MITIGATION PLAN

ABBEY LAMM
STREAM AND WETLAND MITIGATION SITE

Alamance County, North Carolina
Full Delivery Contract No. 5790

Cape Fear River Basin
Cataloging Unit 03030002

Prepared for:

NCDENR-Ecosystem Enhancement Program
217 West Jones Street, Suite 3000A
Raleigh, North Carolina 27603

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217 West Jones Street, Suite 3000A
Raleigh, North Carolina 27603

Prepared by:

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December 2014

EXECUTIVE SUMMARY

The Abbey Lamm Stream and Wetland Mitigation Site (Site) is located approximately 2.0 miles east of Snow Camp in southern Alamance County within 14-digit Cataloging Unit and Targeted Local Watershed 03030002050050 of the Cape Fear River Basin.

The Site encompasses approximately 17.3 acres of agricultural land used for livestock grazing and hay production. The Site is situated along unnamed tributaries to Reedy Branch, a tributary to Cane Creek. A 3.5-acre farm pond is located at the downstream extent of the Site. Existing Site streams have been cleared of vegetation, dredged of cobble substrate, trampled by livestock, eroded vertically and laterally, and received extensive sediment and nutrient inputs from livestock. Approximately 86 percent of the existing stream channel has been degraded contributing to sediment export from the Site resulting from mechanical processes from livestock hoof shear. In addition, streamside wetlands have been drained by channel incision, and soils have been compacted, cleared of forest vegetation, and altered by existing land uses. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in meeting its stream and wetland restoration goals.

Site activities include the restoration of perennial and intermittent stream channels, enhancement (level II) of perennial and intermittent stream channels, and restoration of riparian wetlands. Priority I restoration of intermittent channels at the Site is imperative to provide significant functional uplift to Site hydrology, water quality, and habitat, in addition to restore adjacent streamside, riparian wetlands. A total of 4731 Stream Mitigation Units (SMUs) and 1.0 Riparian Wetland Mitigation Units (WMUs) are being offered as depicted in the following tables.

Stream Mitigation Type	Perennial Stream Counting Towards Mitigation Credits (linear feet)	Intermittent Stream Counting Towards Mitigation Credits (linear feet)	Ratio	Stream Mitigation Units
Restoration	2629	1771	1:1	4400
Enhancement (Level II)	403	426	2.5:1	331
Totals	**3032**	**2197**		**4731**

Wetland Mitigation Type	Acreage	Ratio	Riparian Wetland Mitigation Units
Riparian Restoration	1.0	1:1	1.0
Riparian Enhancement*	0.4	--	--
Totals	**1.4**		**1.0**

***Wetland enhancement acreage is not included in mitigation credit calculations as per RFP 16-005568 requirements.**

Positive aspects supporting proposed mitigation activities at the Site include the following.

- Streams have a Best Usage Classification of WS-V, NSW (Nutrient Sensitive Waters)
- Located in a Targeted Local Watershed (TLW)
- According to the *Cape Fear River Basin Restoration Priorities 2009*, benthic ratings in the TLW vary from "Fair" to "Good-Fair" indicating a need for improvement of aquatic conditions in the watershed (NCEEP 2009)
- A Significant Natural Heritage Area is located immediately east of the Site

The following table summarizes the project goals/objectives and proposed functional uplift based on proposed Site restoration activities and observations of two reference areas located in the vicinity of the Site.

Project Goals and Objectives

Project Goal/Objective	How Goal/Objective will be Accomplished
Improve Hydrology	
Restore Floodplain Access	Building a new channel at the historic floodplain elevation to restore overbank flows
Restore Wooded Riparian Buffer	Planting a woody riparian buffer
Improve Microtopography	Scarifying soils to reduce compaction and hoof shear due to cattle
Restore Stream Stability	Building a new channel, planting a woody riparian buffer, and removing cattle
Increase Sediment Transport	
Improve Stream Geomorphology	
Increase Surface Storage and Retention	Building a new channel at the historic floodplain elevation restoring overbank flows, removing cattle, scarifying compacted soils, and planting woody vegetation
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	Raising the stream bed elevation
Improve Water Quality	
Increase Upland Pollutant Filtration	Planting a native, woody riparian buffer and installing 8 marsh treatment areas
Increase Thermoregulation	Planting a native, woody riparian buffer
Reduce Stressors and Sources of Pollution	Removing cattle and installing 8 marsh treatment areas
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Raising the stream bed elevation, restoring overbank flows, planting with woody vegetation, removing cattle, increasing surface storage and retention, restoring appropriate inundation/duration, and installing 8 marsh treatment areas
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Raising the stream bed elevation, restoring overbank flows, planting with woody vegetation, and installing 8 marsh treatment areas
Restore Habitat	
Restore In-stream Habitat	Building a stable channel with a cobble/gravel bed and planting a woody riparian buffer
Restore Stream-side Habitat	Planting a woody riparian buffer
Improve Vegetation Composition and Structure	

This mitigation plan has been written in compliance with the requirements of the following documents, which govern NCEEP operations and procedures for the delivery of compensatory mitigation.

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010.

This detailed restoration plan includes 1) descriptions of existing conditions; 2) reference stream, wetland, and forest studies; 3) restoration plans; and 4) monitoring and success criteria. Proposed restoration activities may be modified during the design stage to address constraints such as access issues, sediment-erosion control measures, drainage needs (floodway constraints), or other design considerations.

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APPENDICES

1.0 PROJECT SITE IDENTIFICATION AND LOCATION

The Abbey Lamm Stream and Wetland Mitigation Site is located approximately 2.0 miles east of Snow Camp in southern Alamance County (Figure 1, Appendix A). The Abbey Lamm Stream and Wetland Mitigation Site (hereafter referred to as the "Site") encompasses approximately 17.3 acres of agricultural land used for livestock grazing and hay production. Within the Site, existing streams have been cleared of vegetation, dredged of cobble substrate, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. In addition, streamside wetlands have been drained by channel incision, soils have been compacted, cleared of forest vegetation, and altered by existing land uses.

1.1 Directions to Project Site

Directions to the Site from Interstate 40 in Chapel Hill/Durham, North Carolina.

- Travel west on NC 54 for 7 miles,
- Exit onto Jones Ferry Road and turn left,
- Travel west for 1 mile,
- Turn right onto Old Greensboro Road (SR 1005) and travel 16 miles,
  (The road name changes to Greensboro-Chapel Hill Road at the Haw River)
- Turn left onto Holman Mill Road (SR 2356) and travel 1.5 miles,
- Turn left onto Major Hill Road (SR 2348) and the Site is on the left.
  - Site Latitude, Longitude
    35.885584ºN, -79.394638ºW (NAD83/WGS84)

1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within the Cape Fear River Basin in 14-digit United States Geological Survey (USGS) Cataloging Unit and Targeted Local Watershed 03030002050050 of the South Atlantic/Gulf Region (North Carolina Division of Water Resources [NCDWR], formerly the North Carolina Division of Water Quality, subbasin number 03-06-04) [Figure 2, Appendix A]). Topographic features of the Site drain to Reedy Branch, which has been assigned Stream Index Number 16-28-3 and a Best Usage Classification of WS-V, NSW (NCDWR 2013).

1.3 Project Components and Structure

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 4400 linear feet of Priority I stream restoration, 829 linear feet of stream enhancement (Level II), 1.0 acre of riparian wetland restoration, and 0.4 acre of riparian wetland enhancement (Table 1) (Figures 6A-6D, Appendix A).

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4.

Table 1. Project Components and Mitigation Credits
Abbey Lamm Restoration Site

Mitigation Credits			
Stream	**Stream**	**Riparian Wetland**	**Nonriparian Wetland**
Restoration	**Enhancement**	**Restoration**	**Restoration**
4400	**331**	**1.0**	**--**

Projects Components							
Station Range	**Existing Linear Footage/ Acreage**	**Priority Approach**	**Restoration/ Restoration Equivalent**	**Restoration Linear Footage/ Acreage**	**Mitigation Ratio**	**Mitigation Credits**	**Comment**
UT 1 Station 00+21 to 05+62	531	PI	Restoration	541	1:1	541	
UT 1a Station 00+00 to 01+54	154	PI	Restoration	154-8=146	1:1	146	8 lf of UT1a located outside of easement is not credit generating
UT 2 Station 00+22 to 04+77	502	PI	Restoration	455	1:1	455	
UT 3a Station 00+00 to 00+93	93		EII	93	2.5:1	37	
UT 3b Station 00+00 to 01+43	143		EII	143	2.5:1	57	
UT 3c Station 00+00 to 01+90	190		EII	190	2.5:1	76	
UT 3 Station 00+93 to 11+77	1021	PI	Restoration	1084	1:1	1084	
Mainstem Channel Station 04+77 to 16+31	1098	PI	Restoration	1154-61-63= 1030	1:1	1030	61 lf and 63 lf of Mainstem located outside of easement at two crossings are not credit generating
Mainstem Channel Station 16+31 to 20+59	428		EII	428-25=403	2.5:1	161	25 lf of Mainstem located outside of easement are not credit generating
Mainstem Channel Station 20+59 to 32+58	NA	PI	Restoration	1199-55=1144	1:1	1144	55 lf of Mainstem located outside of easement are not credit generating

Table 1. Project Components and Mitigation Credits (continued)
Abbey Lamm Restoration Site

Component Summation			
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**	**Nonriparian Wetland (acreage)**
Restoration	4400*	1.0	--
Enhancement (Level 1)	--	--	--
Enhancement (Level II)	829**	--	
Enhancement	--	0.4***	
Totals	**5229**	--	--
Mitigation Units	**4731 SMUs**	**1.0 Riparian WMUs**	**0.00 Nonriparian WMUs**

*An additional 187 linear feet of stream restoration is proposed outside of the easement and is therefore not included in this total or in mitigation credit calculations.

**An additional 25 linear feet of stream enhancement (level II) is proposed outside of the easement and is therefore not included in this total or in mitigation credit calculations.

***Wetland enhancement acreage is not included in mitigation credit calculations as per RFP 16-005568 requirements.

Table 2. Project Activity and Reporting History
Abbey Lamm Restoration Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-005568)	--	October 2013
EEP Contract No. 5790	--	February 2014
Mitigation Plan	--	September 2014
Construction Plans	--	--

Table 3. Project Contacts Table
Abbey Lamm Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Worth Creech 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Abbey Lamm Restoration Site

Project Information	
Project Name	Abbey Lamm Restoration Site
Project County	Alamance County, North Carolina
Project Area (acres)	17.3
Project Coordinates (latitude & latitude)	35.885584ºN, 79.394638ºW
Project Watershed Summary Information	
Physiographic Province	Piedmont
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030002050050
NCDWR Sub-basin for Project	03-06-04
Project Drainage Area (acres)	257
Percentage of Project Drainage Area that is Impervious	<2%

Table 4. Project Attribute Table
Abbey Lamm Restoration Site (continued)

Reach Summary Information				
Parameters	**Main**	**UT 1**	**UT 2**	**UT 3**
Length of reach (linear feet)	3258	695	455	1510
Valley Classification	alluvial			
Drainage Area (acres)	257	49	56	32
NCDWR Stream ID Score	--	29	35.25	28
NCDWR Water Quality Classification	WS-V, NSW			
Existing Morphological Description (Rosgen 1996)	Eg5/Fc5	E/G 5	C/G 5	Eg5
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	II/III	IV/III	III
Underlying Mapped Soils	Efland silt loam, Goldston slaty silt loam, Herndon silt loam, Moderately gullied land, Orange silt loam			
Drainage Class	Well-drained, well-drained, well-drained, poorly to well-drained, moderately well-drained			
Hydric Soil Status	Nonhydric			
Slope	0.0179	0.0256-0.0362		
FEMA Classification	NA			
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest			
Watershed Land Use/Land Cover (Site)	40% forest, 58% agricultural land, <2% low density residential/impervious surface			
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface			
Percent Composition of Exotic Invasive Vegetation	<5%			

Wetland Summary Information	
Parameters	**Wetlands**
Wetland acreage	1.4
Wetland Type	Riparian
Mapped Soil Series	Worsham
Drainage Class	Poorly drained
Hydric Soil Status	Hydric
Source of Hydrology	Groundwater, stream overbank
Hydrologic Impairment	Incised streams, compacted soils, livestock
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest
% Composition of Exotic Invasive Vegetation	<5%

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	In progress	JD Package (App D)
Waters of the United States-Section 404	Yes	In progress	JD Package (App D)
Endangered Species Act	No	--	CE Document (App E)
Historic Preservation Act	No	--	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	No	--	Appendix F
Essential Fisheries Habitat	No	--	NA

2.0 WATERSHED CHARACTERIZATION

2.1 Drainage Area

The Site provides water quality function to a 0.4-square mile (257-acre) watershed at the Site outfall (Figure 3, Appendix A). The Site drainage area is primarily composed of agricultural and pastoral land, with sparse residential areas along state maintained roads, and forest land in the upper headwaters and immediately east of the Site associated with a Significant Natural Heritage Area (Major Hill Monadnock Forest).

2.2 Surface Water Classification/Water Quality

The Site is located within the Cape Fear River Basin 14-digit United States Geological Survey (USGS) Cataloging Unit and Targeted Local Watershed 03030002050050 of the South Atlantic/Gulf Region (NCDWR subbasin number 03-06-04) (Figure 2, Appendix A). Topographic features of the Site drain to Reedy Branch, which has been assigned Stream Index Number 16-28-3 and a Best Usage Classification of WS-V, NSW (NCDWR 2013). Streams with a designation of WS-V are protected as water supplies which are generally upstream and draining to Class WS-IV waters, or waters used by industry to supply their employees with drinking water or as waters formerly used as water supply. These waters are also protected for Class C uses, such as aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Secondary recreation includes wading, boating, and other uses not involving human body contact with waters on an organized or frequent basis. The designation NSW (Nutrient Sensitive Waters) includes areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

The North Carolina Department of Environment and Natural Resources (NCDENR) has assembled a list of impaired waterbodies according to the Clean Water Act Section 303(d) and 40 CFR 130.7, which is a comprehensive public accounting of all impaired waterbodies. An impaired waterbody is one that does not meet water quality standards including designated uses, numeric and narrative criteria, and anti-degradation requirements defined in 40 CFR 131. Site tributaries and their receiving waters are not listed on the NCDENR draft 2014 or final 2012 303(d) lists (NCDENR 2013, NCDENR 2014).

2.3 Physiography, Geology, and Soils

The Site is located in the Carolina Slate Belt portion of the Piedmont Ecoregion of North Carolina within USGS Cataloging Unit 03030002 (North Carolina Division of Water Resources [NCDWR] subbasin number 03-06-04) of the Cape Fear River Basin. Regional physiography is characterized by dissected, irregular plains with moderate to steep slopes and low to moderate gradient streams over boulder and cobble-dominated substrate (Griffith et al. 2002). Onsite elevations range from a high of 600 feet National Geodetic Vertical Datum (NGVD) at the upper reaches of UT3 to a low of approximately 520 feet NGVD at the Site outfall (USGS Snow Camp, North Carolina 7.5-minute topographic quadrangle) (Figure 3, Appendix A).

Geology of the Site includes felsic metavolcanic rock of the Charlotte and Milton Belts as well as intrusive rock of metamorphosed granitic rock. Felsic rocks are metamorphosed dacitic to rhyolitic flows and tuffs that are light gray to greenish-gray in color. Metamorphosed granitic rocks are megacrystic and well-foliated; locally they contain hornblende (NCGS 1985). Rock

outcrops at the Site were surveyed and depicted on mapping as avoidance areas for channel excavation. In addition, bedrock outcrops in the channels were mapped and have been incorporated into the design channel as natural grade control.

Soils that occur within the Site, according to the *Web Soil Survey* (USDA 2013) are depicted in Figure 4 (Appendix A) and are described in Table 5.

Table 5. Site Soils
Abbey Lamm Restoration Site

Soil Series	Hydric Status	Description
Efland silt loam (EaD)	Nonhydric	This series consists of well-drained soils found along slopes ranging from 10-15 percent. This soil is thin and can be associated with large rock outcrops. It is derived from parent material of the Carolina slate belt.
Goldston slaty silt loam (GcC, GcD)	Nonhydric	This series consists of moderately sloped, well-drained soils in uplands and along breaks near streams. These soils are derived from parent material of the Carolina slate belt. GcC are found along slopes ranging from 6-10 percent. GcD are found along slopes ranging from 10-15 percent and tend to occur further downslope near stream breaks.
Herndon silt loam (HdB_2, HdE)	Nonhydric	This soil series consists of well-drained soils found on moderate to steep slopes and along major streams. Slopes range from 2-6 percent for HdE soils and 15-25 percent for HdB_2 soils. This soil series is derived from parent material of the Carolina slate belt.
Moderately Gullied Land (Mf)	Nonhydric	This series consists of mixed soils eroded from uplands and deposited along low areas. This alluvial soil ranges from poorly to well-drained. This particular mapping unit is made up of soils derived from volcanic parent materials and silt. It is found along 6-25 percent slopes.
Orange silt loam (ObC)	Nonhydric	This series consists of moderately well-drained soils found on 6-10 percent slopes. They are developed from igneous and metamorphic parent materials. This series has poor runoff and slow internal drainage.

2.4 Protected Species

Plants and animals with federal classifications of Endangered, Threatened, Proposed Endangered, and Proposed Threatened are protected under provisions of Sections 7 and 9 of the Endangered Species Act of 1973, as amended.

Based on the most recently updated county-by-county database of federally listed species in North Carolina as posted by the United States Fish and Wildlife Service (USFWS) at http://www.fws.gov/southeast/es/county%20lists.htm, no federally protected species are listed for Alamance County.

2.5 Cultural Resources

The term "cultural resources" refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. "Significant" cultural resources are those that are eligible or potentially eligible for inclusion in the *National Register of Historic Places*. Evaluations of Site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

In a letter dated March 20, 2014, SHPO indicated they "conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed." A copy of the letter is included in the Categorical Exlusion document in Appendix E.

2.6 Potential Constraints

The presence of conditions or characteristics that have the potential to hinder restoration activities within the Site was evaluated. The evaluation focused primarily on the presence of hazardous materials, utilities and restrictive easements, rare/threatened/endangered species or critical habitats, and the potential for hydrologic trespass. Existing information regarding constraints was acquired and reviewed. In addition, any Site conditions that have the potential to restrict the proposed restoration design and implementation were documented during the field investigation.

No constraints that may hinder restoration activities have been identified for this Site.

2.6.1 Property Ownership and Boundary

The property is held by James and Carol Lamm. A perpetual conservation easement will be prepared that incorporates the results of this study. The conservation easement will be depicted on a recordable map, signed by the owner, and recorded in Alamance County.

2.6.2 Site Access

The Site is accessed from Major Hill Road (SR 2348). An access easement to the conservation easement will be obtained and recorded in Alamance County.

2.6.3 Utilities

Utilities are not located within the vicinity of the project and are therefore not considered a constraint for this project.

2.6.4 FEMA/Hydrologic Trespass

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel number 8787). Based on existing floodplain mapping, the Site is not located in a Special Flood Hazard Area and the project should not alter FEMA flood zones. Therefore, a "Conditional Letter of Map Revision" (CLOMR) is not expected for this project (see Appendix F for the EEP Floodplain Requirements Checklist).

Surface drainage on the Site and surrounding areas are in the process of being analyzed to predict the feasibility of manipulating existing surface drainage patterns without adverse effects to the Site or adjacent properties. The following presents a summary of hydrologic and hydraulic analyses

along with provisions designed to maximize groundwater recharge and wetland restoration while reducing potential for impacts to adjacent properties.

The purpose of the analysis is to predict flood extents for the 1-, 2-, 5-, 10-, 50-, and 100-year storms under existing and proposed conditions after stream and wetland restoration activities have been implemented. The comparative flood elevations are evaluated by simulating peak flood flows for Site features using the WMS (Watershed Modeling System, BOSS International) program and regional regression equations. Once the flows are determined, the river geometry and cross-sections are digitized from a DTM (Digital Terrain Model) surface (prepared by a professional surveyor) using the HEC-GeoRAS component of ArcView. The cross-sections are adjusted as needed based on field-collected data. Once corrections to the geometry are performed, the data is imported into HEC-RAS.

Watersheds and land use estimations were measured from existing DEM (Digital Elevation Model) data and aerial photography. Field surveyed cross-sections and water surfaces were obtained along Site features. Valley cross-sections were obtained from both onsite cross-sections and detailed topographic mapping of 1-foot contour intervals using the available DTM. Observations of existing hydraulic characteristics will be incorporated into the model and the computed water surface elevations will be calibrated using engineering judgment.

The HEC-RAS will be completed prior to completion of detailed construction plans for Site restoration activities. A primary objective of the stream and wetland restoration design is maintenance of a no-rise in the 100-year floodplain. It is assumed that a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) are not necessary. However, coordination with FEMA will be conducted, if necessary, prior to initiating Site construction activities.

3.0 PROJECT SITE STREAMS (EXISTING CONDITIONS)

Streams targeted for restoration include unnamed tributaries to Reedy Branch (Main Stem and UTs 1-3), which have been cleared, dredged of cobble substrate, straightened, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Approximately 86 percent of the existing stream channel has been degraded contributing to sediment export from the Site resulting from mechanical processes from livestock hoof shear. In addition, streamside wetlands have been cleared and drained by channel downcutting and land uses. Current Site conditions have resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and greatly reduce sediment loss from channel banks.

3.1 Existing Conditions Survey

Site stream dimension, pattern, and profile were measured to characterize existing channel conditions. Locations of existing stream reaches are depicted in Figure 4 (Appendix A) and cross-section locations are depicted in Figure B1 (Appendix B). Stream geometry measurements under existing conditions are summarized in Table 6 (Morphological Stream Characteristics).

3.2 Channel Classification and Morphology

Stream geometry and substrate data have been evaluated to classify existing stream conditions based on a classification utilizing fluvial geomorphic principles (Rosgen 1996). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. Primary components of the classification include degree of entrenchment, width-depth ratio, sinuosity, channel slope, and stream substrate composition.

Existing Site reaches are classified as unstable C/G-type, E/G-type, Eg-type, and Fc-type streams with little to no sinuosity. Each stream type is modified by a number 1 through 6 (e. g., E5), denoting a stream type which supports a substrate dominated by 1) bedrock, 2) boulders, 3) cobble, 4) gravel, 5) sand, or 6) silt/clay. Existing Site reaches are characterized by sand substrate as the result of channel impacts including livestock trampling, channel straightening, and riparian vegetation removal, in addition to manual removal of substrate by the landowner. Substrate removed from streams was stockpiled on-Site and will be used in the restored stream channel to mimic relatively undisturbed reaches upstream of the Site, which are comprised of gravel/cobble substrate.

3.3 Channel Evolution

Bed and bank erosion typically leads to channel downcutting and evolution from a stable E-type channel into a G-type (gully) channel. Continued erosion eventually results in lateral extension of the G-type channel into an F-type (widened gully) channel. The F-type channel will continue to widen laterally until the channel is wide enough to support a stable C-type or E-type channel at a lower elevation so that the original floodplain is no longer subject to regular flooding.

Site streams have been channelized and are continually trampled by livestock resulting primarily in channels classified as degraded (Class III) and degraded and widened (Class IV) channels throughout the Site (Simon and Hupp 1986).

3.4 Valley Classification

The Site is located within a small stream, headwater, alluvial valley with an average 40- to 50-foot floodplain valley width. Valley slopes are typical for the Piedmont region and range from 0.186-0.0435. Typical streams in this region include C- and E-type streams with slightly entrenched, meandering channels with a riffle-pool sequence.

3.5 Discharge

This hydrophysiographic region is characterized by moderate rainfall with precipitation averaging approximately 40-50 inches per year (USDA 1960). Drainage basin sizes range from 0.04-square mile for UT3 to 0.4-square mile for the Main Stem at the Site outfall.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on regional curves (Harman et al. 1999), the bankfull discharge for a 0.04-square mile watershed and a 0.4-square mile watershed is expected to average 10.2 cubic feet per second and 46.0 cubic feet per second, respectively. Bankfull discharge is expected to occur on average once per year.

Table 6. Morphological Stream Characteristics
Abbey Lamm Restoration Site

Variables	REFERENCE - CEDAROCK PARK	REFERENCE - CAUSEY* FARM	Existing UT 1	Existing UT 2	Existing UT 3	PROPOSED	Main Channel (Upstream)	Main Channel (Downstream)	PROPOSED
Stream Type	Eb 4	E 5	E/G 5	C/G 5	Eg 5	E/C 3/4	Eg 5	Fc 5	E/C 3/4
Drainage Area (mi^2)	0.21	0.63	0.08	0.09	0.04	0.08	0.4	0.4	0.4
Bankfull Discharge (cfs)	28.8	60.6	12.9	14.1	9.2	12.9	41.3	41.3	41.3
Dimension Variables									
Bankfull Cross-Sectional Area (A_{bkf})	8.0	14.7	3.5	3.8	2.6	3.5	10.4	10.4	10.4
Existing Cross-Sectional Area at TOB ($A_{existing}$)	8.0	14.7	4.7 - 24.5	3.8 - 24.8	2.9 - 20.9	3.5	10.4 - 30	16.6 - 59.4	10.4
Bankfull Width (W_{bkf})	Mean: 8.1 Range: 8.0 - 12.1	Mean: 11.0 Range: 10.7 - 11.3	Mean: 6.5 Range: 4.0 - 12.0	Mean: 9.7 Range: 7.1 - 15.6	Mean: 7.2 Range: 3.4 - 12.3	Mean: 7.0 Range: 6.5 - 7.5	Mean: 18.5 Range: 11.7 - 26.5	Mean: 13.0 Range: 8.7 - 17.0	Mean: 12.1 Range: 11.2 - 12.9
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.8 - 1.0	Mean: 1.4 Range: 1.3 - 1.4	Mean: 0.6 Range: 0.3 - 0.9	Mean: 0.4 Range: 0.2 - 0.5	Mean: 0.4 Range: 0.2 - 0.8	Mean: 0.5 Range: 0.46 - 0.55	Mean: 0.6 Range: 0.4 - 0.9	Mean: 0.9 Range: 0.6 - 1.2	Mean: 0.9 Range: 0.8 - 0.9
Bankfull Maximum Depth (D_{max})	Mean: 1.4 Range: 1.1 - 1.4	Mean: 2.0 Range: 1.9 - 2.0	Mean: 1.0 Range: 0.7 - 1.3	Mean: 0.8 Range: 0.5 - 1.3	Mean: 0.8 Range: 0.5 - 1.3	Mean: 0.7 Range: 0.6 - 0.8	Mean: 1.3 Range: 1.1 - 1.7	Mean: 1.4 Range: 0.9 - 1.9	Mean: 1.3 Range: 1.1 - 1.4
Pool Width (W_{pool})	Mean: 9.3 Range: 8.9 - 9.7	Mean: 10.5 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities			Mean: 7.8 Range: 7.0 - 9.8	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 13.3 Range: 12.1 - 16.9
Maximum Pool Depth (D_{pool})	Mean: 1.8 Range: 1.5 - 2.1	Mean: 2.7 Range:				Mean: 1.0 Range: 0.7 - 1.1			Mean: 1.7 Range: 1.2 - 1.9
Width of Floodprone Area (W_{fpa})	Mean: 18 Range: 15 - 25	Mean: 131 Range: 122 - 140	Mean: 17 Range: 6.0 - 27.0	Mean: 27 Range: 15 - 40	Mean: 26 Range: 18.0 - 40.0	Mean: 50 Range: 30 - 90	Mean: 56 Range: 29 - 75	Mean: 22 Range: 17.0 - 24.0	Mean: 40 Range: 20 - 90
Dimension Ratios									
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 2.1 Range: 1.9 - 2.2	Mean: 12 Range: 11 - 13	Mean: 2.9 Range: 1.0 - 6.8	Mean: 3.0 Range: 1.0 - 5.6	Mean: 4.1 Range: 2.4 - 7.0	Mean: 7.1 Range: 4.3 - 12.9	Mean: 6.2 Range: 1.9 - 24.0	Mean: 1.8 Range: 1.2 - 2.6	Mean: 3.3 Range: 1.7 - 7.4
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.1 Range: 8.0 - 15.1	Mean: 9 Range: 8 - 9	Mean: 13.8 Range: 4.4 - 40.0	Mean: 28.8 Range: 14.2 - 78.0	Mean: 24.0 Range: 4.3 - 61.5	Mean: 14.0 Range: 12.0 - 16.0	Mean: 31.5 Range: 11.7 - 66.3	Mean: 17.4 Range: 7.3 - 28.3	Mean: 14.0 Range: 12.0 - 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.4 - 1.8	Mean: 1.4 Range: 1.4 - 1.5	Mean: 1.7 Range: 1.4 - 2.3	Mean: 2.0 Range: 1.6 - 2.6	Mean: 1.9 Range: 1.5 - 3.0	Mean: 1.4 Range: 1.2 - 1.5	Mean: 2.1 Range: 0.9 - 3.0	Mean: 1.6 Range: 1.3 - 2.2	Mean: 1.4 Range: 1.2 - 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range: 1.0 - 1.8	Mean: 1.4 Range:	Mean: 1.7 Range: 1.3 - 2.6	Mean: 1.6 Range: 1.0 - 3.0	Mean: 1.4 Range: 1.0 - 2.0	Mean: 1.0 Range: 1.0 - 1.3	Mean: 1.2 Range: 1.0 - 1.9	Mean: 2.0 Range: 1.3 - 2.7	Mean: 1.0 Range: 1.0 - 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 1.9 Range: 0 - 2.1	Mean: 2 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities			Mean: 1.9 Range: 1.3 - 2.1	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 - 2.1
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.1 Range: 0 - 1.2	Mean: 1 Range:				Mean: 1.1 Range: 1.0 - 1.4			Mean: 1.1 Range: 1.0 - 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.4 Range: 0 - 1.6	Mean: 1.4 Range:				Mean: 1.4 Range: 1.1 - 1.6			Mean: 1.4 Range: 1.1 - 1.6

* Causey Farm includes measurments from a Reference Site measured in 2004.

Table 6. Morphological Stream Characteristics (continued)
Abbey Lamm Restoration Site

Variables	REFERENCE - CEDAROCK PARK	REFERENCE - CAUSEY* FARM	Existing UT 1	Existing UT 2	Existing UT 3	PROPOSED	Main Channel (Upstream)	Main Channel (Downstream)	PROPOSED
Pattern Variables			**Pattern Variables**				**Pattern Variables**		
Pool to Pool Spacing (L_{p-p})	Med: 37.2 Range: 25 - 69	Med: 44.3 Range: 22 - 81	No distinct repetitive pattern of riffles and pools due to staightening activities			Med: 28.0 Range: 21 - 56	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 48.0 Range: 36 - 97
Meander Length (L_m)	Med: 68.4 Range: 44 - 116	Med: 62.9 Range: 10 - 91				Med: 60.0 Range: 42 - 84			Med: 103.0 Range: 73 - 145
Belt Width (W_{belt})	Med: 22.8 Range: 20 - 38	Med: 29.8 Range: 17 - 36				Med: 28.0 Range: 21 - 42			Med: 48.0 Range: 36 - 73
Radius of Curvature (R_c)	Med: 16.5 Range: 11 - 27	Med: 30.6 Range: 9 - 113				Med: 21.0 Range: 14 - 70			Med: 36.0 Range: 24 - 121
Sinuosity (Sin)	1.20	1.46	1.02	1.03	1.05	1.20	1.05		1.20
Pattern Ratios			**Pattern Ratios**				**Pattern Ratios**		
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.6 Range: 3.1 - 8.4	Med: 4 Range: 2.0 - 7.4	No distinct repetitive pattern of riffles and pools due to staightening activities			Med: 4.0 Range: 3.0 - 8.0	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 - 8.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 8.4 Range: 5.5 - 14.3	Med: 5.7 Range: 0.9 - 8.3				Med: 8.5 Range: 6.0 - 12.0			Med: 8.5 Range: 6.0 - 12.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.8 Range: 2.4 - 4.7	Med: 2.7 Range: 1.5 - 3.5				Med: 4.0 Range: 3.0 - 6.0			Med: 4.0 Range: 3.0 - 6.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 2.0 Range: 1.4 - 3.3	Med: 2.8 Range: 0.8 - 10.3				Med: 3.0 Range: 2.0 - 10.0			Med: 3.0 Range: 2.0 - 10.0
Profile Variables			**Profile Variables**				**Profile Variables**		
Average Water Surface Slope (S_{ave})	0.0258	0.0053	0.0284	0.0307 - 0.0431	0.0334	0.0256 - 0.0362	0.0176	NA	0.0179
Valley Slope (S_{valley})	0.0310	0.0077	0.0268	0.0295 - 0.0435	0.0330	0.0268 - 0.0435	0.0185	0.0186	0.0186
Riffle Slope (S_{riffle})	Mean: 0.0316 Range: 0.01 - 0.0576	Mean: 0.0098 Range: 0.002 - 0.01198	No distinct repetitive pattern of riffles and pools due to staightening activities			Mean: 0.0494 Range: 0.0371 - 0.0773	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0286 Range: 0.0215 - 0.04475
Pool Slope (S_{pool})	Mean: 0.0007 Range: 0 - 0.018	Mean: 0.0006 Range: 0 - 0.004				Mean: 0.0031 Range: 0 - 0.0216			Mean: 0.0018 Range: 0 - 0.0125
Run Slope (S_{run})	Mean: 0.0353 Range: 0 - 0.3565	Mean: Range:				Mean: 0.0124 Range: 0 - 0.0247			Mean: 0.0072 Range: 0 - 0.0143
Glide Slope (S_{glide})	Mean: 0.0029 Range: 0 - 0.0431	Mean: Range:				Mean: 0.0034 Range: 0 - 0.0247			Mean: 0.0020 Range: 0 - 0.0143
Profile Ratios			**Profile Ratios**				**Profile Ratios**		
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.2 Range: 0.39 - 2.23	Mean: 1.6 Range: 0 - 3.7	No distinct repetitive pattern of riffles and pools due to staightening activities			Mean: 1.60 Range: 1.2 - 2.5	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.60 Range: 1.2 - 2.5
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.0 Range: 0 - 0.70	Mean: 0.1 Range: 0 - 0.8				Mean: 0.10 Range: 0 - 0.7			Mean: 0.10 Range: 0 - 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 1.37 Range: 0 - 13.82	Mean: Range:				Mean: 0.40 Range: 0 - 0.8			Mean: 0.40 Range: 0 - 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.11 Range: 0 - 1.67	Mean: Range:				Mean: 0.11 Range: 0 - 0.8			Mean: 0.11 Range: 0 - 0.8

* Causey Farm Reference includes measurments from a Reference Site measured in 2004.

3.6 Channel Stability Assessment

3.6.1 Stream Power

Stability of a stream refers to its ability to adjust itself to inflowing water and sediment load. One form of instability occurs when a stream is unable to transport its sediment load, leading to aggradation, or deposition of sediment onto the stream bed. Conversely, when the ability of the stream to transport sediment exceeds the availability of sediments entering a reach, and/or stability thresholds for materials forming the channel boundary are exceeded, erosion or degradation occurs.

Stream power is the measure of a stream's capacity to move sediment over time. Stream power can be used to evaluate the longitudinal profile, channel pattern, bed form, and sediment transport of streams. Stream power may be measured over a stream reach (total stream power) or per unit of channel bed area. The total stream power equation is defined as:

$$\Omega = \rho g Q s$$

where Ω = total stream power (ft-lb/s-ft), ρ = density of water (lb/ft3), g = gravitational acceleration (ft/s2), Q = discharge (ft3/sec), and s = energy slope (ft/ft). The specific weight of water (γ = 62.4 lb/ft3) is equal to the product of water density and gravitational acceleration, ρg. A general evaluation of power for a particular reach can be calculated using bankfull discharge and water surface slope for the reach. As slopes become steeper and/or velocities increase, stream power increases and more energy is available for reworking channel materials. Straightening and clearing channels increases slope and velocity and thus stream power. Alterations to the stream channel may conversely decrease stream power. In particular, over-widening of a channel will dissipate energy of flow over a larger area. This process will decrease stream power, allowing sediment to fall out of the water column, possibly leading to aggradation of the stream bed.

The relationship between a channel and its floodplain is also important in determining stream power. Streams that remain within their banks at high flows tend to have higher stream power and relatively coarser bed materials. In comparison, streams that flood over their banks onto adjacent floodplains have lower stream power, transport finer sediments, and are more stable. Stream power assessments can be useful in evaluating sediment discharge within a stream and the deposition or erosion of sediments from the stream bed.

3.6.2 Shear Stress

Shear stress, expressed as force per unit area, is a measure of the frictional force that flowing water exerts on a streambed. Shear stress and sediment entrainment are affected by sediment supply (size and amount), energy distribution within the channel, and frictional resistance of the stream bed and bank on water within the channel. These variables ultimately determine the ability of a stream to efficiently transport bedload and suspended sediment.

For flow that is steady and uniform, the average boundary shear stress exerted by water on the bed is defined as follows:

$$\tau = \gamma Rs$$

where τ = shear stress (lb/ft2), γ = specific weight of water, R = hydraulic radius (ft), and s = the energy slope (ft/ft). Shear stress calculated in this way is a spatial average and does not necessarily provide a good estimate of bed shear at any particular point. Adjustments to account for local variability and instantaneous values higher than the mean value can be applied based on channel form and irregularity. For a straight channel, the maximum shear stress can be assumed from the following equation:

$$\tau max = 1.5\tau$$

for sinuous channels, the maximum shear stress can be determined as a function of plan form characteristics:

$$\tau max = 2.65\tau(Rc /Wbkf)-0.5$$

where Rc = radius of curvature (ft) and Wbkf = bankfull width (ft).

Shear stress represents a difficult variable to predict due to variability of channel slope, dimension, and pattern. Typically, as valley slope decreases channel depth and sinuosity increase to maintain adequate shear stress values for bedload transport. Channels that have higher shear stress values than required for bedload transport will scour bed and bank materials, resulting in channel degradation. Channels with lower shear stress values than needed for bedload transport will deposit sediment, resulting in channel aggradation.

The actual amount of work accomplished by a stream per unit of bed area depends on the available power divided by the resistance offered by the channel sediments, plan form, and vegetation. The stream power equation can thus be written as follows:

$$\omega = \rho gQs = \tau v$$

where ω = stream power per unit of bed area (N/ft-sec, Joules/sec/ft2), τ = shear stress, and v = average velocity (ft/sec). Similarly,

$$\omega = \Omega/Wbkf$$

where Wbkf = width of stream at bankfull (ft).

3.6.3 Stream Power and Shear Stress Methods and Results

Channel degradation or aggradation occurs when hydraulic forces exceed or do not approach the resisting forces in the channel. The amount of degradation or aggradation is a function of relative magnitude of these forces over time. The interaction of flow within the boundary of open channels is only imperfectly understood. Adequate analytical expressions describing this interaction have yet to be developed for conditions in natural channels. Thus, means of characterizing these processes rely heavily upon empirical formulas.

Traditional approaches for characterizing stability can be placed in one of two categories: 1) maximum permissible velocity and 2) tractive force, or stream power and shear stress. The former is advantageous in that velocity can be measured directly. Shear stress and stream power cannot be measured directly and must be computed from various flow parameters. However, stream power and shear stress are generally better measures of fluid force on the channel boundary than velocity.

Using these equations, stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Important input values and output results (including stream power, shear stress, and per unit shear power and shear stress) are presented in Table 7. Average stream velocity and discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions.

In order to maintain sediment transport functions of a stable stream system, the proposed channel should exhibit stream power and shear stress values so the channel is neither aggrading nor degrading. Results of the analysis indicate the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 3.55-3.81 and shear stress values of approximately 0.84 (comparable to that of the Cedarrock reference reach, which most closely resembles the Site).

Table 7. Stream Power (Ω) and Shear Stress (τ) Values

	Discharge (ft^3/s)	Water surface Slope (ft/ft)	Total Stream Power (Ω)	Ω/W	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
UT1	12.9	0.0284	22.86	**3.52**	1.90	**3.36**	0.88	2.97	5.04
UT2	14.1	0.0369	32.47	**3.35**	1.36	**3.14**	0.99	3.09	4.70
UT3	9.2	0.0334	19.17	**2.66**	1.49	**3.10**	0.77	2.40	4.65
Main Channel	41.3	0.0176	45.36	**2.45**	1.03	**1.13**	2.04	2.30	1.69
Reference Conditions									
Reference Reach-Cedarock	28.8	0.0258	46.37	**5.72**	0.82	**1.33**	3.60	4.78	6.67
Reference Causey Farm	60.6	0.0053	20.04	**1.82**	1.07	**0.35**	4.12	1.45	2.10
Proposed Conditions									
UTs 1, 2, 3	12.9	0.0309	24.87	**3.55**	0.44	**0.84**	3.69	3.11	1.27
Main Channel	41.3	0.0179	46.13	**3.81**	0.75	**0.84**	3.97	3.32	1.25

Cedarock reference reach values for stream power and shear stress, as well as valley and water surface slopes are comparable to values for proposed channels. Causey Farm reference reach values for stream power and shear stress are slightly lower due to flatter valley and water surface slopes resulting in lower stream power and shear stress values.

Existing, preconstruction Site streams are not characterized by excessive scour or erosion, and impacts are due primarily to removal of stream bed material (reduction in channel roughness) and

livestock trampling. Stream power values of existing streams are not elevated as evidenced by minimal channel erosion at the Site. Stream power values of existing streams are comparable to reference reaches, residing between the Cedarock and Causey Farm. Therefore, proposed stream power values should not be considerably different from existing values and should remain between reference reach values. Proposed stream power and shear values appear adequate to mobilize and transport sediment through the Site, without aggradation or erosion on proposed stream banks.

3.7 Bankfull Verification

Discharge estimates for the Site utilize an assumed definition of "bankfull" and the return interval associated with that bankfull discharge. For this study, the bankfull channel is defined as the channel dimensions designed to support the "channel forming" or "dominant" discharge (Gordon et al. 1992).

Based on available Piedmont regional curves, the bankfull discharge for the reference reaches averages approximately 28.8 and 63.8 cubic feet per second (cfs) for Cedarock and Causey Farm, respectively (Harmen et al. 1999). The USGS regional regression equation for the Piedmont region indicates that bankfull discharge for the reference reaches at a 1.3-1.5 year return interval average approximately 27-32 and 53-65 cfs, respectively (USGS 2006).

Field indicators of bankfull, primarily topographic breaks identified on the banks, and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches. The Piedmont regional curves were then utilized to plot the watershed area and discharge for the reference reach cross-sectional area. Field indicators of bankfull approximate an average discharge of 31.3 and 59.8 cfs, respectively for the reference reaches, which is 108 and 94 percent of that predicted by the regional curves.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on bankfull indicators found on the reference reaches and most importantly onsite indicators of bankfull. Based on field indicators of bankfull in upstream, relatively undisturbed reaches and the Causey Farm Reference Reach (94 percent of the curves), which closely resembles on-Site conditions, the designed onsite channel restoration area will equal approximately 90 percent of the channel size indicated by Piedmont regional curves. Table 8 summarizes all methods analyzed for estimating bankfull discharge.

4.0 REFERENCE STREAMS

Two reference reaches were identified for the Site. The first reference stream (Cedarock) is located approximately 5 miles north of the Site in Cedarock Park on an unnamed tributary to Rock Creek (Figures 1 and 5A-5C, Appendix A). The second reference stream (Causey Farm) is located less than 10 miles west of the Site, immediately north of Causey Airport on unnamed tributaries to Stinking Quarter Creek (Figure 1, Appendix A). The Causey Farm reference was measured in 2004 as a reference reach for the Causey Farm stream mitigation project, which was a successful project through five years of monitoring with no issues. The streams were measured and classified by stream type (Rosgen 1996).

Table 8. Reference Reach Bankfull Discharge Analysis
Abbey Lamm Restoration Site

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
Cedarock Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.2	1.3-1.5	28.8
Peidmont Regional Regression Model (USGS 2004)	0.2	1.3-1.5	27-32
Field Indicators of Bankfull	0.2	1.3-1.5	31.3
Causey Farm Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.6	1.3-1.5	63.8
Peidmont Regional Regression Model (USGS 2004)	0.6	1.3-1.5	53-65
Field Indicators of Bankfull	0.6	1.3-1.5	59.8

4.1 Channel Classification

The reference reaches are both characterized as E-type streams; Cedarock is a moderately sinuous (1.2) channel dominated by gravel substrate and Causey Farm had slightly higher sinuousity channel, due to a lower valley slope, with a sand-dominated substrate. E-type streams are characterized as slightly entrenched, riffle-pool channels exhibiting high sinuosity (1.3 to greater than 1.5); however, reference streams in the region typically are characterized by sinuosities slightly lower than 1.3. E-type streams typically exhibit a sequence of riffles and pools associated with a sinuous flow pattern. In North Carolina, E-type streams often occur in narrow to wide valleys with well-developed alluvial floodplains (Valley Type VIII). E-type channels are typically considered stable; however, these streams are sensitive to upstream drainage basin changes and/or channel disturbance, and may rapidly convert to other stream types.

4.2 Discharge

Based on an analysis of bankfull discharge, proposed conditions at the Site will be based on Piedmont regional curves (see Section 3.7 Bankfull Verification).

4.3 Channel Morphology

Dimension: Data collected at Cedarock and Causey Farm indicate bankfull cross-sectional areas of 8.0 and 14.7 square feet, respectively. Cedarock was slightly larger than predicted by regional curves (7.5 square feet) and Causey Farm was slightly smaller than predicted by regional curves (15.7 square feet). However, both streams are within a reasonable deviation from predictions by regional curve calculations and adequately verify the use of regional curves at the Site. Cedarock and Causey exhibit a bankfull width of 8.1 and 11.0, a bankfull depth of 0.8 and 1.4 feet, and width-to-depth ratios of 10.1 and 9.0, respectively (see Table 6, Morphological Stream Characteristics). Figures 5A-5C (Appendix A) provide plan view and cross-sectional data for the Cedarock reference reach. The reference reaches exhibit a bank-height ratio of 1.0 and 1.4, respectively.

Pattern and Profile: In-field measurements of the reference reaches have yielded an average sinuosity of 1.2 at Cedarock and 1.45 at Causey Farm (thalweg distance/straight-line distance). Onsite valley slopes range from 0.0185-0.0435 in the dominant hydrologic features of the Site. Valley slopes exhibited by reference channels range from slightly higher (0.0310 at Cedarock) than the Site to the lower range of Site valley slopes (0.0077 at Causey Farm), providing a good range of slopes to compare existing and proposed Site conditions.

Substrate: Reference channels are characterized by substrate dominated by gravel and sand sized particles, respectively.

5.0 PROJECT SITE WETLANDS (EXISTING CONDITIONS)

5.1 Existing Jurisdictional Wetlands

Jurisdictional wetlands/hydric soils within the Site were delineated in the field following guidelines set forth in the *Corps of Engineers Wetlands Delineation Manual* and subsequent regional supplements, and located using GPS technology with reported submeter accuracy (Environmental Laboratory 1987). Jurisdictional delineations were approved by David Bailey of the United States Army Corps of Engineers (USACE) during a field visit on May 29, 2014. Existing jurisdictional wetlands are depicted in green on Figure 4 (Appendix A).

5.2 Hydrological Characterization

Construction activities are expected to restore groundwater hydrology to approximately 1.0 acre of drained riparian hydric soils and enhance 0.4 acre of cleared riparian wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into the wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Hydrological impairment in drained soils has resulted from lateral draw-down of the water table adjacent to existing, incised stream channels.

5.3 Soil Characterization

5.3.1 Taxonomic Classification

Detailed soil mapping conducted by a North Carolina Licensed Soil Scientist (NCLSS) in October 2013 indicate that 1.4 acres of the Site is currently underlain by hydric soils of the Worsham Series (Figure 4, Appendix A). Onsite hydric soils are grey to gley in color and are compacted and pockmarked by livestock trampling. Livestock trampling, grazing, and annual mowing for harvest of hay has resulted in an herbaceous vegetative community. Groundwater springs and surface runoff contribute hydrology to these areas, although the dominant hydrological influence is the lateral draw-down of the water table adjacent to incised stream channels. Detailed soil profiles conducted by a NCLSS include the following; locations are depicted on Figure 4 (Appendix A).

5.3.2 Profile Description

Soil Profile 1

0 to 1 inches; (10YR 4/3) clay loam

1 to 4 inches; (10YR 7/1) fine sandy loam, extensive rhizoshperes

4 to 14 inches; (10YR 6/1) fine sandy loam, common medium faint strong brown (10YR 7/4) mottles, extensive rhizospheres

14 + inches; (10YR 5/1) fine sandy loam, many coarse prominent reddish yellow (7.5YR 7/1) mottles, extensive rhizospheres

Soil Profile 2

0 to 2 inches; (10YR 4/3) loam

2 to 7 inches; (2.5Y 5/2) clay loam, common medium red (2.5Y 6/6) mottles

7 to 18 inches; (2.5Y 5/2) loam extensive rhizospheres

18 to 27 inches; (2.5Y 7/1) sandy loam, many coarse prominent grey (2.5Y 5/1) and red (2.5Y 6/6) mottles

27 + inches; (2.5Y 7/1) sandy loam, many coarse prominent grey (2.5Y 5/1) and red (2.5Y 5/8) mottles

5.4 Plant Community Characterization

Areas proposed for wetland restoration and enhancement are primarily vegetated by fescue and opportunistic herbaceous species with very little vegetative diversity.

6.0 Reference Forest Ecosystem

A Reference Forest Ecosystem (RFE) is a forested area on which to model restoration efforts at the Site in relation to soils and vegetation. RFEs should be ecologically stable climax communities and should be a representative model of the Site forested ecosystem as it likely existed prior to human disturbances. Data describing plant community composition and structure should be collected at the RFEs and subsequently applied as reference data in an attempt to emulate a natural climax community.

The RFE for this project is located just upstream of the Site on UT1 and UT2. The RFE supports plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest and outlined in Table 9 will be used, in addition to other relevant species in appropriate Schafale and Weakley (1990) community descriptions.

Table 9. Reference Forest Ecosystem

Piedmont/Low Mountain Alluvial Forest
red maple (*Acer rubrum*)
tag alder (*Alnus serrulata*)
ironwood (*Carpinus caroliniana*)
pignut hickory (*Carya glabra*)
green ash (*Fraxinus pennsylvanica*)
eastern red cedar (*Juniperus virginiana*)
tulip poplar (*Liriodendron tulipifera*)
sweetgum (*Liquidambar styraciflua*)
black gum (*Nyssa sylvatica*)
black cherry (*Prunus serotina*)
white oak (*Quercus alba*)
swamp chestnut oak (*Quercus michauxii*)
water oak (*Quercus nigra*)
cherrybark oak (*Quercus pagoda*)
willow oak (*Quercus phellos*)
slippery elm (*Ulmus rubra*)

7.0 PROJECT SITE RESTORATION PLAN

7.1 Restoration Project Goals and Objectives

Based on the *Cape Fear River Basin Restoration Priorities Report 2009* (NCEEP 2009), Targeted Local Watershed 03030002050050 is characterized by benthic ratings varying between "Fair" and "Good-Fair" indicating a need for improvement to aquatic conditions. The Site is not included in a Local Watershed Plan; however, this project will meet overall goals of the Local Watershed Plans including 1) reduce sediment loading, 2) reduce nutrient loading, 3) manage stormwater runoff, 4) reduce toxic inputs, 5) provide and improve instream habitat, 6) provide and improve terrestrial habitat, 7) improve stream stability, and 8) improve hydrologic function.

Site activities include the restoration of perennial and intermittent stream channels, enhancement (level II) of perennial and intermittent stream channels, and restoration of riparian wetlands. Priority I restoration of intermittent channels at the Site is imperative to provide significant functional uplift to Site hydrology, water quality, and habitat, in addition to restore adjacent streamside, riparian wetlands. The following table summarizes the project goals/objectives and proposed functional uplift based on proposed Site restoration activities and observations of two reference areas located in the vicinity of the Site.

Table 10. Project Goals and Objectives

Project Goal/Objective	How Goal/Objective will be Accomplished
Improve Hydrology	
Restore Floodplain Access	Building a new channel at the historic floodplain elevation, restoring overbank flows
Restore Wooded Riparian Buffer	Planting a woody riparian buffer
Improve Microtopography	Scarifying soils to reduce compaction and hoof shear due to cattle
Restore Stream Stability	Building a new channel, planting a woody riparian buffer, and removing cattle
Increase Sediment Transport	
Improve Stream Geomorphology	
Increase Surface Storage and Retention	Building a new channel at the historic floodplain elevation restoring overbank flows, removing cattle, scarifying compacted soils, and planting woody vegetation
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	Raising the stream bed elevation
Improve Water Quality	
Increase Upland Pollutant Filtration	Planting a native, woody riparian buffer and installing 8 marsh treatment areas
Increase Thermoregulation	Planting a native, woody riparian buffer
Reduce Stressors and Sources of Pollution	Removing cattle and installing 8 marsh treatment areas
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Raising the stream bed elevation restoring overbank flows, planting with woody vegetation, removing cattle, increasing surface storage and retention, restoring appropriate inundation/duration, and installing 8 marsh treatment areas
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Raising the stream bed elevation and restoring overbank flows, planting with woody vegetation, and installing 8 marsh treatment areas
Restore Habitat	
Restore In-stream Habitat	Building a stable channel with a cobble/gravel bed and planting a woody riparian buffer
Restore Stream-side Habitat	Planting a woody riparian buffer
Improve Vegetation Composition and Structure	

Restoration and protection of aquatic resources with a conservation easement will result in net gains in hydrology, water quality, and habitat functions at the Site. A summary of mitigation activities includes the following.

- Providing a minimum of 4731 SMUs, as calculated in accordance with the requirements stipulated in RFP #16-005568.
  - Restoring approximately 2629 linear feet of perennial stream channel through construction of stable stream channels in the historic floodplain location and elevation.
  - Restoring approximately 1771 linear feet of intermittent channel through construction of a stable channel at the historic floodplain elevation in order to restore downstream

perennial channels at historic floodplain elevations and rehydrate adjacent hydric soils thereby restoring jurisdictional riparian wetlands.
    - Enhancing (Level II) approximately 403 linear feet of perennial stream channel and 426 linear feet of intermittent stream channel by ceasing current land use practices, removing invasive species, and planting with native forest vegetation.
- Providing a minimum of 1.0 riparian WMUs, as calculated in accordance with the requirements stipulated in RFP #16-005568.
    - Restoring 1.0 acre of riparian wetland by removing livestock, restoring compacted soils, raising stream channels to historic elevations, and rehydrating floodplain soils.
    - Enhancing an additional 0.4 acre of riparian wetland.
- Installing 8 marsh treatment areas to treat stormwater runoff prior to entire the Site.
- Removing cattle from the Site and fencing the entire conservation easement.
- Revegetating wetlands, floodplains, and slopes adjacent to restored streams.
- Protecting the Site in perpetuity with a conservation easement.

7.2 Stream Design

Onsite streams targeted for restoration have endured significant disturbance from land use activities such as land clearing, livestock grazing, straightening and rerouting of channels, and other anthropogenic maintenance. Site streams will be restored to emulate historic conditions at the Site utilizing parameters from nearby, relatively undisturbed reference streams (see Section 4.0 Reference Streams).

7.2.1 Designed Channel Classification

The proposed channel has been designed to emulate parameters of the relatively undisturbed reference streams (see Table 6 Morphological Stream Characteristics). Proposed channels are expected to be characterized by sand, gravel, and cobble substrate similar to reference streams, which emulate historic Site conditions.

7.2.2 Target Wetland Communties/Buffer Communities

Onsite wetland and buffer areas targeted for restoration and enhancement have endured significant disturbance from land use activities such as land clearing, livestock grazing, and other anthropogenic maintenance. These areas will be planted with native forest species typical of wetland and buffer communities in the region such as those found within the reference forest (see Section 6.0 Reference Forest Ecosystem). Emphasis will focus on developing a diverse plant assemblage.

7.3 Stream Restoration

Stream restoration efforts depicted in Figures 6A-6D (Appendix A) are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be Priority I restoration; therefore, bankfull elevations will be raised to meet the adjacent valley floodplain elevation.

Belt-width Preparation and Grading

Stream restoration is expected to entail 1) belt-width preparation, 2) channel excavation, 3) spoil stockpiling, 4) channel stabilization, 5) channel diversion, and 6) channel backfill.

Belt-width corridor preparation will entail channel staking, floodplain clearing and grubbing, and any necessary grading prior to channel excavation. After the floodplain has been prepped, the proposed design channel will be staked and/or clearly marked to the design parameters. Spoil material excavated during floodplain grading will be stockpiled adjacent to the existing channels. After construction of the new channel is complete, existing channels will be abandoned and backfilled with stockpiled soils. Grading of topsoil at the Site is expected to be minimal; however, where grading is necessary, topsoils will be stockpiled, managed, and reapplied after grading is complete.

Once belt-width corridor preparation is complete, the proposed channel will be excavated to the average width, depth, and cross-sectional area derived from reference reach studies and detailed measurements of the onsite reach (Figure 7, Appendix A). Stream banks and the belt-width area of constructed channels will be immediately planted with shrub and herbaceous vegetation. Root mats may also be selectively removed from adjacent areas and placed as erosion control features on channel banks.

Once the proposed design channel has been excavated and stabilized, abandoned channels will be backfilled utilizing spoil material stockpiled from channel excavation and/or from suitable material excavated from the Site, or adjacent to the Site. Abandoned channels will be backfilled to the maximum extent feasible.

In-stream Structures

The use of in-stream structures for grade control and habitat is essential for successful stream restoration (Figure 8A, Appendix A). In-stream structures may be placed in the channel to elevate local water surface profiles in the channel, potentially flattening the water energy slope or gradient. The structures would likely consist of log/rock cross-vanes or log/rock j-hook vanes designed primarily to direct stream energy into the center of the channel and away from banks. In addition, the structures would be placed in relatively straight reaches to provide secondary (perpendicular) flow cells during bankfull events.

Piped Channel Crossings

Landowner constraints will necessitate the installation of piped channel crossings within breaks in the easement to allow access to portions of the property isolated by stream restoration activities Figures 6A-6D (Appendix A). The crossings may be constructed of properly sized pipes and hydraulically stable rip-rap or suitable rock. Crossings will be large enough to handle the weight of anticipated vehicular traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines.

Dam Removal and Restoration within Pond Bed

The dam located at the Site outfall will be removed in order to restore stream channels within the existing pond bed. The Site was historically used for livestock grazing rather than row-crop production; therefore, extensive quantities of legacy sediments are not expected. The dam was notched on June 11, 2014 to match downstream floodplain elevations, thereby draining the pond and allowing sediments to stabilize. During Site construction, the dam will be removed and

materials stockpiled in the soil disposal area denoted on Figure 6A (Appendix A). Sediments will be removed once they have fully drained, as necessary, for design channel and floodplain construction. Sediments will be contoured within the pond bed and stabilized with in-stream log structures, erosion control matting, herbaceous seeding, and planted with woody vegetation. The extent of grade control utilized will primarily need to be determined in the field during construction.

Outfall Structures

Drop structures are proposed at the Site outfall below the existing pond and at tie in locations of smaller tributaries with the Main Channel. The locations of proposed drop structures are depicted on Figures 6A-6D (Appendix A). The drop structures may be constructed out of Terracell, or large cobble depending upon anticipated scour from the restored stream channels (Figure 8B, Appendix A). The structures should be constructed to resist erosive forces associated with hydraulic drops proposed at the Site.

TerraCell is a light weight, flexible mat made of high density polyethylene strips. The strips are bonded together to form a honeycomb configuration. The honeycomb mat is fixed in place and filled with gravel or sand. Material in the TerraCell structure may be planted with grasses and shrubs for additional erosion protection. The TerraCell structure will form a nickpoint that approximates geologic controls in stream beds.

Marsh Treatment Areas

Eight shallow wetland marsh treatment areas will be excavated in the floodplain to intercept surface waters draining through agricultural areas prior to discharging into the Site. Marsh treatment areas are intended to improve the mitigation project and are not generating mitigation credit. Proposed marsh treatment area locations are depicted on Figures 6A-6D (Appendix A) and will consist of shallow depressions that will provide treatment and attenuation of initial stormwater pulses (Figure 8B, Appendix A). The outfall of each treatment area will be constructed of hydraulically stable rip-rap or other suitable material that will protect against headcut migration into the constructed depression. It is expected that the treatment areas will fill with sediment and organic matter over time.

7.4 Stream Enhancement (Level II)

Stream enhancement (level II) will occur in a wooded reach of the Main Stem Channel immediately upstream of the existing pond, and on UT3A-3C (Figures 6B, 6C, and 6D, Appendix A). Stream enhancement will entail the cessation of current land management practices, excluding livestock removal of spoil material along the stream banks, invasive species control (predominantly Chinese privet), and planting riparian buffers with native forest vegetation. Riparian buffers will extend a minimum of 50 feet from the top of stream banks to facilitate stream recovery and prevent further degradation of the stream.

7.5 Sediment Transport Analysis

Existing Site reaches are characterized by sand substrate as the result of channel impacts including livestock trampling, channel straightening, and riparian vegetation removal, in addition to manual removal of substrate by the landowner. Substrate removed from streams was stockpiled on-Site

and will be used in the restored stream channel to mimic relatively undisturbed reaches upstream of the Site, which are comprised of gravel/cobble substrate. The upstream reaches are forested with natural substrate free of excessive fines; therefore, pulses of fine materials from upstream are not expected to infiltrate Site streams.

Stream stability assessment includes calculations of stream power and shear stress to compare 1) existing dredged and straightened reaches, 2) Cedarock Reference Reach, 3) Causey Farm Reference Reach, and 4) proposed Site conditions are discussed in Section 3.6 (Channel Stability Assessment).

7.6 HEC RAS Analysis

The HEC-RAS analysis will be completed prior to completion of detailed construction plans for Site restoration activities. This analysis is discussed in more detail in Section 2.6.4 (FEMA/Hydrological Trespass).

7.7 Hydrological Modifications (Wetland Restoration and Enhancement)

Alternatives for wetland restoration are designed to restore a fully functioning wetland system, which will provide surface water storage, nutrient cycling, removal of imported elements and compounds, and will create a variety and abundance of wildlife habitat. Portions of the Site underlain by hydric soils have been impacted by channel incision, vegetative clearing, channel straightening and manipulation, and earth movement associated with agricultural practices. Wetland restoration options will focus on the removal of fill materials, restoration of vegetative communities, the reestablishment of soil structure and microtopographic variations, and redirecting normal surface hydrology back to Site floodplains. These activities will result in the restoration of 1.0 acre of riparian wetland and enhancement of 0.4 acre of riparian wetland (Figure 6B-6D, Appendix A).

Reestablishment of Historic Groundwater Elevations

Hydric soils adjacent to the incised channels appear to have been drained due to lowering of the groundwater table and a lateral drainage effect from existing stream reaches. Reestablishment of channel inverts is expected to rehydrate soils adjacent to Site streams, resulting in the restoration of jurisdictional hydrology to riparian wetlands.

Reestablishment of Soil Structure

Soil structure throughout the Site, particularly within wetland areas, will be reestablished to allow for penetration of rain water to the groundwater table. This will be accomplished by removing livestock from the Site, ripping compacted soils, and revegetating the Site.

Hydrophytic Vegetation

Site wetland areas targeted for restoration and enhancement have endured significant disturbance from land use activities such as land clearing, livestock grazing, and other anthropogenic maintenance. Wetland areas will be revegetated with native vegetation typical of wetland communities in the region. Emphasis will focus on developing a diverse plant assemblage. Section 7.9 (Natural Plant Community Restoration) provides detailed information concerning community species associations.

Reconstruction of Stream Corridors

The stream restoration plan involves the reconstruction of Site streams in place, or on new location. Existing channels will be backfilled so that water tables may be restored to historic conditions.

7.8 Soil Restoration

Soil grading will occur during stream restoration activities. Topsoils will be stockpiled during construction activities and will be spread on the soil surface once critical subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species.

7.9 Natural Plant Community Restoration

Restoration of floodplain forest and stream-side habitat allows for development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Reference Forest Ecosystem (RFE) data, onsite observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community associations that will be promoted during community restoration activities.

7.9.1 Planting Plan

Stream-side trees and shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with bankfull flow and overbank flood events. Stream-side trees and shrubs will be planted within 15 feet of the channel throughout the meander belt-width. Shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Piedmont Alluvial Forest is the target community for Site floodplains and Dry-Mesic Oak-Hickory Forest is the target community for upland side-slopes.

Bare-root seedlings within the Piedmont Alluvial and Dry-Mesic Oak-Hickory Forests will be planted at a density of approximately 680 stems per acre on 8-foot centers. Shrub species in the stream-side assemblage and Marsh Wetland Treatment Areas will be planted at a density of 2720 stems per acre on 4-foot centers.

Table 11 depicts the total number of stems and species distribution within each vegetation association (Figure 9, Appendix A). Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

In addition to planting seedlings, a seed mix will be spread within Marsh Treatment Wetland Areas as follows.

1. Virginia wildrye (*Elymus virginicus*)
2. Switch grass (*Panicum virgatum*)
3. Big blue stem (*Andropogon gerardii*)
4. Indian grass (*Sorghastrum nutans*)
5. Deer tongue (*Dichanthelium clandestinum*)

Table 11. Planting Plan

Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Marsh Treatment Wetland**		Stream-side Assemblage**		TOTAL
Area (acres)	**1.6**		**10.7**		**0.5**		**3.6**		**16.4**
Species	**# planted***	**% of total**	**# planted***	**% of total**	**# planted****	**% of total**	**# planted****	**% of total**	**# planted**
Tag alder (*Alnus serrulata*)	--	--	--	--	136	10	490	5	626
River birch (*Betula nigra*)	109	10	--	--	--	--	490	5	599
Ironwood (*Carpinus caroliniana*)	--	--	1455	20	--	--	--	--	1455
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	272	20	--	--	272
Red bud (*Cercis canadensis*)			1091	15					1091
Sweet pepperbush (*Clethra alnifolia*)	--	--	--	--	204	15	--	--	204
Silky dogwood (*Cornus amomum*)	109	10	--	--	204	15	1958	20	2271
Persimmon (*Diospyros virginiana*)	--	--	728	10	--	--	--	--	728
White ash (*Fraxinus americana*)	--	--	364	5	--	--	--	--	364
Green ash (*Fraxinus pennsylvanica*)	218	20	--	--	--	--	1958	20	2176
Inkberry (*Ilex glabra*)	--	--	--	--	136	10	--	--	136
Tulip poplar (*Liriodendron tulipifera*)	109	10	--	--	--	--	--	--	109
Sycamore (*Platanus occidentalis*)	218	20	--	--	--	--	1958	20	2176
Black gum (*Nyssa sylvatica*)	--	--	1091	15	--	--	--	--	1091
Water oak (*Quercus nigra*)	164	15	1455	20	--	--	979	10	2598
Willow oak (*Quercus phellos*)	164	15	1091	15	--	--	979	10	2234
Black willow (*Salix nigra*)	--	--	--	--	--	--	979	10	979
Elderberry (*Sambucus canadensis*)	--	--	--	--	272	20	--	--	272
Possumhaw (*Viburnum nudum*)	--	--	--	--	136	10	--	--	136
TOTAL	**1091**	**100**	**7275**	**100**	**1360**	**100**	**9791**	**100**	**19,517**

* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.

7.9.2 Nuisance Species Management

Chinese privet (*Ligustrum sinense*), thorny olive (*Eleagnus pungens*), and multiflora rose (*Rosa multiflora*) are scattered within the Site, primarily above the existing pond. These species will be controlled mechanically and/or chemically, as part of this project. No other nuisance species controls are proposed at this time. Inspections for beaver and other potential nuisance species will occur throughout the course of the monitoring period. Appropriate actions may be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis. The presences of nuisance species will be monitored over the course of the monitoring period. Appropriate actions will be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis.

8.0 PERFORMANCE CRITERIA

Monitoring requirements and success criteria outlined in the latest guidance by NCEEP dated November 7, 2011 (*Monitoring Requirements and Reporting Standards for Stream and/or Wetland Mitigation*) will be followed and are briefly outlined below. Monitoring data collected at the Site should include reference photos, plant survival analysis, channel stability analysis, and biological data, if specifically required by permit conditions.

Wetland hydrology is proposed to be monitored for a period of seven years (years 1-7). Riparian vegetation and stream morphology is proposed to be monitored for a period of seven years with measurements completed in years 1-3, year 5, and year 7. If monitoring demonstrates the Site is successful by year 5 and no concerns have been identified, Restoration Systems may propose to terminate monitoring at the Site and forego monitoring requirements for years 6 and 7. Early closure will only be provided through written approval from the USACE in consultation with the Interagency Review Team. Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCEEP by Restoration Systems no later than December 31 of each monitoring year data is collected.

8.1 Streams

Annual monitoring will include development of channel cross-sections and substrate on riffles and pools. Data to be presented in graphic and tabular format will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, and 5) width-to-depth ratio. Post construction, permanently-monumented cross sections will be installed throughout the Site, at approximately 50 foot intervals. Approximately 60 monitoring cross sections are expected to be measured annually. Longitudinal profiles will not be measured routinely unless monitoring demonstrates channel bank or bed instability, in which case, longitudinal profiles may be required by the USACE along reaches of concern to track changes and demonstrate stability.

Visual assessment of in-stream structures will be 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. In addition, visual assessments of the entire channel will be conducted in each of the seven years of monitoring as outlined in NCEEP *Monitoring Requirements and Reporting Standards for Stream and/or Wetland Mitigation*. Areas of concern will be depicted on a plan view figure identifying the location of concern along with a written assessment and photograph of the area.

Intermittent stream reaches, including UT 1 and UT 3, will receive priority 1 stream restoration to restore adjacent wetlands and elevate stream function. Priority 1 stream restoration along intermittent stream reaches may raise concern of adequate base flow once stream restoration is complete. Therefore, stream flow gauges will be installed in the upper and lower reaches of UT 1 and UT 3 to catalog flow of 30 consecutive days. The approximate location of stream flow gauges are depicted on Figure 6 (Appendix A).

8.1.1 Stream Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving vegetation success criteria. The following summarizes stream success criteria related to goals and objectives.

Project Goal/Objective	Stream Success Criteria
Improve Hydrology	
Restore Floodplain Access	Two overbank events will be documented, in separate years, during the monitoring period.
Restore Wooded Riparian Buffer	Attaining Vegetation Success Criteria (Section 8.3.1).
Improve Microtopography	Removal of cattle and scarification of soils during construction.
Restore Stream Stability	Cross-sections, monitored annually, will be compared to as-built measurements to determine channel stability and maintenance of channel geomorphology.
Improve Stream Geomorphology	
Increase Surface Storage and Retention	Removal of cattle, installation of 8 marsh treatment areas, scarification of soils during construction, documentation of two overbank events in separate monitoring years, and attaining Wetland and Vegetation Success Criteria (Sections 8.2.1 and 8.3.1).
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	Two overbank events will be documented, in separate years, during the monitoring period and attaining Wetland Success Criteria (Section 8.2.1).
Increase Sediment Transport	Pebble counts documenting coarsening of bed material from pre-existing conditions.
Improve Water Quality	
Increase Upland Pollutant Filtration	Installation of 8 marsh treatment areas and attaining Wetland and Vegetation Success Criteria (Section 8.3.1)
Increase Thermoregulation	Attaining Vegetation Success Criteria (Section 8.3.1)
Reduce Stressors and Sources of Pollution	Removal of cattle and installation of 8 marsh treatment areas
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Removal of cattle, installation of 8 marsh treatment areas, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria (Section 8.3.1)
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Installation of 8 marsh treatment areas, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria (Section 8.3.1)

Restore Habitat	
Restore In-stream Habitat	Reincorporating natural substrate removed from existing Site streams and stockpiled onsite into proposed stream beds, pebble counts documenting coarsening of bed material from pre-existing conditions, and attaining Vegetation Success Criteria (Section 8.3.1)
Restore Stream-side Habitat	Attaining Vegetation Success Criteria (Section 8.3.1)
Improve Vegetation Composition and Structure	Attaining Vegetation Success Criteria (Section 8.3.1)

Intermittent channels (UT 1 and UT 3) may be subject to scrutiny by IRT members with respect to jurisdictional status. Success criteria in these reaches require surface water flow within the stream channels during years with normal climactic conditions for at least 30 consecutive days. Furthermore, we expect these systems to have a discernible ordinary high water mark, which will be evaluated and considered towards project success.

8.1.2 Stream Contingency

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

Structure Failure

In the event that structures are compromised the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures which remain intact, but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the pilings. Structures which have been compromised, resulting in shifting or collapse of header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site

In the event that a headcut occurs within the Site (identified visually or through measurements [i.e. bank-height ratios exceeding 1.4]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures (rip-rap sill and/or log cross-vane weir) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

Bank Erosion

In the event that severe bank erosion occurs within the Site, resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of log-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

8.2 Wetlands

Six groundwater monitoring gauges will be installed to take measurements after hydrological modifications are performed at the Site. Groundwater gauges will be installed in larger wetland sections along UT 1, UT 2, and the main stem channel. Gauges will be installed at various elevations within the floodplain to accurately determine hydrology of wetland re-establishment areas. Approximate locations of wetland groundwater monitoring gauges are depicted on Figure 6 (Appendix A). Hydrological sampling will continue throughout the growing season at intervals necessary to satisfy jurisdictional hydrology success criteria (USEPA 1990). In addition, an on-site rain gauge will document rainfall data for comparison of groundwater conditions with extended drought conditions and floodplain crest gauges will be installed to confirm overbank flooding events.

8.2.1 Wetland Success Criteria

Monitoring and success criteria for wetland restoration should relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving vegetation success criteria. The following summarizes wetland success criteria related to goals and objectives.

Project Goal/Objective	Wetland Success Criteria
Improve Hydrology	
Restore Wooded Riparian Buffer	Attaining Vegetation Success Criteria (Section 8.3.1).
Improve Microtopography	Removal of cattle and scarification of soils during construction.
Increase Surface Storage and Retention	Removal of cattle, scarification of soils during construction, documentation of two overbank events in separate monitoring years, attaining Vegetation Success Criteria (Section 8.3.1), and documentation of an elevated groundwater table (within 12 inches of the soil surface) for greater than 10 percent of the growing season during average climatic conditions.
Restore Appropriate Inundation/Duration	
Increase Subsurface Storage and Retention	
Improve Water Quality	
Increase Upland Pollutant Filtration	Installation of 8 marsh treatment areas and attaining Wetland and Vegetation Success Criteria (Section 8.2.1 and 8.3.1).
Reduce Stressors and Sources of Pollution	Removal of cattle and installation of 8 marsh treatment areas.
Increase Removal and Retention of Pathogens, Particulates (Sediments), Dissolved Materials (Nutrients), and Toxins from the Water Column	Removal of cattle, installation of 8 marsh treatment areas, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria (Section 8.3.1).
Increase Energy Dissipation of Overbank/Overland Flows/Stormwater Runoff	Installation of 8 marsh treatment areas, documentation of two overbank events in separate monitoring years, and attaining Vegetation Success Criteria (Section 8.3.1).
Restore Habitat	
Restore Stream-side Habitat	Attaining Vegetation Success Criteria (Section 8.3.1).
Improve Vegetation Composition and Structure	

According to the *Soil Survey of Alamance County*, the growing season for Alamance County is from April 17 – October 22 (USDA 1960). However, the start date for the growing season is not

typical for the Piedmont region; therefore, for purposes of this project gauge hydrologic success will be determined using data from February 1 - October 22 to more accurately represent the period of biological activity. Based on growing season information outlined in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (USACE 2010), this will be confirmed annually by soil temperatures exceeding 41 degrees Fahrenheit at 12 inches depth and/or bud burst.

Target hydrological characteristics include saturation or inundation for 10 percent of the monitored period (February 1-October 22), during average climatic conditions. During years with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed. The jurisdictional determination will not supersede monitoring data, or overturn a failure in meeting success criteria; however, this information may be used by the IRT, at the discretion of the IRT, to make a final determination on Site wetland re-establishment success.

8.2.2 Wetland Contingency

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

8.3 Vegetation

After planting has been completed in winter or early spring, an initial evaluation will be performed to verify planting methods and to determine initial species composition and density. Supplemental planting and additional Site modifications will be implemented, if necessary.

During quantitative vegetation sampling, 14 sample plots (10-meter by 10-meter) will be installed within the Site as per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph.

8.3.1 Vegetation Success Criteria

An average density of 320 planted stems per acre must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4, 260 planted stems per acre in year 5, and 210 planted stems per acre in year 7. In addition, planted vegetation must average 10 feet in height in each plot at year 7 since this Site is located in the Piedmont. Volunteer stems may be considered on a case-by-case basis in determining overall vegetation success; however, volunteer stems should be counted separately from planted stems.

8.3.2 Vegetation Contingency

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

9.0 MAINTENANCE PLAN

Restoration Systems shall monitor the Site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These Site inspections may identify Site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Table 12. Site Maintenance Plan

Component/Feature	Maintenance through Project Close-out
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical (i.e. chainsaw) and/or chemical (i.e. basal bark herbicide application) methods. Any vegetation control requiring herbicide application & soil fertilization will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations & 15A NCAC 02B .0233.
Streams	Stream contingency may include structure repair and/or installation; repair of dimension, pattern, and/or profile variables; bank stabilization; chinking of in-stream structures to prevent piping; securing of loose coir-fiber matting; supplemental planting along the channel; and/or maintenance to areas of the stream bank where stormwater or floodplain flows are intercepted to prevent bank failure and head-cutting of the channel. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria.
Hydrology	Hydrologic contingency may include floodplain surface modifications such as construction of ephemeral pools, deep ripping of the soil profile, installation of berms to retard surface water flows, supplemental planting, and/or maintenance to areas of the wetland where stormwater or floodplain flows are intercepted to prevent scour. Recommendations for contingency to establish wetland hydrology may be implemented and monitored until hydrology success criteria are achieved. In the event that beaver become a nuisance within the Bank, beaver management will be initiated and continued on an as-needed basis in accordance with North Carolina Wildlife Resource Commission (NCWRC) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

Marsh Treatment Areas	Marsh treatment areas used to intercept initial stormwater pulses will be visually inspected throughout the mitigation monitoring period. These areas are expected to naturalize and maintenance is not anticipated.
Terracell Drop Structures	The Terracell drop structure proposed will be monitored annually at a minimum. In the event of erosion or scour within the structure, maintenance may include structure repair, chinking of the structure to prevent piping, securing of loose coir-fiber matting, and/or supplemental planting of livestakes and erosion control grasses. In the event that debris clogs or inhibits flow over the structure, manual or mechanical removal of debris will occur; maintenance is only expected until the structure naturalizes.

10.0 LONG-TERM MANAGEMENT PLAN

Upon approval for close-out by the NC IRT, the Site will be transferred to a third party for long term management as described in the NC EEP's in lieu free instrument.

11.0 ADAPTIVE MANAGEMENT PLAN

Upon completion of Site construction Restoration Systems will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as described previously in this document. If, during the course of annual monitoring it is determined the Site's ability to achieve site performance standards are jeopardized, Restoration Systems will notify the NC EEP of the need to develop a Plan of Corrective Action. The Plan of Corrective Action may be prepared using in-house technical staff or may require engineering and consulting services. Once the Corrective Action Plan is prepared and finalized Restoration Systems will complete the following.

1. Notify the NC EEP
2. Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the NC DWR/NC EEP.
3. Obtain other permits as necessary.
4. Implement the Corrective Action Plan.
5. Provide the NC EEP a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

12.0 FINANCIAL ASSURANCES

As required by RFP # 16-005568 Restoration Systems will provide a performance bond for 100% of the total value of the contract to be submitted with this document. This bond will remain in effect until the successful completion of Task 6 (Baseline Monitoring Report Submittal). After the successful completion of Task 6, the bond will be retired and a second bond for 25% of the total value of the contract will be substituted for the first to cover the monitoring period. The monitoring phase performance bond may be reduced concurrent with the payment schedule once the yearly deliverable is approved by EEP and credits are released by the Interagency Review Team (IRT). Therefore, the monitoring phase performance bond can be reduced after release of mitigation credit each monitoring year as follows.

Release of Mitigation Credit	Bond Value as % of Total Contract Value
Monitoring Year 1	20%
Monitoring Year 2	18%
Monitoring Year 3	16%
Monitoring Year 4	14%
Monitoring Year 5	12%
Monitoring Year 6	10%

The monitoring phase performance bond will be maintained at 10% through Monitoring Year 7 and project closeout until the final determination and release of mitigation credit by the IRT.

13.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey. The release of project credits will be subject to the criteria described as follows.

Forested Wetlands Credits

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%
5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the NCEEP to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

Stream Credits

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (60%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%*)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%*)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%*)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%)

*For stream projects a reserve of 10% of a site's total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT.

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCEEP without prior written approval of the DE upon satisfactory completion of the following activities.

a. Approval of the final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property

c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCEEP Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the NCEEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

14.0 REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. Stream Hydrology: an Introduction for Ecologists. John Wiley & Sons, Ltd. West Sussex, England.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Schafale, W.H. McNab, D.R. Lenat, T.F. MacPherson, J.B. Glover, and V.B. Shelbourne. 2002. Ecoregions of North Carolina and South Carolina. U.S. Geological Survey, Reston, Virginia.

Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.A. O'Hara, A. Jessup, R. Everhart. 1999. Bankfull Hydraulic Geometry Relationships for North Carolina Streams. N.C. State University, Raleigh, North Carolina.

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

Leopold, L.B. 1994. A View of the River. Harvard University Press. Cambridge, MA. 298 pp.

North Carolina Department of Environment and Natural Resources (NCDENR). 2013. Water Quality Data Assessment (2012 Final 303(d) List) (online). Available: http://portal.ncdenr.org/c/document_library/get_file?uuid=9d45b3b4-d066-4619-82e6-ea8ea0e01930&groupId=38364 [October 15, 2013]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Department of Environment and Natural Resources (NCDENR). 2014. 2014 Draft Category 5 Water Quality Assessments-303(d) List (online). Available: http://portal.ncdenr.org/c/document_library/get_file?uuid=d61a8974-6af6-4edb-829f-e658935e3341&groupId=38364 [March 12, 2014]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Division of Water Resources (NCDWR). 2001. Benthic Macroinvertebrate Monitoring Protocols for Compensatory Mitigation. 401/Wetlands Unit, Department of Environment and Natural Resources. Raleigh, North Carolina.

North Carolina Division of Water Resources (NCDWR). 2013. North Carolina Water Bodies Report (online). Available: http://portal.ncdenr.org/c/document_library/get_file?uuid=10c60296-dcc8-439f-a41c-d475ea7ad1fa&groupId=38364 [October, 2013]. North Carolina Department of Environment and Natural Resources, Raleigh.

North Carolina Ecosystem Enhancement Program (NCEEP 2009). Cape Fear River Basin Restoration Priorities 2009 (online). Available : http://portal.ncdenr.org/c/document_library/get_file?uuid=864e82e8-725c-415e-8ed9-c72dfcb55012&groupId=60329

North Carolina Geological Survey (NCGS), Philip M. Brown, Chief Geologist, and John M. Parker, III, State Geologic Map Coordinator in association with The State Geologic Map Advisory Committee,1985, 1 plate. Copyright: NCGS.

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

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Ccarolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

Simon A, Hupp CR. 1986. Geomorphic and Vegetative Recovery Processes Along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems. Forest Hydrology and Watershed Management. IAHS-AISH Publ.167.

United States Department of Agriculture (USDA). 2013. Web Soil Survey (online). Available: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx [October 2013].

United States Department of Agriculture (USDA). 1960. Soil Survey of Alamance County, North Carolina. Soil Conservation Service.

United States Environmental Protection Agency (USEPA). 1990. Mitigation Site Type Classification (MiST). EPA Workshop, August 13-15, 1989. EPA Region IV and Hardwood Research Cooperative, NCSU, Raleigh, North Carolina.

United States Geological Survey (USGS). 2006. Estimating the Magnitude and Frequency of Floods in Rural Basins of North Carolina – Recompiled. USGS Water-Resources Investigations Report 01-4207. Raleigh, North Carolina.

APPENDIX A
FIGURES

Figure 1. Project Location
Figure 2. Hydrologic Unit Map
Figure 3. Topography and Drainage Area
Figure 4. Existing Conditions
Figure 5A. Cedarock Reference Drainage Area
Figure 5B. Existing Conditions Cedarock Reference
Figure 5C. Cedarock Reference Reach Dimension, Pattern, and Profile
Figures 6A-D. Restoration Plan
Figure 7. Proposed Dimension, Pattern, and Profile
Figures 8A-B. Typical Structure Details
Figure 9. Planting Plan

Directions to the Site from Interstate 40 in Chapel Hill/Durham, NC:
- Travel west on NC 54 for 7 miles,
- Exit onto Jones Ferry Road and turn left,
- Travel west for 1 mile,
- Turn right onto Old Greensboro Road (SR 1005) and travel 16 miles, (The road name changes to Greensboro-Chapel Hill Road at the Haw River)
- Turn left onto Holman Mill Road (SR 2356) and travel 1.5 miles,
- Turn left onto Major Hill Road (SR 2348) and the Site is on the left.

Cedarock Reference Site Location

Causey Farm Reference Site Location

Abbey Lamm Stream and Wetland Restoration Site

35.885584 N
-79.394638 W

Cedarock Park

Rock Creek Upland Depressions

Cane Creek Mountains/Observatory Woods

Saxapahaw Sloughs and Slopes

Marys Creek Aquatic Habitat

Eli Whitney Rich Slopes

Box Elder Bottomlands

Haw River Aquatic Habitat

Kimesville Road Basic Forest

Pine Hill Xeric Woodlands

Alamance
Bellemont
Kimesville
Saxapahaw
Snow Camp
Sulphin
Causey Airport
Hinshaw Greenacres Airport
Timber Ridge Lake
Radio Tower
Bass Mountain
Cane Creek Mountains

Greensboro-Chapel Hill Road
Snow Camp Road
Holman Mill Road
Major Hill Road
Jones Ferry Road

GUILFORD CO
RANDOLPH CO
ALAMANCE CO
CHATHAM CO

Legend
- Abbey Lamm Stream and Wetland Restoration Site
- NCNHP Significant Natural Heritage Area
- County lines (inset)

1 0.5 0 1 2 3 Miles

Axiom Environmental, Inc.

Prepared for:
RESTORATION SYSTEMS | LLC

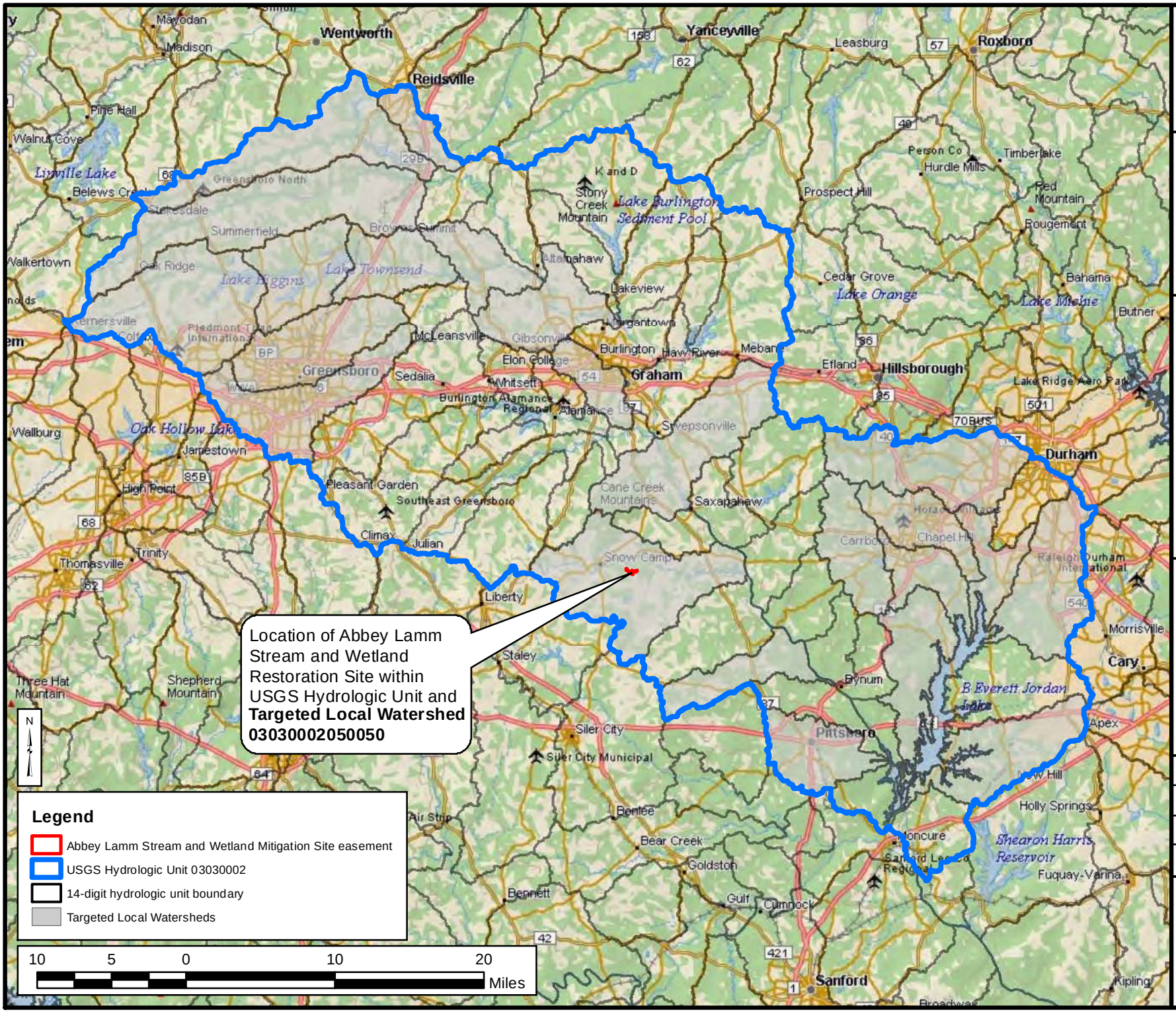
Project:
Abbey Lamm Restoration Site
Alamance County, NC

Title:
Project Location

Notes:
Background Imagery sources (provided by ESRI Data and Maps):
1. Physical Map of the United States (2009) created by the U.S. Park Service (upper inset).
2. Delorme World Basemap digital mapping (2010, lower inset).
3. Snow Camp, NC (1978), Crutchfield Crossroads, NC (1974), Saxapahaw, NC (1977), and Silk Hope, NC (1974) 7.5-minute topographic quadrangles provided by the U.S. Geological Survey.

Drawn by:	SGD
Date:	JULY 2014
Scale:	As Shown
Project No.:	14-005

FIGURE
1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

Abbey Lamm Restoration Site

Alamance County, NC

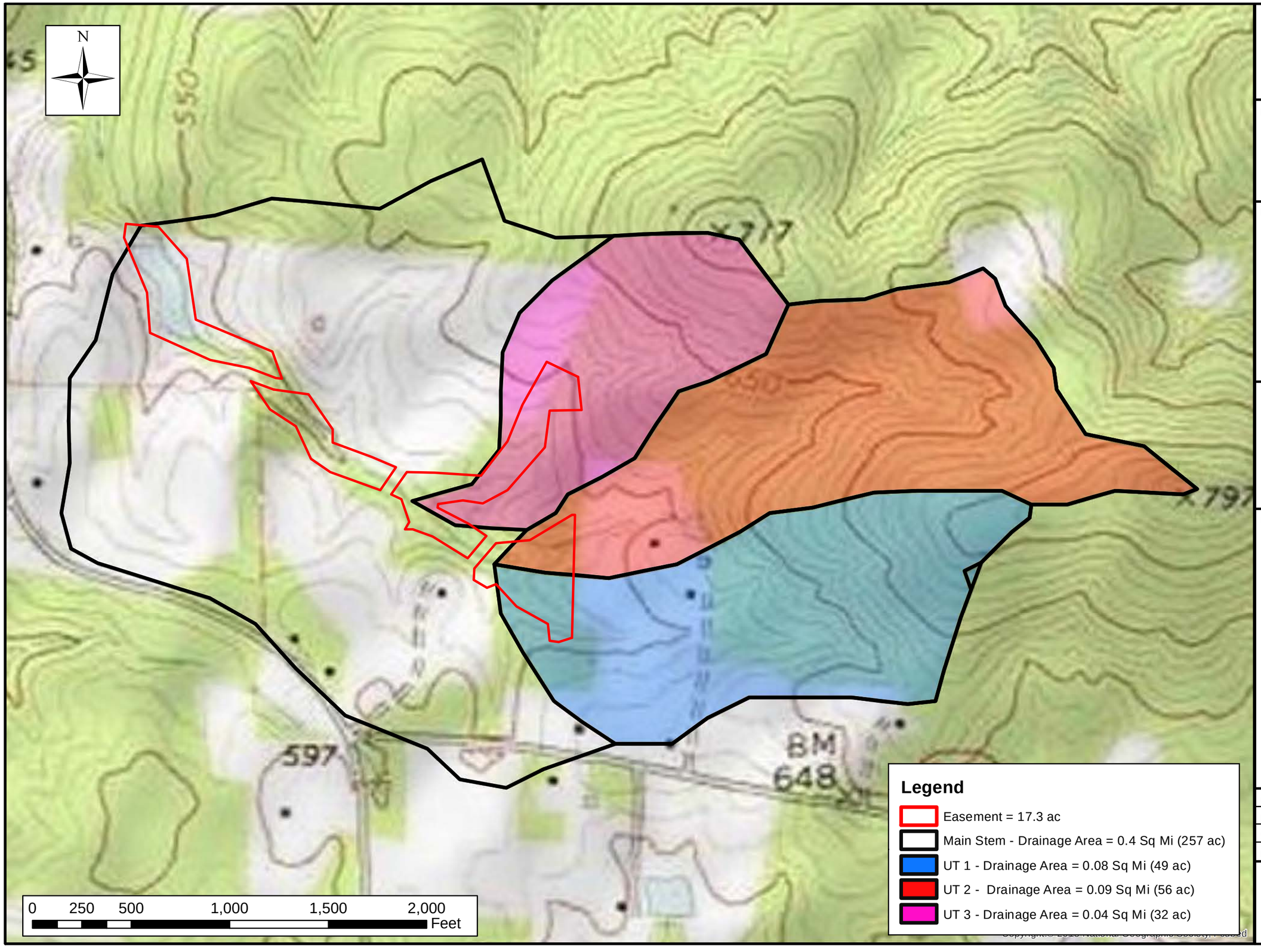
Title:

Hydrologic Unit Map

Drawn by:	SGD
Date:	JUNE 2014
Scale:	1:540,000
Project No.:	14-005

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

Abbey Lamm Restoration Site

Alamance County, NC

Title:

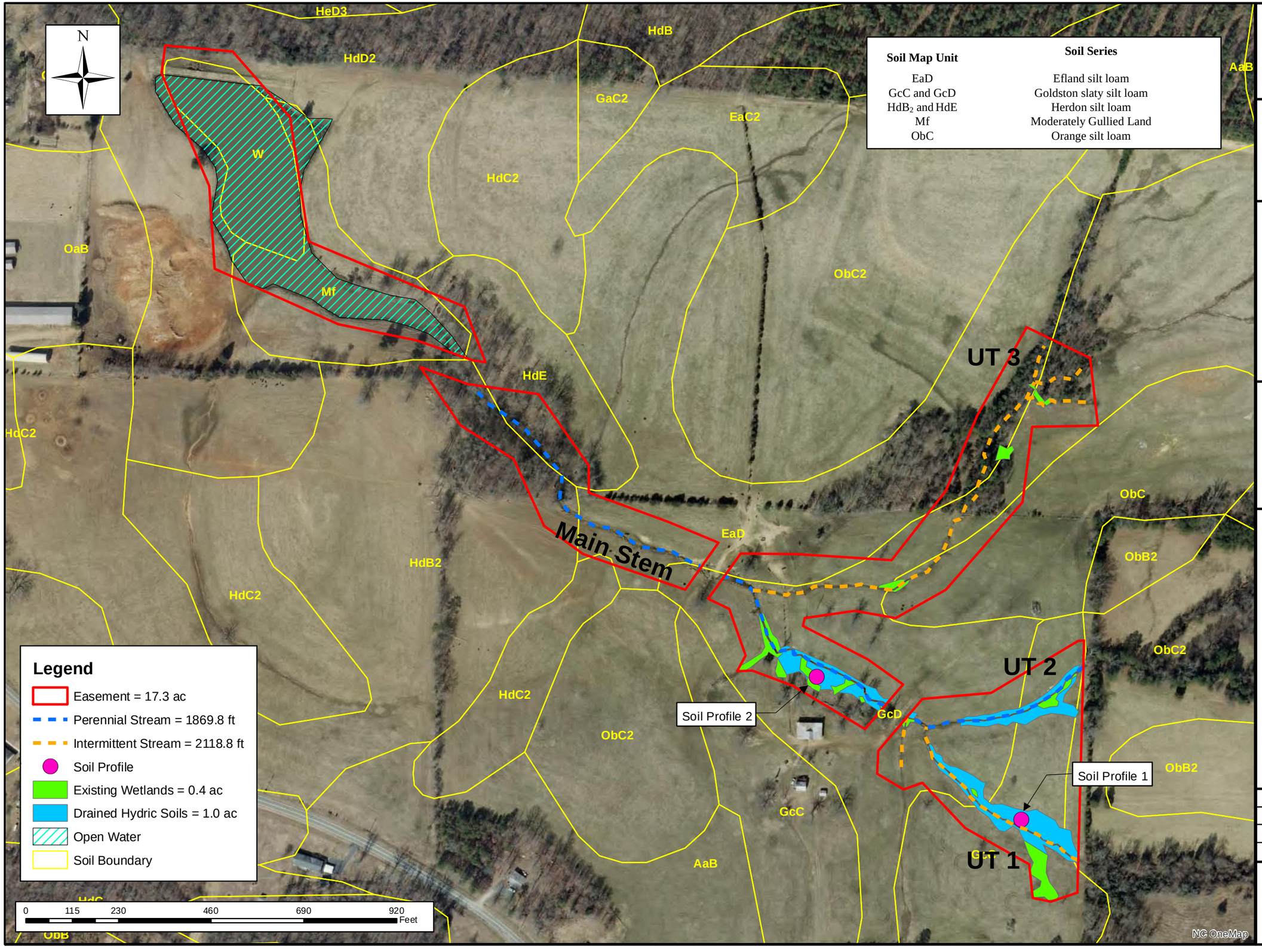
TOPOGRAPHY AND DRAINAGE AREA

Notes:

Drawn by:	WGL
Date:	June 2014
Scale:	AS SHOWN
Project No.:	14-005

FIGURE

3



Soil Map Unit	Soil Series
EaD	Efland silt loam
GcC and GcD	Goldston slaty silt loam
HdB_2 and HdE	Herdon silt loam
Mf	Moderately Gullied Land
ObC	Orange silt loam

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

Abbey Lamm Restoration Site

Alamance County, NC

Title:

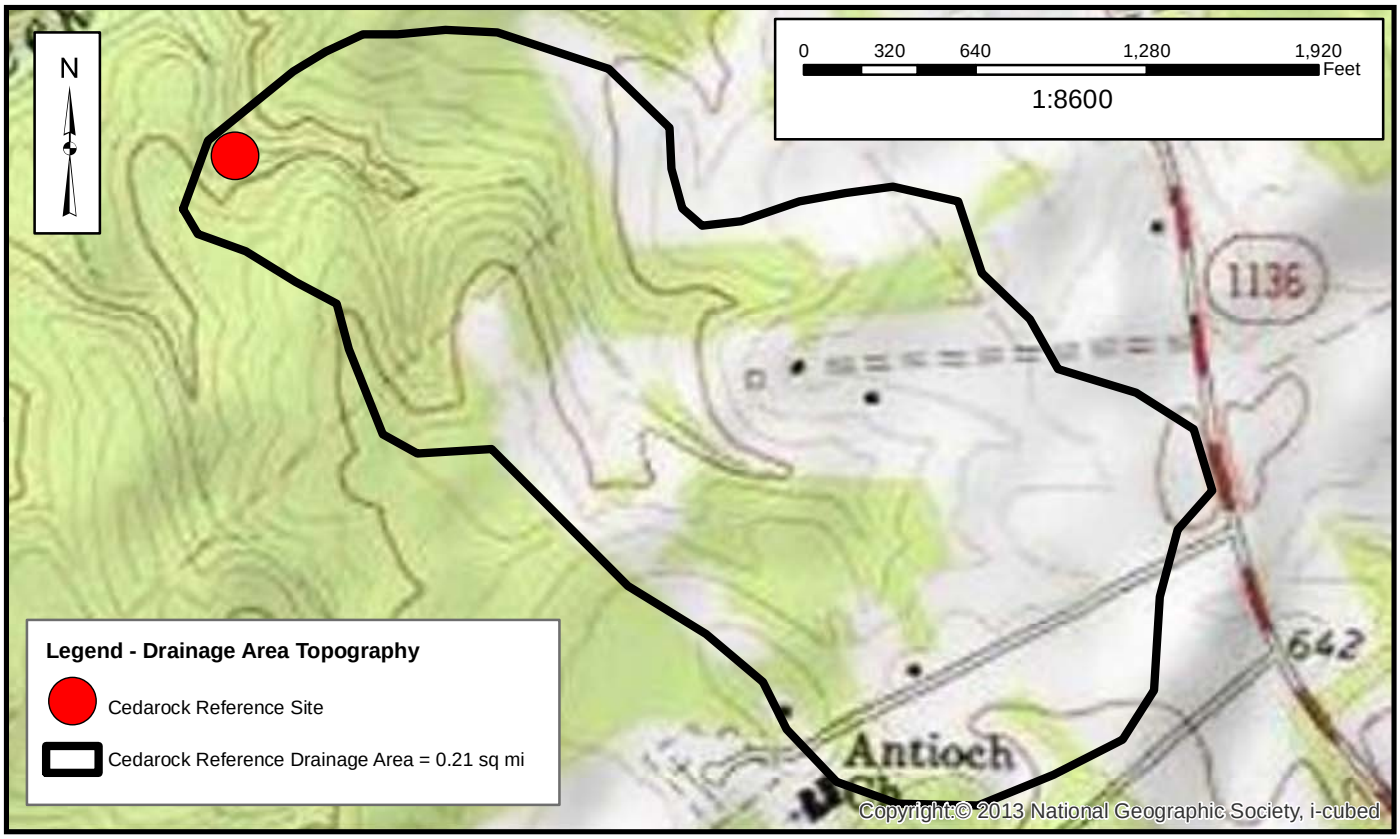
EXISTING CONDITIONS

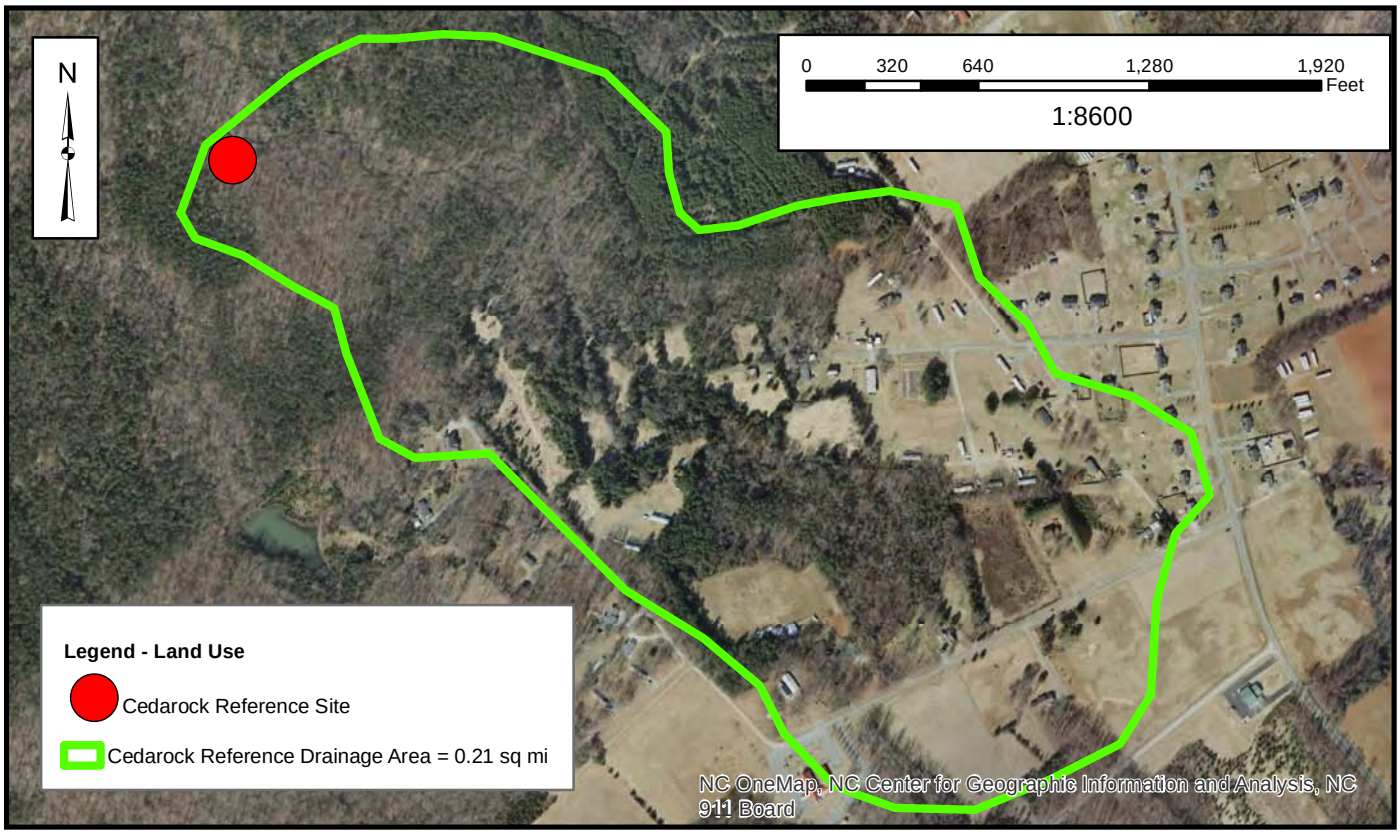
Notes:

Drawn by:	WGL
Date:	May 2014
Scale:	AS SHOWN
Project No.:	14-005

FIGURE

4





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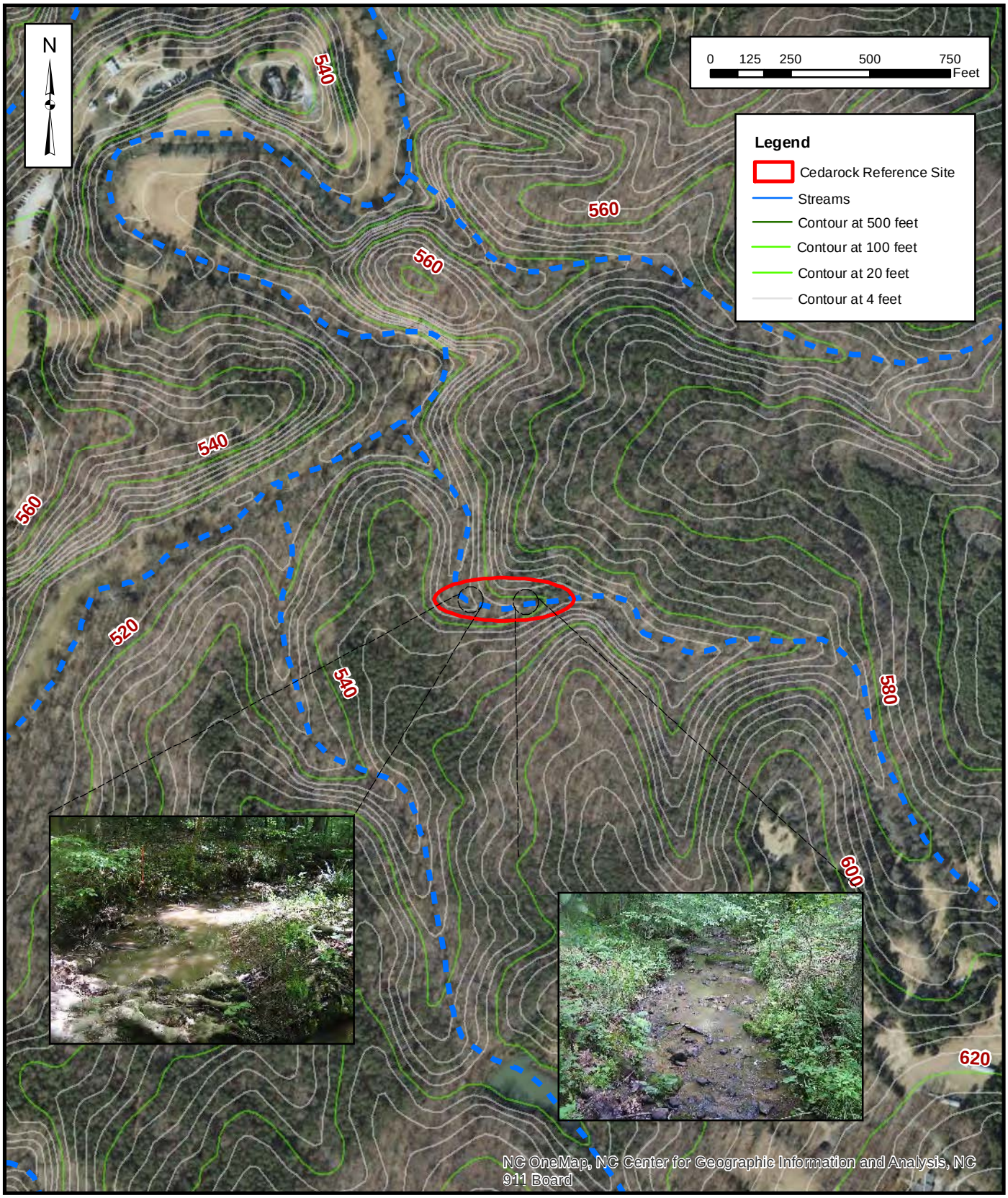
Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693

CEDAROCK REFERENCE DRAINAGE AREA
ABBEY LAMM RESTORATION SITE
Alamance County, North Carolina

Dwn. by.	WGL
Date:	Mar 2014
Project:	14-005

FIGURE
5A



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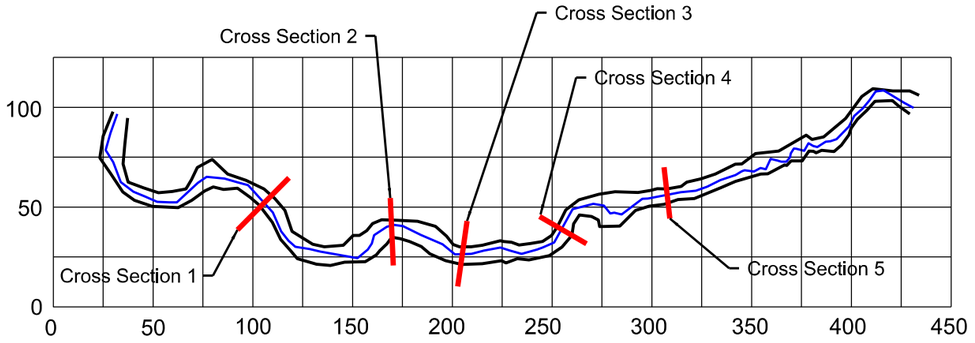
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693
Axiom Environmental, Inc.

EXISTING CONDITIONS
CEDAROCK REFERENCE REACH
ABBEY LAMM REFERENCE SITE
Alamance County, North Carolina

Dwn. by.	WGL
Date:	Mar 2014
Project:	14-005

FIGURE
5B

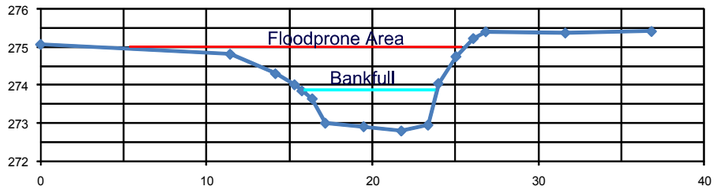


Reference Pattern

Lp-p = 37 (25 - 68) ft
Lm = 68 (44 - 116) ft
Wbelt = 23 (20 - 38) ft
Rc = 16 (11 - 27) ft
Lp-p/Wbkf = 4.6 (3.1 - 8.4)
Lm/Wbkf = 8.4 (5.5 - 14.3)
Wbelt/Wbkf = 2.8 (2.4 - 4.7)
Rc/Wbkf = 2.0 (1.4 - 3.3)
SIN = 1.20

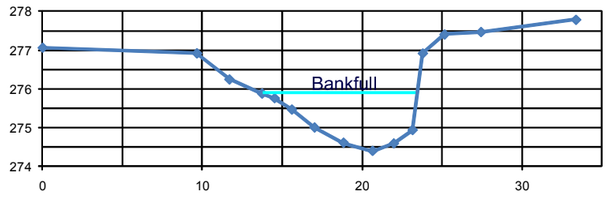
Pattern Legend

- Top of Bank
- Thalweg
- Cross Section



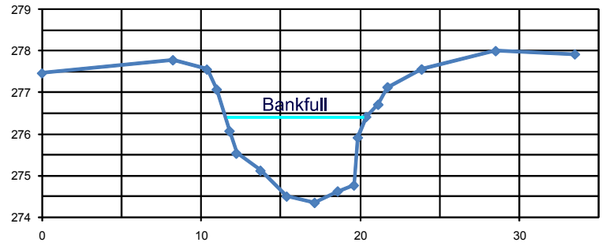
Cross Section 1 - Riffle

Abkf = 6.6 ft
Dave = 0.8 ft
Wbkf = 8.1 ft
Dmax = 1.1 ft
Bank Height = 2.0 ft
Bank Height Ratio = 1.8
W/D = 10.0
FPA = 18
ENT = 2.2
Stream Type = E



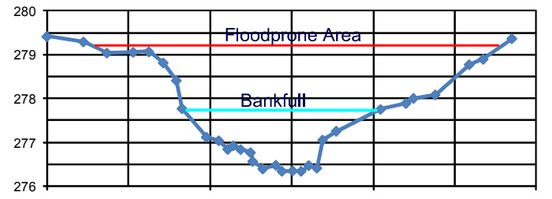
Cross Section 2 - Pool

Abkf = 9.0 ft
Wbkf = 9.7 ft
Dmax = 1.5 ft



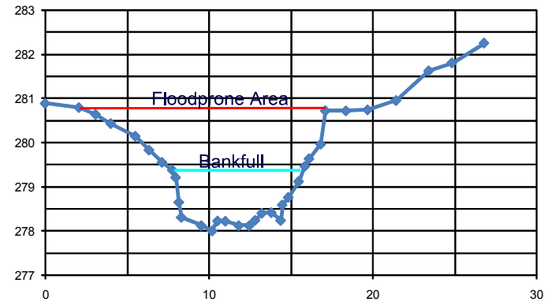
Cross Section 3 - Pool

Abkf = 13.1 ft
Wbkf = 8.9 ft
Dmax = 2.1 ft



Cross Section 4 - Riffle

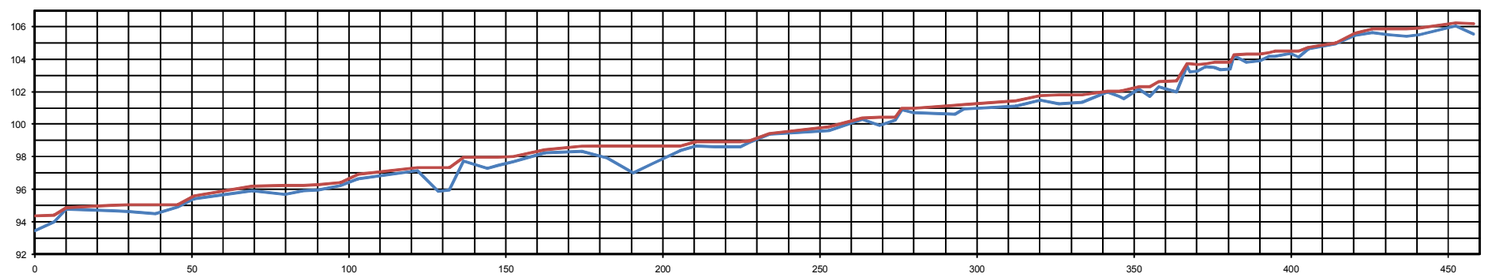
Abkf = 9.6 ft
Dave = 0.8 ft
Wbkf = 12.1 ft
Dmax = 1.4 ft
Bank Height = 1.4 ft
Bank Height Ratio = 1.0
W/D = 15.2
FPA = 25
ENT = 2.1
Stream Type = Eb



Cross Section 5 - Riffle

Abkf = 8.0 ft
Dave = 1.0 ft
Wbkf = 8.0 ft
Dmax = 1.4 ft
Bank Height = 1.4 ft
Bank Height Ratio = 1.0
W/D = 8.0
FPA = 15
ENT = 1.9
Stream Type = Eb

Cedarock Reference Reach



Profile (Reference Reach)

Save = 0.0258 rise/run
Svalley = 0.0310 rise/run
Sriffle = 0.0316 (0 - 0.0576) rise/run
Spool = 0.0007 (0 - 0.018) rise/run
Srun = 0.0353 (0 - 0.3565) rise/run
Sglide = 0.0029 (0 - 0.0431) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

Cedarock Reference Reach Dimension, Pattern, and Profile

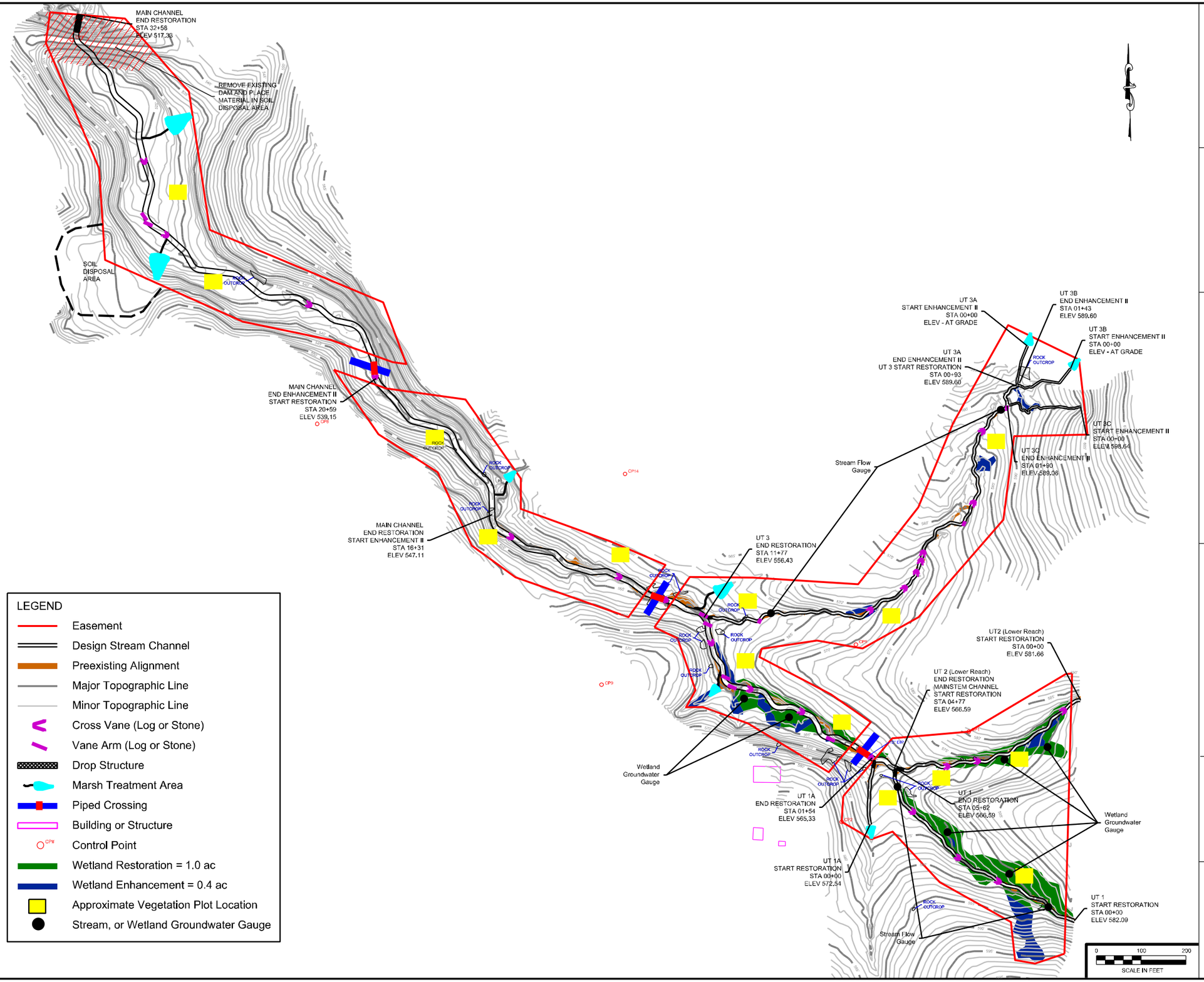
Scale: NA

Date: June 2014

Project No.: 14-005

FIGURE NO.

5C



LEGEND

- Easement
- Design Stream Channel
- Preexisting Alignment
- Major Topographic Line
- Minor Topographic Line
- Cross Vane (Log or Stone)
- Vane Arm (Log or Stone)
- Drop Structure
- Marsh Treatment Area
- Piped Crossing
- Building or Structure
- Control Point
- Wetland Restoration = 1.0 ac
- Wetland Enhancement = 0.4 ac
- Approximate Vegetation Plot Location
- Stream, or Wetland Groundwater Gauge

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

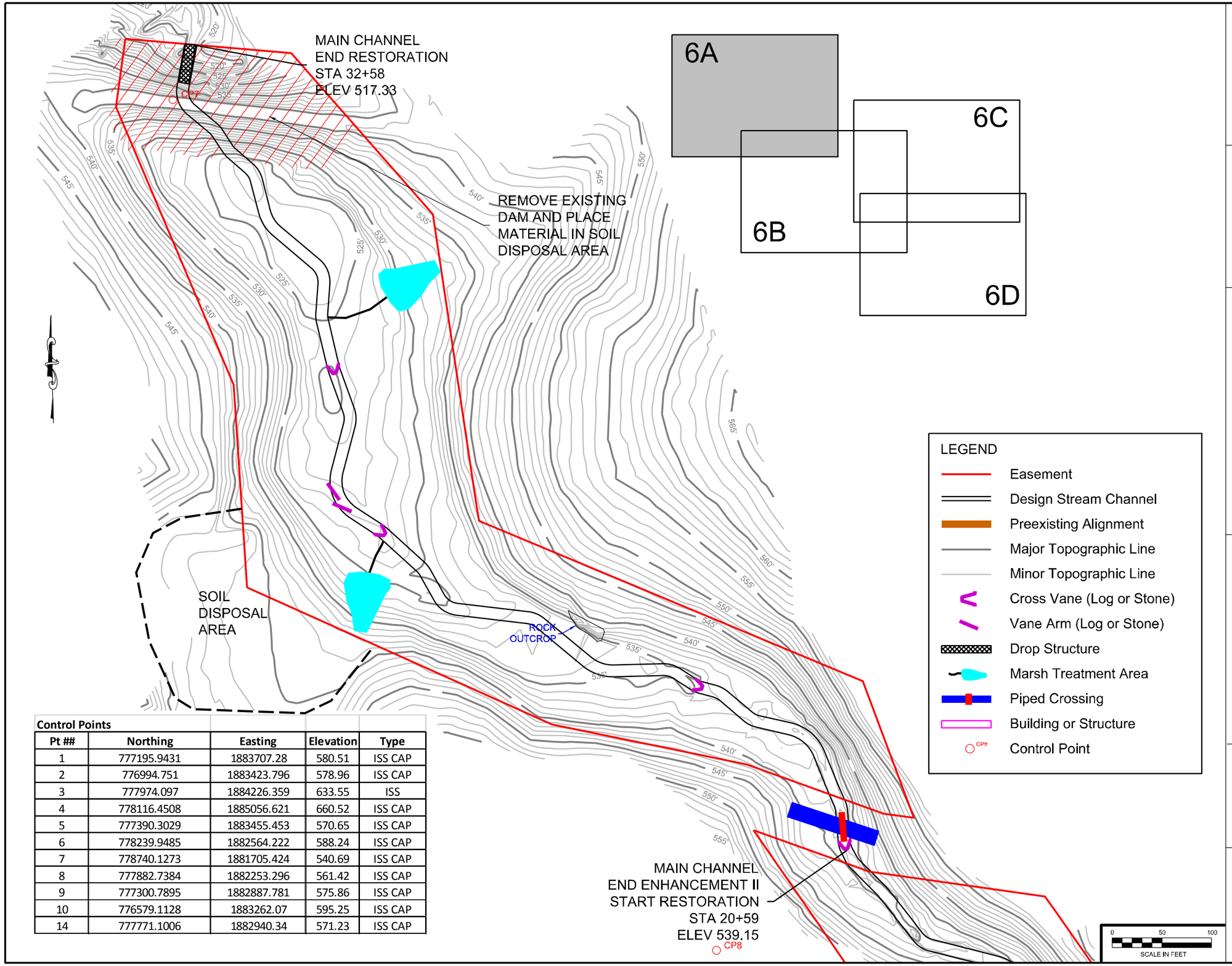
Abbey Lamm
Restoration Site

Alamance County
North Carolina

Title:

RESTORATION
PLAN

Scale:	FIGURE NO.
As Shown	6
Date: June 2014	
Project No.: 14-005	



Control Points

Pt ##	Northing	Easting	Elevation	Type
1	777195.9431	1883707.28	580.51	ISS CAP
2	776994.751	1883423.796	578.96	ISS CAP
3	777974.097	1884226.359	633.55	ISS
4	778116.4508	1885056.621	660.52	ISS CAP
5	777390.3029	1883455.453	570.65	ISS CAP
6	778239.9485	1882564.222	588.24	ISS CAP
7	778740.1273	1881705.424	540.69	ISS CAP
8	777882.7384	1882253.296	561.42	ISS CAP
9	777300.7895	1882887.781	575.86	ISS CAP
10	776579.1128	1883262.07	595.25	ISS CAP
14	777771.1006	1882940.34	571.23	ISS CAP

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm
Restoration Site

Alamance County
North Carolina

Title:

RESTORATION
PLAN

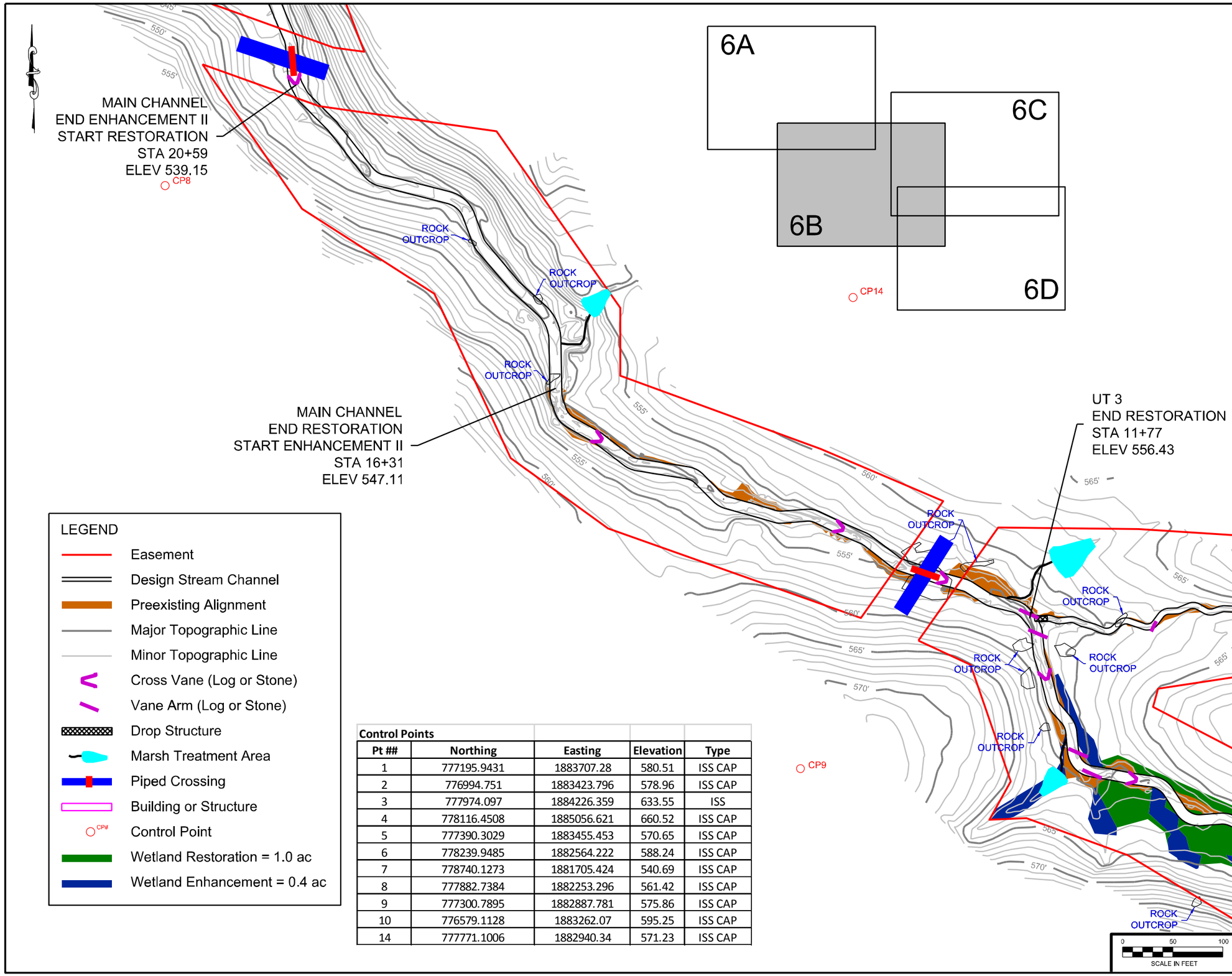
Scale: As Shown

Date: June 2014

Project No.: 14-005

FIGURE NO.

6A



LEGEND

- Easement
- Design Stream Channel
- Preexisting Alignment
- Major Topographic Line
- Minor Topographic Line
- Cross Vane (Log or Stone)
- Vane Arm (Log or Stone)
- Drop Structure
- Marsh Treatment Area
- Piped Crossing
- Building or Structure
- CP# Control Point
- Wetland Restoration = 1.0 ac
- Wetland Enhancement = 0.4 ac

Control Points

Pt ##	Northing	Easting	Elevation	Type
1	777195.9431	1883707.28	580.51	ISS CAP
2	776994.751	1883423.796	578.96	ISS CAP
3	777974.097	1884226.359	633.55	ISS
4	778116.4508	1885056.621	660.52	ISS CAP
5	777390.3029	1883455.453	570.65	ISS CAP
6	778239.9485	1882564.222	588.24	ISS CAP
7	778740.1273	1881705.424	540.69	ISS CAP
8	777882.7384	1882253.296	561.42	ISS CAP
9	777300.7895	1882887.781	575.86	ISS CAP
10	776579.1128	1883262.07	595.25	ISS CAP
14	777771.1006	1882940.34	571.23	ISS CAP

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

RESTORATION PLAN

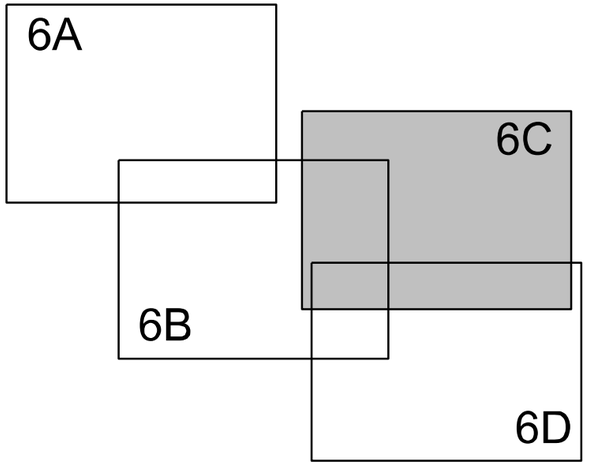
Scale: As Shown

Date: June 2014

Project No.: 14-005

FIGURE NO.

6B



Control Points				
Pt ##	Northing	Easting	Elevation	Type
1	777195.9431	1883707.28	580.51	ISS CAP
2	776994.751	1883423.796	578.96	ISS CAP
3	777974.097	1884226.359	633.55	ISS
4	778116.4508	1885056.621	660.52	ISS CAP
5	777390.3029	1883455.453	570.65	ISS CAP
6	778239.9485	1882564.222	588.24	ISS CAP
7	778740.1273	1881705.424	540.69	ISS CAP
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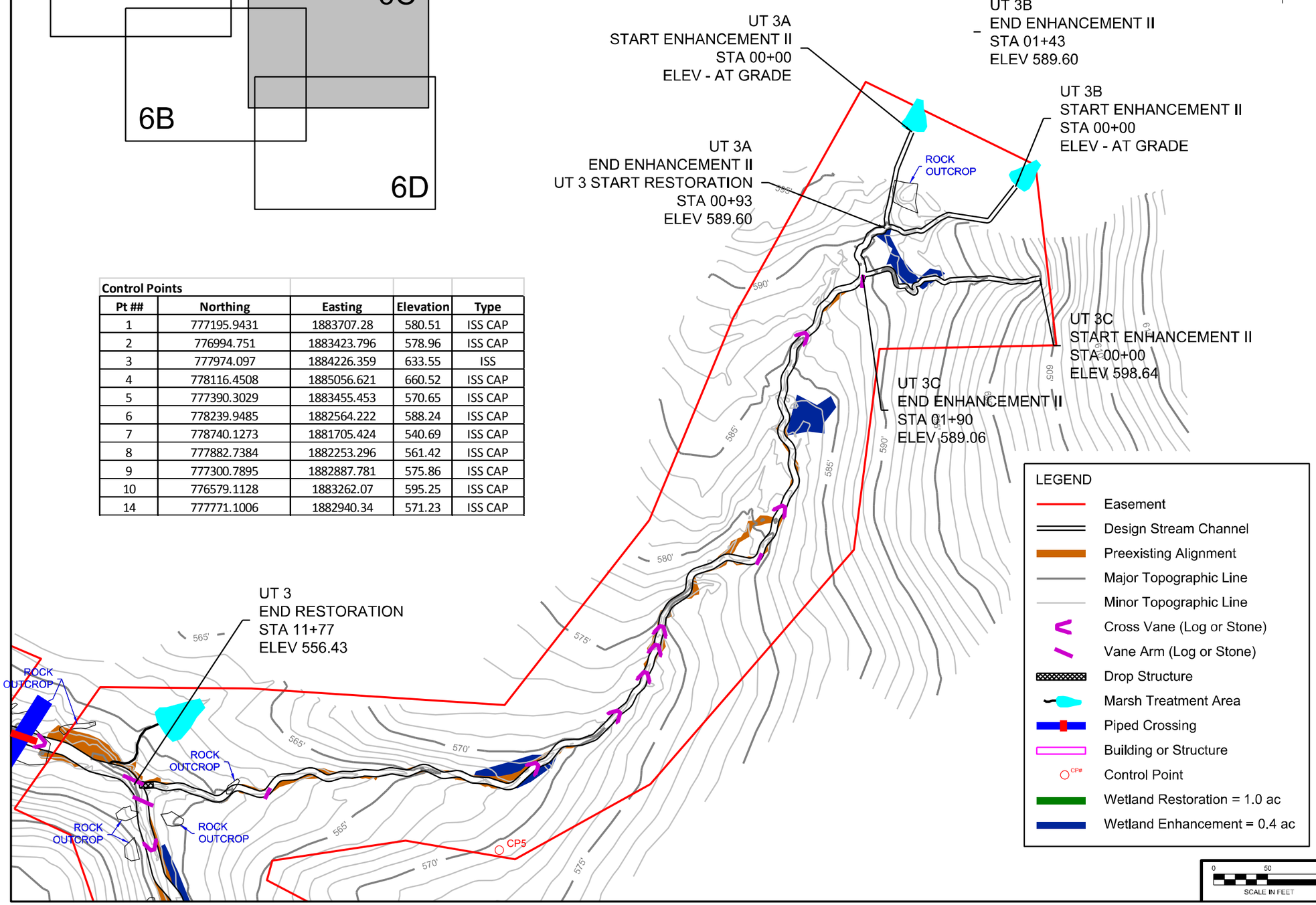
9	777300.7895	1882887.781	575.86	ISS CAP
10	776579.1128	1883262.07	595.25	ISS CAP
14	777771.1006	1882940.34	571.23	ISS CAP



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

RESTORATION PLAN

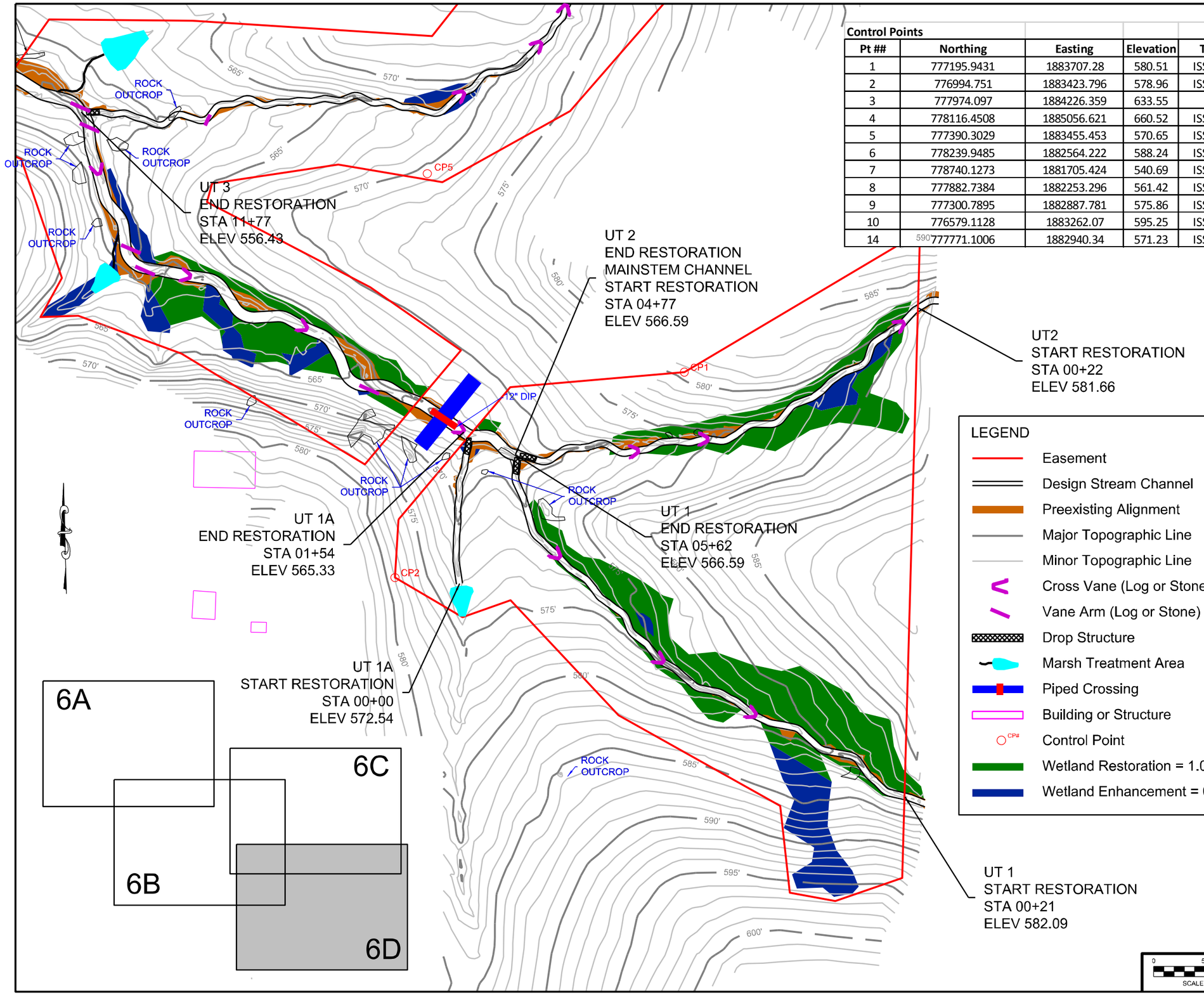
Scale: As Shown

Date: June 2014

Project No.: 14-005

FIGURE NO.

6C



Control Points

Pt ##	Northing	Easting	Elevation	Type
1	777195.9431	1883707.28	580.51	ISS CAP
2	776994.751	1883423.796	578.96	ISS CAP
3	777974.097	1884226.359	633.55	ISS
4	778116.4508	1885056.621	660.52	ISS CAP
5	777390.3029	1883455.453	570.65	ISS CAP
6	778239.9485	1882564.222	588.24	ISS CAP
7	778740.1273	1881705.424	540.69	ISS CAP
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10	776579.1128	1883262.07	595.25	ISS CAP
14	777771.1006	1882940.34	571.23	ISS CAP

LEGEND

- Easement
- Design Stream Channel
- Preexisting Alignment
- Major Topographic Line
- Minor Topographic Line
- Cross Vane (Log or Stone)
- Vane Arm (Log or Stone)
- Drop Structure
- Marsh Treatment Area
- Piped Crossing
- Building or Structure
- CP# Control Point
- Wetland Restoration = 1.0 ac
- Wetland Enhancement = 0.4 ac

0 50 100
SCALE IN FEET

Axiom Environmental, Inc.

RS RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

RESTORATION PLAN

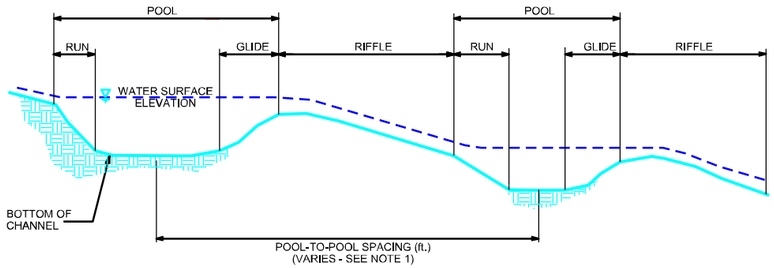
Scale: As Shown

Date: June 2014

Project No.: 14-005

FIGURE NO.

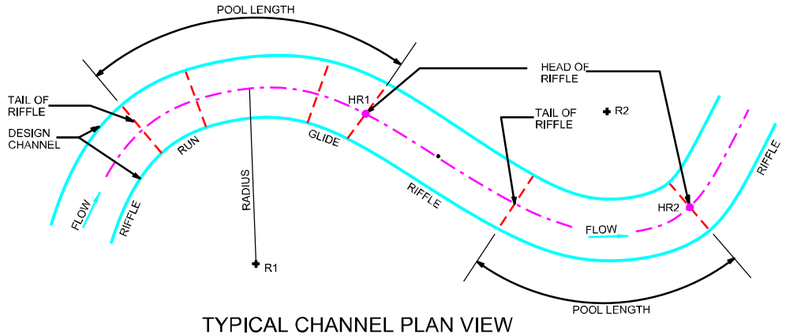
6D



TYPICAL CHANNEL PROFILE

NOTES:

1. POOL-TO-POOL SPACING IS MEASURED FROM CENTER OF POOL BEND TO CENTER OF POOL BEND.

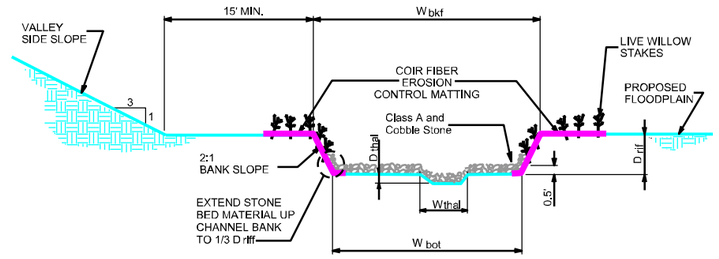


TYPICAL CHANNEL PLAN VIEW

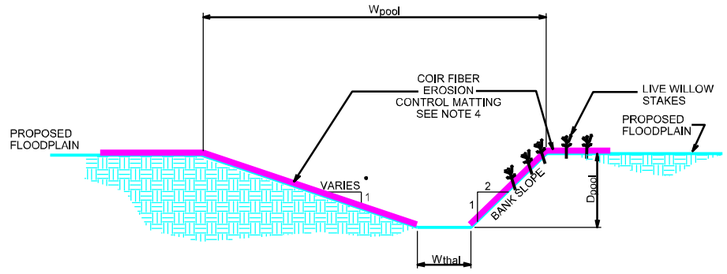
CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



TYPICAL RIFFLE CROSS-SECTION



• MAX. 1:1 SLOPE

TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.

3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF CLASS B AND CLASS 1 STONE.

CROSS-SECTION DIMENSIONS

REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
Main Channel Sta 00+00 to 10+81	11.2	8.8	1.1	0.1	1.7	12.1	1.0
Main Channel Sta 10+81 to 32+58	12.1	9.7	1.1	0.1	1.8	13.2	1.0
Unnamed Tributaries 1 and 2	6.5	5.3	0.5	0.1	1.0	7.7	0.5
Unnamed Tributary 1A	6.0	5.0	0.4	0.1	0.8	7.4	0.5
Unnamed Tributary 3	6.0	5.0	0.4	0.1	0.8	7.4	0.5

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

Scale: NA

Date: June 2014

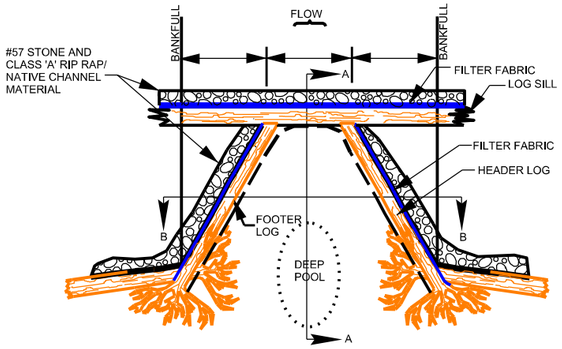
Project No.: 14-005

FIGURE NO. 7

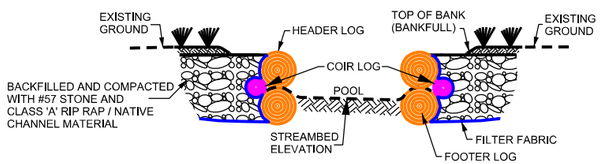
LOG CROSS VANE

SCALE:NTS

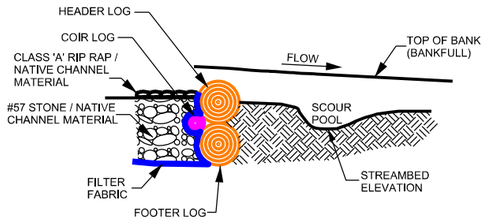
PLAN VIEW



NOTES:
1. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 18" DIAMETER AND SHALL BE A HARDWOOD SPECIES. (FOOTER LOG MAY BE SUBSTITUTED WITH PINE)
2. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
3. ALL STONES ARE TO BE STRUCTURE STONES.
4. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
5. PERPENDICULAR ROOTWAD LOGS ARE REQUIRED IF THE LOG VANE ARM DOES NOT HAVE A ROOTBALL TO TIE INTO THE BANK.



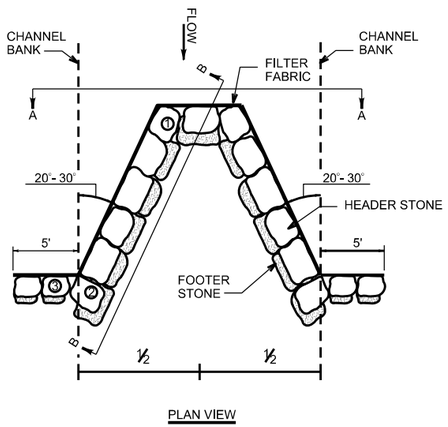
SECTION B-B



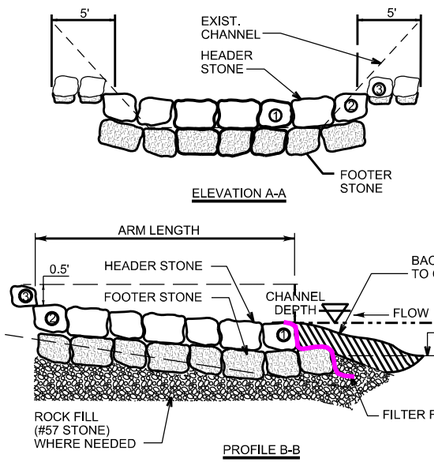
SECTION A-A

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
Tributaries 1, 2, and 3	7	0.6 - 0.8
Main Channel	11	1.1 - 1.4

NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.

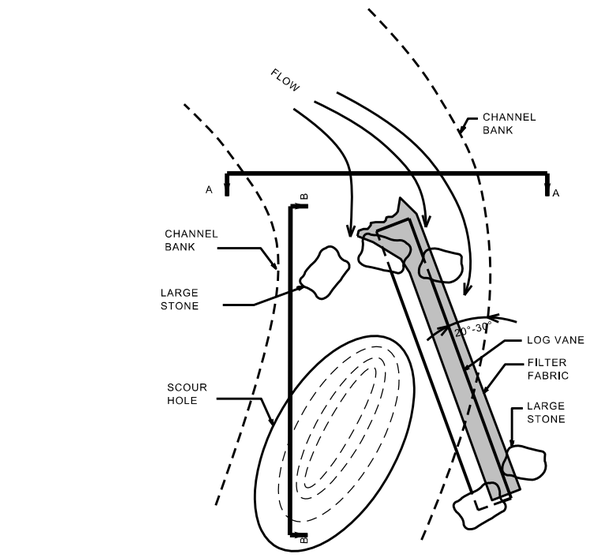


PLAN VIEW



PROFILE B-B

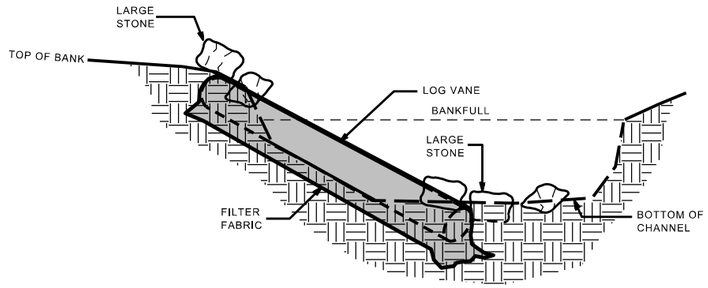
TYPICAL CROSS-VANE



NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

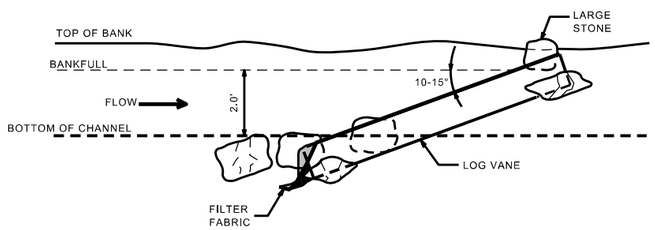
PLAN VIEW

SCALE: N.T.S.



CROSS-SECTION A-A

SCALE: N.T.S.



PROFILE B-B

SCALE: N.T.S.

NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

TYPICAL LOG VANE

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

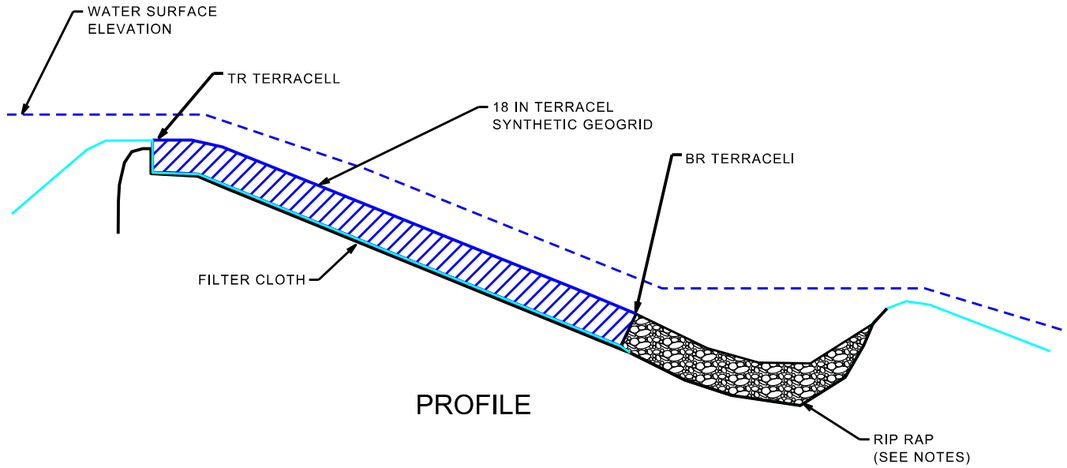
Scale: NO SCALE

Date: June 2014

Project No.: 14-005

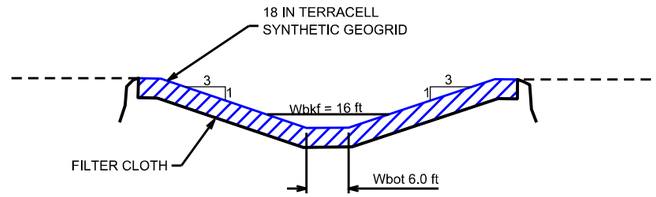
FIGURE NO.

8A



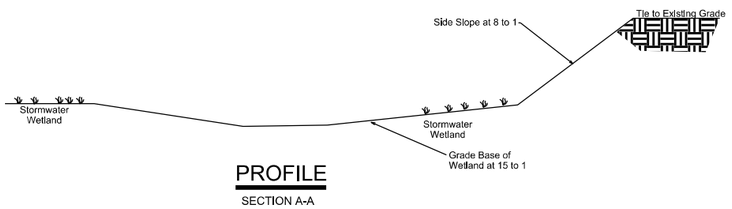
PROFILE

TERRACELL STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL 18-INCH TERRACELL SYNTHETIC GEOGRID AS PER THE MANUFACTURER'S SPECIFICATIONS.
2. AT BOTTOM RIFFLE DOWNSTREAM FROM TERRACELL STRUCTURE THE POOL WILL BE ARMORED WITH EROSION CONTROL FABRIC AND CLASS 1 RIP RAP OR OTHER SUITABLE MATERIAL.

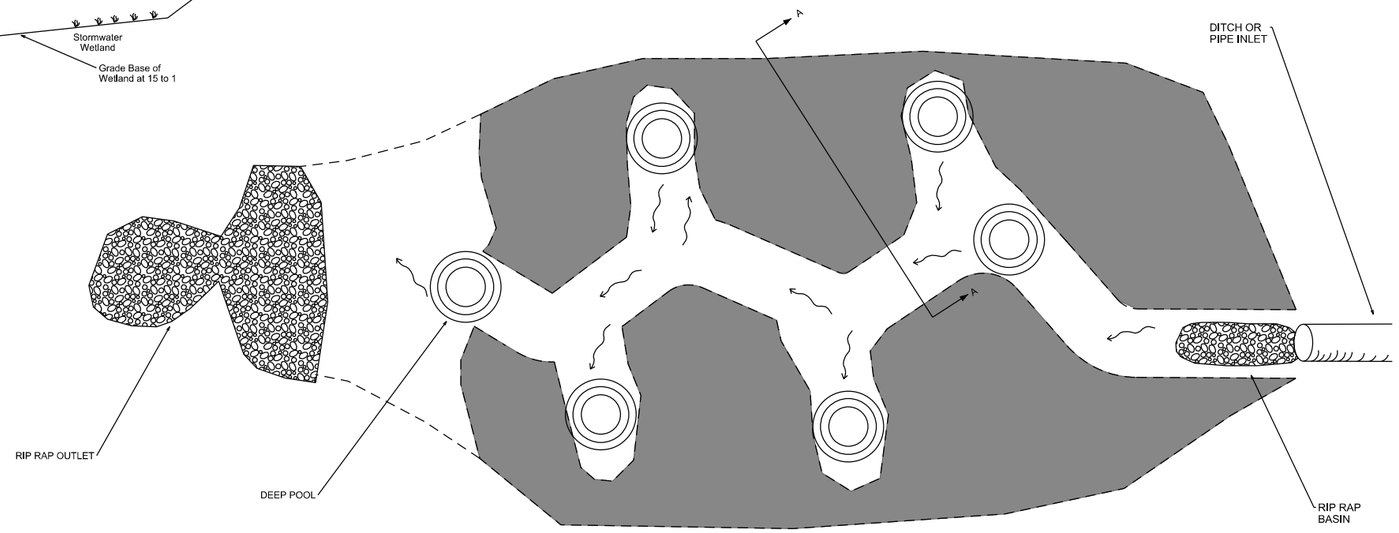


CROSS-SECTION

TERRACELL STRUCTURE NOTES:
1. CONTRACTOR WILL INSTALL 18-INCH TERRACELL SYNTHETIC GEOGRID AS PER THE MANUFACTURER'S SPECIFICATIONS.
2. ONCE THE SYNTHETIC GEOGRID HAS BEEN INSTALLED, GEOCELLS WILL BE BACKFILLED WITH GRAVEL AND TOPSOIL AND PLANTED WITH EROSION CONTROL GRASSES AND WILLOW STAKES (*SALIX NIGRA*).



PROFILE
SECTION A-A



MARSH TREATMENT AREA

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

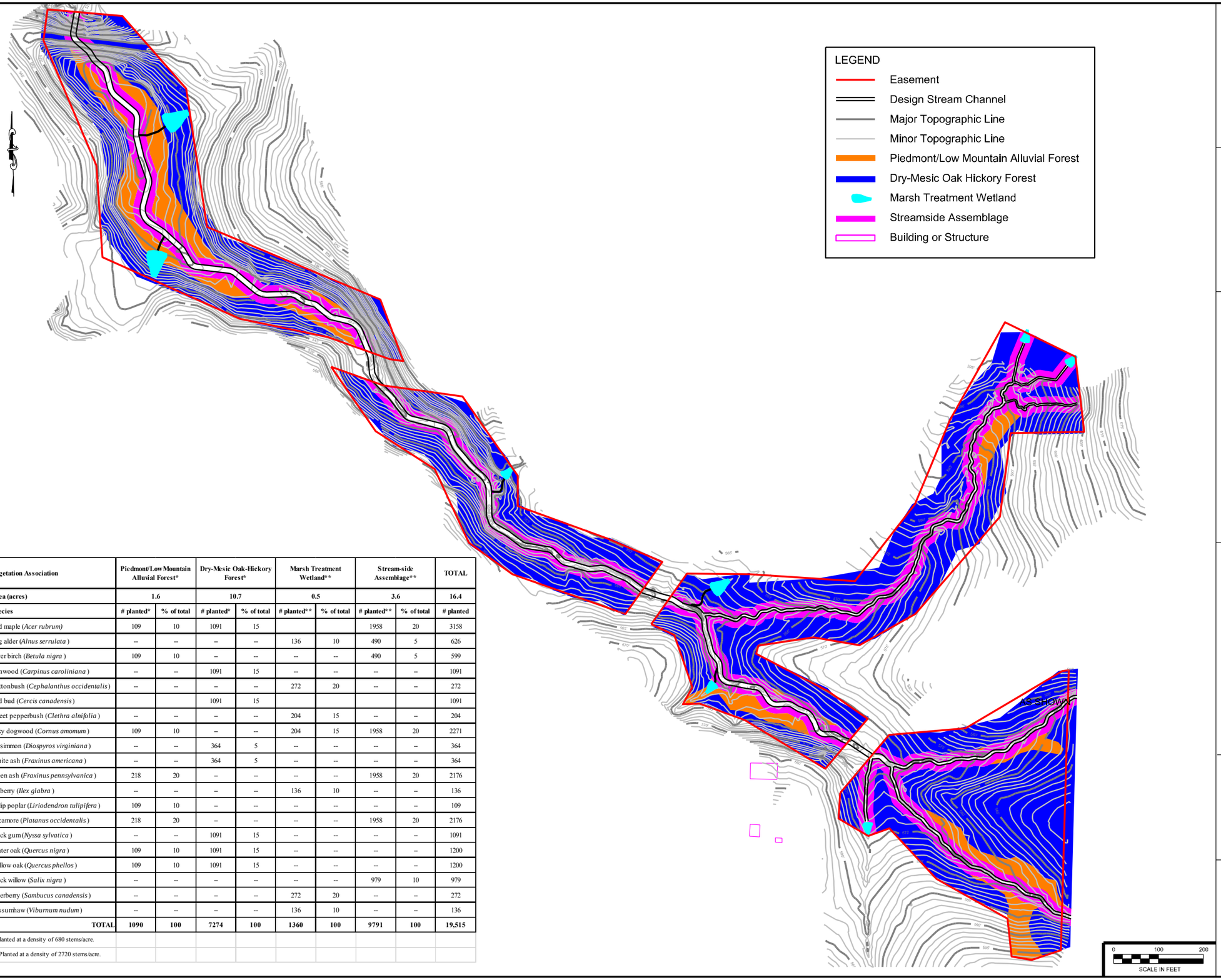
Scale: NO SCALE

Date: June 2014

Project No.: 14-005

FIGURE NO.

8B



Vegetation Association	Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Marsh Treatment Wetland**		Stream-side Assemblage**		TOTAL
Area (acres)	**1.6**		**10.7**		**0.5**		**3.6**		**16.4**
Species	**# planted***	**% of total**	**# planted***	**% of total**	**# planted****	**% of total**	**# planted****	**% of total**	**# planted**
Red maple (*Acer rubrum*)	109	10	1091	15			1958	20	3158
Tag alder (*Alnus serrulata*)	--	--	--	--	136	10	490	5	626
River birch (*Betula nigra*)	109	10	--	--	--	--	490	5	599
Ironwood (*Carpinus caroliniana*)	--	--	1091	15	--	--	--	--	1091
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	272	20	--	--	272
Red bud (*Cercis canadensis*)			1091	15					1091
Sweet pepperbush (*Clethra alnifolia*)	--	--	--	--	204	15	--	--	204
Silky dogwood (*Cornus amomum*)	109	10	--	--	204	15	1958	20	2271
Persimmon (*Diospyros virginiana*)	--	--	364	5	--	--	--	--	364
White ash (*Fraxinus americana*)	--	--	364	5	--	--	--	--	364
Green ash (*Fraxinus pennsylvanica*)	218	20	--	--	--	--	1958	20	2176
Inkberry (*Ilex glabra*)	--	--	--	--	136	10	--	--	136
Tulip poplar (*Liriodendron tulipifera*)	109	10	--	--	--	--	--	--	109
Sycamore (*Platanus occidentalis*)	218	20	--	--	--	--	1958	20	2176
Black gum (*Nyssa sylvatica*)	--	--	1091	15	--	--	--	--	1091
Water oak (*Quercus nigra*)	109	10	1091	15	--	--	--	--	1200
Willow oak (*Quercus phellos*)	109	10	1091	15	--	--	--	--	1200
Black willow (*Salix nigra*)	--	--	--	--	--	--	979	10	979
Elderberry (*Sambucus canadensis*)	--	--	--	--	272	20	--	--	272
Possumhaw (*Viburnum nudum*)	--	--	--	--	136	10	--	--	136
TOTAL	**1090**	**100**	**7274**	**100**	**1360**	**100**	**9791**	**100**	**19,515**
* Planted at a density of 680 stems/acre.									
** Planted at a density of 2720 stems/acre.									

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm Restoration Site

Alamance County North Carolina

Title:

PLANTING PLAN

Scale:

Date: June 2014

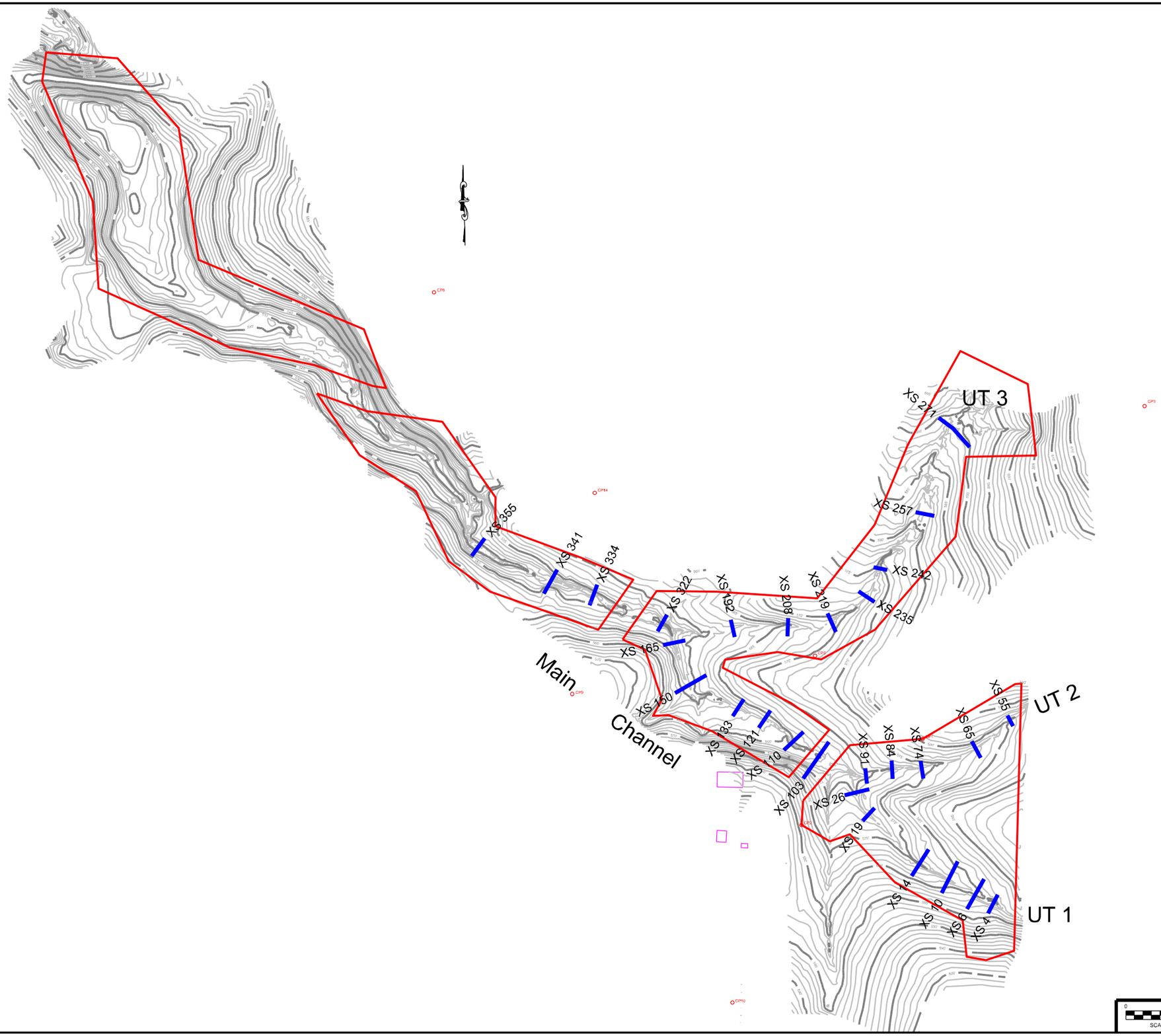
Project No.: 14-005

FIGURE NO.

9

Appendix B
Existing Stream Data

Figure B1. Cross-section Locations
Existing Stream Data



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Abbey Lamm
Restoration Site

Alamance County
North Carolina

Title:

Cross Section
Locations

Scale:
As Shown

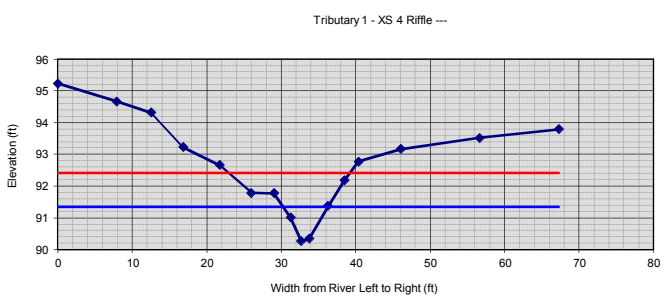
Date:
June 2014

Project No.:
14-005

FIGURE NO.

B1

Cross Section



section: **Tributary 1 - XS 4**

Riffle

---

description: **Tributary 1 - XS 4**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	4.771225	95.22878
		7.905768	5.337259	94.66274
		12.55207	5.686718	94.31328
		16.82045	6.778532	93.22147
		21.72135	7.337997	92.662
		25.98599	8.219385	91.78062
		29.06025	8.225251	91.77475
		31.25332	8.988296	91.0117
		32.69819	9.738895	90.26111
		33.76238	9.656228	90.34377
		36.30518	8.631836	91.36816
		38.48172	7.822397	92.1776
		40.36022	7.223897	92.7761
		46.06041	6.83562	93.16438
		56.59624	6.478551	93.52145
		67.27498	6.21242	93.78758

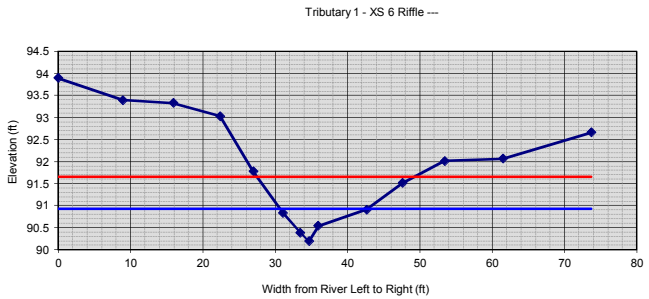
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
8.66	8.22	6.0		
91.34	91.78			

dimensions			
3.5	x-section area	0.6	d mean
5.9	width	6.4	wet P
1.1	d max	0.6	hyd radi
1.5	bank ht	10.0	w/d ratio
6.0	W flood prone area	1.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 1 - XS 6**

Riffle

---

description: **Tributary 1 - XS 6**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	6.106639	93.89336
		8.937948	6.608903	93.3911
		15.94674	6.675004	93.325
		22.35467	6.970865	93.02914
		27.00429	8.226186	91.77381
		31.10768	9.171614	90.82839
		33.49189	9.61269	90.38731
		34.67717	9.810825	90.18918
		35.95351	9.463133	90.53687
		42.61888	9.090011	90.90999
		47.6046	8.489469	91.51053
		53.4413	7.985931	92.01407
		61.49982	7.936165	92.06384
		73.7066	7.340298	92.6597

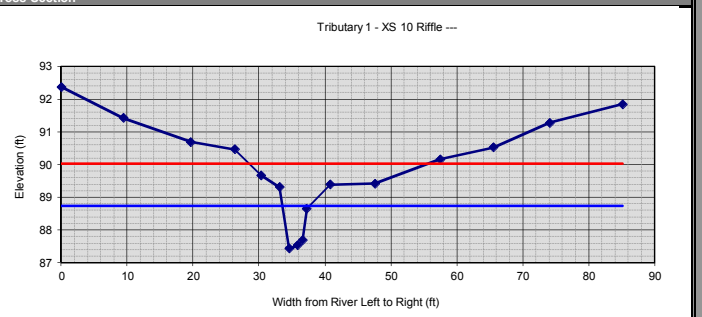
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
9.08	7.99	22.0		
90.92	92.01			

dimensions			
3.5	x-section area	0.3	d mean
12.0	width	12.1	wet P
0.7	d max	0.3	hyd radi
1.8	bank ht	40.7	w/d ratio
22.0	W flood prone area	1.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 1 - XS 10**

Riffle

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description: **Tributary 1 - XS 10**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	7.634261	92.36574
	☐	9.415357	8.57996	91.42004
	☐	19.66814	9.314515	90.68549
	☐	26.29286	9.534623	90.46538
	☐	30.29181	10.33187	89.66813
	☐	33.1237	10.68935	89.31065
	☐	34.57326	12.57265	87.42735
	☐	35.8502	12.47164	87.52836
	☐	36.61208	12.31556	87.68444
	☐	37.24485	11.34728	88.65272
	☐	40.77603	10.60832	89.39168
	☐	47.60653	10.58648	89.41352
	☐	57.45464	9.841251	90.15875
	☐	65.56133	9.482393	90.51761
	☐	74.06978	8.722661	91.27734
	☐	85.11271	8.157264	91.84274
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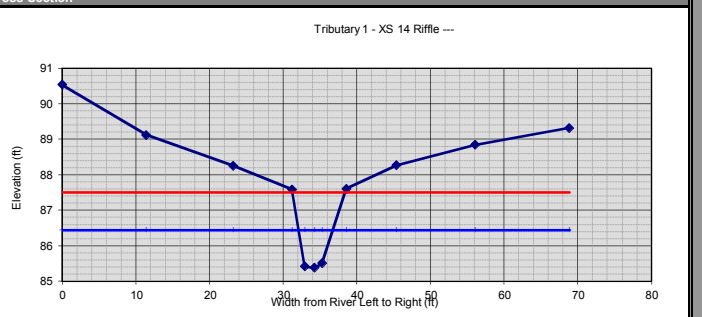
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
11.27	10.6	27.0		
88.73	89.4			

dimensions			
3.5	x-section area	0.9	d mean
4.0	width	5.2	wet P
1.3	d max	0.7	hyd radi
2.0	bank ht	4.7	w/d ratio
27.0	W flood prone area	6.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 1 - XS 14**

Riffle

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description: **Tributary 1 - XS 14**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	9.465159	90.53484
	☐	11.42337	10.8806	89.1194
	☐	23.17955	11.74863	88.25138
	☐	31.19056	12.41406	87.58594
	☐	32.91632	14.58585	85.41415
	☐	34.26721	14.62036	85.37964
	☐	35.23411	14.49449	85.50551
	☐	38.55216	12.39114	87.60886
	☐	45.33585	11.73213	88.26787
	☐	56.04991	11.15798	88.84203
	☐	68.84464	10.67561	89.32439
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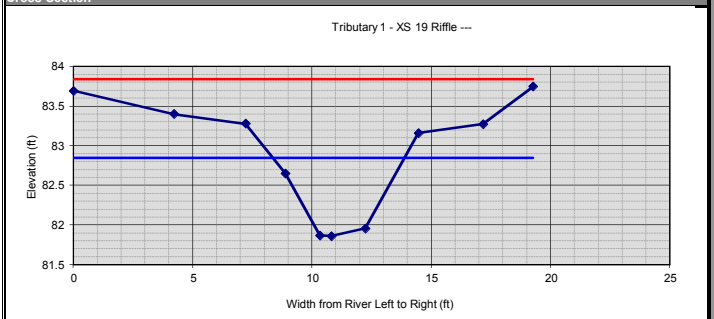
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
13.56	12.41	7.0		
86.44	87.59			

dimensions			
3.5	x-section area	0.8	d mean
4.6	width	5.4	wet P
1.1	d max	0.6	hyd radi
2.2	bank ht	6.1	w/d ratio
7.0	W flood prone area	1.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 1 - XS 19**

Riffle

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description: **Tributary 1 - XS 19**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	16.30935	83.69065
		4.232279	16.60177	83.39823
		7.221334	16.72488	83.27512
		8.888977	17.35141	82.64859
		10.34437	18.13078	81.86922
		10.81274	18.142	81.858
		12.22815	18.04303	81.95697
		14.46579	16.84074	83.15926
		17.1603	16.72599	83.27401
		19.27071	16.25712	83.74288

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
17.15	16.84	20.0		
82.85	83.16			

dimensions			
3.5	x-section area	0.6	d mean
5.5	width	6.0	wet P
1.0	d max	0.6	hyd radi
1.3	bank ht	8.9	w/d ratio
20.0	W flood prone area	3.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Tributary 1 - XS 26**

Riffle

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description: **Tributary 1 - XS 26**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	18.11605	81.88395
		3.296729	18.49138	81.50862
		4.748717	18.48659	81.51341
		6.67959	19.07382	80.92618
		8.574008	19.47725	80.52275
		10.31937	19.39544	80.60456
		12.50686	18.50786	81.49214
		16.26917	18.08574	81.91426

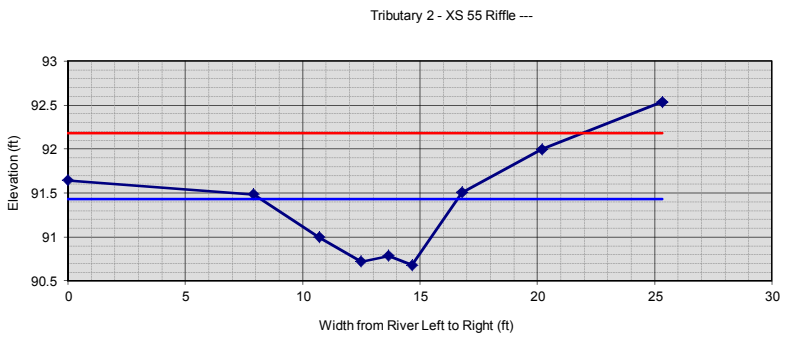
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
18.65	18.49	20.0		
81.35	81.51			

dimensions			
3.5	x-section area	0.5	d mean
6.9	width	7.1	wet P
0.8	d max	0.5	hyd radi
1.0	bank ht	13.3	w/d ratio
20.0	W flood prone area	2.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Tributary 2 - XS 55
	Riffle

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description:	Tributary 2 - XS 55
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	8.354985	91.64502
	☐	7.914137	8.517248	91.48275
	☐	10.70368	9.004252	90.99575
	☐	12.50196	9.27836	90.72164
	☐	13.66711	9.213601	90.7864
	☐	14.67421	9.319437	90.68056
	☐	16.79555	8.495247	91.50475
	☐	20.19617	8.001405	91.9986
	☐	25.33365	7.463453	92.53655
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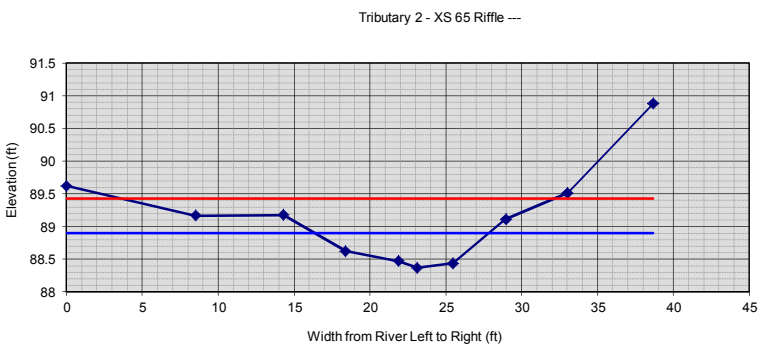
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
8.57	8.52	34.0		
91.43	91.48			

dimensions			
3.8	x-section area	0.5	d mean
8.4	width	8.6	wet P
0.7	d max	0.4	hyd radi
0.8	bank ht	18.6	w/d ratio
34.0	W flood prone area	4.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Tributary 2 - XS 65
	Riffle

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description:	Tributary 2 - XS 65
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	10.37508	89.62492
	☐	8.519042	10.8317	89.16831
	☐	14.3065	10.82136	89.17865
	☐	18.39483	11.37465	88.62535
	☐	21.87261	11.52877	88.47123
	☐	23.12338	11.63152	88.36848
	☐	25.48137	11.56234	88.43766
	☐	28.95108	10.88808	89.11192
	☐	33.03916	10.4838	89.5162
	☐	38.6717	9.121371	90.87863
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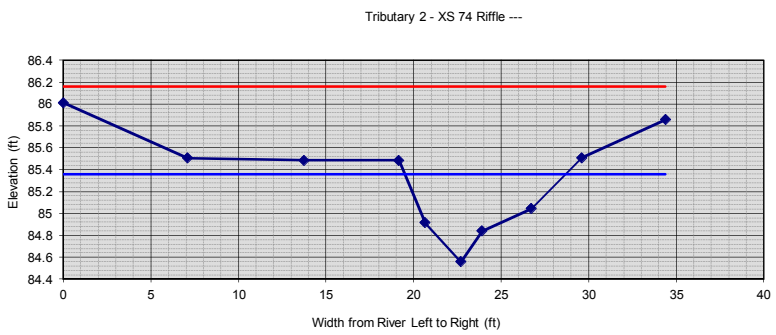
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
11.1	10.82	29.0		
88.9	89.18			

dimensions			
3.8	x-section area	0.3	d mean
11.5	width	11.6	wet P
0.5	d max	0.3	hyd radi
0.8	bank ht	34.6	w/d ratio
29.0	W flood prone area	2.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 74**

Riffle

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description: **Tributary 2 - XS 74**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	13.98693	86.01307
	☐	7.096271	14.49348	85.50652
	☐	13.7456	14.51359	85.48641
	☐	19.17413	14.5135	85.4865
	☐	20.65999	15.08436	84.91564
	☐	22.70537	15.44038	84.55962
	☐	23.90491	15.16035	84.83965
	☐	26.7235	14.95643	85.04358
	☐	29.62565	14.49014	85.50986
	☐	34.38599	14.14268	85.85732

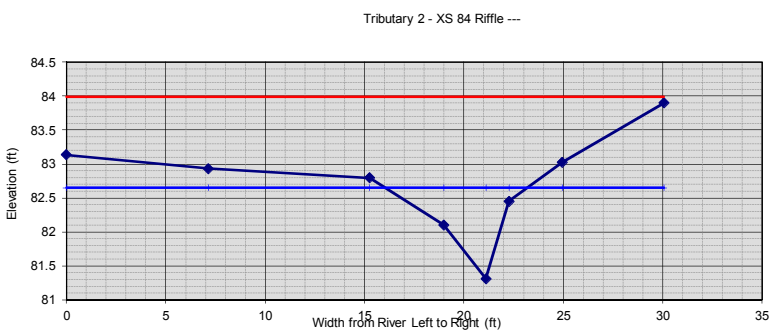
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
14.64	14.51	36.0		
85.36	85.49			

dimensions			
3.8	x-section area	0.4	d mean
9.2	width	9.4	wet P
0.8	d max	0.4	hyd radi
0.9	bank ht	22.1	w/d ratio
36.0	W flood prone area	3.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 84**

Riffle

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description: **Tributary 2 - XS 84**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	16.86696	83.13304
	☐	7.153121	17.07013	82.92987
	☐	15.27127	17.20276	82.79724
	☐	18.98554	17.8964	82.1036
	☐	21.10874	18.69112	81.30888
	☐	22.27223	17.54808	82.45193
	☐	24.96268	16.97478	83.02522
	☐	30.06533	16.10108	83.89892
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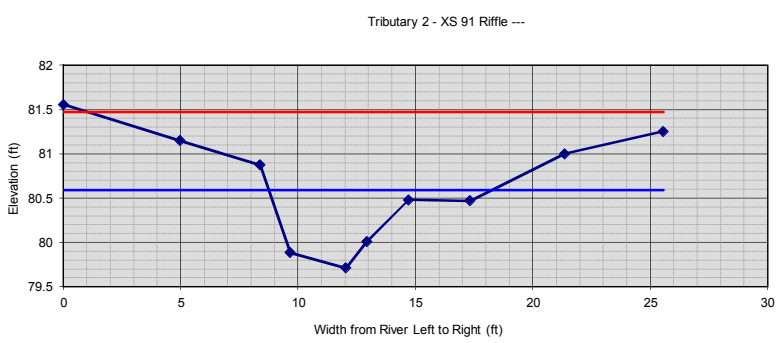
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
17.35	17.2	40.0		
82.65	82.8			

dimensions			
3.8	x-section area	0.5	d mean
7.1	width	7.8	wet P
1.3	d max	0.5	hyd radi
1.5	bank ht	13.5	w/d ratio
40.0	W flood prone area	5.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 91**

Riffle

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description: **Tributary 2 - XS 91**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	18.443	81.557
	☐	4.98192	18.84983	81.15017
	☐	8.390569	19.12753	80.87247
	☐	9.661611	20.11535	79.88465
	☐	12.04241	20.28841	79.71159
	☐	12.93266	19.99449	80.00551
	☐	14.71558	19.5198	80.4802
	☐	17.33166	19.53112	80.46888
	☐	21.35694	19.00144	80.99857
	☐	25.55734	18.74641	81.25359
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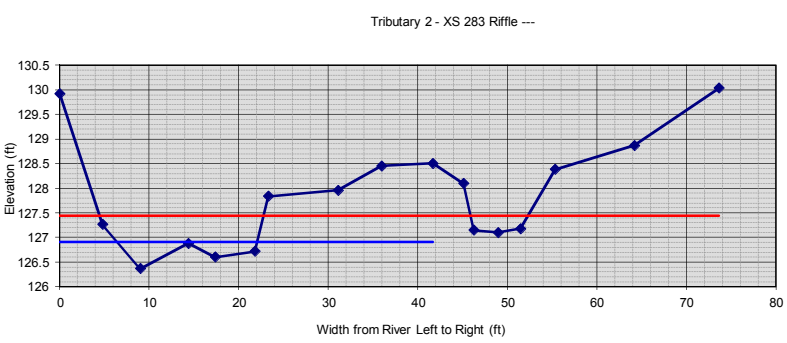
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
19.41	19.13	27.0		
80.59	80.87			

dimensions			
3.8	x-section area	0.4	d mean
9.5	width	9.9	wet P
0.9	d max	0.4	hyd radi
1.2	bank ht	23.5	w/d ratio
27.0	W flood prone area	2.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 283**

Riffle

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description: **Tributary 2 - XS 283**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-29.9231	129.9231
	☐	4.812177	-27.26406	127.2641
	☐	9.030998	-26.36795	126.368
	☐	14.39605	-26.87699	126.877
	☐	17.35929	-26.59911	126.5991
	☐	21.8	-26.71548	126.7155
	☐	23.29933	-27.83793	127.8379
	☐	31.1207	-27.96143	127.9614
	☐	35.98195	-28.45238	128.4524
	☐	41.68378	-28.5071	128.5071
	☑	45.0887	-28.09474	128.0947
	☑	46.25212	-27.1436	127.1436
	☑	48.98228	-27.09798	127.098
	☑	51.45968	-27.18187	127.1819
	☑	55.29918	-28.38467	128.3847
	☑	64.16694	-28.87262	128.8726
	☑	73.61705	-30.03123	130.0312
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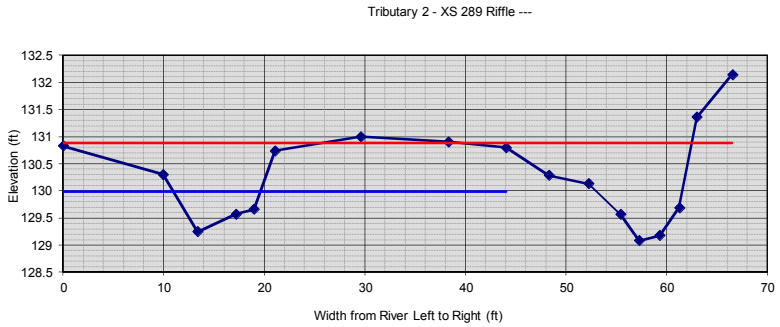
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-26.91	-27.84	16.0		
126.905	127.84			

dimensions			
3.8	x-section area	0.2	d mean
15.6	width	15.7	wet P
0.5	d max	0.2	hyd radi
1.5	bank ht	63.4	w/d ratio
16.0	W flood prone area	1.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Tributary 2 - XS 289
	Riffle

	---
description:	Tributary 2 - XS 289
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	-30.82617	130.8262
	☐	9.966177	-30.30256	130.3026
	☐	13.35235	-29.24513	129.2451
	☐	17.19135	-29.5674	129.5674
	☐	18.97954	-29.65632	129.6563
	☐	21.10148	-30.74018	130.7402
	☐	29.62709	-30.99673	130.9967
	☐	38.30408	-30.90545	130.9054
	☐	44.01827	-30.794	130.794
	☑	48.31303	-30.28236	130.2824
	☑	52.2685	-30.1282	130.1282
	☑	55.42202	-29.56213	129.5621
	☑	57.29571	-29.08228	129.0823
	☑	59.30148	-29.17186	129.1719
	☑	61.24518	-29.68992	129.6899
	☑	62.97049	-31.35648	131.3565
	☑	66.51969	-32.14242	132.1424
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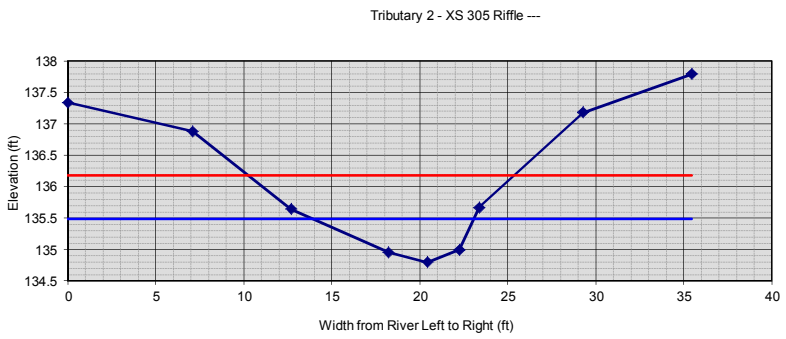
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-29.98	-30.3	24.0		
129.98	130.3			

dimensions			
3.8	x-section area	0.4	d mean
8.6	width	8.8	wet P
0.9	d max	0.4	hyd radi
1.2	bank ht	19.4	w/d ratio
24.0	W flood prone area	2.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 305**
Riffle

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description: **Tributary 2 - XS 305**
height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**-37.33975**	137.3397
	☐	**7.090469**	**-36.88316**	136.8832
	☐	**12.68595**	**-35.64239**	135.6424
	☐	**18.21799**	**-34.95784**	134.9578
	☐	**20.4163**	**-34.79817**	134.7982
	☐	**22.25001**	**-34.99553**	134.9955
	☐	**23.37046**	**-35.67153**	135.6715
	☐	**29.27953**	**-37.18377**	137.1838
	☐	**35.44114**	**-37.79544**	137.7954

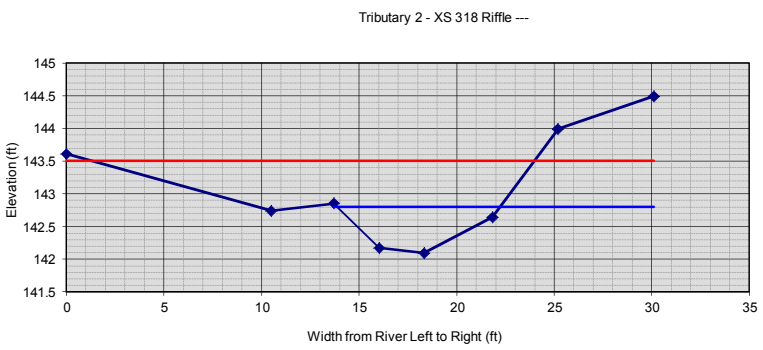
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-35.49	**-36.88**	**15.0**		
135.49	136.88			

dimensions			
3.8	x-section area	0.4	d mean
9.2	width	9.3	wet P
0.7	d max	0.4	hyd radi
2.1	bank ht	22.2	w/d ratio
15.0	W flood prone area	1.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 2 - XS 318**
Riffle

---
description: **Tributary 2 - XS 318**
height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	**0**	**-43.61003**	143.61
	☑	**10.50976**	**-42.7399**	142.7399
	☐	**13.71525**	**-42.85483**	142.8548
	☐	**16.0263**	**-42.1724**	142.1724
	☐	**18.3253**	**-42.09461**	142.0946
	☐	**21.84943**	**-42.64168**	142.6417
	☐	**25.20361**	**-43.99332**	143.9933
	☐	**30.10981**	**-44.49124**	144.4912

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-42.8	**-42.8**	**21.0**		
142.8	142.8			

dimensions			
3.8	x-section area	0.4	d mean
8.3	width	8.5	wet P
0.7	d max	0.4	hyd radi
0.7	bank ht	18.5	w/d ratio
21.0	W flood prone area	2.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Mainstem - XS 103**

Riffle

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description: **Mainstem - XS 103**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	20.74626	79.25374
	☐	7.447971	22.10031	77.89969
	☐	14.4913	22.34161	77.65839
	☐	21.65233	23.37291	76.6271
	☐	23.79514	23.89459	76.10541
	☐	26.56773	24.29536	75.70464
	☐	28.87551	24.35315	75.64685
	☐	30.9843	24.42403	75.57597
	☐	35.12029	23.55363	76.44637
	☐	37.17251	23.18816	76.81185
	☐	39.28437	22.23311	77.76689
	☐	42.29309	21.89915	78.10085
	☐	51.78644	21.7724	78.2276
	☐	61.64877	21.33179	78.66821
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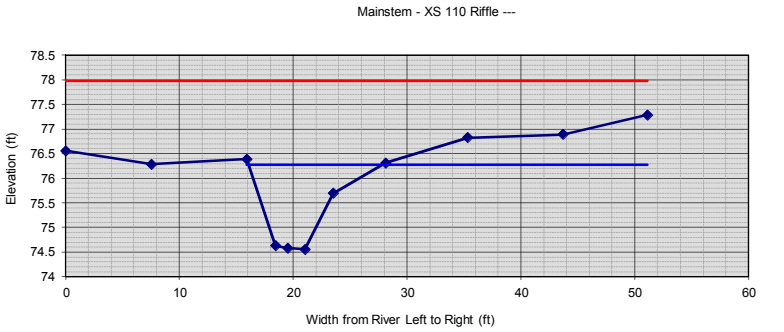
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
23.315	22.34	29.0		
76.685	77.66			

dimensions			
10.4	x-section area	0.7	d mean
15.2	width	15.4	wet P
1.1	d max	0.7	hyd radi
2.1	bank ht	22.3	w/d ratio
29.0	W flood prone area	1.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Mainstem - XS 110**

Riffle

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description: **Mainstem - XS 110**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	23.44034	76.55966
	☑	7.550894	23.71349	76.28651
	☐	15.92732	23.61249	76.38751
	☐	18.44974	25.37538	74.62462
	☐	19.48038	25.41897	74.58104
	☐	21.04776	25.44423	74.55577
	☐	23.47881	24.30674	75.69326
	☐	28.09107	23.69042	76.30958
	☐	35.28481	23.17741	76.82259
	☐	43.67236	23.11004	76.88996
	☐	51.11343	22.71624	77.28376
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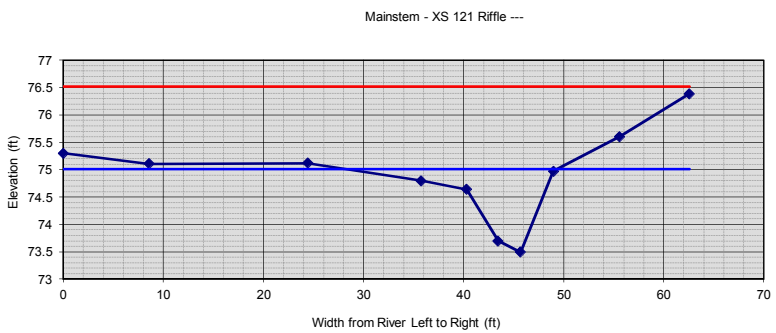
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
23.73	23.61	74.0		
76.27	76.39			

dimensions			
10.4	x-section area	0.9	d mean
11.7	width	12.5	wet P
1.7	d max	0.8	hyd radi
1.8	bank ht	13.2	w/d ratio
74.0	W flood prone area	6.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Mainstem - XS 121
	Riffle

	---
description:	Mainstem - XS 121
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	24.70089	75.29911
	☐	8.564198	24.89479	75.10521
	☐	24.46514	24.88139	75.11861
	☐	35.78083	25.20522	74.79478
	☐	40.33862	25.36056	74.63945
	☐	43.43419	26.29956	73.70044
	☐	45.68309	26.50759	73.49241
	☐	48.98255	25.02681	74.97319
	☐	55.6019	24.39837	75.60163
	☐	62.58873	23.6109	76.38911
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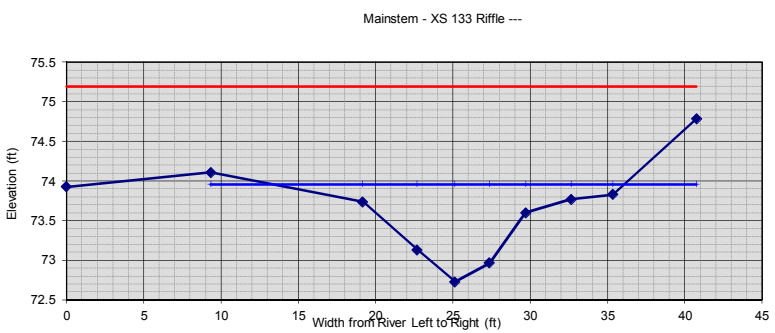
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
24.995	25	75.0		
75.005	75			

dimensions			
10.4	x-section area	0.5	d mean
20.9	width	21.4	wet P
1.5	d max	0.5	hyd radi
1.5	bank ht	42.0	w/d ratio
75.0	W flood prone area	3.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Mainstem - XS 133
	Riffle

	---
description:	Mainstem - XS 133
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	26.07308	73.92692
	☐	9.34373	25.89123	74.10877
	☐	19.17929	26.26408	73.73593
	☐	22.68437	26.87023	73.12977
	☐	25.14036	27.27597	72.72403
	☐	27.35566	27.03551	72.96449
	☐	29.70272	26.3998	73.6002
	☐	32.65011	26.23109	73.76891
	☐	35.36666	26.16996	73.83004
	☐	40.76653	25.21854	74.78146
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
26.04	26.04	75.0		
73.96	73.96			

dimensions			
10.4	x-section area	0.5	d mean
22.8	width	23.0	wet P
1.2	d max	0.5	hyd radi
1.2	bank ht	50.1	w/d ratio
75.0	W flood prone area	3.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section:	Mainstem - XS 150
	Riffle

	---
description:	Mainstem - XS 150
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	28.48505	71.51495
	☐	9.622209	29.40852	70.59148
	☐	17.66222	29.75148	70.24852
	☐	20.42919	29.97282	70.02718
	☐	21.57585	30.08943	69.91057
	☐	22.61012	30.25813	69.74187
	☐	23.87964	29.7885	70.2115
	☐	27.96697	29.34857	70.65143
	☐	36.84989	29.10007	70.89993
	☐	43.40121	28.35291	71.64709
	☐	48.25483	27.99554	72.00446
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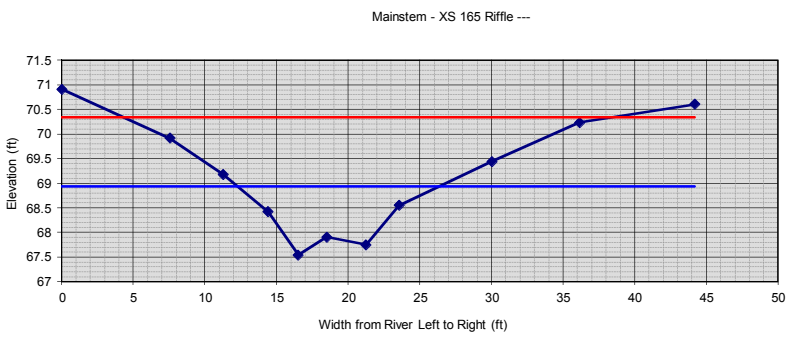
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
29.185	29.185	50.0		
70.815	70.815			

dimensions			
10.4	x-section area	0.4	d mean
26.5	width	26.7	wet P
1.1	d max	0.4	hyd radi
1.1	bank ht	67.5	w/d ratio
50.0	W flood prone area	1.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Mainstem - XS 165
	Riffle

	---
description:	Mainstem - XS 165
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	29.08772	70.91228
	☐	7.572763	30.08253	69.91747
	☐	11.26592	30.81702	69.18298
	☐	14.40964	31.57846	68.42154
	☐	16.50818	32.4551	67.5449
	☐	18.48248	32.09549	67.90451
	☐	21.24569	32.2489	67.7511
	☐	23.53521	31.44901	68.55099
	☐	30.0399	30.56123	69.43877
	☐	36.15161	29.76674	70.23326
	☐	44.1849	29.39686	70.60314
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
31.06	31.06	31.0		
68.94	68.94			

dimensions			
10.4	x-section area	0.7	d mean
14.1	width	14.6	wet P
1.4	d max	0.7	hyd radi
1.4	bank ht	19.2	w/d ratio
31.0	W flood prone area	2.2	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Mainstem - XS 322**

Riffle

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description: **Mainstem - XS 322**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	30.48716	69.51284
	☐	8.846915	31.38467	68.61533
	☐	18.44066	32.25673	67.74327
	☐	22.05517	33.36042	66.63958
	☐	25.53924	34.09633	65.90367
	☐	27.93247	34.06506	65.93494
	☐	30.03614	34.09188	65.90812
	☐	33.35782	32.07769	67.92231
	☐	36.39776	31.13813	68.86187
	☐	44.17958	30.30309	69.69692
	☐	51.85436	29.40189	70.59811
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
32.84	32.36	24.0		
67.16	67.64			

dimensions			
10.4	x-section area	0.9	d mean
11.7	width	12.3	wet P
1.3	d max	0.8	hyd radi
1.7	bank ht	13.3	w/d ratio
24.0	W flood prone area	2.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Mainstem - XS 334**

Riffle

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description: **Mainstem - XS 334**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	33.23408	66.76592
	☐	11.31879	34.19399	65.80601
	☐	19.79406	34.89232	65.10768
	☐	23.91947	37.20284	62.79716
	☐	26.80844	37.83846	62.16154
	☐	28.14381	37.77954	62.22046
	☐	29.30729	36.79977	63.20023
	☐	32.78856	34.24202	65.75798
	☐	39.00451	33.09392	66.90608
	☐	46.11298	31.68852	68.31148
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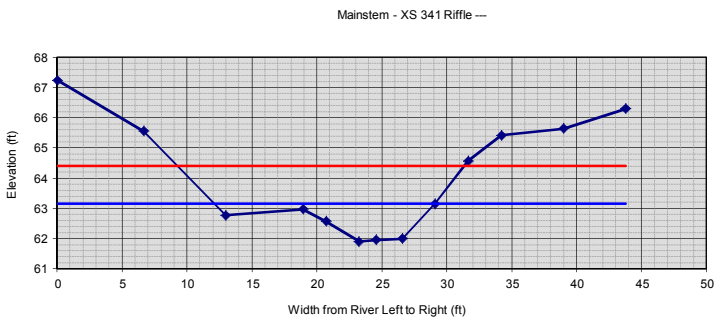
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
35.96	34.89	23.0		
64.04	65.11			

dimensions			
10.4	x-section area	1.2	d mean
8.7	width	9.8	wet P
1.9	d max	1.1	hyd radi
2.9	bank ht	7.4	w/d ratio
23.0	W flood prone area	2.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Mainstem - XS 341
	Riffle

	---
description:	Mainstem - XS 341
height of instrument (ft):	100.00

notes	omit pt	distance (ft)	FS (ft)	elevation
		0	32.76647	67.23354
		6.665164	34.4466	65.5534
		12.99331	37.22837	62.77163
		18.93818	37.03077	62.96924
		20.72215	37.43295	62.56706
		23.24708	38.09542	61.90458
		24.56261	38.04459	61.95541
		26.56246	37.99856	62.00144
		29.10962	36.84995	63.15005
		31.63555	35.42692	64.57308
		34.20817	34.5848	65.4152
		38.982	34.36084	65.63917
		43.7584	33.70756	66.29244

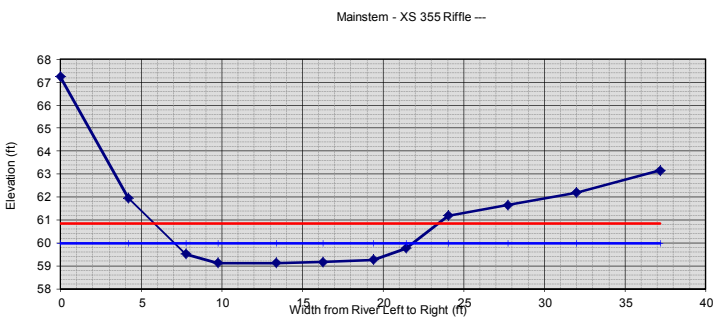
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
36.84	34.59	22.0		
63.16	65.41			

dimensions			
10.4	x-section area	0.6	d mean
17.0	width	17.5	wet P
1.3	d max	0.6	hyd radi
3.5	bank ht	27.9	w/d ratio
22.0	W flood prone area	1.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Mainstem - XS 355
	Riffle

	---
description:	Mainstem - XS 355
height of instrument (ft):	100.00

notes	omit pt	distance (ft)	FS (ft)	elevation
		0	32.76647	67.23354
		4.180257	38.05406	61.94594
		7.776349	40.48041	59.51959
		9.74211	40.87791	59.12209
		13.37549	40.87237	59.12763
		16.27095	40.84112	59.15888
		19.39684	40.73728	59.26272
		21.40129	40.23582	59.76418
		24.0163	38.81284	61.18716
		27.70675	38.34747	61.65253
		31.95477	37.8141	62.1859
		37.16416	36.84554	63.15446

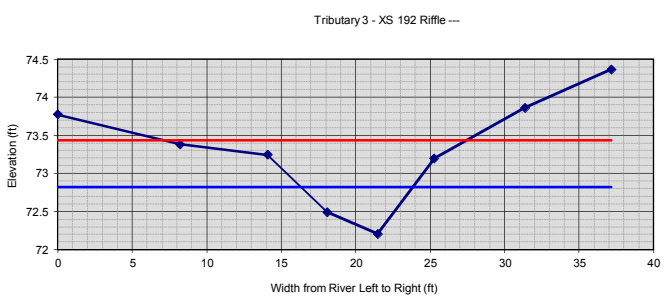
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
40.02	38.81	17.0		
59.98	61.19			

dimensions			
10.4	x-section area	0.7	d mean
14.7	width	15.0	wet P
0.9	d max	0.7	hyd radi
2.1	bank ht	20.9	w/d ratio
17.0	W flood prone area	1.2	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 3 - XS 192**
Riffle

---
description: **Tributary 3 - XS 192**
height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	26.22581	73.77419
		8.20939	26.6182	73.3818
		14.09174	26.75693	73.24307
		18.07698	27.50986	72.49014
		21.46834	27.79431	72.20569
		25.2855	26.80269	73.19731
		31.35641	26.13791	73.8621
		37.14767	25.63555	74.36445

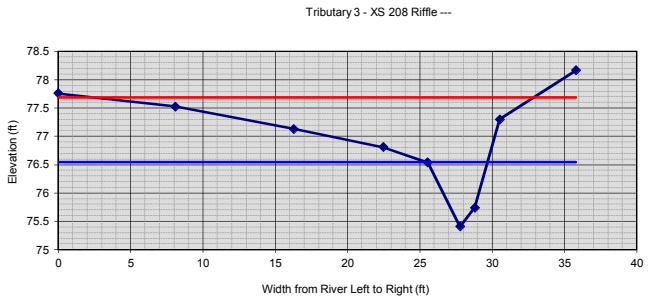
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
27.18	26.76	20.0		
72.82	73.24			

dimensions			
2.6	x-section area	0.3	d mean
7.5	width	7.6	wet P
0.6	d max	0.3	hyd radi
1.0	bank ht	21.5	w/d ratio
20.0	W flood prone area	2.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 3 - XS 208**
Riffle

---
description: **Tributary 3 - XS 208**
height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	22.24329	77.75671
		8.106181	22.47421	77.52579
		16.26999	22.86868	77.13132
		22.46064	23.19396	76.80604
		25.5568	23.46268	76.53732
		27.77337	24.59012	75.40988
		28.79772	24.26061	75.73939
		30.52101	22.69824	77.30176
		35.78445	21.83407	78.16593

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
23.45	23.45	30.0		
76.55	76.55			

dimensions			
2.6	x-section area	0.6	d mean
4.3	width	4.9	wet P
1.1	d max	0.5	hyd radi
1.1	bank ht	6.9	w/d ratio
30.0	W flood prone area	7.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Tributary 3 - XS 219**

Riffle

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description: **Tributary 3 - XS 219**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	18.58606	81.41394
	☑	8.112873	19.04345	80.95655
	☑	12.49955	19.3365	80.6635
	☑	16.16673	19.96978	80.03023
	☑	22.31965	20.13287	79.86713
	☐	25.407	20.0109	79.9891
	☐	27.8969	20.76316	79.23684
	☐	29.57754	20.81533	79.18467
	☐	31.32737	20.63114	79.36886
	☐	33.52801	19.82643	80.17357
	☐	39.37854	19.0636	80.9364
	☐	45.3181	18.39838	81.60162
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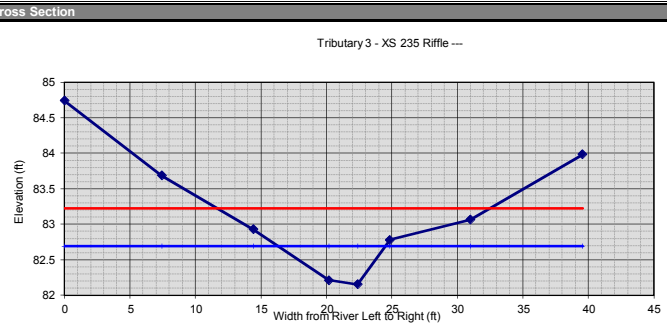
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
20.22	20.01	21.0		
79.78	79.99			

dimensions			
2.6	x-section area	0.4	d mean
6.4	width	6.5	wet P
0.6	d max	0.4	hyd radi
0.8	bank ht	15.8	w/d ratio
21.0	W flood prone area	3.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 3 - XS 235**

Riffle

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description: **Tributary 3 - XS 235**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	15.25886	84.74114
	☐	7.411895	16.31236	83.68764
	☐	14.40156	17.07195	82.92805
	☐	20.17746	17.78881	82.21119
	☐	22.3818	17.84854	82.15146
	☐	24.84957	17.22168	82.77832
	☐	30.96335	16.93466	83.06534
	☐	39.55173	16.01646	83.98354
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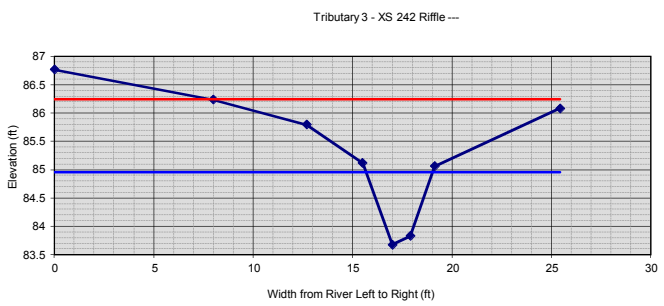
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
17.31	17.22	20.0		
82.69	82.78			

dimensions			
2.6	x-section area	0.3	d mean
8.2	width	8.3	wet P
0.5	d max	0.3	hyd radi
0.6	bank ht	25.6	w/d ratio
20.0	W flood prone area	2.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 3 - XS 242**

Riffle

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description: **Tributary 3 - XS 242**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	13.23556	86.76444
		7.977559	13.76618	86.23382
		12.68442	14.20492	85.79508
		15.50375	14.88159	85.11841
		17.00512	16.3231	83.67691
		17.8873	16.17082	83.82918
		19.13512	14.93782	85.06218
		25.42677	13.91511	86.0849

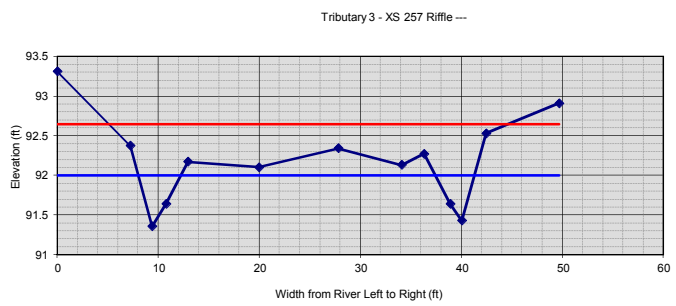
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
15.04	14.94	18.0		
84.96	85.06			

dimensions			
2.6	x-section area	0.8	d mean
3.4	width	4.4	wet P
1.3	d max	0.6	hyd radi
1.4	bank ht	4.4	w/d ratio
18.0	W flood prone area	5.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Tributary 3 - XS 257**

Riffle

---

description: **Tributary 3 - XS 257**

height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	6.691665	93.30834
		7.23242	7.628197	92.3718
		9.411933	8.646194	91.35381
		10.82315	8.359462	91.64054
		12.93731	7.829778	92.17022
		19.9683	7.899994	92.10001
		27.85167	7.660112	92.33989
		34.08193	7.87128	92.12872
		36.32926	7.73005	92.26995
		38.94184	8.361541	91.63846
		40.03077	8.571948	91.42805
		42.43527	7.471196	92.5288
		49.66211	7.089612	92.91039

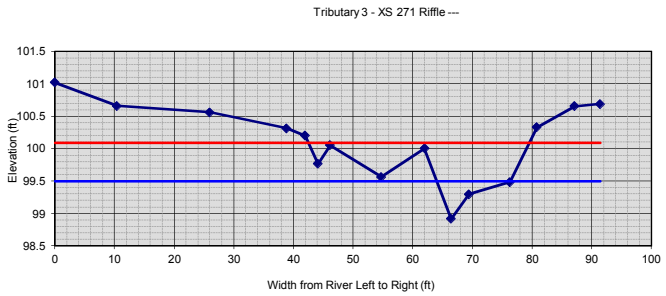
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
8	7.83	40.0		
92	92.17			

dimensions			
2.6	x-section area	0.3	d mean
8.1	width	8.5	wet P
0.6	d max	0.3	hyd radi
0.8	bank ht	25.5	w/d ratio
40.0	W flood prone area	5.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	**Tributary 3 - XS 271**
	Riffle --- ---
description:	**Tributary 3 - XS 271**
height of instrument (ft):	**100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	**-1.019763**	101.0198
		10.41507	**-0.656402**	100.6564
		25.99907	**-0.557415**	100.5574
		38.83746	**-0.311983**	100.312
		41.93338	**-0.198183**	100.1982
		44.15053	**0.233081**	99.76692
		46.21193	**-0.050617**	100.0506
		54.72121	**0.439343**	99.56066
		61.98578	**-0.004024**	100.004
		66.42977	**1.086179**	98.91382
		69.43376	**0.702036**	99.29796
		76.30802	**0.514664**	99.48534
		80.85749	**-0.327285**	100.3273
		87.14607	**-0.655982**	100.656
		91.44633	**-0.686235**	100.6862

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0.5	**-0.198**	**36.0**		
99.5	100.198			

dimensions			
2.6	x-section area	0.2	d mean
12.3	width	12.4	wet P
0.6	d max	0.2	hyd radi
1.3	bank ht	58.0	w/d ratio
36.0	W flood prone area	2.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

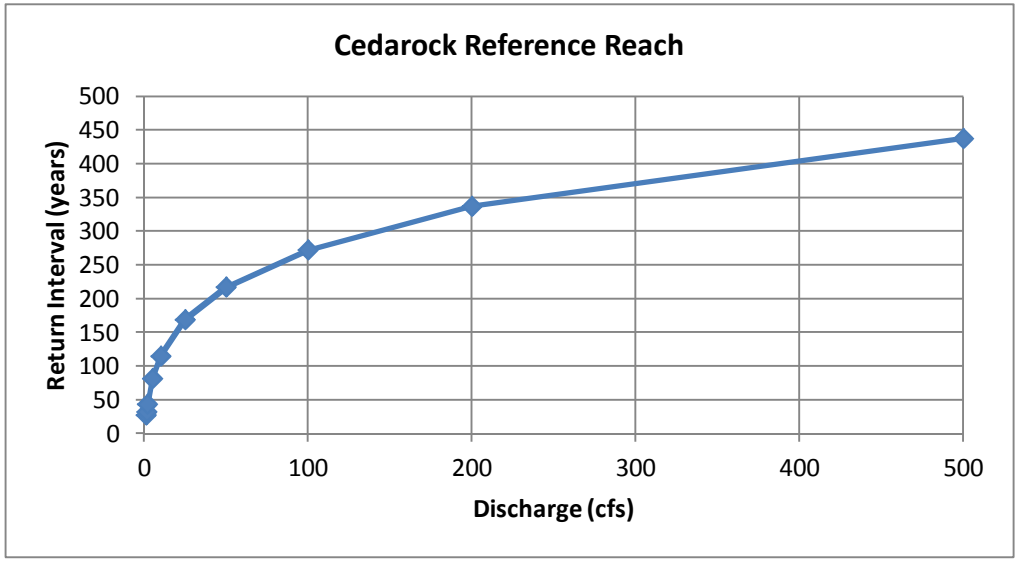
check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Appendix C
Flood Frequency Analysis Data

Reference Reaches
Flood Frequency Analaysis-Regional Regression Equation (USGS 2004)

Cedarock Reference Reach

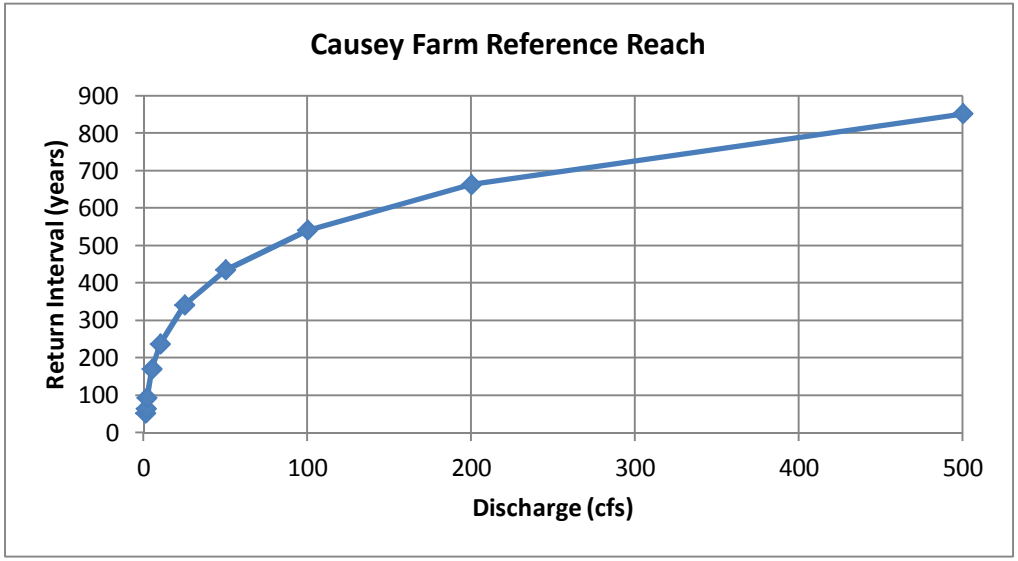
Return Interval (years)	Discharge (cfs)
1.3	**27**
1.5	**32**
2	43.6
5	81.4
10	115
25	169
50	217
100	272
200	337
500	438



Note: Bold values are interpolated.

Causey Farm Reference Reach

Return Interval (years)	Discharge (cfs)
1.3	**53**
1.5	**65**
2	94.3
5	171
10	238
25	342
50	435
100	541
200	663
500	852



Appendix D
Jurisdictional Determination Info

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2014-01710** County: **Alamance** U.S.G.S. Quad: **NC-SNOW CAMP**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Restoration Systems, LLC**
attn: Raymond Holz
Address: **1101 Haynes Street, Suite 211**
Raleigh, NC, 27604

Size (acres) **25** Nearest Town **Snow Camp**
Nearest Waterway **Reedy Branch** River Basin **Haw. North Carolina.**
USGS HUC **3030002** Coordinates **35.886383 N, -79.393669 W**
Location description: **The site is located along approximately 5800 feet of sections of UT to Reedy Branch, approximately 0.2 mile north of Major Hill Road and approximately 0.25 mile east of Holman Mill Road in south central Alamance County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

X Based on preliminary information, there may be waters of the U.S. including wetlands on the above described project area. We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described property subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are waters of the U.S. including wetlands on the above described property subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We strongly suggest you have the wetlands on your property delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

_ The waters of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

_ The waters of the U.S. including wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on _____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are no waters of the U.S., to include wetlands, present on the above described project area which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in Morehead City, NC, at (252) 808-2808 to determine their requirements.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **David Bailey** at **919-554-4884 ext 30** or **David.E.Bailey2@usace.army.mil**.

C. Basis For Determination:

The project area exhibits water bodies with ordinary high water and wetland criteria as defined in the applicable regional supplement to the 1987 wetland delineation manual. The water bodies on the site are listed in the attached table. This determination is based on a field verification by David E. Bailey (USACE) on 5/29/2014.

D. Remarks:

The wetlands and other Waters of the US on the property were flagged by Axiom Environmental with changes made in the field by David E. Bailey (USACE) and are approximated on the attached sheet titled "Jurisdictional Areas", dated June 2014.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **N/A**.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: 

Date: **September 16, 2014**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://regulatory.usacesurvey.com/.

Copy furnished:
Scott Davis, Axiom Environmental, Inc., 218 Snow Avenue, Raleigh, NC 27603
Sue Homewood, NCDENR-DWR, 585 Waughtown Street, Winston-Salem, NC 27107

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Restoration Systems, LLC**	File Number: **SAW-2014-01710**	Date: **September 16, 2014**
Attached is:		See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)		B
☐ PERMIT DENIAL		C
☐ APPROVED JURISDICTIONAL DETERMINATION		D
☒ PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division** **attn: David E. Bailey** **Raleigh Regulatory Field Office** **3331 Heritage Trade Drive, Suite 105** **Wake Forest, North Carolina 27587**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn: David Bailey, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

Jurisdictional Determination Request

US Army Corps of Engineers
Wilmington District

This form is intended for use by anyone requesting a jurisdictional determination (JD) from the U.S. Army Corps of Engineers, Wilmington District (Corps). Please include all supporting information, as described within each category, with your request. You may submit your request to the appropriate Corps Field Office (or project manager, if known) via mail, electronic mail, or facsimile. A current list of county assignments by Field Office and project manager can be found on-line at: http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram.aspx , by telephoning: 910-251-4633, or by contacting any of the field offices listed below:

ASHEVILLE REGULATORY FIELD OFFICE

US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006
General Number: (828) 271-7980
Fax Number: (828) 281-8120

WASHINGTON REGULATORY FIELD OFFICE

US Army Corps of Engineers
2407 West Fifth Street
Washington, North Carolina 27889
General Number: (910) 251-4610
Fax Number: (252) 975-1399

RALEIGH REGULATORY FIELD OFFICE

US Army Corps of Engineers
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
General Number: (919) 554-4884
Fax Number: (919) 562-0421

WILMINGTON REGULATORY FIELD OFFICE

US Army Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403
General Number: 910-251-4633
Fax Number: (910) 251-4025

INSTRUCTIONS:

All requestors must complete Parts A, B, C, D, E and F.

NOTE TO CONSULTANTS AND AGENCIES: If you are requesting a JD on behalf of a paying client or your agency, please note the specific submittal requirements in **Part G**.

NOTE ON PART D – PROPERTY OWNER AUTHORIZATION: Please be aware that all JD requests must include the current property owner authorization for the Corps to proceed with the determination, which may include inspection of the property when necessary. This form must be signed by the current property owner to be considered a complete request.

NOTE ON PART D - NCDOT REQUESTS: Property owner authorization/notification for JD requests associated with North Carolina Department of Transportation (NCDOT) projects will be conducted according to the current NCDOT/USACE protocols.

NOTE TO USDA PROGRAM PARTICIPANTS: A Corps approved or preliminary JD may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should also request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

A. PARCEL INFORMATION

Street Address: 7251 Holman Mill Road, Snow Camp, NC 27349
City, State: Snow Camp, NC 27349
County: Alamance
Directions: From I-40 in Chapel Hill, travel west on NC54 7 miles, exit onto Jones Ferry Road and turn left. Travel 1 mile. Turn right onto Old-Greensboro Rd, travel 16 miles. Turn left on Holman Mill Rd, travel 1.5 miles. Turn left onto Major Hill Rd. Site is on the left.

Parcel Index Number(s) (PIN): 103493, 103516, 103518, 103519

B. REQUESTOR INFORMATION

Name: Grant Lewis - Axiom Environmental, Inc.
Mailing Address: 218 Snow Avenue, Raleigh, NC, 27603
Telephone Number: 919-215-1693
Electronic Mail Address[1]: glewis@axiomenvironmental.org

Select one:

- ☐ I am the current property owner.
- ☑ I am an Authorized Agent or Environmental Consultant[2]
- ☐ Interested Buyer or Under Contract to Purchase
- ☐ Other, please explain.

C. PROPERTY OWNER INFORMATION

Name: James D. and Carol D. Lamm
Mailing Address: 7351 Lindley Mill Road
Graham, NC 27253
Telephone Number: 336-376-6687
Electronic Mail Address[3]: -

☑ Proof of Ownership Attached (e.g. a copy of Deed, County GIS/Parcel/Tax Record data)

[1] If available
[2] Must attach completed Agent Authorization Form
[3] If available

D. PROPERTY OWNER CERTIFICATION[4]

I, the undersigned, a duly authorized owner of record of the property/properties identified herein, do authorize representatives of the Wilmington District, U.S. Army Corps of Engineers (Corps) to enter upon the property herein described for the purpose of conducting on-site investigations and issuing a determination associated with Waters of the U.S. subject to Federal jurisdiction under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899.

*please see attached Agent Authorization form

Property Owner (please print) Date

Property Owner Signature

E. JURISDICTIONAL DETERMINATION TYPE

Select One:

☐ I am requesting that the Corps provide a preliminary JD for the property identified herein. This request does include a delineation.

☑ I am requesting that the Corps provide a preliminary JD for the property identified herein. This request does NOT include a delineation.

☐ I am requesting that the Corps investigate the property/project area for the presence or absence of WoUS[5] and provide an approved JD for the property identified herein. This request does NOT include a request for a verified delineation.

☐ I am requesting that the Corps delineate the boundaries of all WoUS on a property/project area and provide an approved JD (this may or may not include a survey plat).

☐ I am requesting that the Corps evaluate and approve a delineation of WoUS (conducted by others) on a property/project area and provide an approved JD (may or may not include a survey plat).

[4] For NCDOT requests following the current NCDOT/USACE protocols, skip to Part E.
[5] Waters of the United States

F. ALL REQUESTS

☑ Map of Property or Project Area (attached). This Map must clearly depict the boundaries of the area of evaluation.

☑ Size of Property or Project Area 21.0 acres

☐ I verify that the property (or project) boundaries have recently been surveyed and marked by a licensed land surveyor OR are otherwise clearly marked or distinguishable.

G. JD REQUESTS FROM CONSULTANTS OR AGENCIES

(1) Preliminary JD Requests:

☑ Completed and signed Preliminary Jurisdictional Determination Form[6].

☑ Project Coordinates: 35.885514 Latitude -79.394611 Longitude

Maps (no larger than 11x17) with Project Boundary Overlay:

☑ Large and small scale maps that depict, at minimum: streets, intersections, towns

☑ Aerial Photography of the project area

☑ USGS Topographic Map

☑ Soil Survey Map

☑ Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps, LIDAR maps, FEMA floodplain maps)

[6] See Appendix A of this Form. From Regulatory Guidance Letter No. 08-02, dated June 26, 2008

Delineation Information (when applicable)[7]:

Wetlands:

- [x] Wetland Data Sheets[8]
- [x] Upland Data Sheets
- [ ] Landscape Photos, if taken
- [x] Field Sketch overlain on legible Map that includes:
  - All aquatic resources (for sites with multiple resources, label and identify)
  - Locations of wetland data points and/or tributary assessment reaches
  - Locations of photo stations
  - Approximate acreage/linear footage of aquatic resources

Tributaries:

- [x] USACE Assessment Forms
- [ ] Other Assessment Forms (when appropriate)

(2) Approved JDs including Verification of a Delineation:

- [ ] Project Coordinates: _____ Latitude _____ Longitude

Maps (no larger than 11x17) with Project Boundary Overlay:

- [ ] Large and small scale maps that depict, at minimum: streets, intersections, towns
- [ ] Aerial Photography of the project area
- [ ] USGS Topographic Map
- [ ] Soil Survey Map
- [ ] Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps)

[7] 1987 Manual Regional Supplements and Data forms can be found at:
http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/reg_supp.aspx
Wetland and Stream Assessment Methodologies can be found at:
http://portal.ncdenr.org/c/document_library/get_file?uuid=76f3c58b-dab8-4960-ba43-45b7faf06f4c&groupId=38364 and,
http://www.saw.usace.army.mil/Portals/59/docs/regulatory/publicnotices/2013/NCSAM_Draft_User_Manual_130318.pdf

[8] Delineation information must include, at minimum, one wetland data sheet for each wetland/community type.

Delineation Information (when applicable):

Wetlands:

☐ Wetland Data Sheets[9]

☐ Upland Data Sheets

Tributaries:

☐ USACE Assessment Forms

☐ Other Assessment Forms (when appropriate)

☐ Landscape Photos, if taken

☐ Field Sketch overlain on legible Map that includes:

- All aquatic resources (for sites with multiple resources, label and identify)
- Locations of wetland data points and/or tributary assessment reaches
- Locations of photo stations
- Approximate acreage/linear footage of aquatic resources

Supporting Jurisdictional Information (for Approved JDs only)

☐ Approved Jurisdictional Determination Form(s) (also known as "Rapanos Form(s)")

☐ Map(s) depicting the potential (or lack of potential) hydrologic connection(s), adjacency, etc. to navigable waters.

[9] Delineation information must include, at minimum, one wetland data sheet for each wetland/community type.

I. REQUESTS FOR CORPS APPROVAL OF SURVEY PLAT

Prior to final production of a Plat, the Wilmington District recommends that the Land Surveyor electronically submit a draft of a Survey Plat to the Corps project manager for review.

Due to storage limitations of our administrative records, the Corps requires that all hard-copy submittals include at least one original Plat (to scale) that is no larger than 11"x17" (the use of match lines for larger tracts acceptable). Additional copies of a plat, including those larger than 11"x17", may also be submitted for Corps signature as needed. The Corps also accepts electronic submittals of plats, such as those transmitted as a Portable Document Format (PDF) file. Upon verification, the Corps can electronically sign these plats and return them via e-mail to the requestor.

(1) PLATS SUBMITTED FOR APPROVAL

☐ Must be sealed and signed by a licensed professional land surveyor

☐ Must be to scale (all maps must include both a graphic scale and a verbal scale)

☐ Must be legible

☐ Must include a North Arrow, Scale(s), Title, Property Information

☐ Must include a legible WoUS Delineation Table of distances and bearings/metes and bounds/GPS coordinates of all surveyed delineation points

☐ Must clearly depict surveyed property or project boundaries

☐ Must clearly identify the known surveyed point(s) used as reference (e.g. property corner, USGS monument)

☐ When wetlands are depicted:

- Must include acreage (or square footage) of wetland polygons
- Must identify each wetland polygon using an alphanumeric system

☐ When tributaries are depicted:

- Must include either a surveyed, approximate centerline of tributary with approximate width of tributary OR surveyed Ordinary High Water Marks (OHWM) of tributary
- Must identify each tributary using an alphanumeric system
- Must include linear footage of tributaries and calculated area (using approximate widths or surveyed OHWM)
- Must include name of tributary (based on the most recent USGS topographic map) or, when no USGS name exists, identify as "unnamed tributary"

☐ all depicted WoUS (wetland polygons and tributary lines) must intersect or tie-to surveyed project/property boundaries

☐ Must include the location of wetland data points and/or tributary assessment reaches

☐ Must include, label accordingly, and depict acreage of all waters not currently subject to the requirements of the CWA (e.g. "isolated wetlands", "non-jurisdictional waters"). NOTE: An approved JD must be conducted in order to make an official Corps determination that a particular waterbody or wetland is <u>not</u> jurisdictional.

☐ Must include and survey all existing conveyances (pipes, culverts, etc.) that transport WoUS

(2) CERTIFICATION LANGUAGE

☐ When the entire actual Jurisdictional Boundary is depicted:

include the following Corps Certification language:

"This certifies that this copy of this plat accurately depicts the boundary of the jurisdiction of Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is a change in the law or our published regulations, the determination of Section 404 jurisdiction may be relied upon for a period not to exceed five (5) years from this date. The undersigned completed this determination utilizing the appropriate Regional Supplement to the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual."

Regulatory Official: _____

Title: _____

Date: _____

USACE Action ID No.: _____

☐ When uplands may be present within a depicted Jurisdictional Boundary:

include the following Corps Certification language:

"This certifies that this copy of this plat identifies all areas of waters of the United States regulated pursuant to Section 404 of the Clean Water Act as determined by the undersigned on this date. Unless there is change in the law or our published regulations, this determination of Section 404 jurisdiction may be relied upon for a period not to exceed five years from this date. The undersigned completed this determination utilizing the appropriate Regional Supplement to the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual."

Regulatory Official: _____

Title: _____

Date: _____

USACE Action ID No.: _____

(3) GPS SURVEYS

For Surveys prepared using a Global Positioning System (GPS), the Survey must include all of the above, as well as:

☐ be at sub-meter accuracy at each survey point.

☐ include an accuracy verification:
One or more known points (property corner, monument) shall be located with the GPS and cross-referenced with the existing traditional property survey (metes and bounds).

☐ include a brief description of the GPS equipment utilized.

ATTACHMENT A
PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): _____

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

_____

_____

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

_____

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

_____

(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: NC County/parish/borough: Alamance County City: near

Center coordinates of site (lat/long in degree decimal format):
Lat. 35.885514 °N; Long. -79.394611 °W.

Universal Transverse Mercator: _____

Name of nearest waterbody: Reedy Branch

Identify (estimate) amount of waters in the review area:
Non-wetland waters:
~4933 linear feet: ~3 width (ft) and/or 0.3 stream, 3.5 pond acres.

Cowardin Class: PSS1A, PSS1C, PSS1E

Stream Flow: Intermittent, Perennial

Wetlands: ~0.75 acres.

Cowardin Class: R3UB1/3, R3UB1/2, R4SB4/5

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: n/a
Non-Tidal: n/a

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date: _____

☐ Field Determination. Date(s): _____

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☑ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Snow Camp, NC (1978) 7.5-minute quadrangle

☑ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☐ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: _____

☐ Corps navigable waters' study: _____

☐ U.S. Geological Survey Hydrologic Atlas: _____

☐ USGS NHD data

☐ USGS 8 and 12 digit HUC maps

☐ U.S. Geological Survey map(s). Cite scale & quad name: _____

☑ USDA Natural Resources Conservation Service Soil Survey.
Citation: Soil Survey of Alamance County, NC (1960)

☐ National wetlands inventory map(s). Cite name: _____

☐ State/Local wetland inventory map(s): _____

☐ FEMA/FIRM maps: _____

☐ 100-year Floodplain Elevation is: _____
(National Geodectic Vertical Datum of 1929)

☐ Photographs: ☐ Aerial (Name & Date): _____ or
☐ Other (Name & Date): _____

☐ Previous determination(s). File no. and date of response letter: _____

☐ Other information (please specify): _____

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

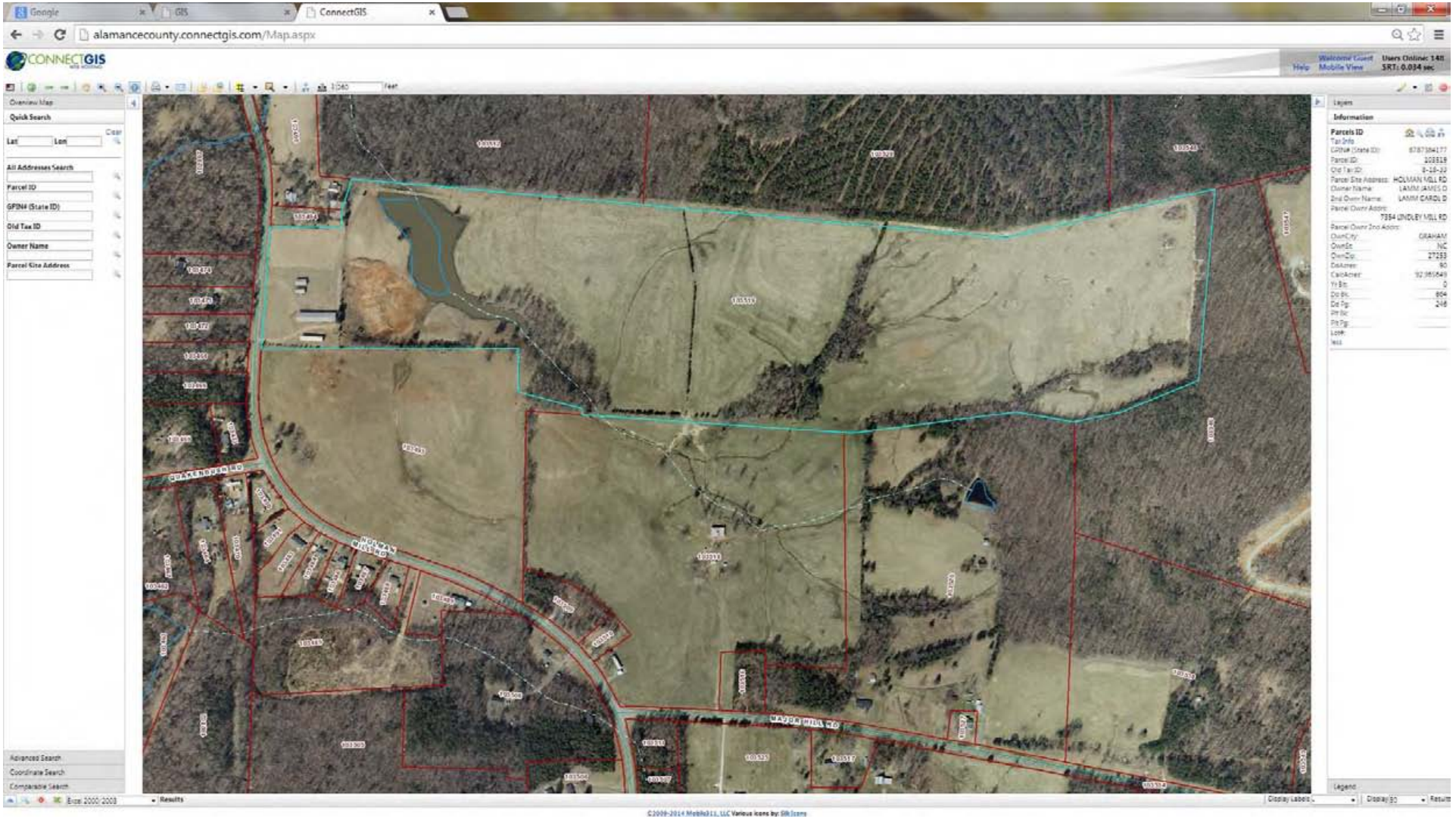
This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

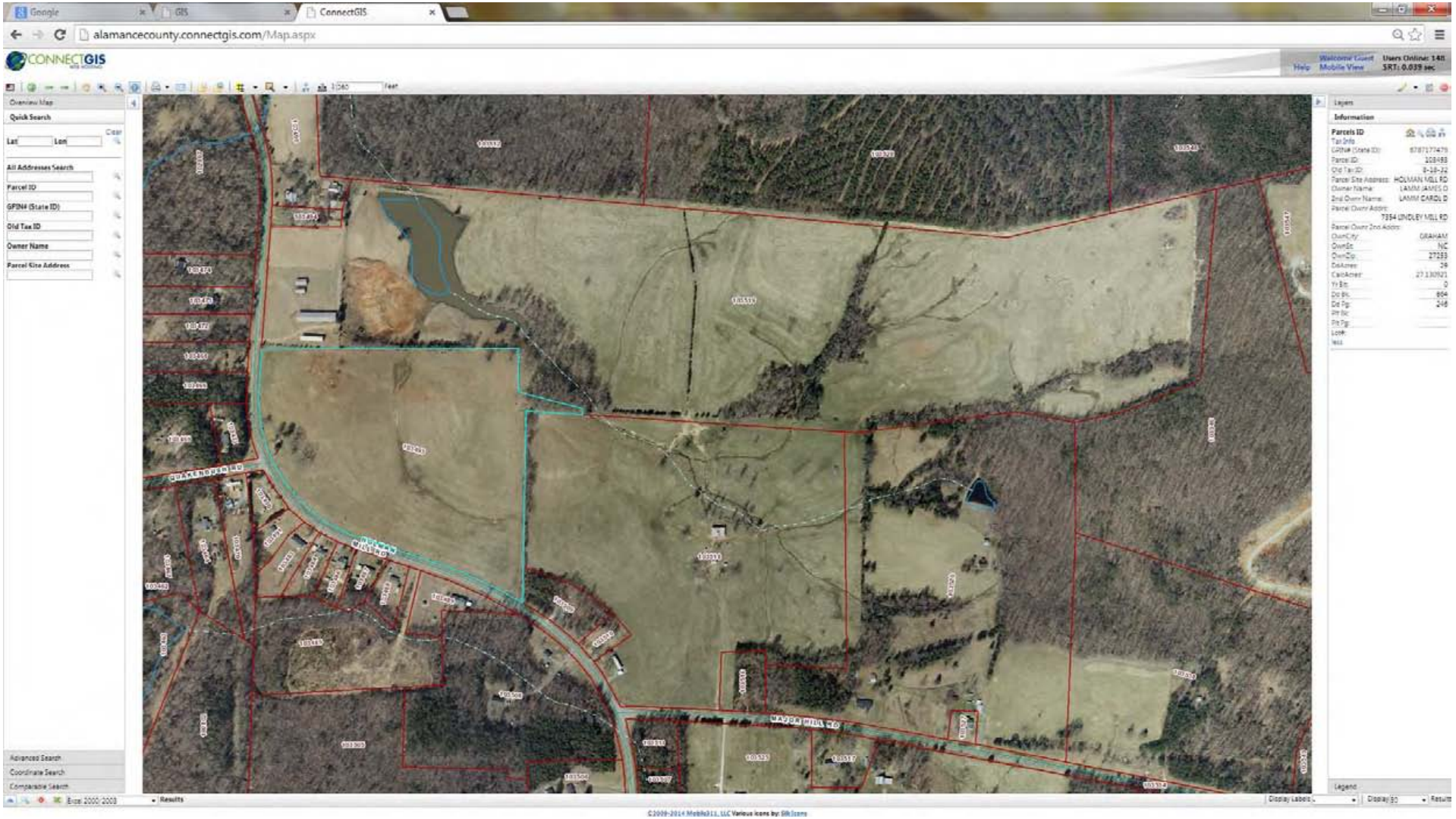
_____	_____
Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

SAMPLE

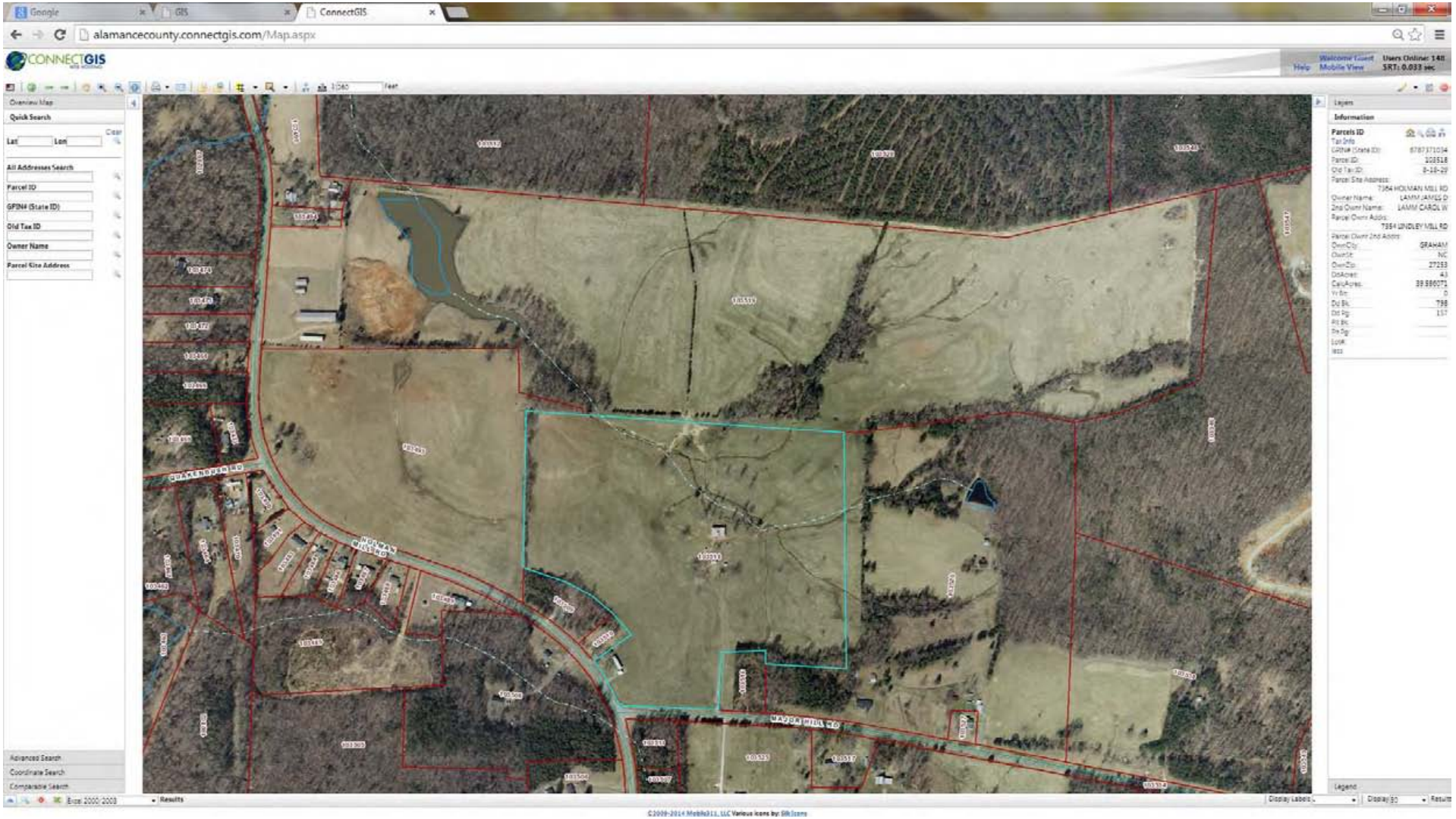
Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
1				0.1 acre	Non-section 10 – non-wetland
2				100 linear feet	Non-section10 – wetland
3				15 square feet	Non-section 10 – wetland
4				0.01 acre	Non-section 10 – non-wetland



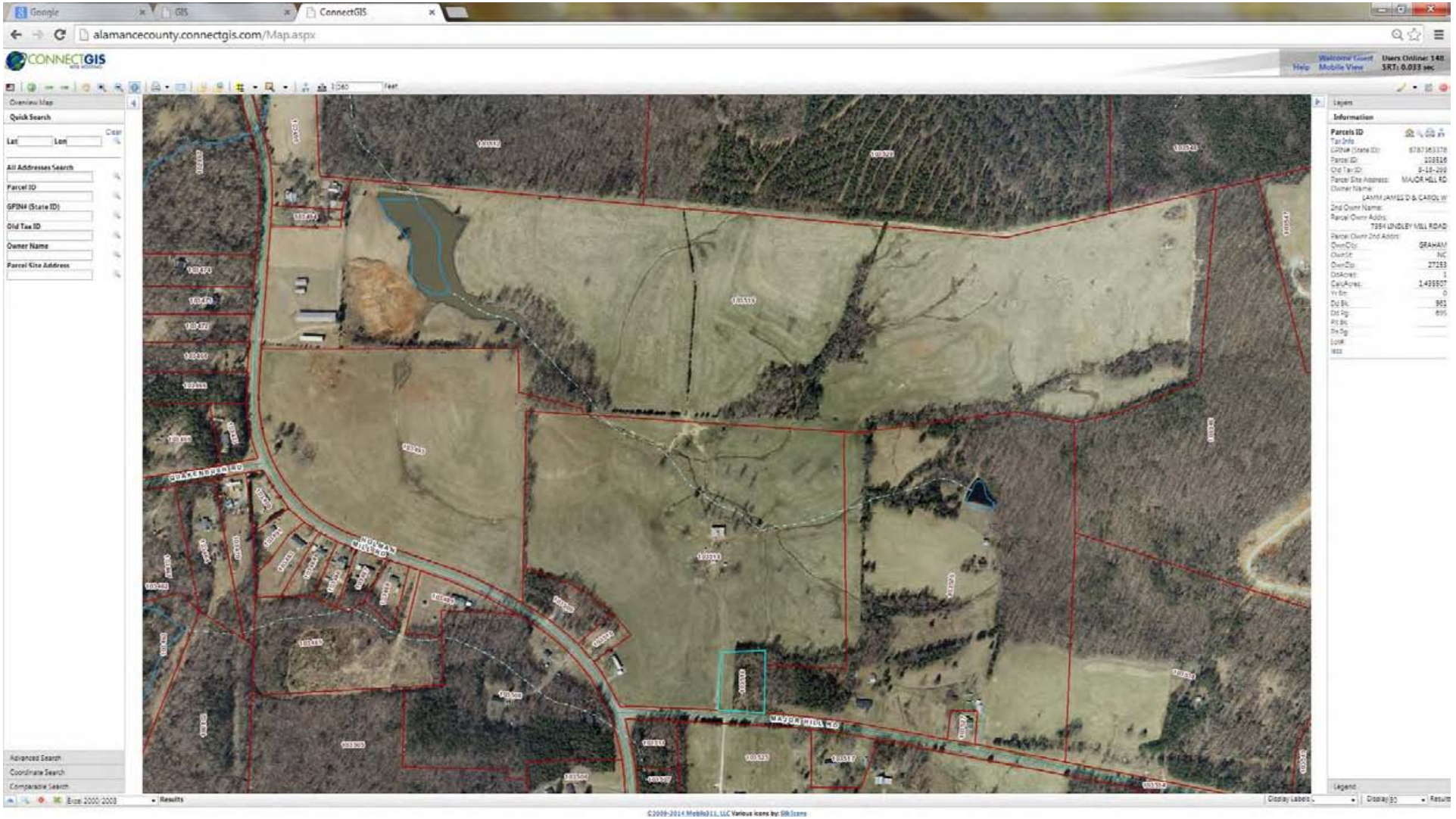
Source: Alamance County GIS (online, alamancecounty.connect.gis.com)



Source: Alamance County GIS (online, alamancecounty.connect.gis.com)

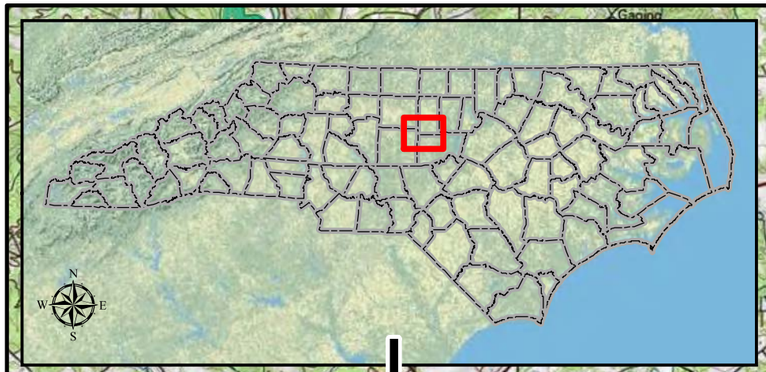


Source: Alamance County GIS (online, alamancecounty.connect.gis.com)



Source: Alamance County GIS (online, alamancecounty.connect.gis.com)

Site Number/ Feature Name	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
UT1 to Reedy Branch	35.884052	-79.392693	R4SB4/5	558 linear feet	Non-Section 10, Non-wetland
UT2 to Reedy Branch	35.886371	-79.388849	R3UB1/3	270 linear feet	Non-Section 10, Non-wetland
UT3 to Reedy Branch	35.885766	-79.397778	R4SB4/5	1020 linear feet	Non-Section 10, Non-wetland
UT4 to Reedy Branch	35.884455	-79.393322	R4SB4/5	124 linear feet	Non-Section 10, Non-wetland
UT5 to Reedy Branch (Main Stem)	35.884939	-79.393878	R3UB1/2	2961 linear feet	Non-Section 10, Non-wetland
Wetland W1	35.886760	-79.387873	PSS1C	0.032 acre	Non-Section 10, Wetland
Wetland W2	35.886688	-79.388199	PSS1C	0.113 acre	Non-Section 10, Wetland
Wetland W3	35.886418	-79.388291	PSS1E	0.086 acre	Non-Section 10, Wetland
Wetland W4	35.886349	-79.389281	PSS1A	0.121 acre	Non-Section 10, Wetland
Wetland W5	35.884779	-79.392055	PSS1C	0.034 acre	Non-Section 10, Wetland
Wetland W6	35.883576	-79.392165	PSS1A	0.119 acre	Non-Section 10, Wetland
Wetland W7	35.884606	-79.393262	PSS1C	0.010 acre	Non-Section 10, Wetland
Wetland W8	35.884719	-79.393507	PSS1C	0.003 acre	Non-Section 10, Wetland
Wetland W9	35.884756	-79.393668	PSS1C	0.003 acre	Non-Section 10, Wetland
Wetland W10	35.884846	-79.393832	PSS1C	0.020 acre	Non-Section 10, Wetland
Wetland W11	35.884923	-79.394116	PSS1C	0.035 acre	Non-Section 10, Wetland
Wetland W12	35.885079	-79.394525	PSS1C	0.099 acre	Non-Section 10, Wetland
Wetland W13	35.885540	-79.393415	PSS1A	0.026 acre	Non-Section 10, Wetland
Wetland W14	35.886442	-79.392486	PSS1A	0.025 acre	Non-Section 10, Wetland
Wetland W15	35.886826	-79.392183	PSS1A	0.020 acre	Non-Section 10, Wetland
Wetland W16	35.884127	-79.392724	PSS1A	0.005 acre	Non-Section 10, Wetland



Directions to the Site from Interstate 40 in Chapel Hill/Durham, NC:
- Travel west on NC 54 for 7 miles,
- Exit onto Jones Ferry Road and turn left,
- Travel west for 1 mile,
- Turn right onto Old Greensboro Road (SR 1005) and travel 16 miles, (The road name changes to Greensboro-Chapel Hill Road at the Haw River)
- Turn left onto Holman Mill Road (SR 2356) and travel 1.5 miles,
- Turn left onto Major Hill Road (SR 2348) and the Site is on the left.

Cedarock Park

Rock Creek Upland Depressions

Cedarock Reference Site Location

Saxapahaw Sloughs and Slopes

Cane Creek Mountains/Observatory Woods

Causey Farm Reference Site Location

Marys Creek Aquatic Habitat

Eli Whitney Rich Slopes

Box Elder Bottomlands

Kimesville Road Basic Forest

Haw River Aquatic Habitat

Abbey Lamm Stream and Wetland Restoration Site

35.885584 N
-79.394638 W

Pine Hill Xeric Woodlands

Legend

- Abbey Lamm Stream and Wetland Restoration Site
- NCNHP Significant Natural Heritage Area
- County lines (inset)

1 0.5 0 1 2 3 Miles

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

Abbey Lamm Stream and Wetland Restoration Site

Alamance County, NC

Title:

Project Location

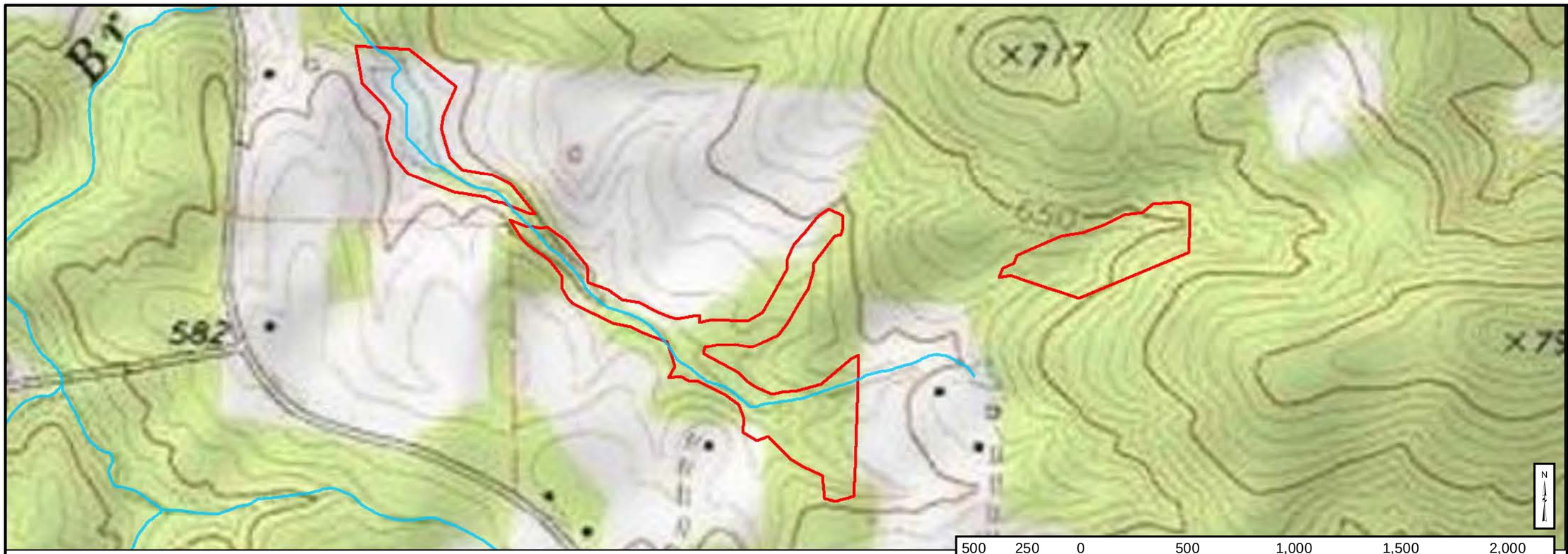
Notes:

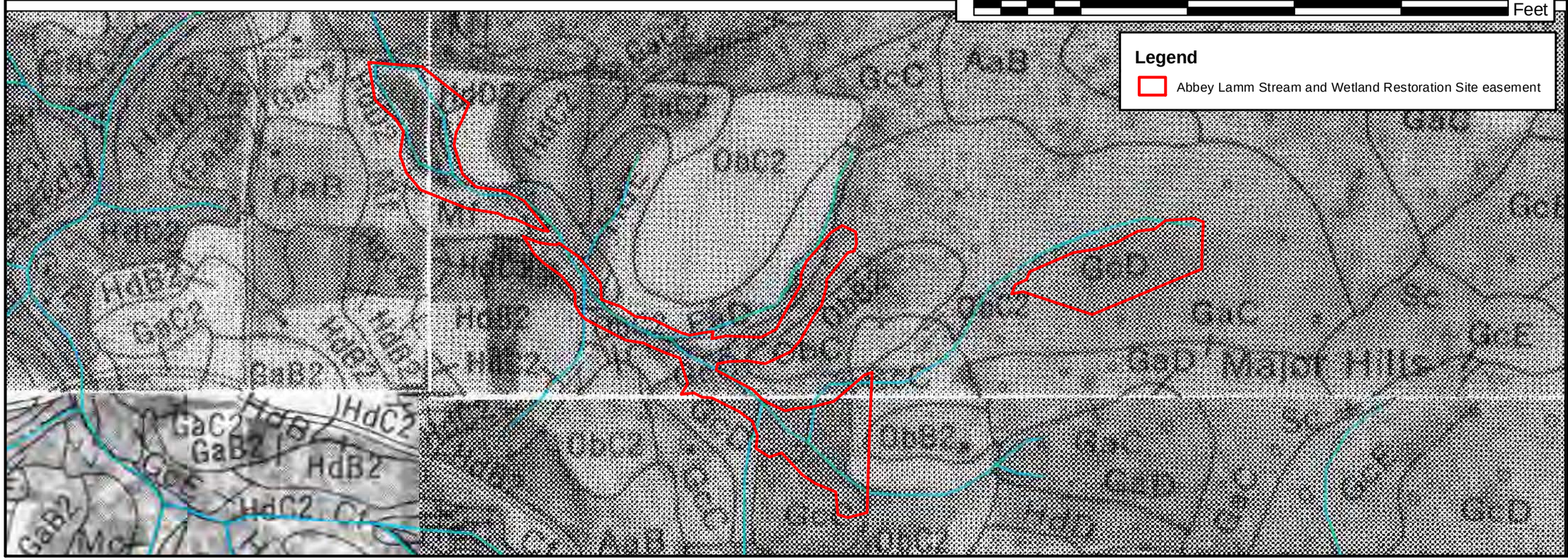
Background Imagery sources (provided by ESRI Data and Maps):
1. Physical Map of the United States (2009) created by the U.S. Park Service (upper inset).
2. Delorme World Basemap digital mapping (2010, lower inset).
3. Snow Camp, NC (1978), Crutchfield Crossroads, NC (1974), Saxapahaw, NC (1977), and Silk Hope, NC (1974) 7.5-minute topographic quadrangles provided by the U.S. Geological Survey.

Drawn by:	SGD
Date:	MAR 2014
Scale:	As Shown
Project No.:	13-004.01

FIGURE

1





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

Abbey Lamm Stream and Wetland Restoration Site

Alamance County, NC

Title:

PROJECT MAPPING

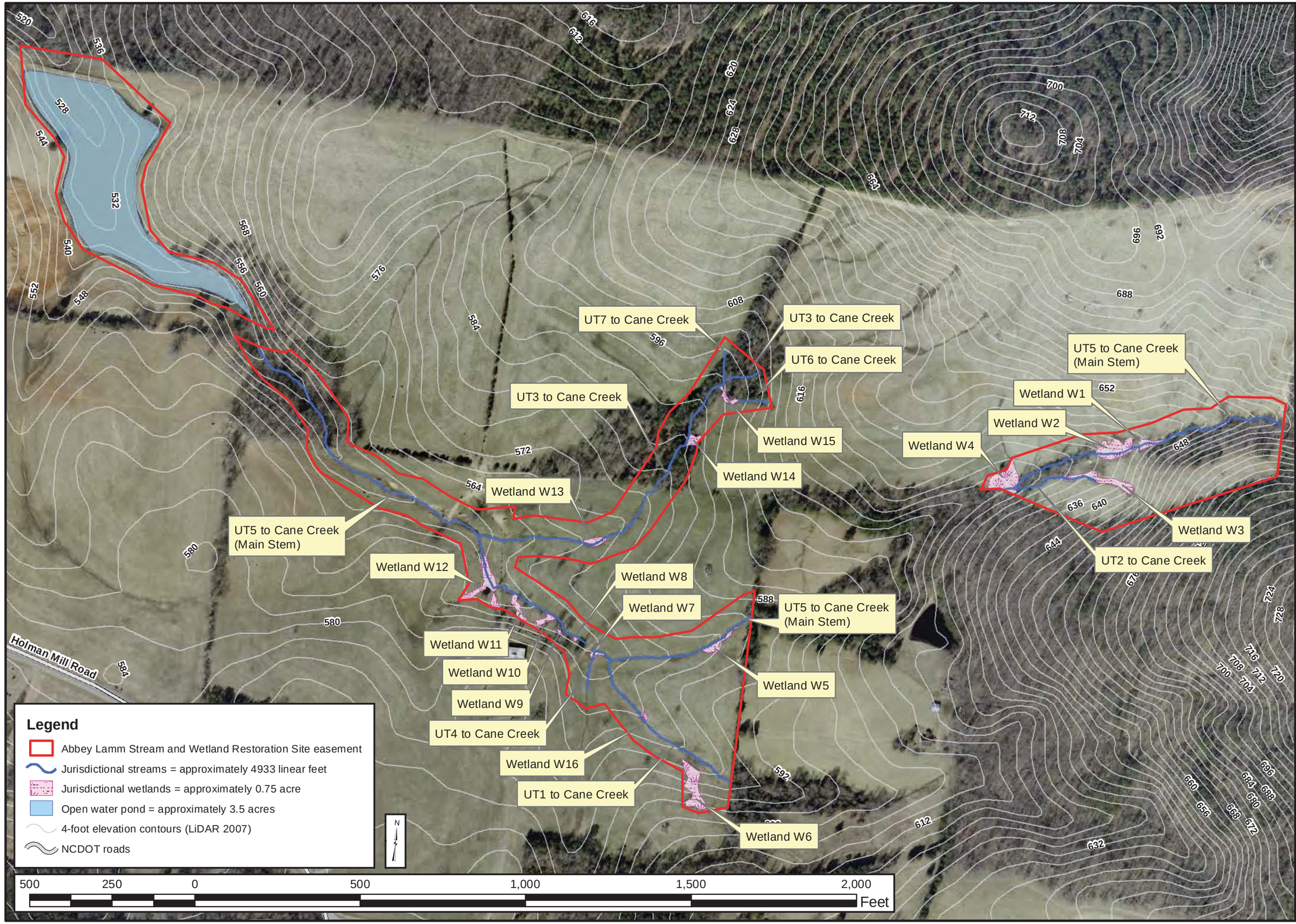
Notes:

1. Background imagery sources:
a. Snow Camp (1978) 7.5-minute topographic quadrangle provided by the U.S. Geological Survey (USGS, upper window).
b. Soil Survey of Alamance County, NC (1960) provided by the National Resource Conservation Service, sheets 30, 31, 34, and 35 (lower window).
2. Due to poor image quality, streams depicted on the USGS 7.5-minute quadrangle and the Soil Survey of Alamance County have been highlighted for clarity.

Drawn by:	SGD
Date:	MAY 2014
Scale:	1:6000
Project No.:	14-005

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

Abbey Lamm Stream and Wetland Restoration Site

Alamance County, NC

Title:

JURISDICTIONAL AREAS

Notes:

1. Background imagery source: 2010 aerial photography provided by the NC OneMap program (online, supported by the NC Geographic Information Coordination Council).

Drawn by:	SGD
Date:	JUN 2014
Scale:	1:3200
Project No.:	14-005

FIGURE

3

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Abbey Lane Mitigation Site City/County: Alamance Sampling Date: 4-22-14

Applicant/Owner: Restoration Systems State: NC Sampling Point: OBS7 WOT

Investigator(s): Axiom - C. Lewis, S. Davis Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain, FP Slope Local relief (concave, convex, none): Gently concave Slope (%): 0.3

Subregion (LRR or MLRA): P/136 Lat: 35.884812 Long: -79.393847 Datum: WGS84

Soil Map Unit Name: GcO - Goldston Slaty Silt Loam NWI classification: PSSIC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ✓, Soil ____, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓*	No ____	

Remarks: Active cow pasture - grazing & hoof compaction have altered vegetation & hydrology

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes* ✓ No ____ Depth (inches): 0-2

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* Saturation of surface layer only

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: DP07 WET

Tree Stratum (Plot size: 30'r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus pennsylvanica	5	✓	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15'r)			
1. Juniperus virginica	10	✓	FACU
2. Eupatorium capillifolium	15	✓	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	25	= Total Cover	
Herb Stratum (Plot size: 5'r)			
1. Juncus Effusus	30	✓	FACW
2. Trifolium Repens	20	✓	FACU
3. Ranunculus sp	2		
4. fescue sp	30	✓	FAC-FACU
5. Geranium carolinianum	10		FACU
6. Rumex crispa	5		FAC
7.			
8.			
9.			
10.			
11.			
12.			
	97	= Total Cover	
Woody Vine Stratum (Plot size: 30r)			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2-3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40-60% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	35 35	x 2 =	70 70
FAC species	35 5	x 3 =	105 15
FACU species	85 105	x 4 =	340 460
UPL species		x 5 =	
Column Totals:	155 145 (A)		515 545 (B)

Prevalence Index = B/A = 3.3 - 3.5

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

/ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No /

Remarks: (Include photo numbers here or on a separate sheet.)

GRAZING & HOOF COMPACTION HAVE ALTERED VEGETATION COMMUNITY.

SOIL

Sampling Point: DP7 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 5/2		7.5YR 5/6	10	C	M	clay loam	
				2	C	PL		
4-7	10YR 5/2		10YR 6/6	15	C	M	clay loam	
			10YR 4/3	1	C	M		
7+	10YR 4/6		7.5YR 6/1	1	D	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: ABBEY LAWN SITE City/County: ALAMANCE Sampling Date: 4-22-14

Applicant/Owner: RESTORATION SYSTEMS State: NC Sampling Point: DA09 WET

Investigator(s): AXIOM - S. DAVIS, C. LEWIS Section, Township, Range: NEWLIN

Landform (hillslope, terrace, etc.): FLOODPLAIN, FP SLOPE Local relief (concave, convex, none): GENTLY CONCAVE Slope (%): 0-3

Subregion (LRR or MLRA): P/136 Lat: 35.884841 Long: -79.394097 Datum: WGS84

Soil Map Unit Name: GeD - GOLDSTON SLATY SILT LOAM, STRONGLY SLOPING NWI classification: PSSIC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation ✓, Soil _____, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:
ACTIVE COW PASTURE HAS AFFECTED VEGETATION & HYDROLOGY

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes *	No ✓	Depth (inches): _____
Water Table Present?	Yes ✓	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ☆	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
* - SURFACE WATER - IN SMALL DEPRESSIONS ONLY (HOOFPRINTS)
☆ - SATURATION ONLY WITHIN UPPER 2" OF SOIL.
✓ - NO MOISTURE / SATURATION FROM 2-16"

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: ORB9W

Tree Stratum (Plot size: 30'r)	Absolute % Cover	Dominant Species?	Indicator Status
1. FRAXINUS PENNSYLVANICA	5	/	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15'r)			
1. JUNIPERUS VIRGINIANA	10	/	FACU
2. RUBUS SP.	5	/	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	15	= Total Cover	
Herb Stratum (Plot size: 5'r)			
1. RUMEX CRISPA	1		FAC
2. GERANIUM CAROLINIANA	50	/	FACU
3. FESTUCA	15		FAC-FACU
4. XANTHIUM STRUMARIUM	2		FAC
5. JUNCUS EFFUSUS	10		FACW
6. CAREX SP.	5		FAC-OBL
7. ACHILLEA MILLEFOLIUM	1		FACU
8.			
9.			
10.			
11.			
12.			
	84	= Total Cover	
Woody Vine Stratum (Plot size: 30'r)			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	15 / 15	x 2 =	30 / 30
FAC species	18 / 8	x 3 =	54 / 24
FACU species	66 / 81	x 4 =	264 / 324
UPL species		x 5 =	
Column Totals:	104	(A)	353 / 378 (B)

Prevalence Index = B/A = 3.4 - 3.6

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

/ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No /

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DP09w

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3	99	5YR 4/4	1	C	M	LOAM	
2-6	5YR 5/4	65	10YR 5/2	35	D	M	CL	
6-12	10YR 5/2	75	5YR 5/4	25	C	M	CL	
12-16+	10YR 5/2	85	10YR 4/3	10	D	M	CL	
			5YR 5/4	5	C	M	CL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Abbey Lane site City/County: Alamance Sampling Date: 4-22-14

Applicant/Owner: Restoration Systems State: NC Sampling Point: near DP4

Investigator(s): Axiom - S. Davis, G. Lewis Section, Township, Range: Newlin N

Landform (hillslope, terrace, etc.): floodplain slope Local relief (concave, convex, none): none Slope (%): 1-3

Subregion (LRR or MLRA): P / 136 Lat: 35.884841 Long: -79.394097 Datum: WGS 84

Soil Map Unit Name: GcD - Goldston slaty silt loam, strongly sloping NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: 0109 U

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15' r)			
1. JUNIPERUS VIRGINIANA	25	✓	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	25 = Total Cover		
Herb Stratum (Plot size: 5' r)			
1. ANDROPOGON VIRGINICUS	10		FACU
2. GERANIUM CAROLINIANA	5		FACU
3. OXALIS SP	5		-
4. TRIFOLIUM REPENS	45	✓	FACU
5. VICIA SP.	2		FACU
6. FESTUCA SP.	30	✓	FACU
7.			
8.			
9.			
10.			
11.			
12.			
	97 = Total Cover		
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: DA09 UP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/4	100					L	
2-6	10YR 4/3	100					GL	
6-12+	10YR 5/4	100					GL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

UT 1 UPSTREAM REACH

USACE AID#_____ DWQ #_____ Site # 1 (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: Nolan
3. Date of evaluation: 10-9-13
4. Time of evaluation: ~ 12 pm
5. Name of stream: UT to REEDY BRANCH
6. River basin: CAPE FEAR
7. Approximate drainage area: ~ 40 ACRES
8. Stream order: 1
9. Length of reach evaluated: ~ 100'
10. County: ALAMANCE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35, 883551 Longitude (ex. -77.556611): -79, 391389

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: ~0.8" RAIN IN PAST WEEK, WARM
16. Site conditions at time of visit: COOL, OVERCAST, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO) 20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 10 % Agricultural 90 % Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 2 23. Bank height (from bed to top of bank): 1
24. Channel slope down center of stream: ___Flat (0 to 2%) ✓Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ____Straight ✓Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 76 **Comments:**

Evaluator's Signature FOR A. LEWIS **Date** 5-4-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 - 5	0 - 4	0 - 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 - 6	0 - 5	0 - 5	4
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	3
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	4
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	0
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 - 5	0 - 4	0 - 2	4
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	0
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	4
	10	**Sediment input** (extensive deposition = 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	4
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	3
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	4
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	4
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0; no evidence = max points)	0 - 5	0 - 4	0 - 5	3
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	4
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	5
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	4
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	4
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 - 6	0 - 5	0 - 5	1
		Total Points Possible	100	100	100	
		TOTAL SCORE (also enter on first page)				70

* These characteristics are not assessed in coastal streams.

UT1 DOWNSTREAM REACH UTs 1 & 4

USACE AID#_____ DWQ #_____ Site # 13 (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: Dixon
3. Date of evaluation: 10-9-13
4. Time of evaluation: ~12 pm
5. Name of stream: UT to REEDY BRANCH
6. River basin: CAPE FEAR
7. Approximate drainage area: ~50 acres
8. Stream order: 1
9. Length of reach evaluated: ~200'
10. County: ALAMANCE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35.883854 Longitude (ex. -77.556611): -79.392259

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: WARM, ~0.8" RAIN IN PAST WEEK
16. Site conditions at time of visit: COOL, OVERCAST, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 60 % Agricultural 40 % Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 2'
23. Bank height (from bed to top of bank): 1'
24. Channel slope down center of stream: ___Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: (Straight) ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 23 **Comments:**

Evaluator's Signature FOR G. LEWIS **Date** 5-4-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 - 5	0 - 4	0 - 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 - 6	0 - 5	0 - 5	0
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	0
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	1
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	2
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 - 5	0 - 4	0 - 2	2
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	1
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	2
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	0
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	1
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0; no evidence = max points)	0 - 5	0 - 4	0 - 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	1
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	0
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) - (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	0
	21	**Presence of amphibians** (no evidence = 0, common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	22	**Presence of fish** (no evidence = 0, common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	23	**Evidence of wildlife use** (no evidence = 0, abundant evidence = max points)	0 - 6	0 - 5	0 - 5	1
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						23

* These characteristics are not assessed in coastal streams.

UT 3 UPSTREAM REACH

USACE AID#_____ DWQ #_____ Site # 3 (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: DAVIS
3. Date of evaluation: 10-9-13
4. Time of evaluation: 10 AM
5. Name of stream: UT TO REEDY BRANCH
6. River basin: CAPE FEAR
7. Approximate drainage area: ~30 ACRES
8. Stream order: 1-2
9. Length of reach evaluated: ~100
10. County: ALAMANCE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35.886791 Longitude (ex. –77.556611): -79.392470

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo GIS Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: WARM, ~0.8" RAIN IN PAST WEEK
16. Site conditions at time of visit: COOL, OVERCAST, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 95 % Agricultural 5 % Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 3'
23. Bank height (from bed to top of bank): 1 ✓
24. Channel slope down center of stream: ___Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 38 **Comments:**

Evaluator's Signature _____ FOR G. LEWIS **Date** 5-4-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 - 5	0 - 4	0 - 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 - 6	0 - 5	0 - 5	3
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 - 5	0 - 4	0 - 2	3
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	3
	10	**Sediment input** (extensive deposition = 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	2
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0, no evidence = max points)	0 - 5	0 - 4	0 - 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	0
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	3
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 - 6	0 - 5	0 - 5	1
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						38

* These characteristics are not assessed in coastal streams.

UT 3 DOWNSTREAM REACH

USACE AID#_____ DWQ #_____ Site #3B (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: ADAM G. LEWIS
3. Date of evaluation: 10-9-13
4. Time of evaluation: 10:30 AM
5. Name of stream: UT TO REEDY BRANCH
6. River basin: CAPE FEAR
7. Approximate drainage area: ~ 32 ACRES
8. Stream order: 1-2
9. Length of reach evaluated: ~100'
10. County: ORANGE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35.885518 Longitude (ex. -77.556611): -79.343996

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: WARM, ~0.8" RAIN IN PAST WEEK
16. Site conditions at time of visit: COOL, OVERCAST, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 90% Agricultural 10% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 3
23. Bank height (from bed to top of bank): 1-2'
24. Channel slope down center of stream: ___Flat (0 to 2%) ✓Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ✓Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 25 **Comments:**

Evaluator's Signature _____ FOR G. LEWIS **Date** 5-4-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 - 5	0 - 4	0 - 5	1
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 - 6	0 - 5	0 - 5	2
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	0
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	1
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	2
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 - 5	0 - 4	0 - 2	3
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	1
	10	**Sediment input** (extensive deposition = 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	2
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	0
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0; no evidence = max points)	0 - 5	0 - 4	0 - 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	0
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	0
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) * (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	6
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 - 6	0 - 5	0 - 5	0
		Total Points Possible	100	100	100	
		TOTAL SCORE (also enter on first page)				25

* These characteristics are not assessed in coastal streams

UTs 2 & 5 (UPSTREAM REACH UTS)

USACE AID#_____ DWQ #_____ Site #_2_ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: ADAM
3. Date of evaluation: 10-9-13
4. Time of evaluation: ~1 pm
5. Name of stream: UTS TO REEDY BRANCH
6. River basin: CAPE FEAR
7. Approximate drainage area: ~30 ACRES
8. Stream order: 2+
9. Length of reach evaluated: ~200'
10. County: ALAMANCE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35.587045 Longitude (ex. –77.556611): -79.386779

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: WARM, ~0.8" RAIN IN PAST WEEK
16. Site conditions at time of visit: COOL, OVERCAST, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? (YES) NO (UTs)
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 60% Agricultural 40% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 4
23. Bank height (from bed to top of bank): 1
24. Channel slope down center of stream: ___Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ____Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 57 **Comments:**

Evaluator's Signature [signature] FOR A. LEWIS **Date** 5-4-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0, strong flow = max points)	0 - 5	0 - 4	0 - 5	3
	2	**Evidence of past human alteration** (extensive alteration = 0, no alteration = max points)	0 - 6	0 - 5	0 - 5	2
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0, frequent flooding = max points)	0 - 5	0 - 4	0 - 2	3
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	3
	10	**Sediment input** (extensive deposition = 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	2
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	3
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	3
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0, no evidence = max points)	0 - 5	0 - 4	0 - 5	2
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	4
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	4
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	4
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	2
	21	**Presence of amphibians** (no evidence = 0, common, numerous types = max points)	0 - 4	0 - 4	0 - 4	2
	22	**Presence of fish** (no evidence = 0, common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	23	**Evidence of wildlife use** (no evidence = 0, abundant evidence = max points)	0 - 6	0 - 5	0 - 5	1
		Total Points Possible	100	100	100	
		TOTAL SCORE (also enter on first page)				57

* These characteristics are not assessed in coastal streams.

UT 5 DOWNSTREAM

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: RESTORATION SYSTEMS
2. Evaluator's name: Dixon S. Davis
3. Date of evaluation: 4-23-14
4. Time of evaluation: ~10 AM
5. Name of stream: UT 5 TO REEDY BRANCH MAIN STEM
6. River basin: CAPE FEAR
7. Approximate drainage area: ~250 ACRES
8. Stream order: 2+
9. Length of reach evaluated: ~300'
10. County: ALAMANCE
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 35.885388 Longitude (ex. –77.556611):

Method location determined (circle): (GPS) Topo Sheet Ortho (Aerial) (Photo/GIS) Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

14. Proposed channel work (if any): RESTORATION
15. Recent weather conditions: WARM, LIGHT RAIN SEVERAL DAYS EARLIER
16. Site conditions at time of visit: WARM, NORMAL FLOW
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ____(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES NO If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? (YES) NO
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 80% Agricultural 20% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 3-4'
23. Bank height (from bed to top of bank): 1-2'
24. Channel slope down center of stream: ___Flat (0 to 2%) /Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: /Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 26 **Comments:**

Evaluator's Signature _____ **Date** 4-23-14

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 - 5	0 - 4	0 - 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 - 6	0 - 5	0 - 5	0
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 - 6	0 - 4	0 - 5	0
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 - 5	0 - 4	0 - 4	1 cow manure
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 - 3	0 - 4	0 - 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 - 4	0 - 4	0 - 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 - 5	0 - 4	0 - 2	2
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 - 6	0 - 4	0 - 2	2
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 - 5	0 - 4	0 - 3	0
	10	**Sediment input** (extensive deposition = 0; little or no sediment = max points)	0 - 5	0 - 4	0 - 4	1
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 - 4	0 - 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 - 5	0 - 4	0 - 5	2
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 - 5	0 - 5	0 - 5	1
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 - 3	0 - 4	0 - 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact = 0; no evidence = max points)	0 - 5	0 - 4	0 - 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 - 3	0 - 5	0 - 6	2
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 - 6	0 - 6	0 - 6	1
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 - 5	0 - 5	0 - 5	0
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 - 4	0 - 4	1
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 5	0 - 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 - 4	0 - 4	0 - 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 - 6	0 - 5	0 - 5	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						26

* These characteristics are not assessed in coastal streams

Figure 4-Site 1

Photo 2196-7 **NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11**

UT 1
UPSTREAM REACH off-SITE

NC DWQ Stream Identification Form Version 4.11

Date: 10/9/13	Project/Site: Abby - Lamm	Latitude: 35.883551
Evaluator: S. Smith / Axiom Environmental	County: Alamance	Longitude: -79.391389
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 19)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	1	2	**3**
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	**3**
4. Particle size of stream substrate	0	1	2	**3**
5. Active/relict floodplain	0	1	**2**	3
6. Depositional bars or benches	0	1	**2**	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	0.5	1	**1.5**
10. Natural valley	0	0.5	1	**1.5**
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

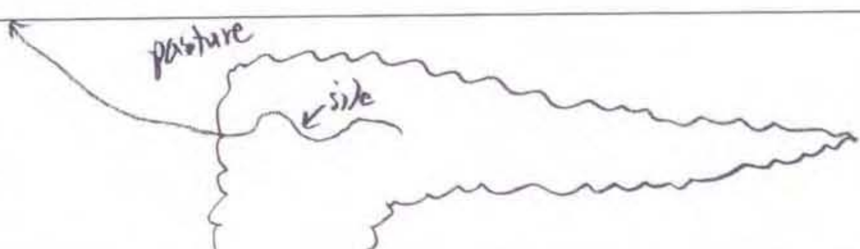
B. Hydrology (Subtotal = 5)				
12. Presence of Baseflow	**0**	1	2	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	1	**0.5**	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	0.5	**1**	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	**2**	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:



No water

Figure 4 Site 1 (1B)
Down stream on-site

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

UT 1 & UT 4

NC DWQ Stream Identification Form Version 4.11

Date: 10/9/13	Project/Site: Abby - Lamm	Latitude: 35.883854
Evaluator: S. Smith	County: Alamance	Longitude: -79.392259
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 16.25	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* Snow Camp

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 0.75)				
18. Fibrous roots in streambed	3	2	1	(0)
19. Rooted upland plants in streambed	3	2	1	(0)
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = (0.75) OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Active cattle pasture

Sketch:
water in pools only
No benthics

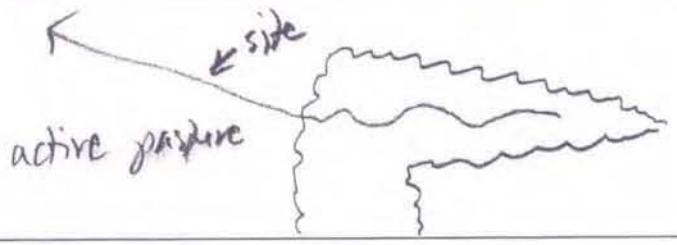


Figure 4
Site 2

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

UT 5 (MAIN STEM) UPSTREAM REACH
UT 2 & UT 5

NC DWQ Stream Identification Form Version 4.11

Date: 10/9/13	Project/Site: Abby-Lamm	Latitude: 35.687045
Evaluator: S.Smith / Axiom Environmental	County: Alamance	Longitude: -79.386779
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35.25	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7.75)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = (0.75); OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: No benthics

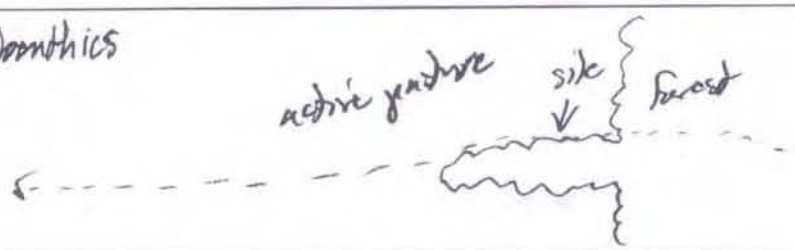


Figure 4- Site 3 -2735

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

UT 3

NC DWQ Stream Identification Form Version 4.11

Date: 10/9/13	Project/Site: Abby- Lamm	Latitude: 35.886791
Evaluator: S. Smith / Axiom Environmental	County: Alamance	Longitude: -79.342470
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 20	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other e.g. Quad Name: Snow Camp

A. Geomorphology (Subtotal = 14)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 4)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	3	(2)	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Water in pools. No benthics

Sketch:

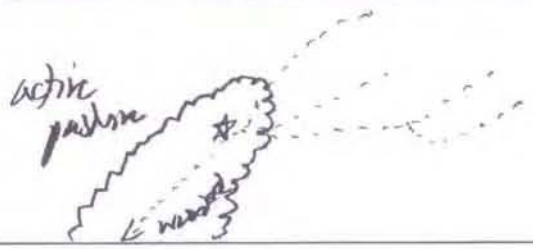


Figure 4 (3B)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

UT3 DOWNSTREAM REACH

NC DWQ Stream Identification Form Version 4.11

Date: 10/9/13	Project/Site: Abby - Lamm	Latitude: 35.885518
Evaluator: S.Smith / Axiom	County: Alamance	Longitude: -79.393996
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 8	Stream Determination (circle one) Ephemeral Intermittent Perennial ☆	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 6)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

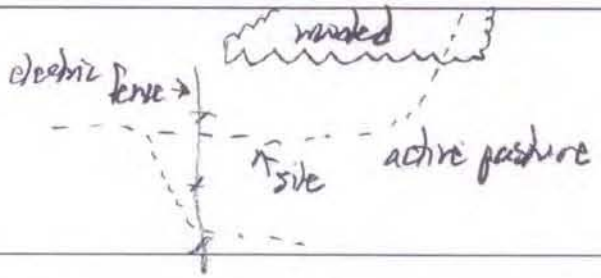
B. Hydrology (Subtotal = 2)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 0)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:



☆ INTERMITTENT UPSTREAM, DEGRADED UPON ENTERING ACTIVE COW PASTURE

Appendix E
Categorical Exclusion Document

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Abbey Lamm Stream and Wetland Mitigation Site
County Name:	Alamance County
EEP Number:	
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	Worth Creech
Project Contact Address:	1101 Haynes Street, Suite 211 Raleigh, NC 27604
Project Contact E-mail:	Worth@restorationsystems.com
EEP Project Manager:	

Project Description

The Abby Lamm encompasses approximately 21 acres of agricultural land used for livestock grazing and hay production Existing Site streams have been cleared dredged of cobble substrate. trampled by livestock, eroded vertically and laterally. The project will restore streams and wetlands within the Site for total of 5294 Stream Mitigation Units (SMUs) and 1.3 Riparian Wetland Mitigation Units (WMUs).

For Official Use Only

Reviewed By:

4-30-2014
Date

Kristie Cobon
EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

4-30-14
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☒ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☒ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☒ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☒ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☒ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☒ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☒ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☒ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☒ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☒ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☒ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☒ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Does the project require the acquisition of real estate?	☒ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☒ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☒ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☒ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☒ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☒ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☒ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☒ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☒ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☐ Yes ☒ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☐ No ☒ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☐ No ☒ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☒ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☒ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☒ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☒ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☒ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☒ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☒ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☒ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☒ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☒ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☒ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☒ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☒ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☒ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☒ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☒ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☒ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☒ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☒ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☒ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☒ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☒ N/A

North Carolina Department of Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Pat McCrory
Secretary Susan Kluttz

Office of Archives and History
Deputy Secretary Kevin Cherry

March 20, 2014

Grant Lewis
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, NC 27603

Re: Abbey Lamm Stream and Wetland Mitigation Project, Alamance County, ER 14-0440

Dear Mr. Lewis:

Thank you for your letter of March 7, 2014, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or renee.gledhill-earley@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

April 4, 2014

Grant Lewis
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, NC 27603

Re: Abbey Lamm Stream and Wetland Mitigation Project - Alamance County, NC

Dear Mr. Lewis:

This letter is to inform you that a list of all federally-protected endangered and threatened species with known occurrences in North Carolina is now available on the U.S. Fish and Wildlife Service's (Service) web page at http://www.fws.gov/raleigh. Therefore, if you have projects that occur within the Raleigh Field Office's area of responsibility (see attached county list), you no longer need to contact the Raleigh Field Office for a list of federally-protected species.

Our web page contains a complete and frequently updated list of all endangered and threatened species protected by the provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), and a list of federal species of concern[1] that are known to occur in each county in North Carolina.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes.

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[1] The term "federal species of concern" refers to those species which the Service believes might be in need of concentrated conservation actions. Federal species of concern receive no legal protection and their designation does not necessarily imply that the species will eventually be proposed for listing as a federally endangered or threatened species. However, we recommend that all practicable measures be taken to avoid or minimize adverse impacts to federal species of concern.

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

With regard to the above-referenced project, we offer the following remarks. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

However, the Service is concerned about the potential impacts the proposed action might have on aquatic species. Aquatic resources are highly susceptible to sedimentation. Therefore, we recommend that all practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures. An erosion and sedimentation control plan should be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls should be installed and maintained between the construction site and any nearby down-gradient surface waters. In addition, we recommend maintaining natural, vegetated buffers on all streams and creeks adjacent to the project site.

The North Carolina Wildlife Resources Commission has developed a Guidance Memorandum (a copy can be found on our website at (http://www.fws.gov/raleigh) to address and mitigate secondary and cumulative impacts to aquatic and terrestrial wildlife resources and water quality. We recommend that you consider this document in the development of your projects and in completing an initiation package for consultation (if necessary).

We hope you find our web page useful and informative and that following the process described above will reduce the time required, and eliminate the need, for general correspondence for species' lists. If you have any questions or comments, please contact Kathy Matthews of this office at (919) 856-4520 ext. 27.

Sincerely,

Kathryn H. Matthews

for Pete Benjamin
Field Supervisor

List of Counties in the Service's Raleigh Field Office Area of Responsibility

Alamance
Beaufort
Bertie
Bladen
Brunswick
Camden
Carteret
Caswell
Chatham
Chowan
Columbus
Craven
Cumberland
Currituck
Dare
Duplin
Durham
Edgecombe
Franklin
Gates
Granville
Greene
Guilford
Halifax
Harnett
Hertford
Hoke
Hyde
Johnston
Jones
Lee
Lenoir
Martin
Montgomery
Moore
Nash
New Hanover
Northampton
Onslow
Orange
Pamlico
Pasquotank
Pender
Perquimans
Person
Pitt
Randolph
Richmond
Robeson
Rockingham
Sampson
Scotland
Tyrrell
Vance
Wake
Warren
Washington
Wayne
Wilson

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 03/07/2014
Name of Project Abbey Lamm Sites	Federal Agency Involved FHWA
Proposed Land Use Stream Restoration Site	County and State Alamance County and North Carolina
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 03/10/2014 — Person Completing Form: Milton Cortes-NRCS NC

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑	NO ☐	Acres Irrigated: none — Average Farm Size: 117
Major Crop(s): Corn	Farmable Land In Govt. Jurisdiction — Acres: 179,30′ acres 64.4 %		Amount of Farmland As Defined in FPPA — Acres: 240,62 acres 86.4 %
Name of Land Evaluation System Used: Alamance Co. Lesa	Name of State or Local Site Assessment System: N/A		Date Land Evaluation Returned by NRCS: 04/09/2014

PART III *(To be completed by Federal Agency)*	Alternative Site Rating: Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	17.5			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	21			
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	1			
B. Total Acres Statewide Important or Local Important Farmland	3.62			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0019			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	81			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)	52			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	Maximum Points	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	18			
4. Protection Provided By State and Local Government	(20)	0			
5. Distance From Urban Built-up Area	(15)	15			
6. Distance To Urban Support Services	(15)	10			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	0			
9. Availability Of Farm Support Services	(5)	5			
10. On-Farm Investments	(20)	2			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	0			
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	52	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	085	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	52	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form: FHWA (Axiom Environmental) — Date: 4/11/14

(See Instructions on reverse side)

Form AD-1006 (03-02)

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

11 March 2014

Mr. Grant Lewis, Senior Project Manager
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

Subject: Abbey Lamm Stream and Wetland Restoration Site, Alamance County

Dear Mr. Lewis:

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the subject information. Our comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The proposed project would remove a farm pond, restore stream channels through active pasture land, and provide in-kind mitigation for unavoidable stream and wetland impacts. Several sections of channel have been identified as significantly degraded. The project site includes an unnamed tributary to Reedy Branch in the Cape Fear River basin. The Significant Natural Heritage Area – Piedmont Monadnock Forest (Typic Subtype) – is located adjacent to the project site.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. Provided measures are taken to minimize erosion and sedimentation from construction/restoration activities, we do not anticipate the project to result in significant adverse impacts to aquatic and terrestrial wildlife resources.

Thank you for the opportunity to review this proposed project. If we can provide further assistance, please contact our office at (336) 449-7625 or shari.bryant@ncwildlife.org.

Sincerely,

Shari L. Bryant

Shari L. Bryant
Piedmont Region Coordinator
Habitat Conservation Program

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

Abbey Lamm Stream and Wetland Site
Major Hill Road
Snow Camp, NC 27349

Inquiry Number: 3873620.2s
March 06, 2014

The EDR Radius Map™ Report

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

MAJOR HILL ROAD
SNOW CAMP, NC 27349

COORDINATES

Latitude (North):	35.8856000 - 35° 53' 8.16''
Longitude (West):	79.3946000 - 79° 23' 40.56''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	644909.0
UTM Y (Meters):	3972250.0
Elevation:	586 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	35079-H4 SNOW CAMP, NC
Most Recent Revision:	1978
South Map:	35079-G4 CRUTCHFIELD CROSSROADS, NC
Most Recent Revision:	1974

AERIAL PHOTOGRAPHY IN THIS REPORT

Photo Year:	2012
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL---------- National Priority List

EXECUTIVE SUMMARY

Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

CERCLIS ---------- Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY ---------- Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP ---------- CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-CESQG ---------- RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS ---------- Engineering Controls Sites List
US INST CONTROL ---------- Sites with Institutional Controls
LUCIS ---------- Land Use Control Information System

Federal ERNS list

ERNS ---------- Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS ---------- Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS ---------- Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ---------- List of Solid Waste Facilities
OLI ---------- Old Landfill Inventory

State and tribal leaking storage tank lists

LUST ---------- Regional UST Database

LUST TRUST ---- State Trust Fund Database
LAST ---- Leaking Aboveground Storage Tanks
INDIAN LUST ---- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST ---- Petroleum Underground Storage Tank Database
AST ---- AST Database
INDIAN UST ---- Underground Storage Tanks on Indian Land
FEMA UST ---- Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL ---- No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

VCP ---- Responsible Party Voluntary Action Sites
INDIAN VCP ---- Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS ---- Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI ---- Open Dump Inventory
DEBRIS REGION 9 ---- Torres Martinez Reservation Illegal Dump Site Locations
SWRCY ---- Recycling Center Listing
HIST LF ---- Solid Waste Facility Listing
INDIAN ODI ---- Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ---- Clandestine Drug Labs
US HIST CDL ---- National Clandestine Laboratory Register

Local Land Records

LIENS 2 ---- CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ---- Hazardous Materials Information Reporting System
IMD ---- Incident Management Database
SPILLS 80 ---- SPILLS 80 data from FirstSearch
SPILLS 90 ---- SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR ---- RCRA - Non Generators

EXECUTIVE SUMMARY

DOT OPS	Incident and Accident Data
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
US MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
RMP	Risk Management Plans
UIC	Underground Injection Wells Listing
DRYCLEANERS	Drycleaning Sites
NPDES	NPDES Facility Location Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
COAL ASH	Coal Ash Disposal Sites
2020 COR ACTION	2020 Corrective Action Program List
LEAD SMELTERS	Lead Smelter Sites
EPA WATCH LIST	EPA WATCH LIST
US FIN ASSUR	Financial Assurance Information
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
US AIRS	Aerometric Information Retrieval System Facility Subsystem
PRP	Potentially Responsible Parties
Financial Assurance	Financial Assurance Information Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR US Hist Auto Stat	EDR Exclusive Historic Gas Stations
EDR US Hist Cleaners	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

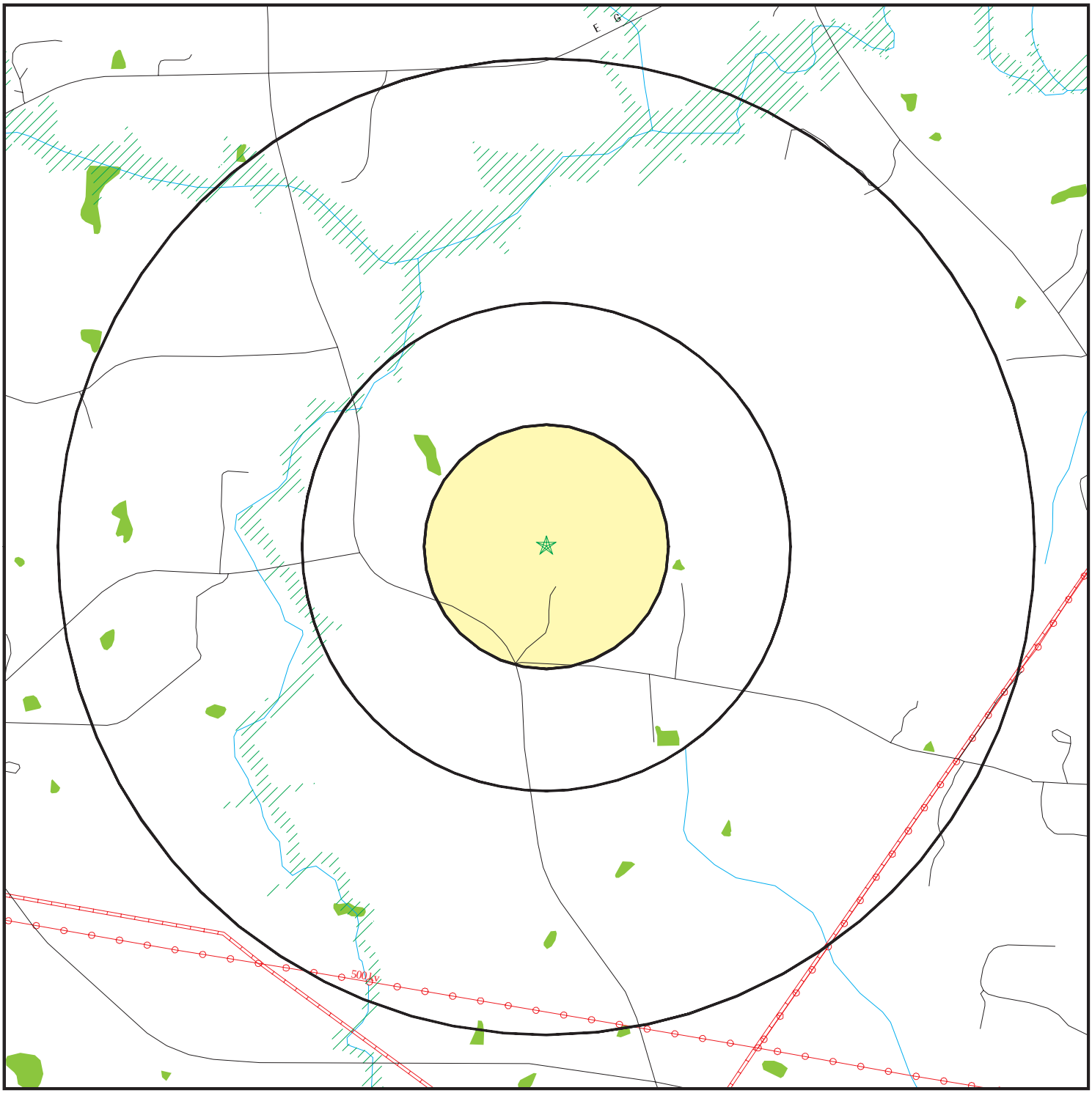
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 6 records.

Site Name	Database(s)
SNOW CAMP	IMD, LAST
RAY'S QUICK STOP	LUST
KING PROPERTY, EDWARD	LUST, RGA LUST
WALL'S GARAGE	UST
N C FOREST SERVICE	UST
INEZ FOGLEMAN SERVICE	UST

OVERVIEW MAP - 3873620.2s

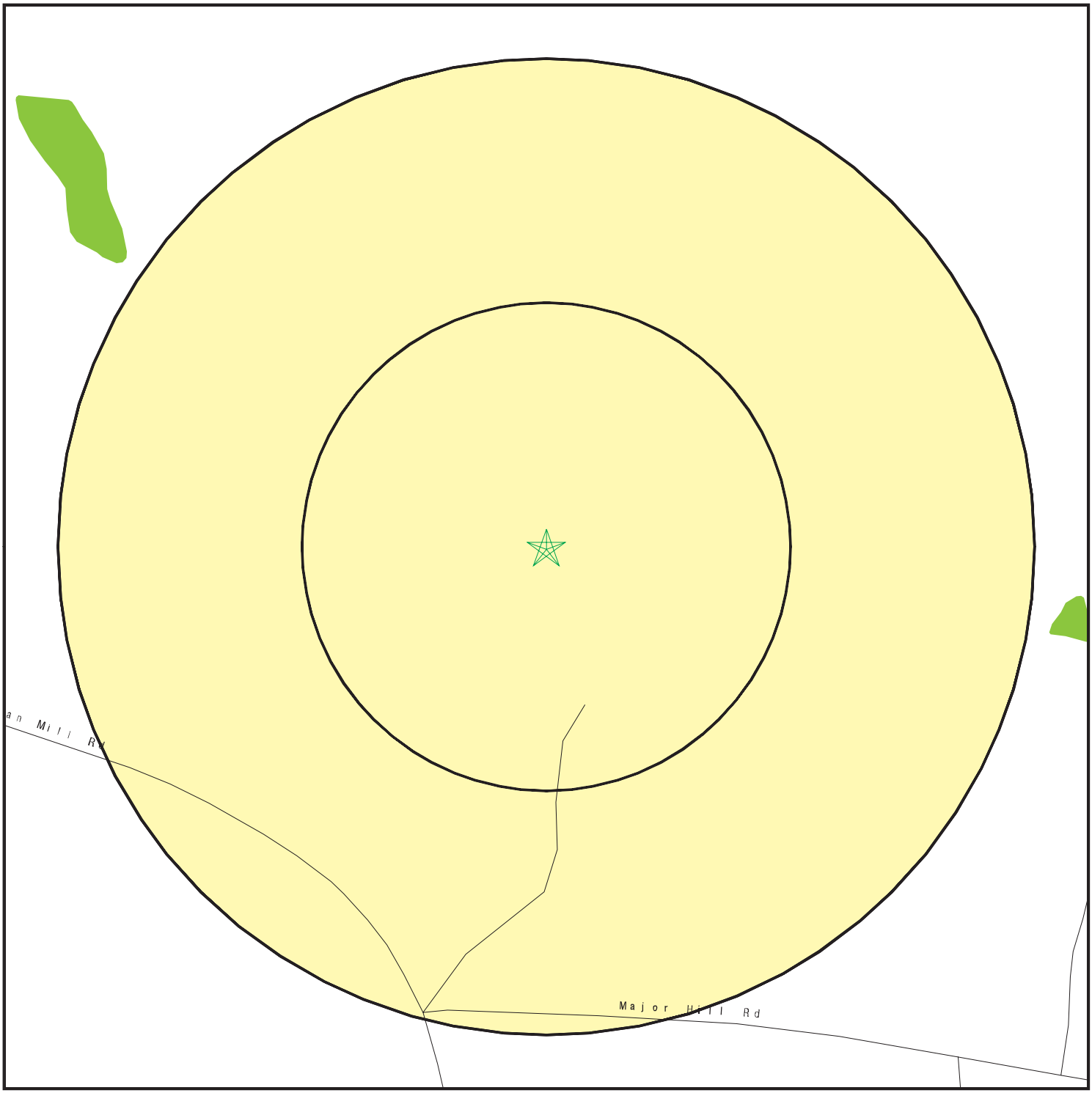


- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Abbey Lamm Stream and Wetland Site	CLIENT: Axiom Environmental
ADDRESS: Major Hill Road Snow Camp NC 27349	CONTACT: Grant Lewis
LAT/LONG: 35.8856 / 79.3946	INQUIRY #: 3873620.2s DATE: March 06, 2014 6:07 pm

DETAIL MAP - 3873620.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Abbey Lamm Stream and Wetland Site	CLIENT:	Axiom Environmental
ADDRESS:	Major Hill Road Snow Camp NC 27349	CONTACT:	Grant Lewis
LAT/LONG:	35.8856 / 79.3946	INQUIRY #:	3873620.2s
		DATE:	March 06, 2014 6:08 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST TRUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR US Hist Auto Stat	0.250		0	0	NR	NR	NR	0
EDR US Hist Cleaners	0.250		0	0	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

Count: 6 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SNOW CAMP	S103130617	SNOW CAMP	ROUTE 1		IMD, LAST
SNOW CAMP	U001200749	WALL'S GARAGE	ROUTE 2	27349	UST
SNOW CAMP	U001188730	N C FOREST SERVICE	RT 2 BOX 238B	27349	UST
SNOW CAMP	U003145941	INEZ FOGLEMAN SERVICE	ROUTE 2, BOX 49	27349	UST
SNOW CAMP	S114020736	RAY'S QUICK STOP	7610 NC HIGHWAY 87 S	27349	LUST
SNOW CAMP	S112061121	KING PROPERTY, EDWARD	NC HWY 87 AND SNOW CAMP RD.	27349	LUST, RGA LUST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 01/21/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 01/09/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 01/09/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 05/31/2013
Date Data Arrived at EDR: 07/08/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 151

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 01/10/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/17/2013
Date Data Arrived at EDR: 01/14/2014
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/17/2013
Date Data Arrived at EDR: 01/14/2014
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 11/20/2013
Date Data Arrived at EDR: 11/21/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 95

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 06/02/2014
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 02/07/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

State- and tribal - equivalent NPL

HSDS: Hazardous Substance Disposal Site

Locations of uncontrolled and unregulated hazardous waste sites. The file includes sites on the National Priority List as well as those on the state priority list.

Date of Government Version: 08/09/2011
Date Data Arrived at EDR: 11/08/2011
Date Made Active in Reports: 12/05/2011
Number of Days to Update: 27

Source: North Carolina Center for Geographic Information and Analysis
Telephone: 919-754-6580
Last EDR Contact: 02/05/2014
Next Scheduled EDR Contact: 05/19/2014
Data Release Frequency: Biennially

State- and tribal - equivalent CERCLIS

SHWS: Inactive Hazardous Sites Inventory

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 12/11/2013
Date Data Arrived at EDR: 12/19/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 42

Source: Department of Environment, Health and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/19/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: List of Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 12/30/2013
Date Data Arrived at EDR: 12/31/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 30

Source: Department of Environment and Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 12/31/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Semi-Annually

OLI: Old Landfill Inventory

Old landfill inventory location information. (Does not include no further action sites and other agency lead sites).

Date of Government Version: 04/05/2013
Date Data Arrived at EDR: 04/18/2013
Date Made Active in Reports: 05/09/2013
Number of Days to Update: 21

Source: Department of Environment & Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 01/13/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Regional UST Database

This database contains information obtained from the Regional Offices. It provides a more detailed explanation of current and historic activity for individual sites, as well as what was previously found in the Incident Management Database. Sites in this database with Incident Numbers are considered LUSTs.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/13/2013
Number of Days to Update: 28

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 02/12/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

LUST TRUST: State Trust Fund Database

This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

Date of Government Version: 10/11/2013
Date Data Arrived at EDR: 10/15/2013
Date Made Active in Reports: 10/30/2013
Number of Days to Update: 15

Source: Department of Environment and Natural Resources
Telephone: 919-733-1315
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Semi-Annually

LAST: Leaking Aboveground Storage Tanks
A listing of leaking aboveground storage tank site locations.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/13/2013
Number of Days to Update: 28
Source: Department of Environment & Natural Resources
Telephone: 877-623-6748
Last EDR Contact: 02/12/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 08/27/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 66
Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 02/13/2014
Date Data Arrived at EDR: 02/14/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 10
Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 29
Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42
Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49
Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59
Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 02/21/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 11/21/2013
Date Data Arrived at EDR: 11/26/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 90

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 184

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

State and tribal registered storage tank lists

UST: Petroleum Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/13/2013
Number of Days to Update: 28

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 02/12/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

AST: AST Database
Facilities with aboveground storage tanks that have a capacity greater than 21,000 gallons.

Date of Government Version: 12/17/2013
Date Data Arrived at EDR: 12/24/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 37

Source: Department of Environment and Natural Resources
Telephone: 919-715-6183
Last EDR Contact: 12/17/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Semi-Annually

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 08/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 92

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 43

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/13/2014
Date Data Arrived at EDR: 02/14/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 10

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 11/21/2013
Date Data Arrived at EDR: 11/26/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 90

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 01/27/2014
Number of Days to Update: 271

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 02/06/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 65

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 07/30/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 129

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55
Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 01/13/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: No Further Action Sites With Land Use Restrictions Monitoring
A land use restricted site is a property where there are limits or requirements on future use of the property due to varying levels of cleanup possible, practical, or necessary at the site.

Date of Government Version: 12/11/2013
Date Data Arrived at EDR: 12/19/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 42
Source: Department of Environment, Health and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/19/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VCP: Responsible Party Voluntary Action Sites
Responsible Party Voluntary Action site locations.

Date of Government Version: 12/11/2013
Date Data Arrived at EDR: 12/19/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 42
Source: Department of Environment and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/19/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Semi-Annually

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/17/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66
Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27
Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Projects Inventory
A brownfield site is an abandoned, idled, or underused property where the threat of environmental contamination has hindered its redevelopment. All of the sites in the inventory are working toward a brownfield agreement for cleanup and liabitliy control.

Date of Government Version: 12/03/2013
Date Data Arrived at EDR: 01/07/2014
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 23
Source: Department of Environment and Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 01/07/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 09/24/2013
Date Data Arrived at EDR: 09/24/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 02/25/2014
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

HIST LF: Solid Waste Facility Listing

A listing of solid waste facilities.

Date of Government Version: 11/06/2006
Date Data Arrived at EDR: 02/13/2007
Date Made Active in Reports: 03/02/2007
Number of Days to Update: 17

Source: Department of Environment & Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 01/19/2009
Next Scheduled EDR Contact: 04/19/2009
Data Release Frequency: Quarterly

SWRCY: Recycling Center Listing

A listing of recycling center locations.

Date of Government Version: 11/23/2013
Date Data Arrived at EDR: 11/25/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 21

Source: Department of Environment & Natural Resources
Telephone: 919-707-8137
Last EDR Contact: 11/18/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52
Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 12/04/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 65
Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/04/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Quarterly

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131
Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/06/2013
Date Data Arrived at EDR: 04/25/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 15
Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/03/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 52
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 01/13/2014
Data Release Frequency: Annually

IMD: Incident Management Database
Groundwater and/or soil contamination incidents

Date of Government Version: 07/21/2006
Date Data Arrived at EDR: 08/01/2006
Date Made Active in Reports: 08/23/2006
Number of Days to Update: 22

Source: Department of Environment and Natural Resources
Telephone: 919-733-3221
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: No Update Planned

SPILLS 90: SPILLS90 data from FirstSearch
Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 09/27/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/06/2013
Number of Days to Update: 62

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SPILLS 80: SPILLS80 data from FirstSearch
Spills 80 includes those spill and release records available from FirstSearch databases prior to 1990. Typically, they may include chemical, oil and/or hazardous substance spills recorded before 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 80.

Date of Government Version: 06/14/2001
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/06/2013
Number of Days to Update: 62

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 10/02/2013
Date Made Active in Reports: 12/16/2013
Number of Days to Update: 75

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 02/06/2014
Next Scheduled EDR Contact: 05/19/2014
Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 15

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/24/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 31

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/12/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 02/25/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 09/05/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 28

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 03/05/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/31/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 44

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 02/24/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 02/24/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77
Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 01/28/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61
Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/09/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2013
Date Data Arrived at EDR: 07/17/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 107
Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 01/28/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/09/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/09/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 23
Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 01/10/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 03/08/2013
Date Data Arrived at EDR: 03/21/2013
Date Made Active in Reports: 07/10/2013
Number of Days to Update: 111

Source: EPA
Telephone: (404) 562-9900
Last EDR Contact: 12/10/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 11/01/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Biennially

UIC: Underground Injection Wells Listing

A listing of uncerground injection wells locations.

Date of Government Version: 11/13/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/20/2013
Number of Days to Update: 35

Source: Department of Environment & Natural Resources
Telephone: 919-807-6412
Last EDR Contact: 02/10/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Varies

DRYCLEANERS: Drycleaning Sites

Potential and known drycleaning sites, active and abandoned, that the Drycleaning Solvent Cleanup Program has knowledge of and entered into this database.

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 12/24/2013
Date Made Active in Reports: 01/30/2014
Number of Days to Update: 37

Source: Department of Environment & Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 12/24/2013
Next Scheduled EDR Contact: 04/07/2014
Data Release Frequency: Varies

NPDES: NPDES Facility Location Listing

General information regarding NPDES(National Pollutant Discharge Elimination System) permits.

Date of Government Version: 05/01/2013
Date Data Arrived at EDR: 06/05/2013
Date Made Active in Reports: 07/05/2013
Number of Days to Update: 30

Source: Department of Environment & Natural Resources
Telephone: 919-733-7015
Last EDR Contact: 02/17/2014
Next Scheduled EDR Contact: 05/19/2014
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 01/20/2014
Next Scheduled EDR Contact: 05/05/2014
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 11/20/2013
Date Data Arrived at EDR: 12/03/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 72

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 06/02/2014
Data Release Frequency: Quarterly

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 04/15/2013
Date Data Arrived at EDR: 07/03/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 72

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 01/02/2014
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Quarterly

Financial Assurance 2: Financial Assurance Information Listing
Information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 10/02/2012
Date Data Arrived at EDR: 10/03/2012
Date Made Active in Reports: 10/26/2012
Number of Days to Update: 23

Source: Department of Environmental & Natural Resources
Telephone: 919-508-8496
Last EDR Contact: 12/30/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Varies

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: N/A

Financial Assurance 3: Financial Assurance Information
Hazardous waste financial assurance information.

Date of Government Version: 09/30/2012
Date Data Arrived at EDR: 10/19/2012
Date Made Active in Reports: 11/29/2012
Number of Days to Update: 41

Source: Department of Environment & Natural Resources
Telephone: 919-707-8222
Last EDR Contact: 12/16/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Varies

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)
The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 12/26/2013
Next Scheduled EDR Contact: 04/14/2014
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Financial Assurance 1: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/15/2013
Date Made Active in Reports: 12/13/2013
Number of Days to Update: 28

Source: Department of Environment & Natural Resources
Telephone: 919-733-1322
Last EDR Contact: 02/12/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 01/29/2013
Date Data Arrived at EDR: 02/14/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 01/03/2014
Next Scheduled EDR Contact: 04/21/2014
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 01/13/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Sites

A listing of coal combustion products distribution permits issued by the Division for the treatment, storage, transportation, use and disposal of coal combustion products.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/04/2009
Date Made Active in Reports: 08/17/2009
Number of Days to Update: 13

Source: Department of Environment & Natural Resources
Telephone: 919-807-6359
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 08/13/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 02/10/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/13/2013
Next Scheduled EDR Contact: 03/24/2014
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Proprietary Historic Dry Cleaners - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Auto Stat: EDR Proprietary Historic Gas Stations - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/20/2013
Number of Days to Update: 172

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/13/2014
Number of Days to Update: 196

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/24/2013
Number of Days to Update: 176

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 02/21/2014
Next Scheduled EDR Contact: 06/02/2014
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 08/28/2012
Number of Days to Update: 40

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 01/17/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 11/01/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 11/18/2013
Number of Days to Update: 11

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 02/07/2014
Next Scheduled EDR Contact: 05/19/2014
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 07/24/2013
Date Made Active in Reports: 08/19/2013
Number of Days to Update: 26

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 01/20/2014
Next Scheduled EDR Contact: 05/05/2014
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 06/21/2013
Date Made Active in Reports: 08/05/2013
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 02/24/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 08/09/2013
Date Made Active in Reports: 09/27/2013
Number of Days to Update: 49

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/11/2013
Next Scheduled EDR Contact: 03/31/2014
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Health & Human Services
Telephone: 919-662-4499

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Environment & Natural Resources
Telephone: 919-733-2090

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

Appendix F
EEP Floodplain Requirements Checklist

Axiom Environmental, Inc.

Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, North Carolina 27603 919-270-9306

July 23, 2014

John Gerber, PE, CFM
State NFIP Coordinator
NC Floodplain Management Branch
4218 Mail Service Center
Raleigh, NC 27699-4218

Re: Abbey Lamm Stream and Wetland mitigation project in Alamance County **14-005**
FEMA Floodplain Requirements Checklist

Dear Mr. Gerber:

The purpose of this letter is to request concurrence from the National Flood Insurance Program (NFIP) concerning a stream and wetland restoration site located in Alamance County. The Site encompasses approximately 17.3 acres of agricultural land used for livestock grazing and hay production. A 3.5-acre farm pond is located at the downstream extent of the Site. Existing Site streams have been cleared, dredged of cobble substrate, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Proposed activities at the Site include the restoration of perennial and intermittent stream channels, enhancement of perennial stream channel, and restoration of riparian wetlands.

The project easement is depicted on the attached figures and lengths/priority of restoration are as follows.

Reach	**Length**	**Priority**
UT 1	687	Priority 1 Restoration
UT 2	455	Priority 1 Restoration
UT 3	1084	Priority 1 Restoration
Main Stem	3079	Priority 1 Restoration
Main Stem	403	Enhancement Level II

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel number 8787). Based on existing floodplain mapping, the site is not located in a Special Flood Hazard Area and the project should not alter FEMA flood zones. Therefore, a "Conditional Letter of Map Revision" (CLOMR) is not expected for this project. Please see the attached Project Location Map and Topographic Map for your review. Also please find attached three copies of the EEP Floodplain Requirements Checklist for your records.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced EEP Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

AXIOM ENVIRONMENTAL

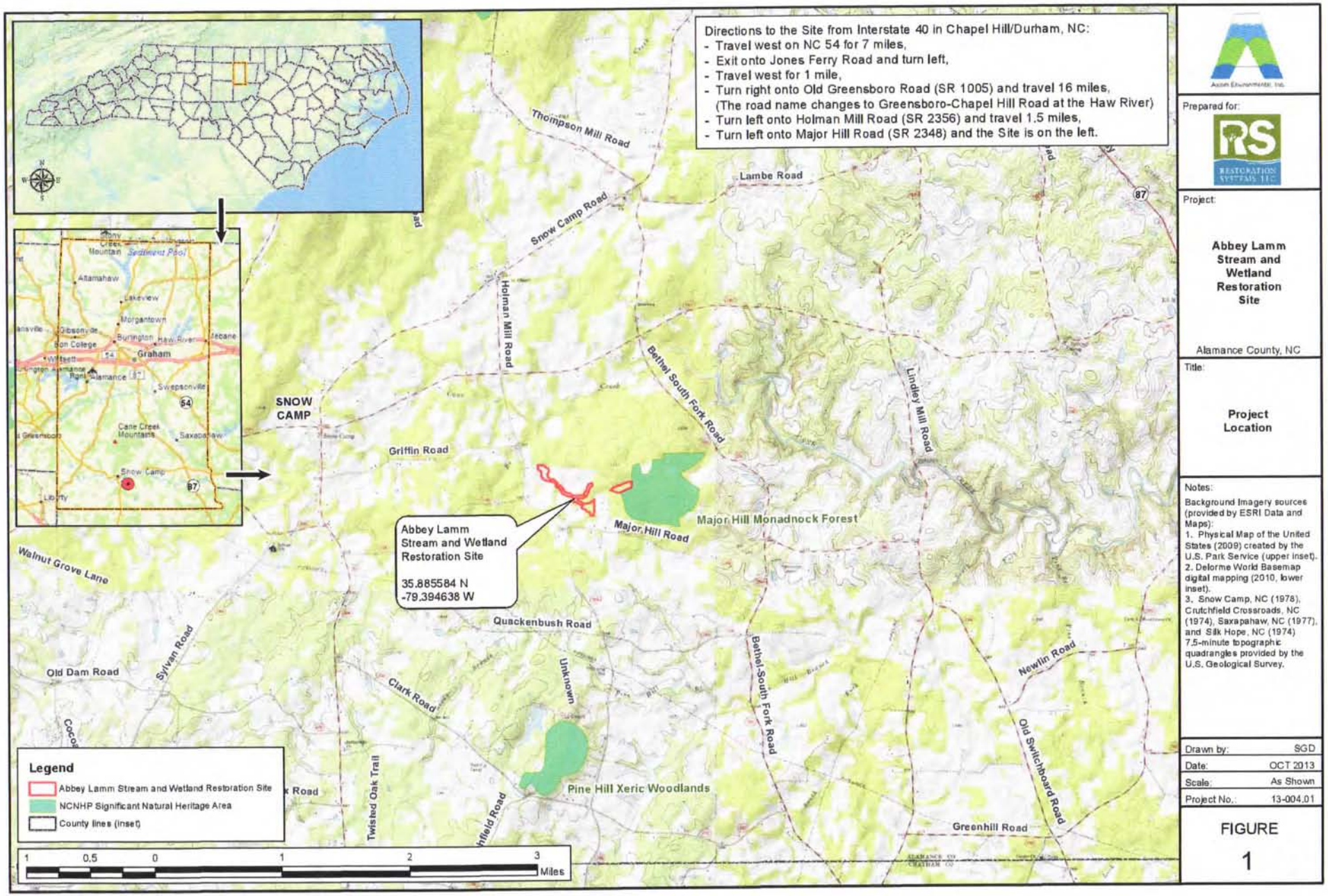
W Grant Lewis

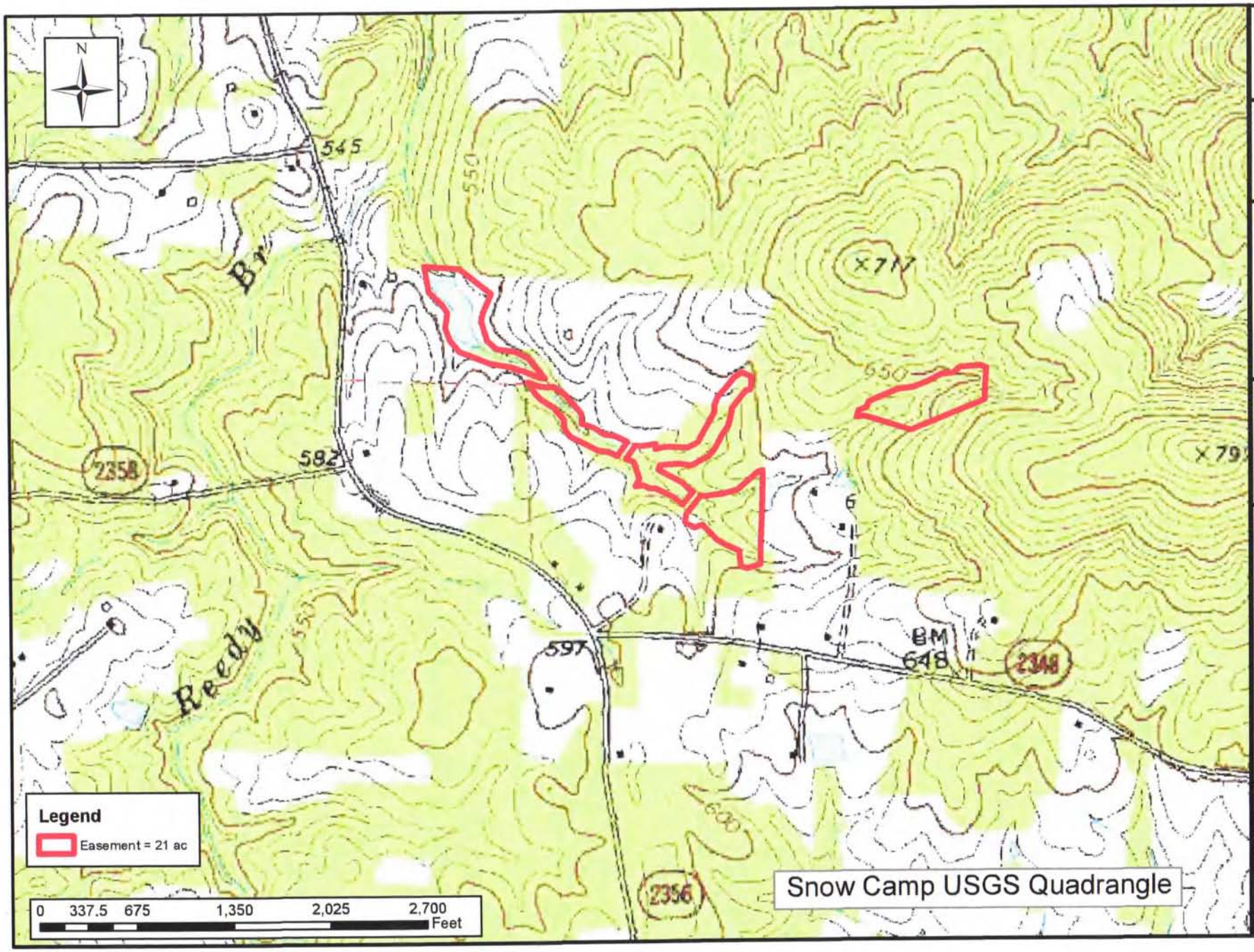
W. Grant Lewis
Senior Project Manager

Attachments

- Figure 1 Project Location
- Figure 2 Topography
- EEP Floodplain Requirements Checklist

Cc Raymond Holz
Kristie Corson
Jeff Schaffer


Directions to the Site from Interstate 40 in Chapel Hill/Durham, NC:
- Travel west on NC 54 for 7 miles,
- Exit onto Jones Ferry Road and turn left,
- Travel west for 1 mile,
- Turn right onto Old Greensboro Road (SR 1005) and travel 16 miles,
(The road name changes to Greensboro-Chapel Hill Road at the Haw River)
- Turn left onto Holman Mill Road (SR 2356) and travel 1.5 miles,
- Turn left onto Major Hill Road (SR 2348) and the Site is on the left.
Thompson Mill Road
Lambe Road
Snow Camp Road
Holman Mill Road
Bethel South Fork Road
Lindley Mill Road
SNOW CAMP
Griffin Road
Major Hill Road
Major Hill Monadnock Forest
Abbey Lamm Stream and Wetland Restoration Site
35.885584 N
-79.394638 W
Walnut Grove Lane
Quackenbush Road
Old Dam Road
Sylvan Road
Clark Road
Unknown
Bethel-South Fork Road
Newlin Road
Old Switchboard Road
Twisted Oak Trail
Pine Hill Xeric Woodlands
Greenhill Road
Legend
Abbey Lamm Stream and Wetland Restoration Site
NCNHP Significant Natural Heritage Area
County lines (inset)
1 0.5 0 1 2 3 Miles
Prepared for:
Project:
Abbey Lamm Stream and Wetland Restoration Site
Alamance County, NC
Title:
Project Location
Notes:
Background Imagery sources (provided by ESRI Data and Maps):
1. Physical Map of the United States (2009) created by the U.S. Park Service (upper inset).
2. Delorme World Basemap digital mapping (2010, lower inset).
3. Snow Camp, NC (1978), Crutchfield Crossroads, NC (1974), Saxapahaw, NC (1977), and Silk Hope, NC (1974) 7.5-minute topographic quadrangles provided by the U.S. Geological Survey.
Drawn by: SGD
Date: OCT 2013
Scale: As Shown
Project No.: 13-004.01
FIGURE
1



Axiom Environmental, Inc.

Prepared for:

Project:

Abbey Lamm Stream and Wetland Restoration Site

Alamance County, NC

Title:

TOPOGRAPHY

Notes:

Drawn by:	WGL
Date:	OCT 2013
Scale:	AS SHOWN
Project No.:	13-004.01

FIGURE

2

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Abbey Lamm Stream and Wetland Restoration Site
Name if stream or feature:	UT to Reedy Branch
County:	Alamance
Name of river basin:	Cape Fear
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Alamance
DFIRM panel number for entire site:	8787
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500". (See Attached)

Summarize stream reaches or wetland areas according to their restoration priority. (See Attached)

Example

Reach	Length	Priority
Example: Reach A	*1000*	*One (Restoration)*
Example: Reach B	*2000*	*Three (Enhancement)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

○ Yes ◉ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☐ AE Zone

- ○ Floodway
- ○ Non-Encroachment
- ◉ None

☐ A Zone

- ○ Local Setbacks Required
- ○ No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

○ Yes ◉ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

◉ Yes ○ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)

Name of Local Floodplain Administrator:
Phone Number:

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☑ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

☐ Other Requirements

List other requirements:

Comments:

Name: W. Grant Lewis Signature: W Grant Lewis

Title: President Date: 7/23/14

Appendix G
Performance Bond

The Hartford

Bond, T-4
One Hartford Plaza
Hartford, Connecticut 06155

Performance Bond

Bond No. **22BSBCN8026**

KNOW ALL MEN BY THESE PRESENTS, that we, **Restoration Systems, LLC**, as Principal, and **Hartford Fire Insurance Company**, licensed to do business in the State of, **NC** as Surety, are held and firmly bound unto **North Carolina Department of Environment and Natural Resources** (Obligee), in the penal sum of **One Million Nine Hundred Forty One Thousand Two Hundred Twenty Two Dollars ($1,941,222.00)** lawful money of the United States of America, for the payment of which sum, well and truly to be made, the Principal and Surety do bind themselves, their heirs, executors, administrators, and successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the above bounden Principal has entered into certain written **Contract # 5790 (RFP 16-005568)** with the above named Obligee, effective the **1st** day of **March, 2014** for **Abbey Lamm Site in the Cape Fear River Basin, Cataloging Unit 03030002** and more fully described in said Contract, a copy of which is attached, which Agreement is made a part hereof and incorporated herein by reference, except that nothing said therein shall alter, enlarge, expand or otherwise modify the term of the bond as set out below.

NOW, THEREFORE, if Principal, its executors, administrators, successors and assigns shall promptly and faithfully perform the Contract, according to the terms, stipulations or conditions thereof, then this obligation shall become null and void, otherwise to remain in full force and effect subject to the following:

Notwithstanding the provisions of the Contract, this bond will commence on the date of the submittal of Task 3 (submittal of Mitigation Plan) and remain in effect until the Contractor has received written notification from the EEP that the requirements of Task 6 (Submittal of Baseline Monitoring Report) have been met. After the successful completion of Task 6, the bonded obligation is retired.

Sealed with our seals and dated this **30** day of **September**, **2014**

Restoration Systems, LLC

Witness

Principal

HARTFORD FIRE INSURANCE COMPANY

Witness

Kenneth J. Peeples, Attorney-in-Fact

Agreed and acknowledged this ___ day of _____, 2014

By: _____

Obligee

POWER OF ATTORNEY

Direct Inquiries/Claims to:
THE HARTFORD
BOND, T-4
One Hartford Plaza
Hartford, Connecticut 06155
call: 888-266-3488 *or fax:* 860-757-5835

KNOW ALL PERSONS BY THESE PRESENTS THAT: **Agency Code: 22-270187**

- [X] **Hartford Fire Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [X] **Hartford Casualty Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [X] **Hartford Accident and Indemnity Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Hartford Underwriters Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Twin City Fire Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of Illinois**, a corporation duly organized under the laws of the State of Illinois
- [ ] **Hartford Insurance Company of the Midwest**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of the Southeast**, a corporation duly organized under the laws of the State of Florida

having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute and appoint, ***up to the amount of unlimited:***

Laura Krosky, Sandra B. Byrum, Southgate Jones III, Angela B. Britt, James P. Carter II, Phoebe Honeycutt, Kenneth J. Peeples, Kitara A. Smith, Heather K. Burroughs, Neil B. Biller, Bobbi D. Pendleton
of
Durham, NC

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by ☒, and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

In Witness Whereof, and as authorized by a Resolution of the Board of Directors of the Companies on January 22, 2004 the Companies have caused these presents to be signed by its Assistant Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.

Wesley W. Cowling, Assistant Secretary

M. Ross Fisher, Assistant Vice President

STATE OF CONNECTICUT }
COUNTY OF HARTFORD } ss. Hartford

On this 3rd day of November, 2008, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Assistant Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.

Scott E. Pascka
Notary Public
My Commission Expires October 31, 2012

CERTIFICATE

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of 9/30/14

Signed and sealed at the City of Hartford.

Gary W. Stumper, Assistant Vice President