FINAL
ANNUAL MONITORING REPORT
GOOSE CREEK

STREAM RESTORATION
DURHAM COUNTY, NORTH CAROLINA
(EEP Project Number 147)

Monitoring Year 3 of 5 (2011)

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

August 2011

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Prepared by:
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

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Biohabitats
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Raleigh, North Carolina 27613

Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

August 2011

1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Goose Creek Stream Restoration Site (Site) is located in the City of Durham, North Carolina in a highly developed watershed (Figure 1, Appendix A). Goose Creek is part of the Neuse River Basin (Upper Neuse, Subbasin 03-04-01) and is located in USGS Cataloging Unit 03020201. This project is located in the EEP's *Ellerbe Creek Local Watershed Plan* (http://www.nceep.net/services/lwps/Upper_Neuse/Ellerbe_Creek_Local_Watershed_Plan.pdf) area, which is targeted for mitigation to protect watershed functions, increase aquatic life, decrease destructive flooding, provide recreational opportunities, and protect the Falls Lake drinking water supply. The preproject stream was highly modified and artificially confined by concrete along the southern/upstream channel and banks, and by rock walls in the northern/downstream reach. The project aimed to eradicate artificial hardening structures, and restore a more natural channel geometry and riparian buffer. Project restoration efforts provided 1465 linear feet of stream restoration, 1.38 acres of riparian buffer restoration, and 0.06 acre of riparian buffer enhancement. Tables summarizing project objectives and activities can be found in Appendix B. This report (compiled based on the EEP's *Revised Table of Contents for 2009 Monitoring Report Submissions* Version 1.2.1 dated 6/1/09) summarizes data for year 3 (2011) monitoring.

The goals of the Goose Creek stream restoration project included the following.

- To improve aquatic habitat by removing the fabriform channel liner on the Eastway Elementary School reach (upstream/southern reach) and the stone retaining walls on the Longmeadow Park reach (downstream/northern reach) and reintroduce a more defined and natural riffle/pool channel geometry.
- To improve water quality by reducing nutrient loading from adjacent developed properties through restoration of a riparian buffer.
- To improve terrestrial habitat by restoring a riparian buffer.
- To decrease the sediment and nutrient content of stormwater flow originating in the Barnes Street Redevelopment project site, which flows through the Site and into Goose Creek, through the means of a re-configured stormwater channel which slows stormwater flow, allowing sediment to settle and nutrients to be absorbed by planted vegetation.

Goals were accomplished by removing artificial hardening structures; constructing a natural, stable profile and dimension for the stream channel; and reestablishing a continuous riparian buffer along the stream banks. Project implementation has greatly increased the prominence of riffles and pools in the reach and improved aquatic habitat within the Site.

Success criteria dictate that an average density of 320 stems per acre 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). Based on the number of stems counted, average densities were measured at 496 planted stems per acre surviving in year 3 (2011). The dominant species identified at the Site were planted stems of green ash (*Fraxinus pennsylvanica*), tulip tree (*Liriodendron tulipifera*), and sycamore (*Platanus occidentalis*). All individual plots met success criteria based on planted stems alone.

On March 25, 2011, the EEP completed supplemental planting at the Site with a total of 130 five-gallon and 35 ten-gallon sized containerized plants consisting of Carolina ash (*Fraxinus caroliniana*), ironwood (*Carpinus caroliniana*), persimmon (*Diospyros virginiana*), red maple (*Acer rubrum*), red oak (*Quercus rubra*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), white oak (*Quercus alba*), and elderberry (*Sambucus canadensis*). In addition, three large willow oaks (located on the

downstream/northern reach) that had succumbed to the stress of old age and drought were removed by the City of Durham with the approval of EEP.

Noted vegetation problem areas within the Site, depicted on Figures 2A-2B (Appendix A), include the development of invasive species such as Johnson grass (*Sorghum halepense*) scattered along the northern/downstream reach between Liberty Street and Holloway Street. Other invasive species include small patches of Japanese hops (*Humulus japonicas*) just north of the Liberty Street bridge on the right bank and adjacent to the left bank of the western tributary to the southern/upstream reach. Chinese privet (*Ligustrum sinense*) and Japanese privet (*Ligustrum japonicum*) are located just north of the stormwater wetland and adjacent to the fence just south of the tributary to the southern/upstream reach coming from the west. Scotch broom (*Cytisus scoparius*) is located at the very southeastern corner of the Site and has spread rapidly over the past year; some treatment/control of this species occurred earlier in the monitoring year by cutting plants to remove the seed source. In addition, scattered stems of Bradford pear (*Pyrus calleryana*), white mulberry (*Morus alba*), wintercreeper (*Euonymous fortunei*), and multiflora rose (*Rosa multiflora*) are located adjacent to the southern/upstream reach. Wisteria (*Wisteria frutescens*) is located just north of Liberty Street on the right bank adjacent to the bridge; this is not an invasive species but can be problematic due to its growth habits and potential to shade or girdle planted trees. Currently, invasive species within the Site are not affecting planted tree stem survival or growth and are therefore expected to be shaded out as planted trees mature; however, they will continue to be watched throughout the monitoring period. In addition, an area of sparse herbaceous survival and stunted vegetative growth in the southernmost area of the Site as the result of poor soils.

Success criteria for stream restoration reaches dictate that little to no change from the as-built channel occur over the monitoring period. Year 3 (2011) monitoring measurements indicate that there have been minimal changes in cross-sections and profile downstream of Liberty Street as compared to as-built data. The stream profile upstream of Liberty Street was designed to adjust itself to changes in watershed flows. A total of seven bankfull events are documented to have occurred at the Site with three events in year 1 (2009), three events in year 2 (2010), and one event occurring so far during the year 3 (2011) monitoring period. Noted stream problem areas within the Site include two areas of bank erosion (one on the right bank and one on the left bank) between Cross-sections 5 and 6 (Figure 2B, Appendix A). Rocks from the existing structures have fallen into the stream; however, the compromised structures are not affecting stream stability. Proactive measures are not recommended at this time; however, these areas will continue to be watched throughout the monitoring period.

In summary, the Site achieved success criteria for vegetation and stream attributes in the Third Monitoring Year (2011). 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 are available from EEP upon request.

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Appendices

2.0 METHODOLOGY

2.1 Vegetation Assessment

Following Site construction, four plots (10-meters square) were established and monumented with metal rebar at all plot corners. Sampling was conducted for year 3 (2011) on June 20, 2011 as outlined in 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). The locations of vegetation monitoring plots are depicted on Figure 2 in Appendix A. Visual assessments were completed on June 23, 2011 for year 3 (2011).

2.2 Stream Assessment

Eight 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. Longitudinal profile measurements of the entire Site restoration reaches include thalweg and water surface; with each measurement taken at the head of facets (i.e. riffle, run, pool, and glide) in addition to the maximum pool depth. Visual assessment of in-stream structures was conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure. Stream measurements were completed on February 9, 2011 and March 25, 2011 and are included in Appendix D. Visual assessments were completed on March 25, 2011 and June 23, 2011 for year 3 (2011).

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

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.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado.

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.

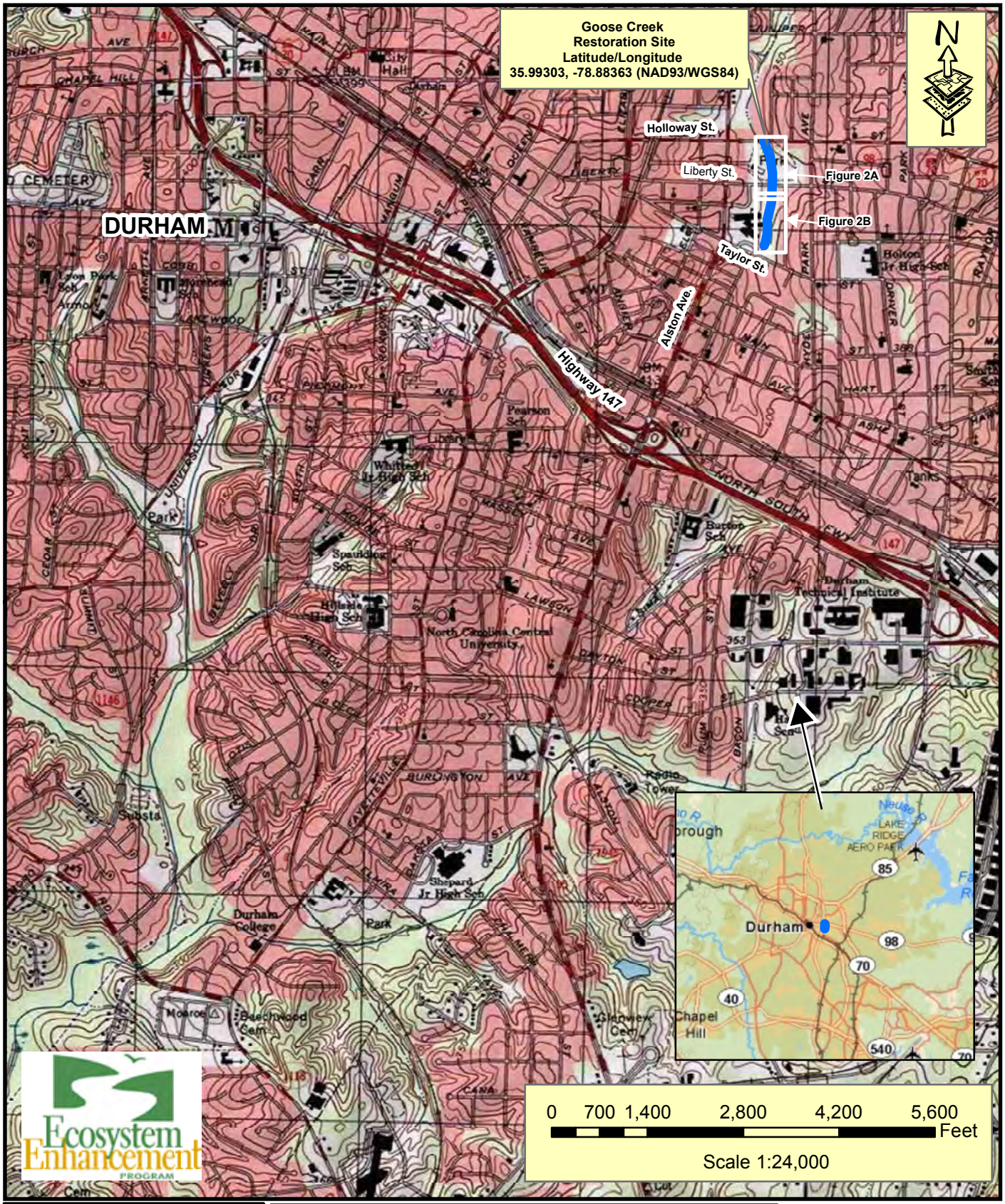
Weather Underground. 2011. Station at Raleigh-Durham Airport, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KRDU/ [June 23, 2011]. Weather Underground.

APPENDIX A

FIGURES AND PLAN VIEWS

Figure 1. Site Location

Figures 2a-2b. Monitoring Plan View



Ecosystem Enhancement Program

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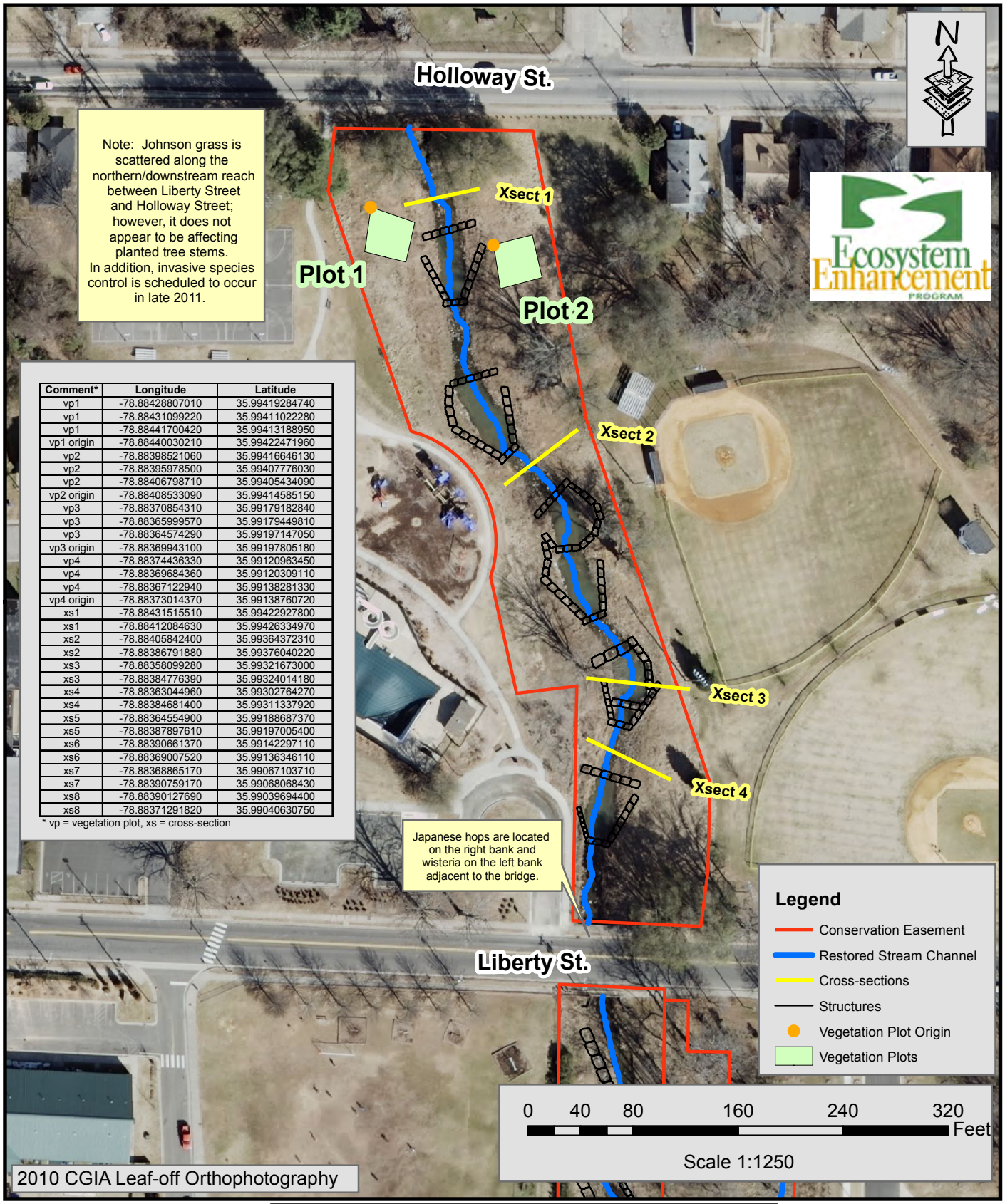
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693

Axiom Environmental, Inc.

SITE LOCATION MAP
GOOSE CREEK SITE
EEP PROJECT NUMBER 147
Durham County, North Carolina

Dwn. by.	CLF
Date:	June 2011
Project:	10-009
FIGURE	1



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vp1	-78.88431099220	35.99411022280
vp1	-78.88441700420	35.99413188950
vp1 origin	-78.88440030210	35.99422471960
vp2	-78.88398521060	35.99416646130
vp2	-78.88395978500	35.99407776030
vp2	-78.88406798710	35.99405434090
vp2 origin	-78.88408533090	35.99414585150
vp3	-78.88370854310	35.99179182840
vp3	-78.88365999570	35.99179449810
vp3	-78.88364574290	35.99197147050
vp3 origin	-78.88369943100	35.99197805180
vp4	-78.88374436330	35.99120963450
vp4	-78.88369684360	35.99120309110
vp4	-78.88367122940	35.99138281330
vp4 origin	-78.88373014370	35.99138760720
xs1	-78.88431515510	35.99422927800
xs1	-78.88412084630	35.99426334970
xs2	-78.88405842400	35.99364372310
xs2	-78.88386791880	35.99376040220
xs3	-78.88358099280	35.99321673000
xs3	-78.88384776390	35.99324014180
xs4	-78.88363044960	35.99302764270
xs4	-78.88384681400	35.99311337920
xs5	-78.88364554900	35.99188687370
xs5	-78.88387897610	35.99197005400
xs6	-78.88390661370	35.99142297110
xs6	-78.88369007520	35.99136346110
xs7	-78.88368865170	35.99067103710
xs7	-78.88390759170	35.99068068430
xs8	-78.88390127690	35.99039694400
xs8	-78.88371291820	35.99040630750

* vp = vegetation plot, xs = cross-section

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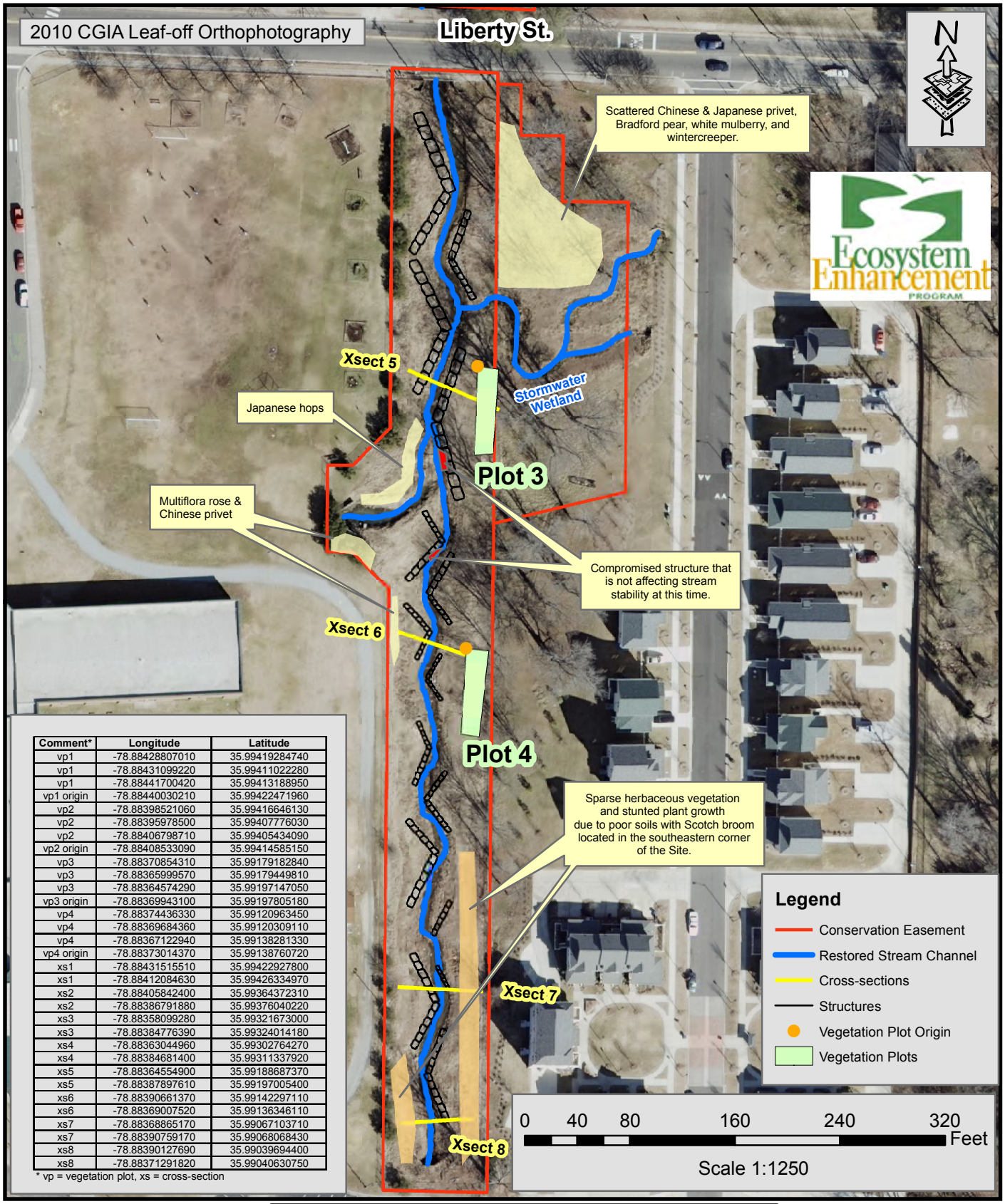
MONITORING PLAN VIEW
GOOSE CREEK SITE
EEP PROJECT NUMBER 147
Durham County, North Carolina

Dwn. by: CLF
Date: Aug 2011
Project: 10-009

FIGURE
2A



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vp1 origin	-78.88440030210	35.99422471960
vp2	-78.88398521060	35.99416646130
vp2	-78.88395978500	35.99407776030
vp2	-78.88406798710	35.99405434090
vp2 origin	-78.88408533090	35.99414585150
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vp3	-78.88365999570	35.99179449810
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xs4	-78.88384681400	35.99311337920
xs5	-78.88364554900	35.99188687370
xs5	-78.88387897610	35.99197005400
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xs6	-78.88369007520	35.99136346110
xs7	-78.88368865170	35.99067103710
xs7	-78.88390759170	35.99068068430
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* vp = vegetation plot, xs = cross-section

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MONITORING PLAN VIEW
GOOSE CREEK SITE
EEP PROJECT NUMBER 147
Durham County, North Carolina

Dwn. by: CLF
Date: July 2011
Project: 10-009

FIGURE
2B

APPENDIX B

GENERAL PROJECT TABLES

Table 1. Site Restoration Structures and Objectives

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Attributes Table

Table 1. Site Restoration Structures and Objectives
Goose Creek Restoration Site (EEP Project Number 147)

Reach	Pre-Project Length (ft)	Stationing	Restoration Level	Approach	Planted Easement Acreage	Buffer Restoration (acres)*	Buffer Enhancement (acres)*	Restoration Length (ft)**
Eastway Upstream	514	3+48-8+61	Restoration	P2	0.86	--	-	514
Eastway Downstream	347	0+00-3+47	Restoration	P2	1.4	0.58	0.06	347
Longmeadow Park Section	659	0+55-6+59	Restoration	P2	1.69	0.8	--	604
TOTALS	**1500**				**3.95**	**1.38**	**0.06**	**1465**

Component Summations

Restoration Level	Stream (linear feet)	Restoration Buffer (acres)*
Restoration	1465	1.38
Enhancement	--	0.06
TOTALS	**1465 linear feet**	**1.44 acres**
	1465 SMUs	**1.41 BMUs**

*Buffer restoration and enhancement is to be used to mitigate for buffer impacts per the Neuse River Buffer Rules
**Restored length of Longmeadow reach does not include 55 feet of stream between the end of the project and the Holloway Street culvert that was not restored.

Table 2. Project Activity and Reporting History
Goose Creek Restoration Site (EEP Project Number 147)

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	July 2005	October 2005
Final Design-Construction Plans	November 2006	April 2008
Construction	--	September 2008
Permanent Seeding Completed	--	September 2008
As-Builts	October 2008	December 2008
Planting	--	February 2009
Mitigation Plan	March 2009	March 2009
Year 1 (2009) Monitoring	October 2009	November 2009
Year 2 (2010) Monitoring	August 2010	January 2011
Year 3 (2011) Monitoring	June 2011	July 2011

Table 3. Project Contacts Table
Goose Creek Restoration Site (EEP Project Number 147)

Designer Biohabitats, Inc	8918 Creedmoor Road, Suite 200 Raleigh, NC 27613 Kevin Nunnery 919-518-0311
Construction Contractor Shamrock Environmental, Inc	6106 Corporate Park Dr. Browns Summit, NC 27214 Dan Albert 336-375-1989
Survey Contractor Level Cross Surveying, PLLC	668 Marsh Country Lane Randleman, NC 23717 Sheri Willard 336-495-1713
Planting Contractor Southern Garden, Inc	1932 Holt Rd Cary, NC 27519 Todd Laakso 919-362-1050
Seed Mix Suppliers Green-Resource	1218 Management Way, Garner, NC 27529 Rodney Montgomery 919-779-4727
Planting Stock Suppliers Container Stock-Cure Nursery	880 Buteo Ridge Road Pittsboro, NC 27312 Bill Cure 919-542-6186
Balled in Burlap Taylor's Nursery	3705 New Bern Ave Raleigh, NC 27610 Richard Taylor 919 231-6161
Year 1-3 (2009-11) Monitoring Performer Axiom Environmental, Inc.	218 Snow Avenue Raleigh, NC 27603 Grant Lewis (919) 215-1693

Table 4. Project Attribute Table
Goose Creek Restoration Site (EEP Project Number 147)

Project County	Durham		
Physiographic Region	Piedmont		
Ecoregion	Triassic Basin		
Project River Basin	Neuse		
USGS HUC for Project (14 digit)	3020201050010		
NCDWQ Sub-basin for Project	03-04-01		
Within extent of EEP Watershed Plan?	Ellerbe Creek Local Watershed Plan		
WRC Hab Class (Warm, Cool, Cold)	Warm		
% of project easement demarcated	100%		
Beaver activity observed?	No		
	Eastway upstream	Eastway downstream	Longmeadow
Drainage area	350	396	481
Stream order	2	2	2
Restored length (feet)	514	347	604
Perennial or Intermittent	perennial	perennial	perennial
Watershed type (Rural, Urban, etc.)	urban	urban	urban
Watershed LULC Distribution (%)			
Urban-Low Intensity Developed	44	44	43
Urban-High Intensity Developed	22	22	22
Residential Urban	18	18	19
Forest, Herbaceous, Open Water	16	16	16
Watershed impervious cover (%)	~55	~55	~54
NCDWQ AU/Index number	27-5-1	27-5-1	27-5-1
NCDWQ classification	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW
303d listed?	no	no	no
Upstream of a 303d listed segment?	yes	yes	yes
Reasons for 303d listing or stressor	urban stormwater	urban stormwater	urban stormwater
Total acreage of easement	0.9	1.4	1.7
Rosgen classification of pre-existing	N/A	N/A	N/A
Rosgen classification of As-built	Bc5	Bc5	Bc5
Valley type/slope	N/A	N/A	N/A
Valley side slope range (e.g. 2-3.%)	10-15%	10-15%	10-15%
Valley toe slope range (e.g. 2-3.%)	3-5%	3-5%	3-5%
Dominant soil series/characteristics			
Series	Whitestore-Urban	Whitestore-Urban	Whitestore-Urban
Depth	60"	60"	60"
Clay%	5-70	5-70	5-70

Used N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

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
Goose Creek Restoration Site (EEP Project Number 147)

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

Goose Creek Restoration Site
Year 3 (2011) Annual Monitoring
Vegetation Plot Photos (taken June 20, 2011)

Table 6. Vegetation Metadata Table
Goose Creek Restoration Site (EEP Project Number 147)

Report Prepared By	Corri Faquin
Date Prepared	6/22/2011 13:17
database name	Axiom-EEP-2011-C.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	41750528
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	147
project Name	Goose Creek
Description	
River Basin	Neuse
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	4

Table 7. Total and Planted Stems by Plot and Species
EEP Project Code 147. Project Name: Goose Creek

			Current Plot Data (MY3 2011)												Annual Means											
			E147-AXE-0001			E147-AXE-0002			E147-AXE-0003			E147-AXE-0004			MY3 (2011)			MY2 (2010)			MY1 (2009)			MY0 (2009)		
Scientific Name	Common Name	Species Type	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 negundo	boxelder	Tree							1	1	1				1	1	1			2						
Acer rubrum	red maple	Tree	1	1	1	1	1	1							2	2	2	1	1	1	1	1	1	1	1	1
Acer saccharinum	silver maple	Tree																						2	2	2
Amelanchier arborea	common serviceberry	Shrub Tree	2	2	2				1	1	1				3	3	3	3	3	3	3	3	3	3	3	3
Baccharis halimifolia	eastern baccharis	Shrub Tree						2			1						3			7						
Betula nigra	river birch	Tree							1	1	1	2	2	2	3	3	3	2	2	4	2	2	2	11	11	11
Callicarpa americana	American beautyberry	Shrub	2	2	2				1	1	1				3	3	3	3	3	3	3	3	3	3	3	3
Catalpa bignonioides	southern catalpa	Tree																		8						
Cephalanthus occidentalis	common buttonbush	Shrub Tree																			1	1	1	10	10	10
Cercis canadensis	eastern redbud	Shrub Tree							1	1	1	2	2	2	3	3	3	2	2	3	2	2	2	3	3	3
Cornus	dogwood	Shrub Tree				1	1	1							1	1	1	1	1	1	1	1	1			
Fraxinus	ash	Shrub Tree			9			3									12									
Fraxinus caroliniana	Carolina ash	Shrub Tree	1	1	1	1	1	1							2	2	2									
Fraxinus pennsylvanica	green ash	Tree				1	1	1	3	3	3	5	5	5	9	9	9	9	9	22	7	7	7			
Ilex decidua	possumhaw	Shrub Tree	1	1	1							1	1	1	2	2	2	2	2	2	2	2	2	7	7	7
Juniperus virginiana	eastern redcedar	Tree						1									1			1						
Liquidambar styraciflua	sweetgum	Tree						1									1			4						
Liriodendron tulipifera	tuliptree	Tree				3	3	3				4	4	4	7	7	7	8	8	9	10	10	10	10	10	10
Morus	mulberry	Shrub Tree																		93						
Morus alba	white mulberry	Shrub Tree			4			3			19			1			27									
Morus rubra	red mulberry	Tree																		2						
Oxydendrum arboreum	sourwood	Shrub Tree																			2	2	2	4	4	4
Platanus occidentalis	American sycamore	Tree				3	3	4				3	3	3	6	6	7	4	4	14	5	5	5	6	6	6
Prunus serotina	black cherry	Shrub Tree				1	1	1							1	1	1	1	1	1	1	1	1	1	1	1
Quercus	oak	Shrub Tree																						3	3	3
Quercus falcata	southern red oak	Tree				1	1	1							1	1	1									
Quercus phellos	willow oak	Tree							2	2	2	2	2	2	4	4	4	4	4	4	4	4	4			
Ulmus	elm	Tree			1												1			1						
Unknown		unknown																						1	1	1
Viburnum dentatum	southern arrowwood	Shrub Tree	1	1	1										1	1	1	1	1	1	1	1	1			
		Stem count	8	8	22	12	12	23	10	10	30	19	19	20	49	49	95	41	41	186	45	45	45	65	65	65
		size (ares)	1			1			1			1			4			4			4			4		
		size (ACRES)	0.02			0.02			0.02			0.02			0.10			0.10			0.10			0.10		
		Species count	6	6	9	8	8	13	7	7	9	7	7	8	16	16	22	13	13	21	15	15	15	14	14	14
		Stems per ACRE	323.7	323.7	890.3	485.6	485.6	930.8	404.7	404.7	1214	768.9	768.9	809.4	495.7	495.7	961.1	414.8	414.8	1882	455.3	455.3	455.3	657.6	657.6	657.6

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 exclusing livestakes
P-all = All planted stems including livestakes
T = All planted and natural recruit stems including livestakes
Total includes natural recruit stems

APPENDIX D

STREAM ASSESSMENT DATA

Table 8. Verification of Bankfull Events

Table 9a. North Reach Goose Creek Qualitative Stability Assessment

Table 9b. South Reach Goose Creek Qualitative Stability Assessment

Cross-section Plots and Tables

Longitudinal Profile Plots

Pebble Count Plots

Table 8. Verification of Bankfull Events

Goose Creek Restoration Site (EEP Project Number 147)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
November 11, 2009	November 11, 2009	Visual observation of overbank as the result of Tropical Storm Ida	1-2
September 29, 2010	June 11, 2009	Visual observation of overbank in addition to a total of 0.82 inches* of rain occurring after numerous rain events, within the 2 weeks prior, that totaled 2.75 inches*.	--
September 29, 2010	September 23, 2009	Visual observations of wrack lines within the floodplain with a total of 1.7 inches* of rain occurring within a 2-day period from September 22-23, 2009.	--
February 10, 2010	February 5, 2010	Visual observations of overbank event including wrack lines and sediment deposition resulting from a 1.37 inch* rainfall event on February 5, 2009 that occurred after numerous rainfall events, within the 3 weeks prior, that totaled 3.94 inches*.	3-4
September 29, 2010	May 23, 2010	A total of 4.57 inches* of rain occurring between May 16-23, 2010.	--
September 29, 2010	September 27, 2010	A total of 2.9 inches* of rain fall between September 26-27, 2010 with more rain expected to follow.	--
June 23, 2011	May 27, 2011	Visual observations of overbank event including wrack lines resulting from a 1.64 inch* rainfall event on May 27, 2011.	5

* Reported at the Raleigh-Durham Airport (Weather Underground 2011)

Bankfull Event Photos 1-2 showing an overbank event

Bankfull Event Photos 3-4 showing evidence of a recent overbank event

Bankfull Event Photo 5 showing wrack due to a recent overbank event

Table 9a. Eastway (Southern/Upstream) Reach Goose Creek Qualitative Visual Stability Assessment (861 linear feet)

Goose Creek Restoration Site (EEP Project Number 147)

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	7	7	N/A	100	**100**
	2. Armor stable (e.g. no displacement)?	7	7	N/A	100	
	3. Facet grade appears stable?	7	7	N/A	100	
	4. Minimal evidence of embedding/fining?	7	7	N/A	100	
	5. Length appropriate?	7	7	N/A	100	
B. Pools	1. Present? (e.g. no severe aggradation)	6	6	N/A	100	**100**
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	6	6	N/A	100	
	3. Length appropriate?	6	6	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	NA	NA	N/A		**N/A**
	2. Downstream of meander centering?	NA	NA	N/A		
D. Meanders	1. Outer bend in state of limited/controlled erosion?	NA	NA	N/A		**N/A**
	2. Of those eroding, # w/ concomitant point bar formation?	NA	NA	N/A		
	3. Apparent Rc within spec?	NA	NA	N/A		
	4. Sufficient floodplain access and relief?	NA	NA	N/A		
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	**100**
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	0	100	**100**
G. Vanes	1. Free of back or arm scour?	13	15	N/A	87	**100**
	2. Height appropriate?	13	15	N/A	87	
	3. Angle and geometry appear appropriate?	15	15	N/A	100	
	4. Free of piping or other structural failures?	13	15	N/A	87	
H. Wads / Boulders	1. Free of scour?	N/A	N/A	N/A	N/A	**N/A**
	2. Footing stable?	N/A	N/A	N/A	N/A	

Table 9b. Long Meadow (Northern/Downstream) Reach Goose Creek Qualitative Visual Stability Assessment (659 linear feet)

Goose Creek Restoration Site (EEP Project Number 147)

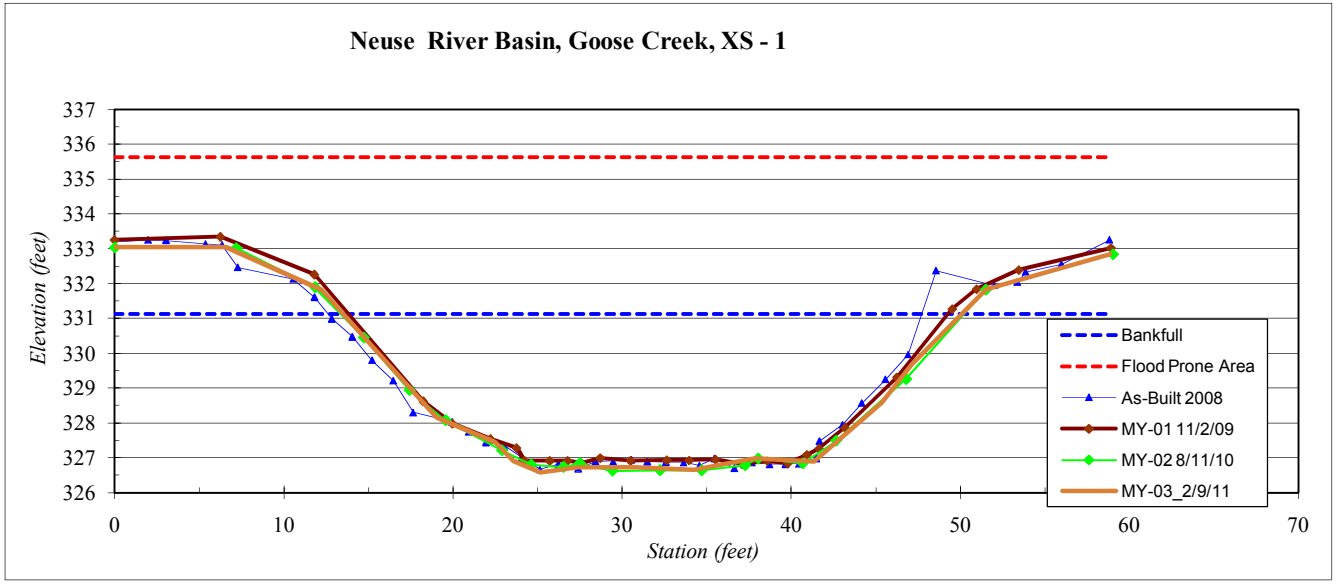
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	9	9	N/A	100	**100**
	2. Armor stable (e.g. no displacement)?	9	9	N/A	100	
	3. Facet grade appears stable?	9	9	N/A	100	
	4. Minimal evidence of embedding/fining?	9	9	N/A	100	
	5. Length appropriate?	9	9	N/A	100	
B. Pools	1. Present? (e.g. no severe aggradation)	7	7	N/A	100	**100**
	2. Sufficiently deep (Dmax pool:Mean Bkf > 2.2?)	7	7	N/A	100	
	3. Length appropriate?	7	7	N/A	100	
C. Thalweg	1. Upstream of meander bend centering?	NA	NA	N/A		**N/A**
	2. Downstream of meander centering?	NA	NA	N/A		
D. Meanders	1. Outer bend in state of limited/controlled erosion?	NA	NA	N/A		**N/A**
	2. Of those eroding, # w/ concomitant point bar formation?	NA	NA	N/A		
	3. Apparent Rc within spec?	NA	NA	N/A		
	4. Sufficient floodplain access and relief?	NA	NA	N/A		
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0	100	**100**
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0	100	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A	N/A	20	98	**98**
G. Vanes	1. Free of back or arm scour?	N/A	N/A	N/A		**N/A**
	2. Height appropriate?	N/A	N/A	N/A		
	3. Angle and geometry appear appropriate?	N/A	N/A	N/A		
	4. Free of piping or other structural failures?	N/A	N/A	N/A		
H. Wads / Boulders	1. Free of scour?	N/A	N/A	N/A		**N/A**
	2. Footing stable?	N/A	N/A	N/A		

River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 1
Feature	Riffle
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.00	333.04
6.55	333.04
12.23	331.82
14.80	330.43
19.04	328.16
22.49	327.44
23.57	326.91
25.19	326.58
27.39	326.73
30.75	326.73
34.24	326.65
37.85	326.98
41.34	326.89
45.37	328.58
47.15	329.69
51.53	331.83
58.88	332.84

SUMMARY DATA	
Bankfull Elevation:	331.1
Bankfull Cross-Sectional Area:	120.5
Bankfull Width:	36.5
Flood Prone Area Elevation:	335.6
Flood Prone Width:	170.0
Max Depth at Bankfull:	4.5
Mean Depth at Bankfull:	3.3
W / D Ratio:	11.1
Entrenchment Ratio:	4.7
Bank Height Ratio:	1.0

Stream Type	E

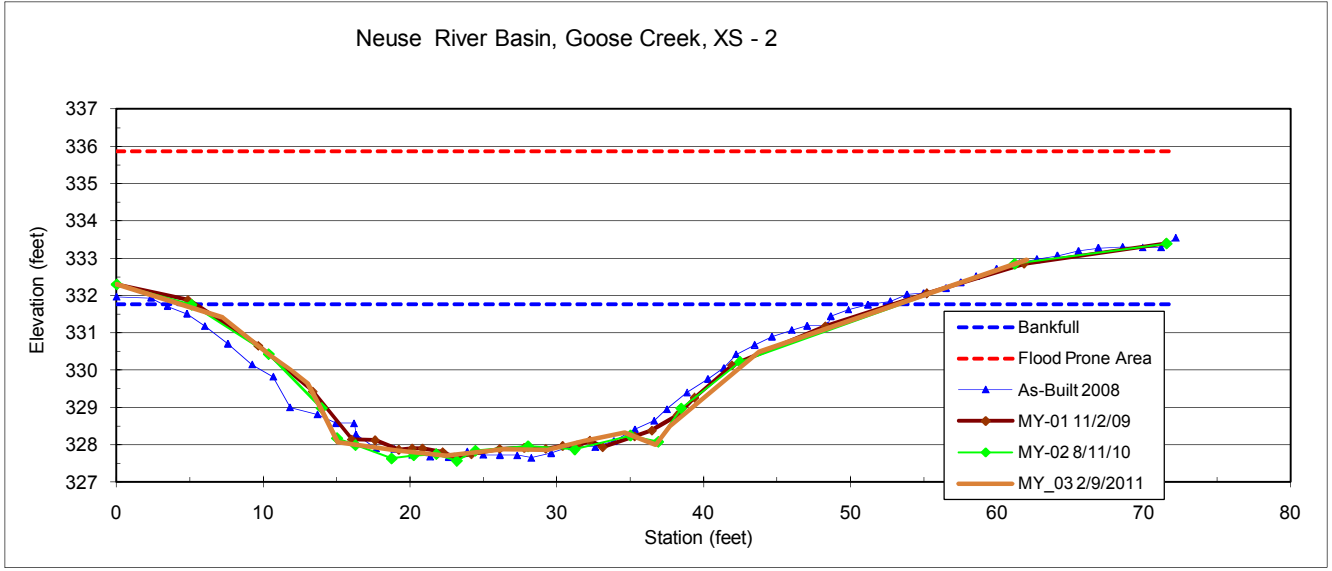


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 2
Feature	Riffle
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.00	332.30
7.23	331.42
10.44	330.40
11.83	330.03
13.03	329.65
13.86	329.02
15.06	328.07
19.11	327.84
22.43	327.71
26.37	327.88
29.38	327.86
31.85	328.11
34.62	328.33
36.74	327.99
37.69	328.49
43.8	330.48
62.0	332.95

SUMMARY DATA	
Bankfull Elevation:	331.8
Bankfull Cross-Sectional Area:	120.4
Bankfull Width:	49.1
Flood Prone Area Elevation:	335.9
Flood Prone Width:	300.0
Max Depth at Bankfull:	4.1
Mean Depth at Bankfull:	2.5
W / D Ratio:	20.0
Entrenchment Ratio:	6.1
Bank Height Ratio:	1.0

Stream Type	E/C

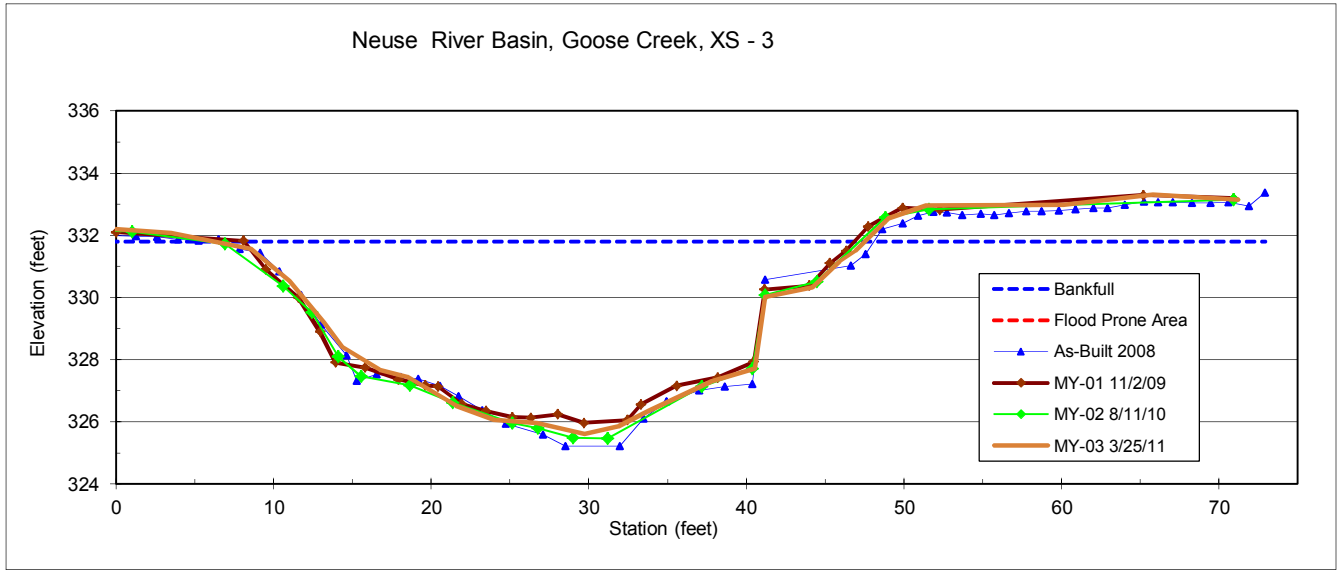


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 3
Feature	Pool
Date:	3/25/2011
Field Crew:	Dean, Perkinson

Station	Elevation
-8.2	332.34
-2.9	332.30
3.5	332.07
8.6	331.55
11.0	330.54
13.2	329.19
14.4	328.39
16.8	327.66
18.5	327.43
21.6	326.52
24.0	326.06
26.8	325.97
29.7	325.61
31.9	325.85
33.8	326.34
37.8	327.30
40.5	327.70
41.2	330.01
44.2	330.32
46.0	331.17
46.9	331.49
49.0	332.54
51.4	332.96
60.2	332.99
65.8	333.31
71.2	333.14

SUMMARY DATA	
Bankfull Elevation:	331.8
Bankfull Cross-Sectional Area:	153.3
Bankfull Width:	41.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	6.2
Mean Depth at Bankfull:	3.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	1.0

Stream Type	-

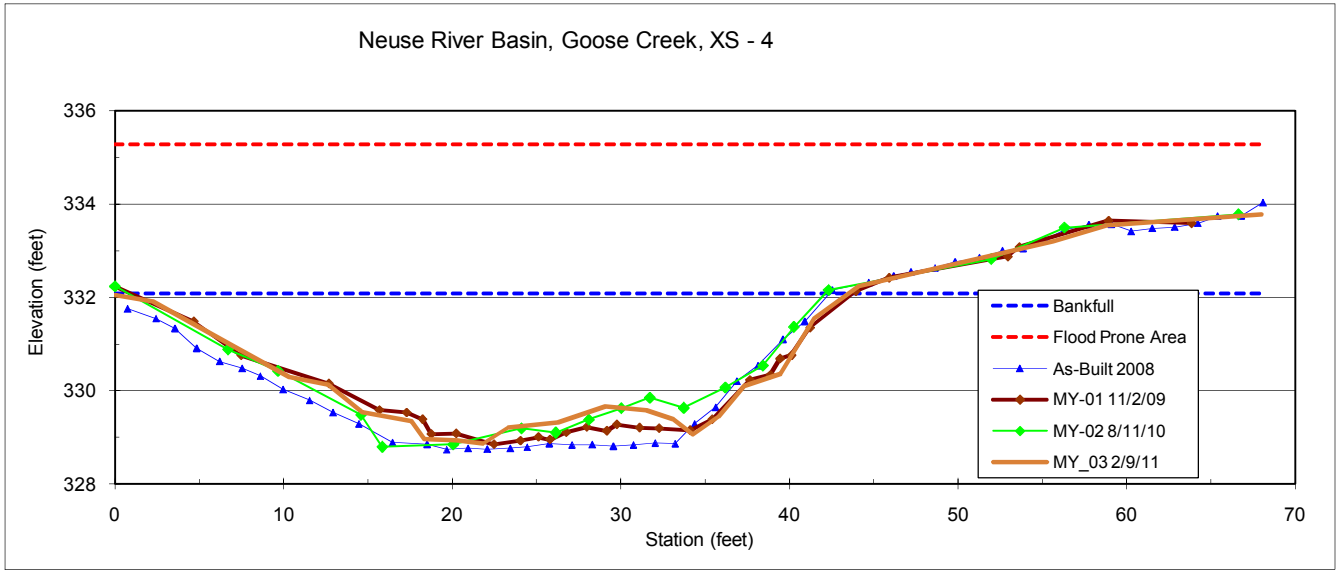


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 4
Featuer	Riffle
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	332.1
2.2	331.9
7.0	330.9
10.3	330.3
12.6	330.1
14.7	329.5
17.6	329.4
18.4	329.0
20.3	328.9
21.8	328.9
23.3	329.2
26.3	329.3
29.1	329.7
31.5	329.6
33.1	329.39
34.3	329.05
35.8	329.44
37.3	330.11
39.5	330.37
41.5	331.56
44.1	332.24
55.7	333.20
58.9	333.55
68.0	333.78

SUMMARY DATA	
Bankfull Elevation:	332.1
Bankfull Cross-Sectional Area:	86.0
Bankfull Width:	43.5
Flood Prone Area Elevation:	335.3
Flood Prone Width:	240.0
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	2.0
W / D Ratio:	22.0
Entrenchment Ratio:	5.5
Bank Height Ratio:	1.0

Stream Type	C

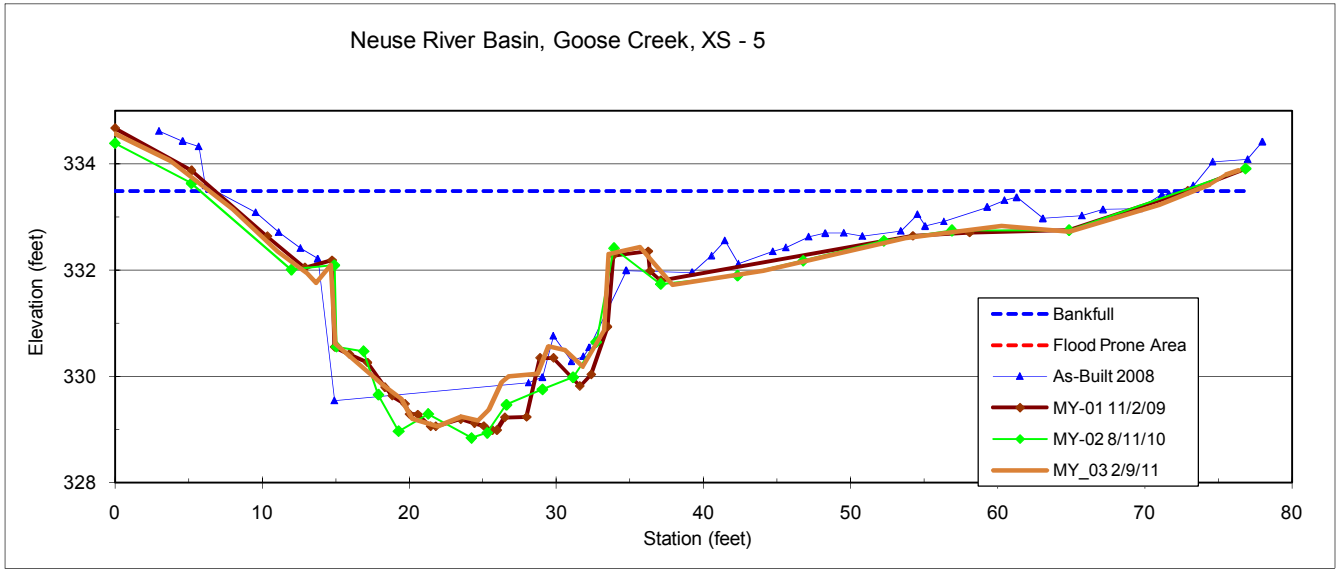


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 5
Feature	Pool
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	334.4
5.2	333.6
12.0	332.0
14.9	332.1
15.1	330.6
16.9	330.5
17.9	329.7
19.3	329.0
21.3	329.3
24.2	328.8
25.3	328.9
26.6	329.5
29.1	329.8
31.1	330.0
32.7	330.6
33.9	332.4
37.1	331.7
42.3	331.9
46.8	332.2
52.3	332.6
56.9	332.8

SUMMARY DATA	
Bankfull Elevation:	333.5
Bankfull Cross-Sectional Area:	114.9
Bankfull Width:	67.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.4
Mean Depth at Bankfull:	1.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	-

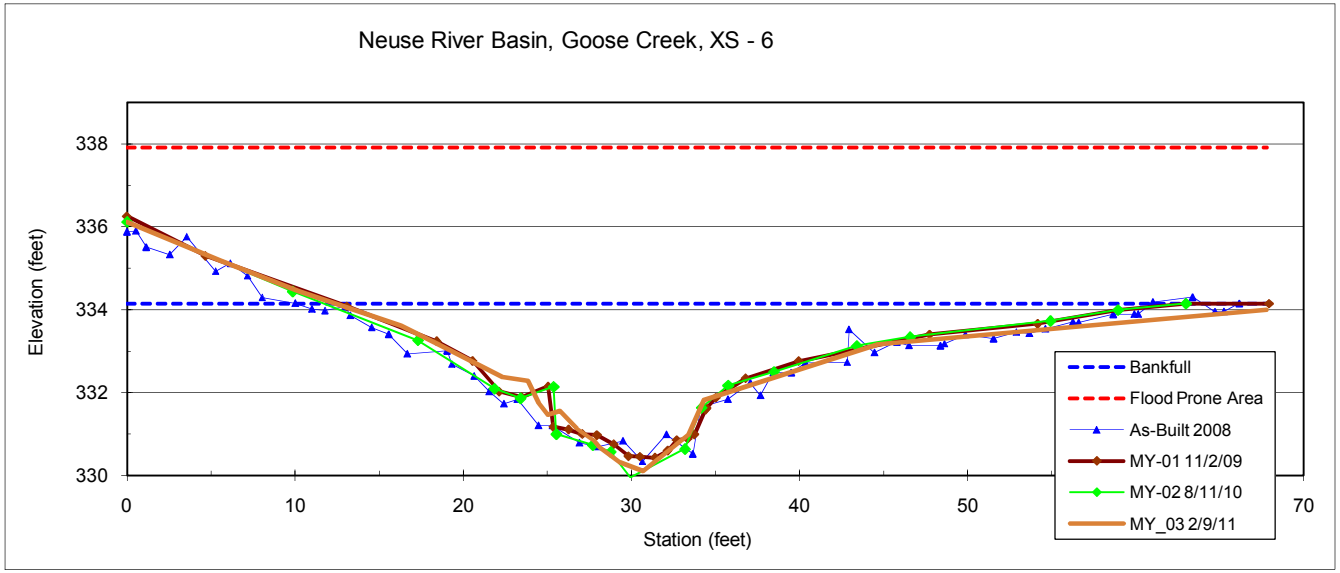


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 6
Feature	Riffle
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	336.1
5.5	335.2
10.2	334.4
16.3	333.6
18.7	333.1
22.3	332.4
23.8	332.3
24.5	331.7
25.0	331.5
25.8	331.6
26.8	331.1
27.8	330.9
28.1	330.7
29.3	330.3
30.7	330.1
33.4	331.0
34.3	331.8
44.7	333.2
67.8	334.0

SUMMARY DATA	
Bankfull Elevation:	334.0
Bankfull Cross-Sectional Area:	67.2
Bankfull Width:	54.4
Flood Prone Area Elevation:	337.9
Flood Prone Width:	162.0
Max Depth at Bankfull:	3.9
Mean Depth at Bankfull:	1.2
W / D Ratio:	44.1
Entrenchment Ratio:	3.0
Bank Height Ratio:	1.0

Stream Type	C

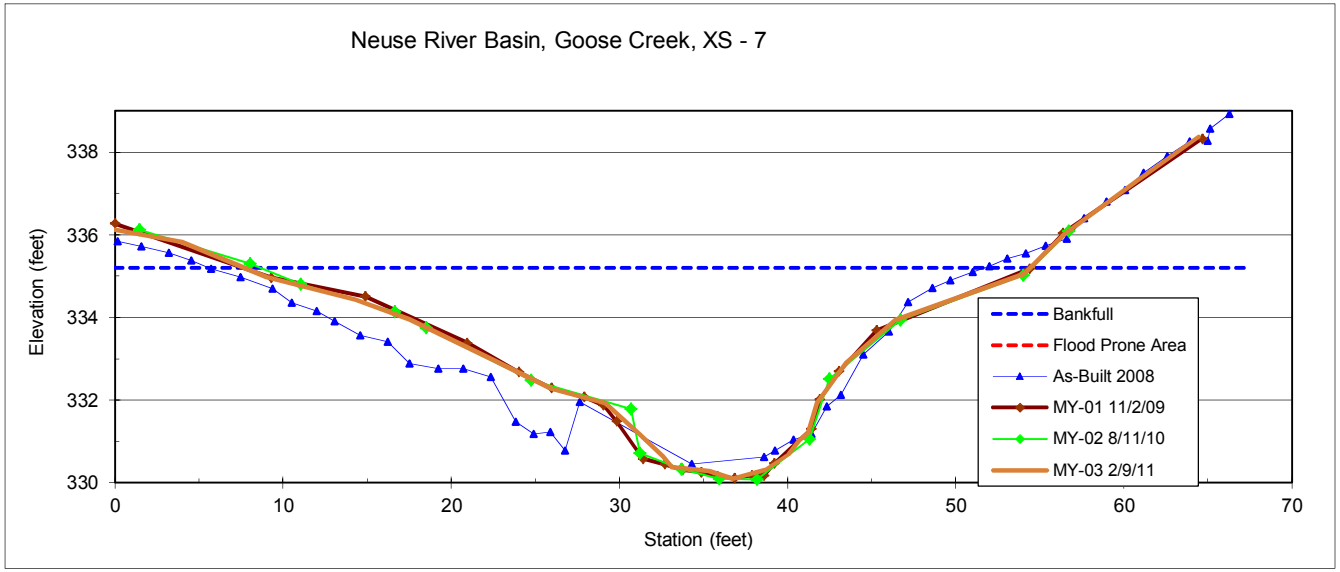


River Basin:	Neuse
Watershed:	Goose Creek
XS ID	XS - 7
Feature	Pool
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
0.0	336.1
4.0	335.8
9.0	335.0
14.3	334.4
17.5	334.0
22.5	333.0
25.9	332.3
29.2	331.9
31.2	331.2
32.6	330.6
33.1	330.4
34.3	330.3
35.3	330.3
36.8	330.1
38.7	330.3
40.1	330.7
40.7	331.0
41.2	331.2
41.8	331.9
43.5	332.9
46.4	333.9
54.1	335.1
56.4	336.0
60.9	337.3
64.4	338.4

SUMMARY DATA	
Bankfull Elevation:	335.2
Bankfull Cross-Sectional Area:	103.8
Bankfull Width:	46.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	5.1
Mean Depth at Bankfull:	2.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	-

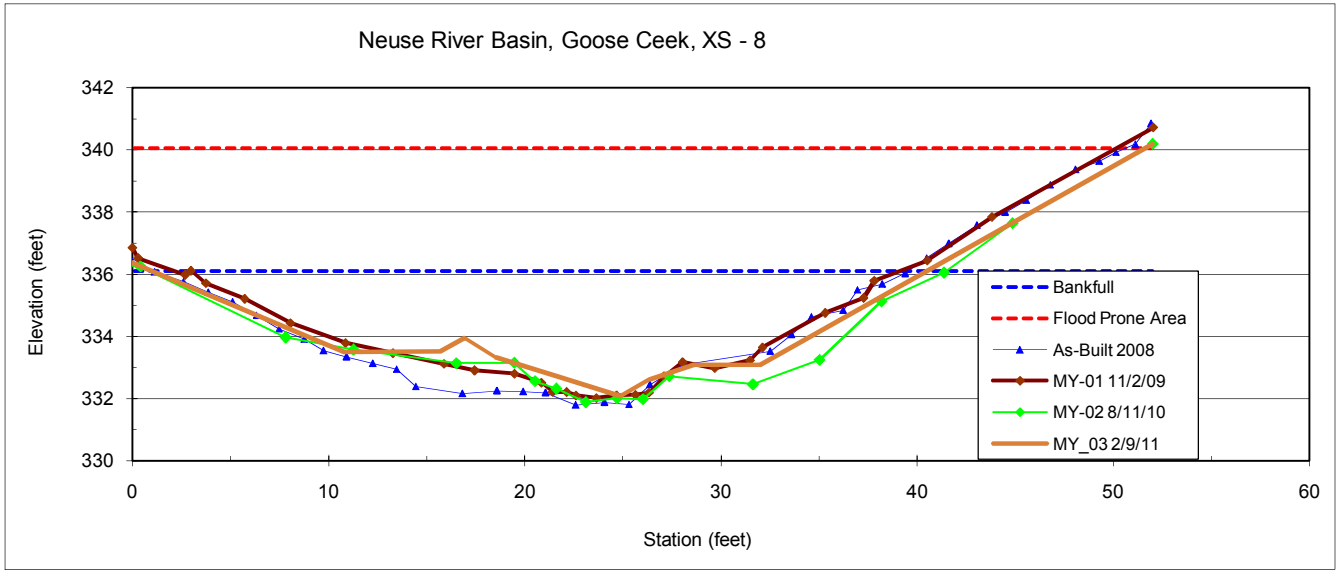


River Basin:	Neuse
Watershed:	Goose Ceek
XS ID	XS - 8
Feature	Riffle
Date:	2/9/2011
Field Crew:	Dean, Perkinson

Station	Elevation
-3.0	336.5
-0.1	336.4
10.8	333.5
15.7	333.5
16.9	333.9
18.5	333.3
21.8	332.7
24.9	332.1
26.3	332.6
28.6	333.1
32.0	333.1
52.0	340.2

SUMMARY DATA	
Bankfull Elevation:	336.1
Bankfull Cross-Sectional Area:	87.7
Bankfull Width:	39.2
Flood Prone Area Elevation:	340.1
Flood Prone Width:	170.0
Max Depth at Bankfull:	4.0
Mean Depth at Bankfull:	2.2
W / D Ratio:	17.5
Entrenchment Ratio:	4.3
Bank Height Ratio:	1.0

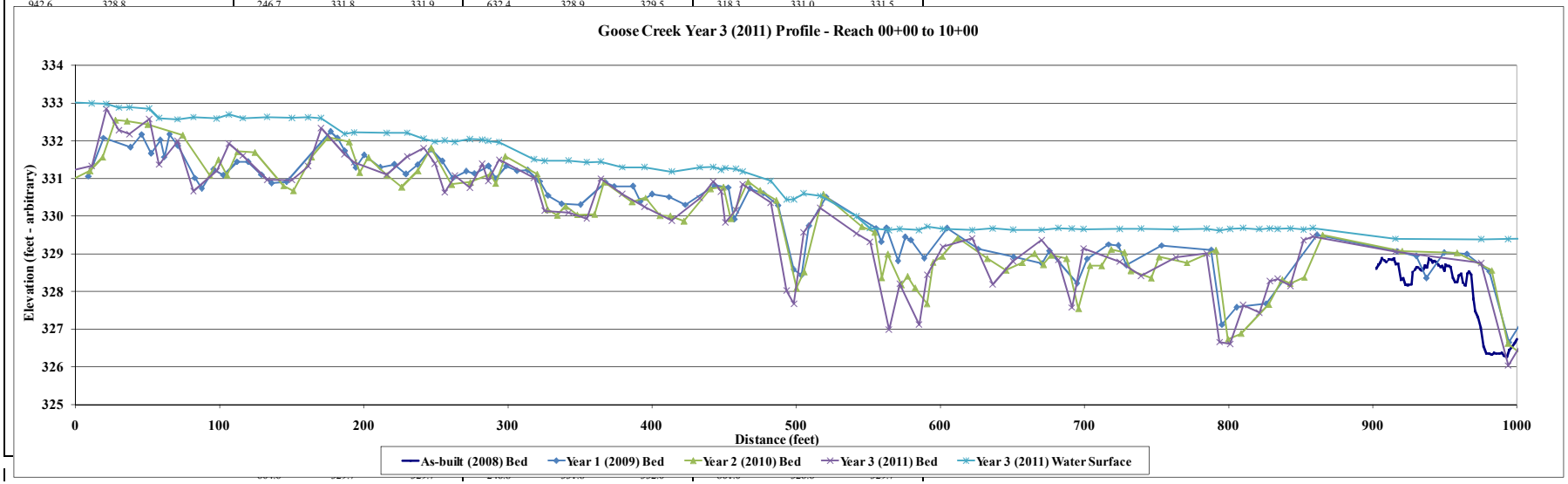
Stream Type	E/C



Project Name	Goose Creek - Year 3 (2011) Profile
Reach	00+00 to 10+00
Feature	Profile
Date	2/9/11
Crew	Dean, Perkinson

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
902.6	328.6		0.0		332.3	1001.6	326.4	329.3	-6.7	331.2	333.0
903.9	328.7		9.1	331.1	332.3	993.7	326.6	329.3	11.4	331.3	333.0
905.2	328.8		19.6	332.1	332.3	982.5	328.6	329.3	21.4	332.8	333.0
906.4	328.9		38.4	331.8		958.4	329.0	329.3	30.2	332.3	332.9
907.9	328.8		46.1	332.2	332.2	920.3	329.1	329.3	37.5	332.2	332.9
909.4	328.8		52.6	331.7	332.3	865.1	329.5		51.3	332.6	332.8
911.2	328.9		59.1	332.0	332.3	852.5	328.4	329.5	58.0	331.4	332.6
913.4	328.8		61.7	331.6	332.3	842.6	328.2	329.5	71.0	332.0	332.6
914.7	328.9		65.3	332.2	332.4	837.0	328.3	329.5	81.9	330.7	332.6
916.2	328.7		71.2	331.9	332.4	827.8	327.7	329.5	98.1	331.2	332.6
917.6	328.7		83.0	331.0	332.3	808.5	326.9	329.5	106.6	331.9	332.7
919.6	328.3		87.9	330.7	332.3	799.6	326.7	329.4	116.3	331.6	332.6
921.2	328.3		96.0	331.2	332.3	791.1	329.1	329.5	133.0	331.0	332.6
922.7	328.2		102.8	331.1	332.3	771.0	328.8	329.4	150.2	331.0	332.6
924.4	328.2		112.2	331.4	332.3	751.6	328.9	329.5	161.6	331.3	332.6
926.7	328.2		120.0	331.4	332.3	746.2	328.4	329.5	170.4	332.3	332.6
927.8	328.5		129.1	331.1	332.3	732.1	328.5	329.5	186.7	331.6	332.2
929.2	328.6		136.3	330.9	332.3	727.6	329.0	329.5	193.4	331.4	332.2
930.3	328.6		146.6	330.9	332.3	718.5	329.1	329.5	216.1	331.1	332.2
931.5	328.6		177.2	332.2	332.3	711.7	328.7	329.5	230.1	331.6	332.2
932.7	328.6		181.8	332.1	332.1	703.7	328.7	329.5	241.7	331.8	332.1
933.8	328.6		186.9	331.7	331.9	695.8	327.5	329.5	249.4	331.4	332.0
935.1	328.6		194.6	331.3	331.9	687.5	328.9	329.5	256.1	330.6	332.0
936.1	328.7		200.5	331.6	331.9	676.9	329.0	329.5	263.4	331.1	332.0
937.5	328.6		211.7	331.3	331.9	671.4	328.7	329.5	273.6	330.8	332.0
938.8	328.9		221.4	331.4	332.0	665.3	329.0	329.5	282.3	331.4	332.0
940.3	328.8		229.3	331.1	331.9	656.7	328.8	329.5	286.4	330.9	332.0
941.4	328.8		237.5	331.4	331.9	645.4	328.6	329.5	294.0	331.5	332.0
942.6	328.8		246.7	331.8	331.9	632.4	328.9	329.5	318.3	331.0	331.5

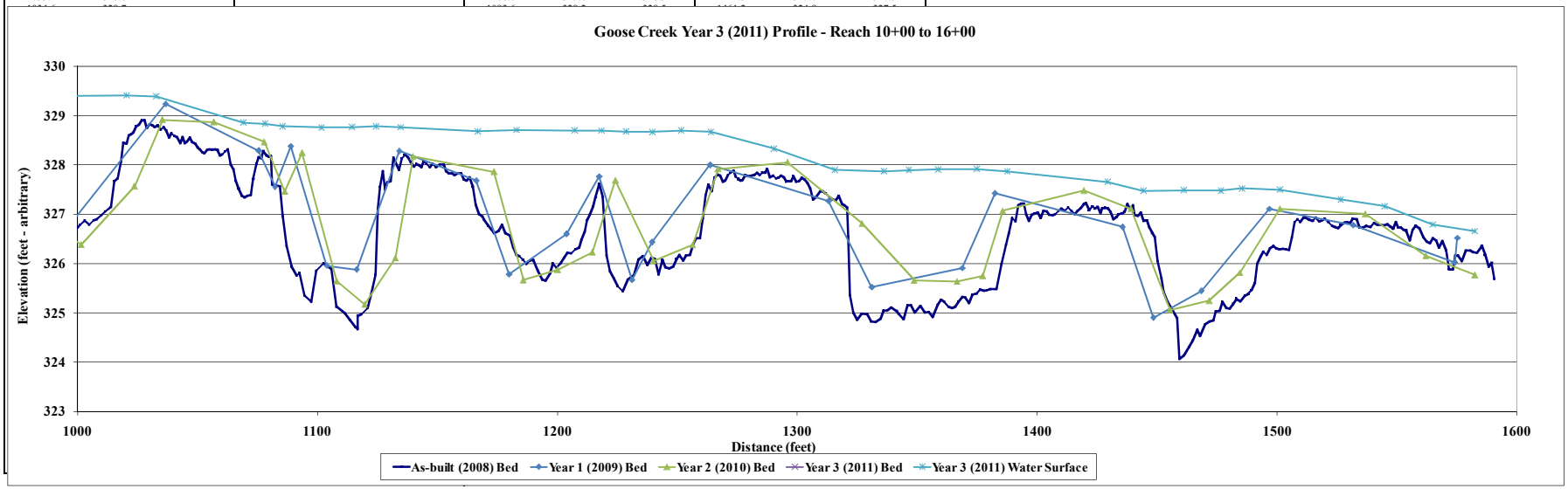
	2009	2010	2011	2012
Avg. Water Surface Slope	0.0037	0.0037	0.0037	
Riffle Length	35	36	37	
Avg. Riffle Slope	0.2290	0.0075	0.0102	
Pool Length	40	33	30	
Pool Slope	0.0008	0.0007	0.0008	



Project Name	Goose Creek - Year 3 (2011) Profile
Reach	10+00 to 16+00
Feature	Profile
Date	2/9/11
Crew	Dean, Perkinson

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
998.4	326.6		994.5	326.7	329.4	1582.5	325.8	326.6	993.9	326.0	329.4
1000.2	326.7		1036.6	329.2	329.4	1562.1	326.2	326.6	1020.3	327.7	329.4
1001.1	326.8		1075.4	328.3	328.6	1536.8	327.0	327.1	1032.8	329.0	329.4
1002.9	326.9		1082.2	327.6	328.6	1501.2	327.1	327.3	1069.2	328.5	328.9
1004.9	326.8		1088.8	328.4	328.5	1484.5	325.8	327.3	1078.2	327.1	328.8
1006.7	326.9		1103.8	326.0	328.5	1471.8	325.2	327.3	1085.6	328.7	328.8
1008.2	326.9		1116.3	325.9	328.5	1455.3	325.1	327.3	1101.7	325.7	328.8
1009.8	327.0		1134.0	328.3	328.5	1439.1	327.1	327.3	1114.4	325.1	328.8
1011.6	327.1		1166.1	327.7	328.2	1419.5	327.5	327.6	1124.5	325.8	328.8
1013.9	327.2		1179.8	325.8	328.2	1385.7	327.1	327.6	1134.6	328.6	328.8
1015.3	327.7		1203.7	326.6	328.2	1377.3	325.8	327.6	1166.8	328.1	328.7
1016.7	327.7		1217.4	327.8	328.2	1366.6	325.6	327.6	1183.0	325.4	328.7
1018.1	328.1		1231.0	325.7	328.2	1348.8	325.7	327.6	1207.3	326.2	328.7
1019.1	328.4		1239.4	326.4	328.2	1327.0	326.8	327.6	1218.5	327.8	328.7
1020.4	328.4		1263.6	328.0	328.2	1296.0	328.1	328.2	1228.7	325.9	328.7
1021.3	328.6		1313.0	327.3	327.5	1267.0	327.9	328.3	1239.7	326.4	328.7
1022.3	328.6		1331.0	325.5	327.5	1256.5	326.4	328.3	1251.6	326.7	328.7
1023.2	328.7		1368.8	325.9	327.6	1240.1	326.1	328.3	1264.0	328.3	328.7
1024.3	328.8		1382.4	327.4	327.6	1224.2	327.7	328.3	1290.3	328.0	328.3
1025.6	328.8		1435.6	326.7	327.3	1214.6	326.2	328.3	1315.6	327.2	327.9
1026.7	328.9		1448.5	324.9	327.2	1200.1	325.9	328.3	1336.1	325.6	327.9
1027.9	328.9		1468.4	325.4	327.3	1185.8	325.7	328.3	1346.6	325.6	327.9
1028.7	328.7		1496.8	327.1	327.2	1173.6	327.9	328.3	1358.8	325.9	327.9
1030.0	328.8		1531.7	326.8	326.9	1139.8	328.2	328.6	1374.9	325.6	327.9
1031.0	328.8		1574.0	326.0	326.5	1132.5	326.1	328.5	1387.6	327.2	327.9
1032.2	328.8		1575.2	326.5		1119.7	325.2	328.5	1429.4	327.3	327.7
1033.4	328.8					1108.0	325.6	328.5	1444.3	327.0	327.5

	2009	2010	2011	2012
Avg. Water Surface Slope	0.0037	0.0037	0.0037	
Riffle Length	35	36	37.0	
Avg. Riffle Slope	0.2290	0.0075	0.0102	
Pool Length	40	33	30.0	
Pool Slope	0.0008	0.0007	0.0008	

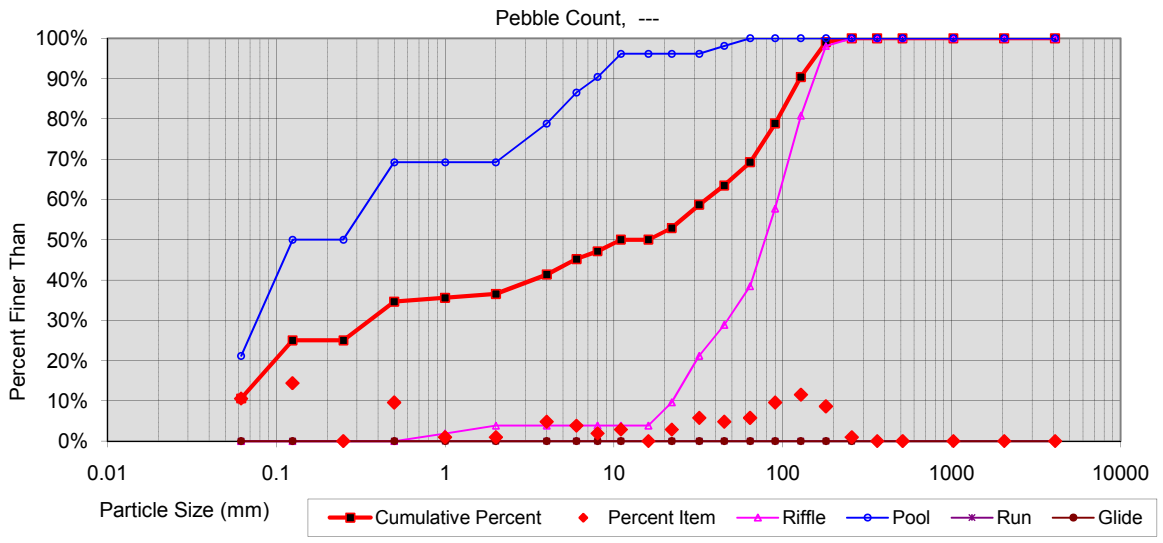


Weighted Pebble Count

Percent Riffle:	50	Percent Run:	
Percent Pool:	50	Percent Glide:	

Material	Size Range (mm)		Total #
silt/clay	0	0.062	10.6
very fine sand	0.062	0.13	14.4
fine sand	0.13	0.25	0.0
medium sand	0.25	0.5	9.6
coarse sand	0.5	1	1.0
very coarse sand	1	2	1.0
very fine gravel	2	4	4.8
fine gravel	4	6	3.8
fine gravel	6	8	1.9
medium gravel	8	11	2.9
medium gravel	11	16	0.0
coarse gravel	16	22	2.9
coarse gravel	22	32	5.8
very coarse gravel	32	45	4.8
very coarse gravel	45	64	5.8
small cobble	64	90	9.6
medium cobble	90	128	11.5
large cobble	128	180	8.7
very large cobble	180	256	1.0
small boulder	256	362	0.0
small boulder	362	512	0.0
medium boulder	512	1024	0.0
large boulder	1024	2048	0.0
very large boulder	2048	4096	0.0
bedrock			0.0
		Weighted Count:	100
		True Total Particle Count:	104

Note: **Goose Creek Upstream Reach 2011**



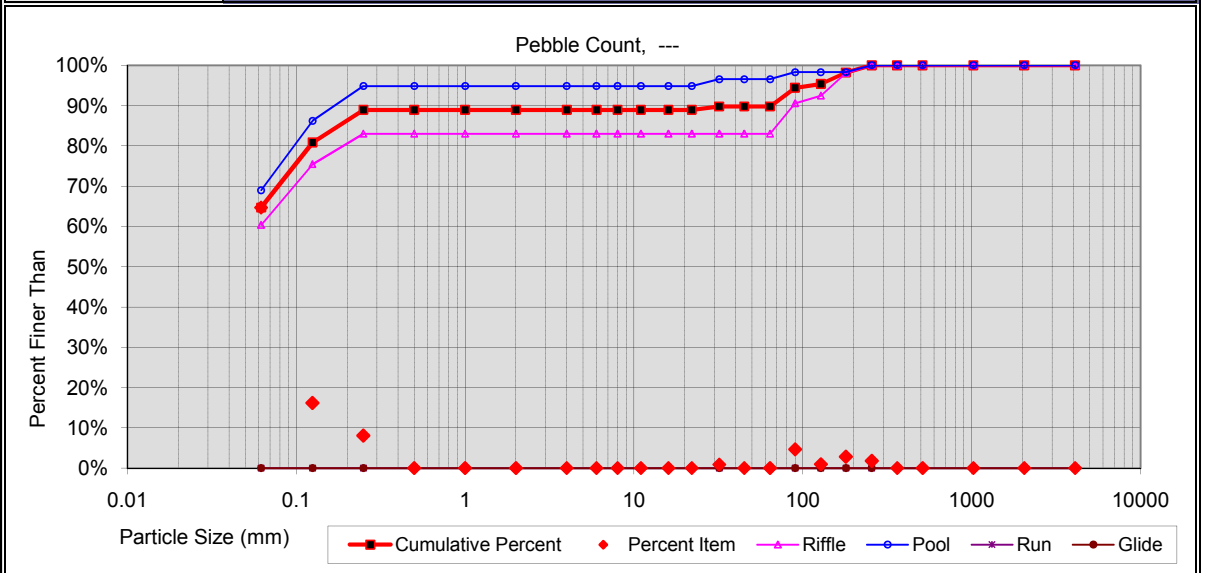
Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.081	0.66	16.0	105	154	11%	26%	33%	31%	0%	0%

Weighted Pebble Count

Percent Riffle:	50	Percent Run:	
Percent Pool:	50	Percent Glide:	

Material	Size Range (mm)		Total #
silt/clay	0	0.062	64.7
very fine sand	0.062	0.13	16.2
fine sand	0.13	0.25	8.1
medium sand	0.25	0.5	0.0
coarse sand	0.5	1	0.0
very coarse sand	1	2	0.0
very fine gravel	2	4	0.0
fine gravel	4	6	0.0
fine gravel	6	8	0.0
medium gravel	8	11	0.0
medium gravel	11	16	0.0
coarse gravel	16	22	0.0
coarse gravel	22	32	0.9
very coarse gravel	32	45	0.0
very coarse gravel	45	64	0.0
small cobble	64	90	4.6
medium cobble	90	128	0.9
large cobble	128	180	2.8
very large cobble	180	256	1.8
small boulder	256	362	0.0
small boulder	362	512	0.0
medium boulder	512	1024	0.0
large boulder	1024	2048	0.0
very large boulder	2048	4096	0.0
bedrock			0.0
		Weighted Count:	100
		True Total Particle Count:	111

Note: **Goose Creek Downstream Reach 2011**



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	#N/A	#N/A	0	112	65%	24%	1%	10%	0%	0%

APPENDIX E

SUPPLEMENTAL PLANTING

INSPECTION REPORT

Date of Inspection: **March 25, 2011**

Date of Report: April 1, 2011

SCO ID#: n/a

Supplemental Planting – Goose Creek #147

Project: **Goose Creek – EEP #147**

Location: Durham, North Carolina

Inspection of: Supplemental Planting (Contract(s))

By: Perry Sugg – NC EEP (Designer)
(Name)

Name & Title of Inspector Perry Sugg

COMMENTS:

EEP implemented and completed supplemental planting at the Goose Creek stream restoration site on March 25, 2011. At the direction and supervision of EEP, Bruton Natural Systems (planting contractor) installed a total of **130** five-gallon and **35** ten-gallon sized container plants within the conservation easement in designated areas per EEP guidance. The Bruton crew was supervised by Charlie Bruton. All plant material was procured by EEP from the NC Wildlife Resources Commission's Dan River nursery in Yanceyville NC. WRC delivered the plant material to the site in an enclosed trailer on the same day as plant installation. All plants were inspected by EEP prior to installation and were deemed to meet size requirements and exhibited good size and vigor.

Upon completion, EEP conducted a final inspection along with Charlie Bruton and gave final approval and acceptance of the work.

Attachments:

- Supplemental Planting Plan
- Plant List with Size and Quantities

EEP Supplemental Planting Plan for Goose Creek #147 - Durham

March 25, 2011

Species	Type	Minimum Caliper (inches)	Minimum Height (feet)	Eastway 01	LM 01	LM 02	LM 03	LM 04	LM Streamside	TOTAL EEP
Carolina Ash 10-gal	tree	3/4	7.0	7	5	6	10	7		35
Ironwood	tree	7/16	4.0						35	35
Persimmon	tree	3/8	3.5	10						10
Red Maple	tree	3/8	3.0		5		5			10
Red Oak	tree	1/2	4.5	8	5	10	10	7		40
River Birch 5-gal	tree	7/8	6.0						6	6
Sycamore	tree	5/8	6.0						2	2
White Oak	tree	5/8	3.0		10	5				15
Elderberry	shrub	1/2	4.5						12	12
Subtotals				**25**	**25**	**21**	**25**	**14**	**55**	**165**

Supplemental Planting Areas
Streamside Supplemental Planting
CE_Goose_FINAL
Thalwag

μ

0 75 150 300 Feet

Supplemental Planting Plan

Goose Creek - EEP #147

Durham NC

March 2011