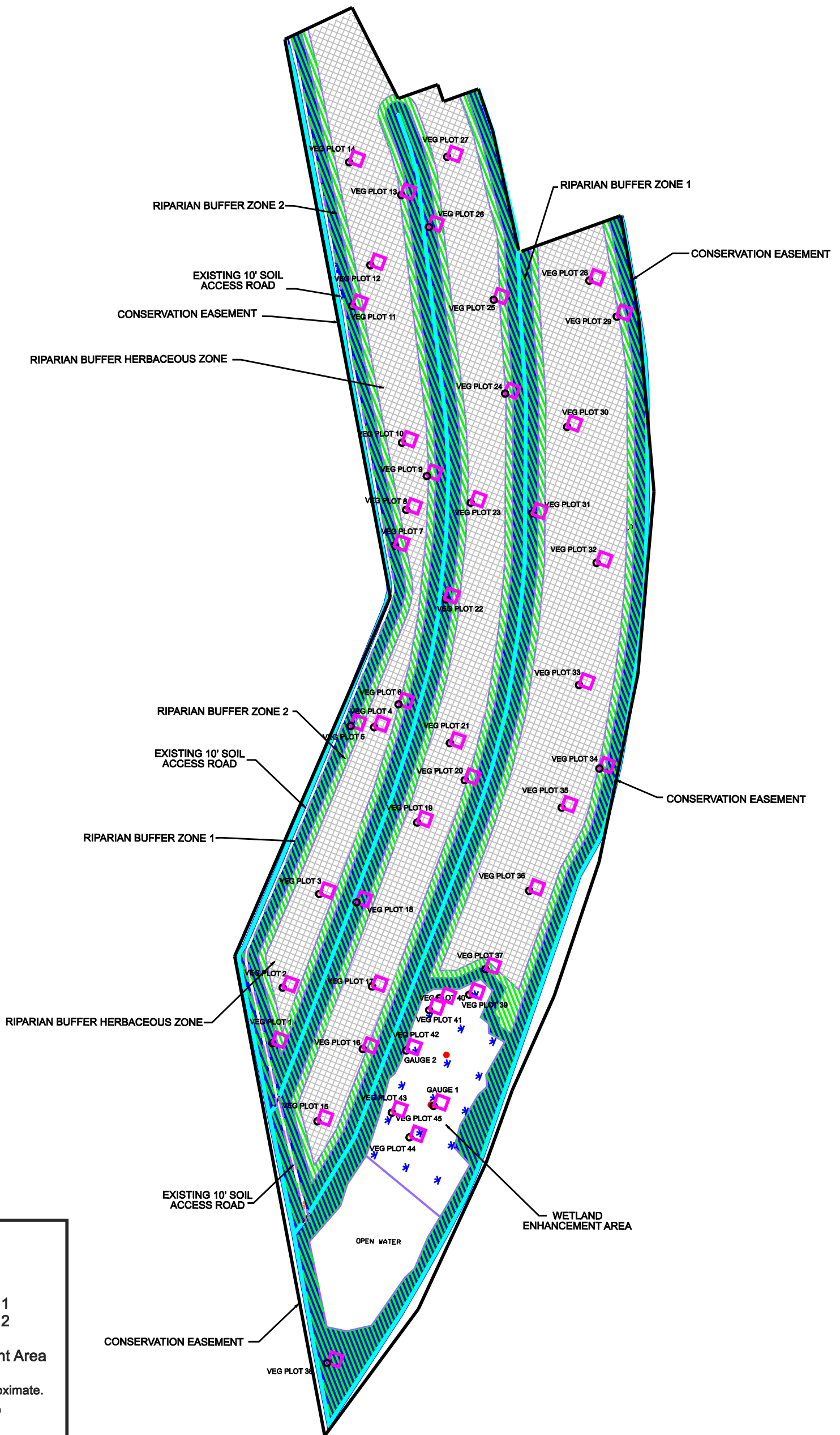
| Table IV. Project Background Norwood Gainey Riparian Buffer Restoration Site-EEP # 628 | |
|---|---|
| Project County | Wayne County |
| Drainage Area | 67 Acres |
| Drainage impervious cover estimate (%) | 0% |
| Physiographic Region | Coastal Plain |
| Ecoregion | 65p; Southeastern Floodplains and Low Terraces |
| Cowardin Classification | PUB; PEM |
| Dominant soil types | Leaf loam, Lumbee sandy loam, Dragston loamy sand |
| Reference site ID | Bouge Swamp (project study area's eastern boundary) |
| USGS HUC for Project and Reference | 03020202 |
| NCDWQ Sub-basin for Project and Reference | 03-04-05 |
| NCDWQ classification for Project and Reference | C, NSW |
| Any portion of the project 303d listed? | No |
| Any upstream portion 303d listed? | No |
| % of project easement fenced | 0% |

5.0 Monitoring Plan View

Using CVS-EEP Protocol for Recording Vegetation Version 4.0 (Lee), eighteen (10 m X 10m) plots were established within the 50-ft riparian buffer zone. Seven (10m X 10m) plots were established within the wetland enhancement area. The location of the plots is based on representative conditions for the mitigation type as a whole. For each plot, species composition and density are recorded to determine if vegetative success criterion is met. Twenty (10m X 10m) plots were established within the herbaceous zone. The 20 vegetation plots within the herbaceous zone will be monitored concurrently with the riparian buffer zone. The percent coverage of planted and naturally recruited vegetation will be visually estimated. Herbaceous coverage is not tied directly to success criteria, although coverage of at least 80% is desirable. Representative photographs of all vegetative plots will be taken and included in monitoring reports.

In 2007, hydrologic monitoring was initiated in the wetland enhancement area. Environmental Services, Inc. installed two groundwater gauges in the wetland enhancement area. No monitoring is proposed for the open water area adjacent to the wetland enhancement area. Groundwater monitoring is conducted onsite to determine if the hydrologic success criterion for a wetland mitigation site is being met.

Figure 2 provides a plan view of the site showing the location of all monitoring features including groundwater gauges, vegetation plots, and photo points.



Easement Boundary*
Monitoring Gauge*
Veg Plot Locations*
Photo Locations*
Riparian Buffer Zone 1
Riparian Buffer Zone 2
Herbaceous Zone
Wetland Enhancement Area
Ditch*

*Location and extent is approximate.

0 150 300
 Feet

Source: Ecosystem Enhancement Program;
 As-built provided by KO & Associates, P.C.

Disclaimer: The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes. This information presented is not for regulatory review and is intended for use only by a Professional Land Surveyor prior to regulatory review.

KO & ASSOCIATES, P.C.
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Ecosystem Enhancement PROGRAM

Monitoring Plan View
Norwood Gainey Riparian Buffer Restoration Site EEP # 628
 Wayne County, North Carolina
 Monitoring Report Year 1

| | |
|------------|------------|
| Project: | ER05148.00 |
| Date: | Mar 2008 |
| Drwn/Chkd: | KT/TM |
| Figure: | 2 |

II. Project Condition and Monitoring Results

1.0 Vegetation Assessment

Riparian Buffer

The 50-ft riparian buffer adjacent to the onsite agricultural ditches (± 21.6 ac) was planted with native bare root tree species on 10-ft centers providing a density of approximately 440 trees per acre. Zones 1 and 2 of the restored riparian buffers were planted with the following bare root tree species: persimmon (*Diospyros virginiana*), river birch (*Betula nigra*), water oak (*Quercus nigra*), swamp chestnut oak (*Quercus michauxii*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), American sycamore (*Platanus occidentalis*), black gum (*Nyssa sylvatica*), and flowering dogwood (*Cornus florida*).

Native shrub species were incorporated into the Zone 2 planting plan in order to provide more diversity and to enhance wildlife habitat. Shrubs were planted on 13-ft centers providing a density of approximately 260 shrubs per acre. The following shrub species were planted within Zone 2: silky dogwood (*Cornus amomum*), red mulberry (*Morus rubra*), and winged sumac (*Rhus copallinum*).

A seed mixture of perennial native grasses was used in the herbaceous areas outside the immediate 50-ft riparian buffer. This native grass seed mixture was also spread throughout Zone 1 and Zone 2 in order to provide additional cover and increase the overall effectiveness of the riparian buffer. The native grass mixture consisted of a mixture of several of the following native grass species: broomsedge (*Andropogon virginicus*), deertongue (*Panicum clandestinum*), switchgrass (*Panicum virgatum*), indiagrass (*Sorghastrum nutans*), and purple-top (*Tridens flavus*).

Wetland Enhancement

The 5.4-acre wetland enhancement area was planted with native bare root wetland trees on 10-ft centers providing a density of approximately 440 per acre. Tree species planting include the following: sweet bay (*Magnolia virginiana*), river birch, and green ash (*Fraxinus pennsylvanica*). Shrub species that were planting include buttonbush (*Cephalanthus occidentalis*) and red mulberry.

Silky dogwood was originally proposed for planting in the wetland enhancement area; however, the entire allotted silky dogwood was ultimately used in the Zone 2 planting.

1.1 Vegetative Problem Areas

Riparian Buffer

In 2007, 16 of the 18 plots (88.9%) in the riparian buffer met the 320 stems/acre success criterion that would be required for Year 3 monitoring. Drought conditions during the 2007 growing season are the probable cause for a significant number of stem deaths.

It is assumed, for monitoring purposes, that the appropriate species mix was planted at a rate of 440 stems/acre. However, examining the stems/acre baseline counts, several plots have planted stem averages lower than the expected rate. This variation is expected due to plot location variability and stem planting variability. This variation can result in unsuccessful

plots which experience relatively few stem deaths. Plot 22 did not meet the success criterion for Year 3 with four stem deaths. However, four stem deaths is less than the 4.3 stem deaths average for the riparian buffer area.

Plot 7 did not meet the success criterion with nine stem deaths. Drought conditions during the 2007 growing season likely contributed to the high mortality rate in this plot.

Wetland Enhancement

In 2007, six of the seven plots (85.7%) in the wetland enhancement area met the 320 stems/acre success criterion that would be required for Year 3 monitoring.

The wetland enhancement area experienced lower stem mortality rates than the riparian buffer area with an average of two stem deaths per plot. This area remained saturated for a significant time during the growing season which may have lessened the effect of the drought conditions.

Plot 40 did not meet the Year 3 vegetative success criterion with seven stem deaths. Plot 40 is located in an area which experienced higher water levels during the 2007 growing season potentially contributing to the high stem death rate.

Overall Vegetative Problem Areas

Dogfennel (*Eupatorium cappillifolium*) is present throughout the site. Plots 5, 7, 11, and 31 have the largest percentages of dogfennel cover. It is unclear what effect this could have upon the saplings. There is a potential that the herbaceous competition could decrease sapling vigor due to canopy coverage and nutrient competition.

The effects of drought conditions late in the 2007 growing season were observed in multiple plots, primarily in the form of leaf scorch. Low vigor scores were attributed to the drought conditions for multiple plots. It is unknown what effects the drought will have upon the survival rates of stems for the 2008 monitoring event.

Herbaceous

The percent coverage of planted and naturally recruited vegetation was visually estimated. Although, the percent herbaceous coverage is not tied directly to success criteria, a coverage of 80% is desirable. Nineteen of the 20 herbaceous plots met the desired goal of 80% coverage (Table V.) Plot 14 did not meet the desired goal of 80% coverage. Plot 14 is located in the northwestern edge of the site. This area was extensively wet during the initial seeding process and significant rutting occurred. These ruts were inundated early in the growing season which may have contributed to the lower coverage estimate. No problems with invasive vegetation were apparent within the herbaceous plots. The herbaceous plot assessment is depicted within the report as Table V and was not included in the CVS data submittal at the request of the EEP.

| Herbaceous Plot | | |
|-----------------|------------------|----------------------|
| Plot | Percent coverage | Met desired coverage |
| 2 | 100 | Y |
| 3 | 95 | Y |
| 4 | 80 | Y |
| 8 | 80 | Y |
| 10 | 90 | Y |
| 12 | 85 | Y |
| 14 | 70 | N |
| 15 | 100 | Y |
| 17 | 100 | Y |
| 19 | 100 | Y |
| 21 | 95 | Y |
| 23 | 95 | Y |
| 25 | 95 | Y |
| 27 | 90 | Y |
| 28 | 100 | Y |
| 30 | 100 | Y |
| 32 | 95 | Y |
| 33 | 100 | Y |
| 35 | 90 | Y |
| 36 | 90 | Y |

1.2 Vegetative Problem Area Plan View

Figure 3 in Appendix C provides an overview of vegetative plot success with regard to the scale and layout of the entire project.

Refer to Appendix A for additional vegetation related data and information.

2.0 Wetland Assessment

In accordance with federal guidelines for wetland mitigation, the success criterion for hydrologic restoration states that the soil must be ponded, flooded, or saturated within 12 inches of the surface for at least 12.5% of the growing season during years with normal precipitation. The growing season for Wayne County is 243 days, therefore in order to demonstrate success, a gauge must have saturated conditions for a minimum of 31 consecutive days during the growing season.

There are two automated groundwater monitoring gauges installed in the wetland enhancement area to monitor hydrologic success.

2.1 Wetland Problem Areas

During the 2007 monitoring period, the two monitoring gauges met the hydrology success criterion (Table VI), a 100.0% success rate. Hydrographs for the individual monitoring gauges can be found in Appendix B.

| Table VI. Hydrologic Success Criterion Attainment Norwood Gainey Riparian Buffer Restoration Site-EEP # 628 | | |
|--|------------------------------|------------------------|
| Wetland Enhancement Area | | |
| Gauge | Percentage of growing season | Hydrologic success met |
| GW-1 | 37.9 | Y |
| GW-2 | 42.4 | Y |

2.2. Problem Areas Plan View (Wetland)

Figure 3 in Appendix C provides an overview of hydrologic gauge success with regard to the scale and layout of the entire project. Gauges are identified in terms of meeting hydrologic success criterion.

III. Methodology Section

The first year of monitoring for the NGRBR site occurred in 2007. Using CVS-EEP Protocol for Recording Vegetation Version 4.0 (Lee), 18 (10 meter X 10 meter) plots were designated in the riparian buffer and seven (10 meter X 10 meter) plots were designated in the wetland enhancement area based on representative conditions for the respective areas. Stem counts by species were conducted for each plot, including vigor and damage estimates. The taxonomic standard applied was the Manual of the Vascular Flora of the Carolinas (Radford). Volunteer trees were not included in the stem counts, although natural recruitment of target species is included. The 2007 monitoring event for the NGRBR site represents the first year of monitoring. There is no vegetative success criterion for Years 1 and 2. However, the third year success criterion is 320 stems/acre of target species. Therefore, any plots with stem counts less than 320 stems/acre were not considered to have met the vegetative success criterion in the 2007 monitoring report. A density of 260 surviving stems per acre is necessary for success at the end of the anticipated five-year monitoring period.

The 20 vegetation plots within the herbaceous zone were monitored concurrently with the riparian buffer zone. The percent coverage of planted and naturally recruited vegetation was visually estimated. Herbaceous coverage is not tied directly to success criteria, although coverage of at least 80 percent is desirable. Assessment of percent groundcover for the 20 herbaceous plots is not conducive to the submittal requirements of the CVS data entry tool. Therefore, the herbaceous plot assessment is depicted within the report as Table V and was not included in the CVS data submittal at the request of the EEP.

Representative photographs of each plot were taken and are included Appendix A.

IV. Reference

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved September 1 2007, from: <http://cvs.bio.unc.edu/methods.htm>.

Radford, Albert E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 1183 pp.

Appendix A
Vegetation Data Tables
Vegetation Photos

1. Vegetation Data Tables

| Table A-1. Vegetative Plot Metadata Norwood Gainey Riparian Buffer Restoration Site EEP #628 | |
|---|--|
| Report Prepared By | M. Todd Milam |
| Date Prepared | 11/16/2007 8:57 |
| database name | ESI-2007-B-resampleLevel3.mdb.mdb |
| database location | P:\Projects\2005\ER05-148\Veg Plots |
| computer name | ES01171 |
| DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----- | |
| Metadata | This worksheet, which is a summary of the project and the project data. |
| Proj. planted | Each project is listed with its PLANTED stems, for each year. This excludes live stakes and lists stems per acre. |
| Proj. total stems | Each project is listed with its TOTAL stems, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems. Listed in stems per acre. |
| Plots | List of plots surveyed. |
| Vigor | Frequency distribution of vigor classes. |
| Vigor by Spp | Frequency distribution of vigor classes listed by species. |
| Damage | List of most frequent damage classes with number of occurrences and percent of total stems impacted by each. |
| Damage by Spp | Damage values tallied by type for each species. |
| Damage by Plot | Damage values tallied by type for each plot. |
| ALL Stems by Plot and spp | Count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded. |
| PROJECT SUMMARY----- | |
| Project Code | 628 |
| project Name | Norwood Gainey Buffer Restoration |
| Description | Buffer restoration |
| River Basin | Neuse |
| length(ft) | |
| stream-to-edge width (ft) | |
| area (sq m) | |
| Required Plots (calculated) | |
| Sampled Plots | 45 |

**Table A-2. Vigor by Species
Norwood Gainey Riparian Buffer Restoration Site EEP #628**

| | Species | 4 | 3 | 2 | 1 | 0 | Missing |
|-------------|----------------------------------|------------|------------|-----------|-----------|-----------|----------------|
| | <i>Betula nigra</i> | 14 | 9 | 2 | | | |
| | <i>Cephalanthus occidentalis</i> | 4 | 2 | | | | |
| | <i>Cornus amomum</i> | 4 | 3 | 2 | | | |
| | <i>Cornus florida</i> | 2 | 5 | | 3 | | |
| | <i>Diospyros virginiana</i> | 21 | 21 | 8 | 2 | | |
| | <i>Fraxinus pennsylvanica</i> | 15 | 8 | 3 | | | |
| | <i>Juglans nigra</i> | 3 | 6 | 6 | 3 | | |
| | <i>Quercus michauxii</i> | 6 | 9 | 7 | 1 | | |
| | <i>Quercus nigra</i> | 9 | 6 | | | 1 | 1 |
| | <i>Morus rubra</i> | 4 | 13 | 1 | | | |
| | <i>Rhus copallinum</i> | 1 | | 1 | | | |
| | <i>Magnolia virginiana</i> | 8 | 15 | 10 | | 1 | |
| | <i>Platanus occidentalis</i> | 7 | 6 | 2 | | | |
| | <i>Prunus serotina</i> | 4 | 8 | 1 | 2 | 1 | |
| | Unknown | | 1 | | 2 | 40 | 48 |
| Tot: | 15 | 102 | 112 | 43 | 13 | 43 | 49 |

**Table A-3. Vegetation Damage by Species
Norwood Gainey Riparian Buffer Restoration Site EEP #628**

| | Species | All Damage Categories | no damage | Deer | Diseased | Drought | Insects | Unknown | Vine Strangulation |
|------------|----------------------------------|--------------------------------------|----------------------|-------------|-----------------|----------------|----------------|----------------|-------------------------------|
| | <i>Betula nigra</i> | 25 | 22 | 1 | | 2 | | | |
| | <i>Cephalanthus occidentalis</i> | 6 | 4 | 1 | | | 1 | | |
| | <i>Cornus amomum</i> | 9 | 6 | 3 | | | | | |
| | <i>Cornus florida</i> | 10 | 7 | 2 | | | | | 1 |
| | <i>Diospyros virginiana</i> | 52 | 42 | 1 | | 4 | | 4 | 1 |
| | <i>Fraxinus pennsylvanica</i> | 26 | 23 | 1 | 1 | 1 | | | |
| | <i>Juglans nigra</i> | 18 | 8 | 4 | 1 | 2 | 1 | 1 | 1 |
| | <i>Magnolia virginiana</i> | 34 | 25 | 2 | | 6 | | 1 | |
| | <i>Morus rubra</i> | 18 | 16 | 1 | | | | 1 | |
| | <i>Platanus occidentalis</i> | 15 | 12 | 1 | | 1 | 1 | | |
| | <i>Prunus serotina</i> | 16 | 12 | 1 | | 1 | | 2 | |
| | <i>Quercus michauxii</i> | 23 | 15 | 2 | 1 | 2 | 3 | | |
| | <i>Quercus nigra</i> | 17 | 16 | | | 1 | | | |
| | <i>Rhus copallinum</i> | 2 | 1 | 1 | | | | | |
| | Unknown | 91 | 79 | | | 5 | 1 | 3 | 3 |
| tot | 15 | 362 | 288 | 21 | 3 | 25 | 7 | 12 | 6 |

**Table A-4 Vegetation Damage by Plot
Norwood Gainey Riparian Buffer Restoration Site EEP #628**

| | plot | All Damage Categories | no damage | Deer | Diseased | Drought | Insects | Unknown | Vine Strangulation |
|------------|--------------------|-----------------------|------------|-----------|----------|-----------|----------|-----------|--------------------|
| | 628-01-0001-year:1 | 16 | 13 | 1 | | | 1 | 1 | |
| | 628-01-0005-year:1 | 18 | 13 | | | 2 | | 3 | |
| | 628-01-0006-year:1 | 18 | 16 | 1 | | 1 | | | |
| | 628-01-0007-year:1 | 13 | 10 | | | 2 | | 1 | |
| | 628-01-0009-year:1 | 15 | 14 | | | 1 | | | |
| | 628-01-0011-year:1 | 15 | 15 | | | | | | |
| | 628-01-0013-year:1 | 15 | 14 | | | 1 | | | |
| | 628-01-0016-year:1 | 14 | 7 | 1 | 1 | | | 5 | |
| | 628-01-0018-year:1 | 13 | 7 | 4 | | 1 | 1 | | |
| | 628-01-0020-year:1 | 19 | 14 | 3 | | | 1 | 1 | |
| | 628-01-0022-year:1 | 10 | 9 | 1 | | | | | |
| | 628-01-0024-year:1 | 18 | 13 | 1 | 1 | 3 | | | |
| | 628-01-0026-year:1 | 13 | 12 | | | | | | 1 |
| | 628-01-0029-year:1 | 20 | 15 | 2 | | 1 | | | 2 |
| | 628-01-0031-year:1 | 12 | 11 | 1 | | | | | |
| | 628-01-0034-year:1 | 14 | 9 | 1 | | | 1 | | 3 |
| | 628-01-0037-year:1 | 11 | 7 | | | 2 | 2 | | |
| | 628-01-0038-year:1 | 13 | 10 | 1 | | 2 | | | |
| | 628-01-0039-year:1 | 13 | 10 | 2 | | 1 | | | |
| | 628-01-0040-year:1 | 12 | 11 | | | | 1 | | |
| | 628-01-0041-year:1 | 19 | 17 | | 1 | 1 | | | |
| | 628-01-0042-year:1 | 15 | 14 | 1 | | | | | |
| | 628-01-0043-year:1 | 16 | 12 | 1 | | 3 | | | |
| | 628-01-0044-year:1 | 10 | 7 | | | 3 | | | |
| | 628-01-0045-year:1 | 10 | 8 | | | 1 | | 1 | |
| Tot | 25 | 362 | 288 | 21 | 3 | 25 | 7 | 12 | 6 |

**Table A-5. Vegetation Count by Plot and Species
Norwood Gainey Riparian Buffer Restoration Site EEP #628**

| | | Total Planted Stems | # plots | avg# stems | plot 628-01-0001- year:1 | plot 628-01-0005- year:1 | plot 628-01-0006- year:1 | plot 628-01-0007- year:1 | plot 628-01-0009- year:1 | plot 628-01-0011- year:1 | plot 628-01-0013- year:1 | plot 628-01-0016- year:1 | plot 628-01-0018- year:1 | plot 628-01-0020- year:1 | plot 628-01-0022- year:1 | plot 628-01-0024- year:1 |
|----------------------------------|-----------|---------------------|-----------|------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Species | | | | | | | | | | | | | | | | |
| <i>Betula nigra</i> | | 25 | 8 | 3.12 | | | 3 | | | | | | | | 1 | |
| <i>Cephalanthus occidentalis</i> | | 6 | 3 | 2 | | | | | | | | | | | | |
| <i>Cornus amomum</i> | | 9 | 6 | 1.5 | | 1 | | | | | | | | 2 | 1 | 3 |
| <i>Cornus florida</i> | | 10 | 5 | 2 | | 1 | 5 | | | | | 1 | | | 2 | |
| <i>Diospyros virginiana</i> | | 52 | 16 | 3.25 | 1 | 6 | 6 | 1 | | 2 | 2 | 4 | 2 | 4 | | 4 |
| <i>Fraxinus pennsylvanica</i> | | 26 | 4 | 6.5 | | | | | | | | | | | | |
| <i>Juglans nigra</i> | | 18 | 5 | 3.6 | | | | | | 2 | | | 3 | 4 | | 5 |
| <i>Magnolia virginiana</i> | | 33 | 5 | 6.6 | | | | | | | | | | | | |
| <i>Morus rubra</i> | | 18 | 11 | 1.64 | 3 | 1 | 1 | 1 | 3 | 1 | | 2 | | 3 | | 1 |
| <i>Platanus occidentalis</i> | | 15 | 8 | 1.88 | | 1 | | 1 | | 1 | | | | 3 | | |
| <i>Prunus serotina</i> | | 15 | 6 | 2.5 | 2 | 3 | | 1 | 4 | 3 | | 2 | | | | |
| <i>Quercus michauxii</i> | | 23 | 7 | 3.29 | 3 | | | | | | 6 | 2 | 7 | | | |
| <i>Quercus nigra</i> | | 15 | 6 | 2.5 | | | | | 2 | | | | | | | |
| <i>Rhus copallinum</i> | | 2 | 2 | 1 | | 1 | | | | | | | | | | |
| Unknown | | 3 | 3 | 1 | | | | | | | | | 1 | | | 1 |
| TOT: | 15 | 270 | 15 | | 9 | 14 | 15 | 4 | 9 | 9 | 8 | 11 | 13 | 16 | 4 | 14 |

Table A-5 Continues.

Table A-5-Continued.
Vegetation Count by Plot and Species
Norwood Gainey Riparian Buffer Restoration Site EEP #628

| | Species | Total Planted Stems | # plots | avg# stems | plot 628-01-0026- year:1 | plot 628-01-0029- year:1 | plot 628-01-0031- year:1 | plot 628-01-0034- year:1 | plot 628-01-0037- year:1 | plot 628-01-0038- year:1 | plot 628-01-0039- year:1 | plot 628-01-0040- year:1 | plot 628-01-0041- year:1 | plot 628-01-0042- year:1 | plot 628-01-0043- year:1 | plot 628-01-0044- year:1 | plot 628-01-0045- year:1 |
|-------------|----------------------------------|---------------------|-----------|------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | <i>Betula nigra</i> | 25 | 8 | 3.12 | 2 | 2 | | | | | 1 | | 2 | 8 | | 6 | |
| | <i>Cephalanthus occidentalis</i> | 6 | 3 | 2 | | | | | | | 1 | 2 | 3 | | | | |
| | <i>Cornus amomum</i> | 9 | 6 | 1.5 | | | | 1 | | 1 | | | | | | | |
| | <i>Cornus florida</i> | 10 | 5 | 2 | 1 | | | | | | | | | | | | |
| | <i>Diospyros virginiana</i> | 52 | 16 | 3.25 | 1 | 5 | 4 | 4 | 3 | 3 | | | | | | | |
| | <i>Fraxinus pennsylvanica</i> | 26 | 4 | 6.5 | | 1 | | | | | 8 | 3 | 14 | | | | |
| | <i>Juglans nigra</i> | 18 | 5 | 3.6 | | 4 | | | | | | | | | | | |
| | <i>Magnolia virginiana</i> | 33 | 5 | 6.6 | | | | | | | 3 | | | 4 | 14 | 4 | 8 |
| | <i>Morus rubra</i> | 18 | 11 | 1.64 | | 1 | | | 1 | | | | | | | | |
| | <i>Platanus occidentalis</i> | 15 | 8 | 1.88 | 4 | | 1 | 2 | 2 | | | | | | | | |
| | <i>Prunus serotina</i> | 15 | 6 | 2.5 | | | | | | | | | | | | | |
| | <i>Quercus michauxii</i> | 23 | 7 | 3.29 | | 1 | | 1 | 3 | | | | | | | | |
| | <i>Quercus nigra</i> | 15 | 6 | 2.5 | 2 | 2 | 2 | 1 | | 6 | | | | | | | |
| | <i>Rhus copallinum</i> | 2 | 2 | 1 | | | 1 | | | | | | | | | | |
| | Unknown | 3 | 3 | 1 | | | | | | 1 | | | | | | | |
| TOT: | 15 | 270 | 15 | | 10 | 16 | 8 | 9 | 9 | 11 | 13 | 5 | 19 | 12 | 14 | 10 | 8 |

Norwood Gainey Riparian Buffer Restoration EEP #628
Vegetative Plot Photos
Riparian Buffer Plots

Plot 1



Plot 5



Plot 6



Plot 7



Plot 9



Plot 11



Plot 13



Plot 16



Plot 18



Plot 20



Plot 22



Plot 24



Plot 26



Plot 29



Plot 31



Plot 34



Plot 37



Plot 38



Wetland Enhancement Area

Plot39



Plot 40



Plot 41



Plot 42



Plot 43



Plot 44



Plot 45



Herbaceous Plots
Plot 2



Plot 3



Plot 4



Plot 8



Plot 10



Plot 12



Plot 14



Plot 15



Plot 17



Plot 19



Plot 21



Plot 23



Plot 25



Plot 27



Plot 28



Plot 30



Plot 32



Plot 33



Plot 35

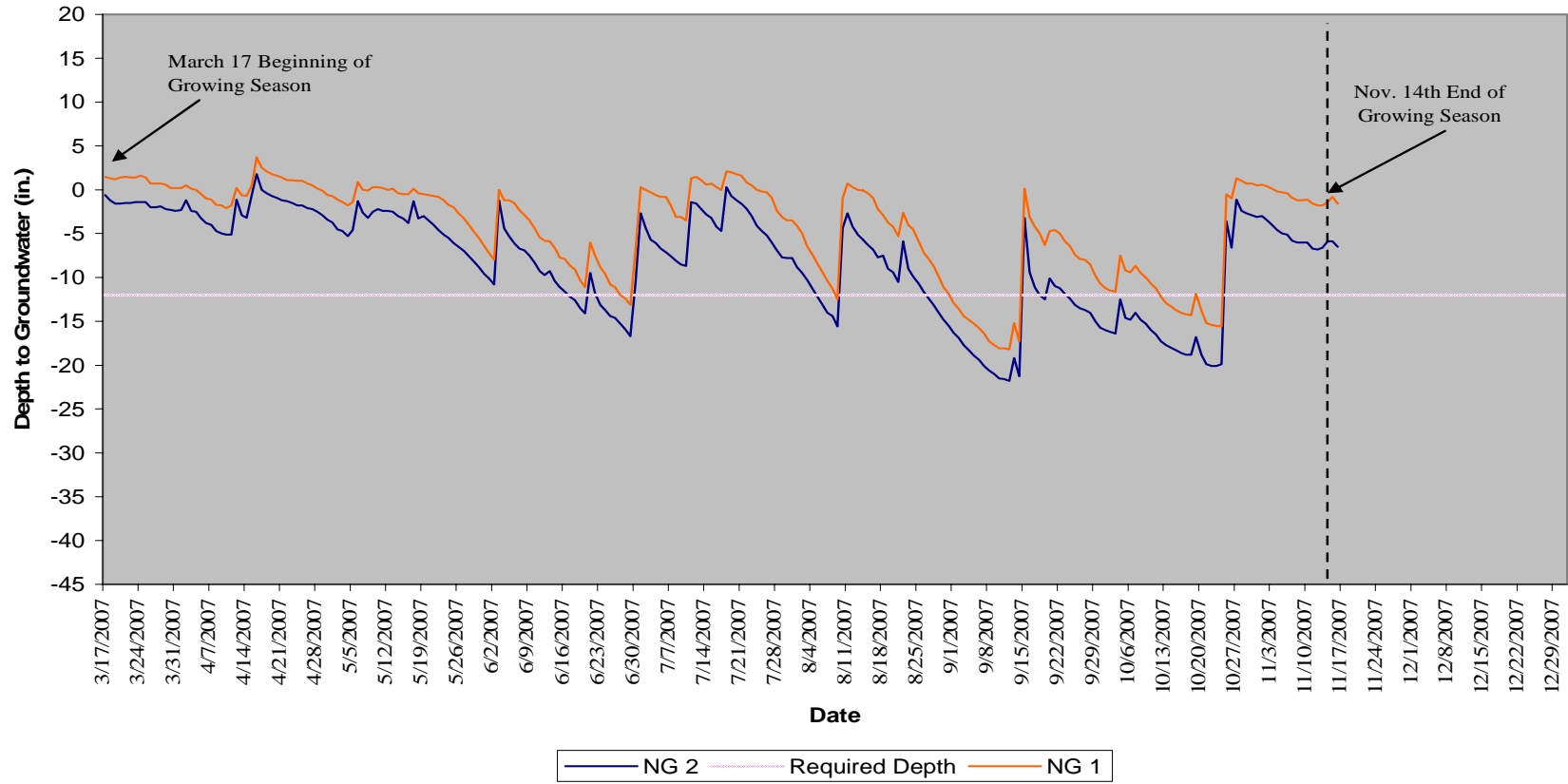


Plot 36



Appendix B
Data Tables for Hydrological Data

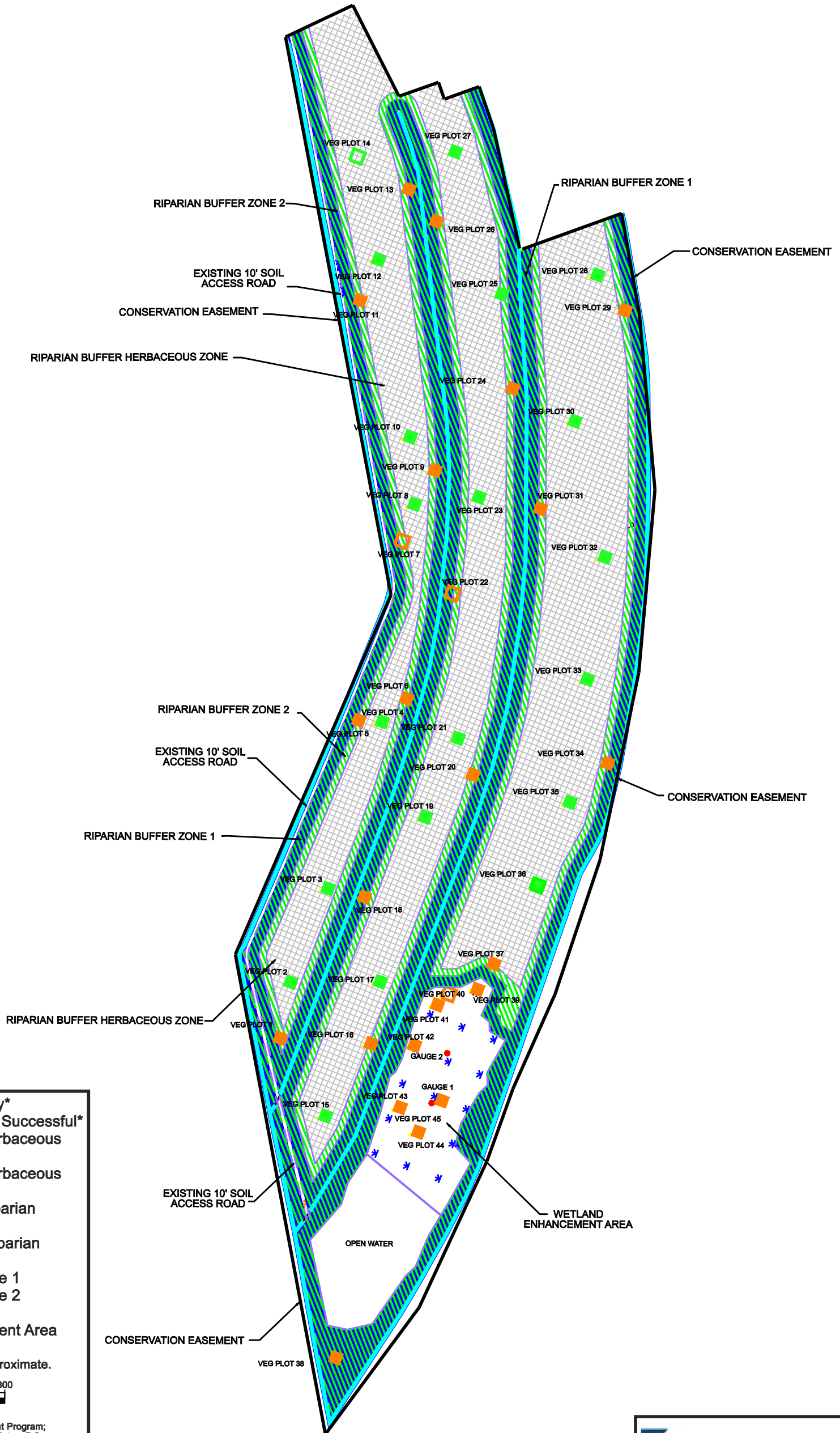
Norwood Gainey Gauges 1 and 2



**Table B-1. 2007 Hydrologic Monitoring Results
Norwood Gainey Riparian Buffer Restoration Site-EEP # 628**

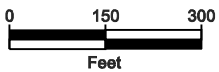
| Wetland Enhancement Area | | | |
|---------------------------------|-------------------------------------|---|---------------------------|
| Gauge | Percentage of Growing Season | No. Days Jurisdictional 3/17-11/14 | Hydrologic Success |
| GW-1 | 37.9% | 92 | Y |
| GW-2 | 42.4% | 103 | Y |

Appendix C
Integrated Overview



- Easement Boundary*
- Monitoring Gauge - Successful*
- Vegetation Plot, Herbaceous - Successful*
- Vegetation Plot, Herbaceous - Unsuccessful*
- Vegetation Plot, Riparian - Successful*
- Vegetation Plot, Riparian - Unsuccessful*
- Riparian Buffer Zone 1
- Riparian Buffer Zone 2
- Herbaceous Zone
- Wetland Enhancement Area
- Ditch*

*Location and extent is approximate.



Source: Ecosystem Enhancement Program;
As-built provided by KO & Associates, P.C.

Disclaimer: The information depicted on this figure is for informational purposes only and was not prepared for, and is not suitable for legal or engineering purposes. This information presented is not for regulatory review and is intended for use only by a Professional Land Surveyor prior to regulatory review.



Integrated Project Problem Areas - Plan View
Norwood Gainey Riparian Buffer Restoration Site EEP # 628
 Wayne County, North Carolina
 Monitoring Report Year 1

| | |
|------------|------------|
| Project: | ER05148.00 |
| Date: | Mar 2008 |
| Drwn/Chkd: | KT/TM |
| Figure: | 3 |