RESTORATION PLAN
THREEMILE CREEK RESTORATION SITE
AVERY COUNTY, NORTH CAROLINA
(Contract #16-D06125-A)

FULL DELIVERY PROJECT
TO PROVIDE STREAM AND WETLAND MITIGATION
IN THE FRENCH BROAD RIVER BASIN
CATALOGING UNIT 06010108

Prepared for:

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EXECUTIVE SUMMARY

Restoration Systems, LLC is developing stream and wetland restoration plans for the **Threemile Creek Restoration Site** (Site) designed specifically to assist in fulfilling North Carolina Department of Environment and Natural Resources (NCDENR) Ecosystem Enhancement Program (EEP) restoration goals. The Site is located in southwestern Avery County within 14-digit Hydrologic Unit and Targeted Local Watershed 06010108010020 approximately 5.2 miles northeast of Spruce Pine, North Carolina. The Site encompasses approximately 26.7 acres, consisting of 12,384 linear feet of existing stream channels and riparian buffer along Threemile Creek, 12 unnamed tributaries to Threemile Creek, and Fork Creek, 2.5 acres of drained hydric soils, and 2.3 acres of disturbed wetlands. Approximately 6446 linear feet of stream restoration, 638 linear feet of stream enhancement (Level I), 875 linear feet of stream enhancement (Level II), 6744 linear feet of stream preservation, 2.5 acres of riverine wetland restoration, and 2.3 acres of riverine wetland enhancement are being proposed at the Site.

Site drainage features provide water quality functions to an approximately 5.1-square mile watershed at the Site outfall. The watershed is characterized by approximately 60 percent timber land, with the remainder comprised of agricultural land and sparse residential development. Agricultural land is characterized by strawberry production, Fraser fir Christmas tree farms, and ornamental nurseries. Impervious surfaces account for less than five percent of the upstream watershed land surface. The Site consists of Threemile Creek, 12 unnamed tributaries to Threemile Creek, Fork Creek, and adjacent floodplains, slopes, drained hydric soils, and forested wetlands.

Restoration of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Threemile Creek watershed. Restoration of onsite streams and wetlands will achieve the following goals:

1. Remove nonpoint and point sources of pollution associated with agricultural practices including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to the Site and b) provide a forested riparian buffer to treat surface runoff.
2. Reduce sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and plowing adjacent to Site streams and wetlands and b) planting a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablish stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promote floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; c) restoration of depressional floodplain wetlands and floodwater storage capacity within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters.
5. Improve aquatic habitat with bed variability and the use of in-stream structures upstream of a reach identified by the North Carolina Wildlife Resources Commission as supporting naturally reproducing rainbow trout populations.
6. Provide a terrestrial wildlife corridor and refuge in an area that is developed for agricultural production.

These goals will be achieved by:

- Restoring approximately 6446 linear feet of stream channel through construction of stable Ce- and E-type channels (Priority I), thereby reestablishing stable dimension, pattern, and profile.
- Enhancing (Level I) approximately 638 linear feet of stream channel by stabilizing banks and supplemental planting with native forest vegetation.
- Enhancing (Level II) approximately 875 linear feet of stream channel by supplemental planting with native forest vegetation.
- Preserving approximately 6744 linear feet of stream channel along a stable, forested reach.
- Restoring approximately 2.5 acres of riverine wetlands by reconstructing Site tributaries within the floodplain, filling ditched channels, rehydrating floodplain soils, and planting with native forest vegetation.
- Enhancing approximately 2.3 acres of cleared riverine wetlands by planting with native forest vegetation.
- Planting a native forested riparian buffer adjacent to restored streams and within Site floodplains and wetlands.
- Protecting the Site in perpetuity with a conservation easement.

This project complies with interagency guidelines outlined in *Information Regarding Stream Restoration with Emphasis on the Coastal Plain – Draft* (USACE et al 2007), *Stream Mitigation Guidelines* (USACE et al 2003), Mitigation Site Type (MiST) documentation (USEPA 1990), and *Compensatory Hardwood Mitigation Guidelines* (DOA 1993). Specifically Site selection, restoration goals, and monitoring procedures/objectives comply with project design considerations outlined by interagency guidance.

This document represents a detailed restoration plan summarizing activities proposed within the Site. The plan includes 1) details of existing conditions; 2) reference stream, wetland, and forest studies; 3) restoration plans; and 4) monitoring and success criteria. Upon approval of this plan, engineering construction plans will be prepared and activities implemented as outlined. Proposed restoration activities may be modified during the civil design stage due to constraints such as access issues, sediment-erosion control measures, drainage needs (floodway constraints), or other design considerations.

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1.0 PROJECT SITE IDENTIFICATION AND LOCATION

Restoration Systems, LLC is developing stream and wetland restoration plans for the Threemile Creek Restoration Site (hereafter referred to as the "Site") designed specifically to assist in fulfilling North Carolina Department of Environment and Natural Resources (NCDENR) Ecosystem Enhancement Program (EEP) restoration goals. The Site is located in southwestern Avery County approximately 5.2 miles northeast of Spruce Pine, North Carolina (Figure 1, Appendix A).

The Threemile Creek Restoration Site encompasses approximately 26.7 acres of land that is used for agricultural purposes. Approximately 12,384 linear feet of existing stream channels associated with Threemile Creek, 12 unnamed tributaries to Threemile Creek, and Fork Creek, 2.5 acres of historic floodplain/riverine wetlands, and 2.3 acres of existing cleared riverine wetlands exhibit mitigation potential. Agricultural practices including the maintenance and removal of riparian vegetation and relocation, dredging, and straightening of onsite streams have resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and reduced storage capacity and floodwater attenuation. Table 1 identifies and locates specific stream and wetland mitigation objectives in contrast to existing conditions.

Table 1. Project Mitigation Objectives

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Existing Linear Footage/ Acreage	Designed Linear Footage/ Acreage**	Comment
Threemile Creek	1+25-37+30	Restoration	1	3552	3557	Restoration of a straightened channel on new location.
	37+30-42+35	Enhancement I	2	505	505	Restoration of dimension and profile in the existing channel location.
Fork Creek	0+00-1+58	Enhancement II	NA	158	158	Removal of invasive species and supplemental planting.
Tributary 1	0+00-3+84	Restoration	1	172	384	Restoration of a straightened channel on new location.
Tributary 2	0+00-1+33	Enhancement I	2	133	133	Restoration of dimension and profile in the existing channel location.
	NA	Enhancement II	NA	351	351	Removal of invasive species and supplemental planting.
Tributary 3	0+00-3+40	Restoration	1	252	340	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	1808	1808	Preservation of existing reach
Tributary 4	Tributary 40+00-2+28	Restoration	1	136	216	Restoration of a ditched and disturbed channel on new location.
	NA	Enhancement II	NA	366	366	Removal of invasive species and supplemental planting.
Tributary 5	0+00-2+44	Restoration	1	150	232	Restoration of a ditched and disturbed channel on new location.

Tributary 5 Continued	NA	Preservation	NA	931	931	Preservation of stable, forested stream reaches.
Tributary 6a	0+00-2+03	Restoration	1	124	191	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	681	681	Preservation of stable, forested stream reaches.
Tributary 6b	0+00-1+49	Restoration	1	125	149	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	323	323	Preservation of stable, forested stream reaches.
Tributary 7	0+00-2+75	Restoration	1	146	259	Restoration of a ditched and disturbed channel on new location.
Tributary 8	0+00-7+66	Restoration	1	519	766	Restoration of a ditched and disturbed channel on new location.
	242	Restoration	1	242	242	Filling a ditched springhead systems and braiding restoration channel.
Tributary 9	0+00-0+43	NA	NA	0	43	Tie spring head to design channel.
Tributary 10	0+00-0+39	NA	NA	0	39	Tie spring head to design channel.
Tributary 11	0+00-1+10	Restoration	1	72	110	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	49	49	Preservation of stable, forested stream reaches.
Tributary 12	0+00-1+36	NA	NA	136	136	Tie spring head to design channel.
Preservation Tributaries	NA	Preservation	NA	2952	2952	Preservation of stable, forested stream reaches.
Riparian/ Riverine Wetlands	--	Restoration	--	--	2.5	Reconstructing site tributaries, filling ditched channels and ditches, rehydrating floodplain soils, and planting with native forest vegetation.
	--	Enhancement	--	--	2.3	Planting with native forest vegetation.

* Locations of each tributary and restoration type are depicted on Figures 6A-6C (Restoration Plan)
** Proposed design linear footage excludes crossings or areas outside of easement; therefore, is slightly shorter than stationing depicts.

Priority Approach 1 – Convert incised stream to stable stream at historic floodplain elevation
Priority Approach 2 – Convert incised stream to stable stream and reestablish floodplain at present location

1.1 Directions to the Site

- From Asheville or Raleigh, take I-40 to Marion; take NC 226 north through Linville Falls; go left on NC 194; site is ~4.5 miles on left
- Or, From Asheville take 19/23 North to 19E through Spruce Pine to NC 194
- Take a right on NC 194 and travel approximately 1.5 miles
- The Site is on the right
- Latitude, Longitude of Site: 35.9827°N, 81.9843°W (NAD83/WGS84)

1.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designation

The Site is located within the French Broad River Basin in 14-digit United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 06010108010020 North Carolina Division of Water Quality (NCDWQ) subbasin number 04-03-06 (Figure 2, Appendix A) (NCWRP 2005).

2.0 WATERSHED CHARACTERIZATION

2.1 Drainage Area

Threemile Creek has a watershed encompassing approximately 5.1 square miles at the Site outfall (Table 2 and Figure 3, Appendix A). The watershed is characterized by approximately 60 percent timber land, with the remainder comprised of agricultural land and sparse residential development. Agricultural land is characterized by livestock production, Fraser fir Christmas tree farms, and ornamental nurseries. Impervious surfaces account for less than five percent of the upstream watershed land surface. Onsite elevations range from a high of 3120 feet National Geodetic Vertical Datum (NGVD) on slopes to a low of approximately 2830 feet NGVD at the Site outlet (USGS Linville Falls, North Carolina 7.5-minute topographic quadrangle).

Table 2. Drainage Areas

Reach	Drainage Area	
	Acreage	Square Miles
Tributary 1	30	0.05
Tributary 2	20	0.03
Tributary 3	30	0.05
Tributary 4	10	0.02
Tributary 5	20	0.03
Tributary 6	15	0.02
Tributary 7	115	0.2
Tributaries 8-12	35	0.05
Preservation Tributaries	35	0.05
Fork Creek	1150	1.8
Threemile Creek (at Site outfall)	3252	5.1

2.2 Surface Water Classification/Water Quality

Within the Site, Threemile Creek and its tributaries have been assigned Stream Index Number 7-2-25-(0.7) and a Best Usage Classification of **WS-IV Tr** (NCDWQ 2007). Streams with a designation **WS-IV** are protected as water supplies, which are generally in moderately to highly developed watersheds. These waters are suitable for all Class C uses including 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 **Tr** (Trout Waters) includes areas protected for natural trout propagation and survival of stocked trout.

Threemile Creek and its tributaries are not listed on the NCDWQ final 2004 or draft 2006 303(d) lists; however, the receiving water of the North Toe River (Stream Index Number 7-2-[27.7]b) is listed on the draft 2006 303(d) list for impaired biological integrity and turbidity (NCDWQ 2006a, 2006b).

2.3 Physiography, Geology, and Soils

The Site is located in the Blue Ridge Physiographic Province in the Southern Crystalline Ridges and Mountains ecoregion of North Carolina within USGS Cataloging Unit 06010108 of the French Broad River Basin. Regional physiography is characterized by low to high mountains, gently rounded to steep slopes, narrow valleys, and high gradient streams with bedrock and boulder substrates (Griffith 2002).

Soils that occur within the Site, according to the *Soil Survey of Avery County, North Carolina* (USDA 1955) are described in Table 3.

Table 3. Soils Mapped within the Site

Soil Series	Hydric Status	Family	Description
Chandler	Nonhydric	*Typic Dystrudepts*	This series consists of very deep, somewhat excessively drained, moderately rapid permeable soils of gently to steeply sloping ridges and side slopes. Slopes are generally between 2 and 95 percent. Bedrock occurs at a depth of more than 60 inches.
Cullowhee	Nonhydric	*Fluvaquentic Dystrudepts*	This series consists of somewhat poorly drained, moderately rapid permeable soils on floodplains. Slopes are generally between 0 and 3 percent. These soils are very deep, with bedrock occurring at a depth of more than 80 inches.
Nikwasi	Class A	*Cumulic Humaquepts*	This series consists of poorly drained and very poorly drained, moderately rapid permeable soils on floodplains. Slopes are generally between 0 and 3 percent. Bedrock occurs at a depth of more than 60 inches.
Micaville	Nonhydric	*Typic Dystrudept*	This series consists of deep, somewhat excessively drained, moderately rapid permeable soils of ridges and side slopes. Slopes are generally between 8 and 95 percent. Bedrock occurs at a depth of more than 60 inches.
Saunook	Nonhydric	*Humic Hapludults*	This series consists of very deep, well-drained, moderately permeable soils on benches, fans, and toe slopes in coves. Slopes are generally between 2 and 60 percent. Bedrock occurs at a depth of more than 60 inches.
Thunder	Nonhydric	*Humic Hapludults*	This series consists of very deep, well-drained, moderately rapid permeable soils on colluvial toe slopes, in drainageways, and in coves. Slopes are generally between 2 and 80 percent. Bedrock occurs at a depth of more than 60 inches.

Two distinct land features occur within the Site boundaries: floodplain and side slope. Floodplains are underlain by soils of the Cullowhee, Saunook, and Nikwasi soil series. Side slopes are underlain by soils of the Saunook-Thunder complex and Chandler-Micaville complex.

Natural Resource Conservation Service mapping (USDA 1955) indicates that hydric soils within the Site are Nikwasi loam, which occurs centrally within the Site. Detailed soil mapping conducted by a licensed soil scientist on May 30, 2007 indicates that hydric soils also occur along the upper and lower reaches of the Site, as depicted in Figure 4 (Appendix A). Landscape alterations associated with current land use practices including ditching of the floodplain and rerouting of streams to the floodplain edge have resulted in a loss of hydrology to onsite hydric soils.

2.4 Historical Land Use and Development Trends

Land use within the Site watershed is dominated by forest, agricultural land, and sparse industrial/residential development (Table 4). Impervious surfaces account for less than 5 percent of the upstream watershed land surface.

Table 4. Drainage Area Land Use

Land Use	Acreage	Percentage
Forest Land	2552	78.5
Agricultural Land	630	19.4
Industrial/Residential Development	70	2.1
Total	**3252**	**100**

Onsite land use is characterized by agricultural land utilized for Christmas tree and ornamental landscape nursery plant production, timber harvest, and livestock grazing (Figure 4, Appendix A). Riparian vegetation adjacent to Site streams is primarily sparse and disturbed due to plowing and regular maintenance. In addition, the Site hydric soils may have historically been characterized as palustrine forested wetlands. Soils within these areas have been disturbed due to agricultural activities including regular plowing and vegetation maintenance, hoof shear from livestock, and the removal of groundwater hydrology inputs from the rerouting and straightening of Site tributaries.

2.5 Threatened and Endangered Species

Based on the most recently updated (05-10-07) county-by-county database of federally listed species in North Carolina as posted by the United States Fish and Wildlife Service (USFWS) at http://nc-es.fws.gov/es/countyfr.html, nine federally protected species are listed in Avery County. Table 5 lists these species and indicates if suitable habitat exists within the Site. An approved Categorical Exclusion Document is provided in Appendix E.

Table 5. Federally Protected Species for Avery County

Common Name	Scientific Name	Status*	Habitat Present Within Site	Biological Conclusion
Bog turtle	*Clemmys muhlenbergii*	Threatened (S/A)	Yes	N/A
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	Endangered	No	No Effect
Virginia big-eared bat	*Corynorhinus townsendii virginianus*	Endangered	No	No Effect
Spruce-fir moss spider	*Micohexura montivaga*	Endangered	No	No Effect
Blue Ridge goldenrod	*Solidago spithamaea*	Threatened	No	No Effect
Heller's blazing star	*Liatris helleri*	Threatened	No	No Effect
Roan Mountain bluet	*Hedyotis purpurea* var. *montana*	Endangered	No	No Effect
Spreading avens	*Geum radiatum*	Endangered	No	No Effect
Rock gnome lichen	*Gymnoderma lineare*	Endangered	No	No Effect

*Endangered = a taxon "in danger of extinction throughout all or a significant portion of its range"; Threatened = a taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range"; Threatened (S/A) = a species that is threatened due to similarity of appearance with other rare species and is listed for its protection; these species are not biologically endangered or threatened and are not subject to Section 7 consultation.

Bog Turtle

Suitable habitat does occur within the Site for the bog turtle; however, the portion of the site where this habitat occurs is not slated for construction activities. Furthermore, this species' status is threatened due to similarity of appearance (T (S/A)) with another rare species and is not subject to Section 7 consultation in North Carolina.

Virginia big-eared bat

The Virginia big-eared bat can forage in riparian areas, but usually nests or roosts in caves. No caves are located within the Site nor in areas adjacent to the Site. While it is appropriate to realize that bats of more than one species probably forage in or near the Site, it is a fact that nesting opportunities are not available for bats that require caves, or which utilize certain trees with exfoliating bark. Bitternut and shag-bark hickory are not found within the Site. Based on these factors it can be concluded that the project will have **No Effect** on the Virginia big-eared bat.

Most of the other listed species for Avery County depend upon high elevation (over 3300 feet) and/or rocky cliff habitats, which do not exist within the Site. This includes the Carolina northern flying squirrel, spruce-fir moss spider, Heller's blazing star, Blue Ridge goldenrod, Roan Mountain bluet,

spreading avens and rock gnome lichen. The Site is largely contained within a fluvial floodplain at or below 3000 feet in elevation; therefore, no suitable habitat exists for these species. Based on the absence of suitable habitat it is reasonable to conclude the project will have **No Effect** on these species.

North Carolina Natural Heritage Program (NCNHP) records were reviewed on March 7, 2006 and no known documents occur within the Site. Bog turtles were documented to occur approximately 1 mile northeast of the Site near the town of Pyatte and approximately 1 mile downstream/southwest of the Site near Mullin Hill. In addition, a Significant Natural Heritage Area, Mullin Hill Bog, and a Natural Community, Southern Appalachian Bog, are documented to occur approximately 1 mile southwest of the Site near Mullin Hill.

One designated unit of Critical Habitat for spruce-fir moss spider is located in Avery County; however, this habitat occurs above 5400 feet in elevation and the project will not affect this Designated Critical Habitat.

2.6 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). Concurrence has been received from SHPO for this project and is provided in Appendix E.

A thorough review of state and local data was performed prior to initiating field investigations. This review included the examination of archaeological records at the North Carolina Office of Stat Archeology (OSA), architectural records at the Survey and Planning Branch of the North Carolina Division of Archives and History, and historic documents, maps, and publications held at the State Library of North Carolina. All three repositories are located in Raleigh, North Carolina. Data collected during the background research provided information necessary to understand the historic context of any resources identified during the survey. The data also enabled an assessment of existing cultural resources within the project area.

Archaeological surveys were completed at the Site on April 17-18, 2007 by Legacy Research Associates, Inc. to locate, document, and conduct National Register of Historic Places (NRHP) eligibility evaluations for archaeological resources that may be affected by this project.

Archaeological investigations consisted of pedestrian surveys, informant interviews, and subsurface shovel testing within the project Area of Potential Effects (APE). Surveys resulted in the recording of three archaeological sites: 1) site 31AV120 located within the APE, 2) site 31AV119 adjoining the APE, and 3) site 31AV121** located outside the APE. Table 6 summarizes each of the sites; no further work is recommended for any of the sites; however the boundary of site 31AV119 adjoins the project APE and should not be used as a temporary staging area during construction. In site 31AV119 should be flagged as an avoidance area during construction implementation to ensure its integrity throughout project implementation. If the site cannot be avoided, further archaeological work will be necessary.

2.7 Interagency Guidance

This project complies with interagency guidelines outlined in *Information Regarding Stream Restoration with Emphasis on the Coastal Plain – Draft* (USACE et al 2007), *Stream Mitigation Guidelines* (USACE et al 2003), Mitigation Site Type (MiST) documentation (USEPA 1990), and *Compensatory Hardwood Mitigation Guidelines* (DOA 1993). Specifically Site selection, restoration goals, and monitoring procedures/objectives comply with project design considerations outlined by interagency guidance.

Table 6. Recorded Archaeological Sites

Site Number	Component(s)	Description	NRHP Eligibility Recommendation	Project Recommnedation
31AV119	Prehistoric, Middle Archaic to Early Woodland	Long-term habitation	Eligible under Criterion D for information potential	No further work; however, the boundary of the site adjoins the project APE and should not be used as a temporary staging area during construction
31AV120	Unknown Prehistoric	Lithic isolated find	Not eligible	No further work
31AV121**	Historic, early 19th century	Cemetery	Eligible under Criterion B for association with the lives of past significant persons	No further work, located outside project APE

NRHP – National Register of Historic Places

2.7.1 Site Selection

Site selection considerations including 8-digit Cataloging Unit; 14-digit Hydrologic Unit; physiographic region; wildlife habitat uplift; biological, chemical, and physical integrity; and flow regime were considered during Site selection and design. In addition, the Site is located in a Targeted Local Watershed (06010108010020), a water supply watershed, and, based on a meeting with North Carolina Wildlife Resources (NCWRC) representatives, is upstream from a reach of Threemile Creek that supports naturally reproducing populations of rainbow trout.

Based on recent guidance from USACE and NCDWQ (USACE et al 2007), the primary Site selection metric is flow regime and/or the historic presence of a stream prior to ditching or other impacts. This guidance suggests a minimum drainage basin of 50 acres, the presence of a defined valley with latitudinal and longitudinal slope, and soils conducive of natural stream formation.

Stream restoration reaches are characterized by drainage areas ranging from 0.02 to 5.1 square miles (10 to 3264 acres) which are situated in steeply sloped alluvial/colluvial floodplains. Although some Site tributaries are characterized by drainage areas smaller than 50 acres, mountain streams such as Site tributaries frequently originate at spring heads which are perennial. Onsite tributaries support characteristics (benthic macroinvertabrates, defined valleys, substrate different from the adjacent landscape, and hydrologic flow) indicative of a perennial flow regime.

2.7.2 Project Design Considerations

Site evaluations and goals focus on functional lift associated with project implementation. Agency guidance indicates that in the Mountain and Piedmont regions deforestation, stream channelization, and/or damage to the riparian buffer are most often targeted as potential restoration sites. Decreasing sinuosity and bank destabilization are primary indicators of increased sediment input and unnatural sediment transport, leading to degradation of water quality and habitat (USACE 2007). In addition elevated water temperatures and lack of well-developed structures and pools have a direct effect on resident and downstream trout populations.

2.7.3 Site Monitoring

In Mountain and Piedmont settings it is widely accepted that restoring pre-impacted pattern, dimension, and profile to impacted stream reaches and replacing structure will result in improved stability, water quality, and habitat (USACE 2007). In these systems, measuring physical properties of pattern,

dimension, and profile is typically appropriate for estimating function. Stream monitoring and success criteria associated with this project conform to these fundamental tenets.

2.8 Potential Constraints

The presence of conditions or characteristics that have the potential to hinder restoration activities on 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 Site constraints was acquired and reviewed. In addition, any Site conditions that have the potential to restrict the restoration design and implementation were documented during the field investigation.

No evidence of natural or man-made conditions was identified with the potential to impede the proposed restoration activities (see attached Categorical Exclusion Document in Appendix E).

2.8.1 Property Ownership and Boundaries

The Site is located within one parcel owned by the Spry family. A permanent conservation easement totaling 26.68 acres will encompass Site restoration activities.

2.8.2 Project Access

The Site is located immediately adjacent to Highway 194. A transportation plan, including the location of access routes and staging areas will be designed to minimize disturbance to the maximum extent feasible. The number of transportation access points into the floodplain will be maximized to avoid traversing long distances through the Site interior.

2.8.3 Utilities

Site restoration activities will not disturb any utilities.

2.8.4 FEMA/Hydrologic Trespass

A detailed HEC-RAS analysis is being conducted for this project to ensure that the project will not affect adjacent properties and will result in "no rise" to existing flood elevations. Currently the Site is not included in detailed FEMA studies of flood elevations; therefore, preparation of CLOMAR/LOMAR is not a requirement for this project. However, updated FEMA mapping is expected to be released later this year which may include the Site. Coordination with FEMA will be conducted, if necessary, prior to initiating Site construction activities. The HEC-RAS is discussed in more detail in Section 6.3 (HEC-RAS Analysis).

2.8.5 Trout Moratorium

Site reviews with NCWRC representative Bob Brown indicate that downstream reaches of Threemile Creek contain naturally reproducing populations of rainbow trout. Therefore a trout moratorium extending from January 1 to April 15 will be adhered to for this project. No ground disturbing activities will occur during the moratorium period unless coordination with NCWRC representatives occurs and compliance is received.

3.0 SITE STREAMS (EXISTING CONDITIONS)

Streams targeted for restoration include Threemile Creek, unnamed tributaries 1-12 to Threemile Creek, and Fork Creek, which have been dredged, straightened, rerouted, or otherwise impacted within the Site. 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). In addition, the lack of deep-rooted riparian vegetation, and continued clearing and dredging of Site steams have exacerbated erosion adjacent to Site channels. 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 Channel Classification

Stream geometry and substrate data have been evaluated to classify existing stream conditions based on a classification utilizing fluvial geomorphic principles (Rosgen 1996a). 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 Ce-type (moderately entrenched, high to moderate width-depth ratio) and E-type (moderately entrenched, low width-depth ratio) streams. 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. Locations of existing stream reaches and cross-sections are depicted in Figure 4 (Appendix A). Stream geometry measurements under existing conditions are summarized in the Morphological Stream Characteristics Table (Table 7) and Appendix B.

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. Existing stream characteristics are summarized below.

3.2 Discharge

Threemile Creek has an approximately 5.1-square mile watershed at the Site outfall and a bankfull discharge of 90 cubic feet per second. Site tributaries drainage areas range from 0.02 to 0.2-square mile with bankfull discharges ranging from 1.6 to 8.4 cubic feet per second, respectively.

3.3 Channel Morphology

Site streams have been impacted by land clearing, erosive flows, plowing, and manipulation of channels including straightening and rerouting. Plowing, deforestation, and hoof shear near stable streams typically leads to channel adjustments including increases in bank erosion, width/depth ratio, stream gradient, and sediment supply. In addition, these impacts may lead to decreases in channel sinuosity, meander-width-ratios, and sediment transport capacity (Rosgen 1996b). Onsite streams are expected to continue to erode and deposit sediment into receiving streams until a stable stream pattern has been carved from the adjacent floodplain.

Dimension: Site streams have been dredged and straightened and are classified as unstable Ce-type and E-type reaches. Cross-sectional areas of Site streams are approximately 2 to 4 times larger than predicted for this study. For example, the upstream reach of the Main Channel currently has a cross-sectional area of 79.8 to 141.5 square feet compared to the 36.5 square feet predicted by this study. Channel incision is indicated by bank-height ratios ranging from 1.5 to 2.5. The channels are currently characterized by eroding banks as the channels attempt to enlarge to a stable cross-sectional area as described in the evolutionary process outlined above.

Table 7. Morphological Stream Characteristics Table
Three Mile Stream and Wetland Restoration Site

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY	Existing Main Channel Upstream of Fork Creek	PROPOSED	Existing Main Channel Downstream of Fork Creek	PROPOSED	Existing Channel Fork Creek	PROPOSED	Tributaries	PROPOSED
Stream Type	Cb3	E4	Ce4	Ce4	E4	Ce4	E5	Ce4	E4/5	E4
Drainage Area (mi^2)	7.46	0.70	2.70	2.70	4.70	4.70	1.70	1.70	0.10	0.10
Bankfull Discharge (cfs)	75.3	28.7	56.3	56.3	84.4	84.4	40.2	40.2	5.1	5.1
Dimension Variables			**Dimension Variables**		**Dimension Variables**		**Dimension Variables**		**Dimension Variables**	
Bankfull Cross-Sectional Area (A_{bkf})	46.0	20.2	36.5	36.5	53.0	53.0	26.8	26.8	4.0	4.0
Existing Cross-Sectional Area ($A_{existing}$)	45.9 - 46.1	19.9 - 20.4	79.8 - 141.5	36.5	91.0 - 95.5	53.0	24.5 - 28.5	26.8	10.2 - 14.6	4.0
Bankfull Width (W_{bkf})	Mean: 30.1 Range: 27.2 - 33.0	Mean: 12.5 Range: 11.8 - 13.2	Mean: 20.7 Range: 17.4 - 23.0	Mean: 22.6 Range: 20.9 - 24.2	Mean: 20.7 Range: 18.7 - 22.6	Mean: 27.2 Range: 25.2 - 29.1	Mean: 12.5 Range: 12.0 - 13.0	Mean: 19.4 Range: 17.9 - 20.7	Mean: 5.3 Range: 4.4 - 6.1	Mean: 5.7 Range: 4.9 - 6.3
Bankfull Mean Depth (D_{bkf})	Mean: 1.6 Range: 1.4 - 1.7	Mean: 1.6 Range: 1.5 - 1.7	Mean: 1.8 Range: 1.6 - 2.1	Mean: 1.6 Range: 1.5 - 1.8	Mean: 2.6 Range: 2.3 - 2.8	Mean: 1.9 Range: 1.8 - 2.1	Mean: 1.9 Range: 1.8 - 2.0	Mean: 1.4 Range: 1.3 - 1.5	Mean: 0.8 Range: 0.7 - 0.9	Mean: 0.7 Range: 0.6 - 0.8
Bankfull Maximum Depth (D_{max})	Mean: 2.4 Range: 2.2 - 2.6	Mean: 1.9 Range:	Mean: 2.3 Range: 1.9 - 2.9	Mean: 2.1 Range: 2.0 - 2.3	Mean: 3.3 Range: 3.2 - 3.3	Mean: 2.5 Range: 2.3 - 2.7	Mean: 3.6 Range: 3.3 - 3.9	Mean: 1.8 Range: 1.7 - 2.0	Mean: 1.4 Range: 1.3 - 1.4	Mean: 0.8 Range: 0.7 - 1.0
Pool Width (W_{pool})	Mean: 24.4 Range: 23.8 - 25.0	Mean: 15.7 Range:	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 29.4 Range: 22.0 - 36.2	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 35.4 Range: 27.2 - 43.5	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 25.2 Range: 19.4 - 31.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 7.4 Range: 5.7 - 9.1
Maximum Pool Depth (D_{pool})	Mean: 2.7 Range: 2.6 - 2.7	Mean: 2.7 Range:		Mean: 2.7 Range: 1.9 - 3.5		Mean: 3.2 Range: 2.3 - 4.2		Mean: 2.4 Range: 1.7 - 3.1		Mean: 1.2 Range: 0.8 - 1.5
Width of Floodprone Area (W_{fpa})	Mean: 100.0 Range:	Mean: 75.0 Range:	Mean: 77.3 Range: 32.0 - 100.0	Mean: 75.0 Range: 50.0 - 100.0	Mean: 150.0 Range:	Mean: 150.0 Range: 80.0 - 200.0	Mean: 100.0 Range:	Mean: 100.0 Range: 75.0 - 125.0	Mean: 13.0 Range: 8.0 - 18.0	Mean: 15.0 Range: 8.0 - 20.0
Dimension Ratios			**Dimension Ratios**		**Dimension Ratios**		**Dimension Ratios**		**Dimension Ratios**	
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 3.4 Range: 3.0 - 3.7	Mean: 6.0 Range: 5.7 - 6.4	Mean: 3.9 Range: 1.5 - 5.7	Mean: 3.3 Range: 2.2 - 4.4	Mean: 7.3 Range: 6.6 - 8.0	Mean: 5.5 Range: 2.9 - 7.4	Mean: 8.0 Range: 7.7 - 8.3	Mean: 5.2 Range: 3.9 - 6.4	Mean: 2.4 Range: 1.8 - 3.0	Mean: 2.6 Range: 1.4 - 3.5
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 20.0 Range: 16.1 - 23.8	Mean: 7.8 Range: 7.0 - 8.5	Mean: 11.9 Range: 8.2 - 14.5	Mean: 14.0 Range: 12.0 - 16.0	Mean: 8.2 Range: 6.6 - 9.7	Mean: 14.0 Range: 12.0 - 16.0	Mean: 6.6 Range: 6.1 - 7.1	Mean: 14.0 Range: 12.0 - 16.0	Mean: 7.1 Range: 4.9 - 9.3	Mean: 8.0 Range: 6.0 - 10.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.6 Range: 1.5 - 1.6	Mean: 1.2 Range: 1.1 - 1.3	Mean: 1.3 Range: 1.2 - 1.4	Mean: 1.2 Range: 1.0 - 1.4	Mean: 1.3 Range: 1.2 - 1.4	Mean: 1.2 Range: 1.0 - 1.4	Mean: 1.9 Range: 1.7 - 2.2	Mean: 1.2 Range: 1.0 - 1.4	Mean: 1.7 Range: 1.4 - 2.0	Mean: 1.2 Range: 1.0 - 1.4
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.3 Range: 1.0 - 1.6	Mean: 1.0 Range:	Mean: 2.1 Range: 1.9 - 2.5	Mean: 1.0 Range: 1.0 - 1.3	Mean: 1.5 Range:	Mean: 1.0 Range: 1.0 - 1.3	Mean: 1.1 Range: 1.0 - 1.1	Mean: 1.0 Range: 1.0 - 1.3	Mean: 1.8 Range: 1.5 - 2.2	Mean: 1.0 Range: 1.0 - 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 1.7 Range: 1.6 - 1.9	Mean: 1.7 Range: 1.6 - 1.8	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 - 2.2	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 - 2.2	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 - 2.2	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 - 2.2
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 0.8 Range: 0.7 - 0.9	Mean: 1.3 Range: 1.2 -1.3		Mean: 1.3 Range: 1.0 - 1.6		Mean: 1.3 Range: 1.0 - 1.6		Mean: 1.3 Range: 1.0 - 1.6		Mean: 1.3 Range: 1.0 - 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 0.9 Range: 0.9 - 1.0	Mean: 1.4 Range: 1.4 - 1.5		Mean: 1.4 Range: 1.0 - 1.8		Mean: 1.4 Range: 1.0 - 1.8		Mean: 1.4 Range: 1.0 - 1.8		Mean: 1.4 Range: 1.0 - 1.8

Table 7. Morphological Stream Characteristics Table (continued)
Three Mile Stream and Wetland Restoration Site

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY	Existing Main Channel Upstream of Fork Creek	PROPOSED	Existing Main Channel Downstream of Fork Creek	PROPOSED	Existing Channel Fork Creek	PROPOSED	Tributaries	PROPOSED
Pattern Variables			**Pattern Variables**		**Pattern Variables**		**Pattern Variables**		**Pattern Variables**	
Pool to Pool Spacing (L_{p-p})	Med: 104.3 Range: 65.2 - 166.7	Med: 54.8 Range: 37.0 - 82.6	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 90.4 Range: 67.8 - 135.6	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 126.0 Range: 75.6 - 176.4	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 77.6 Range: 58.2 - 116.4	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 22.8 Range: 17.1 - 34.2
Meander Length (L_m)	Med: 199.4 Range: 101.7 - 273.2	Med: 103.8 Range: 76.6 - 131.0		Med: 192.1 Range: 135.6 - 226.0		Med: 214.2 Range: 151.2 - 252.0		Med: 164.9 Range: 116.4 - 194.0		Med: 48.5 Range: 34.2 - 57.0
Belt Width (W_{belt})	Med: 46.8 Range: 40.0 - 55.0	Med: 23.3 Range: 16.0 - 27.6		Med: 45.2 Range: 27.1 - 67.8		Med: 50.4 Range: 30.2 - 75.6		Med: 38.8 Range: 23.3 - 58.2		Med: 11.4 Range: 6.8 - 17.1
Radius of Curvature (R_c)	Med: 94.5 Range: 62.4 - 312.1	Med: 47.0 Range: 30.5 - 65.7		Med: 90.4 Range: 45.2 - 226.0		Med: 100.8 Range: 50.4 - 252.0		Med: 77.6 Range: 38.8 - 194.0		Med: 22.8 Range: 11.4 - 57.0
Sinuosity (Sin)	1.20	1.04	1.08	1.10	1.08	1.10	1.08	1.10	1.08	1.10
Pattern Ratios			**Pattern Ratios**		**Pattern Ratios**		**Pattern Ratios**		**Pattern Ratios**	
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 3.5 Range: 2.2 - 5.5	Med: 4.4 Range: 3.0 - 6.6	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 - 6.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 - 6.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 - 6.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 -6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 6.6 Range: 3.4 - 9.1	Med: 8.3 Range: 6.1 - 10.5		Med: 8.5 Range: 6.0 - 10.0		Med: 8.5 Range: 6.0 - 10.0		Med: 8.5 Range: 6.0 - 10.0		Med: 8.5 Range: 6.0 - 10.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 1.6 Range: 1.3 - 1.8	Med: 1.8 Range: 1.3 - 2.2		Med: 2.0 Range: 1.2 - 3.0		Med: 2.0 Range: 1.2 - 3.0		Med: 2.0 Range: 1.2 - 3.0		Med: 2.0 Range: 1.2 - 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 3.1 Range: 2.1 - 10.4	Med: 3.8 Range: 2.4 - 5.3		Med: 4.0 Range: 2.0 - 10.0		Med: 4.0 Range: 2.0 - 10.0		Med: 4.0 Range: 2.0 - 10.0		Med: 4.0 Range: 2.0 - 10.0
Profile Variables			**Profile Variables**		**Profile Variables**		**Profile Variables**		**Profile Variables**	
Average Water Surface Slope (S_{ave})	0.0121	0.0112	0.0103	0.0097	0.0103	0.0097	0.0103	0.0102	0.0103	0.0102
Valley Slope (S_{valley})	0.0131	0.0116	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112	0.0112
Riffle Slope (S_{riffle})	Mean: 0.0118 Range: 0.0026 - 0.0183	Mean: 0.0195 Range: 0.0178 - 0.0225	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0243 Range: 0.0194 - 0.0291	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0243 Range: 0.0194 - 0.0291	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0255 Range: 0.0204 - 0.0306	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0255 Range: 0.0204 - 0.0306
Pool Slope (S_{pool})	Mean: 0.0097 Range: 0 - 0.0254	Mean: 0.0015 Range: 0.0002 - 0.0036		Mean: 0.0019 Range: 0 - 0.0039		Mean: 0.0019 Range: 0 - 0.0039		Mean: 0.0020 Range: 0 - 0.0041		Mean: 0.0020 Range: 0 - 0.0041
Run Slope (S_{run})	Mean: 0.0085 Range: 0.0030 - 0.0202	Mean: 0 Range:		Mean: 0.0039 Range: 0 - 0.0078		Mean: 0.0039 Range: 0 - 0.0078		Mean: 0.0041 Range: 0 - 0.0082		Mean: 0.0041 Range: 0 - 0.0082
Glide Slope (S_{glide})	Mean: 0.0041 Range: 0 - 0.0083	Mean: 0.0028 Range: 0.0001 - 0.0054		Mean: 0.0029 Range: 0 - 0.0078		Mean: 0.0029 Range: 0 - 0.0078		Mean: 0.0031 Range: 0 - 0.0082		Mean: 0.0031 Range: 0 - 0.0082
Profile Ratios			**Profile Ratios**		**Profile Ratios**		**Profile Ratios**		**Profile Ratios**	
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 0.98 Range: 0.21 - 1.51	Mean: 1.74 Range: 1.59 - 2.01	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50 Range: 2.0 - 3.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50 Range: 2.0 - 3.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50 Range: 2.0 - 3.0	No distinctive repetitive pattern of riffles and pools due to staightening activities	Mean: 2.50 Range: 2.0 - 3.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.80 Range: 0 - 2.10	Mean: 0.13 Range: 0.02 - 0.32		Mean: 0.20 Range: 0 - 0.4		Mean: 0.20 Range: 0 - 0.4		Mean: 0.20 Range: 0 - 0.4		Mean: 0.20 Range: 0 - 0.4
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.70 Range: 0.25 - 1.67	Mean: 0.00 Range:		Mean: 0.40 Range: 0 - 0.8		Mean: 0.40 Range: 0 - 0.8		Mean: 0.40 Range: 0 - 0.8		Mean: 0.40 Range: 0 - 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.34 Range: 0 - 0.69	Mean: 0.25 Range: 0.01 - 0.48		Mean: 0.30 Range: 0 - 0.8		Mean: 0.30 Range: 0 - 0.8		Mean: 0.30 Range: 0 - 0.8		Mean: 0.30 Range: 0 - 0.8

Pattern: Straightening of the channels has resulted in a loss of pattern variables such as belt-width, meander wavelength, pool-to-pool spacing, and radius of curvature. The channels are currently characterized by low sinuosities of 1.08 (thalweg distance/straight-line distance) with no distinct repetitive pattern of riffles and pools due to straightening activities.

Profile: The average water surface slope for the Site measures approximately 0.0103 (rise/run). Typically, dredging and straightening will oversteepen a channel reducing channel length over a particular drop in valley slope. In addition, dredging and straightening channels disturbs perpendicular flow vectors that maintain riffles and pools, resulting in headcuts, oversteepened riffles, and loss of pools.

The channel is characterized by a lack of pools, structure, woody debris, coarse substrate, and gravel glides which are primary feeding and nesting habitat features for resident trout populations.

Substrate: Channel substrate is characterized by gravel- or sand-sized particles. Stable, undisturbed streams in the area are characterized by cobble and gravel substrate with gravel in pools and glides. Existing fine grained substrate results from excessive bank erosion and a lack of sediment transport capacity in the onsite streams.

3.4 Channel Stability Assessment

3.4.1 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/ft^3), g = gravitational acceleration (ft/s^2), Q = discharge (ft^3/sec), and s = energy slope (ft/ft). The specific weight of water (γ = 62.4 lb/ft^3) 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.

3.4.2 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/ft^2), 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:

$$\tau_{max} = 2.65\tau(R_c / W_{bkf})^{-0.5}$$

where R_c = radius of curvature (ft) and W_{bkf} = 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:

$$\omega = \rho g Q s = \tau v$$

where ω = stream power per unit of bed area (N/ft-sec, Joules/sec/ft^2), τ = shear stress, and v = average velocity (ft/sec). Similarly,

$$\omega = \Omega / W_{bkf}$$

where W_{bkf} = width of stream at bankfull (ft).

3.4.3 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 8. 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 that the channel is neither aggrading nor degrading. Results of the analysis indicate that proposed channel reaches are expected to maintain stream power as a function of width values comparable to that of the reference reaches when taking into consideration the watershed side and expected bankfull discharge and far below existing values for degraded reaches.

Stream power and shear stress values are higher for the existing, dredged and straightened reaches than for proposed channels. Existing reaches are degrading as evidenced by bank erosion, channel incision, and bank-height ratios ranging from 1.5 to 2.5; degradation has resulted from a combination of water surface slopes that have been steepened, channel straightening, dredging, and trampling by livestock. Stream power and shear stress values for the proposed channels should be lower than for existing channels to effectively transport sediment through the Site without eroding and downcutting, resulting in stable channel characteristics.

Reference reach values for stream power and shear stress are similar to values for the proposed Threemile Creek channel. Values are slightly higher than for the proposed tributaries; however, the watershed sizes and bankfull discharges are larger resulting in higher stream power and shear stress values. The reference reaches are characterized by fully forested riparian fringes and are therefore able to resist stream power and shear stress of these magnitudes. However, the proposed channels will be devoid of deep-rooted vegetation; therefore, proposed targets for stream power and shear stress values should be slightly less than predicted for the reference reach.

3.5 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). Current research also estimates the bankfull discharge would be expected to occur approximately every 1.3 to 1.5 years (Rosgen 1996a, Leopold 1994).

Table 8. Stream Power (Ω) and Shear Stress (τ) Values

	Discharge (ft^2/s)	Water Surface Slope (ft/ft)	Total Stream Power (Ω)	Total Stream Power/Bankfull Width (Ω/W)	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
Threemile Creek (upstream)	56.3	0.0103	36.19	1.75	4.55	2.93	0.51	1.49	4.39
Threemile Creek (downstream)	84.4	0.0103	54.25	2.62	3.60	2.31	0.91	2.09	3.47
Tributaries	5.1	0.0103	3.28	0.62	1.80	1.16	0.41	0.48	1.73
Reference Reaches									
Stone Mountain Reference	75.3	0.0121	56.83	1.89	1.38	1.04	1.64	1.71	1.56
Cranberry Reference	28.7	0.0112	20.06	1.60	1.29	0.90	1.42	1.28	1.35
Proposed Conditions									
Threemile Creek (upstream)	56.3	0.0097	34.08	1.51	1.41	0.86	1.54	1.32	1.28
Threemile Creek (downstream)	84.4	0.0097	51.09	1.88	1.71	1.03	1.59	1.65	1.55
Tributaries	5.1	0.0102	3.25	0.57	0.56	0.36	1.28	0.46	0.54

The Site is located in the Mountain Physiographic province; therefore, regional curves for the Mountains (Harman et al. 2001) were utilized and verified by regional regression equations, Cowan's roughness equation method, and reference stream data.

Based on available Mountain regional curves, the bankfull discharge is approximately 139.1 cubic feet per second for Stone Mountain, 24.7 cubic feet per second for Cranberry Creek, and 99.3 cubic feet per second for the onsite cross-section with bankfull indicators (Harman et al. 2001). The USGS regional regression equation for the Blue Ridge-Piedmont region indicates that bankfull discharge for Stone Mountain, Cranberry Creek, and the onsite cross-section with bankfull indicators at a 1.3 to 1.5 year return interval average approximately 385 to 410 cubic feet per second, 65 to 80 cubic feet per second, and 260 to 300 cubic feet per second, respectively (USGS 2003), which are above estimates based on field indicators and regional curves as discussed below (plots are included in Appendix C). In addition, a stream roughness coefficient (n) was estimated using a version of Arcement and Schneider's (1989) weighted method for Cowan's (1956) roughness component values and applied to the following equation (Manning 1891) to obtain a bankfull discharge estimate.

$$Qbkf = [1.486/n] * [A*R2/3*S1/2]$$

where, A equals bankfull area, R equals bankfull hydraulic radius, and S equals average water surface slope. The Manning's "n" method indicates that bankfull discharge for averages approximately 206.5 cubic feet per second for Stone Mountain, 102.6 cubic feet per second for Cranberry Creek, and 234.2 cubic feet per second for the onsite cross-section, which are also above estimates based on field indicators and regional curves as discussed below.

Field indicators of bankfull and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches and onsite cross-section. The Mountain 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 75.3 cubic feet per second for Stone Mountain, 28.7 for Cranberry Creek, and 84.4 for the onsite cross-section, which is approximately 54 percent, 116 percent, and 85 percent of that predicted by the Mountain regional curves.

To verify regional curves and USGS regression models gauged streams are typically analyzed to determine a return interval for momentary peak discharges. However, no stations are located within Avery County; stations located in the surrounding counties have drainage areas of 60-plus square miles that are not comparable to the 0.7 and 7.5-square mile reference sites.

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 onsite cross-section with bankfull indicators and an average of the two reference site, which resulted in an area 85 percent of the size indicated by Mountain regional curves. Table 9 summarizes all methods analyzed for estimating bankfull discharge.

3.6 Vegetation

The Site is characterized predominately by agricultural land utilized for strawberry production, Fraser fir Christmas tree farms, and ornamental nurseries. The Site is regularly maintained and cleared in support of land use practices leaving soils disturbed and exposed to the edges of the stream banks. South facing slopes are characterized by mesic hardwood forest that is frequently harvested for timber. North facing slopes are characterized by evergreen stands and are suitable for Fraser fir Christmas tree farming, which is a large economic feature of Avery County. Riparian vegetation adjacent to Site streams is predominantly disturbed (Figure 4, Appendix A).

Table 9. Reference Reach Bankfull Discharge Analysis

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
Onsite Cross-section with Bankfull Indicators			
Mountain Regional Curves (Harman et al. 2001)	4.7	1.3 – 1.5	99.3
Blue Ridge-Piedmont Regional Regression Model (USGS 2003)	4.7	1.3 – 1.5	260 - 300
Manning's "n" using Cowan's Method (1956)	4.7	NA	234.2
Field Indicators of Bankfull	4.7	1.3 – 1.5	84.4
Stone Mountain Reference Reach			
Mountain Regional Curves (Harman et al. 2001)	7.5	1.3 – 1.5	139.1
Blue Ridge-Piedmont Regional Regression Model (USGS 2003)	7.5	1.3 – 1.5	385 - 410
Manning's "n" using Cowan's Method (1956)	7.5	NA	206.5
Field Indicators of Bankfull	7.5	1.3 – 1.5	75.3
Cranberry Creek Reference Reach			
Mountain Regional Curves (Harman et al. 2001)	0.7	1.3 – 1.5	24.7
Blue Ridge-Piedmont Regional Regression Model (USGS 2003)	0.7	1.3 – 1.5	65 - 80
Manning's "n" using Cowan's Method (1956)	0.7	NA	102.6
Field Indicators of Bankfull	0.7	1.3 – 1.5	28.7

4.0 REFERENCE STREAMS

Distinct bankfull indicators were present within the reference stream channels. In addition, dimension, pattern, and profile variables have not been altered or degraded, allowing for assistance with the proposed restoration reaches (Figure 5A-B, Appendix A).

4.1 Stone Mountain Reference Reach

4.1.1 Watershed Characterization

Stone Mountain is located in northern Wilkes County in Stone Mountain State Park (Figure 1, Appendix A). Alterations, development, and impervious surfaces within the watershed are minimal.

4.1.2 Channel Classification

Stream geometry and substrate data have been evaluated to classify the reference reach based on a classification utilizing fluvial geomorphic principles (Rosgen 1996a). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. The reference reach is characterized as a Cb-type, low sinuosity (1.08) channel with a cobble-dominated substrate. Cb-type streams are characterized as slightly to moderatly entrenched, riffle-pool channels exhibiting a moderate to high width-depth ratio. Cb-type streams often occur in narrower valleys with moderately-developed alluvial floodplains.

4.1.3 Discharge

The reference stream has an approximately 7.5-square mile watershed and a bankfull discharge of 75.3 cubic feet per second based on bankfull indicators.

4.1.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream (Figure 5A, Appendix A). The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table 7).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 46.0 square feet, a bankfull width of 30.1 feet, a bankfull depth of 1.6 feet, and a width-to-depth ratio of 20.0. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 85.0 square feet for the approximate 7.5-square mile watershed (Harman et al. 2001), slightly above the 46.0-square feet displayed by channel bankfull indicators identified in the field. For a more detailed discussion on bankfull verification see Section 3.5 (Bankfull Verification).

The reference reach exhibits a bank-height ratio averaging 1.3, which is slightly high for a stable Cb-type channel. In addition, the width of the floodprone area is approximately 100 feet giving the channel an entrenchment ratio of 3.0 to 3.7, typical of a stable C-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.2 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio ($L_{p\text{-}p}/W_{bkf}$) of 3.5, a meander wavelength ratio (L_m/W_{bkf}) of 6.6, and a radius of curvature ratio (R_c/W_{bkf}) of 3.1. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0131 (rise/run). Ratios of the reference reach riffle, run, pool, and glide slopes to average water surface slope are 0.98, 0.80, 0.70, and 0.34, respectively.

Substrate: The channel is characterized by a channel substrate dominated by cobble-sized particles.

4.2 Cranberry Creek Reference Reach

4.2.1 Watershed Characterization

Cranberry Creek is located in Burke County east of the Site (Figure 1, Appendix A). Alterations, development, and impervious surfaces within the watershed are minimal.

4.2.2 Channel Classification

The reference reach is characterized as an E-type, low sinuosity (1.04) channel with a cobble-dominated substrate. E-type streams are characterized as slightly entrenched, riffle-pool channels. 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.

4.2.3 Discharge

The reference stream has an approximately 0.7-square mile watershed and a bankfull discharge of 28.7 cubic feet per second based on bankfull indicators.

4.2.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream (Figure 5B, Appendix A). The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table 7).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 20.2 square feet, a bankfull width of 12.5 feet, a bankfull depth of 1.6 feet, and a width-to-depth ratio of 7.8. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 17.4 square feet for the approximate 0.7-square mile watershed (Harman et al. 2001), slightly below the 20.2-square feet displayed by channel bankfull indicators identified in the field. For a more detailed discussion on bankfull verification see Section 3.5 (Bankfull Verification).

The reference reach exhibits a bank-height ratio of 1.0, which is representative of a stable E-type channel. In addition, the width of the floodprone area is approximately 75 feet giving the channel an entrenchment ratio of 5.7 to 6.4, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.04 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio (L_{p-p}/W_{bkf}) of 4.4, a meander wavelength ratio (L_m/W_{bkf}) of 8.3, and a radius of curvature ratio (R_c/W_{bkf}) of 3.8. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0116 (rise/run). Ratios of the reference reach riffle, run, pool, and glide slopes to average water surface slope are 1.74, 0.13, 0, and 0.25, respectively.

Substrate: The channel is characterized by a channel substrate dominated by Cobble-sized particles.

4.3 Reference Forest Ecosystem

According to Mitigation Site Classification (MiST) guidelines (USEPA 1990), a Reference Forest Ecosystem (RFE) must be established for restoration sites. RFEs are forested areas on which to model restoration efforts of the restoration site in relation to soils and vegetation. RFEs should be ecologically stable climax communities and should represent believed historical (predisturbance) conditions of the restoration site. Quantitative data describing plant community composition and structure are collected at the RFEs and subsequently applied as reference data for design of the restoration Site planting scheme.

The RFE for this project is located on the Stone Mountain Reference reach. 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	
Canopy Species	**Understory Species**
white pine (*Pinus strobus*)	dogwood (*Cornus florida*)
white oak (*Quercus alba*)	ironwood (*Carpinus caroliniana*)
sycamore (*Platanus occidentalis*)	spice bush (*Lindera benzoin*)
black locust (*Robinia pseudoacacia*)	rhododendron (*Rhododendron* sp.)
red maple (*Acer rubrum*)	wild azalea (*Rhododendron periclymenoides*)
red oak (Q*uercus* sp.)	strawberry bush (*Euonymous americana*)
black cherry (*Prunus serotina*)	
tulip poplar (*Liriodendron tulipifera*)	
hemlock (*Tsuga* sp.)	

5.0 SITE WETLAND (EXISTING CONDITIONS)

5.1 Jurisdictional Wetlands

Jurisdictional wetland limits are defined using criteria set forth in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). As stipulated in this manual, the presence of three clearly defined parameters (hydrophytic vegetation, hydric soils, and evidence of wetland hydrology) are required for a wetland jurisdictional determination.

Hydric soil limits were mapped in the field during May 2007 by a Licensed Soil Scientist. Based on field surveys, approximately 2.3 acres of cleared jurisdictional wetlands currently occur within the Site enhancement areas (Figure 4, Appendix A). An additional 2.5 acres of drained hydric soils occur within the Site restoration areas. The drained hydric soils have been significantly disturbed by compaction due to agricultural practices; relocation, dredging, straightening, and rerouting of Site streams; ditching of fields; and removal of vegetation and are effectively drained below jurisdictional wetland hydrology thresholds.

During stream enhancement and restoration implementation approximately 0.3 to 0.5 acres of jurisdictional wetland will be temporarily impacted. Specifically, Tributary 2 will be enhanced and Tributary 3 will be restored within the jurisdictional wetland area boundaries (Stream Enhancement and Restoration is described in Section 6.2 Restoration Plan). Upon completion of stream enhancement/restoration activities, the jurisdictional wetlands will be enhanced through vegetative plantings and will continue to exhibit jurisdictional wetland characteristics.

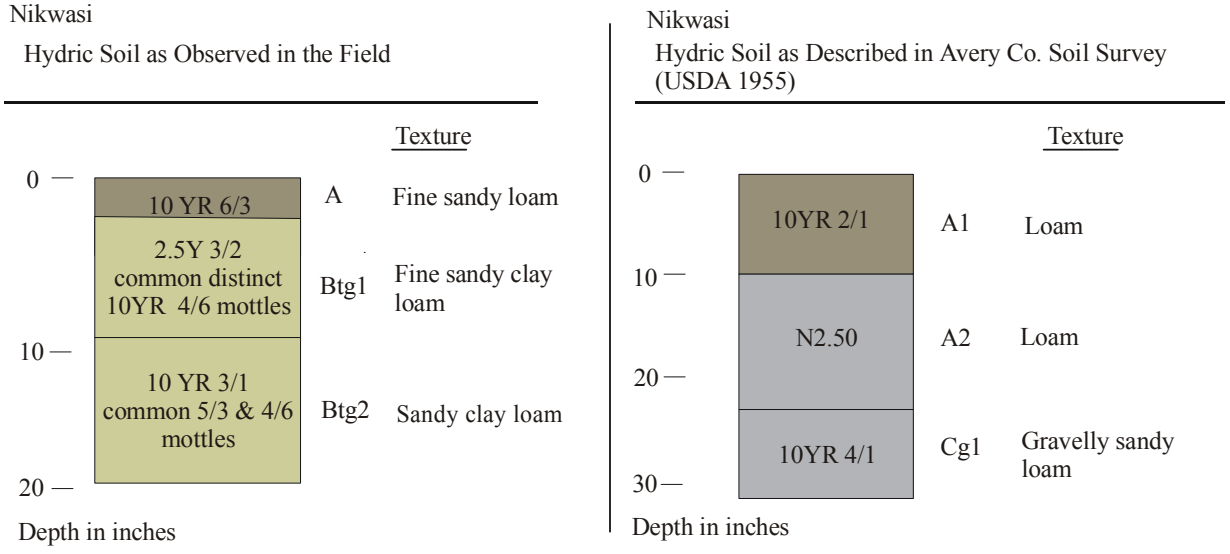
5.2 Hydrological Characterization

Areas of the Site targeted for riverine wetland restoration will receive hydrological inputs from periodic overbank flooding of the restored tributaries, groundwater migration into the wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation.

5.3 Soil Characteristics

Restorable portions of the Site are underlain by hydric Nikwasi soils. Soils have been impacted by plowing, land clearing, ditching, agricultural production, in addition to landscape alterations associated with dredging and straightening of stream channels. A typical profile is as follows.

Soil Profiles (Boring Log)



5.4 Plant Community Characterization

Historically, Site wetlands may have supported a community similar to a Piedmont/Low Mountain Alluvial Forest (Schafale and Weakley 1990). Piedmont/Low Mountain Alluvial Forest communities typically occur on river and stream floodplains and are seasonally or intermittently flooded.

Typical species of this community, according to Schafale and Weakley include river birch (*Betula nigra*), sycamore (*Platanus occientalis*), sweetgum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), American elm (*Ulmus americana*), hackberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformis*), and shagbark hickory (*Carya ovata*). Understory species typically include ironwood (*Carpinus caroliniana*), box elder (*Acer negundo*), red maple (*Acer rubrum*), pawpaw (*Asiminia triloba*), and American holly (*Ilex opaca*).

6.0 SITE RESTORATION PLAN

6.1 Project Goals

Restoration of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Threemile Creek watershed. Restoration of onsite streams and wetlands will achieve the following goals:

1. Remove nonpoint and point sources of pollution associated with agricultural practices including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to the Site and b) provide a forested riparian buffer to treat surface runoff.
2. Reduce sedimentation within onsite and downstream receiving waters by a) reducing bank erosion associated with vegetation maintenance and plowing adjacent to Site streams and wetlands and b) planting a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablish stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promote floodwater attenuation by a) reconnecting bankfull stream flows to the abandoned floodplain terrace; b) restoring secondary, dredged, straightened, and entrenched tributaries, thereby reducing floodwater velocities within smaller catchment basins; c) restoration of depressional floodplain wetlands and floodwater storage capcity within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters.
5. Improve aquatic habitat with bed variability and the use of in-stream structures upstream of a reach identified by the North Carolina Wildlife Resources Commission as supporting naturally reproducing rainbow trout populations.
6. Provide a terrestrial wildlife corridor and refuge in an area that is developed for agricultural production.

These goals will be achieved by:

- Restoring approximately 6446 linear feet of stream channel through construction of stable Ce- and E-type channels (Priority I), thereby reestablishing stable dimension, pattern, and profile.
- Enhancing (Level I) approximately 638 linear feet of stream channel by stabilizing banks and supplemental planting with native forest vegetation.
- Enhancing (Level II) approximately 875 linear feet of stream channel by supplemental planting with native forest vegetation.
- Preserving approximately 6744 linear feet of stream channel along a stable, forested reach.
- Restoring approximately 2.5 acres of riverine wetlands by reconstructing Site tributaries within the floodplain, filling ditched channels, rehydrating floodplain soils, and planting with native forest vegetation.
- Enhancing approximately 2.3 acres of cleared riverine wetlands by planting with native forest vegetation.
- Planting a native forested riparian buffer adjacent to restored streams and within Site floodplains and wetlands.
- Protecting the Site in perpetuity with a conservation easement.

6.2 Restoration Plan

The complete restoration plan is depicted in Figures 6A-6C (Appendix A). Components of this plan may be modified based on construction or access constraints. Primary activities proposed at the Site include 1) stream restoration, 2) stream enhancement (level I and level II), 3) stream preservation, 4) wetland

restoration, 5) wetland enhancement, 6) soil scarification, and 7) plant community restoration. A monitoring plan and contingency plan are outlined in Section 7 (Performance Criteria) of this document.

6.2.1 Stream Restoration

This stream restoration effort is designed to restore a stable, meandering stream on new location that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Geometric attributes for the existing, degraded channels and the proposed, stable channels are listed in Table of Morphological Stream Characteristics (Table 7).

An erosion control plan and construction/transportation plan are expected to be developed during the next phase of this project. Erosion control will be performed locally throughout the Site and will be incorporated into construction sequencing. Exposed surficial soils at the Site are unconsolidated, alluvial sediments, which do not revegetate rapidly after disturbance; therefore, seeding with appropriate grasses and immediate planting with disturbance-adapted shrubs will be employed following the earth-moving process. In addition, onsite root mats (seed banks) and vegetation will be stockpiled and redistributed after disturbance.

A transportation plan, including the location of access routes and staging areas will be designed to minimize disturbance to existing vegetation and soils to the extent feasible. The number of transportation access points into the floodplain will be maximized to avoid traversing long distances through the Site's interior.

6.2.1.1 Stream Construction

Primary activities designed to restore the channels include 1) belt-width preparation and grading, 2) floodplain bench excavation, 3) channel excavation, 4) installation of channel plugs, and 5) backfilling of the abandoned channel.

Belt-width Preparation and Grading

Care will be taken to avoid the removal of existing, deeply rooted vegetation within the belt-width corridor, which may provide design channel stability. Material excavated during grading will be stockpiled immediately adjacent to channel segments to be abandoned and backfilled. These segments will be backfilled after stream diversion is completed.

Spoil material may be placed to stabilize temporary access roads and to minimize compaction of the underlying floodplain. However, all spoil will be removed from floodplain surfaces upon completion of construction activities.

After preparation of the corridor, the design channel and updated profile survey will be developed and the location of each meander wavelength plotted and staked along the profile. Pool locations and relative frequency configurations may be modified in the field based on local variations in the floodplain profile.

Floodplain Bench Excavation

The creation of a bankfull, floodplain bench is expected to 1) remove the eroding material and collapsing banks, 2) promote overbank flooding during bankfull flood events, 3) reduce the erosive potential of flood waters, and 4) increase the width of the active floodplain. Bankfull benches may be created by excavating the adjacent floodplain to bankfull elevations or filling eroded/abandoned channel areas with suitable material. After excavation, or filling of the bench, a relatively level floodplain surface is expected to be stabilized with suitable erosion control measures. Planting of the bench with native floodplain vegetation is expected to reduce erosion of bench sediments, reduce flow velocities in flood waters, filter pollutants, and provide wildlife habitat.

Channel Excavation
The channel will be constructed within the range of values depicted in the Table of Morphological Stream Characteristics (Table 7). Figure 7 (Appendix A) provides proposed cross-sections, plan views, and profiles for the constructed channel.

The stream banks and local belt-width area of constructed channels will be immediately planted with shrub and herbaceous vegetation. Deposition of shrub and woody debris into and/or overhanging the constructed channel is encouraged.

Particular attention will be directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Live willow stake revetments, available root mats, and/or biodegradable, erosion-control matting may be embedded into the break-in-slope to promote more rapid development of an overhanging bank. Willow stakes will be purchased and/or collected onsite and inserted through the root/erosion mat into the underlying soil.

Channel Plugs
Impermeable plugs will be installed along abandoned channel segments. The plugs will consist of low-permeability materials or hardened structures designed to be of sufficient strength to withstand the erosive energy of surface flow events across the Site. Dense clays may be imported from off-site or existing material, compacted within the channel, may be suitable for plug construction. The plug will be of sufficient width and depth to form an imbedded overlap in the existing banks and channel bed.

Channel Backfilling
After impermeable plugs are installed, the abandoned channel will be backfilled. Backfilling will be performed primarily by pushing stockpiled materials into the channel. The channel will be filled to the extent that onsite material is available and compacted to maximize microtopographic variability, including ruts, ephemeral pools, and hummocks in the vicinity of the backfilled channel.

A deficit of fill material for channel backfill may occur. If so, a series of closed, linear depressions may be left along confined channel segments. Additional fill material for critical areas may be obtained by excavating shallow depressions along the banks of these planned, open-channel segments. These excavated areas will represent closed linear, elliptical, or oval depressions. In essence, the channel may be converted to a sequence of shallow, ephemeral pools adjacent to effectively plugged and backfilled channel sections. These pools are expected to stabilize and fill with organic material over time. Vegetation debris (root mats, top soils, shrubs, woody debris, etc.) will be redistributed across the backfill area upon completion.

6.2.1.2 Marsh Treatment Areas
Shallow wetland marsh treatment areas will be excavated in the floodplain to intercept surface waters draining through agricultural areas prior to discharging into the mainstem Threemile Creek channel. Marsh treatment areas are depicted on Figures 6A through 6C (Appendix A) and will consist of shallow depressions that will provide treatment and attenuation of initial stormwater pulses. The outfall of each treatment area will be constructed of hydrolocally stable rip-rap or other suitable material that will protect against headcut migration into the constructed depression and/or upstream stream reaches. It is expected that the treatment areas will fill with sediment and organic matter over time.

6.2.1.3 In-Stream Structures
Stream restoration under natural stream design techniques normally involves the use of in-stream structures for bank stabilization, grade control, and habitat improvement. Primary activities designed to achieve these objectives may include the installation of log vanes, J-hook vanes, cross-vanes, and or a step-pool structure. Details for the structures are depicted on Figures 8A-8B (Appendix A).

6.2.1.4 Forded Channel Crossing

Landowner constraints will necessitate the installation of three channel fords to allow access to portions of the property isolated by the conservation easement and stream restoration activities (Figure 8B, Appendix A). The approximate locations of the proposed channel fords are depicted on Figures 6A-6C (Appendix A). The fords are expected to consist of a shallow depression in the stream banks where vehicular and livestock crossings can be made. The ford will be constructed of hydraulically stable rip-rap or suitable rock and will be large enough to handle the weight of anticipated vehicular traffic. Approach grades to the ford will be at a minimum 15:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines. The bed elevation of the ford will equal the floodplain elevation above and below the ford to reduce the risk of headcutting.

6.2.2 Stream Enhancement (Level I and II)

Stream enhancement (Level I and II) on the upper reaches of Tributaries 2 and 4, the lower reach of Threemile Creek, and Fork Creek will entail the cessation of current land management practices and planting riparian buffers with native forest vegetation. Enhancement Level I will also entail dimension and profile adjustments along with the installation of instream habitat structures. Bank stabilization will occur including the use of root/biodegradable erosion control matting, live staking, and bank sloping where necessary to prevent further bank erosion/degradation. Particular attention will be directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Riparian buffers will extend a minimum of 30 feet from the top of stream banks to facilitate stream recovery and prevent further degradation of Site streams. In addition, water quality functions and aquatic and wildlife habitat associated with stable riparian corridors/streams will be improved.

6.2.3 Stream Preservation

Preservation is being proposed on the forested/upstream reaches of Tributaries 3, 5, 6, and 11 and on the Preservation Tributaries (Figures 6A to 6C, Appendix A). Based on preliminary analysis and field investigations, these reaches are relatively stable due a lack of human induced impact and a well-developed riparian buffer. These areas will be protected in perpetuity through the establishment of a conservation easement including a minimum 30-foot forested buffer adjacent to each bank of the stream.

6.3 HEC-RAS Analysis

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 an aerial photograph. 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 to 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. The Site is not located within a Federal Emergency Management Agency (FEMA) floodway; therefore, a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) are not expected to be necessary at this time. However, mapping of the region is expected to be released later this year. Therefore coordination with FEMA may be conducted, if necessary, prior to initiating Site construction activities.

6.4 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. Restoration activities are expected to restore a minimum of 2.5 acres of jurisdictional riverine wetland and enhance approximately 2.3 acres of jurisdictional riverine wetland (Figures 6A-6C, Appendix A).

Portions of the Site underlain by hydric soils have been impacted by channel incision, drainage ditch excavation, vegetative clearing, hoof shear, and earth movement associated with agricultural practices. Wetland restoration options should focus on the removal of fill materials, restoration of vegetative communities, filling drainage ditches, the reestablishment of soil structure and microtopographic variations, and redirecting normal surface hydrology from ditches back to Site floodplains. In addition, the construction of (or provisions for) surface water storage depressions (ephemeral pools) will also add an important component to groundwater restoration activities. These activities will result in the restoration of 2.5 acres of jurisdictional riverine floodplain wetlands. An additional 2.3 acres of jurisdictional riverine wetland will be enhanced within the Site by planting cleared wetlands with native species.

Reestablishment of Historic Groundwater Elevations

The existing Tributaries 1 and 8 average 3-5 feet in depth, while the depth for the proposed tributaries average approximately 0.7-1 foot in depth. Hydric soils adjacent to the incised channels appear to have been drained due to lowering of the groundwater tables and a lateral drainage effect from existing stream reaches. Reestablishment of channel inverts is expected to rehydrate soils adjacent to Site streams. In addition, drainage ditches are effectively removing wetland hydrology within the restoration areas. Filling of these ditches and restoring Site tributaries are expected to rehydrate hydric soils within the Site, resulting in the restoration of jurisdictional hydrology to riverine wetlands.

Excavation and Grading of Elevated Spoil and Sediment Embankments

Some areas adjacent to the existing channels and area ditches have experienced both natural and unnatural sediment deposition. Spoil piles were likely cast adjacent to the channel during dredging, straightening, and rerouting of Site streams, and ditching of the adjacent floodplain. Major flood events may have also deposited additional sediment adjacent to stream banks from onsite eroding banks and upstream agricultural fields. The removal of these spoil materials and/or filling of onsite ditches with spoil material represents a critical element of Site wetland restoration.

Hydrophytic Vegetation

Site wetland areas have endured significant disturbance from land use activities such as land clearing, agriculture, 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 6.6 (Plant Community Restoration) provides detailed information concerning community species associations.

Reconstructing Stream Corridors

The stream restoration plan involves the reconstruction of Site streams through the floodplain. Existing channels will be backfilled so that the water table may be restored to historic conditions. However, some portions of the existing channels may remain open for the creation of wetland "oxbow lake-like" features. These features will be plugged on each side of the open channel and will function as open water systems. They are expected to provide habitat for a variety of wildlife as well as create small pockets of open water/freshwater marsh within the Site.

6.5 Floodplain Soil Scarification

Microtopography and differential drainage rates within localized floodplain areas represent important components of floodplain functions. Reference forests in the region exhibit complex surface microtopography. Small concavities, swales, exposed root systems, seasonal pools, oxbows, and hummocks associated with vegetative growth and hydrological patterns are scattered throughout these systems. As discussed in the stream reconstruction section, efforts to advance the development of characteristic surface microtopography will be implemented.

In areas where soil surfaces have been compacted, ripping or scarification will be performed. After construction, the soil surface is expected to exhibit complex microtopography ranging to 1 foot in vertical asymmetry across local reaches of the landscape. Subsequently, community restoration will be initiated on complex floodplain surfaces.

6.6 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.

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/Mountain Bottomland Forest is targeted for the Site wetland areas and Piedmont/Low Mountain Alluvial Forest is targeted for the remainder of the Site (Figure 9, Appendix A). The following planting plan is the blueprint for community restoration.

6.6.1 Planting Plan

The purpose of a planting plan is to reestablish vegetative community patterns across the landscape. The plan consists of 1) acquisition of available plant species, 2) implementation of proposed Site preparation, and 3) planting of selected species.

Species selected for planting will be dependent upon availability of local seedling sources. Advance notification to nurseries (1 year) will facilitate availability of various noncommercial elements.

Bare-root seedlings of tree species will be planted within specified map areas at a density of approximately 680 stems per acre on 8-foot centers. Shrub species in the stream-side assemblage will be planted at a density of 2720 stems per acre on 4-foot centers. Table 10 depicts the total number of stems and species distribution within each vegetation association. 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. A total of 19,449 diagnostic tree and shrub seedlings may be planted during restoration.

6.6.2 Nuisance Species Management

Prior to the revegetation phase of the project, nonnative floral species will be removed. Exotic species currently identified within the project area include multiflora rose. This is a fast growing species that can overwhelm and out-compete the plant communities proposed for stabilization of the new stream channel. Methods for eradication of this species are will to include both manual removal by cutting and grubbing in addition to chemical herbicide treatment. Approximately 9.6 acres of the Site will be treated for removal of multiflora rose, predominantly located within the Stream-side Assemblage and Piedmont/Mountain Bottomland Forest planting zones, as depicted on Figure 9 (Appendix A).

Beavers and other potential nuisance species will be monitored over the course of the 5-year monitoring period. Appropriate actions will be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis.

Table 10. Planting Plan

Vegetation Association	Piedmont/Mountain Bottomland Forest		Piedmont/Low Mountain Alluvial Forest		Stream-side Assemblage		TOTAL
Area (acres)	**5.4**		**4.0**		**4.8**		**14.2**
Species	**Number planted***	**% of total**	**Number planted***	**% of total**	**Number planted****	**% of total**	**Number planted**
Swamp chestnut oak (*Quercus michauxii*)	551	15	--	--	--	--	551
Cherrybark oak (*Quercus pagoda*)	551	15	--	--	--	--	551
Sycamore (*Platanus occidentalis*)	551	15	272	10	--	--	823
Hackberry (*Celtis laevigata*)	551	15	--	--	--	--	551
American elm (*Ulmus americana*)	551	15	--	--	--	--	551
Green ash (*Fraxinus pennsylvanica*)	367	10	--	--	--	--	367
Pawpaw (*Asimina triloba*)	294	8	272	10	--	--	566
American beech (*Fagus grandifolia*)	--	--	408	15	--	--	408
Mockernut hickory (*Carya alba/tomentosa*)	--	--	408	15	--	--	408
Northern red oak (*Quercus rubra*)	--	--	408	15	--	--	408
White oak (*Quercus alba*)	--	--	408	15	--	--	408
Black cherry (*Prunus serotina*)	--	--	272	10	--	--	272
Persimmon (*Diospyros virginiana*)	--	--	272	10	--	--	272
Silky dogwood (*Cornus amomum*)	257	7	--	--	3917	30	4174
Black willow (*Salix nigra*)	--	--	--	--	3917	30	3917
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	2611	20	2611
Elderberry (*Sambucus canadensis*)	--	--	--	--	2611	20	2611
TOTAL	**3673**	**100**	**2720**	**100**	**13,056**	**100**	**19,449**

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

7.0 PERFORMANCE CRITERIA

Monitoring of Site restoration efforts will be performed for five years or until agreed upon success criteria are fulfilled. Monitoring is proposed for the stream channel, hydrology, and vegetation.

7.1 Stream Monitoring

Annual fall monitoring will include development of channel cross-sections on riffles and pools, pebble counts, and a water surface profile of the channel. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) meander wavelength, 7) belt-width, 8) water surface slope, 9) sinuosity, and 10) stream substrate composition. A photographic record of preconstruction and post-construction pictures will also be compiled. Preconstruction photographs are included in Appendix D.

Stream Success Criteria

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996a) and 2) channel variables indicative of a stable stream system.

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.

7.2 Hydrology Monitoring

Groundwater monitoring gauges will be installed to take measurements after hydrological modifications are performed at the Site. Hydrological sampling will continue throughout the growing season at intervals necessary to satisfy the jurisdictional hydrology success criteria within each wetland restoration area (USEPA 1990).

Hydrology Success Criteria

Target hydrological characteristics include saturation or inundation for 5 to 12.5 percent of the growing season, during average climatic conditions. During growing seasons 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.

7.3 Vegetation Monitoring

Restoration monitoring procedures for vegetation are designed in accordance with USEPA guidelines enumerated in Mitigation Site Type (MiST) documentation (USEPA 1990), *Compensatory Hardwood Mitigation Guidelines* (DOA 1993), Stream Mitigation Guidelines (USACE 2003), and CVS-EEP Protocol for Recording Vegetation Level 1-2 Plot Sampling Only (Version 4.0) (Lee et al. 2006). A general discussion of the restoration monitoring program is provided. A photographic record of plant growth should be included in each annual monitoring report.

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 the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed between June 1 and September 30, after each growing season, until the vegetation success criteria are achieved.

During quantitative vegetation sampling in early fall of the first year, up to 10 sample plots (10 meters by 10 meters) will be randomly placed within the Site. Best professional judgment may be necessary to establish vegetative monitoring plots upon completion of construction activities. In each sample plot, vegetation parameters to be monitored include species composition and species density.

Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species, species identified through visual inventory of an approved reference (relatively undisturbed) forest community, and species outlined in Schafale and Weakley (1990).

An average density of 320 stems per acre of Characteristic Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Characteristic Tree Species per acre must be surviving in year 4 and 260 Characteristic Tree Species per acre in year 5.

7.4 Contingency

7.4.1 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) head-cut migration through the Site, and/or 3) bank erosion.

Structure Failure

In the event that onsite 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 pilings 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 pilings, will be removed and replaced with a structure suitable for onsite flows.

Headcut Migration through the Site

In the event that a headcut occurs within the Site (identified visually or through onsite 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 at 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 cross-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.

7.4.2 Hydrologic Contingency

Hydrologic contingency may include floodplain surface modifications such as construction of ephemeral pools, deep ripping of the soil profile, and installation of berms to retard surface water flows. Recommendations for contingency to establish wetland hydrology may be implemented and monitored until hydrology success criteria are achieved.

7.4.3 Vegetation Contingency

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

7.5 Reporting Schedule

The first year monitoring report will be submitted at the end of December after Site implementation. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of December for each monitoring year.

8.0 REFERENCES

Acrement, Jr., G.J. and V.R. Schneider. 1989. Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Floodplains. U.S. Geological Survey Water Supply Paper 2339, 38 pp.

Cowan, W.L. 1956. Estimating Hydraulic Roughness Coefficients. Agricultural Engineering, 37, 473-475.

Department of the Army (DOA). 1993 (unpublished). Corps of Engineers Wilmington District. Compensatory Hardwood Mitigation Guidelines (12/8/93).

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. 2002. Ecoregions of North and South Carolina. Reston Virginia. U.S. Geological Society (map scale 1:1,500,000).

Harman, W.A., G.D. Wise, D.E., Walker, R.M, Cantrell, M.A., Clemmons, M., Jennings, G.D., Clinton, D., and Patterson, J. 2001. Bankfull Regional Curves for North Carolina Mountain Streams. North Carolina State University, Raleigh, North Carolina.

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. 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.

Manning, R. 1891. On the Flow of Water in Open Channels and Pipes. Transactions of the Institution of Civil Engineers of Ireland. 20, 161-20.

North Carolina Division of Water Quality (NCDWQ). 2006a. Final North Carolina Water Quality Assessment and Impaired Waters List (2004 Integrated 305(b) and 303(d) Report) (online). Available: http://h2o.enr.state.nc.us/tmdl/documents/2004IRCategories4-7.PDF [May 14, 2007]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2006b. Draft North Carolina Water Quality Assessment and Impaired Waters List (2006 Integrated 305(b) and 303(d) Report). Public Review (online). Available: http://h2o.enr.state.nc.us/tmdl/documents/2006303dList PublicReviewDraft.pdf [May 14, 2007]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2007. North Carolina Water Bodies Report (online). Available: http://dem.ehnr.state.nc.us/bims/reports/reportsWB.html [May 14, 2007]. North Carolina Department of Environment and Natural Resources, Raleigh.

North Carolina Wetlands Restoration Program (NCWRP). 2005. Broad River Basin Watershed Restoration Plan (online). Available: http://www.nceep.net/services/restplans/French_Broad_Plan.pdf [May 14, 2007]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

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

Rosgen, D. 1996b. Classification of Natural Rivers: Reply to the comments by J.R. Miller and J.B. Ritter. Catena. 27:301-307

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 Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

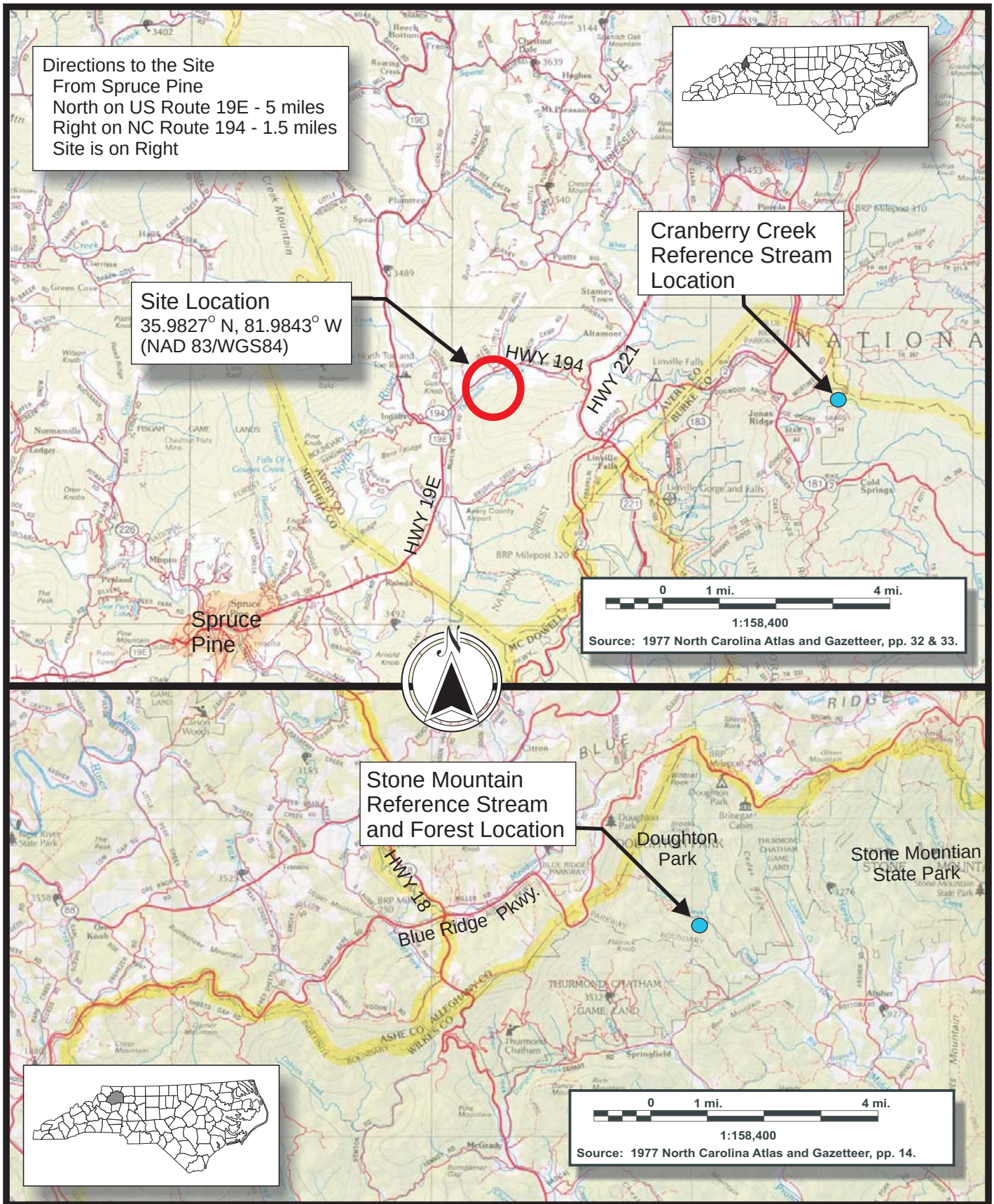
United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), North Carolina Wildlife Resources Commission (NCWRC), Natural Resources Conservation Service (NRCS), and North Carolina Division of Water Quality (NCDWQ). 2003. Stream Mitigation Guidelines. State of North Carolina.

United States Department of Agriculture (USDA). 1955. Soil Survey of Avery County, North Carolina. United States Department of Agriculture.

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

United States Geological Survey (USGS) 2003. The National Flood Frequency Program, Version 3: A Computer Program for Estimating the Magnitude and Frequency of Floods for Ungaged Sites. USGS Water-Resources Investigations Report 02-4168. United States Geological Survey.

Appendix A. Figures

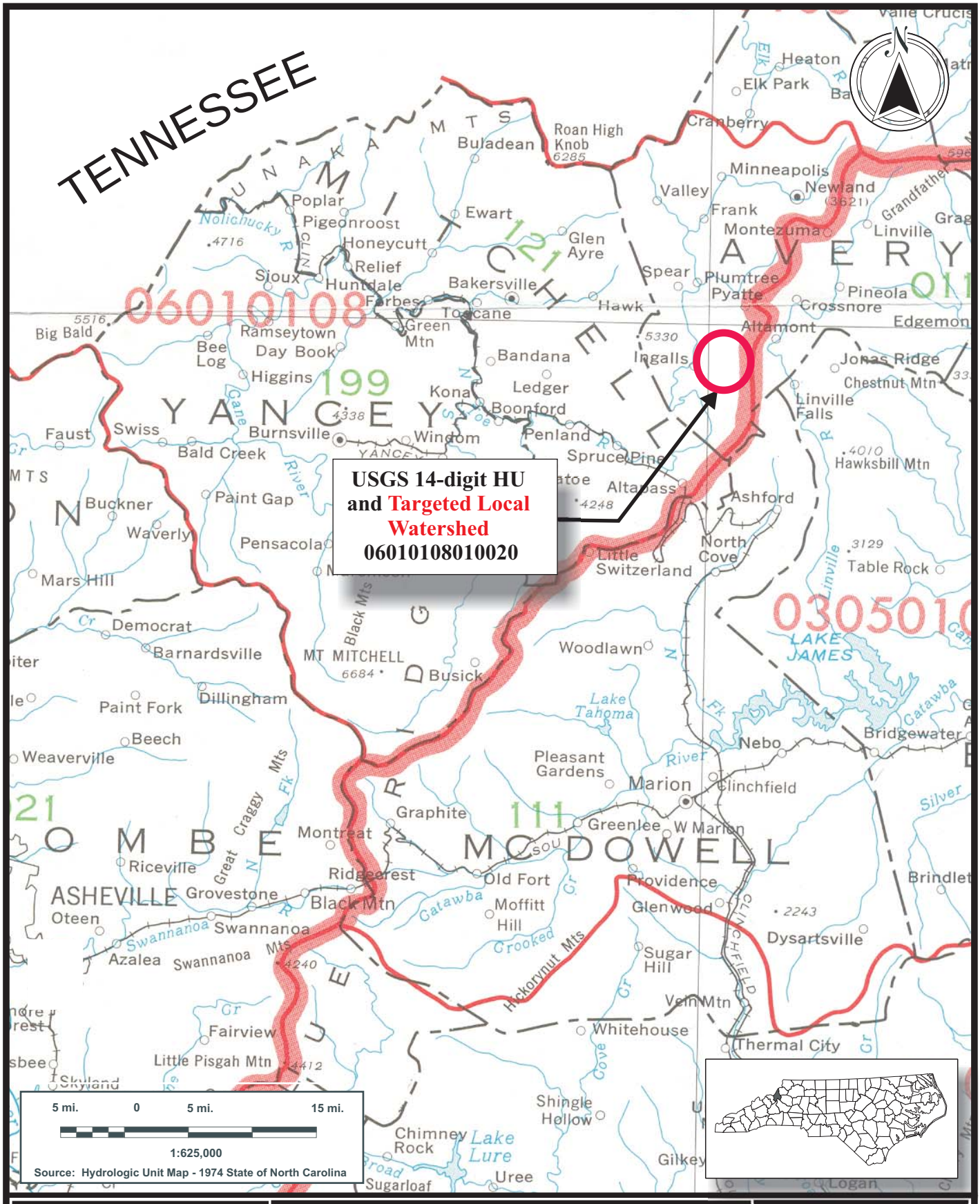


Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE & REFERENCE LOCATION
THREE MILE CREEK RESTORATION SITE
Avery County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	June 2007
Project:	07-004

FIGURE
1

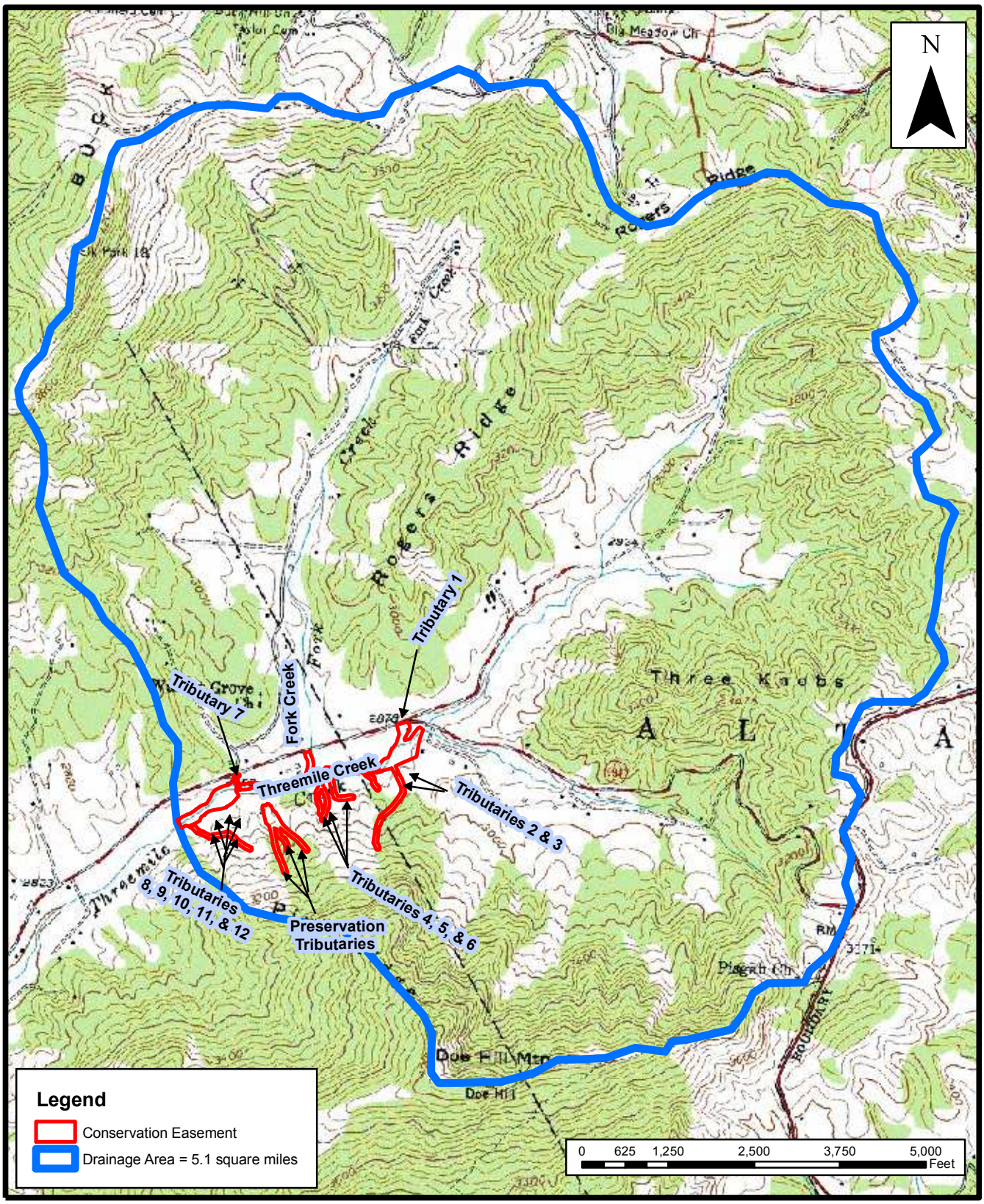


Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

USGS CATOLOGING UNIT MAP
THREE MILE CREEK RESTORATION SITE
Avery County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	June 2007
Project:	07-004

FIGURE
2



Axiom Environmental, Inc.
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TOPOGRAPHY AND DRAINAGE AREA
THREE MILE CREEK RESTORATION SITE
Avery County, North Carolina

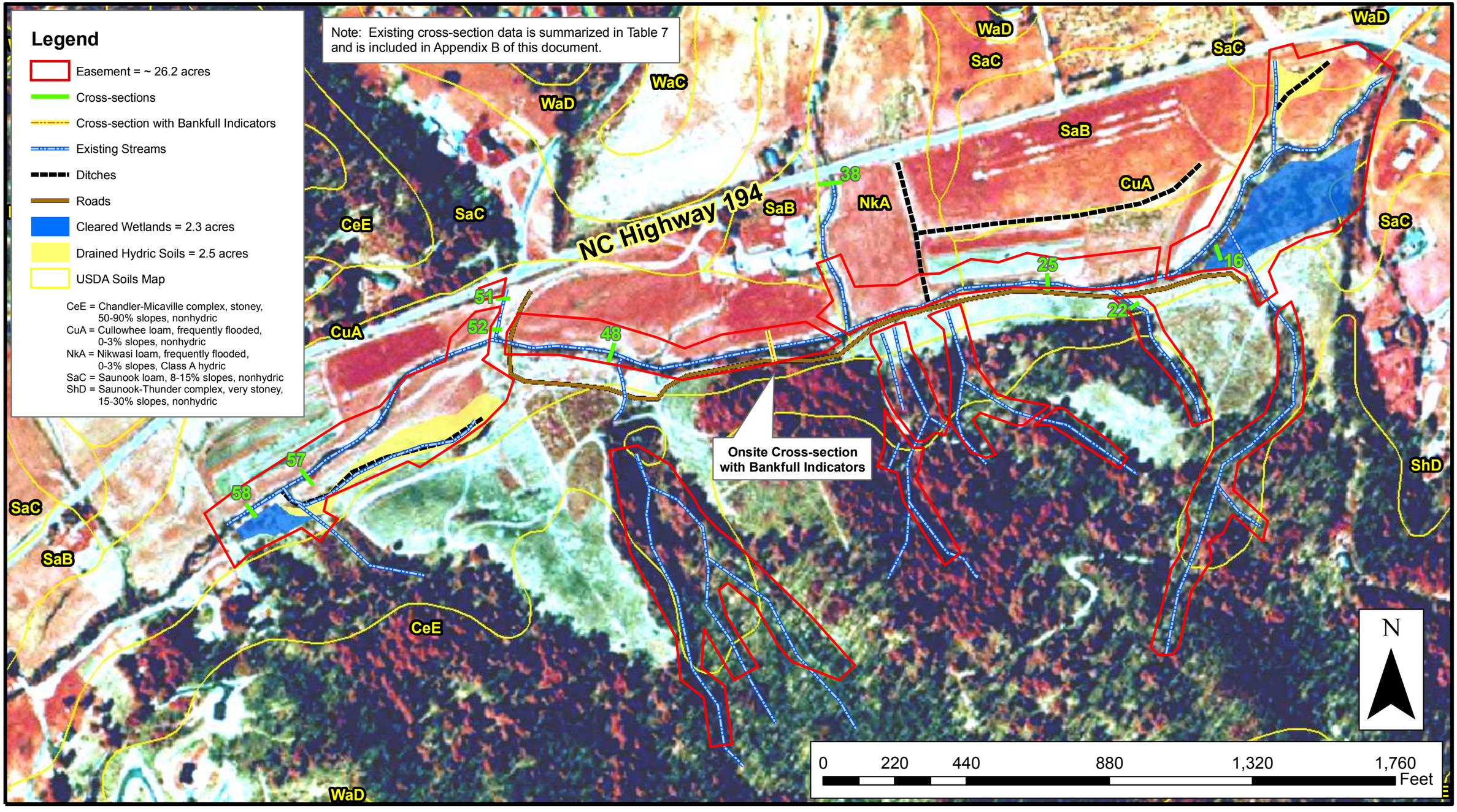
Dwn. By: WGL	FIGURE
Date: June 2007	3
Project: 07-004	

Legend

- Easement = ~ 26.2 acres
- Cross-sections
- Cross-section with Bankfull Indicators
- Existing Streams
- Ditches
- Roads
- Cleared Wetlands = 2.3 acres
- Drained Hydric Soils = 2.5 acres
- USDA Soils Map

CeE = Chandler-Micaville complex, stoney, 50-90% slopes, nonhydric
CuA = Cullowhee loam, frequently flooded, 0-3% slopes, nonhydric
NkA = Nikwasi loam, frequently flooded, 0-3% slopes, Class A hydric
SaC = Saunook loam, 8-15% slopes, nonhydric
ShD = Saunook-Thunder complex, very stoney, 15-30% slopes, nonhydric

Note: Existing cross-section data is summarized in Table 7 and is included in Appendix B of this document.



Axiom Environmental, Inc.
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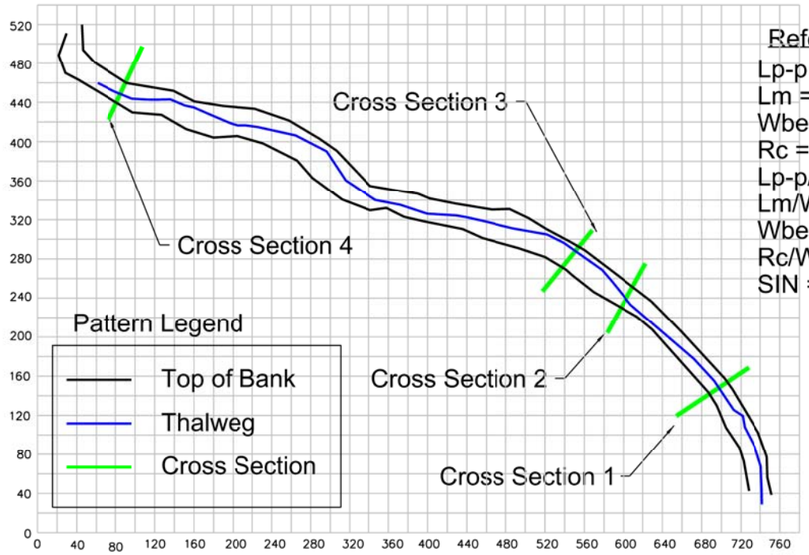
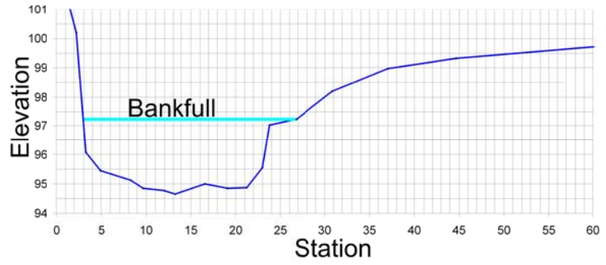
EXISTING CONDITIONS
THREE MILE CREEK RESTORATION SITE
Avery County, North Carolina

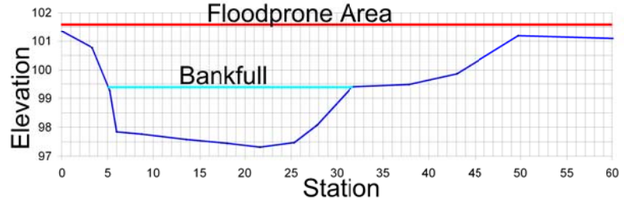
Dwn. By: CLF	FIGURE
Date: Sept 2007	4
Project: 07-004	



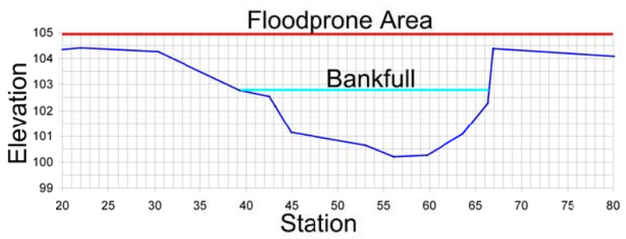
Reference Pattern
Lp-p = 104 (65 - 167) ft
Lm = 199 (102 - 273) ft
Wbelt = 46.8 (40 - 55) ft
Rc = 94 (62 - 312) ft
Lp-p/Wbkf = 3.5 (2.2 - 5.5)
Lm/Wbkf = 6.6 (3.4 - 9.1)
Wbelt/Wbkf = 1.6 (1.3 - 1.8)
Rc/Wbkf = 3.1 (2.1 - 10.4)
SIN = 1.2



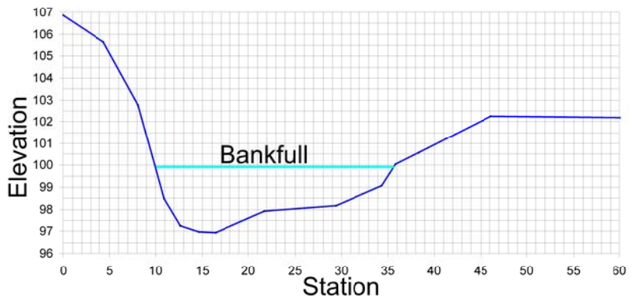
Cross Section 1 - Pool
Abkf = 44.8 ft
Wbkf = 23.8 ft
Dmax = 2.6 ft



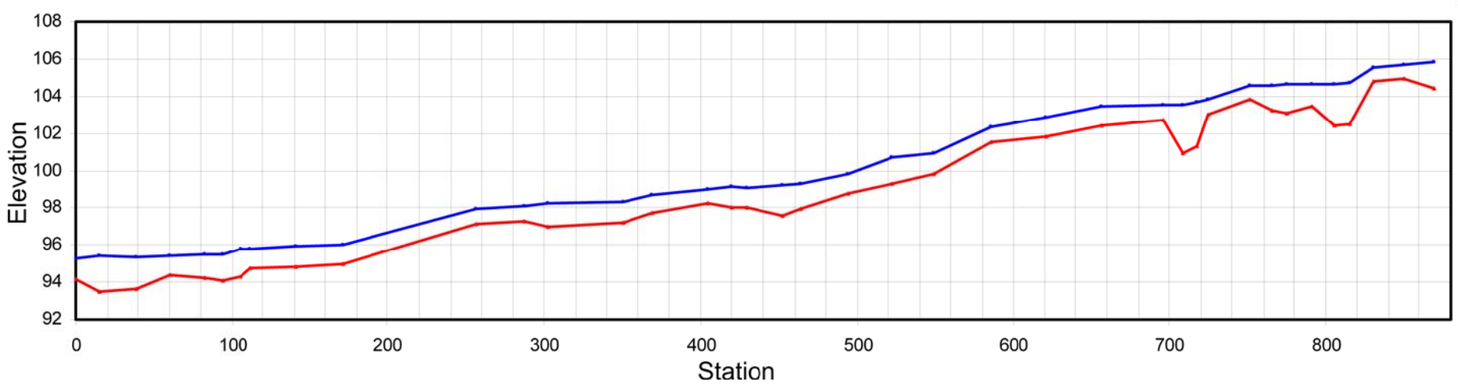
Cross Section 2 - Riffle
Abkf = 45.9 ft
Dave = 1.4 ft
Wbkf = 33.0 ft
Dmax = 2.2 ft
Bank Height = 3.9 ft
W/D = 23.8
FPA = 100
ENT = 3.0
Stream Type = Cb



Cross Section 4 - Riffle
Abkf = 46.1 ft
Dave = 1.7 ft
Wbkf = 27.2 ft
Dmax = 2.6 ft
Bank Height = 2.6 ft
W/D = 16.1
FPA = 100
ENT = 3.7
Stream Type = Cb



Cross Section 3 - Pool
Abkf = 41.8 ft
Wbkf = 25.0 ft
Dmax = 2.7 ft



Profile (Reference Reach)
Save = 0.0121 rise/run
Svalley = 0.0131 rise/run
Sriffle = 0.0118 (0.0026 - 0.0183) rise/run
Spool = 0.0097 (0 - 0.0254) rise/run
Srun = 0.0085 (0.0030 - 0.0202) rise/run
Sglide = 0.0041 (0 - 0.0083) rise/run

Profile Legend
Reference Bed
Reference Water Surface

Axiom Environmental, Inc.

NOTES/REVISIONS

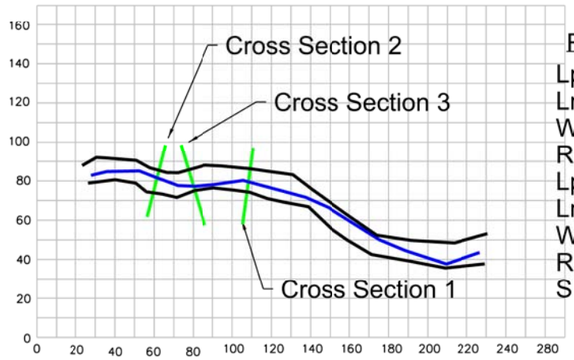
Project:
Threemile Creek Restoration Site

Avery County
North Carolina

Title:
Stone Mountain Reference Dimension, Pattern, and Profile

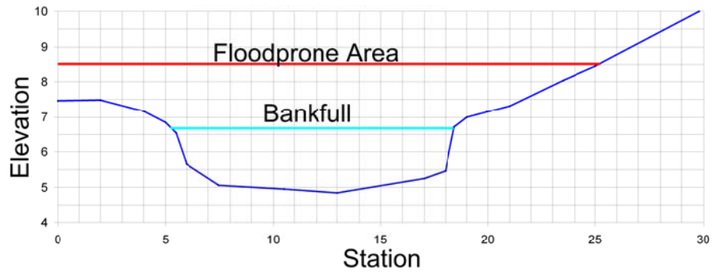
Scale: NA
Date: July 2007
Project No.: 07-004

FIGURE NO.
5A

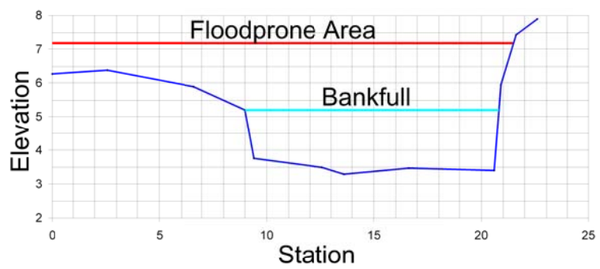


Reference Pattern
Lp-p = 55 (37 - 83) ft
Lm = 104 (77 - 131) ft
Wbelt = 23 (16 - 28) ft
Rc = 47 (31 - 66) ft
Lp-p/Wbkf = 4.4 (3.0 - 6.6)
Lm/Wbkf = 8.3 (6.1 - 10.5)
Wbelt/Wbkf = 1.8 (1.3 - 2.2)
Rc/Wbkf = 3.8 (2.4 - 5.3)
SIN = 1.04

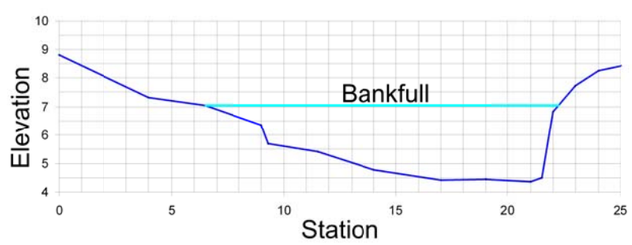
Pattern Legend
- Top of Bank
- Thalweg
- Cross Section



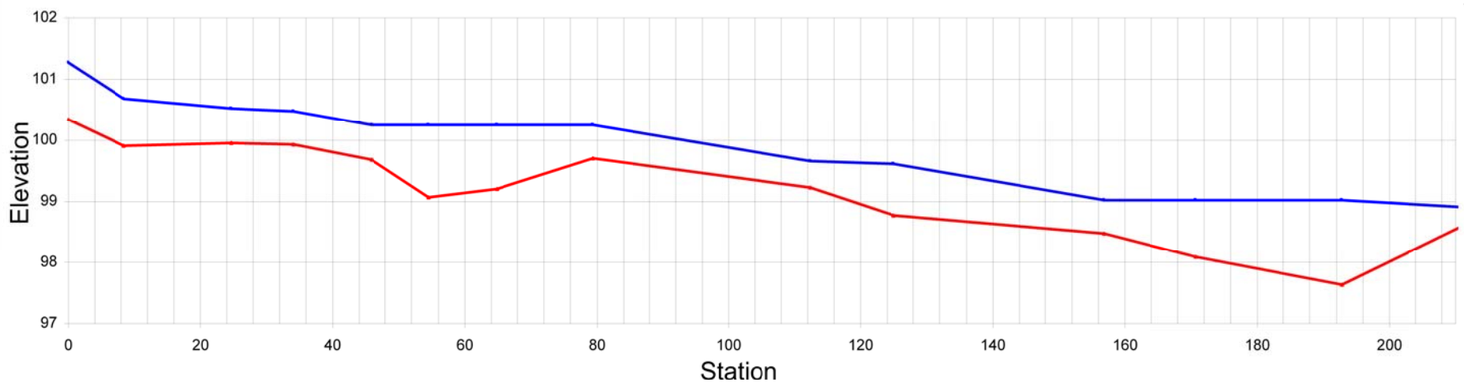
Cross Section 1 - Riffle
Abkf = 20.4 ft
Dave = 1.5 ft
Wbkf = 13.2 ft
Dmax = 1.9 ft
Bank Height = 1.9 ft
W/D = 8.5
FPA = 75
ENT = 5.7
Stream Type = E



Cross Section 2 - Riffle
Abkf = 19.9 ft
Dave = 1.7 ft
Wbkf = 11.8 ft
Dmax = 1.9 ft
Bank Height = 1.9 ft
W/D = 7.0
FPA = 75
ENT = 6.3
Stream Type = E



Cross Section 3 - Pool
Abkf = 29.2 ft
Wbkf = 15.7 ft
Dmax = 2.7 ft



Profile (Reference Reach)
Save = 0.0112 rise/run
Svalley = 0.0116 rise/run
Sriffle = 0.0195 (0.0178 - 0.0225) rise/run
Spool = 0.0015 (0.0002 - 0.0036) rise/run
Srun = 0 (0 - 0) rise/run
Sglide = 0.0028 (0.0001 - 0.0054) rise/run

Profile Legend
- Reference Bed
- Reference Water Surface

Axiom Environmental, Inc.

NOTES/REVISIONS

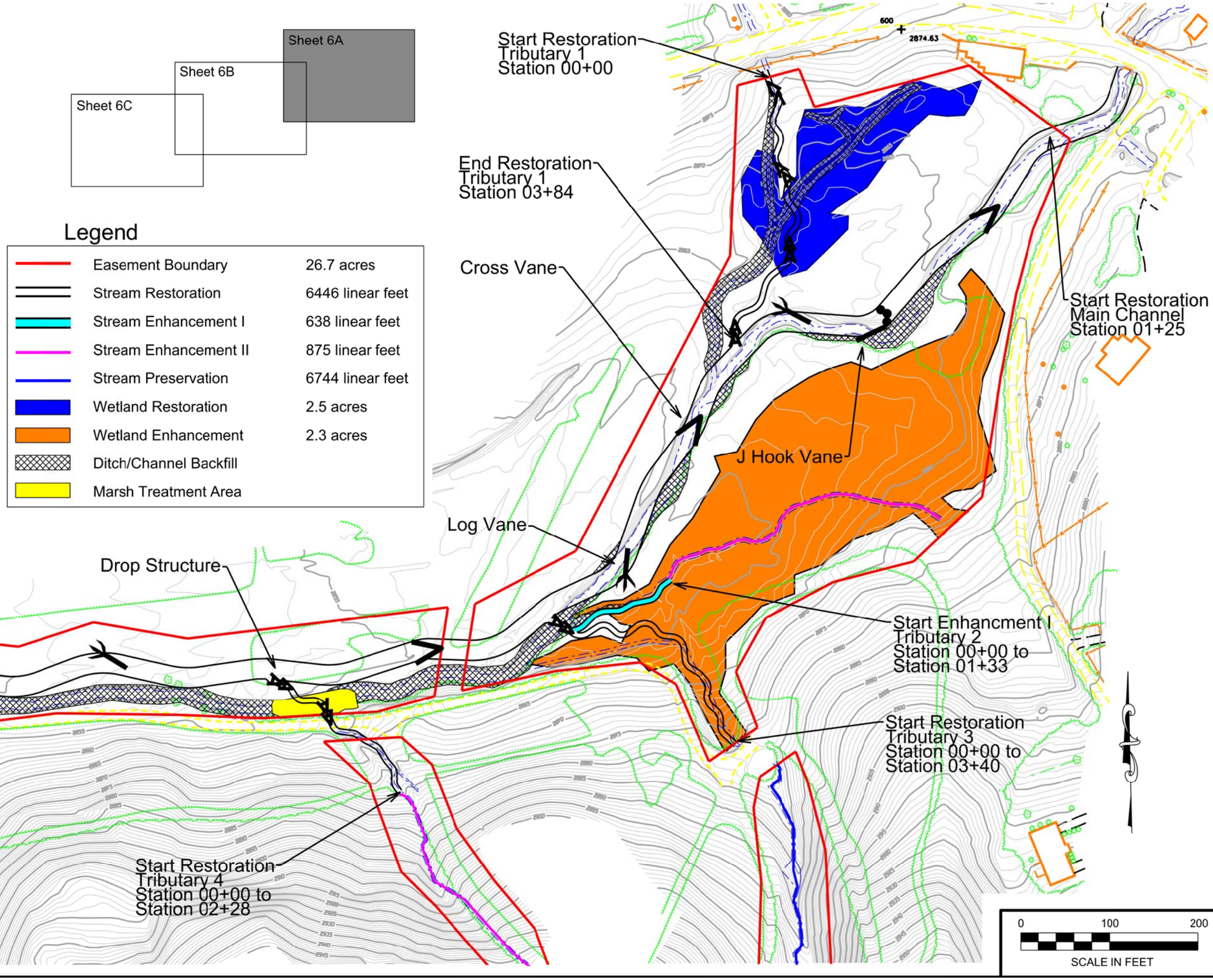
Project:
Threemile Creek Restoration Site

Avery County
North Carolina

Title:
Cranberry Creek Reference Dimension, Pattern, and Profile

Scale: NA
Date: July 2007
Project No.: 07-004

FIGURE NO.
5B



Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County North Carolina

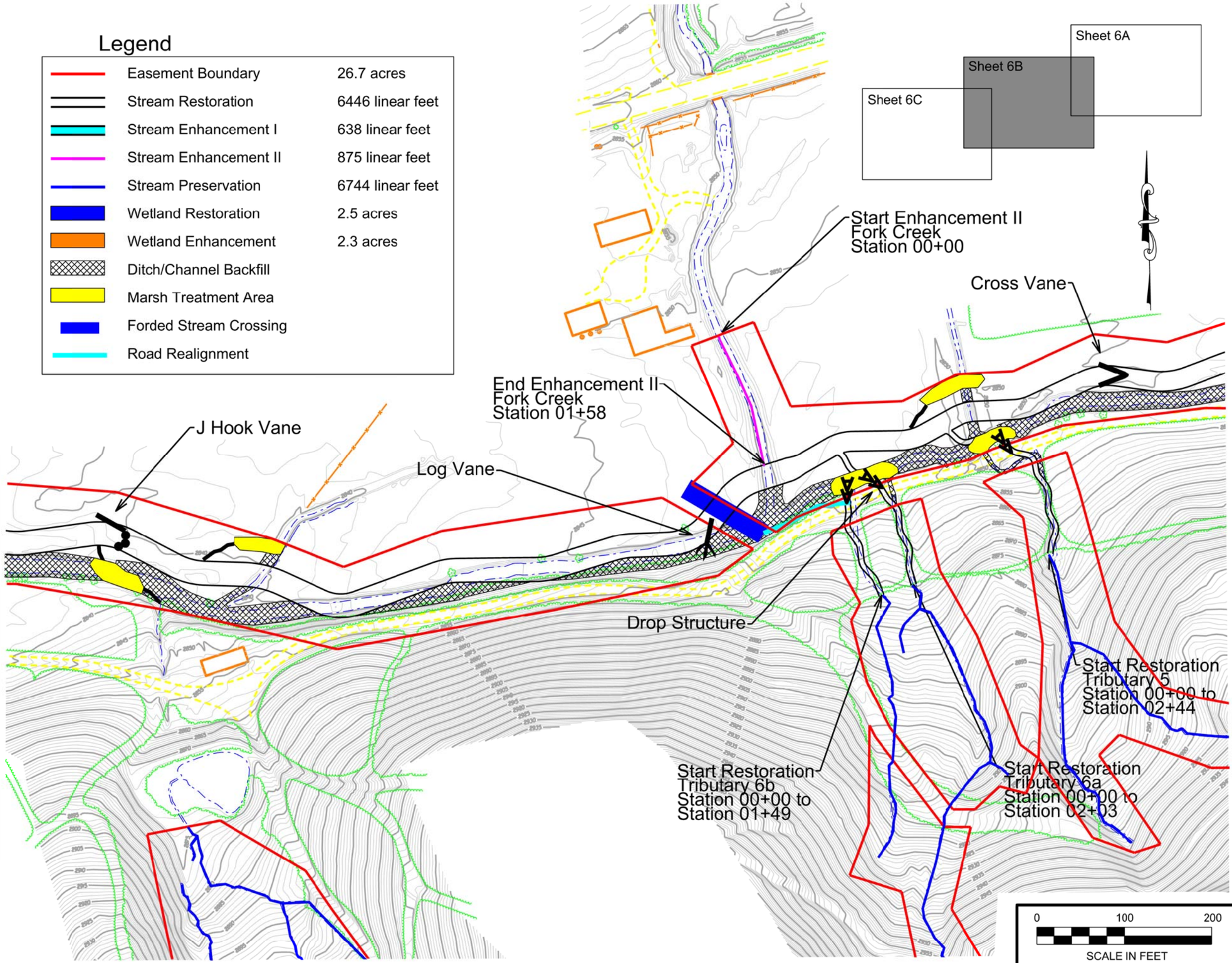
Title:

Restoration Plan

Scale:	FIGURE NO.
1 in = 110 ft	6A
Date: July 2007	
Project No.: 07-004	

Legend

	Easement Boundary	26.7 acres
	Stream Restoration	6446 linear feet
	Stream Enhancement I	638 linear feet
	Stream Enhancement II	875 linear feet
	Stream Preservation	6744 linear feet
	Wetland Restoration	2.5 acres
	Wetland Enhancement	2.3 acres
	Ditch/Channel Backfill	
	Marsh Treatment Area	
	Forded Stream Crossing	
	Road Realignment	



Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County
North Carolina

Title:

Restoration Plan

Scale: 1 in = 110 ft	FIGURE NO. 6B
Date: July 2007	
Project No.: 07-004	

Legend

Easement Boundary	26.7 acres
Stream Restoration	6446 linear feet
Stream Enhancement I	638 linear feet
Stream Enhancement II	875 linear feet
Stream Preservation	6744 linear feet
Wetland Restoration	2.5 acres
Wetland Enhancement	2.3 acres
Ditch/Channel Backfill	
Marsh Treatment Area	
Forded Stream Crossing	
Road Realignment	

Start Restoration
Tributary 7
Station 00+00
to 02+75

J Hook Vane

Log Vane

Drop Structure

Cross Vane

End Enhancement I
Main Channel
Station 42+35

End Restoration
Start Enhancement I
Main Channel
Station 37+30

End Restoration
Tributary 8
Station 07+66

Braided Channel
Restoration
242 feet

Start Restoration
Tributary 8
Station 00+00

Start Restoration
Tributary 9
Station 00+00 to 00+43

Start Restoration
Tributary 10
Station 00+00 to 00+39

Start Restoration
Tributary 11
Station 00+00 to 01+10

Start Restoration
Tributary 12
Station 00+00 to 01+36

Sheet 6A
Sheet 6B
Sheet 6C

0 100 200
SCALE IN FEET

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:
Threemile Creek
Restoration
Site

Avery County
North Carolina

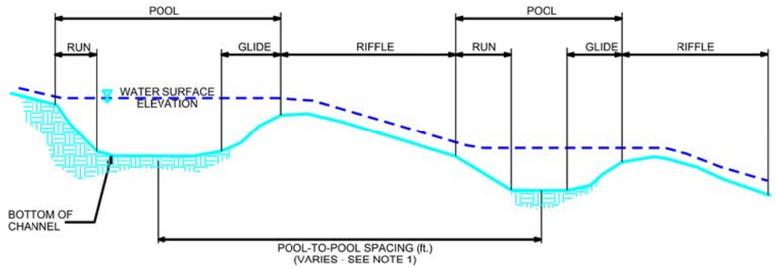
Title:
Restoration
Plan

Scale:
1 in = 110 ft

Date:
July 2007

Project No.:
07-004

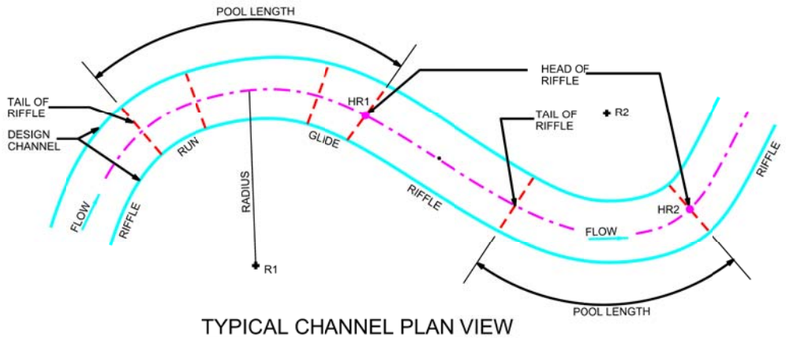
FIGURE NO.
6C



TYPICAL CHANNEL PROFILE

NOTES:

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

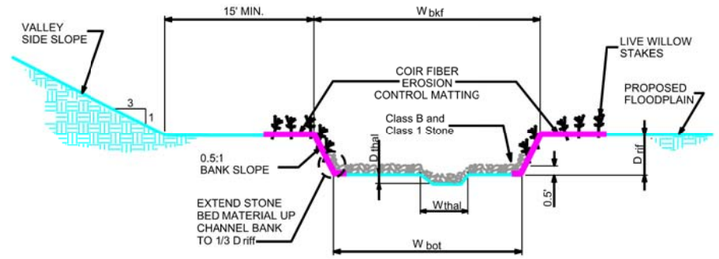


TYPICAL CHANNEL PLAN VIEW

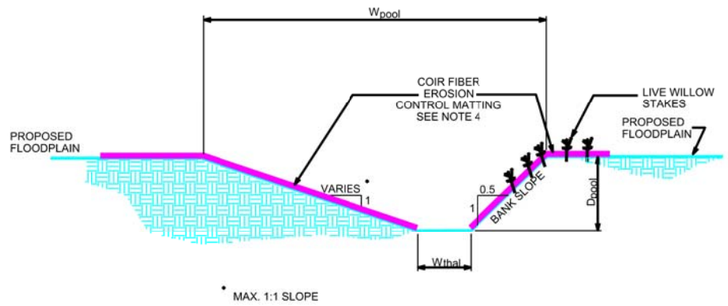
CHANNEL PLAN VIEW NOTES:

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



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 20+50	22.6	18.4	2.1	0.2	2.7	29.4	1.0
Main Channel Sta 20+50 to 42+35	27.2	22.2	2.5	0.2	3.2	35.4	1.0
Fork Creek	19.4	15.8	1.8	0.2	2.4	25.2	1.0
Tribs. 1, 2, 3, 4, 5, 6, 7, 11, and 12	5.7	4.1	0.8	0.2	1.2	7.4	0.5
Tribs. 8, 9, and 10	2.6	1.8	0.4	0.0	0.4	2.6	0.5

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

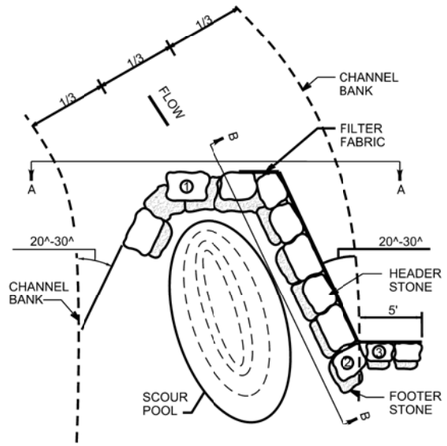
Scale: NA

Date: July 2007

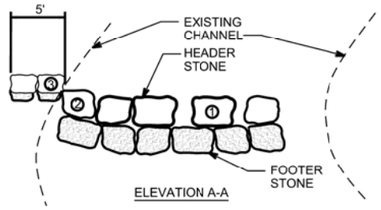
Project No.: 07-004

FIGURE NO. 7

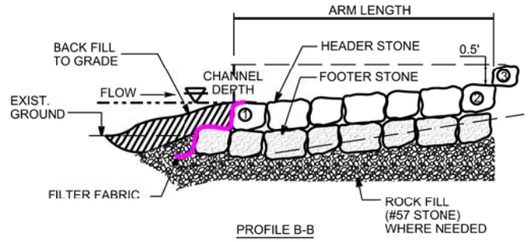
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.



PLAN VIEW



ELEVATION A-A

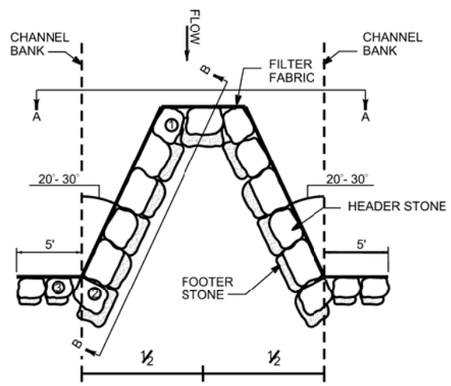


PROFILE B-B

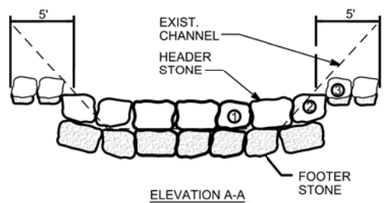
TYPICAL J-HOOK VANE

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
MAIN CHANNEL	20.0	2.1 - 2.5
FORK CREEK	15.0	1.8
TRIBUTARIES	8.0	0.4 - 0.8

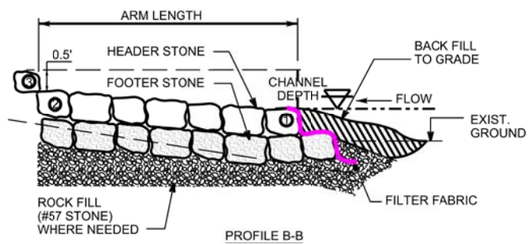
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.



PLAN VIEW



ELEVATION A-A



PROFILE B-B

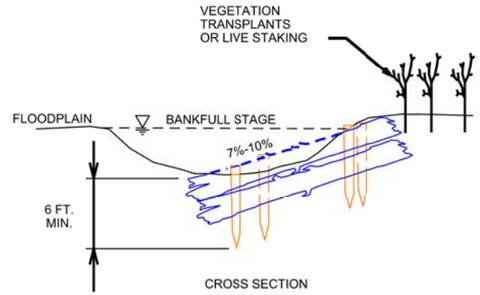
TYPICAL CROSS-VANE

NOTES:
1. EXPOSED VANE OCCUPIES 1/3 OF THE BANKFULL WIDTH OF THE CHANNEL.

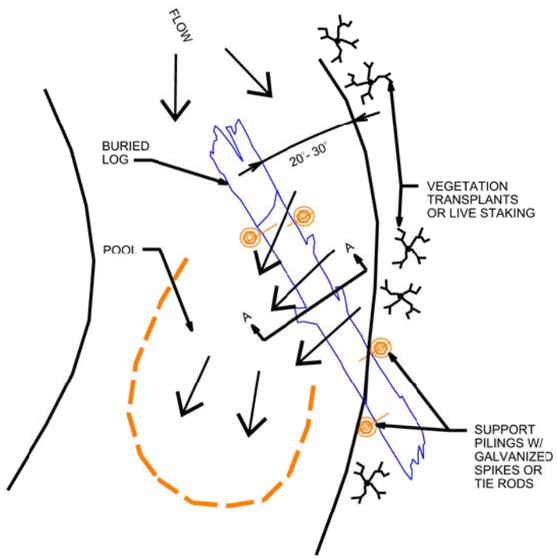
2. SUPPORT PILINGS SHALL BE PENCIL SHARPENED, UNTREATED, PEELED, A MINIMUM OF 4 INCHES IN TOP DIAMETER, AND 8 FEET LONG.

3. LOGS SHALL CONSIST OF NATIVE HARDWOOD SPECIES, RELATIVELY STRAIGHT WITH A MINIMUM DIAMETER OF 15 INCHES AND APPROXIMATELY 35 FEET IN LENGTH.

4. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.

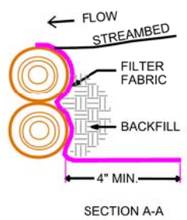


CROSS SECTION

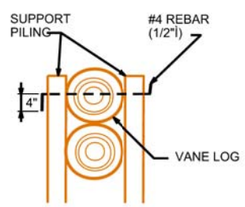


PLAN VIEW

TYPICAL LOG VANE



SECTION A-A



CLOSE-UP OF SUPPORT PILING

- SUPPORT PILINGS SHOULD BE CUT SLIGHTLY BELOW THE TOP LOG.
- AFTER PLACING LOGS, DRIVE REBAR THROUGH LOGS AND BEND ENDS.
- REBAR MAY BE REPLACED WITH LAG BOLT WITH APPROVAL OF THE ENGINEER.

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County North Carolina

Title:

TYPICAL STRUCTURE DETAILS

Scale: NO SCALE

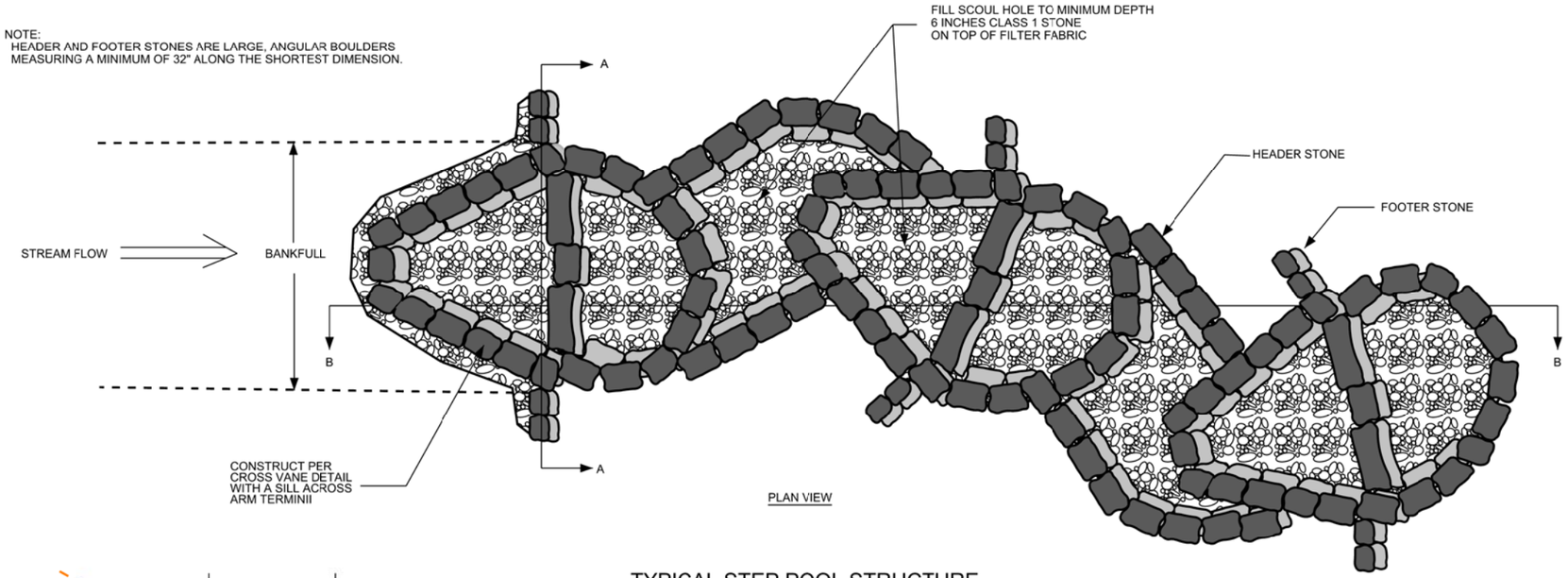
Date: July 2007

Project No.: 07-004

FIGURE NO.

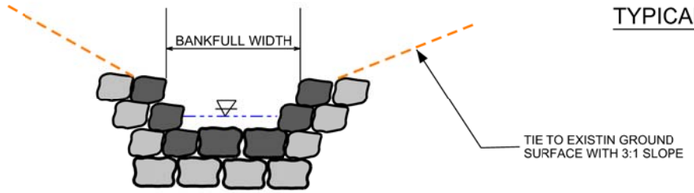
8A

NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.

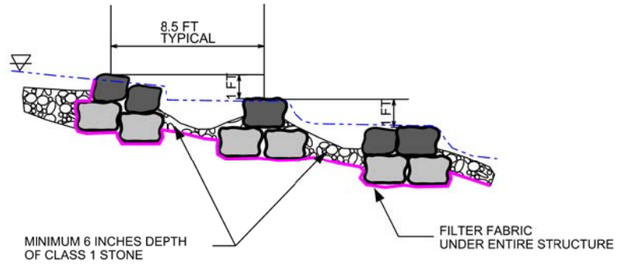


PLAN VIEW

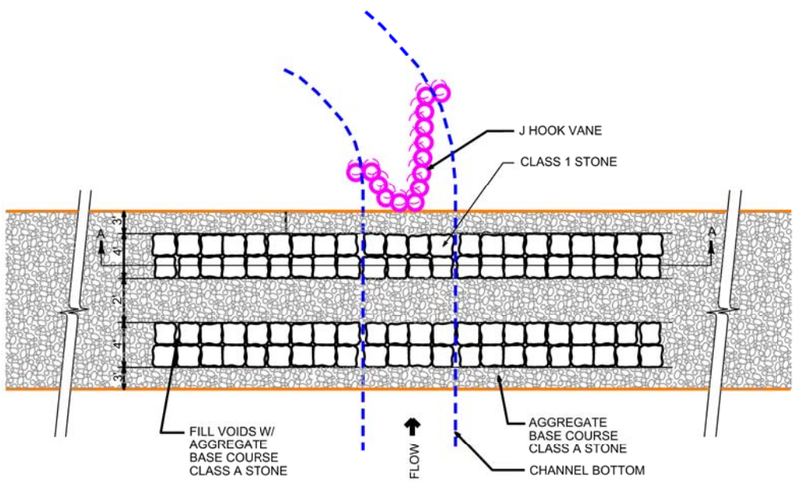
TYPICAL STEP POOL STRUCTURE



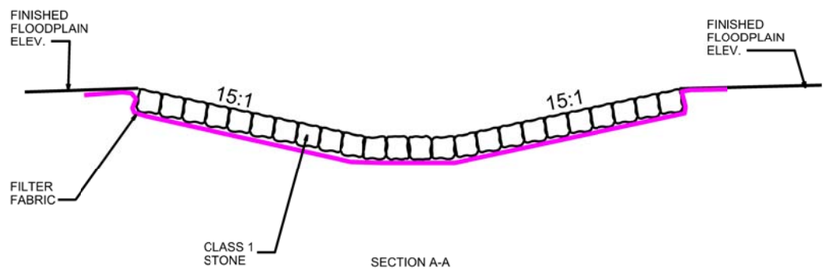
CROSS SECTION A-A



PROFILE B-B



PLAN VIEW



SECTION A-A

NOTES:

1. KEEP FORD CROSS FALL WITHIN 1-2% OF STREAM GRADIENT.
2. FILL VOIDS BETWEEN CLASS 1 STONE WITH AGGREGATE BASE COURSE CLASS A TO CREATE DRIVEABLE SURFACE.

PERMANENT CHANNEL FORD DETAIL

PERMANENT CHANNEL FORD DETAIL

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County
North Carolina

Title:

TYPICAL STRUCTURE DETAILS

Scale:	FIGURE NO.
NO SCALE	8B
Date: July 2007	
Project No.: 07-004	

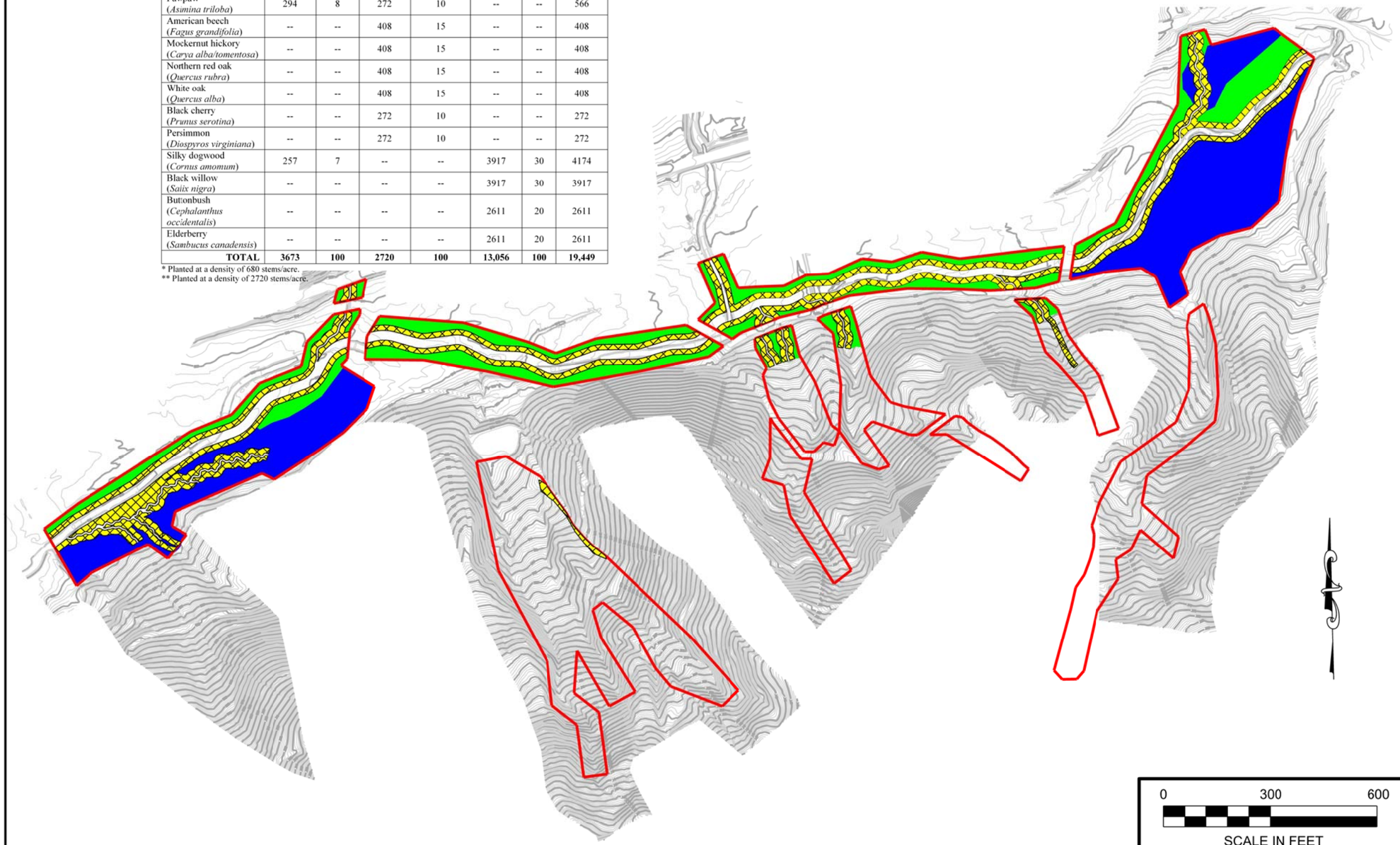
Vegetation Association	Piedmont/Mountain Bottomland Forest		Piedmont/Low Mountain Alluvial Forest		Stream-side Assemblage		TOTAL
Area (acres)	5.4		4.0		4.8		14.2
Species	Number planted*	% of total	Number planted*	% of total	Number planted**	% of total	Number planted
Swamp chestnut oak (*Quercus michauxii*)	551	15	--	--	--	--	551
Cherrybark oak (*Quercus pagoda*)	551	15	--	--	--	--	551
Sycamore (*Platanus occidentalis*)	551	15	272	10	--	--	823
Hackberry (*Celtis laevigata*)	551	15	--	--	--	--	551
American elm (*Ulmus americana*)	551	15	--	--	--	--	551
Green ash (*Fraxinus pennsylvanica*)	367	10	--	--	--	--	367
Pawpaw (*Asumina triloba*)	294	8	272	10	--	--	566
American beech (*Fagus grandifolia*)	--	--	408	15	--	--	408
Mockernut hickory (*Carya alba/tomentosa*)	--	--	408	15	--	--	408
Northern red oak (*Quercus rubra*)	--	--	408	15	--	--	408
White oak (*Quercus alba*)	--	--	408	15	--	--	408
Black cherry (*Prunus serotina*)	--	--	272	10	--	--	272
Persimmon (*Diospyros virginiana*)	--	--	272	10	--	--	272
Silky dogwood (*Cornus amomum*)	257	7	--	--	3917	30	4174
Black willow (*Saiix nigra*)	--	--	--	--	3917	30	3917
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	2611	20	2611
Elderberry (*Sambucus canadensis*)	--	--	--	--	2611	20	2611
TOTAL	3673	100	2720	100	13,056	100	19,449

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

Legend

	Easement Boundary	26.7 acres
	Stream Side Assemblage (15 feet each side of channel)	4.8 acres
	Piedmont Mountain Bottmland Hardwood Forest (Wetland Areas)	5.4 acres
	Piedmont Low Mountain Alluvial Forest	4.0 acres

* Nuisance Species Management will occur primarily within Streamside Assemblage and Hardwood Forest areas for removal of multiflora rose.



0 300 600
SCALE IN FEET

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:
Threemile Creek Restoration Site

Avery County
North Carolina

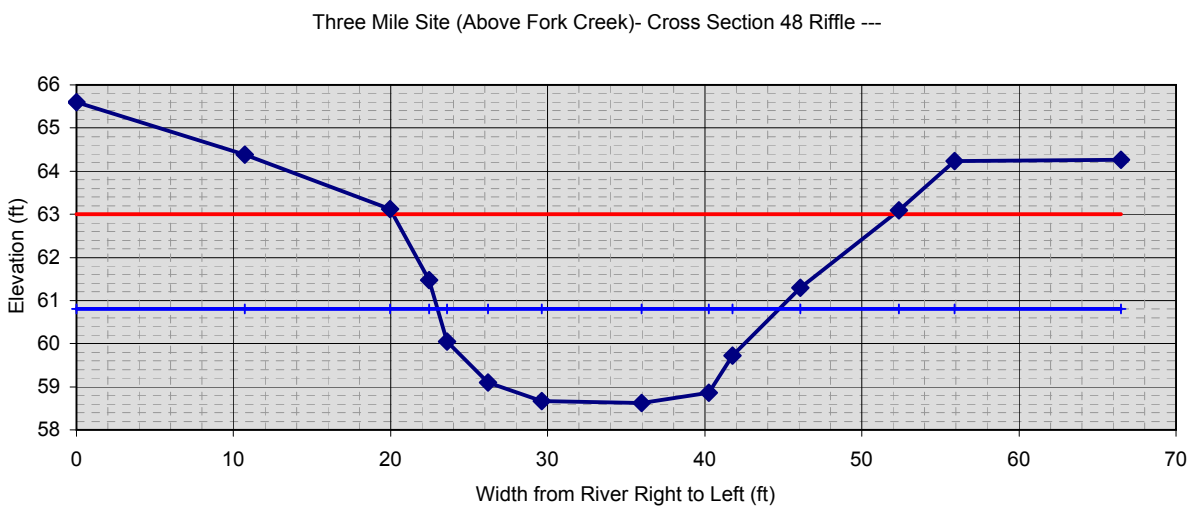
Title:
Planting Plan

Scale: 1 in = 300 ft
Date: July 2007
Project No.: 07-004

FIGURE NO.
9

Appendix B. Existing Stream Data

Cross Section



section:	Three Mile Site (Above Fork Creek)- Cross Section 48
	Riffle

	---
description:	Three Mile Site (Above Fork Creek)- Cross Section 48
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	24.397907	65.602093
	☐	10.717949	25.619388	64.380612
	☐	19.950462	26.881412	63.118588
	☐	22.464956	28.532287	61.467713
	☐	23.582847	29.958525	60.041475
	☐	26.194289	30.90655	59.09345
	☐	29.618993	31.328534	58.671466
	☐	35.992419	31.377223	58.622777
	☐	40.245318	31.139634	58.860366
	☐	41.759576	30.284625	59.715375
	☐	46.096548	28.700339	61.299661
	☐	52.349515	26.908603	63.091397
	☐	55.892361	25.759692	64.240308
	☐	66.494699	25.738427	64.261573
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

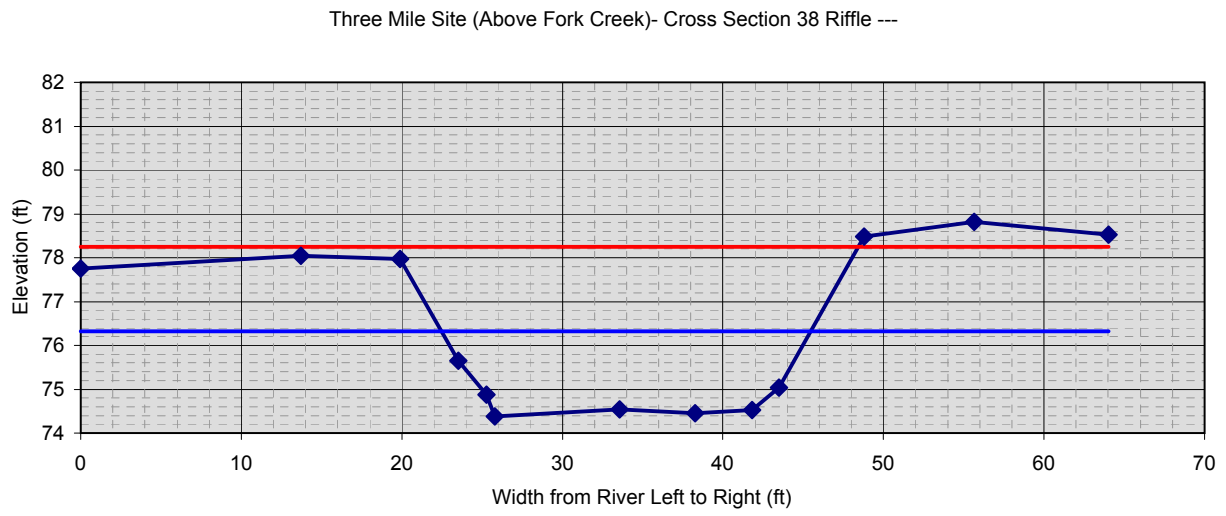
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
29.19	25.76	32.0		
60.81	64.24			

dimensions			
36.6	x-section area	1.7	d mean
21.8	width	22.8	wet P
2.2	d max	1.6	hyd radi
5.6	bank ht	13.0	w/d ratio
32.0	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:	Three Mile Site (Above Fork Creek)- Cross Section 38
	Riffle

	---
description:	Three Mile Site (Above Fork Creek)- Cross Section 38
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	12.242303	77.757697
	☐	13.700079	11.959134	78.040866
	☐	19.886145	12.031019	77.968981
	☐	23.529036	14.356895	75.643105
	☐	25.286197	15.118698	74.881302
	☐	25.793442	15.615052	74.384948
	☐	33.579425	15.46407	74.53593
	☐	38.251477	15.552025	74.447975
	☐	41.816186	15.481714	74.518286
	☐	43.489559	14.962647	75.037353
	☐	48.793499	11.524852	78.475148
	☐	55.659865	11.184323	78.815677
	☐	64.025305	11.474017	78.525983
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

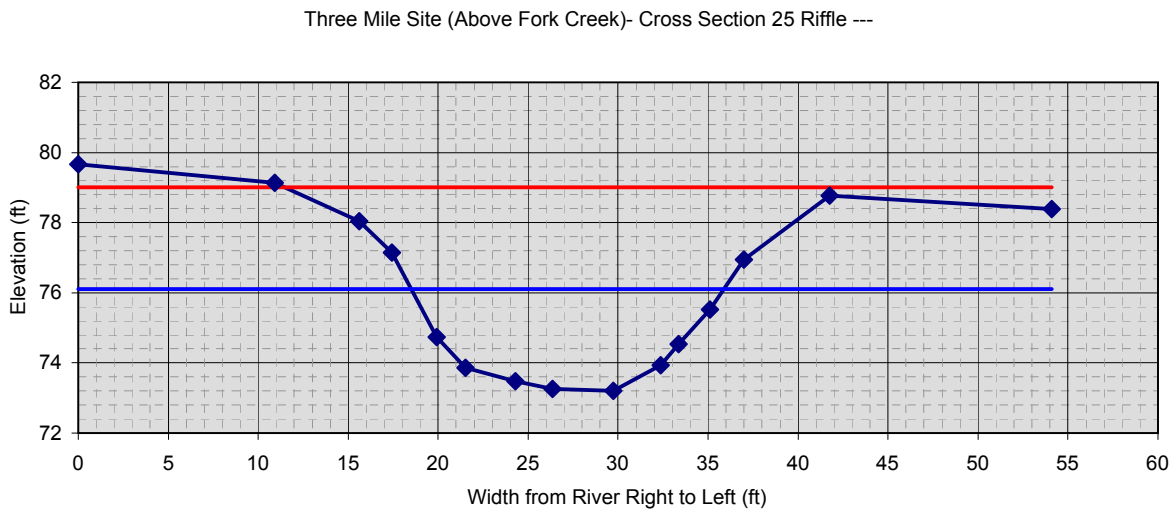
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
13.68	12.03	100.0		
76.32	77.97			

dimensions			
36.5	x-section area	1.6	d mean
23.0	width	24.0	wet P
1.9	d max	1.5	hyd radi
3.6	bank ht	14.5	w/d ratio
100.0	W flood prone area	4.3	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:	Three Mile Site (Above Fork Creek)- Cross Section 25
	Riffle

	---
description:	Three Mile Site (Above Fork Creek)- Cross Section 25
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	10.329355	79.670645
	☐	10.91326	10.857382	79.142618
	☐	15.605008	11.963111	78.036889
	☐	17.42501	12.847065	77.152935
	☐	19.926017	15.254597	74.745403
	☐	21.511076	16.135505	73.864495
	☐	24.276112	16.516658	73.483342
	☐	26.372184	16.73374	73.26626
	☐	29.722635	16.803197	73.196803
	☐	32.382077	16.063902	73.936098
	☐	33.375634	15.472354	74.527646
	☐	35.108621	14.481425	75.518575
	☐	36.995624	13.049045	76.950955
	☐	41.750072	11.230803	78.769197
	☐	54.099788	11.613337	78.386663
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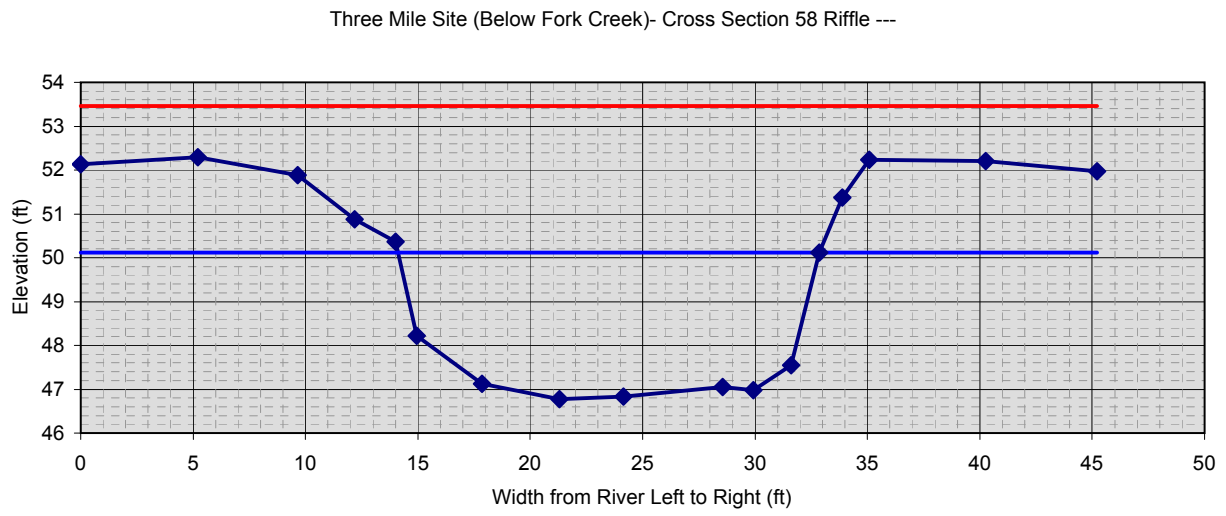
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
13.9	11.23	100.0		
76.1	78.77			

dimensions			
36.5	x-section area	2.1	d mean
17.4	width	18.9	wet P
2.9	d max	1.9	hyd radi
5.6	bank ht	8.2	w/d ratio
100.0	W flood prone area	5.8	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:	Three Mile Site (Below Fork Creek)- Cross Section 58
	Riffle

	---
description:	Three Mile Site (Below Fork Creek)- Cross Section 58
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	37.862931	52.137069
	☐	5.2237429	37.706175	52.293825
	☐	9.6517603	38.123884	51.876116
	☐	12.192708	39.129375	50.870625
	☐	14.009627	39.63463	50.36537
	☐	14.95708	41.779407	48.220593
	☐	17.846287	42.878639	47.121361
	☐	21.303053	43.222084	46.777916
	☐	24.138645	43.164558	46.835442
	☐	28.561401	42.943045	47.056955
	☐	29.927336	43.01881	46.98119
	☐	31.604233	42.454213	47.545787
	☐	32.856671	39.878618	50.121382
	☐	33.895332	38.624223	51.375777
	☐	35.075245	37.767502	52.232498
	☐	40.272802	37.798134	52.201866
	☐	45.203536	38.031187	51.968813
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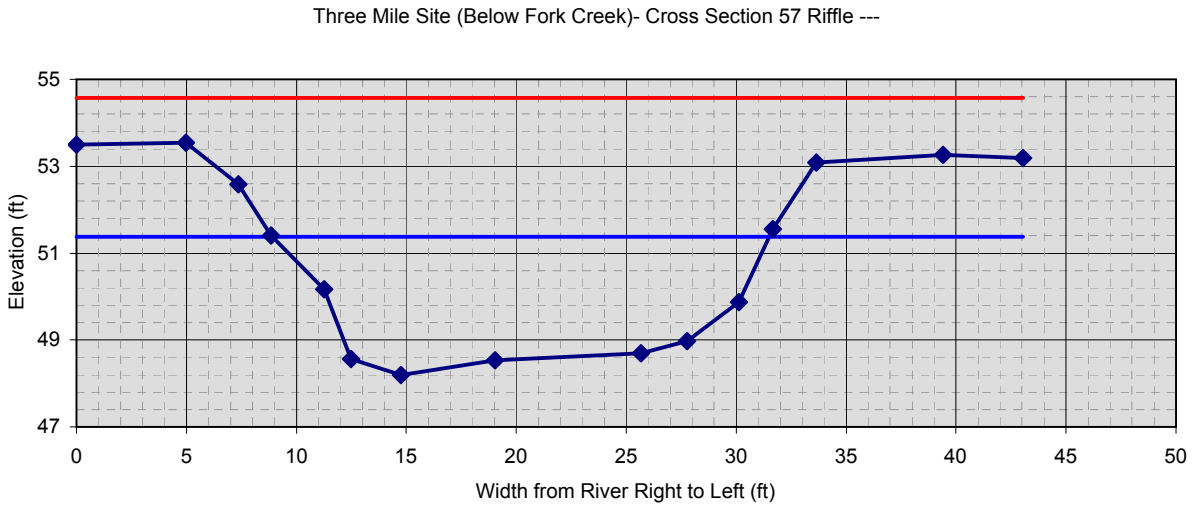
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
39.88	38.12	150.0		
50.12	51.88			

dimensions			
52.9	x-section area	2.8	d mean
18.7	width	21.9	wet P
3.3	d max	2.4	hyd radi
5.1	bank ht	6.6	w/d ratio
150.0	W flood prone area	8.0	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:	Three Mile Site (Below Fork Creek)- Cross Section 57
	Riffle

	---
description:	Three Mile Site (Below Fork Creek)- Cross Section 57
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	36.50403	53.49597
	☐	4.9782296	36.462665	53.537335
	☐	7.3725926	37.418096	52.581904
	☐	8.8475644	38.592674	51.407326
	☐	11.267597	39.826198	50.173802
	☐	12.472029	41.44295	48.55705
	☐	14.748941	41.811142	48.188858
	☐	19.044576	41.468342	48.531658
	☐	25.657828	41.30585	48.69415
	☐	27.750408	41.022059	48.977941
	☐	30.120139	40.121463	49.878537
	☐	31.67232	38.453236	51.546764
	☐	33.653029	36.911815	53.088185
	☐	39.396696	36.733739	53.266261
	☐	43.036163	36.810312	53.189688
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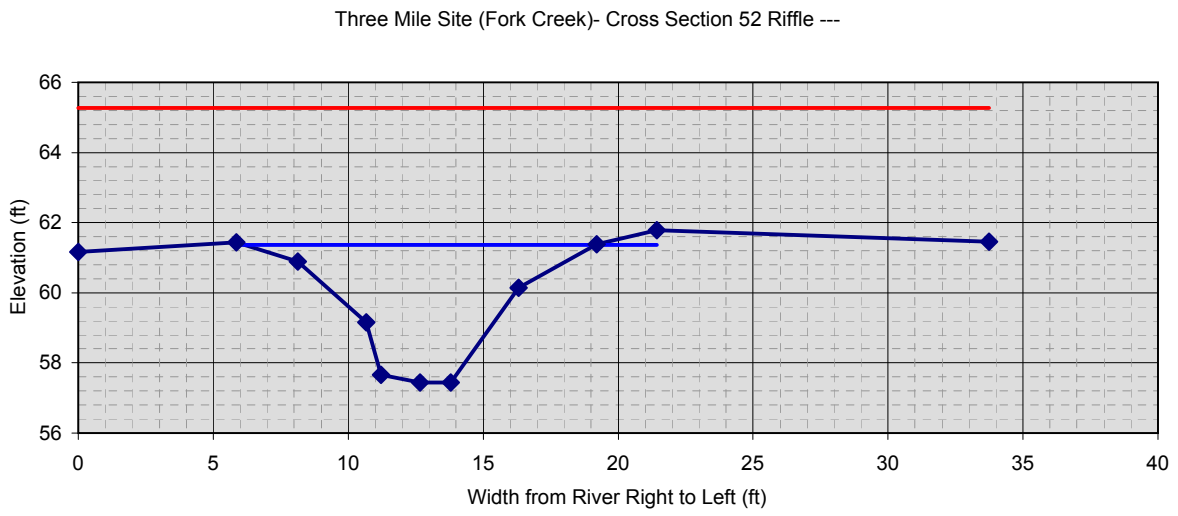
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
38.62	36.91	150.0		
51.38	53.09			

dimensions			
53.0	x-section area	2.3	d mean
22.6	width	24.6	wet P
3.2	d max	2.2	hyd radi
4.9	bank ht	9.7	w/d ratio
150.0	W flood prone area	6.6	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:	Three Mile Site (Fork Creek)- Cross Section 52
	Riffle

	---
description:	Three Mile Site (Fork Creek)- Cross Section 52
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	28.835002	61.164998
	☐	5.8616765	28.570729	61.429271
	☐	8.1405829	29.11198	60.88802
	☐	10.665236	30.836855	59.163145
	☐	11.216606	32.336314	57.663686
	☐	12.657049	32.558308	57.441692
	☐	13.806956	32.553819	57.446181
	☐	16.301606	29.866304	60.133696
	☐	19.211008	28.610752	61.389248
	☐	21.435714	28.223453	61.776547
	☑	33.729045	28.536613	61.463387
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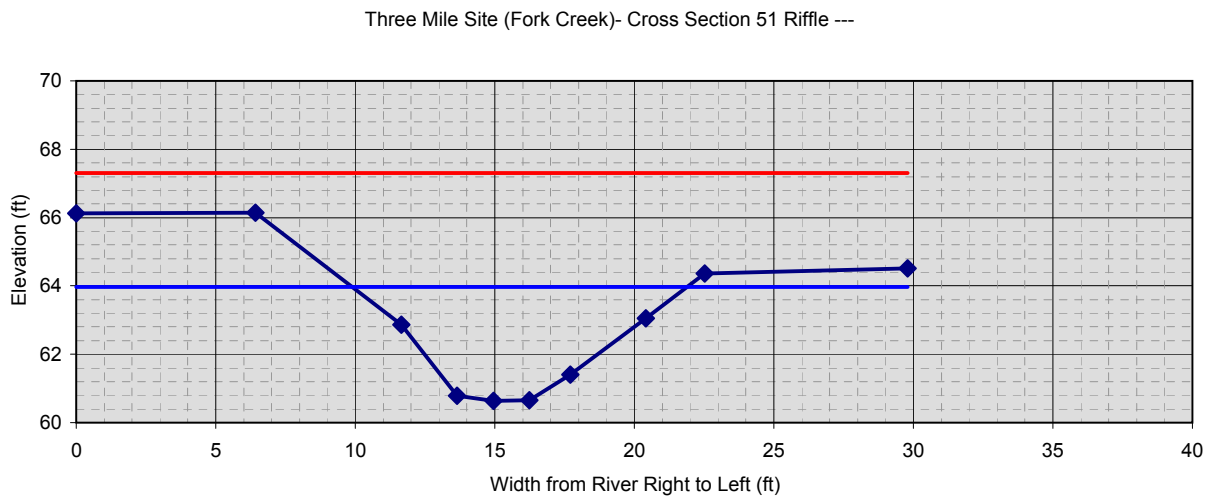
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
28.64	28.57	100.0		
61.36	61.43			

dimensions			
23.6	x-section area	1.8	d mean
13.0	width	16.1	wet P
3.9	d max	1.5	hyd radi
4.0	bank ht	7.1	w/d ratio
100.0	W flood prone area	7.7	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:	Three Mile Site (Fork Creek)- Cross Section 51
	Riffle

	---
description:	Three Mile Site (Fork Creek)- Cross Section 51
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	23.867655	66.132345
	☐	6.415454	23.866665	66.133335
	☐	11.640654	27.138266	62.861734
	☐	13.647896	29.219759	60.780241
	☐	14.947421	29.356055	60.643945
	☐	16.227595	29.353529	60.646471
	☐	17.71429	28.601244	61.398756
	☐	20.408018	26.955369	63.044631
	☐	22.528978	25.637782	64.362218
	☐	29.802675	25.487992	64.512008
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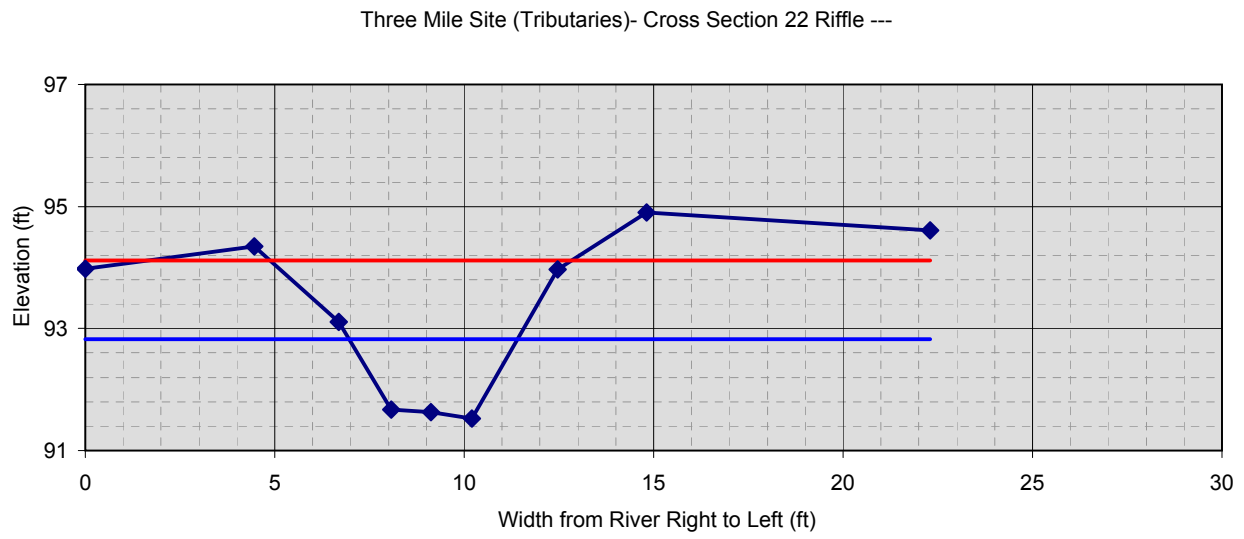
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
26.03	25.64	100.0		
63.97	64.36			

dimensions			
23.6	x-section area	2.0	d mean
12.0	width	14.1	wet P
3.3	d max	1.7	hyd radi
3.7	bank ht	6.1	w/d ratio
100.0	W flood prone area	8.3	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:	Three Mile Site (Tributaries)- Cross Section 22
	Riffle

	---
description:	Three Mile Site (Tributaries)- Cross Section 22
height of instrument (ft):	100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	6.016367	93.98363
	☐	4.461494	5.653388	94.34661
	☐	6.68393	6.896821	93.10318
	☐	8.074088	8.326395	91.67361
	☐	9.127132	8.375168	91.62483
	☐	10.20027	8.477972	91.52203
	☐	12.46571	6.027159	93.97284
	☐	14.80787	5.094661	94.90534
	☐	22.29137	5.388625	94.61138
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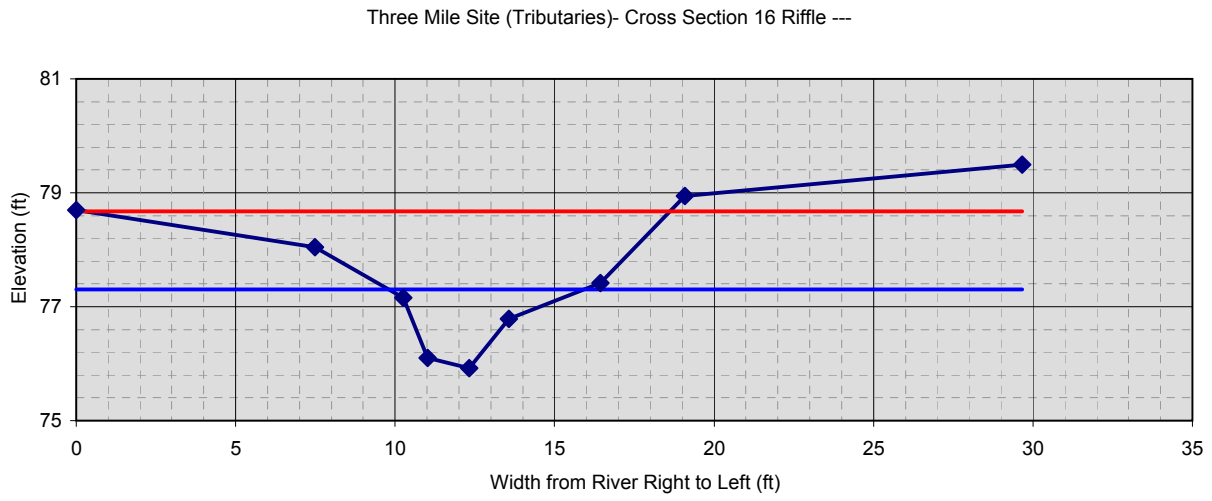
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
7.18	5.65	8.0		
92.82	94.35			

dimensions			
4.0	x-section area	0.9	d mean
4.4	width	5.5	wet P
1.3	d max	0.7	hyd radi
2.8	bank ht	4.9	w/d ratio
8.0	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:	Three Mile Site (Tributaries)- Cross Section 16
	Riffle

	---
description:	Three Mile Site (Tributaries)- Cross Section 16
height of instrument (ft):	90.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	11.304989	78.695011
	☐	7.484958	11.95252	78.04748
	☐	10.248662	12.8479	77.1521
	☐	11.009263	13.898925	76.101075
	☐	12.320202	14.075026	75.924974
	☐	13.574157	13.215983	76.784017
	☐	16.435374	12.587017	77.412983
	☐	19.077615	11.055494	78.944506
	☐	29.655745	10.500643	79.499357
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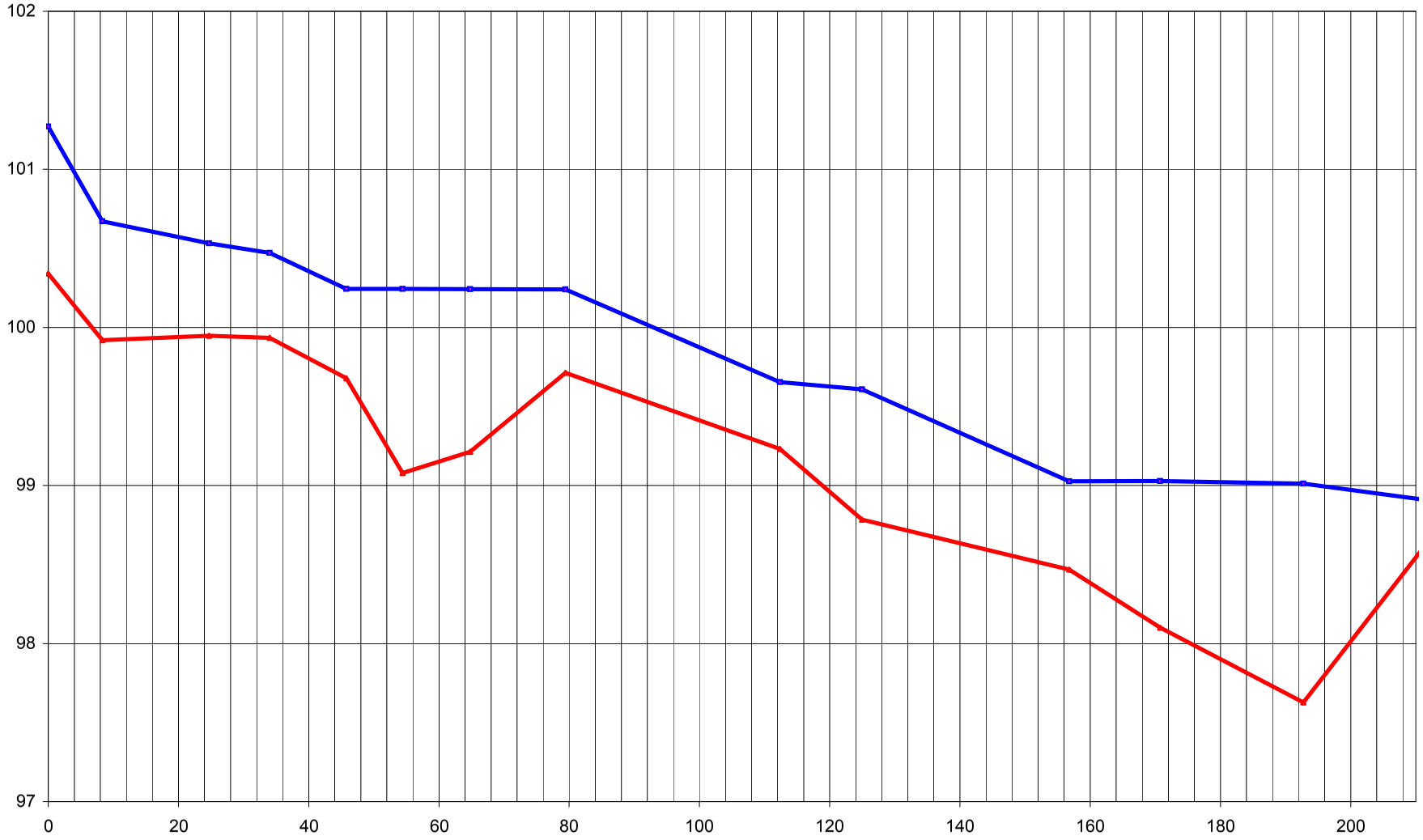
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
12.7	11.95	18.0		
77.3	78.05			

dimensions			
4.0	x-section area	0.7	d mean
6.1	width	7.0	wet P
1.4	d max	0.6	hyd radi
2.1	bank ht	9.3	w/d ratio
18.0	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		

Cranberry Creek Profile



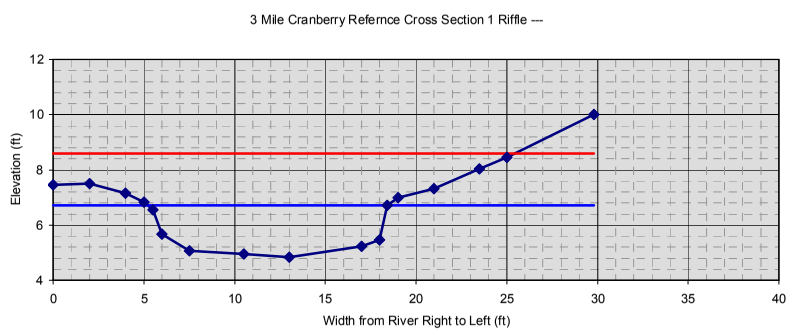
Three Mile Cran Reference
Profile

1
2

Average Water Surface Slope
0.0112

Point	Description	Station	Bed Elevation	Water Elevation		Revised Riffle Slope	Revised Pool Slope	Revised Run Slope	Revised Glide Slope
23	tr	0.00	100.3412	101.2718					
25	mr	8.32	99.91862	100.6718					
27	mr	24.70	99.94679	100.5323					
29	mr x2r	34.00	99.93489	100.4713		0.0225			
31	br	45.79	99.67809	100.2431					
33	r x3p	54.41	99.07827	100.2443				0.0000	
35	p	64.77	99.21253	100.2423			0.0002		
37	tr x1r(I think	79.43	99.71263	100.2412					0.0001
39	br	112.38	99.23088	99.65434		0.0178			
58	tr	124.98	98.78404	99.6089			0.0036		
60	br	156.79	98.46779	99.02623		0.0183		0.0000	
62	run	170.73	98.10109	99.02793					
64	p	192.74	97.62746	99.01141			0.0008		
66	tr	210.94	98.59622	98.91259					0.0054
					average	0.0195	0.0015	0.0000	0.0028
					median	0.0183	0.0008	0.0000	0.0028
					min	0.0178	0.0002	0.0000	0.0001
					max	0.0225	0.0036	0.0000	0.0054

Cross Section



section: 3 Mile Cranberry Refernce Cross Section 1
Riffle

---
description: 3 Mile Cranberry Refernce Cross Section 1
height of instrument (ft): 10.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	29.8	0	10
	☐	25	1.55	8.45
	☐	23.5	1.96	8.04
	☐	21	2.69	7.31
	☐	19	3.02	6.98
	☐	18.4	3.28	6.72
	☐	18	4.54	5.46
	☐	17	4.76	5.24
	☐	13	5.16	4.84
	☐	10.5	5.05	4.95
	☐	7.5	4.94	5.06
	☐	6	4.34	5.66
	☐	5.5	3.46	6.54
	☐	5	3.17	6.83
	☐	4	2.84	7.16
	☐	2	2.51	7.49
	☐	0	2.54	7.46
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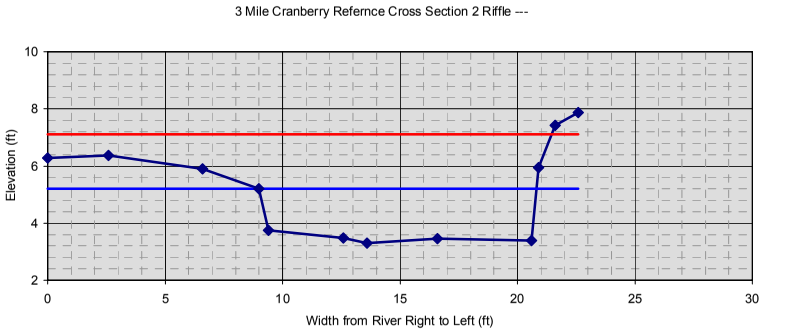
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
3.28	3.28	75.0		
6.72	6.72			

dimensions			
20.4	x-section area	1.5	d mean
13.2	width	14.9	wet P
1.9	d max	1.4	hyd radi
1.9	bank ht	8.5	w/d ratio
75.0	W flood prone area	5.7	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: 3 Mile Cranberry Refernce Cross Section 2
Riffle

---
description: 3 Mile Cranberry Refernce Cross Section 2
height of instrument (ft): 10.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	3.73	6.27
	☐	2.6	3.62	6.38
	☐	6.6	4.11	5.89
	☐	9	4.8	5.2
	☐	9.4	6.25	3.75
	☐	12.6	6.51	3.49
	☐	13.6	6.71	3.29
	☐	16.6	6.54	3.46
	☐	20.6	6.6	3.4
	☐	20.9	4.05	5.95
	☐	21.6	2.58	7.42
	☐	22.6	2.12	7.88
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	☐			
	☐			
	☐			
	☐			
	☐			

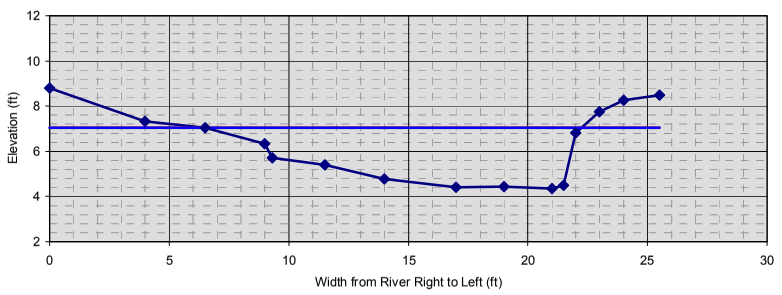
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.8	4.8	75.0		
5.2	5.2			

dimensions			
19.9	x-section area	1.7	d mean
11.8	width	14.6	wet P
1.9	d max	1.4	hyd radi
1.9	bank ht	7.0	w/d ratio
75.0	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: 3 Mile Cranberry Refernce Cross Section 3
Pool

---
description: 3 Mile Cranberry Refernce Cross Section 3
height of instrument (ft): 10.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	1.19	8.81
	☐	4	2.68	7.32
	☐	6.5	2.96	7.04
	☐	9	3.66	6.34
	☐	9.3	4.3	5.7
	☐	11.5	4.6	5.4
	☐	14	5.23	4.77
	☐	17	5.59	4.41
	☐	19	5.56	4.44
	☐	21	5.65	4.35
	☐	21.5	5.5	4.5
	☐	22	3.19	6.81
	☐	23	2.26	7.74
	☐	24	1.73	8.27
	☐	25.5	1.5	8.5
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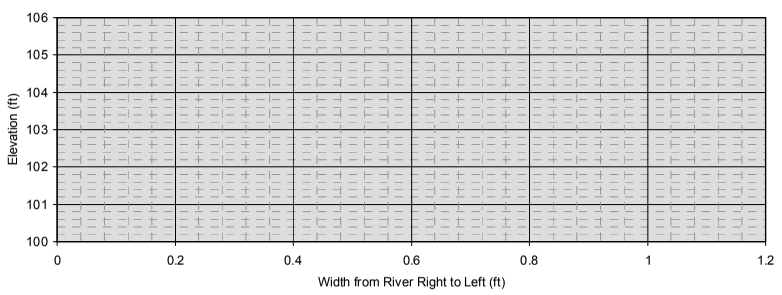
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.96	2.96	15.0		
7.04	7.04			

dimensions			
29.2	x-section area	1.9	d mean
15.7	width	18.3	wet P
2.7	d max	1.6	hyd radi
2.7	bank ht	8.5	w/d ratio
15.0	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:
Riffle

---
description:
height of instrument (ft): 120.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
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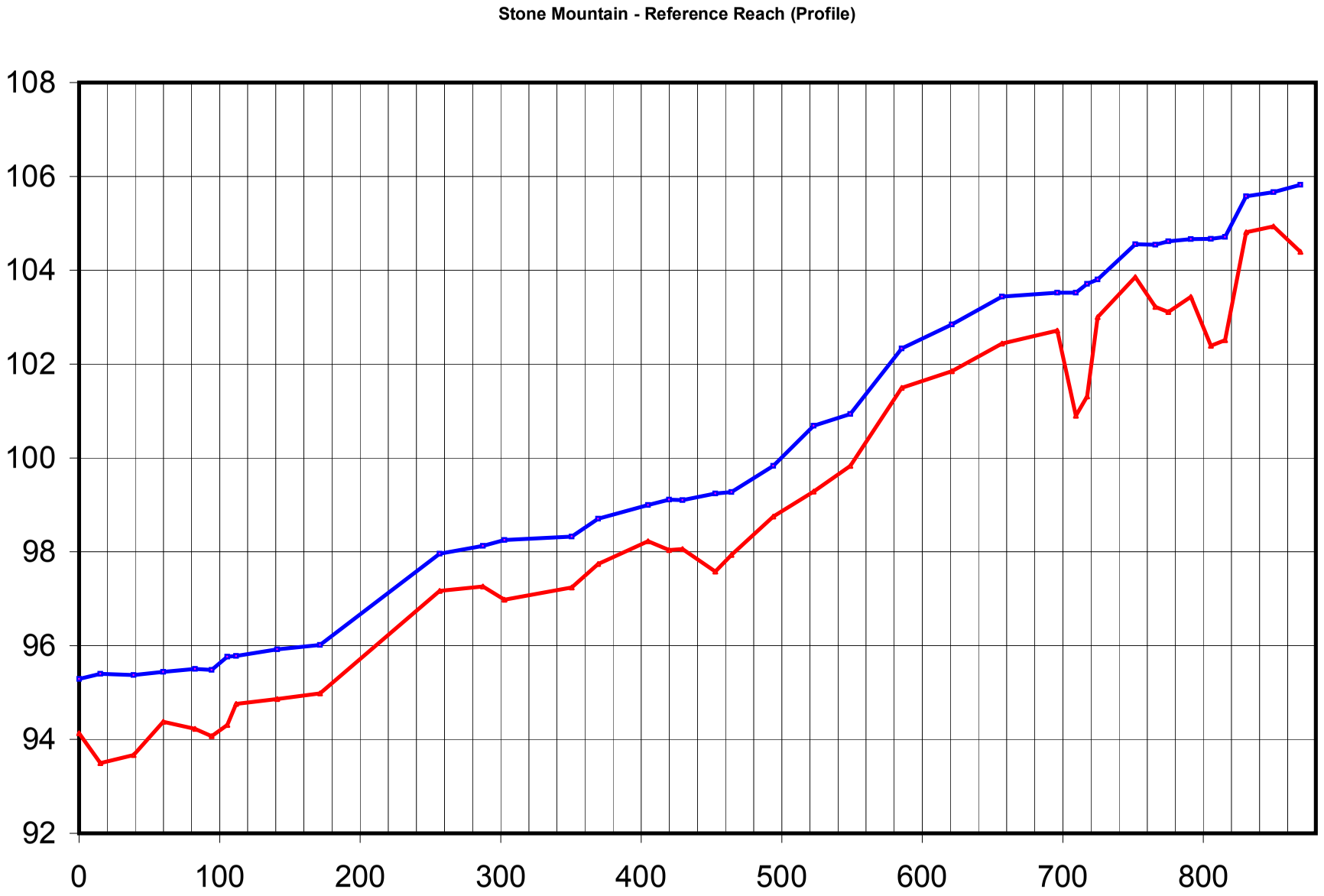
	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
120	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	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		


Stone Mountain - Reference Reach (Profile)
108
106
104
102
100
98
96
94
92
0
100
200
300
400
500
600
700
800

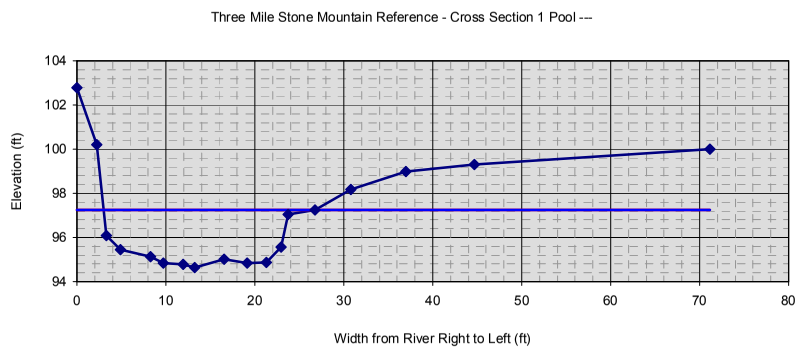
Three Mile Reference
Stone Mountain Profile

1
2

Average Water Surface Slope
0.0121

Point	Description	Station	Bed Elevation	Water Elevation	Revised Riffle Slope	Revised Pool Slope	Revised Run Slope	Revised Glide Slope
23	tr	0	94.13263	95.28835				
25	gl	15.11	93.49411	95.39867				
27	r	38.89	93.67068	95.3751		0.0000		
29	br	59.92	94.37789	95.44286			0.0032	
31	tr	82.54	94.22491	95.50187	0.0026			
33	gl	94.29	94.0706	95.48023				0.0000
35	r	105.39	94.31203	95.76228		0.0254		
37	r/g apex	111.78	94.75754	95.77852				
40	r	141.01	94.86304	95.91908				
42	br	171.36	94.98409	96.01657			0.0032	
44	mr	256.56	97.16899	97.95923				
47	tr	287.32	97.2581	98.12326	0.0182			
49	g	302.71	96.97995	98.25032				0.0083
113	r	350.51	97.23894	98.32526		0.0016		
115	br	369.26	97.73992	98.70362			0.0202	
117	tr	404.84	98.22537	98.9956	0.0082			
119	gl	419.75	98.03464	99.11351				0.0079
121	p	429.32	98.05653	99.10281				
123	r	452.73	97.5777	99.23967		0.0038		
125	br	464.25	97.93262	99.27449			0.0030	
128	mr	493.98	98.75011	99.82854				
150	mr	522.74	99.28535	100.6848				
152	mr	548.74	99.83258	100.9343				
154	mr	585.36	101.4943	102.3335				
156	mr	620.98	101.8458	102.8417				
158	mr	656.61	102.4351	103.4359				
160	tr	696.02	102.7114	103.52	0.0183			
162	g	709.18	100.9006	103.5193				0.0000
164	r	717.25	101.3102	103.7075		0.0233		
166	br	724.79	103.0025	103.8044			0.0128	
168	tr	751.50	103.856	104.5526				
170	gl	765.81	103.2189	104.5449				0.0000
186	p	775.07	103.1101	104.6147				
188	r/g apex	791.03	103.4307	104.6652				
190	gl	805.30	102.3903	104.6703				
192	r	815.38	102.5111	104.7109		0.0040		
194	step	830.33	104.8077	105.5761				
196	mr	849.89	104.936	105.6655				
199	gl	869.07	104.3944	105.8226				0.0082
				average	0.0118	0.0097	0.0085	0.0041
				median	0.0132	0.0039	0.0032	0.0040
				min	0.0026	0.0000	0.0030	0.0000
				max	0.0183	0.0254	0.0202	0.0083

Cross Section



section: Three Mile Stone Mountain Reference - Cross Section 1
Pool

---
description: Three Mile Reference - Cross Section 1
height of instrument (ft): 120.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	17.22914	102.7709
	☐	2.21216	19.80303	100.197
	☐	3.299757	23.91275	96.08725
	☐	4.884124	24.55082	95.44918
	☐	8.264066	24.88059	95.11941
	☐	9.68084	25.15201	94.84799
	☐	11.95856	25.21987	94.78013
	☐	13.26888	25.35927	94.64073
	☐	16.55625	24.99513	95.00487
	☐	19.14937	25.14998	94.85002
	☐	21.29405	25.12401	94.876
	☐	22.96625	24.44118	95.55882
	☐	23.75285	22.95577	97.04423
	☐	26.79018	22.75211	97.24789
	☐	30.77968	21.8168	98.1832
	☐	36.99159	21.02677	98.97323
	☐	44.68403	20.68225	99.31775
	☐	71.13601	20.0089	99.9911
	☐			
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	☐			
	☐			

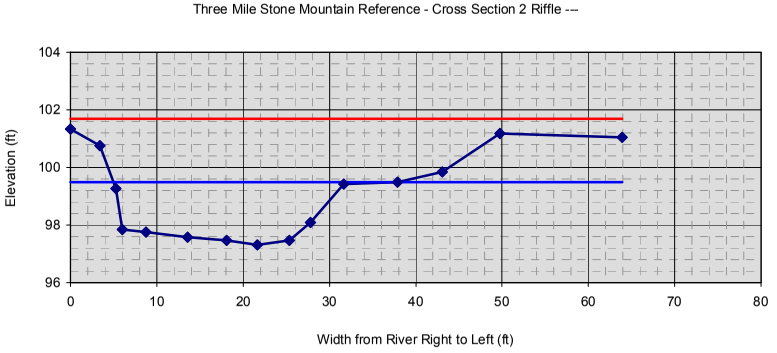
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
22.75	21.8			
97.25	98.2			

dimensions			
44.8	x-section area	1.9	d mean
23.8	width	25.9	wet P
2.6	d max	1.7	hyd radi
3.6	bank ht	12.6	w/d ratio
0.0	W flood prone area	0.0	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: Three Mile Stone Mountain Reference - Cross Section 2
Riffle

---
description: Three Mile Reference - Cross Section 2
height of instrument (ft): 120.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	18.67335	101.3266
	☐	3.399695	19.25212	100.7479
	☐	5.255775	20.72419	99.27581
	☐	6.002993	22.16002	97.83998
	☐	8.759019	22.23359	97.76641
	☐	13.56978	22.41547	97.58453
	☐	18.12065	22.53974	97.46026
	☐	21.68445	22.68453	97.31548
	☐	25.38321	22.53532	97.46468
	☐	27.82071	21.90916	98.09084
	☐	31.67271	20.58449	99.41551
	☐	37.8668	20.51001	99.49
	☐	43.0594	20.14578	99.85422
	☐	49.78147	18.82135	101.1787
	☐	63.91923	18.95529	101.0447
	☐			
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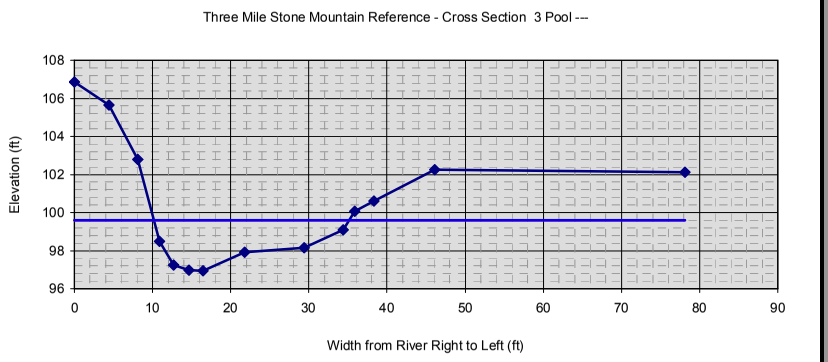
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
20.5	20.5	100.0		
99.5	99.5			

dimensions			
45.9	x-section area	1.4	d mean
33.0	width	34.3	wet P
2.2	d max	1.3	hyd radi
2.2	bank ht	23.8	w/d ratio
100.0	W flood prone area	3.0	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: Three Mile Stone Mountain Reference - Cross Section 3
Pool

---
description: Three Mile Reference - Cross Section 3
height of instrument (ft): 120.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	13.15229	106.8477
	☐	4.403565	14.34504	105.655
	☐	8.102244	17.22335	102.7767
	☐	10.89765	21.5166	98.4834
	☐	12.68193	22.74499	97.25501
	☐	14.64299	23.02224	96.97777
	☐	16.47006	23.07066	96.92935
	☐	21.74711	22.09087	97.90913
	☐	29.38559	21.85079	98.14921
	☐	34.39919	20.91424	99.08576
	☐	35.87001	19.93641	100.0636
	☐	38.36164	19.4092	100.5908
	☐	46.13994	17.74915	102.2509
	☐	78.10538	17.87346	102.1265
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	☐			
	☐			
	☐			
	☐			

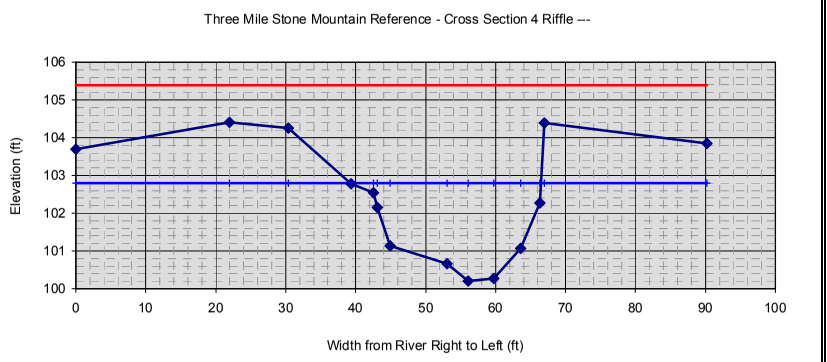
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
20.4	17.75	~~15.0~~		
99.6	102.25			

dimensions			
41.8	x-section area	1.7	d mean
25.0	width	26.3	wet P
2.7	d max	1.6	hyd radi
5.3	bank ht	~~14.9~~	w/d ratio
~~15.0~~	W flood prone area	~~0.6~~	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: Three Mile Stone Mountain Reference - Cross Section 4
Riffle

---
description: Three Mile Reference - Cross Section 4
height of instrument (ft): 120.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	16.29789	103.7021
	☐	21.99309	15.59574	104.4043
	☐	30.3298	15.74057	104.2594
	☐	39.32195	17.2143	102.7857
	☐	42.51465	17.45475	102.5453
	☐	43.13122	17.84494	102.1551
	☐	44.95169	18.85829	101.1417
	☐	53.05083	19.34677	100.6532
	☐	56.08902	19.79749	100.2025
	☐	59.73466	19.73223	100.2678
	☐	63.5952	18.93585	101.0642
	☐	66.3039	17.73635	102.2637
	☐	66.96142	15.60438	104.3956
	☐	90.21228	16.15437	103.8456
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	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
17.2	15.7	100.0		
102.8	104.3			

dimensions			
46.1	x-section area	1.7	d mean
27.2	width	28.4	wet P
2.6	d max	1.6	hyd radi
4.1	bank ht	16.1	w/d ratio
100.0	W flood prone area	3.7	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	

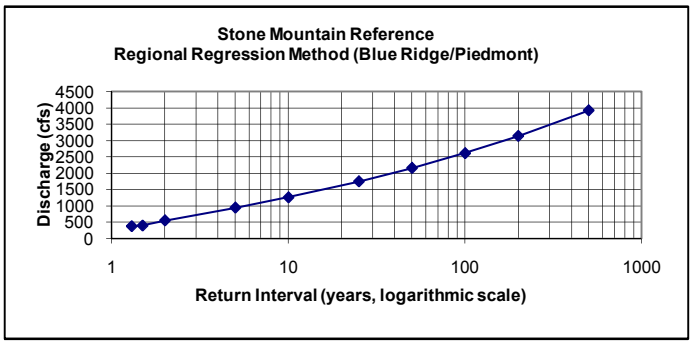
Appendix C. Bankfull Verification

Regional Regression Method
Threemile Creek Restoration Studies

Stone Mountain Reference
(DA = 7.5 square miles)
Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	**385**
1.5	**410**
2	555
5	947
10	1270
25	1750
50	2160
100	2620
200	3140
500	3930

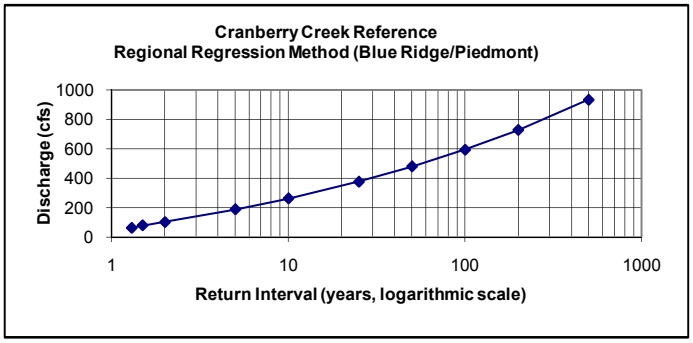
Bold indicates interpolated data.



Cranberry Creek Reference
(DA = 0.7 square mile)
Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	**65**
1.5	**80**
2	105
5	190
10	264
25	378
50	480
100	596
200	729
500	935

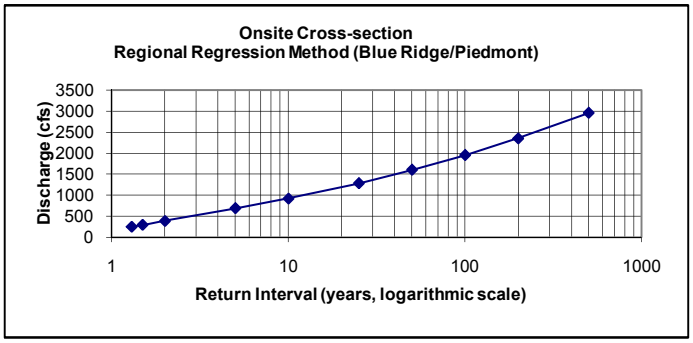
Bold indicates interpolated data.



Onsite Cross-section with Bankfull Indicators
(DA = 4.7 square miles)
Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	**260**
1.5	**300**
2	400
5	690
10	930
25	1290
50	1610
100	1960
200	2360
500	2960

Bold indicates interpolated data.



Appendix D. Site Photographs

Threemile Creek
Preconstruction Photographs
March and May 2007

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:	Three Mile Restoration Site
County Name:	Avery
EEP Number:	Contract # D06125A
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	Travis Hamrick
Project Contact Address:	1101 Haynes Street, Suite 107, Raleigh, NC 27607
Project Contact E-mail:	travis@restorationsystems
EEP Project Manager:	Guy Pearce

Project Description

The Three Mile Creek Restoration Site is located approximately 5 miles northeast of Spruce Pine, in southwestern Avery County. It is located in Cataloging Unit 06010108 of the French Broad River Basin and in Targeted Local Watershed 06010108010020. The Site encompasses approximately 22.7 acres of land that is utilized for Christmas tree production, ornamental landscape nursery plant production, timber harvest, and livestock grazing. A total of 8,021 Stream Mitigation Units and 2.3 Wetland Mitigation Units will be implemented by a combination of restoration, enhancement, and preservation.

For Official Use Only

Reviewed By:

Date — EEP Project Manager

Conditional Approved By:

7-25-07

Date — For Division Administrator FHWA

☐ Check this box if there are outstanding issues

Final Approval By:

7-25-07

Date — For Division Administrator FHWA

Environmental Documentation
for
Three Mile Creek Stream and Wetland Restoration Site

EEP Contract Number D06125-A

Categorical Exclusion Form Items

CZMA
Not applicable, as the project is not located in a CAMA county.

CERCLA
See the attached Executive Summary of the limited Phase 1 Site Assessment.

National Historic Preservation Act (Section 106)
See the attached letters to and from the State Historic Preservation Office. SHPO recommended that an archaeological survey of the site be conducted. RS contracted with Legacy Research Associates, Inc. and the survey was conducted. Two copies of the report were submitted to SHPO and they have concurred with the conclusions. See the attached Management Summary from the report.

Uniform Act
See the attached notification letter to the landowner.

American Indian Religious Freedom Act
A request for concurrence and a copy of the archaeological report was submitted to Mr. Tyler Howe, Tribal Historic Preservation Officer, EBCI. See the attached correspondence to Mr. Howe. He did not offer any comments on this project.

Antiquities Act
Not applicable, as the project is not located on Federal lands.

Archaeological Resources Protection Act
Not applicable, as the project is not located on Federal or Indian lands.

Eastern Band of Cherokee Indians
Letter sent to EBCI. No response.

Endangered Species Act
Literature and field searches revealed that no suitable habitat nor species occurrence exists for the eight Federally protected species listed for Avery county. See the attached internal memo with the Biological Conclusion of No Effect.

Executive Order 13007
Not applicable, as the project is not located on Federal Lands within a county claimed by the Eastern Band of Cherokee Indians.

Farmland Protection Policy Act
Ten acres of prime farmland and 0.7 acre of statewide important farmland will be impacted by the project. See the attached USDA Form AD-1006 and correspondence with the NRCS.

Fish and Wildlife Coordination Act
See the attached letters to the NCWRC and the USFWS. Only the NCWRC provided comment on the project. They had no objection to the project and suggested that it could improve the trout fishery in the watershed. They also stated that they will require review of the application of the nationwide permit that will be required for the project because the project is located in a "trout county."

Land and Water Conservation Fund Act
Not applicable. The project will not convert recreation lands.

Magnuson-Stevens Fishery Conservation and Management Act
Not applicable. The project is not located in an estuarine system.

Migratory Bird Treaty Act
See the attached letters to the NCWRC and the USFWS. Neither agency made a comment on the project relative to this act.

Other Miscellaneous Items

Public Notice
See the attached Affidavit of Publication of a Public Notice in the Mitchell News.

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

March 12, 2007

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: EEP-Three Mile Stream & Wetland Full Delivery Project, Contract Number D06125-A

Dear Ms. Gledhill-Earley,

Restoration Systems, LLC (RS) has been awarded a contract by the Ecosystem Enhancement Program (EEP) to implement a stream and wetland restoration project in Avery County. As required by the contract, RS requests your review of the project and any comments that you may have with respect to archaeological or historical resources associated with it. The location of the project is shown on the attached map.

The Three Mile Stream and Wetland Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Several sections of channel have been identified as significantly degraded. No architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. In addition, the majority of this site has historically been disturbed due to agricultural purposes such as hay production and cattle grazing. The ground disturbance activities required to complete this project will only impact those areas that have previously been impacted due to these agricultural practices.

The site is located on the Spry Farm, approximately 7 miles northeast of Spruce Pine in Avery County (Figure 1). The project involves the restoration of approximately 6,500 feet of Three Mile Creek, 250 feet of Fork Creek and 2.3 acres of wetlands (Figure 2). An additional 5,000 linear feet of stream will be protected in its natural state within the easement boundaries. The property is owned by Ms. Mary Spry.

We request that you review this site based on the information provided to determine if you know of any existing resources that we need to know about. In addition, please provide us with your comments regarding the proposed project.

Thank you in advance for your timely response and cooperation. Please feel free to contact me at the office (919) 755-9490 or on my cell phone (919) 819-0014 if you have any questions.

Sincerely,

Travis Hamrick, Project Manager

Attachments: 2 maps

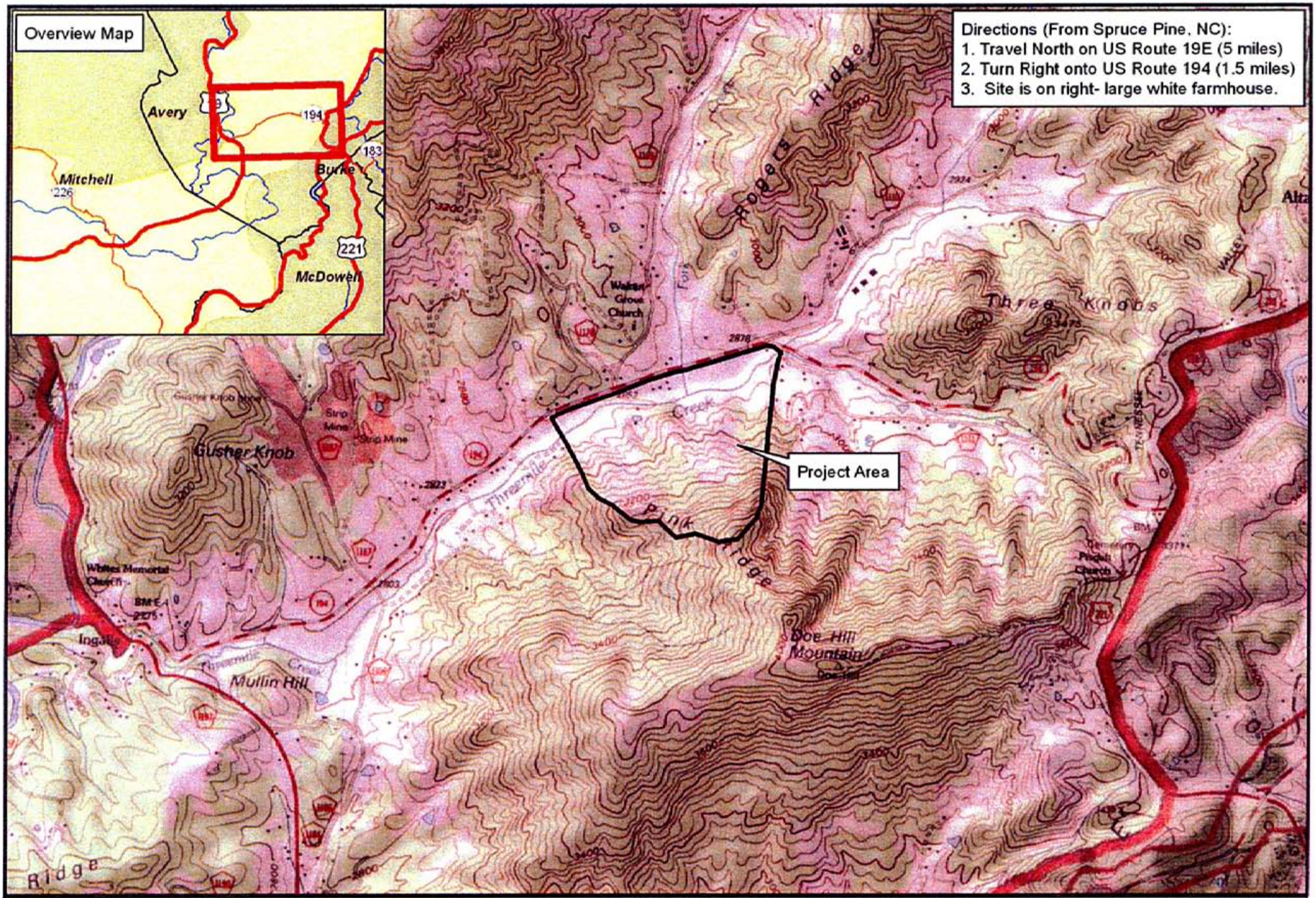


Figure 1: Project Location
Threemile Stream & Wetland
Restoration Site
Avery County, NC

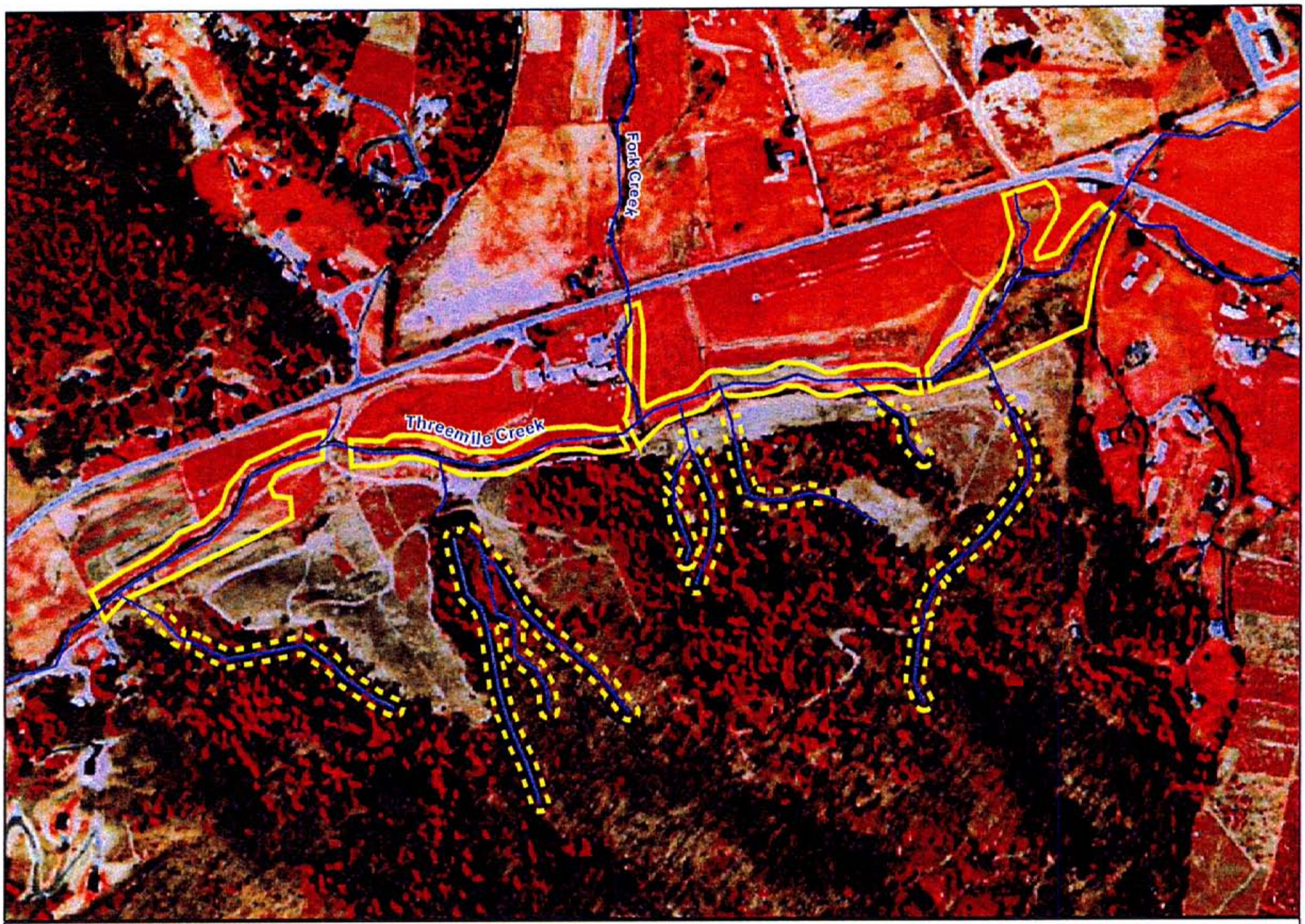


Figure 2: Project Overview
Three Mile Stream & Wetland
Restoration Site
Avery County, NC

RESTORATION SYSTEMS, LLC

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

April 3, 2007

Travis Hamrick
Restoration Systems, LLC
1101 Haynes St., Suite 107
Raleigh, NC 27604

Re: EEP, Three Mile Stream and Wetland Restoration, Northeast of Spruce Pine, Avery County, ER 07-0613

Dear Mr. Hamrick:

Thank you for your letter of March 12, 2007, concerning the above project.

There are no known recorded archaeological sites within the project boundaries. However, the project area has never been systematically surveyed to determine the location or significance of archaeological resources. Based on the topographic and hydrological situation, there is a high probability for the presence of prehistoric or historic archaeological sites.

We recommend that a comprehensive survey be conducted by an experienced archaeologist to identify and evaluate the significance of archaeological remains that may be damaged or destroyed by the proposed project. Potential effects on unknown resources must be assessed prior to the initiation of construction activities.

Two copies of the resulting archaeological survey report, as well as one copy of the appropriate site forms, should be forwarded to us for review and comment as soon as they are available and well in advance of any construction activities.

A list of archaeological consultants who have conducted or expressed an interest in contract work in North Carolina is available at www.arch.dcr.state.nc.us/consults.htm. The archaeologists listed, or any other experienced archaeologist, may be contacted to conduct the recommended survey.

We have determined that the project as proposed will not affect any historic structures.

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 919/733-4763 ext. 246. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

May 15, 2007

Ms. Renee Gledhill-Earley,
Environmental Review Coordinator
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 29699-4617

Subject: EEP, Three Mile Stream and Wetland Restoration, Northeast of Spruce Pine, Avery County, ER 07-0613

Dear Ms. Gledhill-Earley:

Please find enclosed two copies of the report titled "Archaeology Survey for the Three- Mile Creek Stream-and-Wetland Restoration Project in Avery County, North Carolina" and one copy of the associated Archaeology Site Form III.

On April 3, 2007, you responded to Restoration Systems (RS) request for concurrence on this project that is being implemented for the EEP. In your response, you recommended that RS have a comprehensive survey of the project conducted by an experienced archaeologist. RS contracted with Legacy Research Associates, Inc., to conduct the recommended survey.

Three sites were identified in and adjacent to the project boundaries. The one site located within the project boundary (Site 31AV120) consists of a "non-diagnostic prehistoric lithic isolated find" and no further archaeological work was recommended. The two additional sites identified are both located outside the project boundaries. Site 31AV121 is a cemetery adjacent to Highway 194 and is well outside (> 70 meters) the project boundary. There will be zero chance of impacts to this site as a result of stream and wetland restoration work. Site 31AV119 "appears to represent long-term habitation" and is immediately adjacent to the project boundary. We concur with the recommendation from Legacy Research for "site avoidance" and as a result, fencing will be placed around the site to insure its boundary is clearly identified and avoided.

Based on this survey, RS requests a letter of concurrence from your office to complete Environmental Screening of the project. I would appreciate receiving such a letter at your earliest convenience.

Sincerely,

Travis Hamrick, Project Manager

Enclosures

Pilot Mill • 1101 Haynes St., Suite 107 • Raleigh, NC 27604 • www.restorationsystems.com • Phone 919.755.9490 • Fax 919.755.9492

Archaeological Survey for the Three-Mile Creek Stream-and-Wetland Restoration Project in Avery County, North Carolina
North Carolina Environmental Review # 07-0613

MANAGEMENT SUMMARY

Legacy Research Associates, Inc. (Legacy) of Durham, North Carolina, on behalf of Restoration Systems, LLC, of Raleigh, North Carolina, has completed the archaeological survey for the Three-Mile Creek stream-and-wetland restoration project in Avery County, North Carolina (North Carolina Environmental Review Number 07-0613). The project encompasses approximately 71.1 hectares or 175.8 acres (Figure 1). Within the project boundaries, 17.7 km (11 mi) of restoration and 3.6 hectares (9 acres) of preservation are planned (Figure 2).

The purpose of this survey was to locate, document, and conduct National Register of Historic Places (NRHP)-eligibility evaluation investigations for archaeological resources within the project area of potential effects (APE) that may be affected by the proposed restoration of stream-and-wetland areas.

This work complies with the National Historic Preservation Act of 1966 (as amended), the Archaeological and Historical Preservation Act of 1974, Executive Order 11593, and 36 CFR Parts 660-66 and 800, as appropriate. It follows the North Carolina State Historic Preservation Office guidelines and meets the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (Federal Register 48). All information submitted in this report is factual and sufficiently complete to enable the North Carolina State Historic Preservation Office (SHPO) to perform the necessary reviews.

Background Research

Before initiating the archaeological survey, a thorough review of state and local survey data was performed. This included the files at the North Carolina Office of State Archaeology (OSA) and historic documents, maps, and county histories held at the State Library of North Carolina. Both repositories are located in Raleigh.

Data collected during the background research provided information necessary to understand the historic context of any resources identified during the survey. The data also enabled an assessment of existing cultural resources within the project area.

No previously recorded archaeological sites are located within the proposed Three-Mile Creek stream-and-wetland restoration project boundaries or within 1.6 km (1 mi) of the project.

Field Investigation Results

The archaeological survey of the Three-Mile Creek stream-and-wetland project was conducted by Legacy on April 17 and 18, 2007. Deborah Joy served as project director; Jared Roberts served as field director; Andrea Kontrath, Rhonda Cranfill-Moran, Chris Pettyjohn, and Jay Stevens assisted.

The archaeological investigation consisted of pedestrian survey, informant interviews, and subsurface shovel testing within the project APE. The survey resulted in recording three archaeological sites. One

site (31AV120) is located within the APE, the second site (31AV119) adjoins the APE, and the third (31AV121**) is located outside the APE (Table 1). A description of these three archaeological sites follows.

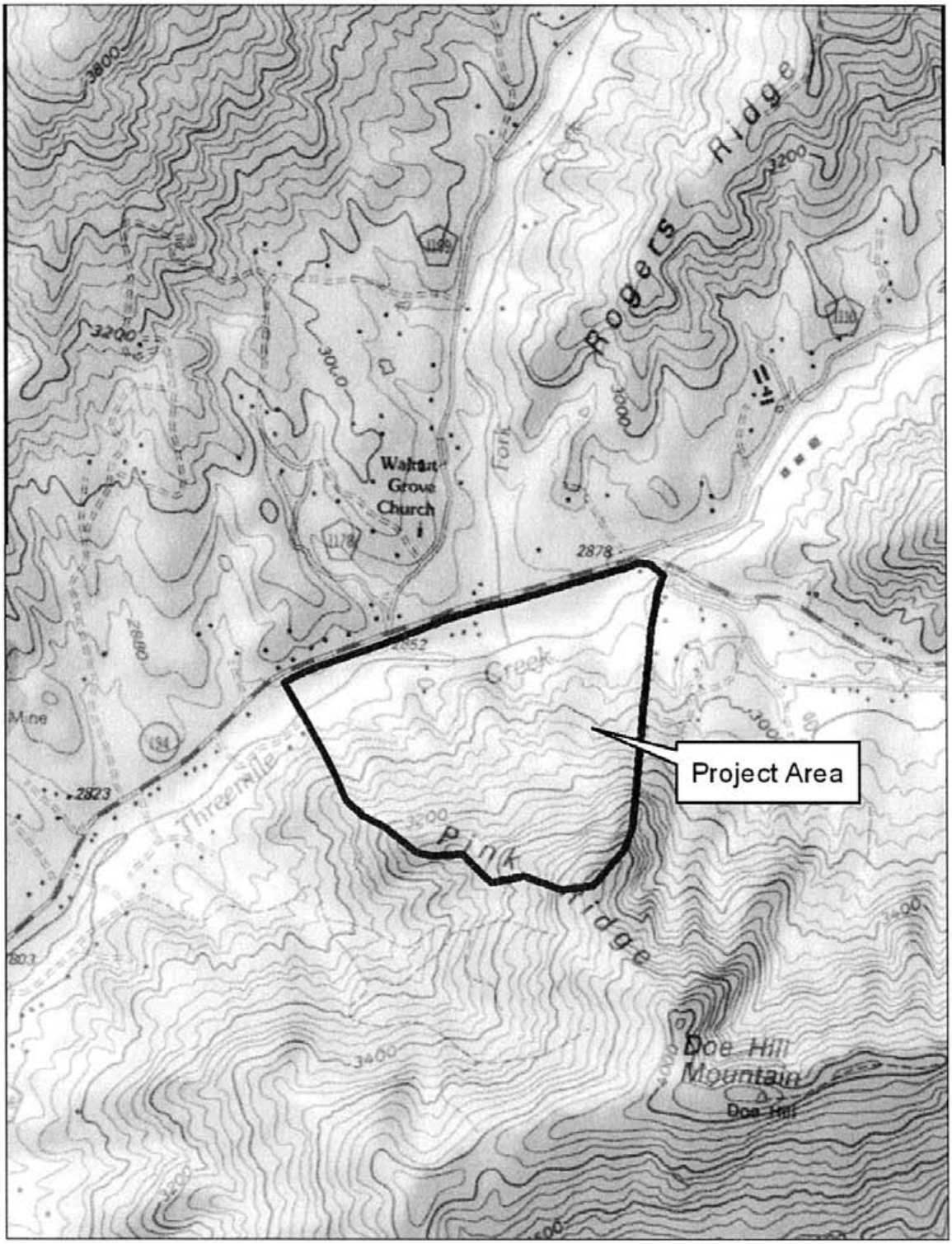


Figure 1. Three-Mile Creek stream-and-wetland restoration project location map (Restoration Systems, LLC).

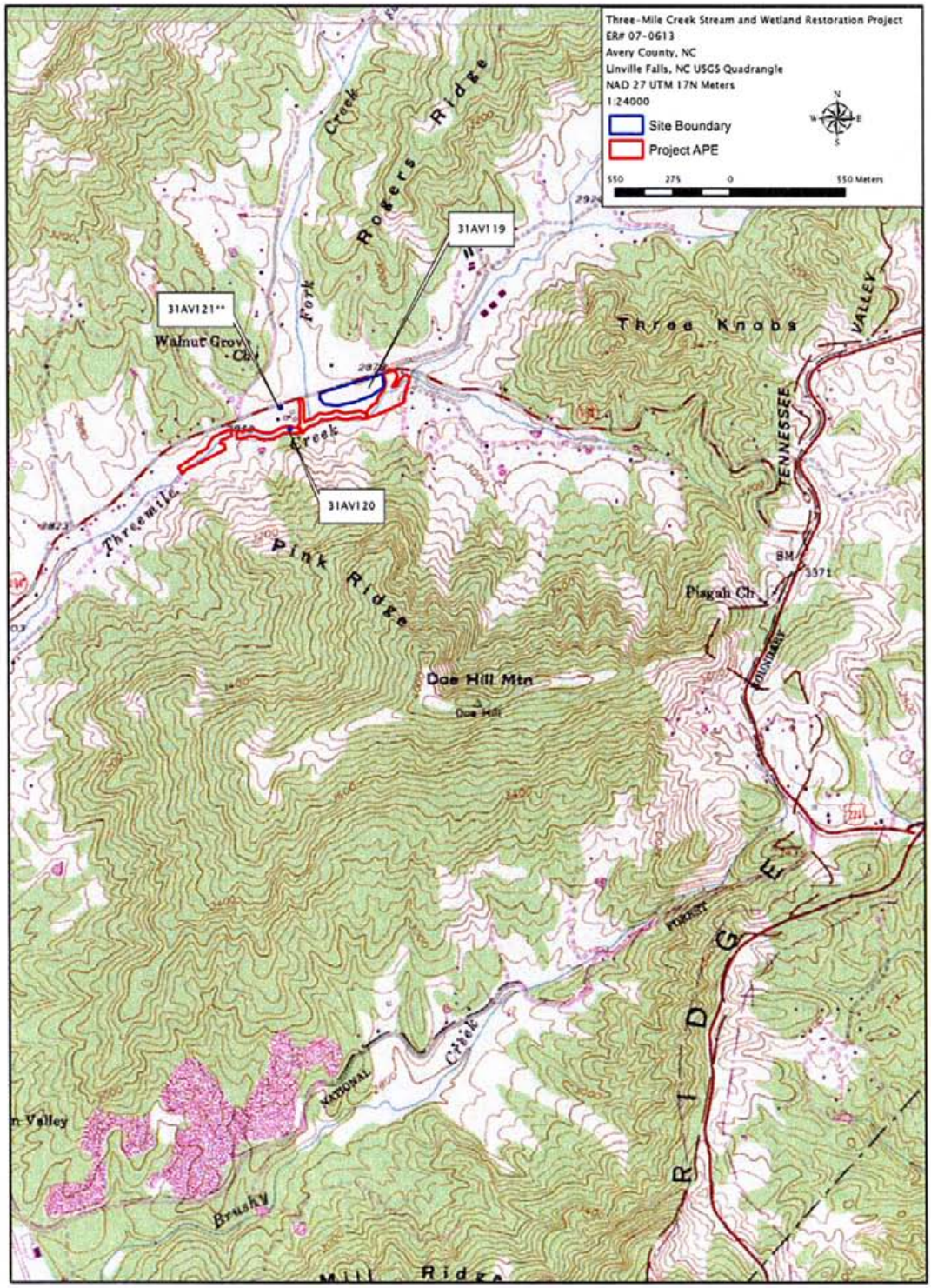


Figure 2. Site location and project APE map (USGS 1994).

Table 1. Archaeological sites recorded during the Three-Mile Creek stream-and-wetland restoration project survey.				
Site Number	Component(s)	Description	NRHP-Eligibility Recommendation	Project Recommendation
31AV119	Prehistoric, Middle Archaic to Early Woodland	Long-term habitation	Eligible under Criterion D for its information potential	No further work. However, the boundary of the site adjoins the project APE. This area should not be used as a temporary staging area during construction
31AV120	Unknown Prehistoric	Lithic isolated find	Not Eligible	No further work
31AV121**	Historic, early-19th century	Cemetery	Eligible under Criterion B for its association with the lives of persons significant in our past	No further work, outside project APE

31AV119 is a large prehistoric site located on the north side of Three-Mile Creek. The site is situated on a first terrace and side slope landform, adjacent to the northeastern boundary of the project APE. This site area consists of a plowed field and grassy pasture.

Based on the results of the archaeological survey, 31AV119 appears to represent long-term habitation that dates from the Middle Archaic to the Early Woodland period. The estimated size of 31AV119 is 60 m (197 ft) north-south and 240 m (787 ft) east west. The eastern boundary of the site adjoins the project APE (see Figure 2).

This site is recommended as being eligible for the NRHP under Criterion D for its information potential. The site contains intact deposits, diversity in artifact material and type, and there is potential for the presence of cultural features that could add to our understanding of the prehistory of the region. Site avoidance is recommended. It is also recommended that the use of heavy machinery on the site should be avoided. If the portion of the site adjacent to the project APE cannot be avoided, then additional archaeological investigations are recommended in this area.

31AV120 is a prehistoric isolated find that was located on the floodplain of the north side of Three-Mile Creek and within a grassy pasture. The site lies approximately 60 m (197 ft) south of Spry Farms, which is a complex consisting of two barns, a shop, and a dwelling.

Based on the results of the archaeological survey, 31AV120 represents a non-diagnostic prehistoric lithic isolated find. The site measures approximately 5 m by 5 m (16.4 by 16.4 ft). The entire site lies within the project boundaries. Due to the sparse artifact recovery and lack of diagnostic material, this site is recommended as being not eligible for the NRHP; it cannot add new information to our understanding of the prehistory of the area. No further archaeological work is recommended.

31AV121** is an early-nineteenth-century cemetery located north of Spry Farms on the south side of US Route 194 (Three-Mile Highway). The cemetery lies approximately I km (0.6 mi) north of Temp Site 2, which is outside the project APE.

The cemetery is not depicted on the current Linville Falls, NC, USGS topographic quadrangle map (USGS 1994). Through consultation with the Site Registrar of the North Carolina OSA, it was determined this resource should be recorded as an archaeological site even through it lies outside the project APE (Susan Myers personal communication 2007).

The cemetery was used by the William Davis family who lived in nearby during the late-eighteenth- and early-nineteenth centuries (Arthur 2002). William Davis served as a Corporal during the Revolutionary War and was a local hero. The Daughters of the American Revolution (DAR) erected a stone monument atop the location of William Davis' grave and his wife Frances' that is inscribed (Avery County Historical Museum):

CPL. WILLIAM DAVIS
20 NC REGT., 1778-1781
BORN c. 1727 DIED OCT. 5 1841

FRANKY CARPENTER WEATHERMAN DAVIS
BORN 1755 DIED SEPT. 10, 1842

It is not known how many other members of the Davis family were buried in this cemetery; however, early-nineteenth-century documentation noted that plain rocks once marked Davis' grave and the graves of two others (Arthur 2002). Currently, two fieldstone markers lie next to the DAR monument. The cemetery encompasses an area of approximately 8 m (26.2 ft) by 8 m (26.2 ft).

This resource lies outside the project APE and will not be affected by the proposed Three-Mile Creek stream-and-wetland restoration project. Therefore, no further archaeological work is recommended.

However, the cemetery is recommended as being eligible for the NRHP under Criterion B for its association with the lives of persons significant in our past. According to the Avery County Museum, William Davis was the last surviving veteran of the Battle of King's Mountain of October 7, 1780; and he was present at Yorktown when General Cornwallis surrendered to Washington (Avery County Historical Museum). Davis also served with Braddock during the French-and-Indian War and later with the Continental Army.

The Davis family homestead was located near the project area. In 1805, Davis was granted 100 acres on Rogers Fork of Three-Mile Creek (Burke County, NC, Deed Book 119, Page 209); the confluence of Rogers Fork and Three-Mile Creek is located within the project APE. Davis built four connecting log cabins and according to the Avery Museum website, "Davis's log home ... stood not far from (his gravesite) and has long been torn down" (Avery County Museum; Arthur 2002). No archaeological evidence of historic occupation within the project APE was found during the survey.

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

June 26, 2007

Travis Hamrick
Restoration Systems, LLC
1101 Haynes St., Suite 107
Raleigh, NC 27604

Re: EEP, Three Mile Stream and Wetland Restoration, Northeast of Spruce Pine, Avery County, ER 07-0613

Dear Mr. Hamrick:

Thank you for your letter of May 15, 2007, transmitting the archaeological survey report by Legacy Research Associates, Inc. for the above project. The report meets our guidelines and those of the Secretary of the Interior.

During the course of the survey one site was located within the project area, and two sites were located adjacent to the project boundaries. For purposes of compliance with Section 106 of the National Historic Preservation Act, we concur that the following properties are eligible for listing in the National Register of Historic Places under the criterion cited:

31AV119	Criterion D	31AV119 is a Middle Archaic to Early Woodland period habitation site with intact cultural deposits.
31AV121**	Criterion B	31AV121** is an early 19th century cemetery associated with Revolutionary War soldier William Davis.

The following property is determined ineligible for listing in the National Register of Historic Places:

31AV120

31AV120 is an isolated find lacking sufficient density of cultural material to have the potential to yield information important in history or prehistory.

The report authors have recommended no further work at 31AV120. Avoidance is recommended for 31AV119 which borders the project area and for 31AV121** which lies outside the project area. We concur with these recommendations. If 31AV119 cannot be avoided, additional archaeological work is necessary.

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 919/733-4763 ext. 246. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Carrie Collins, Legacy Research Associates, Inc.

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

October 10, 2006

Ms. Mary Spry
2145 Three Mile Rd.
Newland, NC 28657

Dear Ms. Spry:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Avery County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490

Sincerely,

Travis Hamrick
Project Manager

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

March 12, 2007

Mr. Tyler Howe
Tribal Historic Preservation Specialist
Eastern Band of Cherokee Indians
Tribal Historic Preservation Office
P.O. Box 455
Cherokee, NC 28719

Subject: EEP- Three Mile Creek Stream & Wetland Full Delivery Project, Contract Number D06125-A

Dear Mr. Howe:

Restoration Systems, LLC (RS) has been awarded a contract by the Ecosystem Enhancement Program (EEP) to implement a stream and wetland restoration project in Avery County. As required by the contract, the EEP requests review and comment on any possible issues that might emerge with respect to archaeological or religious resources associated with a potential stream and wetland restoration project. Please review the attached maps for general project location (Figure 1) and areas of ground disturbance for project implementation (Figure 2).

A similar letter has been sent to the North Carolina State Preservation Office for compliance with Section 106 of the Historic Preservation Act.

The Three Mile Stream & Wetland Restoration site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel & wetland impacts. No architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. In addition, the majority of this site has historically been disturbed due to agricultural purposes such as hay production and cattle grazing. The ground disturbance activities required to complete this project will only impact those areas that have previously been impacted due to these agricultural practices.

The project involves the restoration of approximately 6,500 linear feet of Three Mile Creek and 250 linear feet of Fork Creek. In addition to the restoration of the Three Mile and Fork Creeks, the project consists of 5,000 liner feet of stream preservation on 10 Unnamed Tributaries to Three Mile Creek. Approximately 1.3 acres will be impacted for wetland restoration while an additional 2 acres of existing wetlands will receive impacts from enhancement activities (invasive species removal and native vegetation planting). The project is located approximately 7.3 miles northeast of Spruce Pine, North Carolina (Figure 1). The property is owned by Ms. Mary Spry.

We ask that you review this site based on the attached information to determine if you know of any existing resources that need to be brought to our attention. In addition, please let us know the level your future involvement with this project needs to be (if any). You may contact me at the office (919) 755-9490 or on my cell phone (919) 819-0014.

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.

Sincerely,

Travis Hamrick, Project Manager

Restoration Systems
1101 Haynes St. Suite 107
Raleigh, NC 27604

cc:
Guy Pearce, EEP Project Manager
1652 Mail Service Center
Raleigh, NC 27699-1652

Attachments: 2 maps

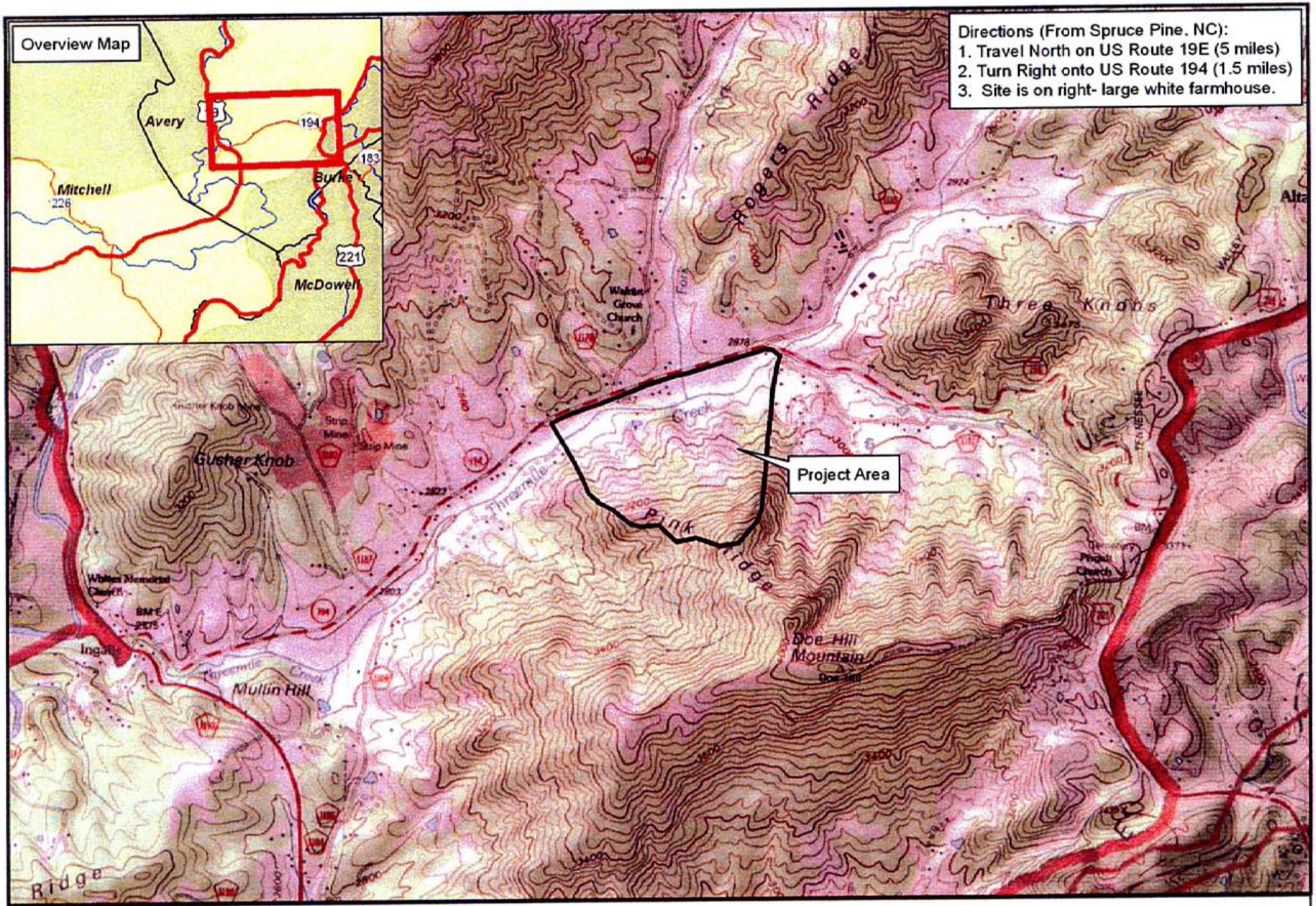


Figure 1: Project Location
Threemile Stream & Wetland
Restoration Site
Avery County, NC

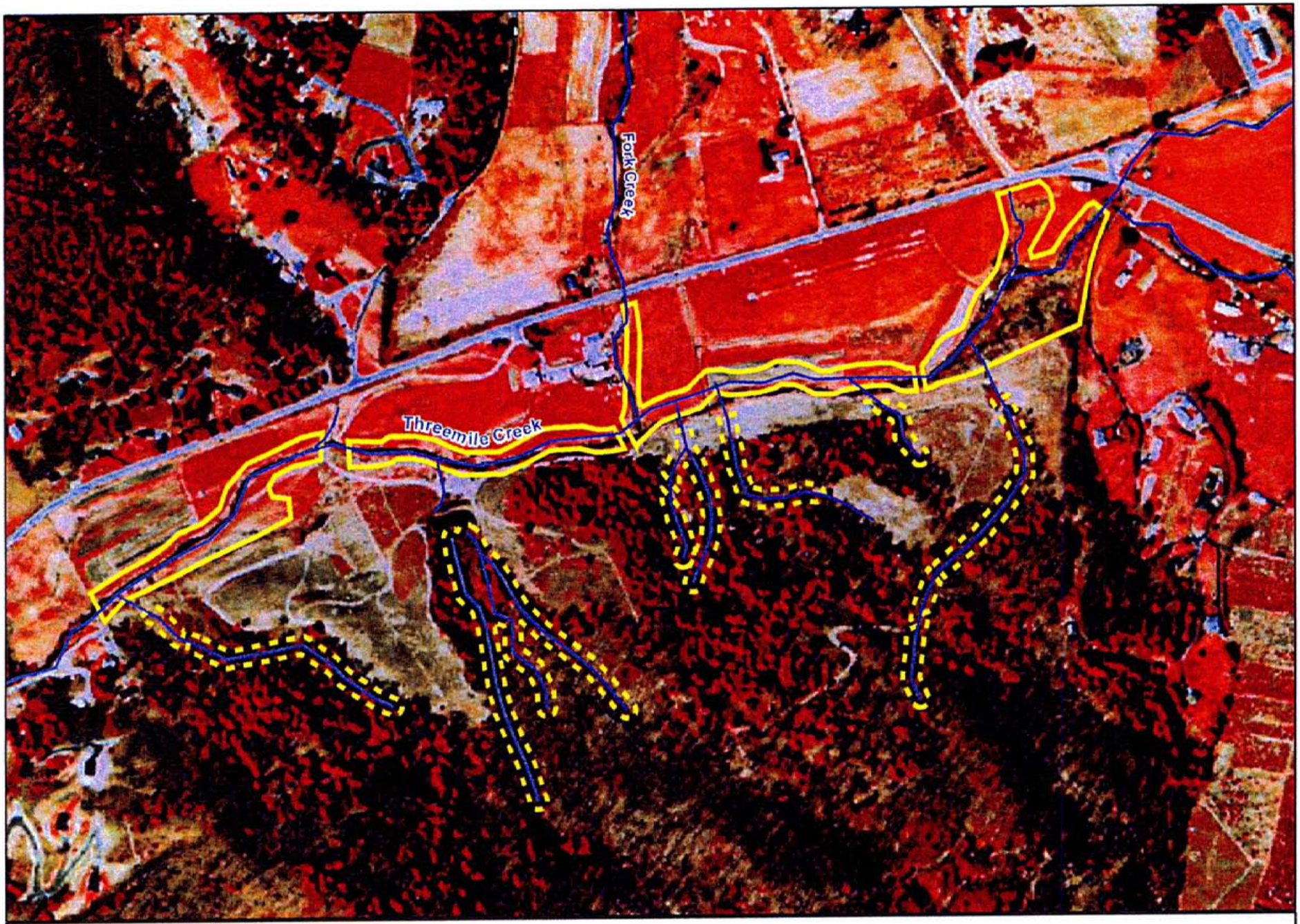


Figure 2: Project Overview
Three Mile Stream & Wetland
Restoration Site
Avery County, NC

Preservation (9 Acres)
Restoration (11 Acres)

N

1 inch equals 450 feet
0 150 300 600 900 1,200
Feet

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

June 4, 2007

Mr. Tyler Howe
Tribal Historic Preservation Specialist
Eastern Band of Cherokee Indians
Tribal Historic Preservation Office
P.O. Box 455
Cherokee, NC 28719

Subject: Three Mile Creek Archaeological Survey

Dear Mr. Howe:

Please find enclosed a copy of the report entitled "Archaeology Survey for the Three- Mile Creek Stream and Wetland Restoration Project in Avery County, North Carolina." This report was required by the State Historical Preservation Office to fulfill part of the Categorical Exclusion process for our restoration project in Avery County. Restoration Systems contracted with Legacy Research Associates, Inc., to conduct the recommended survey.

Three sites were identified in and adjacent to the project boundaries. The one site located within the project boundary (Site 31AV120) consists of a "non-diagnostic prehistoric lithic isolated find" and no further archaeological work was recommended. The two additional sites identified are both located outside the project boundaries. Site 31AV121 is a cemetery adjacent to Highway 194 and is well outside (> 70 meters) the project boundary. There will be zero chance of impacts to this site as a result of stream and wetland restoration work. Site 31AV119 "appears to represent long-term habitation" and is immediately adjacent to the project boundary. We concur with the recommendation from Legacy Research for "site avoidance" and as a result, fencing will be placed around the site to insure its boundary is clearly identified and avoided.

If you have any questions concerning this report you may contact me at the office (919) 755-9490 or on my cell phone (919) 819-0014.

Sincerely,

Travis Hamrick, Project Manager

Restoration Systems
1101 Haynes St. Suite 107
Raleigh, NC 27604

July 16, 2005

MEMO TO: Dave Schiller
FROM: Randy Turner
SUBJECT: Three Mile Creek Restoration Site: Biological Conclusions for Federally Listed Species that are Known From Avery County

Based on the most recently updated (05/10/07) county-by-county database of federally listed species in North Carolina as posted by the United States Fish and Wildlife Service (USFWS) at http://nc-es.fws.gov/es/countyfr.html, eight federally protected species are listed for Avery County. Table 1 lists the federally protected species for Avery County and indicates if potential habitat exists within the Site for each species.

Table 1. Federally Protected Species for Avery County

Common Name	Scientific Name	Status*	Habitat Present Within Site	Biological Conclusion
Vertebrates				
Bog turtle	*Clemmys muhlenbergii*	Threatened (S/A)	Yes	Not Applicable
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	Endangered	No	No Effect
Virginia big-eared bat	*Corynorhinus townsendii virginianus*	Endangered	No	No Effect
Invertebrates				
Spruce-fir moss spider	*Micohexura montivaga*	Endangered	No	No Effect
Vascular Plants				
Blue Ridge goldenrod	*Solidago spithamaea*	Threatened	No	No Effect
Heller's blazing star	*Liatris helleri*	Threatened	No	No Effect
Roan Mountain bluet	*Hedyotis purpurea* var. *montana*	Endangered	No	No Effect
Spreading avens	*Geum radiatum*	Endangered	No	No Effect

*Endangered = a taxon "in danger of extinction throughout all or a significant portion of its range"; Threatened = a taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range"; Threatened (S/A) = a species that is threatened due to similarity of appearance with other rare species and is listed for its protection; these species are not biologically endangered or threatened and are not subject to Section 7 consultation.

The analyses conducted on behalf of each species listed above includes:

- Review of each listed species' natural history including bloom window, soil relationships, general habitat requirements; elevation restrictions, etc.
- Thorough evaluation of all habitats within the conservation easement of the project, not just areas likely to be disturbed by construction;
- Formulation of conclusions about Site availability of suitable habitat for each species;

- Development of biological conclusions.

Field evaluations were conducted in February and September 2006, as well as May 2007. Of the eight listed species, only one, the bog turtle, has any reasonable chance of occurring within the project conservation easements. The "bog" located at the extreme east end of the project appears to be suitable habitat for the bog turtle, which is listed as Threatened Due to Similarity of Appearance (T-S/A) with the Northern population of bog turtle. Section 7 consultation is not required for T-S/A listed species, consequently, no surveys have been conducted for this species. Based on the scope of work planned in this area, no risks are foreseen to the bog turtle.

Based on the absence of suitable habitat for each of the 7 remaining listed species, none of the other species is likely to occur within the boundaries of the project. Furthermore, the only habitat likely to be impacted within the project easement is farm fields. Consequently, it is reasonable to conclude the project will have **No Effect** on federally listed species.

North Carolina Natural Heritage Program (NCNHP) records were reviewed on March 7, 2006 and no known element occurrences have been documented within the Site. Bog turtles were documented to occur approximately 1 mile northeast of the Site near the town of Pyatte and approximately 1 mile downstream/southwest of the Site near Mullin Hill.

cc: Travis Hamrick

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

March 12, 2007

Haywood County NRCS Office
Waynesville Service Center
589 Raccoon Rd. Suite 246
Waynesville, NC 28786
(828) 456-6341 (Ext. 105)

ATTN: Kent Clary

SUBJECT: Completion of NRCS Form AD-1006 for Three Mile Creek Stream & Wetland Full Delivery Project (Contract Number D06125-A) in compliance with the Farmland Protection Policy Act.

Mr. Clary,

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by the EEP to provide 8,021 feet of stream and 2.3 acres of riverine wetland mitigation at the Three Mile Creek Stream & Wetland Restoration Site in Avery County, North Carolina.

One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. The EEP must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with the NRCS to complete Form AD-1006 in compliance with the Farmland Protection Policy Act on behalf of the FHWA. The purpose of this letter is to request your assistance in completion of the Form.

The project is located on the Spry Farm, approximately 7 miles northeast of Spruce Pine in Avery County, North Carolina (Figure 1). The latitude and longitude at the project center is 35.98300 N and -81.98000 W. The project consists of two named tributaries of the North Toe River (Three Mile and Fork Creeks) and 11 unnamed tributaries that flow

into Three Mile Creek (Figure 2). A map (Figure 3) depicting the type of soils within the area of restoration as well as the total acreage is included.

The Site includes approximately 22.7 acres of land situated on the northern flank of Doe Hill Mountain, between the termini of Pink Ridge and Rodgers Ridge. The Site includes spring fed streams draining off the steep slopes of Pink Ridge to the floodplain of Three Mile Creek. The farm is currently used for Fraser Fir Christmas tree production (steep northern facing slopes) and as an ornamental nursery in the valley areas.

Should you have any questions or if any additional information is needed to complete the Form, please feel free to contact me at the office (919) 755-9490 or on my cell phone (919) 819-0014. Your valuable time and cooperation are much appreciated.

Sincerely,

Travis Hamrick, Project Manager

Attachments: 2 maps

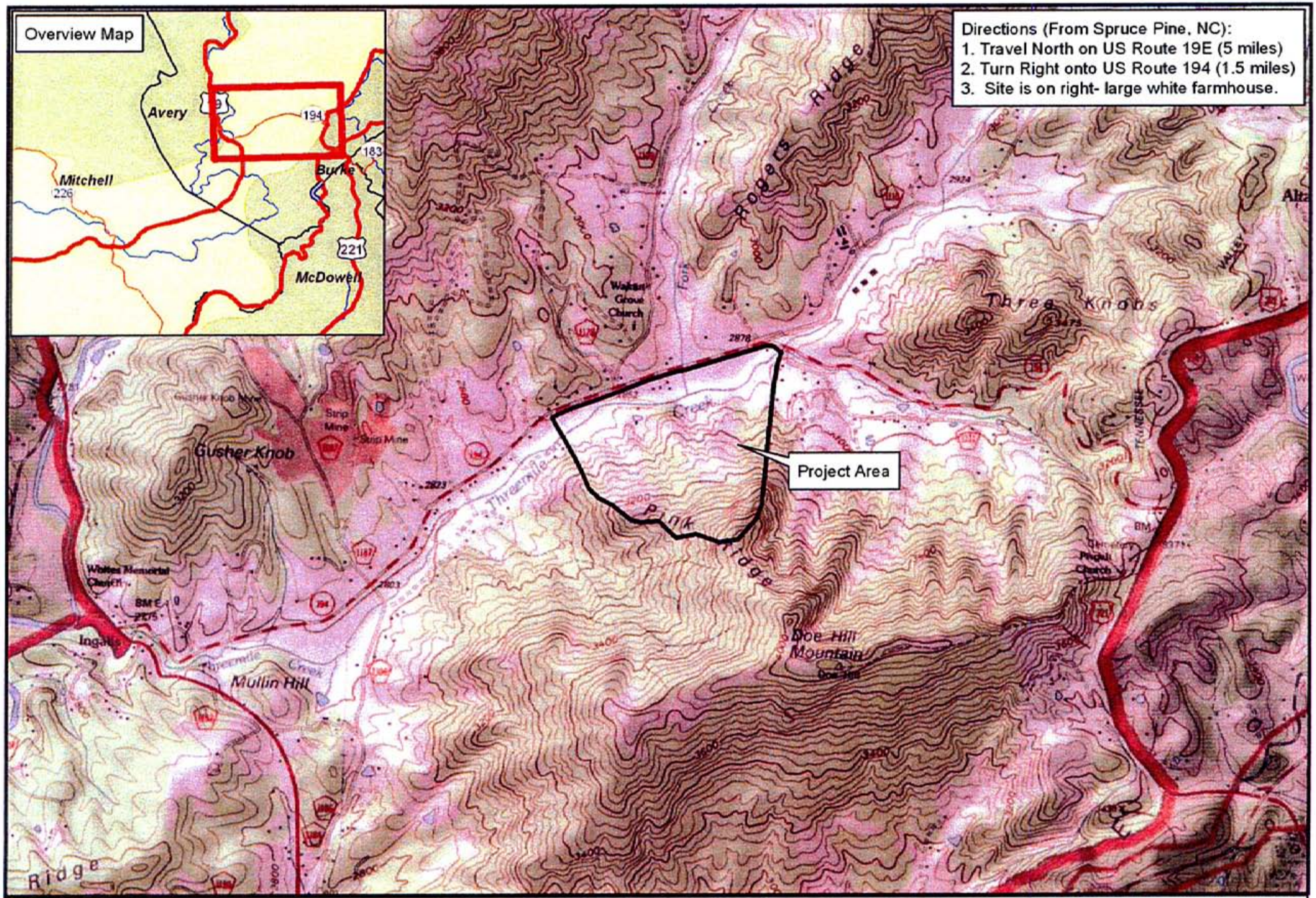


Figure 1: Project Location
Threemile Stream & Wetland
Restoration Site
Avery County, NC

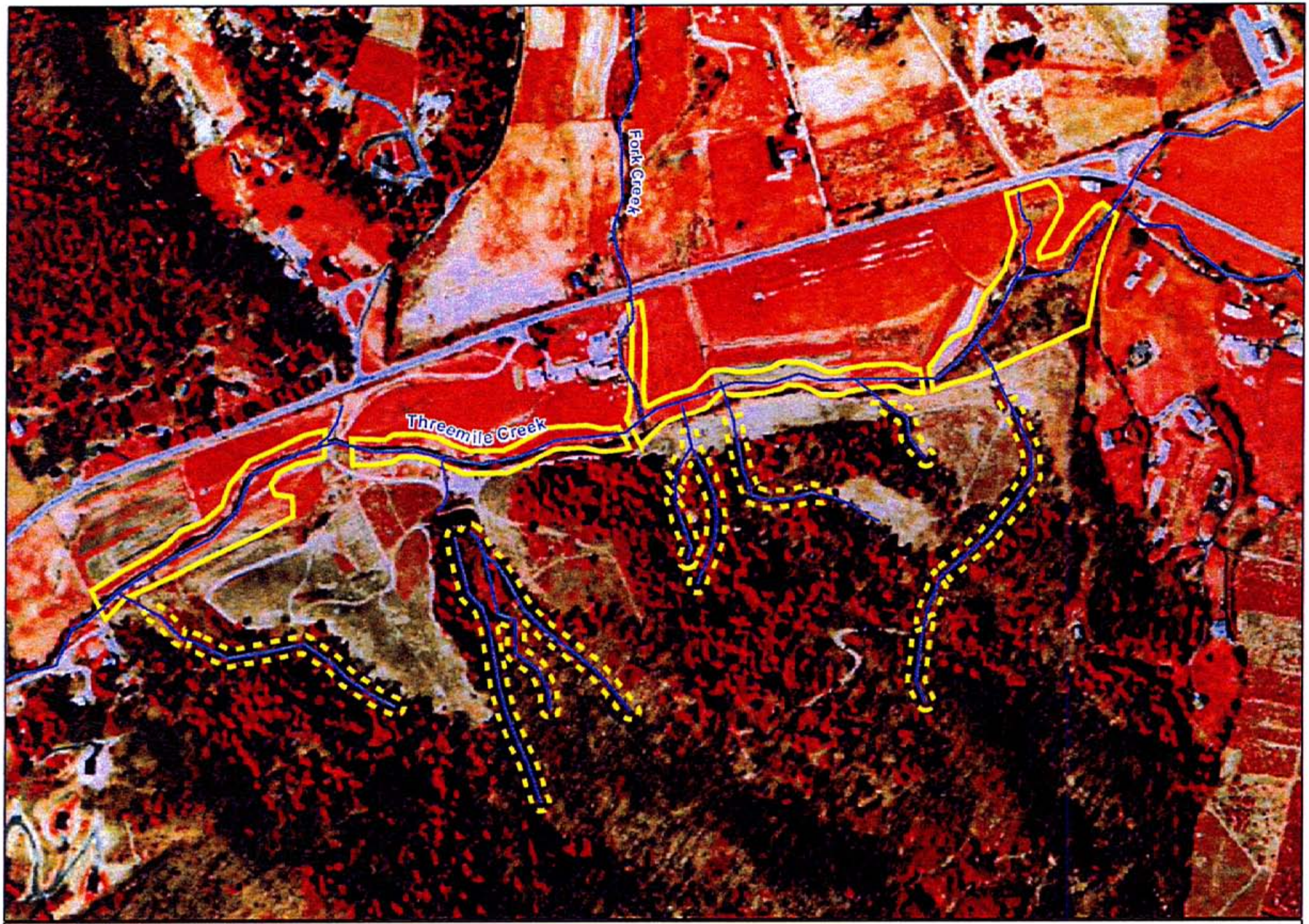


Figure 2: Project Overview
Three Mile Stream & Wetland
Restoration Site
Avery County, NC

Preservation (9 Acres)
Restoration (11 Acres)

N

1 inch equals 450 feet
0 150 300 600 900 1,200
Feet

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
589 Raccoon Road, Suite 246
Waynesville, NC 28786
Phone 828 456-6341 ext. 5 FAX 828 452-7031

March 21, 2007

Travis Hamrick
Restoration Systems
1101 Haynes Street, Suite 107
Raleigh, NC 27604

Subject: Farmland Impact Rating
Three Mile Stream and Wetland Restoration Project

Mr. Hamrick:

Attached are the original and copies of the completed Farmland Conversion Impact Rating form (AD-1006) for the Three MileCreek Stream and Wetland Restoration Project in Avery County, NC.

It appears that 10 acres of prime farmland and 0.7 acres of statewide important farmland will be impacted by the proposed project.

If you have any questions, please contact me at 828-456-6341 ext. 105.

Sincerely,

M. Kent Clary

M. Kent Clary
Area Resource Soil Scientist
USDA-NRCS
589 Raccoon Road Suite246
Waynesville, NC 28786

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 3/12/07
Name Of Project Three Mile Stream & Wetland Restoration Site	Federal Agency Involved FHA
Proposed Land Use Stream & Wetland Mitigation	County And State Avery, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 3/12/07

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 –	Average Farm Size 62

Major Crop(s)	Farmable Land In Govt. Jurisdiction	Amount Of Farmland As Defined in FPPA
HAY	Acres: 5,760 % 20.2	Acres: 11,678 %14.5
Name Of Land Evaluation System Used: AVERY CALES	Name Of Local Site Assessment System	Date Land Evaluation Returned By NRCS: 3/21/07

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	11.9			
B. Total Acres To Be Converted Indirectly	10.8			
C. Total Acres In Site	~~0.0~~ 22.7	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	10.0			
B. Total Acres Statewide And Local Important Farmland	0.7			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	.01			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	65			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	0 71	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	11			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	15	15			
6. Distance To Urban Support Services	15	0			
7. Size Of Present Farm Unit Compared To Average	10	10			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	4			
10. On-Farm Investments	20	3			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160	0 88	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0 71	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0 88	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0 159	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

Form AD-1006 (10-83)

This form was electronically produced by National Production Services Staff

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

March 12, 2007

U. S. Department of the Interior
Fish and Wildlife Service
Asheville Field Office
160 Zillicoa St.
Asheville, NC 28801

ATTN: Marella Buncick, Fish and Wildlife Biologist

SUBJECT: Coordination with the U.S. Fish and Wildlife Service on Behalf of (1) Fish and Wildlife Coordination Act and (2) Migratory Bird Treaty Act for the Three Mile Stream and Wetland Restoration Site.

Mrs. Buncick:

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by the EEP to provide 8,021 feet of stream and 2.3 acres of riverine wetland mitigation at the Three Mile Creek Stream & Wetland Restoration Site. One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. The EEP must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with your office on behalf of the Fish and Wildlife Coordination Act (FWCA) and the Migratory Bird Treaty Act (MBTA). This letter provides you with certain details of the Three Mile Creek Stream and Wetland Restoration Site, including the project's location, a general description of its physiography, hydrography and existing land uses, as well as the intended modifications to the site proposed by RS. You are encouraged to determine if the actions proposed by RS may be inimical to any resources embraced by the FWCA, or the MBTA and provide comments to RS based on your evaluation. It is reasonable to assume that the Service will comment if the actions proposed by RS are, in the Service's opinion, likely to result in harm to resources embraced by the FWCA or the MBTA.

Project Location & Description

The project is located on the Spry Farm, approximately 7 miles northeast of Spruce Pine in Avery County, North Carolina (Figure 1). The latitude and longitude at the project center is 35.98300 N and -81.98000 W. The project consists of two named tributaries of the North Toe River (Three Mile and Fork Creeks) and 11 unnamed tributaries that flow into Three Mile Creek (Figure 2).

The Site includes approximately 22.7 acres of land situated on the northern flank of Doe Hill Mountain, between the termini of Pink Ridge and Rodgers Ridge. The Site includes spring fed streams draining off the steep slopes of Pink Ridge to the floodplain of Three Mile Creek. Doe Hill Mountain, Pink Ridge, and the surrounding region are characterized primarily by forested land in mountainous terrain that is too steep to clear for agricultural production. South facing slopes are characterized by mesic hardwood forest that are frequently harvested for timber. North facing slopes are characterized by evergreen stands and are suitable for Fraser fir Christmas tree farming, which is a large economic feature of Avery County.

Restoration Means & Methods

To perform the necessary stream restoration along the impaired reaches, natural channel design methods will be used. The restoration will allow a reconnection of the stream channel with the adjacent historic floodplain. The restoration design will result in a riffle-pool system with proper pattern and profile. Meanders of varying radii will be integrated along the length of the restored reaches to mimic the variability of a natural channel and utilize the available project area to the maximum extent possible based on existing site conditions. The restored channel banks will be planted with native vegetation that represents both woody (trees and shrubs) and herbaceous species.

As suitable hydric soils already exist, the restoration of riverine wetlands will be performed through the rehydration of existing hydric soils by routing the restored stream through these areas (with an appropriate pattern) as well as restoring the potential for over-bank flooding of these areas. Once grading and structural development is complete, suitable wetland vegetation, including tree and shrub species, will be planted within all restored wetland areas.

Summary of Anticipated Effects

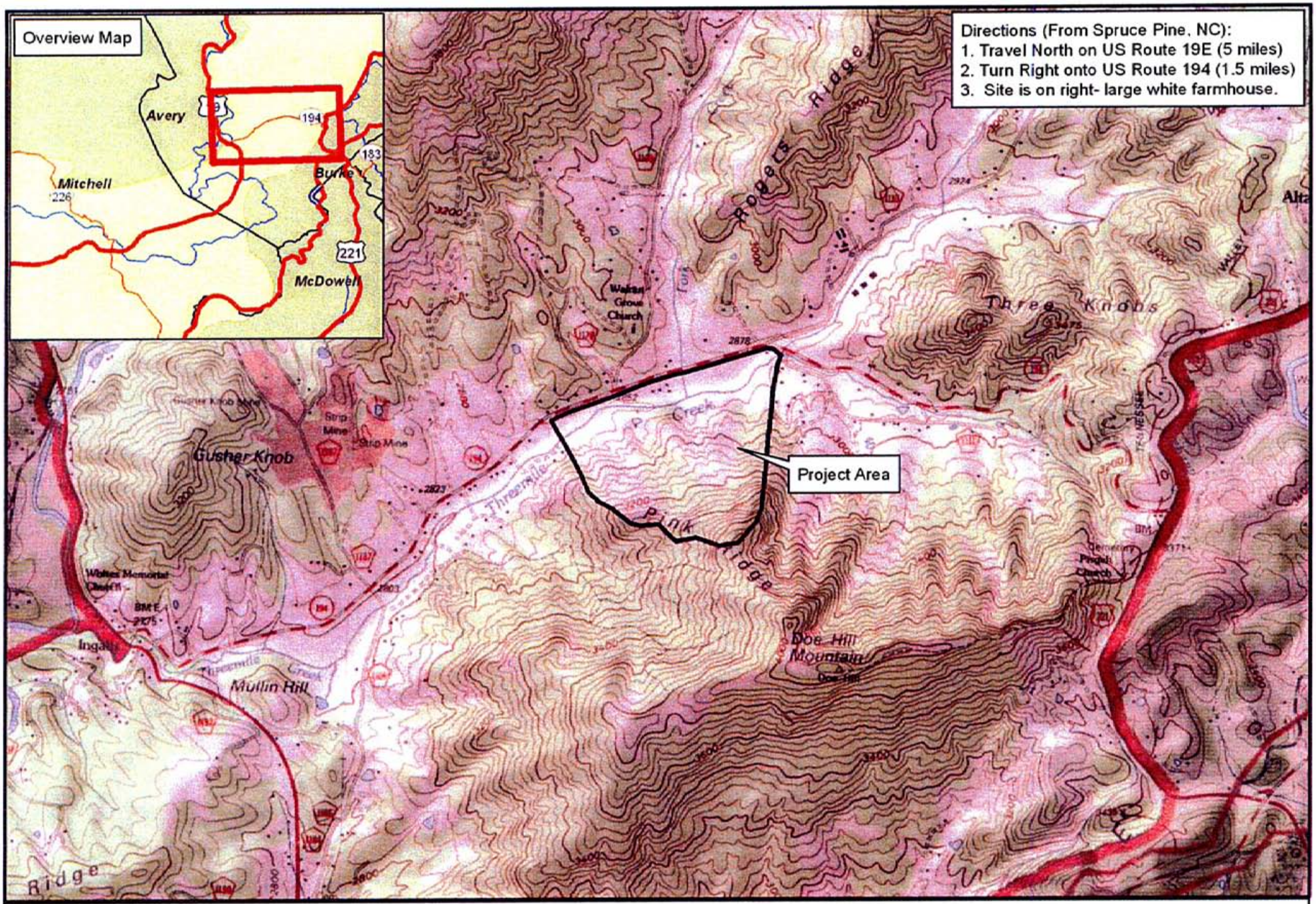
We anticipate that the immediate effects of this project (construction phase) will cause ground disturbance within the project area due to the use of heavy machinery to complete channel construction. Again, this site has historically received extensive ground disturbance due to livestock and agricultural operations. The long term effects of this project (post construction) will result in an overall enhancement to the integrity of the immediate ecosystems and result in long term beneficial effects to fish or wildlife. This site will also be protected in perpetuity with a conservation easement.

Should you have any questions or if any additional information is needed to complete your review, please feel free to contact me at the office (919) 755-9490 or on my cell phone (919) 819-0014. Your valuable time and cooperation are much appreciated.

Sincerely,

Travis Hamrick, Project Manager

Attachments: 2 maps



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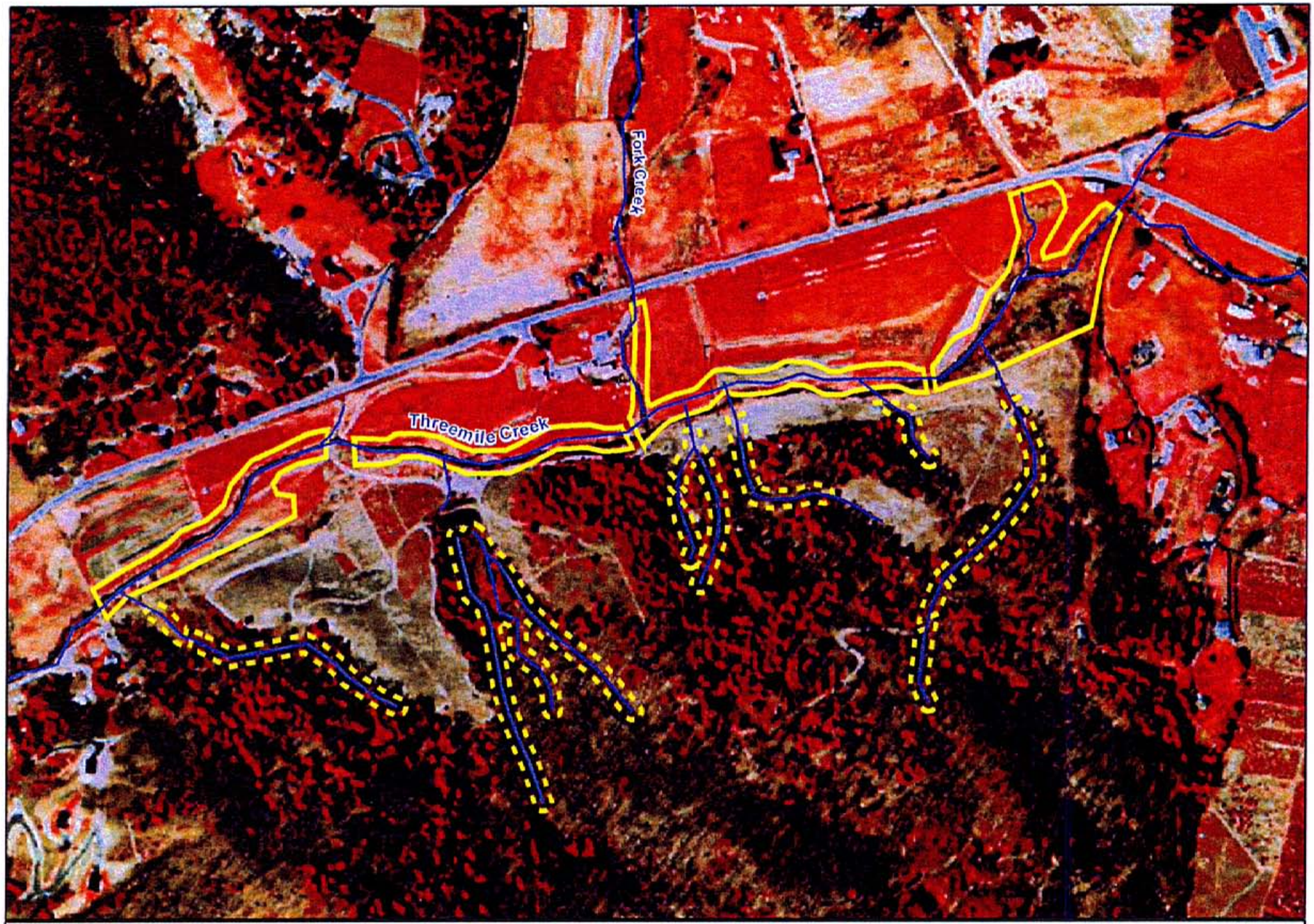

Figure 2: Project Overview
Three Mile Stream & Wetland
Restoration Site
Avery County, NC

RESTORATION SYSTEMS, LLC

Natural Resource
Restoration & Conservation

March 12, 2007

North Carolina Wildlife Resources Commission
Division of Inland Fisheries
Falls Lake Office
1142 I-85 Service Road
Creedmore, NC 27522

ATTN: David Cox, Technical Guidance Supervisor

SUBJECT: Coordination with the North Carolina Wildlife Resources Commission on Behalf of the Fish and Wildlife Coordination Act for the Three Mile Stream & Wetland Restoration Site (Contract Number : D06125-A)

Mr. Cox:

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by the EEP to provide 8,021 feet of stream and 2.3 acres of riverine wetland mitigation at the Three Mile Creek Stream & Wetland Restoration Site. One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. The EEP must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

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Sincerely,

Travis Hamrick, Project Manager

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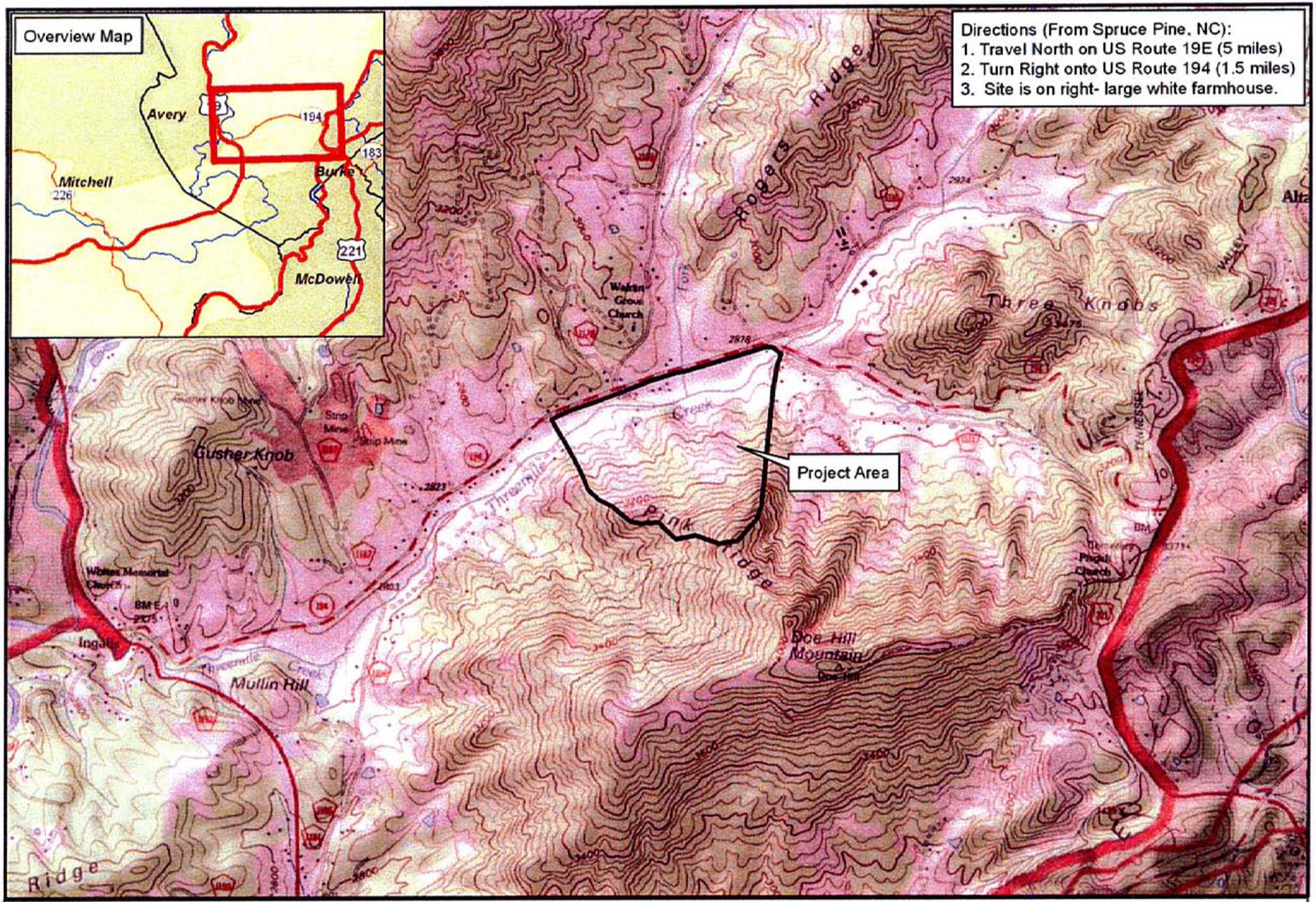
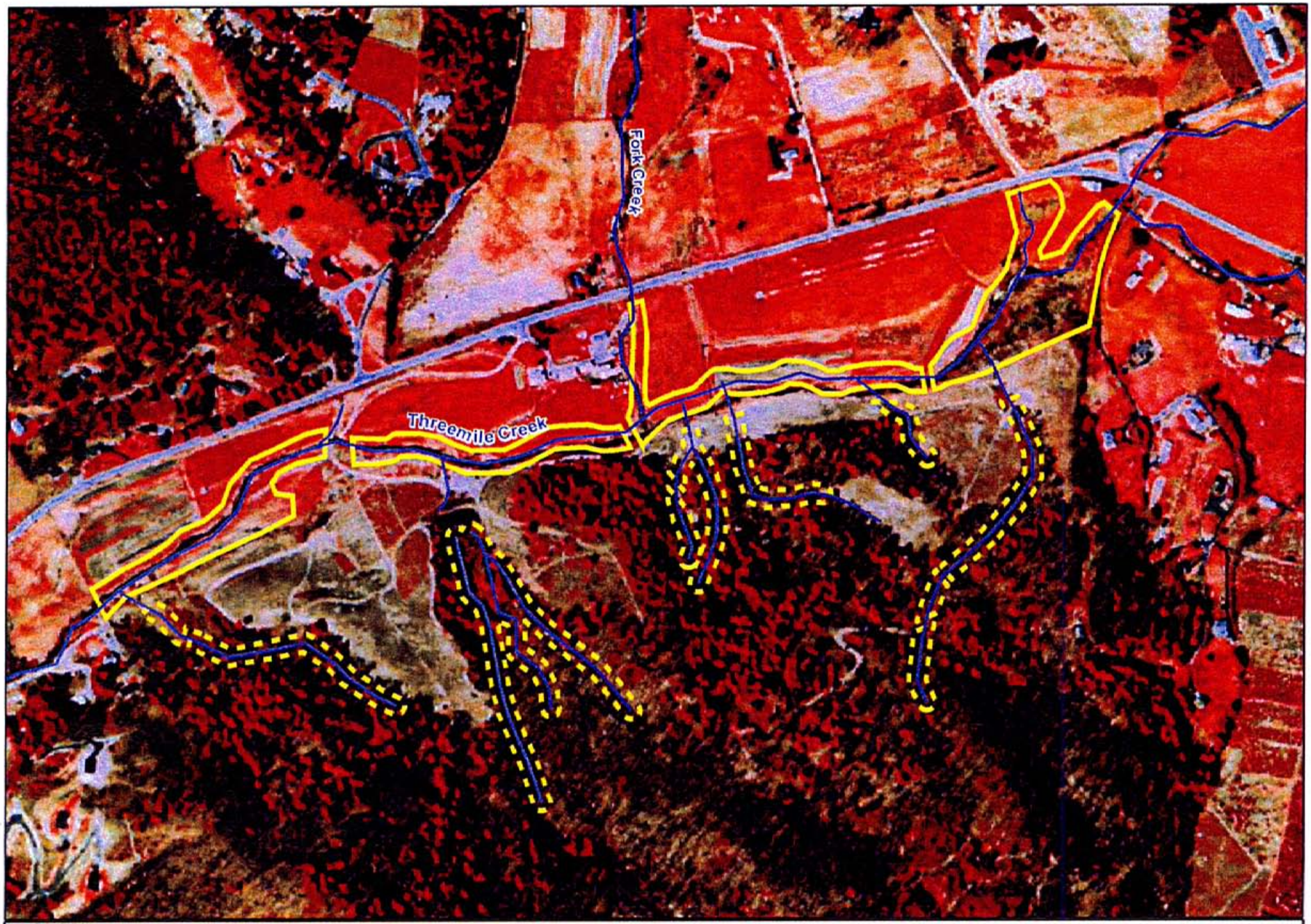


Figure 1: Project Location
Threemile Stream & Wetland
Restoration Site
Avery County, NC

Project Area



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Three Mile Stream & Wetland
Restoration Site
Avery County, NC

Preservation (9 Acres)
Restoration (11 Acres)

N

1 inch equals 450 feet
0 150 300 600 900 1,200
Feet

North Carolina Wildlife Resources Commission

Richard B. Hamilton, Executive Director

March 27, 2007

Mr. Travis Hamrick
Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, North Carolina 27604

RE: Request for Information and Comment about Proposed EEP Stream Mitigation Project, Three Mile Stream and Wetland Restoration Site, Avery County

Dear Mr. Hamrick:

This correspondence is in response to your letter of March 12, 2007 concerning coordination pursuant to the Fish and Wildlife Coordination Act considerations at the proposed stream mitigation site indicated above. Biologists with the North Carolina Wildlife Resources Commission (NCWRC) are familiar with habitat values in the area. The NCWRC is authorized to comment and make recommendations which relate to the impacts of this project on fish and wildlife pursuant to Clean Water Act of 1977, North Carolina Environmental Policy Act, US National Environmental Policy Act, Endangered Species Act (16 U. S. C. 1531-1543; 87 Stat 884), the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d) and/or Federal License of Water Resource Project Act (Federal Power Act-16 U.S.C. 791a et seq.) as applicable.

The Three Mile Creek site is being evaluated as an Ecosystem Enhancement Program mitigation site for unavoidable wetland and stream impacts. The streams are located on Spry Farm. The site consists of 22.7 acres. Restoration activities proposed include reconnecting streams to floodplains, increasing wetland hydrology, and restoring natural channel form and dimensions. Our in-house review has determined that streams in this area are suitable for restoration activities and that wild Rainbow trout are known for area streams. Additionally, conversion of prior converted wetlands to restored wetlands could provide needed habitat for listed animal species like the Bog turtle, *Glyptemys muhlenbergii* (NCT, FT S/A).

Project proponents should be made aware of the above information. Improvements in stream and wetland habitats should improve habitats for aquatic listed species in the area as well as for trout. Accordingly, project proponents are encouraged to pursue mitigation activities at the site including preconstruction Clean Water Act permitting and certifications. Spring investigations for bog turtles are encouraged. These should be done prior to ground disturbing activities. If Bog turtles are found in the work area, they should be relocated by professionally certified turtle biologists. Wildlife Diversity biologist, Lori Williams has requested that the restoration site be evaluated for the provision of Bog turtle habitats. Project proponents should contact Ms. Williams at 828/684-0358 to discuss this option further. Only autochthonous plants should be

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

used for the project. Only state-of-the-art stream and wetland natural channel design methodologies should be used for stream and wetland restoration. Maximum available, undisturbed forested stream buffers should be provided and protected from livestock unless periodic livestock disturbance is appropriate for listed species management. Provision and maintenance of trout and potential bog turtle habitats should be evaluated as an integral part of the project. Habitat should be considered as important as stream and wetland equilibrium and stability. Instream work and land disturbance within the 25-foot wide buffer zone should be prohibited during the rainbow trout spawning season of January 1 through April 15 to protect the egg and fry stages of trout.

Please be advised that NCWRC only reviews for animal species. You should contact the NC Natural Heritage Program and the US Fish and Wildlife Service for their review about the proposed stream and wetland restoration activities.

Thank you for the opportunity to comment on your proposed project during early planning stages. If you have any questions regarding these comments, please contact me at 336/769-9453.

Sincerely,

Ron Linville
Regional Coordinator
Habitat Conservation Program

E-copy: Bryan Tompkins, USFWS
Sarah McRae, NHP

Filed with Restoration Systems
Attn: Jane Ralston
1101 Haynes St. Ste. 107
On Raleigh, NC 27604, 19__

$_____

Certification

of publication of legal notice in
MITCHELL NEWS-JOURNAL

Spruce Pine, Mitchell County, NC 1 weeks

3-28-07	$ 54.81
	$
	$
	$
	$
	$

Public Notice
Avery County Restoration

Paid_____

_____19__

_____

No. 5747

MITCHELL NEWS-JOURNAL

Cost of Advertisment .....$ 54.81

Cost of Affidavit .....$

Total .....$ 54.81

STATE OF NORTH CAROLINA
COUNTY OF MITCHELL

I, Nathaniel A. Ashurst, Publisher of the Mitchell News-Journal, a newspaper published in Mitchell County, North Carolina, in compliance with statutes G.S. 1-597 of North Carolina, as amended in 1947 session of General Assembly, being duly sworn, certify that the attached advertisement of

Public Notice
Avery County Restoration

was duly published in the aforesaid paper once a week for 1 consecutive weeks, beginning with the issue date 3-28, 2007

(signed) _____
(Owner, Partner, Publisher or other Employee Authorized to make the affidavit)

Sworn to and subscribed before me this 28th day of March, 2007

Renee' B. Duncan
Notary Public for Mitchell County North Carolina

My Commission expires 1/30/2011

No.

PUBLIC NOTICE
NOTICE OF OPPORTUNITY FOR AN INFORMATIONAL PUBLIC MEETING ON THE PURCHASE AND OR USE OF PROPERTY FOR THE RESTORATION OF STREAMS AND WETLANDS

Avery County – Restoration Systems proposes to purchase and/or use a 22 +/- acre tract of land in Avery County, North Carolina. The purpose of acquiring and/or using this property is to provide mitigation for impacts to streams and wetlands that will result from existing or future development in this area. Anyone desiring that an informational public meeting be held for this proposed action may make such a request by registered letter c/o Travis Hamrick to Restoration Systems located at 1101 Haynes Street (Suite 107), Raleigh, NC 27604. Request must be made by April 27, 2007. If additional information is required, please contact Travis Hamrick at 919-755-9490. The NC Ecosystem Enhancement Program reserves the right to determine if a public meeting will be held.

#5747 - 3/28/07

EDR® Environmental
Data Resources Inc

The EDR Radius Map
with GeoCheck®

Three Mile Creek Restoration Project
Three Mile Road
Newland, NC 28657

Inquiry Number: 01878966.2r

March 15, 2007

The Standard in Environmental Risk Management Information

440 Wheelers Farms Road
Milford, Connecticut 06461

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

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Detail Map	3
Map Findings Summary	4
Map Findings	6
Orphan Summary	7
Government Records Searched/Data Currency Tracking	GR-1

GEOCHECK ADDENDUM

Physical Setting Source Addendum	A-1
Physical Setting Source Summary	A-2
Physical Setting Source Map	A-7
Physical Setting Source Map Findings	A-8
Physical Setting Source Records Searched	A-14

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 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

THREE MILE ROAD
NEWLAND, NC 28657

COORDINATES

Latitude (North):	35.982500 - 35° 58' 57.0"
Longitude (West):	81.983300 - 81° 58' 59.9"
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	411354.5
UTM Y (Meters):	3982254.0
Elevation:	2843 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	35081-H8 LINVILLE FALLS, NC
Most Recent Revision:	1994
West Map:	35082-H1 SPRUCE PINE, NC
Most Recent Revision:	1994

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:

FEDERAL RECORDS

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
Delisted NPL	National Priority List Deletions
NPL RECOVERY	Federal Superfund Liens
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP	CERCLIS No Further Remedial Action Planned

EXECUTIVE SUMMARY

CORRACTS	Corrective Action Report
RCRA-TSDF	Resource Conservation and Recovery Act Information
RCRA-LQG	Resource Conservation and Recovery Act Information
RCRA-SQG	Resource Conservation and Recovery Act Information
ERNS	Emergency Response Notification System
HMIRS	Hazardous Materials Information Reporting System
US ENG CONTROLS	Engineering Controls Sites List
US INST CONTROL	Sites with Institutional Controls
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
US BROWNFIELDS	A Listing of Brownfields Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
ODI	Open Dump Inventory
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)
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
LUCIS	Land Use Control Information System
US CDL	Clandestine Drug Labs
RADINFO	Radiation Information Database
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
MINES	Mines Master Index File
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System

STATE AND LOCAL RECORDS

SHWS	Inactive Hazardous Sites Inventory
NC HSDS	Hazardous Substance Disposal Site
IMD	Incident Management Database
SWF/LF	List of Solid Waste Facilities
OLI	Old Landfill Inventory
HIST LF	Solid Waste Facility Listing
LUST	Regional UST Database
LUST TRUST	State Trust Fund Database
UST	Petroleum Underground Storage Tank Database
AST	AST Database
INST CONTROL	No Further Action Sites With Land Use Restrictions Monitoring
VCP	Responsible Party Voluntary Action Sites
DRYCLEANERS	Drycleaning Sites
BROWNFIELDS	Brownfields Projects Inventory
NPDES	NPDES Facility Location Listing

TRIBAL RECORDS

INDIAN RESERV	Indian Reservations
INDIAN LUST	Leaking Underground Storage Tanks on Indian Land
INDIAN UST	Underground Storage Tanks on Indian Land

EDR PROPRIETARY RECORDS

Manufactured Gas Plants	EDR Proprietary Manufactured Gas Plants

EXECUTIVE SUMMARY

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

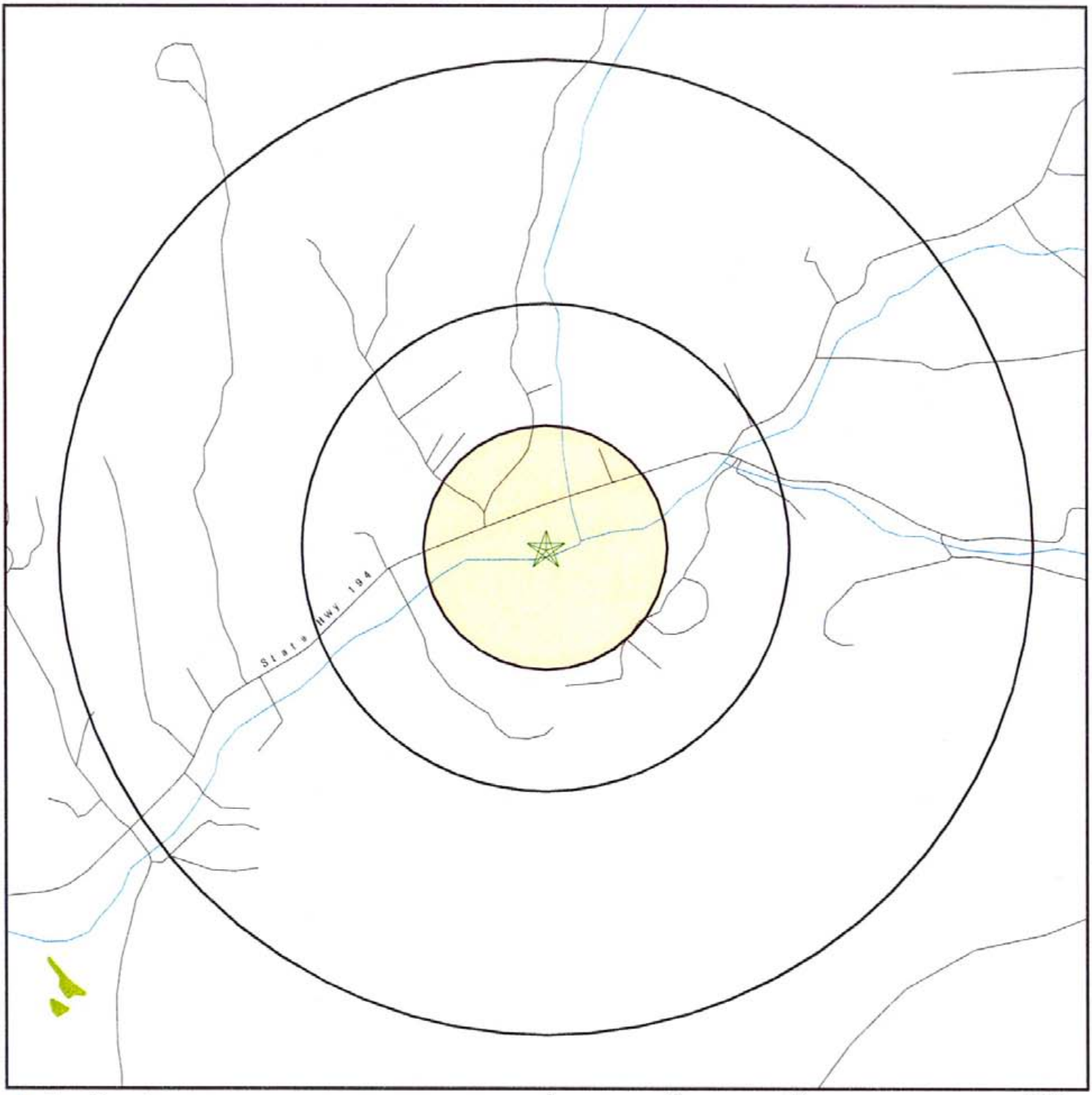
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
AVERY COUNTY C&D LANDFILL	SWF/LF, HIST LF
AVERY COUNTY LANDFILL	SWF/LF, HIST LF
AVERY COUNTY TRANSFER STATION	SWF/LF, HIST LF
S. BELL-ALTAMONT	LUST, IMD
NEWLAND EXXON	LUST, IMD
PARKWAY JUNCTION	LUST, IMD
NCDOT-NEWLAND	LUST, IMD
DON WOODLE PROPERTY	LUST, IMD
RAINBOW PANTRY #5	LUST TRUST
ERWIN'S GROCERY	UST
SPEAR SUPERETTE	UST
SPEAR SUPERETTE	UST
TIME-OUT CONVENIENCE STORE	UST
NEWLAND EXXON	UST
RIVERSIDE ELEMENTARY SCHOOL	UST
TOE RIVER GROCERY	UST
SLUDER FLORAL CO.	UST
SINGLETONS GROCERY	UST
NC DOT - NEWLAND (DIV ELEVEN)	UST
CHAMBER OF COMMERCE BLDG	UST
HUGHES GROC / ALLENS GROC	UST
CARLOS & SONS BODY SHOP	RCRA-SQG, FINDS
CREEK NEAR PROPERTY	ERNS
HENSON CREEK BAPTIST CHURCH	FINDS
ABRUSCI PROPERTY	IMD
AVERY CO. BOARD OF EDUCATION	IMD
THREE OAKS NURSERY	IMD
NCDOT/FRANKLIN RESIDENCE	IMD

OVERVIEW MAP - 01878966.2r

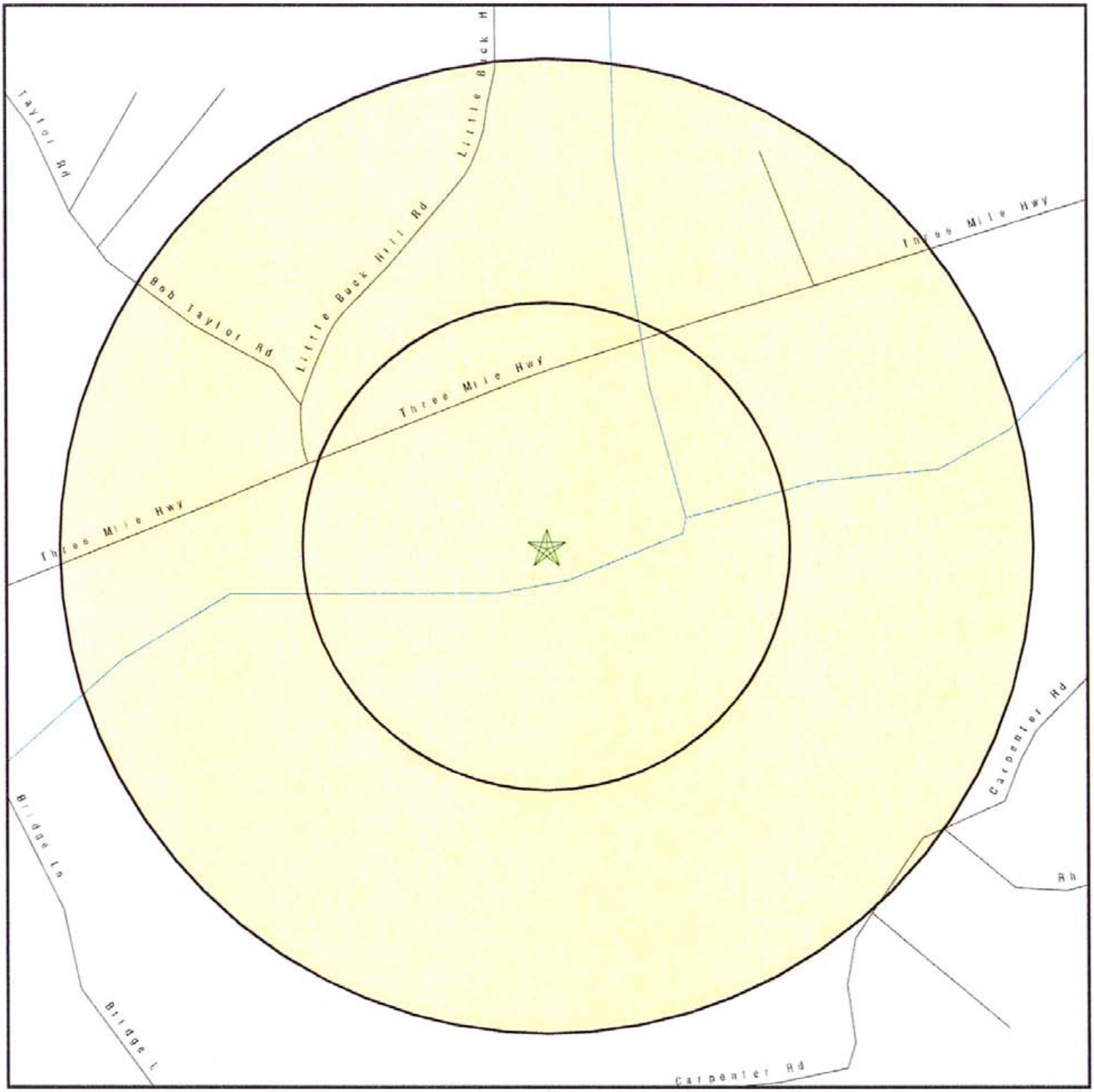


- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Landfill Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- National Wetland Inventory
- 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: Three Mile Creek Restoration Project ADDRESS: Three Mile Road Newland NC 28657 LAT/LONG: 35.9825 / 81.9833	CLIENT: Restoration Systems, LLC CONTACT: Dave Schiller INQUIRY #: 01878966.2r DATE: March 15, 2007 9:55 am

DETAIL MAP - 01878966.2r



- ★ 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
- Landfill Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- Hazardous Substance Disposal Sites

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ADDRESS: Three Mile Road Newland NC 28657	CONTACT: Dave Schiller
LAT/LONG: 35.9825 / 81.9833	INQUIRY #: 01878966.2r DATE: March 15, 2007 9:55 am

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FEDERAL RECORDS								
NPL		1.000	0	0	0	0	NR	0
Proposed NPL		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
NPL RECOVERY		TP	NR	NR	NR	NR	NR	0
CERCLIS		0.500	0	0	0	NR	NR	0
CERC-NFRAP		0.500	0	0	0	NR	NR	0
CORRACTS		1.000	0	0	0	0	NR	0
RCRA TSD		0.500	0	0	0	NR	NR	0
RCRA Lg. Quan. Gen.		0.250	0	0	NR	NR	NR	0
RCRA Sm. Quan. Gen.		0.250	0	0	NR	NR	NR	0
ERNS		TP	NR	NR	NR	NR	NR	0
HMIRS		TP	NR	NR	NR	NR	NR	0
US ENG CONTROLS		0.500	0	0	0	NR	NR	0
US INST CONTROL		0.500	0	0	0	NR	NR	0
DOD		1.000	0	0	0	0	NR	0
FUDS		1.000	0	0	0	0	NR	0
US BROWNFIELDS		0.500	0	0	0	NR	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
ODI		0.500	0	0	0	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
SSTS		TP	NR	NR	NR	NR	NR	0
ICIS		TP	NR	NR	NR	NR	NR	0
LUCIS		0.500	0	0	0	NR	NR	0
CDL		TP	NR	NR	NR	NR	NR	0
RADINFO		TP	NR	NR	NR	NR	NR	0
PADS		TP	NR	NR	NR	NR	NR	0
MLTS		TP	NR	NR	NR	NR	NR	0
MINES		0.250	0	0	NR	NR	NR	0
FINDS		TP	NR	NR	NR	NR	NR	0
RAATS		TP	NR	NR	NR	NR	NR	0
STATE AND LOCAL RECORDS								
State Haz. Waste		1.000	0	0	0	0	NR	0
NC HSDS		1.000	0	0	0	0	NR	0
IMD		0.500	0	0	0	NR	NR	0
State Landfill		0.500	0	0	0	NR	NR	0
OLI		0.500	0	0	0	NR	NR	0
HIST LF		0.500	0	0	0	NR	NR	0
LUST		0.500	0	0	0	NR	NR	0
LUST TRUST		0.500	0	0	0	NR	NR	0
UST		0.250	0	0	NR	NR	NR	0
AST		0.250	0	0	NR	NR	NR	0
INST CONTROL		0.500	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
VCP		0.500	0	0	0	NR	NR	0
DRYCLEANERS		0.250	0	0	NR	NR	NR	0
BROWNFIELDS		0.500	0	0	0	NR	NR	0
NPDES		TP	NR	NR	NR	NR	NR	0
TRIBAL RECORDS								
INDIAN RESERV		1.000	0	0	0	0	NR	0
INDIAN LUST		0.500	0	0	0	NR	NR	0
INDIAN UST		0.250	0	0	NR	NR	NR	0
EDR PROPRIETARY RECORDS								
Manufactured Gas Plants		1.000	0	0	0	0	NR	0

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 Distance (ft.) Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND