

**FINAL
ANNUAL MONITORING REPORT
GOLDSBORO HOUSING AUTHORITY**

**STREAM RESTORATION
WAYNE COUNTY, NORTH CAROLINA
(EEP Project Number 145, Contract No. 09070009)
Construction Completed October 2008**

Monitoring Year 4 of 5 (2012)



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



December 2012

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Submitted to:
North Carolina Department of Environment and Natural Resources
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Prepared by:
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Raleigh, North Carolina 27603

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Dewberry & Davis
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December 2012

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1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Goldsboro Housing Authority Mitigation Site (Site) is located in the northeast quadrant of the intersection of NC-581 and US-13 within the West Haven Apartments complex owned by the Goldsboro Housing Authority (GHA) in central Wayne County. As constructed the Site provides 799 stream mitigation units. The Site is located in United States Geological Survey (USGS) Hydrologic Unit 03020201200020 (North Carolina Division of Water Quality Subbasin 03-04-05) of the Neuse River Basin. The Site was identified to assist the North Carolina Ecosystem Enhancement Program in meeting mitigation goals. Primary activities at the Site included stream enhancement (levels I and II), creation of a Best Management Practice (BMP) constructed wetland, and replanting riparian areas with native vegetation. Project restoration efforts provided 799 Stream Mitigation Units and 1 Stormwater Wetland credit. This report (compiled based on EEP's *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for year 4 (2012) monitoring.

The primary components of the restoration project included the following.

1. In keeping with the Neuse River Basinwide Management Plan developed by the North Carolina Division of Water Quality, a major goal of the project is to reduce sediment and other water quality stressors, nitrogen in particular, to the receiving watershed. This was achieved via the following measures:
 - a. Restore channel dimension throughout the Site to include bank resloping, benching and provision of reference appropriate width-depth ratios to reduce near bank stress and attendant erosion, and to move bedload towards equilibrium, thereby preventing future bank instability related to potential bed aggradation and/or degradation.
 - b. Replace the existing highly managed grass with an appropriate vegetated buffer providing root mass that will stabilize project banks, treating both overland and groundwater inputs.
 - c. Install a large stormwater wetland adjacent to Unnamed Tributary to Borden Field Ditch (UTBFD) designed to receive and provide off-line treatment for a portion of storm flow that meets or exceeds a 1-inch storm event, which on average and over the long term is expected to occur several times per year. This will provide a significant sediment and biogeochemical sink for the inputs from the UTBFD watershed. The drainage area of the UTBFD is approximately 125 acres with approximately 50 acres of impervious surface. The existing Nitrogen load to the UTBFD at the location of the stormwater wetland is approximately 1229 pounds per year. It is anticipated that the stormwater wetland will receive flow during several storm events each year, as the typical 1 inch storm event and the one year design storm are expected to overtop the weir by 1.8 or 2.7 feet, respectively.
2. Attenuate storm flows and excess hydrologic energies associated with this highly urban watershed via 1 a,b,c.
3. Enhance the natural aesthetic of the project corridor
4. Increase local awareness of natural resources in an urban setting and the conditions necessary for their improvement/enhancement.

Based on interagency guidelines (USACE 2003), success criteria dictate that survival of woody species planted at mitigation sites should be at a minimum density of 320 stems per acre at the end of the third monitoring year. Subsequently, 290 stems per acre must be surviving at the end of year 4 and 260 stems per acre at the end of year 5. Based on the number of stems counted, average densities were measured at 648 planted stems per acre surviving in year 4 (2012). Each individual plot met success criteria based on

planted stems alone. Supplemental planting of the Site occurred on February 3, 2012 with 460 containerized trees as follows. Areas planted are depicted on mapping in Appendix G.

Species	Quantity Planted
Scarlet Oak (<i>Quercus coccinea</i>)	75
River Birch (<i>Betula nigra</i>)	116
Green Ash (<i>Fraxinus pennsylvanica</i>)	111
Sugarberry (<i>Celtis laevigata</i>)	74
Shumard Oak (<i>Quercus shumardii</i>)	84

Success criteria for Site streams, to assure that project goals are being achieved, will primarily be based on indicators and trends describing the stability of the channel and success of the riparian buffer. In addition, a minimum of two bankfull events must be documented within the standard 5 year monitoring period. In order for the monitoring to be considered complete, the bankfull events must occur in separate monitoring years. Year 4 (2012) monitoring measurements indicate that there have been minimal changes in the cross-sections as compared to as-built data. In addition, one bankfull event was documented to occur in Year 4 (2012) to date for a total of eight bankfull events.

In summary, the Site achieved success criteria for vegetation and stream attributes in the Fourth Monitoring Year (2012). 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 table 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 Site construction, three plots (20-meters by 5-meters) were established and monumented with metal rebar at all plot corners. Plots were surveyed on August 21, 2012 for the year 4 (2012) monitoring season. Sampling was conducted as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (<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). The locations of vegetation monitoring plots are depicted on Figure 2 in Appendix B.

2.2 Stream Assessment

Four permanent cross-sections were established after construction was completed. Measurements of each cross-section include points at all breaks in slope including top of bank, bankfull, and thalweg. Riffle cross-sections are classified using the Applied Fluvial Morphology (Rosgen 1996) stream classification system. Cross-section plots and data are included in Appendix D; the locations of cross-sections are depicted on Figure 2 in Appendix B.

3.0 REFERENCES

- Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.0. (online). Available: <http://cvs.bio.unc.edu/methods.htm>
- Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado.
- 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.
- 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. 2012. Station in Goldsboro, North Carolina. (online). Available: <http://www.wunderground.com/cgi-bin/findweather/getForecast?query=35.33916855,-77.96055603> [August 23, 2012]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

Figure 1. Site Location

Table 1. Site Restoration Structures and Objectives

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

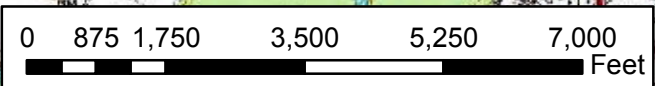
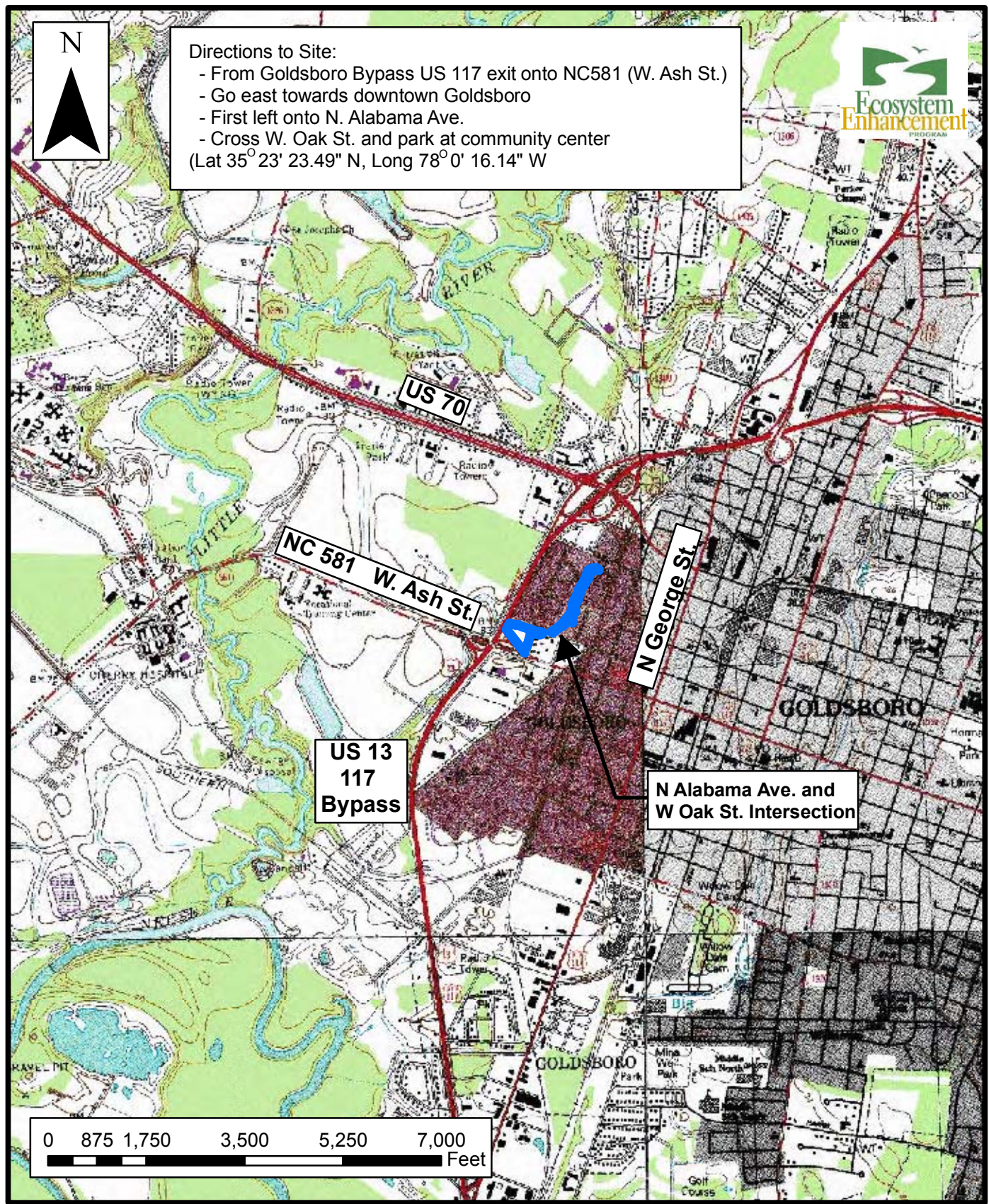
Table 4. Project Attributes Table



Directions to Site:

- From Goldsboro Bypass US 117 exit onto NC581 (W. Ash St.)
- Go east towards downtown Goldsboro
- First left onto N. Alabama Ave.
- Cross W. Oak St. and park at community center

(Lat 35° 23' 23.49" N, Long 78° 0' 16.14" W)



20 Enterprise St. #7
Raleigh, NC 27607
(919) 215-1693
(919) 341-3839 (fax)

SITE LOCATION
GOLDSBORO HOUSING AUTHORITY - EEP #145
STREAM RESTORATION PROJECT
 Wayne County, North Carolina

Dwn. By: WGL
 Date: June 2009
 Project: 08-001

FIGURE
1

**Table 1. Site Restoration Structures and Objectives
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Project Component or Reach ID	Restoration Level	Approach	Footage or Acreage	Stationing *	Ratio	Mitigation Units	BMP Elements **	Comment
UTBFD-Reach1	EII	P2	275	3+75 – 6+50	2.0	138		Systemic change to dimension and planted buffer
UTBFD-Reach2	-	P4	200	8+25 – 10+25	0.0	0		Primarily stabilized via hardening with rip rap above Oak Street due to need to protect adjacent housing
UTBFD-Reach3	EII	P2/P3	275	10+25 – 13+00	2.0	138		Combination of P2/P3. Systemic dimensional enhancement with planted buffer.
UTBFD-Reach4	EI	P2	200	13+00 - 15+00	1.5	133		Alignment change. Systemic enhancement to dimension, modest enhancement to pattern and profile. Obstacle avoidance and removal of pattern jeopardizing stability
UTBFD-Reach5	EII	P3	675	15+00 - 21+75	2.0	338		Systemic change to dimension and planted buffer
UTBFD-Reach6	EII	P2	133	21+75 - 23+08	2.5	53		Alignment change. Systemic enhancement to dimension, pattern and profile. Obstacle avoidance and removal of pattern jeopardizing stability. Buffer is heavily constrained
BMP	-	-	1.09 acre	At confluence			SW	Large stormwater wetland intercepting storm flow from 123 acre UT

*Stationing is from bottom to top

**SW = Stormwater Wetland

Component Summations				
Restoration Level	Stream (lf)	Ratio	Mitigation Units	BMP
Enhancement I	200	1.5	133	
Enhancement II	1225	2.0	613	
Enhancement II	133	2.5	53	
				1 SW
Totals	1558		799	1 SW

**Table 2. Project Activity and Reporting History
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	--	June 2006
Construction Completion	NA	October 2008
BMP Planting	NA	November 2008
Streamside/Buffer Planting	NA	November 2008
Mitigation Plan / Asbuilt (Year 0 Monitoring Baseline)	October 2008	July 2009
Year 1 Annual Monitoring	September 2009	October 2009
Year 2 Annual Monitoring	September 2010	October 2010
Year 3 Annual Monitoring	August 2011	November 2011
Year 4 Annual Monitoring	August 2012	October 2012

**Table 3. Project Contacts Table
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Designer	Dewberry & Davis, Inc. 2301 Rexwoods Drive Raleigh, North Carolina 27607 Sheila Reeves (919) 8819939
Construction Contractor	Appalachian Environmental Services 1165 W. Main St. Sylva, North Carolina 28779 Mickey Henson (828) 5861973
Planting Contractor	Habitat Assessment and Restoration Program, Inc. 9305D Monroe Rd. Charlotte, North Carolina 28270 Alan Peoples (704) 9750881
Year 1-4 (2009-2012) Monitoring Performer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis (919) 215-1693

**Table 4. Project Attribute Table
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Project County	Wayne County, North Carolina
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terraces
River Basin	Neuse
USGS 14digit HUC	03020201200020
NCDWQ Subbasin	030405
Within EEP Watershed Plan?	No
WRC Class	Warm
% of project easement fenced	~ 45%
Beaver activity observed during the design phase?	No
Drainage Area	UTBFD at outfall: 0.40 square miles UT at confluence with UTBFD: 0.17 square miles
Restored/Enhanced stream lengths (linear feet)	1558
Perennial or Intermittent	Perennial
Watershed type	Developed
Watershed distribution	40% Commercial 38% Residential 14% Industrial 10% Open Space
Watershed impervious cover	~ 35 percent
Stream Order	UTBFD: First and Second UT to UTBFD: First
Rosgen Classification of Asbuilt	E5/C5type
Dominant Soil Types	Norfolk, Johns, Lumbee, Wickham
Reference Site ID	UT to Little River (REF1) and unspecified stream in Moores Crossroads, NC (REF2)
NCDWQ Classification	Not classified, drains to Borden Field Ditch (275723, C,NSW)
303d listed?	No
Upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
Total acreage of easement	~ 4.7 acres
Total planted acreage as part of the restoration	~ 4.7 acres
Rosgen classification of preexisting	F5/G5
Rosgen classification of asbuilt	C5/E5
Valley type	VIII
Valley slope	.26.46 %
Cowardin classification	R3UB2
Trout waters designation	No
Species of concern, endangered, etc.?	No

APPENDIX B
VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View

Figure 3. Asset Map

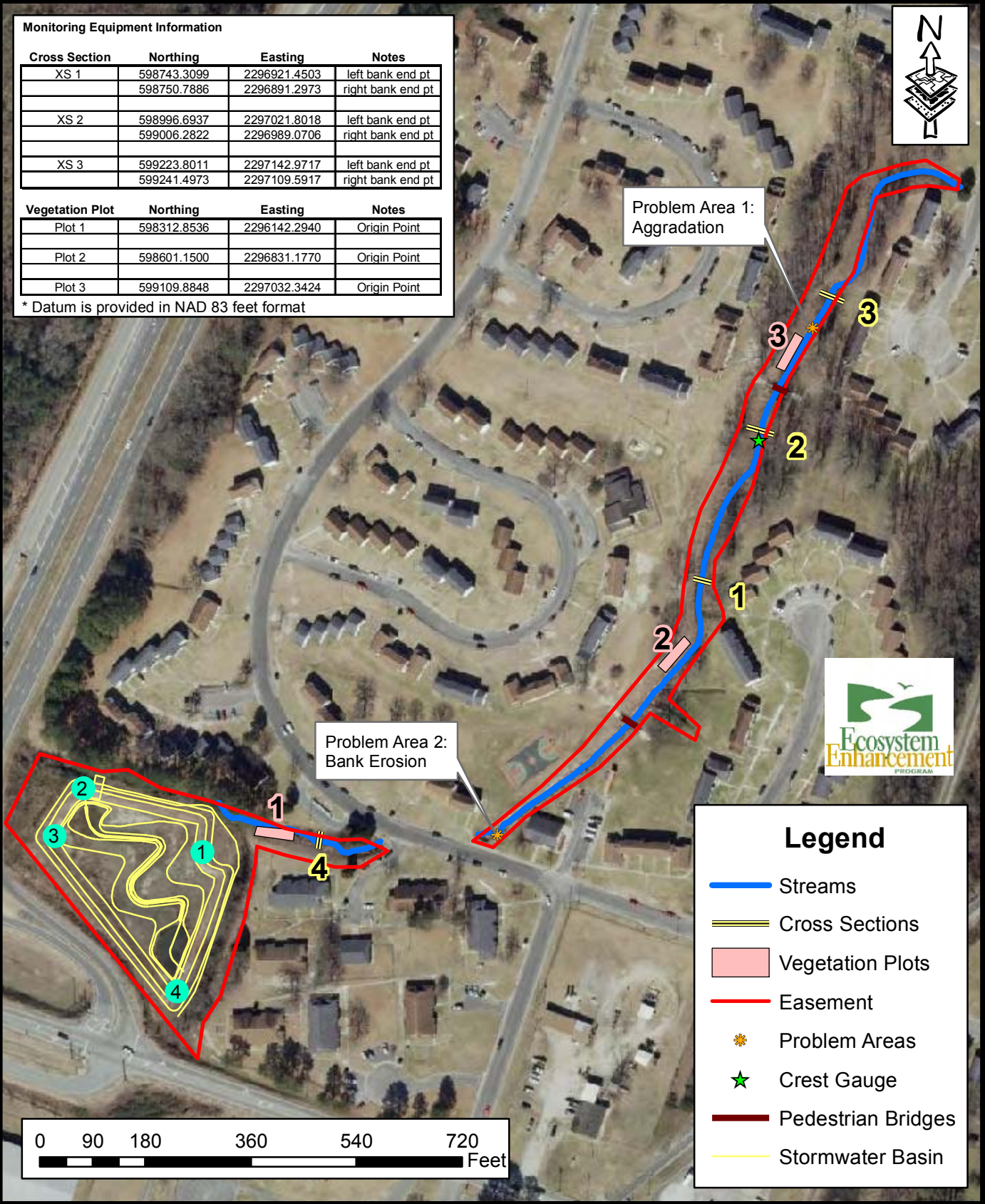
Vegetation Monitoring Plot Photos

Monitoring Equipment Information

Cross Section	Northing	Easting	Notes
XS 1	598743.3099	2296921.4503	left bank end pt
	598750.7886	2296891.2973	right bank end pt
XS 2	598996.6937	2297021.8018	left bank end pt
	599006.2822	2296989.0706	right bank end pt
XS 3	599223.8011	2297142.9717	left bank end pt
	599241.4973	2297109.5917	right bank end pt

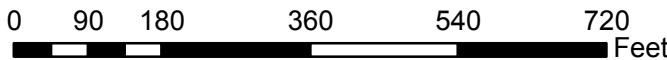
Vegetation Plot	Northing	Easting	Notes
Plot 1	598312.8536	2296142.2940	Origin Point
Plot 2	598601.1500	2296831.1770	Origin Point
Plot 3	599109.8848	2297032.3424	Origin Point

* Datum is provided in NAD 83 feet format



Legend

- Streams
- Cross Sections
- Vegetation Plots
- Easement
- Problem Areas
- Crest Gauge
- Pedestrian Bridges
- Stormwater Basin



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CURRENT CONDITIONS PLAN VIEW
GOLDSBORO HOUSING AUTHORITY - EEP #145
STREAM RESTORATION PROJECT
Wayne County, North Carolina

Dwn. By: CLF
Date: Sept 2011
Project: 10-009

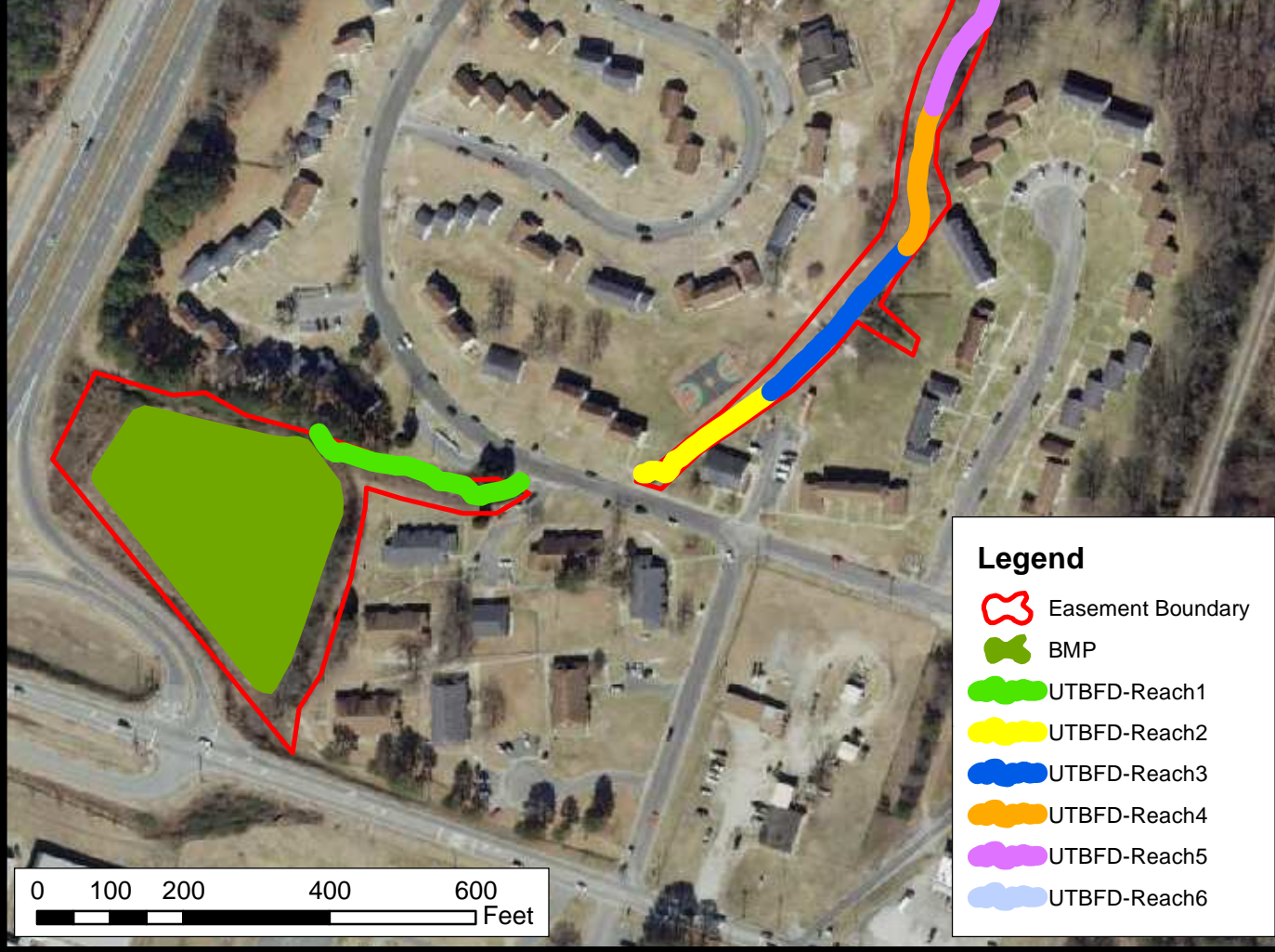
FIGURE
2

Table 1. Site Restoration Structures and Objectives
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)

Project Component or Reach ID	Restoration Level	Approach	Footage or Acreage	Stationing *	Ratio	Mitigation Units	BMP Elements **	Comment
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Component Summations				
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Enhancement II	1225	2.0	613	
Enhancement II	133	2.5	53	
				1 SW
Totals	1558		799	1 SW



Legend

- Easement Boundary
- BMP
- UTBFD-Reach1
- UTBFD-Reach2
- UTBFD-Reach3
- UTBFD-Reach4
- UTBFD-Reach5
- UTBFD-Reach6

Axiom Environmental, Inc.
 218 Snow Avenue
 Raleigh, NC 27603
 (919) 215-1693

ASSET MAP
GOLDSBORO HOUSING AUTHORITY - EEP #145
STREAM RESTORATION PROJECT
 Wayne County, North Carolina

Dwn. By: KRJ
 Date: Dec 2012
 Project: 12-004.08

FIGURE
3

**Goldsboro Housing Authority
Year 4 (2012) Annual Monitoring
Vegetation Plot Photos (taken August 21, 2012)**



APPENDIX C

VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary

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
 Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	

**Table 6. Vegetation Metadata Table
Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)**

Report Prepared By	Corri Faquin
Date Prepared	8/21/2012 15:46
database name	Axiom-EEP-2012-A.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	53612544
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	145
project Name	Goldsboro Housing Authority
Description	Stream Restoration
River Basin	Neuse
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	3

Table 7. Total Planted and Natural Recruits Stems by Plot and Species

Goldsboro Housing Authority

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2012)									Annual Means														
			E145-AXE-0001			E145-AXE-0002			E145-AXE-0003			MY4 (2012)			MY3 (2011)			MY2 (2010)			MY1 (2009)			MY0 (2009)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree													1			1								
Baccharis halimifolia	eastern baccharis	Shrub			1			4			3			8			8			7						
Betula nigra	river birch	Tree	21	21	21	1	1	1	2	2	2	24	24	24	22	22	35	22	22	45	14	14	32	16	16	16
Celtis laevigata	sugarberry	Tree	1	1	1	2	2	2				3	3	3								1				
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1				2	2	2												
Juniperus virginiana	eastern redcedar	Tree									1			1		3										
Liquidambar styraciflua	sweetgum	Tree						17			1			18			30			9			24		9	
Morella cerifera	wax myrtle	shrub	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Pinus taeda	loblolly pine	Tree			8									8			6			2						
Platanus occidentalis	American sycamore	Tree				3	3	3	9	9	9	12	12	12	13	13	13	15	15	15	16	16	16	18	18	18
Prunus serotina	black cherry	Tree			1			4			8			13			50			29			62			
Quercus	oak	Tree																							1	
Quercus phellos	willow oak	Tree			1									1									3	3	3	
Quercus rubra	northern red oak	Tree				1	1	1				1	1	1												
Salix	willow	Shrub or Tree														3										
Salix nigra	black willow	Tree				3	3	3				3	3	3	3	3	3	3	3	3	3	3	3	3	5	
Sambucus canadensis	Common Elderberry	Shrub																						4	4	
Stem count			24	24	35	12	12	37	12	12	25	48	48	97	41	41	155	43	43	114	36	36	141	44	48	60
size (ares)			1			1			1			3			3			3			3			3		
size (ACRES)			0.02			0.02			0.02			0.07			0.07			0.07			0.07			0.07		
Species count			4	4	8	7	7	10	3	3	7	7	7	13	4	4	11	4	4	9	4	4	7	5	6	8
Stems per ACRE			971.2	971.2	1416	485.6	485.6	1497	485.6	485.6	1012	647.5	647.5	1308	553.1	553.1	2091	580	580	1538	485.6	485.6	1902	593.5	647.5	809.4

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

PnoLS = Planted stems excluding lvestakes

P-all= Planted stems including lvestakes

T = Planted stems and natural recruits

Total includes stems of natural recruits

APPENDIX D
STREAM SURVEY DATA
Cross-section Plots

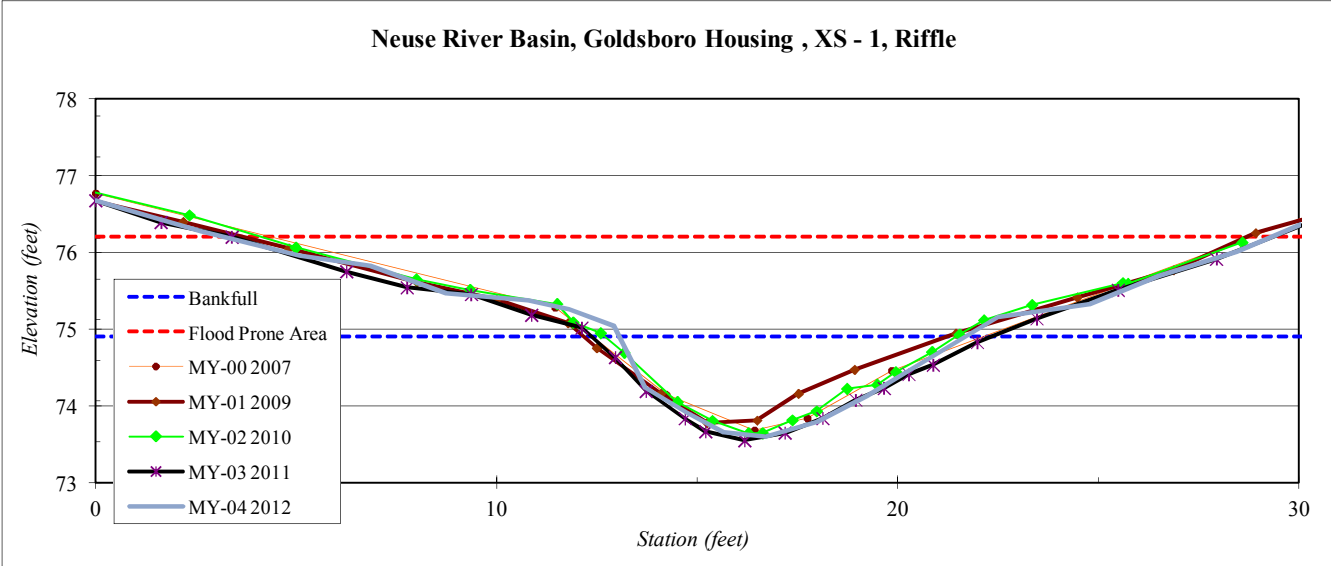
River Basin:	Neuse
Watershed:	Goldsboro Housing
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	0.2
Date:	8/22/2012
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	76.7
2.6	76.3
5.1	76.0
6.8	75.8
8.7	75.5
10.8	75.4
11.8	75.3
12.9	75.0
13.7	74.2
14.7	73.9
15.6	73.7
16.7	73.6
18.0	73.8
19.2	74.1
20.7	74.6
22.5	75.2
24.8	75.3
26.5	75.7
28.4	76.0
31.3	76.6

SUMMARY DATA	
Bankfull Elevation:	74.9
Bankfull Cross-Sectional Area:	7.1
Bankfull Width:	8.6
Flood Prone Area Elevation:	76.2
Flood Prone Width:	25.0
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.8
W / D Ratio:	10.4
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0



Stream Type: E/C



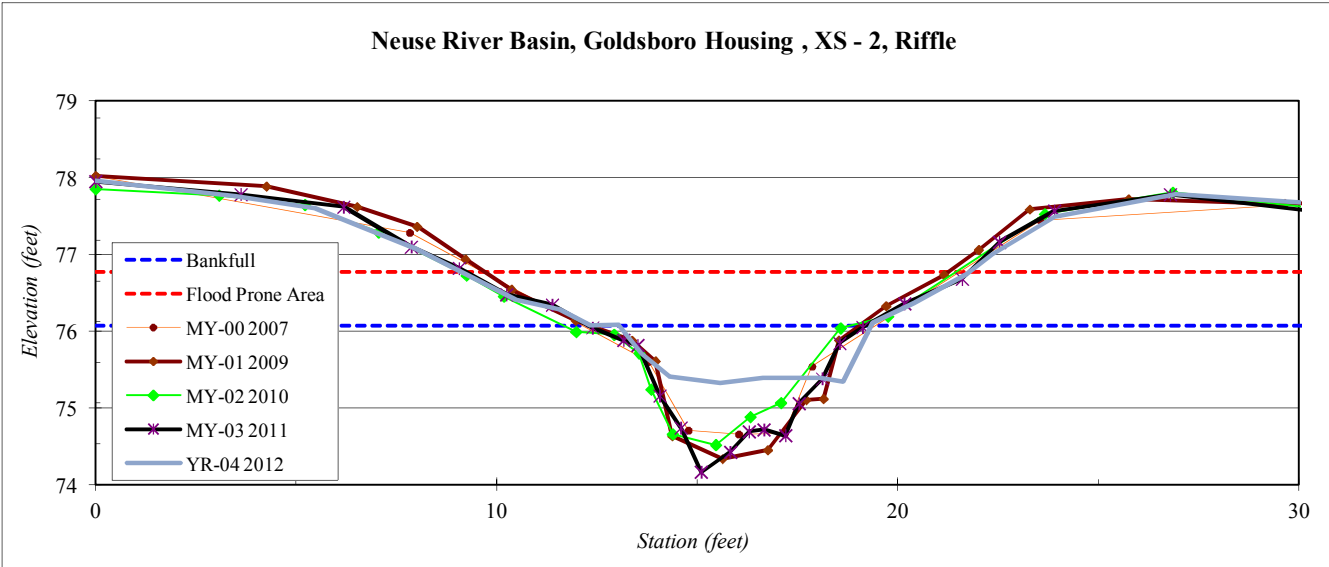
River Basin:	Neuse
Watershed:	Goldsboro Housing
XS ID	XS - 2, Riffle
Drainage Area (sq mi):	0.2
Date:	8/22/2012
Field Crew:	Perkinson, Jernigan

Station	Elevation
0.0	78.0
3.5	77.8
5.5	77.6
8.0	77.1
10.5	76.4
11.6	76.3
12.3	76.1
13.0	76.1
13.6	75.7
14.3	75.4
15.6	75.3
16.6	75.4
18.1	75.4
18.6	75.3
19.4	76.1
20.4	76.4
21.7	76.7
22.4	77.0
23.9	77.5
26.9	77.8
31.7	77.6
34.4	77.9

SUMMARY DATA	
Bankfull Elevation:	76.1
Bankfull Cross-Sectional Area:	3.7
Bankfull Width:	6.4
Flood Prone Area Elevation:	76.8
Flood Prone Width:	13.0
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.6
W / D Ratio:	11.1
Entrenchment Ratio:	2.0
Bank Height Ratio:	1.0



Stream Type	E
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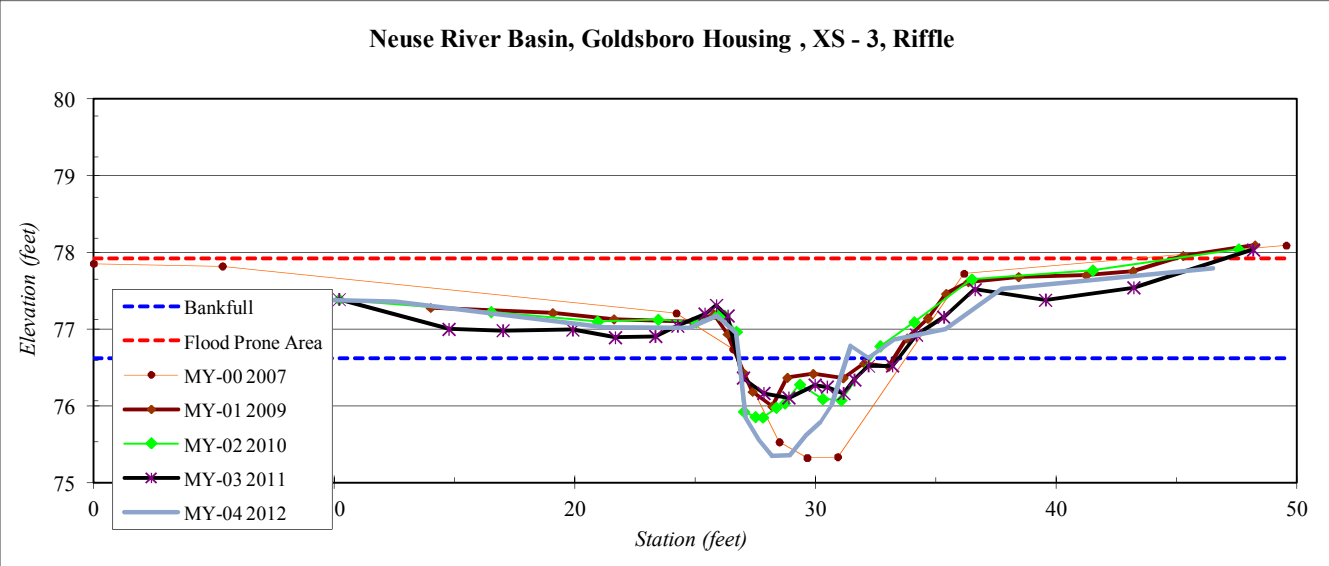
River Basin:	Neuse
Watershed:	Goldsboro Housing
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.2
Date:	8/22/2012
Field Crew:	Perkinson, Jernigan

Station	Elevation
5.3	77.4
8.0	77.4
12.5	77.4
21.2	77.0
24.8	77.0
25.9	77.2
26.7	76.9
27.1	75.8
27.7	75.6
28.2	75.3
28.9	75.4
29.6	75.6
30.2	75.8
30.7	76.0
31.5	76.8
32.2	76.6
33.3	76.9
35.4	77.0
37.7	77.5
46.5	77.8

SUMMARY DATA	
Bankfull Elevation:	76.6
Bankfull Cross-Sectional Area:	4.0
Bankfull Width:	4.5
Flood Prone Area Elevation:	77.9
Flood Prone Width:	50.0
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	5.1
Entrenchment Ratio:	11.1
Bank Height Ratio:	1.0



Stream Type: C/E



River Basin:	Neuse
Watershed:	Goldsboro Housing
XS ID	XS - 4, Riffle
Drainage Area (sq mi):	0.2
Date:	8/22/2012
Field Crew:	Perkinson, Jernigan



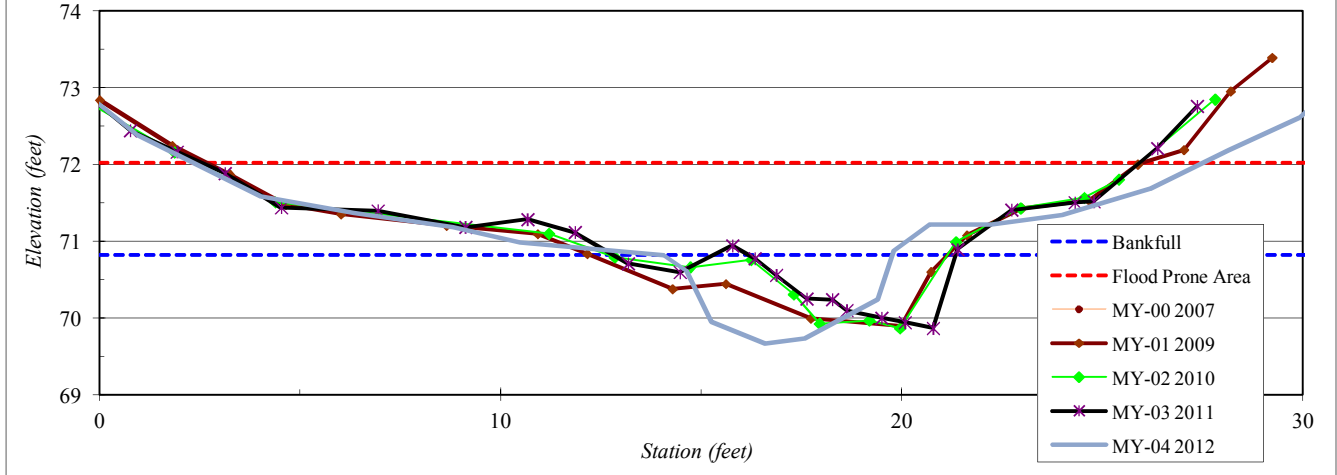
Stream Type	C/E
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Station	Elevation
-0.6	73.0
0.9	72.4
4.0	71.6
6.4	71.4
8.8	71.2
10.5	71.0
14.1	70.8
14.6	70.6
15.2	69.9
16.6	69.7
17.6	69.7
19.4	70.2
19.8	70.9
20.7	71.2
22.2	71.2
24.0	71.3
26.2	71.7
28.2	72.2
29.9	72.6
31.2	73.2
32.7	74.0
34.5	74.9
35.9	75.5
38.0	75.8

SUMMARY DATA	
Bankfull Elevation:	70.8
Bankfull Cross-Sectional Area:	4.5
Bankfull Width:	5.7
Flood Prone Area Elevation:	72.0
Flood Prone Width:	23.0
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.8
W / D Ratio:	7.2
Entrenchment Ratio:	4.0
Bank Height Ratio:	1.0

Neuse River Basin, Goldsboro Housing , XS - 4, Riffle

Note: Cross Section Right Bank End Point Was Not Found.



APPENDIX E
HYDROLOGIC DATA

Table 8. Verification of Bankfull Events

Table 8. Verification of Bankfull Events

Goldsboro Housing Authority Stream/BMP Project (EEP Project Number 145)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
July 11, 2009	Between May 5-11, 2009	Total of 4.74 inches* of rain reported to fall over 7 days	--
November 12, 2009	November 12, 2009	Overbank resulting from a total of 4.47 inches* of rain reported to fall over 3 days as the result of Tropical Storm Ida	--
February 9, 2010	February 5, 2010	Visual observations of overbank event including crest gauge, wrack lines, and wrack in saplings from a 1.95-inch* rainfall event on February 5, 2009 that occurred after numerous rainfall events within the 3 weeks prior to that date that totaled 4.43 inches.	1-2
September 28, 2010	September 26-27, 2010	Rainfall data totaling 3.99 inches* over a period of two days.	--
February 2, 2011	February 2, 2011	Visual observations of overbank event including crest gauge, wrack lines, and wrack in saplings from a 2.58-inch* rainfall event on February 2, 2011 that occurred after a 1.89-inch rainfall event the week before.	3
July 21, 2011	April 16, 2011	Visual observations of overbank event including crest gauge, wrack lines, and wrack in saplings from a 2.25-inch* rainfall event on April 16, 2011 that occurred after a total of 2.25 inches of rain that fell the ten days before.	--
August 31, 2011	August 25, 2011	Visual observations of stream overbanking as a result from 6.12-inch* rainfall from Hurricane Irene	4
August 23, 2012	July 24, 2012	Total of 4.52 inches* of rain reported to fall over 5 days	--

* Reported at the Goldsboro Airport (Weather Underground 2012)

Bankfull Event Photos 1-2



Bankfull Event Photo 4



Bankfull Event Photo 3



APPENDIX F
BMP ASSESSMENT DATA
Fixed Photo Stations

**Goldsboro Housing Authority Stream/BMP Project
(EEP Project Number 145)
Fixed-Station Photographs
taken August 21, 2012**






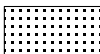

APPENDIX G
SUPPLEMENTAL PLANTING



NOTES:

Vehicle access to staging areas from West Oak Steet.
Gator/4-wheeler access from staging area to project areaa and planting areas.
Project area NOT fenced.
Gator access to planting areas along edge of project area.

Legend

-  Site Entry Points
-  Staging Area
-  Site Access
-  Planting_Zones_EAST
-  Planting_EAST_easements

0 100 200 400 Feet

Supplemental Planting
SITE ACCESS
Goldsboro Housing - EEP #145

October 2010