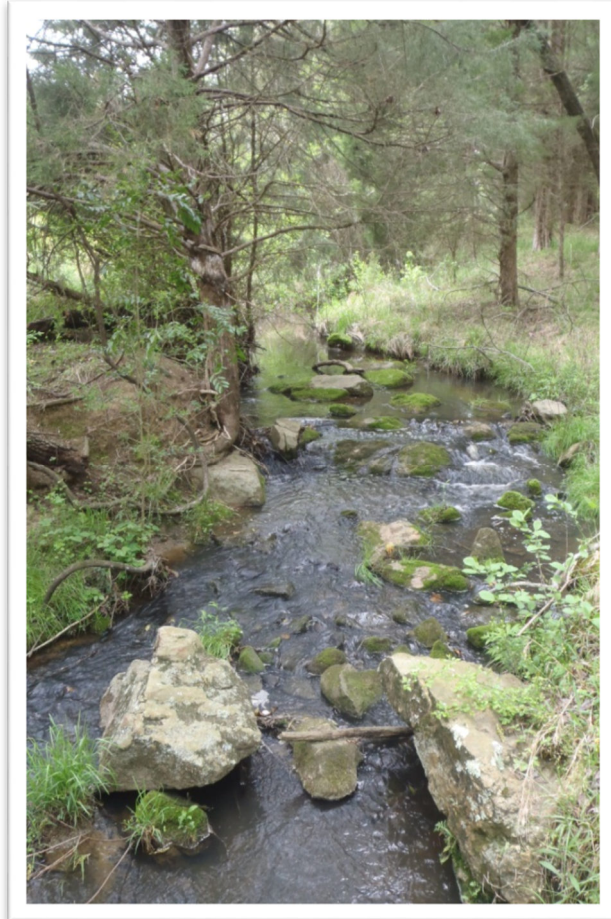


**FINAL
ANNUAL MONITORING REPORT
UT TO HAW BECKOM RESTORATION SITE
ALAMANCE COUNTY, NORTH CAROLINA
(DMS Project No. 92694, Contract No. 004545)**

Monitoring Year 5 of 5 (2015)

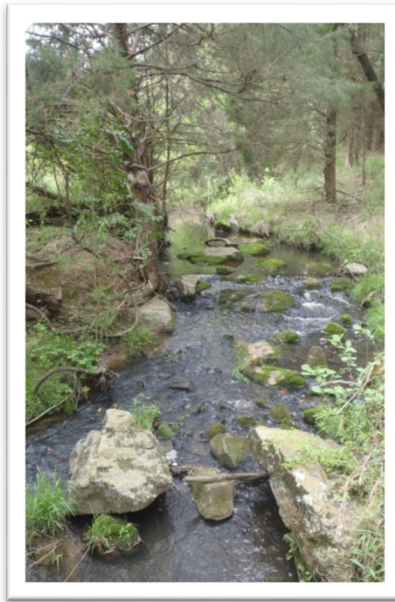


Submitted to:
North Carolina Department of Environmental Quality
Division of Mitigation Services
Raleigh, North Carolina

November 2015

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UT TO HAW BECKOM RESTORATION SITE
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Monitoring Year 5 of 5 (2015)



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

Prepared by:
Axiom Environmental, Inc.
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Axiom Environmental, Inc.

November 2015

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1.0 EXECUTIVE SUMMARY

The North Carolina Department of Environmental Quality- Division of Mitigation Services (DMS) has completed stream and wetland enhancement and preservation at the UT to Haw Beckom Restoration Site (hereafter referred to as the “Site”) to assist in fulfilling stream and wetland mitigation goals in the area. The Site is located approximately 4 miles north of Burlington, in Alamance County, North Carolina. This portion of Alamance County is located within Cape Fear River Basin Hydrologic Unit and Targeted Local Watershed 03030002030010. This report (compiled based on DMS’s *Procedural Guidance and Content Requirements for DMS Monitoring Reports* Version 1.3 dated 1/15/10) summarizes data for year 5 (2015) monitoring.

Site drainage features provide water quality function to an approximately 385-acre (0.6-square mile) watershed. The Site is located within a NCDMS Targeted Local Watershed; in addition, this Site was identified for preservation as part of Site 15 (Travis & Tickle 15.2) in the 2008 NCDMS *Little Alamance and Travis and Tickle Creek Local Watershed Plan* (pages 72-73). Site streams drain to a section of the Haw River, which was included on North Carolina’s 2010 final 303(d) list for impaired ecological/biological integrity of benthic communities.

Prior to construction, Site land use consisted of cleared pasture for livestock grazing and disturbed forest. Site streams were characterized by eroding stream banks and a riparian buffer dominated by active livestock pasture and disturbed forest.

The primary goals of this mitigation project were obtained through removal of livestock from streams, buffers, and wetlands; reforestation of pasture land with native species; and installation of forded crossings to safely move animals and equipment across the Site. The goals of this project focused on improving water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat and include the following.

- Reducing nonpoint sources of pollution by 1) fencing livestock from stream channels, buffers, and wetlands; 2) ceasing the application of agricultural herbicides, pesticides, and fertilizers; and 3) providing a vegetative buffer adjacent to streams and wetlands to treat surface runoff prior to entering Site streams and ultimately the Haw River.
- Reducing sedimentation/siltation within onsite and downstream receiving waters by a) reducing bank erosion associated with livestock hoof shear on Site streams, b) filtering surface runoff and reducing particulate matter deposition into tributaries, and c) providing a forested vegetative buffer adjacent to Site streams and wetlands.
- Promoting floodwater attenuation and improving stream stability by revegetating Site floodplains to reduce floodwater velocities through increased frictional resistance on floodwaters crossing Site floodplains.
- Providing increased habitat for aquatic wildlife by 1) increasing organic matter, carbon export, and woody debris in the stream corridor and 2) restoring shade to Site open waters.
- Providing wildlife habitat including a minimum of a 50-foot forested riparian corridor from the top of each stream bank within a region of the state increasingly dissected by residential/agricultural land use.
- Protecting a Site identified in the 2008 Piedmont Triad Council of Government *Little Alamance, Travis, and Tickle Creek Watersheds Restoration Plan* (PTCG 2008) for preservation due to its location within a remote, rural area with increasing development pressure and appeal to developers.

This project was constructed between December 23, 2010 and January 6, 2011. All stream channels have a minimum of a 50-foot wide riparian buffer from the top of each stream bank, which was verified in the field on January 22, 2011. The project consisted of enhancement (level II) of 2200 linear feet of stream and enhancement of 1.75 acres of riparian wetlands by removing livestock and reforestation with native species. The project includes preservation of 1465 linear feet of perennial stream and 0.05 acre of riparian wetlands. Site activities provide 1173 Stream Mitigation Units and 0.89 riparian riverine Wetland Mitigation Units. The Site will be protected by a permanent conservation easement held by the State of North Carolina.

Success criteria for stream enhancement will include 1) success of riparian vegetation, 2) bank stability, and 3) documentation of two bankfull channel events. One bankfull event was documented to date during year 5 monitoring (2015) for a total of seven documented bankfull events with at least one event documented to occur in each monitoring year.

Vegetation success criteria dictate that an average density of 320 stems per acre must be surviving in the first three monitoring years. Subsequently, 290 stems per acre must be surviving in year 4 and 260 stems per acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted, average densities were measured at 639 planted stems per acre (excluding livestock) surviving in year 5 (2015). The dominant species identified at the Site were planted stems of swamp chestnut oak (*Quercus michauxii*), American sycamore (*Platanus occidentalis*) and American elm (*Ulmus americana*). In addition, each individual vegetation plot met success criteria when counting planted stems alone.

Stems of Chinese privet (*Ligustrum sinense*) and several small patches of Japanese honeysuckle (*Lonicera japonica*) are scattered throughout the Site, mainly in the downstream portion of the Site around mature vegetation. These areas are minimal and pose no threat to the success of planted stems or site performance.

In 2011 herbaceous grasses within the Site, primarily tearthumb (*Polygonum sagittatum*) and rushes (*Juncus* spp.) in wetter areas and fescue (*Festuca* sp.) in drier areas, were vigorous and overtopping many of the smaller planted trees. As a result some of the smaller trees died due to grasses and some of the larger trees died over the summer of 2011 from dry, hot conditions. The Site was replanted as part of the planting warranty on November 1, 2011 including 369 bare root seedlings planted in Swamp Forest areas and 28 bare root seedlings planted in floodplain areas of the Site. Planted species and number of stems of each are as follows.

Swamp Forest (bare root trees)

45 swamp chestnut oak (*Quercus michauxii*)

135 sycamore (*Platanus occidentalis*)

99 American elm (*Ulmus americana*)

90 willow oak (*Quercus phellos*)

TOTAL 369 trees

Floodplain (bare root trees)

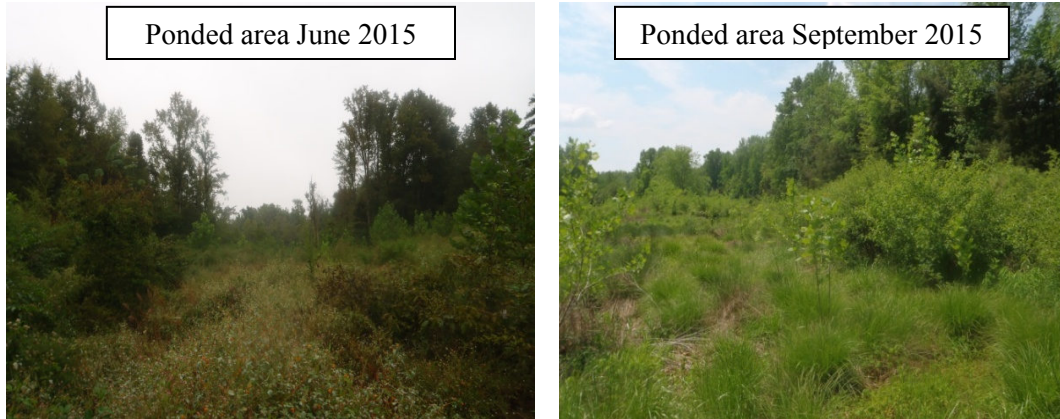
13 sycamore (*Platanus occidentalis*)

10 American elm (*Ulmus americana*)

5 silky dogwood (*Cornus amomum*)

TOTAL 28 trees

Planted stems throughout the site, including bare roots planted in 2011 are vigorous. A small area in the upstream portion of the site previously reported as having low stem densities due to ponding by beavers has become vegetated with native hardwood species. Many of the planted stems in this area were stunted due to competition with herbaceous species after removal of beaver, currently these trees are vigorous and should continue to thrive unless beaver activity resumes.



Success criteria for wetland enhancement will include success of riparian vegetation. Wetland enhancement areas are jurisdictional; therefore, hydrology is not being monitored.

No signs of beaver activity were observed on the Site during monitoring year 5 (2015). One large, well-established dam is located just upstream of the Site, but no dams currently exist on the Site. APHIS personnel are providing beaver management and will continue to trap at the Site as necessary. The beaver dam location is depicted on Figure 2 (Appendix B).

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 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 Stream Assessment

Annual stream monitoring will include vegetation survival (Section 2.2 Vegetation Assessment) and a photographic record of post-construction conditions. Photographs of the enhancement (level II) reach will be taken each monitoring year. In addition, visual assessments of the stream will be conducted by walking the length of stream and bankfull flow events will be documented during the monitoring period.

2.2 Vegetation Assessment

Five vegetation plots were established and marked after construction with four foot metal U-bar post demarking the corners with a ten foot, three-quarter inch PVC at the origin. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed in September 2015 for the year 5 (2015) monitoring season using the *CVS-DMS 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 Southern and Mid-Atlantic States* (Weakley 2012).

3.0 REFERENCES

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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 Burlington, North Carolina. (online). Available: <http://www.wunderground.com/history/airport/KBUY/2015/9/25/CustomHistory.html> [September 25, 2015]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

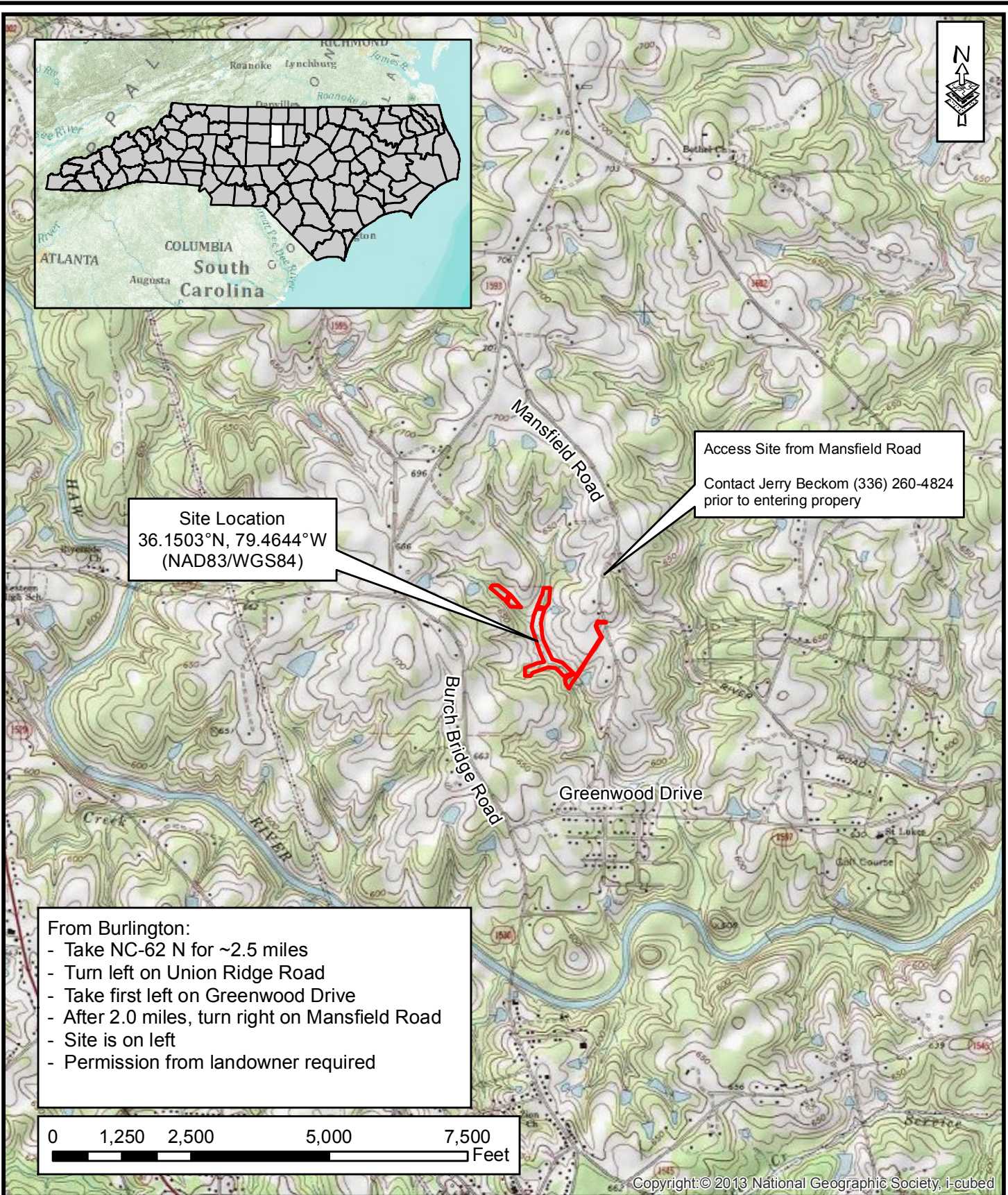
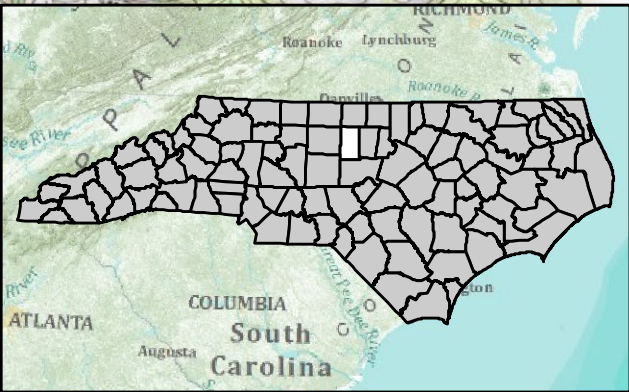
Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

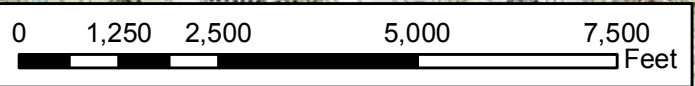
Table 4. Project Baseline Information and Attributes



Site Location
36.1503°N, 79.4644°W
(NAD83/WGS84)

Access Site from Mansfield Road
Contact Jerry Beckom (336) 260-4824
prior to entering property

From Burlington:
- Take NC-62 N for ~2.5 miles
- Turn left on Union Ridge Road
- Take first left on Greenwood Drive
- After 2.0 miles, turn right on Mansfield Road
- Site is on left
- Permission from landowner required



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

SITE LOCATION
UT TO HAW BECKOM SITE (DMS #93694)
Alamance County, North Carolina

Dwn. by:
PHP
Date:
Nov 2015
Project:
12-004.05

FIGURE
1

**Table 1. Project Components and Mitigation Credits
UT to Haw (Beckom) Site, DMS Project No. 92694**

Mitigation Credits								
	Stream		Riparian Wetland		Non-Riparian Wetland	Buffer	Nitrogen Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	--	--	--	--
Totals	--	1173 SMUs	--	0.89 WMUs	--	--	--	--
Project Components								
Project Component/ Reach ID	Station/Location	Existing Footage	Approach	Restoration or Restoration Equivalent	Restoration Footage/ Acreage	Mitigation Ratio		
Main Channel	--	1550	--	Enhancement (Level II)/	1550	2.5:1		
	--	635	--	Preservation	635	5:1		
UT1	--	15	--	Enhancement (Level II)	15	2.5:1		
	--	665	--	Preservation	665	5:1		
UT2	--	635	--	Enhancement (Level II)	635	2.5:1		
UT3	--	165	--	Preservation	165	5:1		
Wetland 1	--	1.15	--	Enhancement	1.15	2:1		
Wetland 2	--	0.25	--	Enhancement	0.25	2:1		
Wetland 3	--	0.05	--	Enhancement	0.05	2:1		
Wetland 4	--	0.15	--	Enhancement	0.15	2:1		
Wetland 5	--	0.05	--	Enhancement	0.05	2:1		
Wetland 6	--	0.10	--	Enhancement	0.10	2:1		
Wetland 7	--	0.01	--	Preservation	0.01	5:1		
Wetland 8	--	0.04	--	Preservation	0.04	5:1		
Component Summation								
Restoration Level	Stream (linear footage)	Riverine Riparian Wetland (acreage)	Planted Riparian Buffer (acreage)					
Enhancement (Level II)	2200	--	--					
Enhancement	--	1.75	--					
Preservation	1465	0.05	--					
Totals	3665	1.8	5.1					
Mitigation Units	1173 SMUs	0.89 WMUs	--					

**Table 2. Project Activity and Reporting History
UT to Haw (Beckom) Site, DMS Project No. 92694**

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	March 2010	March 2010
Soil Amendments, Site Planting, & Baseline Monitoring Document	January 2011	January 2011
Year 1 (2011) Annual Monitoring	September 2011	October 2011
Year 2 (2012) Annual Monitoring	June 2012	August 2012
Year 3 (2013) Annual Monitoring	July 2013	September 2013
Year 4 (2014) Annual Monitoring	September 2014	October 2014
Year 5 (2015) Annual Monitoring	September 2015	November 2015

Table 3. Project Contacts Table
UT to Haw (Beckom) Site, DMS Project No. 92694

Designer	Axiom Environmental 218 Snow Ave Raleigh, NC 27603 Grant Lewis (919-215-1693)
Planting and Soil Amendment Contractor	Riverworks Inc. PO Box 31768 Raleigh NC 27622 George Morris (919-459-9043)

**Table 4. Project Baseline Information and Attributes
UT to Haw (Beckom) Site, DMS Project No. 92694**

Project Information								
Project name			UT to Haw Beckom					
County			Alamance					
Project Area			10 acres					
Project Coordinates			36.1503°N, -79.4644°W					
Project Watershed Summary Information								
Physiographic Province			Southern Outer Piedmont					
River Basin			Cape Fear					
USGS Hydrologic Unit 8-digit		03030002	USGS Hydrologic Unit 14-digit		03030002030010			
DWQ Sub-Basin			03-06-02					
Project Drainage Area			385 acres					
Project Drainage Area Percentage Impervious Surface			<5					
CGIA Land Use Classification			Managed Herbaceous Cover, Hardwood Swamps					
Reach Summary Information								
Parameters	Main Channel		UT 1	UT 2	UT 3			
Length of reach (linear feet)	2185		680	635	165			
Valley classification	VIII		VIII	VIII	VIII			
Drainage area (acres)	150		75	50	30			
NCDWQ stream identification score	42		51	60	68			
NCDWQ Water Quality Classification	WS-V							
Morphological Description (stream type)	-		-	-	-			
Evolutionary trend	-		-	-	-			
Underlying mapped soils	Local Alluvial Land							
Drainage class	Poorly drained							
Soil Hydric status	Hydric							
Slope	.009 feet		.005 feet	.025 feet	.024 feet			
FEMA classification	-		-	-	-			
Percent composition of exotic invasive vegetation	<5		<5	<5	<5			
Wetland Summary Information								
Parameters	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6	Wetland 7	Wetland 8
Size of Wetland (acres)	1.15 acres	0.25 acres	0.05 acres	0.15 acres	0.05 acres	0.10 acres	0.01 acres	0.04 acres
Wetland Type	Riparian							
Drainage class	Poorly Drained							
Soil Hydric Status	Hydric							
Source of Hydrology	Overbank and over-land flow							
Native Vegetation Community	Piedmont/Mountain Swamp Forest						P/M BHF*	P/M BHF*
Percent composition of exotic invasive vegetation	0	0	0	0	0	0	0	0
Regulatory Considerations								
Regulation	Applicable			Resolved?		Supporting Document		
Waters of the United States – Section 404	No							
Waters of the United States – Section 401	No							
Endangered Species Act	No							
Historic Preservation Act	No							
Coastal Management Zone Act (CZMA)/ Coastal Area Management Act (CAMA)	No							
FEMA Floodplain Compliance	No							
Essential Fisheries Habitat	No							

*Piedmont/Mountain Bottomland Hardwood Forest (Schafale and Weakley)

APPENDIX B
VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View

Table 5. Vegetation Condition Assessment Table
Vegetation Monitoring Plot Photos



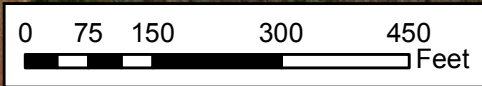
Large Off-site Beaver Dam

Plot Origin	Latitude	Longitude
1	36.15240	-79.46400
2	36.15191	-79.46456
3	36.15096	-79.46441
4	36.15005	-79.46442
5	36.14950	-79.46420

Photo Point	Latitude	Longitude
1	36.14943	-79.46399
2	36.15013	-79.46427
3	36.15088	-79.46457
4	36.15185	-79.46444
5	36.15218	-79.46426

Legend

- Conservation Easement
- Streams
- Vegetation Plots
- ★ Vegetation Plot Origins
- Crest Gauge
- Photo Points
- Swamp Forest
- Streamside Assemblage
- Bottomland Hardwood



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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

CURRENT CONDITIONS PLAN VEIW
UT TO HAW BECKOM SITE
Alamance County, North Carolina

Down by PHP
Date: Sept 2015
Project: 12-004.05

FIGURE
2

Table 5 **Vegetation Condition Assessment**
UT Haw Beckom/DMS Project Number 92694

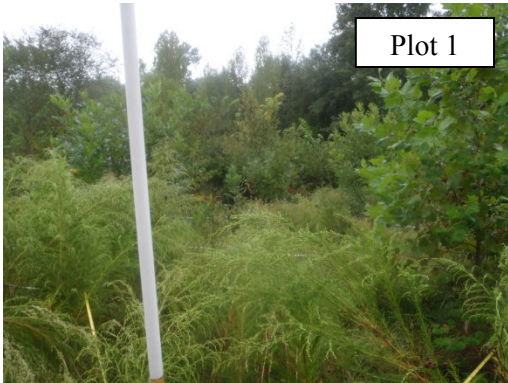
Planted Acreage¹ **5.1**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	NA	NA	0	0.00	0.0%
2. Low Stem Density Areas	NA	NA	NA	0	0.00	0.0%
Total				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	NA	NA	NA	0	0.00	0.0%
Cumulative Total				0	0.00	0.0%

Easement Acreage² **10**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern ⁴	Chinese privet and Japanese honeysuckle scattered throughout downstream portion of site.	NA	NA	0	0.10	1.0%
5. Easement Encroachment Areas ³	NA	NA	NA	0	0.00	0.0%

UT Haw (Beckom) Year 5 - 2015
Vegetation Monitoring Photographs
Taken September 2015



APPENDIX C
VEGETATION PLOT DATA

Table 6. Vegetation Plot Criteria Attainment

Table 7. CVS Vegetation Plot Metadata

Table 8. Total Planted and Natural Recruit Stems by Plot and Species

**Table 6. Vegetation Plot Criteria Attainment
 UT to Haw (Beckom) Site, DMS Project No. 92694**

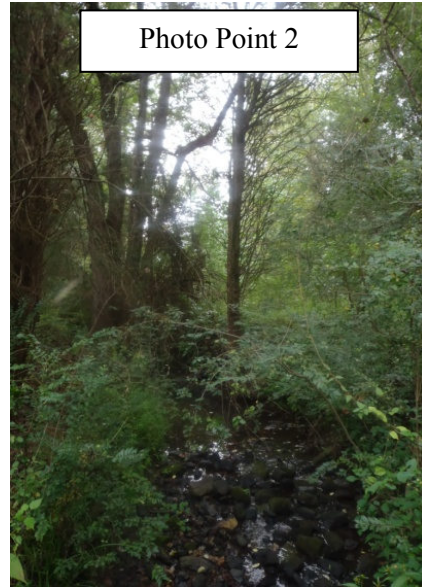
Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	

**Table 7. CVS Vegetation Plot Metadata
UT to Haw (Beckom) Site, DMS Project No. 92694**

Report Prepared By	Corri Faquin
Date Prepared	9/22/2015 15:18
database name	Axiom-EEP-2015-A-v2.3.1.mdb
database location	S:\CVS database\2015
computer name	PHILLIP-PC
file size	52068352
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	92694
project Name	UT Haw (Beckom)
Description	buffer and wetland mitigation
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	5

APPENDIX D
STREAM DATA
Fixed-Station Photos

UT Haw (Beckom) Year 5 - 2015
Fixed-Station Photos
Taken September 2015



APPENDIX E
HYDROLOGY DATA

Table 9. Verification of Bankfull Events

Table 9. Verification of Bankfull Events

UT to Haw (Beckom) Site, DMS Project No. 92694

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
September 30, 2011	June 28, 2011	Total of 2.83 inches* of rain reported to fall over 2 days (June 27-28, 2011)	--
September 30, 2011	September 24, 2011	Total of 3.61 inches* of rain reported to fall over 4 days (September 21-24, 2011) with an additional 0.85 inches* of rain the following 3 days (Sept 25-27, 2011)	--
July 18, 2012	July 11, 2012	Total of 4.84 inches* of rain reported to fall over 3 days (July 9-11, 2012)	--
July 11, 2013	June 31, 2013	Visual observations of overbank event including wrack lines and sediment deposition resulting from 14 days (June 25- July 8) of heavy rainfall totaling 6.27 inches.	1-2
August 13, 2014	September 1, 2013	Total of 2.56 inches* of rain reported to fall on September 1, 2014	--
August 13, 2014	May 15, 2014	Total of 2.74 inches* of rain reported to fall on May 15, 2014	--
September 25, 2015	July 19, 2015	Total of 2.50 inches* of rain reported to fall on July 19, 2015	--

* Reported at KBUY Weather Station in Burlington.

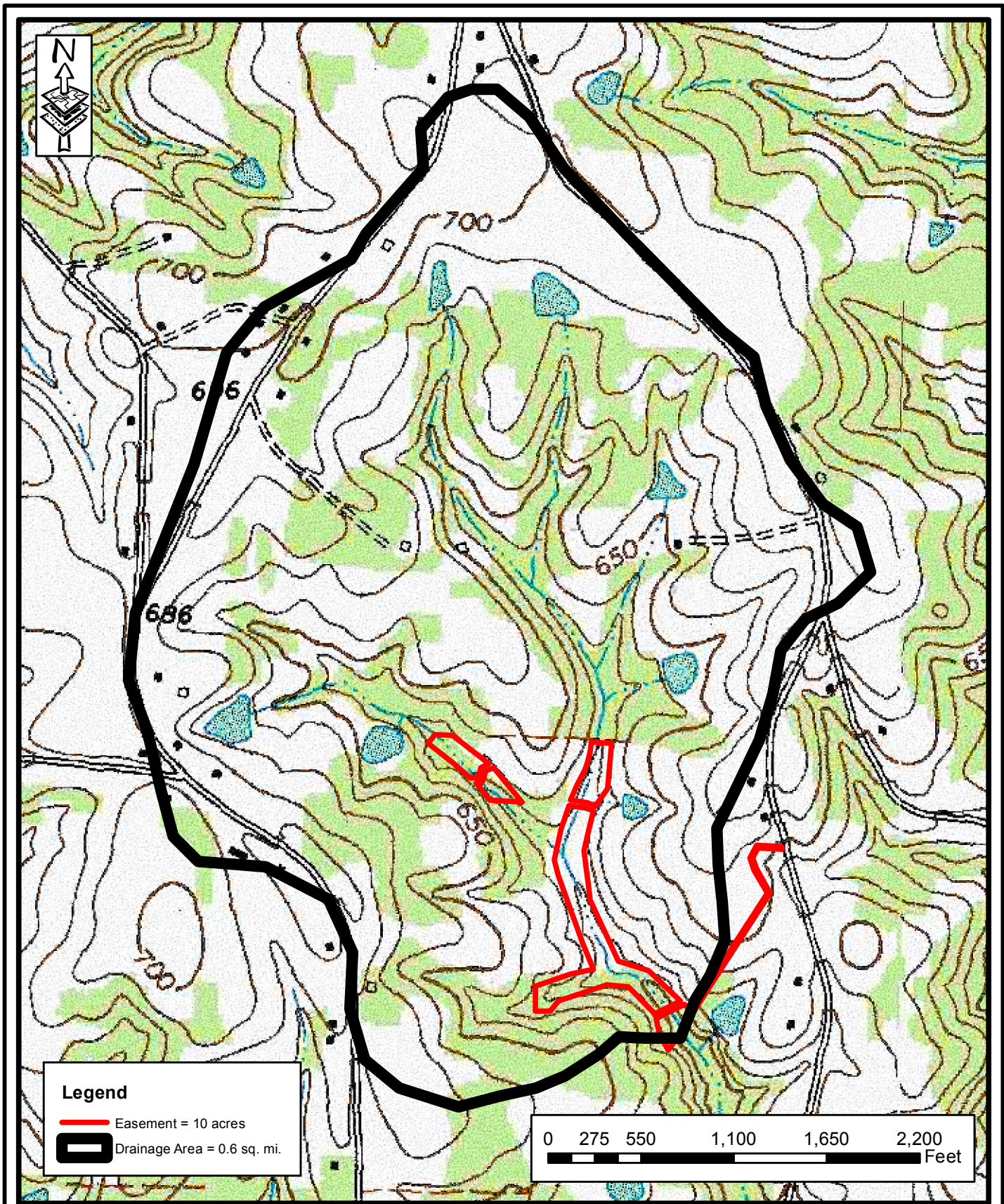


APPENDIX F
ADDITIONAL SITE DATA

Restoration Plan Figure 3. USGS Topographic Map (with drainage area)

Restoration Plan Figure 4. Existing Conditions (with soils)

Preconstruction Photographs

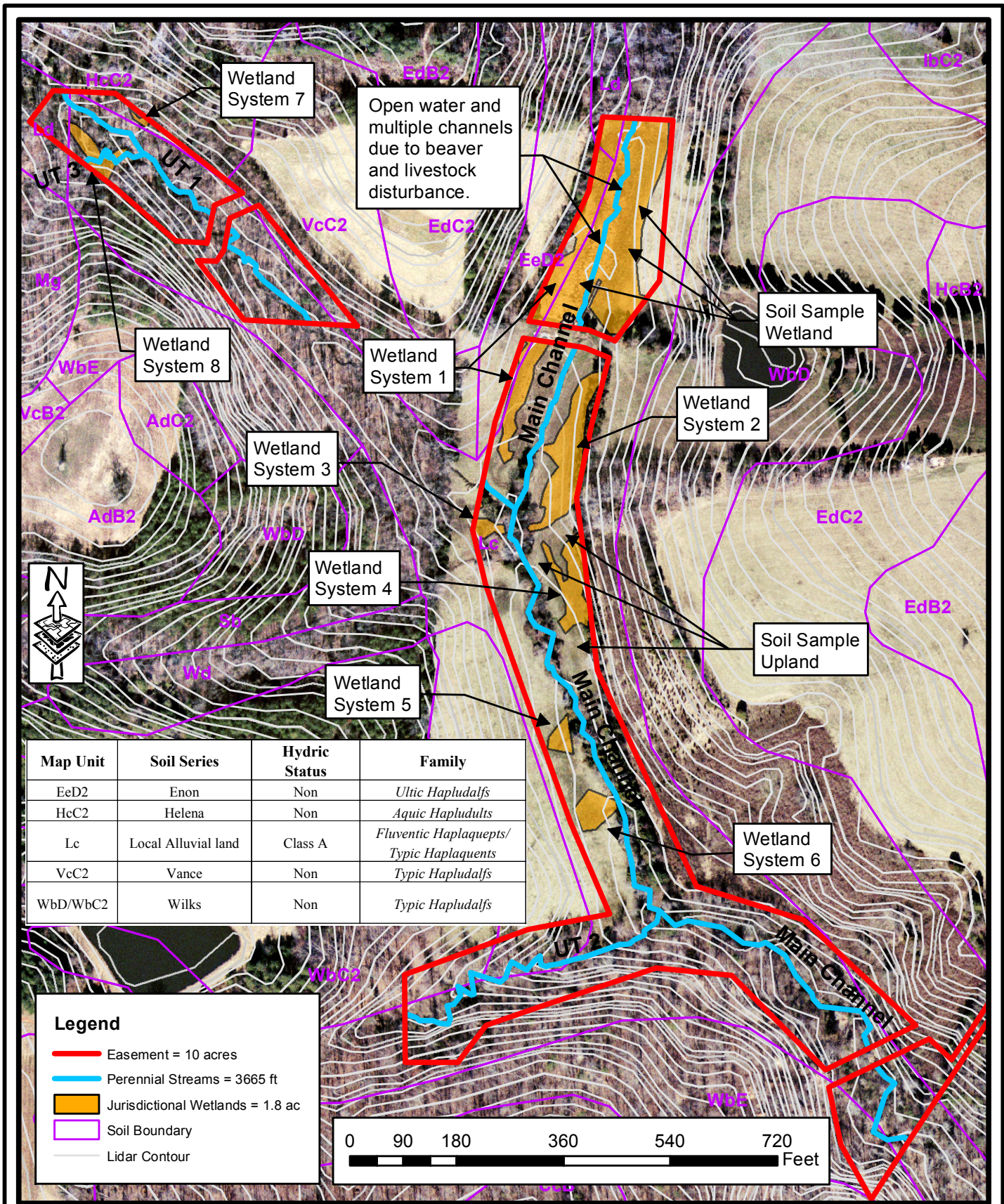



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**TOPOGRAPHY AND DRAINAGE AREA
 UT TO HAW (BECKOM) SITE (DMS# 92694)
 Alamance County, North Carolina**

Dwn. By: WGL
 Date: 1-8-10
 Project: 09-025

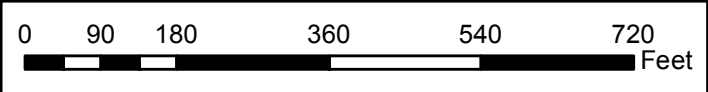
FIGURE
3



Map Unit	Soil Series	Hydric Status	Family
EeD2	Enon	Non	Ultic Hapludalfs
HcC2	Helena	Non	Aquic Hapludults
Lc	Local Alluvial land	Class A	Fluventic Haplaquepts/ Typic Haplaquents
VcC2	Vance	Non	Typic Hapludalfs
WbD/WbC2	Wilks	Non	Typic Hapludalfs

Legend

- Easement = 10 acres
- Perennial Streams = 3665 ft
- Jurisdictional Wetlands = 1.8 ac
- Soil Boundary
- Lidar Contour




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EXISTING CONDITIONS
UT TO HAW (BECKOM) SITE (DMS# 92694)
Alamance County, North Carolina

Dwn. By: **WGL**
 Date: **1-8-10**
 Project: **09-025**

FIGURE
4

**UT to Haw (Beckom) Site
Preconstruction Photographs
Taken January 2010**

