FINAL

ANNUAL MONITORING REPORT
YEAR 5 (2015)
HELMS SITE (UT to DUTCH BUFFALO CREEK)
STREAM/WETLAND ENHANCEMENT SITE
ROWAN COUNTY, NORTH CAROLINA
(DMS Project No. 172, Contract No. 5767)
Construction Completed April 2009

Submitted to:
North Carolina Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

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

Axiom Environmental, Inc.

December 2015

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1.0 EXECUTIVE SUMMARY

The Helms Site (unnamed tributary (UT) to Dutch Buffalo Creek) Stream and Wetland Enhancement Site (hereafter referred to as the "Site") is located approximately 1.5 miles southwest of the Town of Bostian Heights in Rowan County, North Carolina. The UT to Dutch Buffalo Creek is a second-order stream located within the Southern Outer Piedmont Ecoregion of the Piedmont physiographic region in the Yadkin River Basin (USGS HUC 03040105). The Site consisted of stream and wetland enhancement. The restoration plan was designed by EcoScience; construction and seeding activities were completed in April 2009. This report (compiled based on the North Carolina Ecosystem Enhancement Program (NCEEP) *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for Year 5 (2015) monitoring.

Prior to construction, Site streams were dredged and straightened, and vegetation was maintained through regular mowing and active cattle grazing. According to as-built plan sheets, Site activities enhanced (level II) 1394 linear feet of stream and enhanced 0.4 acres of wetlands. Streambanks, riparian areas, and wetlands were stabilized with bare-root seedlings, and temporary and permanent seed mixes. In addition, a fence was installed around the permanent conservation easement to exclude cattle.

Goals of Site stream and wetland enhancement consisted in the following.

- Improve water quality via nutrient removal
- Increase local vegetative biodiversity
- Provide wildlife habitat
- Serve as a forested corridor linking the Site with adjacent forested areas

Site goals were accomplished by the following.

- Enhance (level II) 1394 linear feet of UT to Dutch Buffalo Creek by establishing native vegetation along streambanks and floodplain areas,
- Enhance 0.4 acres of wetland by planting native wetland vegetation in areas with existing hydric soils, and
- Installation of livestock exclusion fencing.

Vegetation success criteria dictates that a minimum 320 planted stems-per-acre must be surviving at the end of three years of monitoring, subsequently 288 planted stems-per-acre must be surviving after four years of monitoring, and 260 planted stems-per-acre must be surviving after five years of monitoring.

Vegetation plot measurements included four previously installed vegetation plots and four additional vegetation plots installed prior to year 4 (2014) annual monitoring for a total of eight 10-meter square plots. Site vegetation averaged 455 planted stems-per-acre (excluding livestakes) in year 5 (2015), which exceeds the minimum stem count for success criteria of 260 stems-per-acre in year 5. In addition, each individual plot exceeded success criteria with the exception of plots 2 and 4, which had 202 and 242 planted stems per acre, respectively. Plot 2 doesn't meet success criteria based on planted stems alone; however, when including naturally recruited stems of persimmon (*Diospyros virginiana*) and black walnut (*Juglans nigra*) this plot was well-above

260 stems per acre. In both cases, low stem density is likely due to competition from blackberry and the dense herbaceous layer.

A supplemental planting occurred on February 19 and 24, 2014. This planting area spanned the majority of the site and consisted of 850 containerized stems of native character species (Figure 2, Appendix B). The areas that were replanted were assessed at the time CVS data was collected, in general these trees were vigorous. The planting list is as follows.

Species	Common Name	Total
Acer negundo	Box Elder	31
Acer rubrum	Red Maple	136
Acer saccharum	Sugar Maple	26
Betula nigra	River Birch	34
Carpinus caroliniana	Ironwood	167
Carya glabra	Pignut hickory	20
Cercis canadensis	Redbud	38
Diospyros virginiana	Persimmon	50
Fraxinus pennsylvanica	Green Ash	36
Nyssa sylvatica	Blackgum	26
Platanus occidentalis	Sycamore	5
Populus deltoides	Cottonwood	7
Quercus michauxii	Swamp Chestnut Oak	30
Quercus palustris	Pin Oak	85
Quercus phellos	Willow Oak	56
Quercus rubra	Red Oak	7
Ulmus americana	American Elm	96
	TOTAL	**850**

The numerous dense patches of blackberry that were identified onsite during previous monitoring years have reduced in size due to shade from maturing trees and canopy development during monitoring year 5 (2015); thus, it was determined that blackberry no longer poses a threat to successional development of Site vegetation. One area of poor/stunted tree growth was observed during year 5 (2015) monitoring activities. This area is characterized by grasses, and poor growth is likely due to soil compaction during previous land use activities. These areas are depicted on Figure 2 (Appendix B). Additionally, trifoliate orange (*Poncirus trifoliate*), Tree of Heaven (*Ailanthus altissima*), and Chinese privet (*Ligustrum sinense*) were observed scattered throughout the Site. These are not currently posing any threat to success, though their numbers have increased from previous monitoring years.

The stream is functioning as designed and appears to be maintaining stability. Some erosion and bank sloughing was observed; however, these areas are a result of previous land-use practices. The areas of scour and erosion appear to be trending towards stability and are expected to pose no major problems in the future. In previous monitoring years, one area of aggradation was identified in the upstream portion of the Site, just downstream of the bridge. The channel bars and instream vegetation have been mostly removed during several large rain events, and the area has stabilized.

Site success criteria dictate that at least two bankfull events are documented over the five year monitoring period, in separate monitoring years. A crest gauge was installed along the UT to

Dutch Buffalo Creek in November 2009 to assist with verification of bankfull events. One bankfull event was documented in year 5 (2015) for a total of nine bankfull events (Table 10, Appendix D).

Summary information/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 Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Four vegetation plots were established and permanently marked following as-built and an additional four vegetation plots were established and permanently marked prior to year 4 (2014) for a total of eight 10-meters square plots. Plots were surveyed in September for the Year 5 (2015) monitoring season using methods outlined in *CVS-EEP Protocol for Recording Vegetation, Levels 1-2 Plot Sampling Only,* 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 Southern and Mid-Atlantic States* (Weakley 2012).

2.2 Stream Assessment

Ten permanent photo points were established throughout the Site; locations are depicted on Figure 2 (Appendix B). In addition, bankfull events will be documented.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Levels 1-2 Plot Sampling Only, Version 4.2. Available online at http://cvs.bio.unc.edu/methods.htm.

North Carolina Ecosystem Enhancement Program. 2012. Helms Site (UT to Dutch Buffalo Creek) Stream and Wetland Enhancement Project – 2011 Final Annual Monitoring Report (Year 3 of 5).

North Carolina Ecosystem Enhancement Program (NCEEP). Unpublished. Procedural Guidance and Content Requirements for EEP Monitoring Projects, Version 1.4, dated 11/07/11. NC Department of Environment and Natural Resources. Available online at http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=2288101&name=DLFE-39268.pdf.

Weakley, Alan S. 2012. Flora of the Southern and Mid-Atlantic States. Available online at: http://www.herbarium.unc.edu/WeakleysFlora.pdf [September 28, 2012]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weather Underground. 2015. Station at Salisbury, NC Airport (KRUQ), North Carolina. (online). Available: www.wunderground.com/history/airport/KRUQ/2014/9/25/CustomHistory.html [September 25, 2015]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

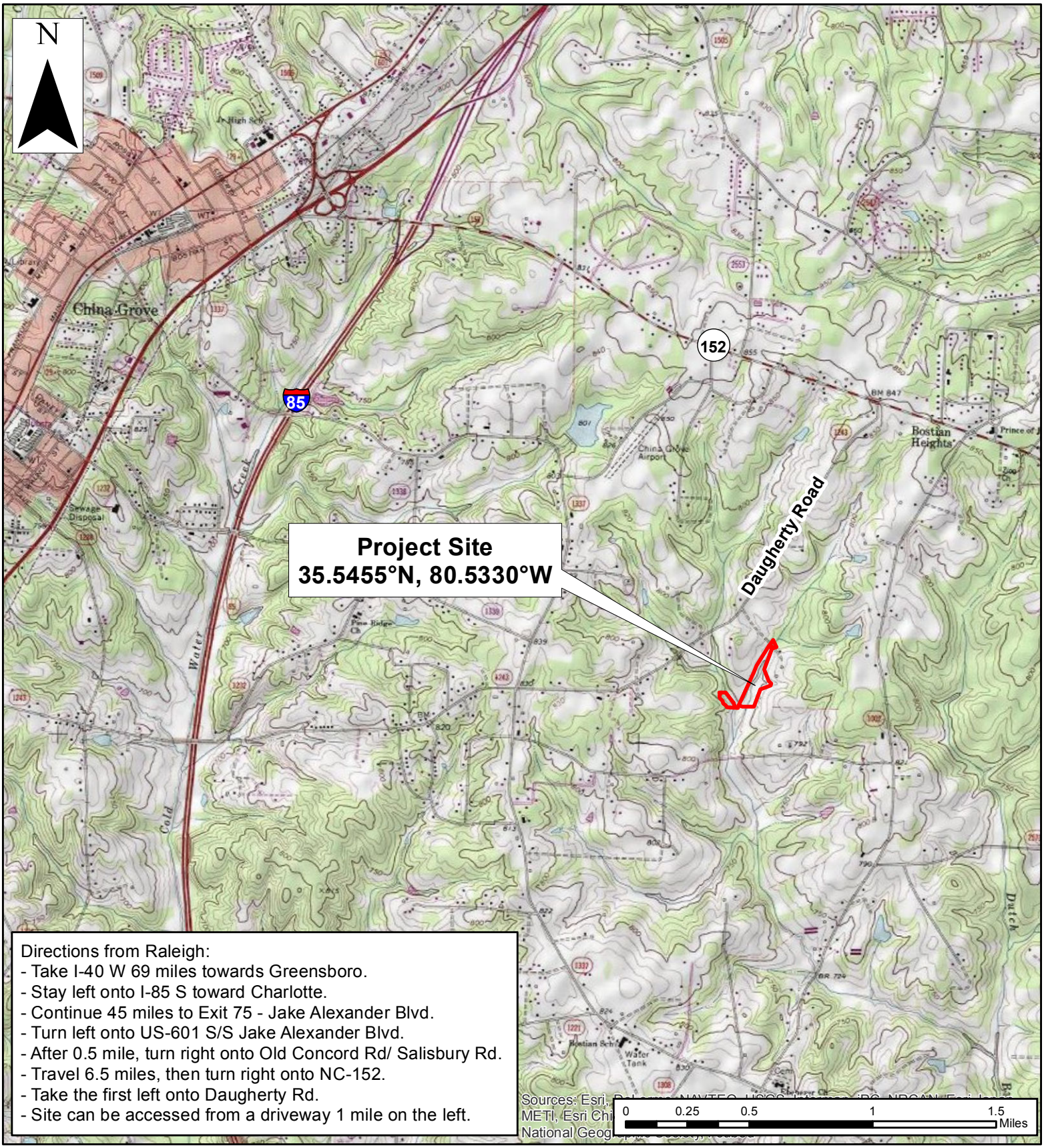
Figure 1. Site Location Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes



Prepared by:	Prepared for:			
Axiom Environmental, Inc.	North Carolina Department of Environmental Quality Division of Mitigation Services	VICINITY MAP HELMS SITE (UT TO DUTCH BUFFALO CREEK) DMS PROJECT NUMBER 172 Rowan County, North Carolina	Dwn. by. PHP/KRJ Date: Dec. 2015 Project: 12.004.18	FIGURE 1

Table 1. Project Components and Mitigation Credits
Helms Enhancement Site (DMS Project Number 172)

Mitigation Credits							
	Stream		Riparian Wetland		Buffer		
Type	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent			
Totals	0	558	0	0.2	0		
Projects Components							
Project Component/ Reach ID	Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
Mainstem	0+00 – 13+94	1394	EII	Enhancement (Level II)	1394	2.5:1	Planted with native, hardwood vegetation and installed fencing to exclude livestock.
Oxbow Depression		0.4	E	Enhancement	0.4	2:1	Planted with native, hardwood vegetation and installed fencing to exclude livestock.

Component Summation			
Restoration Level	Stream (linear footage)	Riparian Wetland (acres)	Buffer (square footage)
Enhancement (Level II)	1394		
Wetland Enhancement		0.4	
Totals	**1394**	**0.4**	
Mitigation Units	**558 SMUs**	**0.2 WMUs**	

Table 2. Project Activity and Reporting History
Helms Enhancement Site (DMS Project Number 172)

Elapsed Time Since Grading Complete: 6 years 8 months
Elapsed Time Since Planting Complete: 6 year 8 months
Number of Reporting Year: 5

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	July 2003	July 2003
Final Design-90%	NA	November 2007
Construction	NA	April 2009
Temporary S&E mix applied to entire project area	NA	April 2009
Permanent seed mix applied to reach	NA	April 2009
Containerized and B&B plantings for reach	NA	April 2009
Mitigation Plan/ As-Built (Year 0 Monitoring)	October 2009	November 2009
Year 1 Monitoring	November 2009	November 2009
Year 2 Monitoring	October 2010	January 2011
Year 3 Monitoring	November 2011	February 2012
Supplemental Planting (850 Containerized Stems)	NA	February 2014
Year 4 Monitoring	August 2014	September 2014
Year 5 Monitoring	September 2015	December 2015

Table 3. Project Contacts Table
Helms Enhancement Site (DMS Project Number 172)

Designer	EcoScience Corporation 1101 Haynes Street, Suite 201 Raleigh, NC 27604 919-828-3433
Construction, Planting, and Seeding Contractor	Husky Construction 617 Westbury Rd. Charlotte, NC 28211
Years 0-3 Monitoring Performers	Jacobs Engineering Group 6801 Governors Lake Parkway Norcross, GA 30071 Alison Nichols 770-455-8555
Years 4-5 Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Baseline Information and Attributes
Helms Enhancement Site (DMS Project Number 172)

Project Information	
Project Name	Helms Site (UT to Dutch Buffalo Creek)
Project County	Rowan County, North Carolina
Project Area (Acres)	9.6 acres
Project Coordinates (NAD83 2007)	35º 32' 44.38" N 80º 31' 58.04" W
Project Watershed Summary Information	
Physiographic Region	Piedmont
Project River Basin	Yadkin/Pee Dee
USGS 8-digit HUC	03040105
USGS 14-digit HUC	03040105020050
NCDWQ Subbasin	03-07-12
Project Drainage Area	384 acres (0.6 sq. mile)
Project Drainage Area Impervious Surface	< 10%
CGIA Land Use Classification	-
Reach Summary Information	
Parameters	**Mainstem**
Restored/Enhanced Length	1394 linear feet
Valley Classification	VIII
Drainage Area	384 acres (0.6 sq. mile)
NCDWQ Index Number	13-17-11-(1)
NCDWQ Classification	WS-II, HQW
Morphological Description (stream type)	Perennial
Evolutionary Trend	G 5/4 to E 5/4
Dominant Soil Series	Chewacla loam
Drainage Class	Somewhat poorly drained
Soil Hydric Status	Hydric inclusions
Slope	0.0076
FEMA Classification	100-year floodplain
Native Vegetation Community	Agriculture, Hay Production
Percent Composition of Exotic Invasives	3.1%
Wetland Summary Information	
Parameters	**Oxbow Depression**
Size of Wetland	0.4 acres
Wetland Type	Riparian non-riverine
Mapped Soil Series	Chewacla loam
Drainage class	Somewhat poorly drained
Soil Hydric Status	Hydric inclusions
Source of Hydrology	Groundwater
Hydrologic impairment	NA
Native vegetation community	Hydrophytic assemblage
Percent composition of exotic invasive vegetation	3.1%
Regulatory Considerations	
Regulation	**Applicable**
Waters of the U.S. –Sections 404 and 401	No
Endangered Species Act	No
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	No
Essential Fisheries Habitat	No

APPENDIX B

VISUAL ASSESSMENT DATA

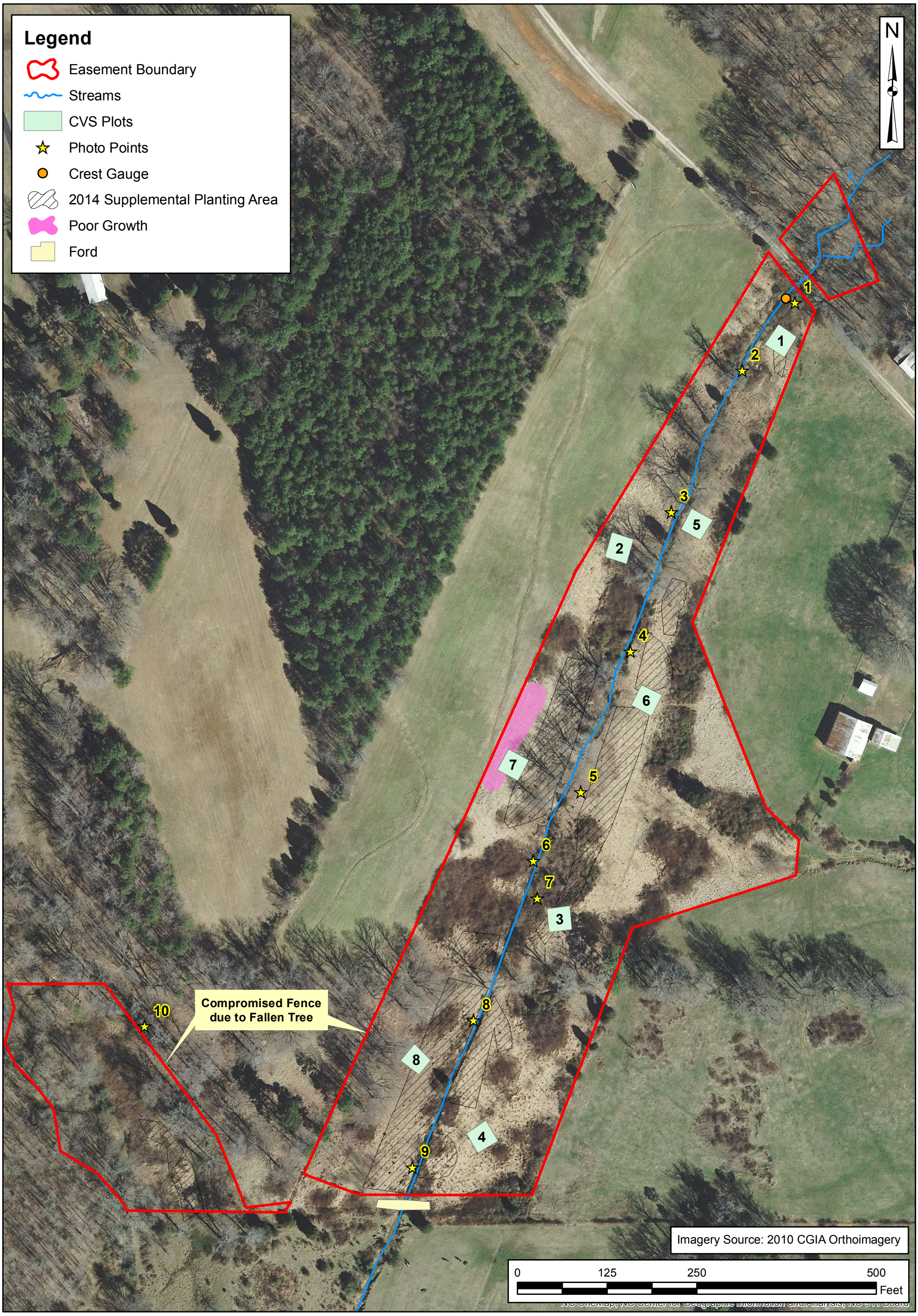
Figure 2. Current Conditions Plan View

Table 5. Visual Stream Morphology Stability Assessment Table

Table 6. Vegetation Condition Assessment Table

Site Fixed-Station Photos

Vegetation Monitoring Photographs



Prepared by: Axiom Environmental, Inc.	Prepared for: **North Carolina Department of Environmental Quality** **Division of Mitigtion Services**	**HELMS SITE (UT to DUTCH BUFFALO CREEK) STREAM AND WETLAND ENHANCEMENT PROJECT CURRENT CONDITIONS PLAN VIEW DMS PROJECT #172 Rowan County, NC**	Drawn by: KRJ Date: December 2015 Project No.: 12-004.18	FIGURE **2**

Table 5 **Visual Stream Morphology Stability Assessment**

Reach ID **Helms (UT to Dutch Buffalo Creek)**

Assessed Length **1394**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	**Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	18	18			100%			
	3. Meander Pool Condition	Depth Sufficient	20	20			100%			
		Length Appropriate	20	20			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	18	18			100%			
		Thalweg centering at downstream of meander bend (Glide)	18	18			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			4	125	96%	3	50	97%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			3	150	95%	2	50	96%
				Totals	7	275	90%	5	100	94%
3. Engineered Structures***	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	N/A	N/A			N/A			

*Data was collected on September 21, 2015

**No stream restoration contruction was conducted; therefore, as-built information is not available. Number of existing features was used in lieu of as-built data.

***No restoration was conducted within the stream; no structures were installed.

Table 6 — Vegetation Condition Assessment

Helms Site (UT to Dutch Buffalo Creek)

Planted Acreage[1] 9.6

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	None	0.1 acres	none	0	0.00	0.0%
2. Low Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Poor/stunted tree growth occurring in an area dominated by grasses	0.1 acres	pink polygon	1	0.11	1.1%
			Cumulative Total	1	0.11	1.1%

Easement Acreage[2] 9.6

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Chinese privet, Tree of Heaven, and Trifoliate Orange are scattered throughout the easement.	1000 SF	none	0	0.30	3.1%
5. Easement Encroachment Areas[3]	None	none	none	0	0.00	0.0%

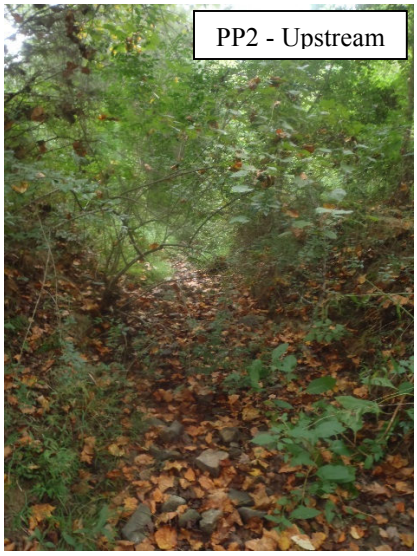
1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

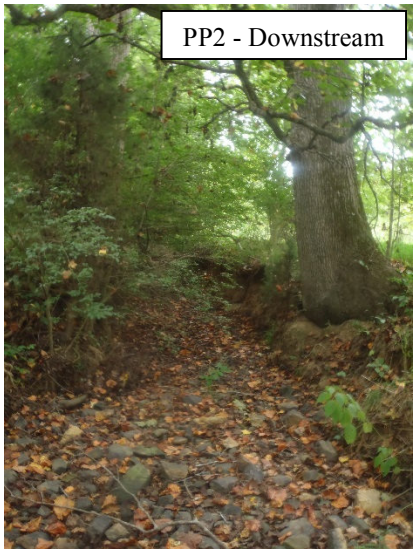
2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

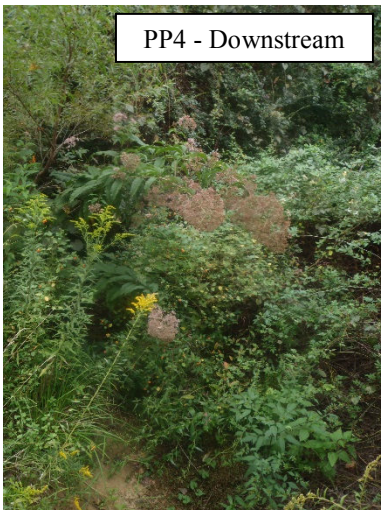
4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

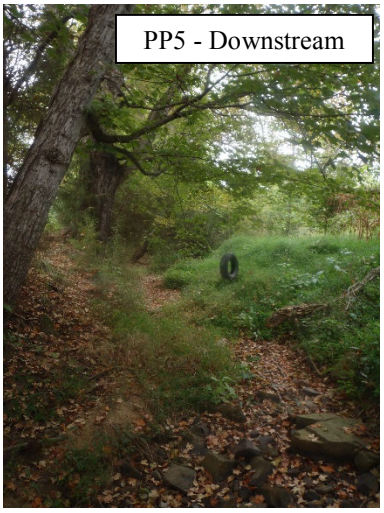
Helms Site (UT to Dutch Buffalo Creek)
Site Fixed-Station Photographs
Taken September 2015





Helms Site (UT to Dutch Buffalo Creek)
Site Fixed-Station Photographs (Continued)
Taken September 2015





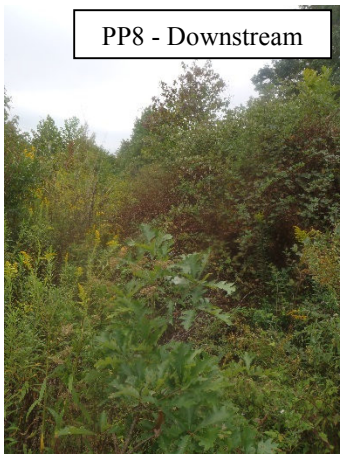
Helms Site (UT to Dutch Buffalo Creek)
Site Fixed-Station Photographs (Continued)
Taken September 2015

PP7 - Upstream

PP7 - Downstream

PP8 - Upstream

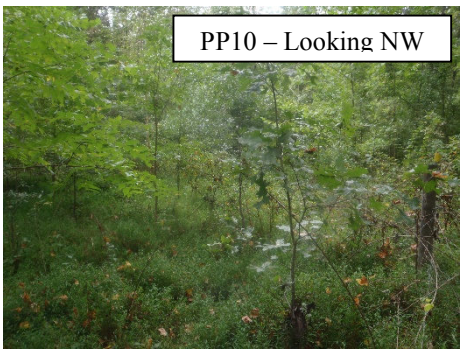
PP8 - Downstream



PP9 - Upstream

PP9 - Downstream

PP10 – Looking NW



PP10 – Looking SE

Helms Site (UT to Dutch Buffalo Creek)
Vegetation Monitoring Photographs
Taken September 2015

APPENDIX C

VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

Table 7. Vegetation Plot Criteria Attainment
Helms Enhancement Site (DMS Project Number 172)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	75%
2	No*	
3	Yes	
4	No	
5	Yes	
6	Yes	
7	Yes	
8	Yes	

*Plot 2 does not meet success criteria based on planted stems alone; however, when including appropriate naturally recruited species such as persimmon (*Diospyros virginiana*) and black walnut (*Juglans nigra*), the plot is well above 260 stems per acre.

Table 8. CVS Vegetation Plot Metadata
Helms Enhancement Site (DMS Project Number 172)

Report Prepared By	Corri Faquin
Date Prepared	9/24/2015 11:48
database name	Axiom-EEP-2015-A-v2.3.1.mdb
database location	S:\CVS database\2015
computer name	ALLISON-LT
file size	42119168
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.
Planted 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.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	172
project Name	Helms
River Basin	
length(ft)	
stream-to-edge width (ft)	
Required Plots (calculated)	
Sampled Plots	8

Table 9. Total and Planted Stems by Plot and Species
DMS Project Code 172. Project Name: Helms

			Current Plot Data (MY5 2015)																					
			172-AXE-0001			172-AXE-0002			172-AXE-0003			172-AXE-0004			172-AXE-0005			172-AXE-0006			172-AXE-0007			172-AXE-0008		
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																3	3	3						
Acer rubrum	red maple	Tree							1	1	1							2	2	2	5	5	5	1	1	1
Asimina triloba	pawpaw	Tree																						4	4	8
Betula nigra	river birch	Tree				1	1	1										1	1	1				1	1	1
Carpinus caroliniana	American hornbeam	Tree																			1	1	1	2	2	2
Carya	hickory	Tree																					1			
Celtis laevigata	sugarberry	Tree																								
Celtis occidentalis	common hackberry	Tree			1																					
Cercis canadensis	eastern redbud	Tree							2	2	2															
Diospyros virginiana	common persimmon	Tree	3	3	8	1	1	5							4	4	7	2	2	3						
Fraxinus pennsylvanica	green ash	Tree	5	5	5	1	1	1	3	3	3							1	1	1						
Juglans nigra	black walnut	Tree						1																		
Liquidambar styraciflua	sweetgum	Tree			1			14			7			6												12
Liriodendron tulipifera	tuliptree	Tree																						1	1	1
Maclura pomifera	osage orange	Shrub Tree																								
Nyssa	tupelo	Tree																								
Nyssa sylvatica	blackgum	Tree	1	1	1																					
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	1	2	2	2	5	5	5	1	1	1							1	1	1
Poncirus trifoliata	Trifoliate Orange	Tree						1									2						3			
Quercus sp.	oak	Tree																								
Quercus alba	white oak	Tree																			1	1	1			
Quercus lyrata	overcup oak	Tree																								
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1	5	5	5				2	2	2	2	2	2				2	2	2
Quercus nigra	water oak	Tree										1	1	1												
Quercus pagoda	cherrybark oak	Tree	1	1	1										1	1	1	3	3	3						
Quercus phellos	willow oak	Tree	1	1	1										3	3	3	1	1	1	6	6	6			
Quercus rubra	northern red oak	Tree																								
Viburnum cassinoides	southern arrowwood	Shrub Tree																								
unknown	unknown	Tree																								
Ulmus americana	American elm	Tree																1	1	1						
		Stem count	14	14	21	5	5	25	13	13	20	6	6	12	11	11	16	16	16	17	13	13	17	12	12	28
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	7	7	9	5	5	8	5	5	6	2	2	3	5	5	6	9	9	9	4	4	6	7	7	8
		Stems per ACRE	566.6	566.6	849.8	202.3	202.3	1012	526.1	526.1	809.4	242.8	242.8	485.6	445.2	445.2	647.5	647.5	647.5	688	526.1	526.1	688	485.6	485.6	1133

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 excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 9. Total and Planted Stems by Plot and Species (continued)
DMS Project Code 172. Project Name: Helms

			Annual Means													
			MY5 (2015)			MY4 (2014)			MY3 (2011)			MY2 (2010)			MY1 (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
Acer negundo	boxelder	Tree	3	3	3	3	3	3									
Acer rubrum	red maple	Tree	9	9	9	9	9	9									
Asimina triloba	pawpaw	Tree	4	4	8	4	4	4									
Betula nigra	river birch	Tree	3	3	3	4	4	4							2	2	2
Carpinus caroliniana	American hornbeam	Tree	3	3	3	3	3	3									
Carya	hickory	Tree			1			1									1
Celtis laevigata	sugarberry	Tree						1									
Celtis occidentalis	common hackberry	Tree			1												
Cercis canadensis	eastern redbud	Tree	2	2	2	2	2	2									
Diospyros virginiana	common persimmon	Tree	10	10	23	10	10	10	1	1	1	1	1	1	3	3	3
Fraxinus pennsylvanica	green ash	Tree	10	10	10	11	11	11	2	2	3	2	2	3	3	3	3
Juglans nigra	black walnut	Tree			1			1									
Liquidambar styraciflua	sweetgum	Tree			40			31			3			3			1
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1									
Maclura pomifera	osage orange	Shrub Tree						8									
Nyssa	tupelo	Tree				1	1	1									
Nyssa sylvatica	blackgum	Tree	1	1	1	1	1	1							1	1	1
Platanus occidentalis	American sycamore	Tree	12	12	12	12	12	12									
Poncirus trifoliata	Trifoliate Orange	Tree			6				3	3	3	3	3	3	3	3	3
Quercus sp.	oak	Tree									1						
Quercus alba	white oak	Tree	1	1	1	1	1	1									
Quercus lyrata	overcup oak	Tree													1	1	1
Quercus michauxii	swamp chestnut oak	Tree	13	13	13	13	13	13	2	2	2	2	2	2	2	2	2
Quercus nigra	water oak	Tree	1	1	1	1	1	1	1	1	1				1	1	1
Quercus pagoda	cherrybark oak	Tree	5	5	5	6	6	6	1	1	1	1	1	1	1	1	1
Quercus phellos	willow oak	Tree	11	11	11	11	11	11							1	1	1
Quercus rubra	northern red oak	Tree						1									
Viburnum cassinoides	southern arrowwood	Shrub Tree							1	1	1	1	1	1	2	2	2
unknown	unknown	Tree													1	1	1
Ulmus americana	American elm	Tree	1	1	1	1	1	1									
		Stem count	90	90	156	94	94	137	11	11	16	10	10	14	21	21	23
		size (ares)	8			8			4			4			4		
		size (ACRES)	0.20			0.20			0.10			0.10			0.10		
		Species count	17	17	22	18	18	24	7	7	9	6	6	7	12	12	14
		Stems per ACRE	455.3	455.3	789.1	475.5	475.5	693	111.3	111.3	161.9	101.2	101.2	141.6	212.5	212.5	232.7

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 excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

APPENDIX D

Table 10. Verification of Bankfull Events

Table 10. Verification of Bankfull Events
Helms Enhancement Site (DMS Project Number 172)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
November 18, 2009	November 11-12, 2009	Visual observations	--
October 1, 2010	Unknown	Visual observations, crest gauge	--
April 2011	April 19, 2011	Visual observations, crest gauge, discussions with landowner	--
May 2011	May 19, 2011	Visual observations, crest gauge, discussions with landowner	--
July 2011	July 2011	Visual observations, crest gauge, discussions with landowner	--
May 2014	August 17, 2013	2.36 inches* of rain in one day indicate that a bankfull event likely occurred.	--
May 2014	March 7, 2014	Wrack observed in floodplain as well as crest gauge observations after 2.08 inches* of rain in one day indicate a bankfull event occurred.	1
September 25, 2014	August 1, 2014	Crest gauge data indicates a bankfull event occurred after 1.75 inches* of rain in one day.	--
September 21, 2015	July 19, 2015	Wrack observed in floodplain along the right bank, just downstream of PP-06, after 1.53 inches* of rain in one day.	2

*Reported at the Salisbury, NC Airport (KRUQ) (Weatherunderground 2015)

Bankfull Photo 1

Bankfull Photo 2

APPENDIX E

Preconstruction Photographs

Helms Site (UT to Dutch Buffalo Creek)
Preconstruction Photographs
Taken April 2005

Helms Site (UT to Dutch Buffalo Creek)
Preconstruction Photographs (continued)
Taken April 2005