

**FINAL
ANNUAL MONITORING REPORT
NORWOOD GAINEY**

**RIPARIAN BUFFER RESTORATION AND WETLAND ENHANCEMENT
WAYNE COUNTY, NORTH CAROLINA
(EEP Project Number 628)**

Monitoring Year 4 of 5 (2010)



Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina



November 2010

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

Design Firm:
Ko & Associates, P.C.
Florence & Hutcheson, Inc.
5121 Kingdom Way, Suite 100
Raleigh, North Carolina 27607



November 2010

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1.0 EXECUTIVE SUMMARY

The Norwood Gainey Riparian Nutrient Offset Buffer Restoration Site (Site) is located within the United States Geological Survey Hydrologic Unit 03020202 (North Carolina Division of Water Quality subbasin 03-04-05) of the Neuse River Basin. The Site includes 58.4 acres located approximately 5 miles south of Goldsboro, North Carolina in Wayne County. A total of 21.6 acres of riparian buffer restoration for nutrient offset credits (13,660 linear feet of agricultural ditch with a 200-foot buffer to each side) and 5.4 acres of wetland enhancement are located within the Site. The Site is currently managed by the North Carolina Ecosystem Enhancement Program. This report (compiled based on EEP's *Revised Table of Contents for 2009 Monitoring Report Submissions* Version 1.2.1 dated 6/1/09) summarizes data for year 4 (2010) monitoring.

The primary goals and objectives of the project included the following.

1. Restore forested riparian buffers adjacent to Site agricultural ditches that convey surface runoff toward Bouge Swamp and ultimately into the Neuse River.
2. Restore ecological functions within the Site to improve water quality, reduce the amount of sediment and pollutants entering the system, and provide landscape continuity.
3. Establish native wetland trees and shrubs within existing jurisdictional wetlands thereby enhancing wetland function, vegetative structure, and wildlife habitat.
4. Provide a variety of habitats from open water to uplands to greatly increase future habitat and food sources for wildlife.

In late 2009 buffer areas greater than 50 feet from agricultural ditches were planted. Eight new plots were established within these areas and were monitored during year 4 (2010) monitoring. In addition, three vegetation plots within wetland enhancement areas were measured for the second time during year 4 (2010) monitoring.

An average density of 320 stems per acre of Character Tree Species must be surviving after five monitoring years in accordance with North Carolina Division of Water Quality Administrative Code 15A NCAC 02B.0242 (*Neuse River Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers*) (NCDWQ 2007). Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted in August 2010, average stem densities were measured as 405 planted stems per acre for the 8 vegetation plots within 0-50 feet of waterways, 268 planted stems per acre for the 8 vegetation plots greater than 50 feet from waterways, and 229 planted stems per acre within wetland enhancement areas. The dominant species identified at the Site were planted stems of river birch (*Betula nigra*), persimmon (*Diospyros virginiana*), black walnut (*Juglans nigra*), and sycamore (*Platanus occidentalis*); and natural recruits of loblolly pine (*Pinus taeda*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*). Only nine of the 19 individual vegetation plots met success criteria when counting planted stems alone; however, when adding naturally recruited stems, primarily loblolly pine establishing from an adjacent seed source, all individual plots met success criteria with the exception of Plot 46. Plot 46 is located in the buffer area greater than 50 feet from waterways.

Death of planted stems within wetland enhancement areas has occurred as the result of excessive inundation due to beaver. Beaver management is now occurring on the Site and will continue as necessary. Within wetland enhancement areas, natural recruits of loblolly pine, red maple, and sweetgum have established during the drier summer months during the 2010 monitoring period. In addition, within areas greater than 50 feet from waterways planted ball and burlap trees appear to be in poor health and many of the planted trees died over the summer as the result of dry conditions. These issues should be monitored closely in subsequent monitoring years.

In accordance with federal guidelines for wetland mitigation, success criteria for wetland groundwater hydrology at the Site require inundation or saturation within 12 inches of the ground surface for a consecutive period of 12.5 percent of the growing season or approximately 30 consecutive days (the



Water level at the location of Gauge 2 on February 8, 2010.

growing season in Wayne County begins March 17 and ends November 14 [243 days]). Groundwater hydrology occurred within 12 inches of the soil surface for greater than 12.5 percent of the growing season in year 4 (2010) monitoring. Gauge 2 was broken prior to the start of the year 4 (2010) growing season and was replaced on July 12, 2010. During the beginning of the growing season conditions were too wet to properly install the gauge due to the sandy soils; therefore, manual readings were taken monthly to document water level trends until the water dropped far enough beneath the soil surface that the gauge could be reinstalled.

In summary, the Site is stable, and vegetation and groundwater hydrology were successful for the year 4 (2010) growing season. Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Following planting 45 vegetation plots (18 plots within riparian buffer restoration areas 0-50 feet from the waterways, 7 plots within the wetland enhancement area, and 20 within herbaceous riparian buffer areas greater than 50 feet from the waterways) were established within the Site as depicted on Figure 2 (Current Conditions Plan View) in Appendix A. The plots are 10 meters square and are located randomly within the Site. All 45 plots were monitored in year 1 (2007); no vegetation monitoring occurred in year 2 (2008). In year 3 (2009) 8 plots within riparian restoration areas 0-50 feet from the waterways were monitored and in late 2009 areas greater than 50 feet from ditches were planted and 8 new plots were established in these areas. In year 4 (2010) 8 plots within riparian restoration areas 0-50 feet from the waterways, 3 plots within the wetland enhancement area, and 8 within riparian buffer areas greater than 50 feet from the waterways were monitored in late August 2010 using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (<http://cvs.bio.unc.edu/methods.htm>); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

2.2 Wetland Assessment

Two groundwater monitoring gauges were maintained for the year 4 (2010) growing season. The graphs of groundwater hydrology and precipitation are included in Appendix D.

3.0 REFERENCES

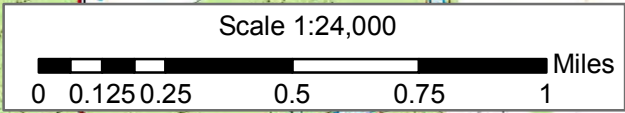
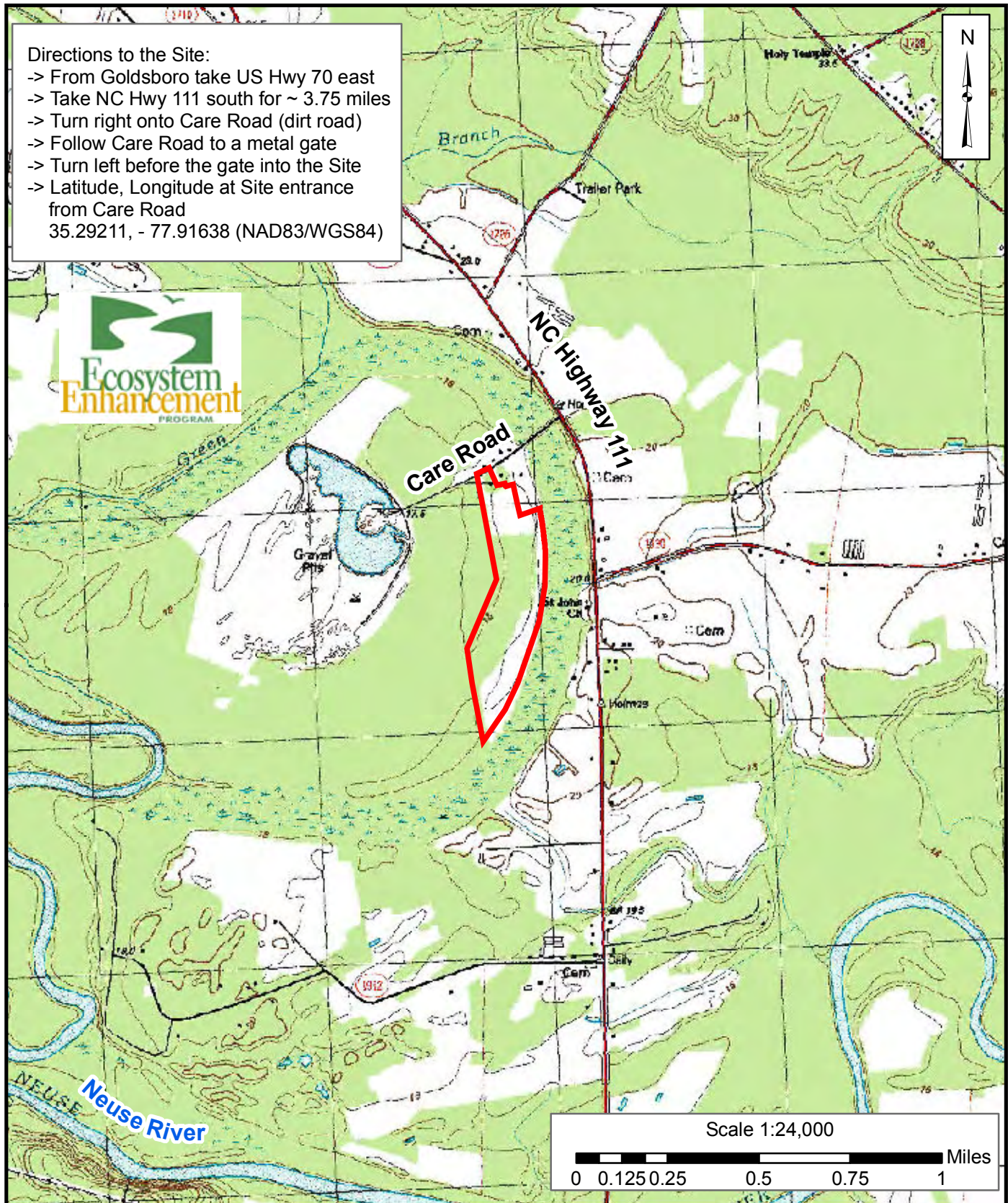

- Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0. (online). Available: <http://cvs.bio.unc.edu/methods.htm>.
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- North Carolina Division of Water Quality (NCDWQ). 2007. Redbook, Surface Waters and Wetlands Standards. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.
- Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: <http://www.herbarium.unc.edu/WeakleysFlora.pdf> [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.
- Weather Underground. 2010. Station at Goldsboro Airport (KGSB) in Goldsboro, North Carolina. (online). Available: <http://www.wunderground.com/history/airport/KGSB/2010/10/28/CustomHistory.html> [October 28, 2010].

APPENDIX A
FIGURES AND PLAN VIEWS

Figure 1. Site Location

Figure 2. Monitoring Plan View

- Directions to the Site:
- > From Goldsboro take US Hwy 70 east
 - > Take NC Hwy 111 south for ~ 3.75 miles
 - > Turn right onto Care Road (dirt road)
 - > Follow Care Road to a metal gate
 - > Turn left before the gate into the Site
 - > Latitude, Longitude at Site entrance from Care Road
35.29211, - 77.91638 (NAD83/WGS84)

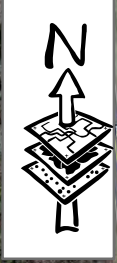



20 Enterprise Street
Suite 7
Raleigh, NC 27607
(919) 215-1693

SITE LOCATION
NORWOOD GAINERY RESTORATION SITE
 Wayne County, North Carolina

Dwn. by:	CLF
Date:	Dec 2009
Project:	08-001

FIGURE
1



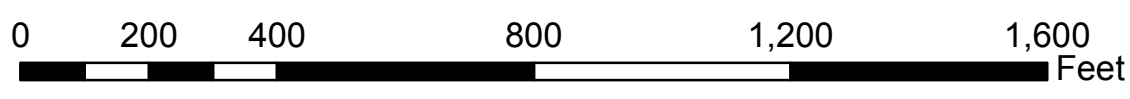
Care Road

Point	Latitude	Longitude
Veg Plot 5 origin	35.286914	-77.915973
Veg Plot 11 origin	35.290121	-77.915897
Veg Plot 18 origin	35.285602	-77.915938
Veg Plot 20 origin	35.286542	-77.914916
Veg Plot 22 origin	35.287896	-77.915084
Veg Plot 26 origin	35.290699	-77.915180
Veg Plot 31 origin	35.288539	-77.914264
Veg Plot 34 origin	35.286601	-77.913676
Veg Plot 42 origin	35.284489	-77.915474
Veg Plot 43 origin	35.284033	-77.915624
Veg Plot 44 origin	35.283831	-77.915433
Veg Plot 46 origin	35.286149	-77.914213
Veg Plot 47 origin	35.288425	-77.913809
Veg Plot 48 origin	35.289726	-77.913875
Veg Plot 49 origin	35.291104	-77.914934
Veg Plot 50 origin	35.287292	-77.914807
Veg Plot 51 origin	35.284067	-77.916399
Veg Plot 52 origin	35.285574	-77.916330
Veg Plot 53 origin	35.290798	-77.915657
Gauge 1	35.284059	-77.915244
Gauge 2	35.284456	-77.915125



Legend

- Site Boundary
- Year 4 (2010) Vegetation Plots
- ★ Vegetation Plot Origins
- Approx. Veg Plot Locations
- Groundwater Gauges
- Wetland Enhancement
- Open Water
- Ditches
- Dirt Access Road



20 Enterprise Street
Suite 7
Raleigh, NC 27607
(919) 215-1693

Axiom Environmental, Inc.

MONITORING PLAN VIEW
NORWOOD GAINEY RESTORATION SITE
 Wayne County, North Carolina

Dwn. by:	CLF	2
Date:	Oct 2010	
Project:	08-001	

APPENDIX B

GENERAL PROJECT TABLES

- Table 1. Project Restoration Components
- Table 2. Project Activity and Reporting History
- Table 3. Project Contacts Table
- Table 4. Project Background Table

**Table 1. Project Restoration Components
Norwood Gainey Riparian Buffer Restoration (EEP Project Number 628)**

Project Segment or Reach ID	Existing Acreage	Mitigation Type	Approach	Acreage	Mitigation Ratio	Mitigation Units	Comment
Woody Riparian Buffer (0-50 feet)	0	Restoration	--	21.6	1:1	21.6	--
Woody Riparian Buffer (50-200 feet)	0	Restoration	--	26.2	--	--	--
Wetland Enhancement	5.4	Enhancement	--	5.4	2:1	2.7	--
Mitigation Unit Summations							
Stream	Riparian Wetland		Nonriparian Wetland	Total Wetland	Woody Riparian Buffer (0-50 feet)		
0	2.7		0	2.7	21.6		
Other Project Attributes Removed From Credit Areas (acres)							
Open Water	Surface Water (Ditches)	Road	Diffuse Flow	Total Acreage Removed From Credit Areas			
2.3	2.0	0.7	0.2	5.2			

**Table 2. Project Activity and Reporting History
Norwood Gainey Riparian Buffer Restoration (EEP Project Number 628)**

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	---	March 2006
Temporary S&E Seed Mix Applied	---	November 2006
Planting/Permanent Seed Mix Applied	---	November 2006
Mitigation Plan/As-built Report (Year 0 Monitoring – baseline)	---	February 2007
Year 1 Monitoring (2007)	October 2007	November 2007
Year 2 Monitoring (2008)	---	---
Year 3 Monitoring (2009)	December 2009	January 2010
Year 4 Monitoring (2010)	November 2010	November 2010
Year 5 Monitoring (2011)	---	---

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
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	
Year 1 (2007) 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
Year 3-4 (2009-2010) Monitoring Performers Wetland and Vegetation POC	Axiom Environmental, Inc. Grant Lewis Email: glewis@axiomenvironmental.org	20 Enterprise Street, Suite 7 Raleigh, North Carolina 27607 Phone: (919) 215-1693

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 Subbasin for Project and Reference	03-04-05
NCDWQ Classification for Project and Reference	C, NSW
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	0%

APPENDIX C

VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary

Vegetation Monitoring Plot Photos

CVS Summary Data Tables

Table 6. Vegetation Metadata Table

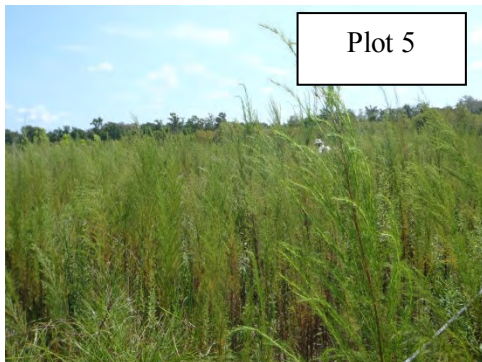
Table 7. Total and Planted Stems by Plot and Species

**Table 5. Vegetation Plot Mitigation Success Summary Table
Norwood Gainey Riparian Buffer Restoration Site (EEP Project Number 628)**

Vegetation Plot Type	Vegetation Plot ID	Based on Planted Stems Only		Based on Total Stems*	
		Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean
Areas within 0-50 feet of Waterways	5	Yes	75%	Yes	100%
	11	Yes		Yes	
	18	Yes		Yes	
	20	Yes		Yes	
	22	No		Yes	
	26	Yes		Yes	
	31	No		Yes	
	34	Yes		Yes	
Wetland Enhancement Areas	42	Yes	66.7%	Yes	100%
	43	No		Yes	
	44	No		Yes	
Areas Greater than 50 feet from Waterways	46	No	25%	No	87.5%
	47	No		Yes	
	48	No		Yes	
	49	No		Yes	
	50	Yes		Yes	
	51	No		Yes	
	52	Yes		Yes	
	53	No		Yes	

*Total Stems include planted stems and naturally recruited stems of appropriate native species.

**Vegetation Monitoring Photographs
Taken August 2010**



Plot 5



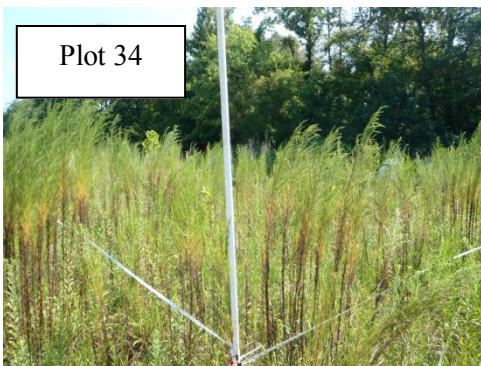
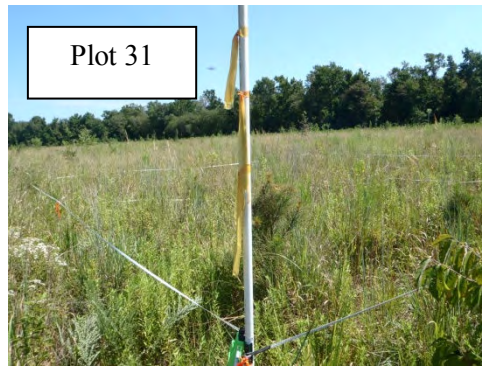
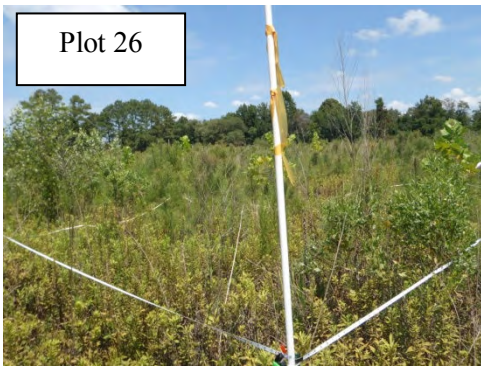
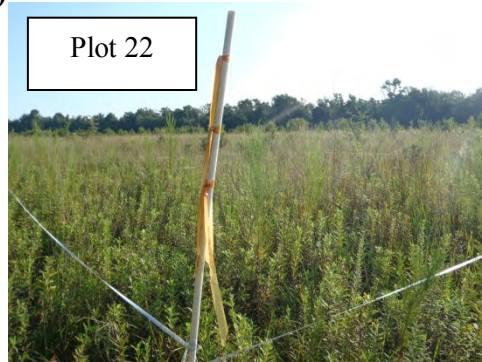
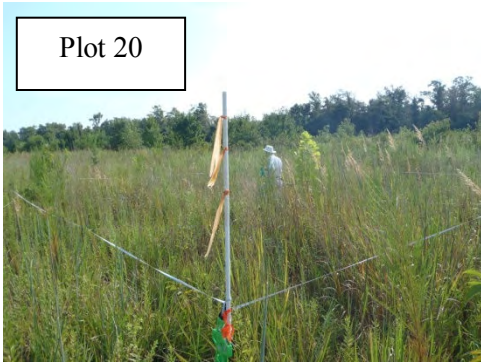
Plot 11



Plot 18

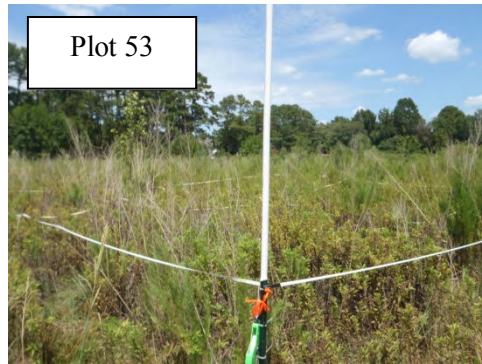
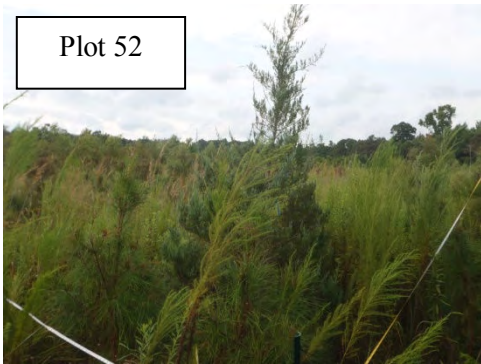
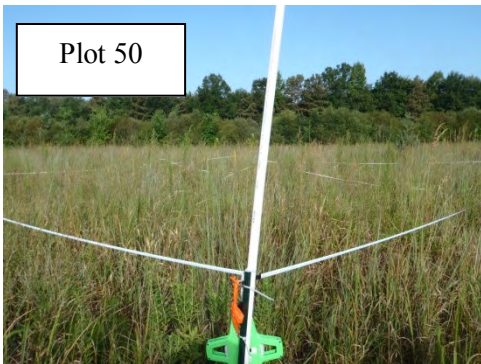
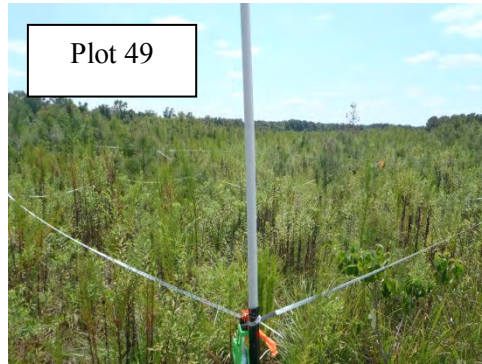
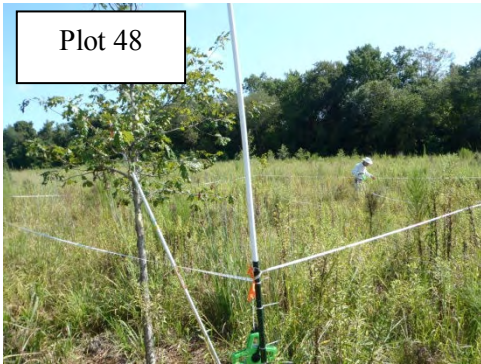
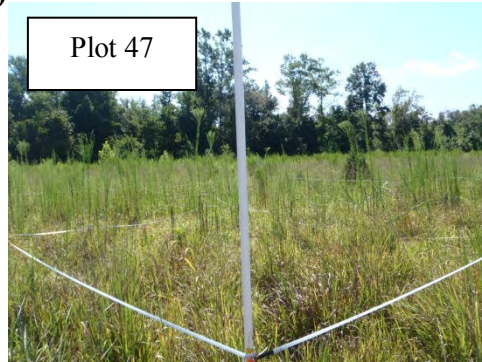
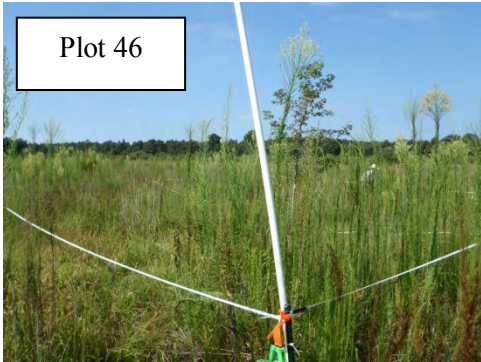
**Vegetation Monitoring Photographs
Taken August 2010**

(continued)



**Vegetation Monitoring Photographs
Taken August 2010**

(continued)



**Table 6. Vegetation Metadata Table
Norwood Gainey Restoration Site (EEP Project Number 628)**

Report Prepared By	Corri Faquin
Date Prepared	10/25/2010 12:27
database name	Axiom-EEP-2010-A.mdb
database location	C:\Axiom\Business\CVS Database\2010
computer name	CORRI
file size	36732928
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
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	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	628
project Name	Norwood Gainey Site (G)
Description	Buffer restoration
River Basin	Neuse
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	19

Table 7. Total and Planted Stems by Plot and Species (continued)
 Norwood Gainey Restoration Site (EEP Project Number 628)

Species	CommonName	Annual Totals: 8 Buffer Plots within 0-50 Feet of Waterways (Plots 5, 11, 18, 20, 22, 26, 31, 34)								Annual Totals: 3 Wetland Enhancement Area Plots (Plots 42-44)								Annual Total: 8 Buffer Plots Geater than 50 Feet from Waterways (Plots 46-53)					
		Current Mean MY4 (2010)		MY3 (2009)		MY2 (2008)		MY1 (2007)		Asbuilt		Current Mean MY4 (2010)		MY2-3 (2008-2009)		MY1 (2007)		Asbuilt		Current Mean MY4 (2010)		Asbuilt- MY3 (2009)	
		Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems	Total stems	Planted stems
<i>Acer rubrum</i>	red maple	44		2							327												
<i>Baccharis halimifolia</i>	eastern baccharis	10		5							10												
<i>Betula nigra</i>	river birch	3	3	3	3			3	3		12	11			14	14				15	13	6	6
<i>Carpinus caroliniana</i>	ironwood																					13	13
<i>Carya</i> sp.	hickory																			1	1		
<i>Carya illinoensis</i>	pecan										1												
<i>Cephalanthus occidentalis</i>	common buttonbush										1	1											
<i>Cercis canadensis</i>	eastern redbud																			1	1	1	1
<i>Cornus amomum</i>	silky dogwood	9	9	8	8			5	5														
<i>Cornus florida</i>	flowering dogwood	1	1	1	1			4	4											2	2	2	2
<i>Diospyros virginiana</i>	common persimmon	19	17	13	12			23	23											7	7		
<i>Fagus grandifolia</i>	American beech																			5	3	6	6
<i>Fraxinus pennsylvanica</i>	green ash	1																					
<i>Ilex opaca</i>	American holly																			1	1	1	1
<i>Juglans nigra</i>	black walnut	6	5	2	1			9	9											8	8		
<i>Juniperus virginiana</i>	eastern redcedar																			1	1	1	1
<i>Liquidambar styraciflua</i>	sweetgum	30	1								30									6			
<i>Liriodendron tulipifera</i>	tuliptree																			2	2	2	2
<i>Magnolia virginiana</i>	sweetbay magnolia										1	1		22	22								
<i>Morella cerifera</i>	wax myrtle										2												
<i>Morus rubra</i>	red mulberry	6	6	3	3			5	5														
<i>Nyssa</i> sp.	tupelo	3	3								4	4								2	2		
<i>Nyssa sylvatica</i>	blackgum																			4	4	3	3
<i>Persea palustris</i>	swamp bay																			1	1		
<i>Pinus taeda</i>	loblolly pine	157		149							58									113			
<i>Platanus occidentalis</i>	American sycamore	13	13	9	9			12	12														
<i>Prunus serotina</i>	black cherry	4	4	4	4			6	6														
<i>Quercus alba</i>	white oak																						
<i>Quercus michauxii</i>	swamp chestnut oak	8	8	8	8			8	8														
<i>Quercus nigra</i>	water oak	6	6	6	6			5	5														
<i>Quercus pagoda</i>	cherrybark oak	2	2	2	2																		
<i>Quercus phellos</i>	willow oak										1									5	5	1	1
<i>Rhus copallinum</i>	flameleaf sumac	1	1																				
<i>Salix</i> sp.	willow										12												
<i>Salix nigra</i>	black willow										7												
<i>Ulmus</i>	elm	1		1																			
Unknown	unknown	2	1	1	1			1	1													15	15
	Plot area (acres)																						
	Species Count	20	15	16	12			11	11		13	4			2	2				17	15	12	12
	Stem Count	326	80	217	58			81	81		466	17			36	36				176	53	53	53
	Stems per acre	1650	405	1098	294			410	410		2358	86			486	486				891	268	268	268

These plots were not measure for year 2 (2008) monitoring.

These plots were not measure for year 0 (asbuilt) monitoring.

These plots were not measure for year 2 (2008) monitoring.

These plots were not measure for year 0 (asbuilt) monitoring.

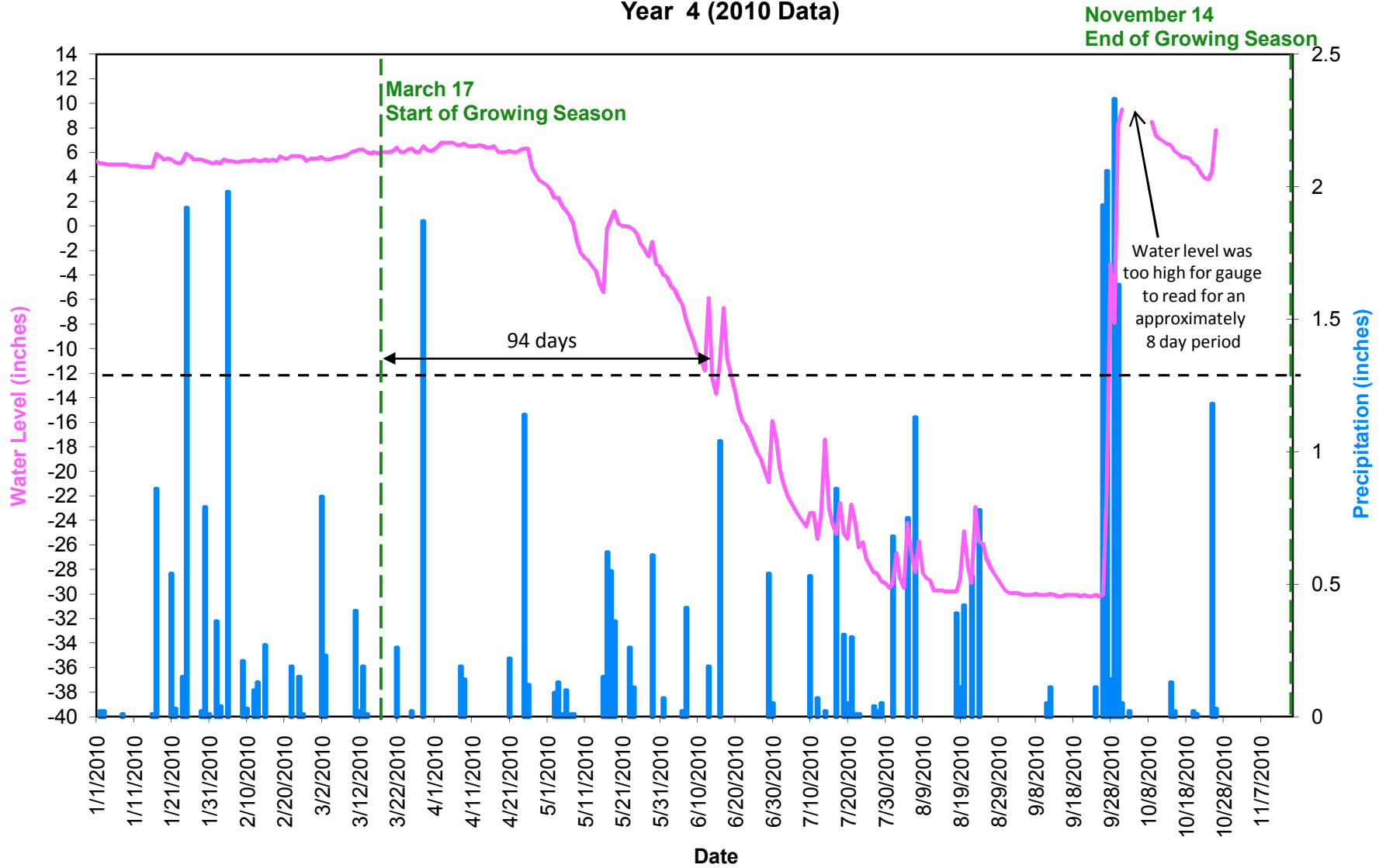
APPENDIX D
WETLAND DATA

2010 (Years 4) Groundwater Gauge Graphs

Table 8. Wetland Hydrology Criteria Attainment

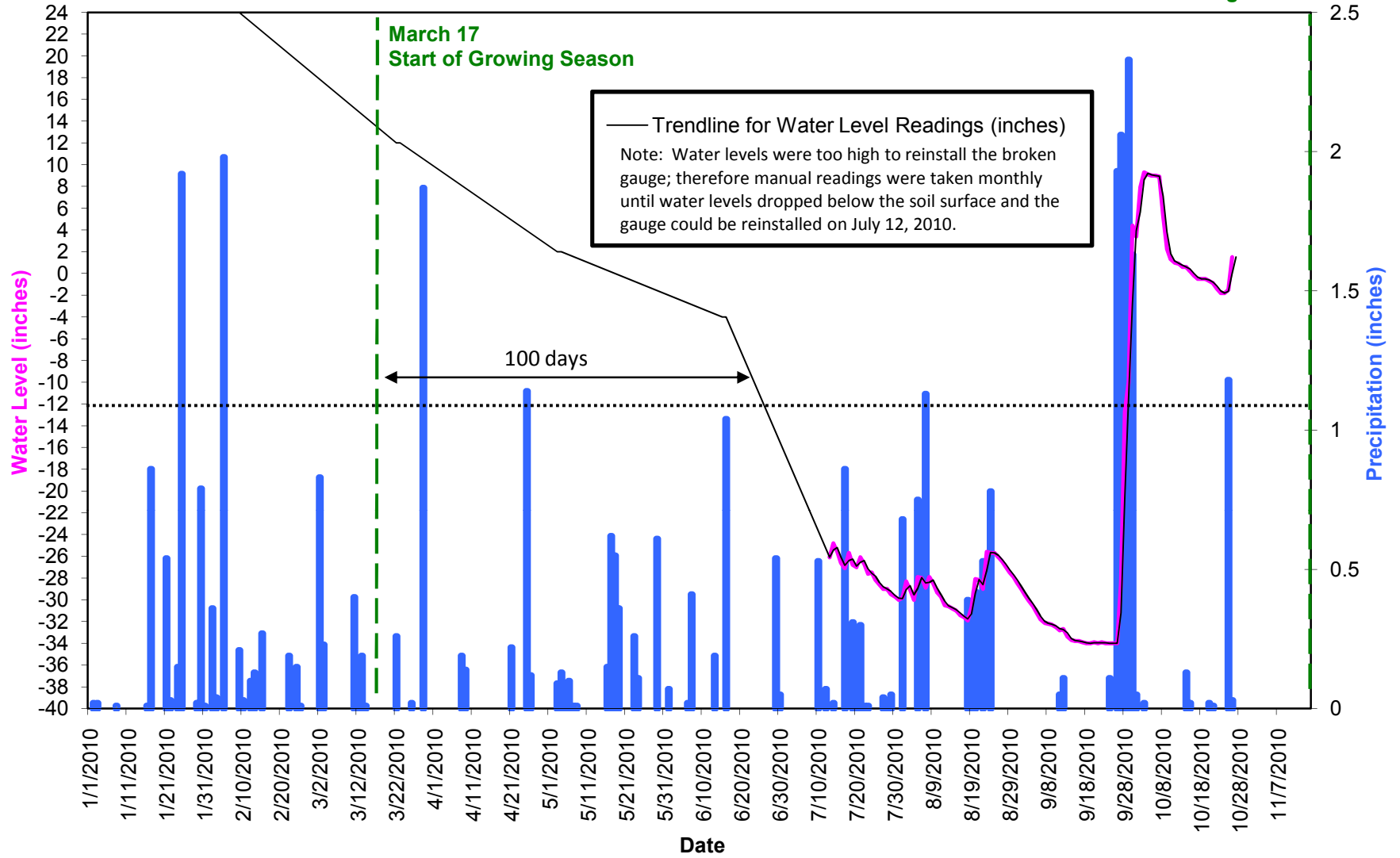
Figure 3. Annual Climatic Data vs. 30-year Historic Data

Norwood Gainey Ground Water Gauge 1 Year 4 (2010 Data)



Norwood Gainey Ground Water Gauge 2 Year 4 (2010 Data)

November 14
End of Growing Season



**Table 8. Wetland Hydrology Criteria Attainment Summary
Norwood Gainey Riparian Buffer Restoration Site (EEP Project Number 628)**

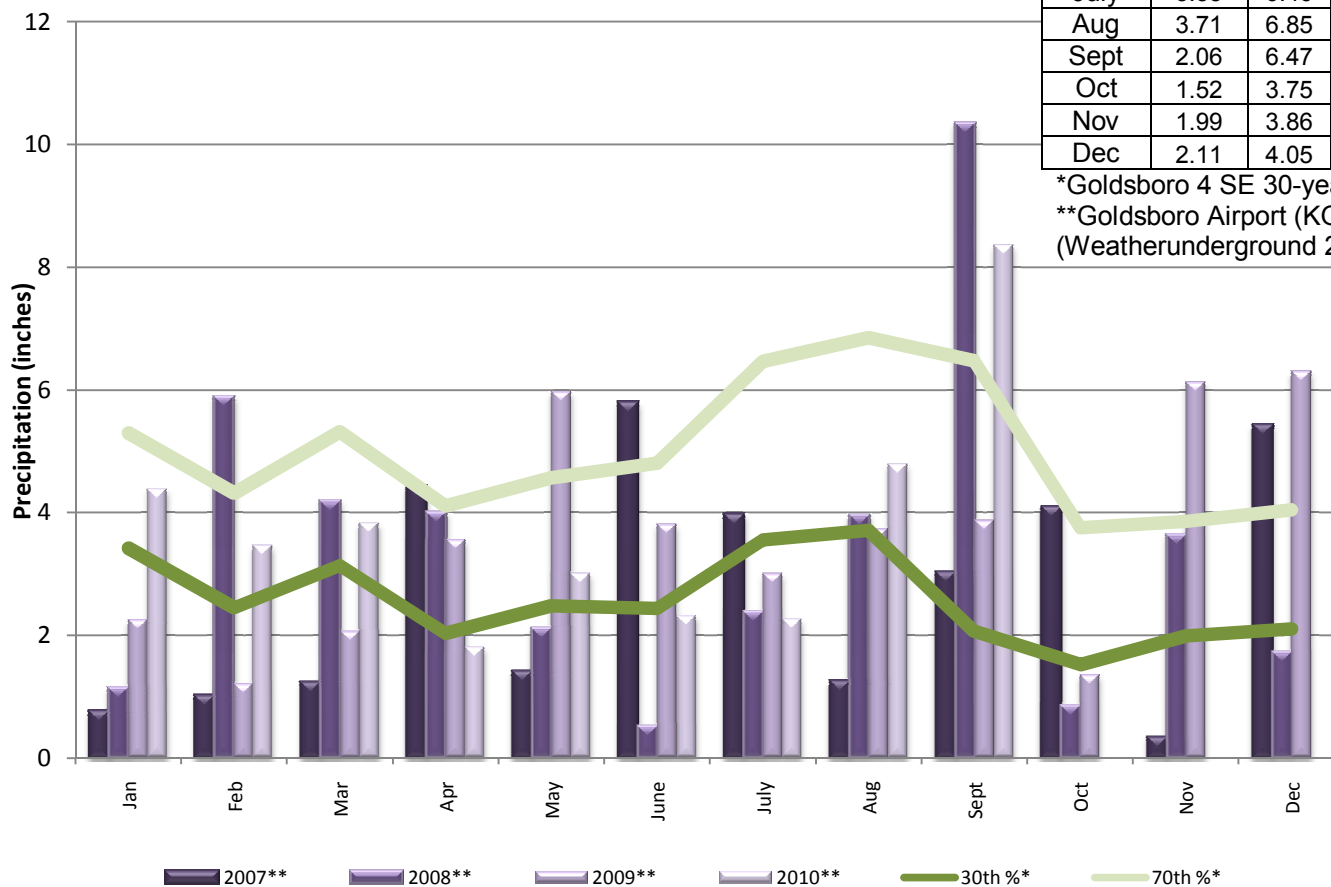
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2007)	Year 2 (2008)	Year 3 (2009)	Year 4 (2010)	Year 5 (2011)
1	Yes/92 days (37.9%)	Yes/99 days (40.7%)	Yes/243 days (100%)	Yes/93 days (38.3%)	
2	Yes/103 days (42.4%)	Yes/101 days (41.6%)	Yes*	Yes/100 days (41.2%)**	

* Gauge 2 was broken prior to the start of the year 3 (2009) growing season and no data could be retrieved; however, based on field observations and the tendency for Gauge 2 to be wetter than Gauge 1 this gauge should be considered successful. This gauge was inundated for the majority of the growing season. The gauge will be replaced prior to the year 4 (2010) monitoring season.

** Gauge 2 was located in an inundated area and it was impossible to reinstall the gauge until water levels dropped below the soil surface. Therefore, manual water level readings were taken monthly until the gauge could be installed on July 12, 2010.

Figure 3. Annual Climatic Data vs. 30-year Historic Data

Month	30th %*	70th %*	2007**	2008**	2009**	2010**
Jan	3.42	5.3	0.76	1.14	2.26	4.38
Feb	2.45	4.32	1.01	5.89	1.21	3.47
Mar	3.14	5.32	1.23	4.19	2.07	3.83
Apr	2.03	4.11	4.43	4	3.56	1.81
May	2.48	4.57	1.41	2.11	5.97	3.01
June	2.44	4.81	5.79	0.51	3.81	2.32
July	3.55	6.46	3.97	2.38	3.01	2.27
Aug	3.71	6.85	1.25	3.96	3.74	4.79
Sept	2.06	6.47	3.03	10.34	3.87	8.36
Oct	1.52	3.75	4.09	0.85	1.36	
Nov	1.99	3.86	0.34	3.63	6.13	
Dec	2.11	4.05	5.43	1.72	6.3	



*Goldsboro 4 SE 30-year historic data (NOAA 2004)
 **Goldsboro Airport (KGSB) rainfall data (Weatherunderground 2010)