AS-BUILT MITIGATION PLAN

THREE MILE 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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THREE MILE CREEK RESTORATION SITE
AS-BUILT MITIGATION PLAN
AVERY COUNTY

EXECUTIVE SUMMARY

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of streams and wetlands at the Three Mile Creek Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in fulfilling stream and wetland mitigation goals. The Site, located in southwestern Avery County approximately 5.2 miles northeast of Spruce Pine, North Carolina, provides the minimum of 8021 stream mitigation units and 2.3 riparian wetland mitigation units as outlined in the October 2006 Technical Proposal. The Site is located in United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 06010108010020 (North Carolina Division of Water Quality Subbasin 04-03-06) of the French Broad River Basin.

A Detailed Stream and Wetland Restoration Plan was completed for the Site in September 2007. The plan outlined methods to complete stream and wetland restoration activities at the Site. A 26.68-acre conservation easement was placed on the Site to incorporate all restoration activities. The Site contains Three Mile Creek, 12 unnamed tributaries to Three Mile Creek, Fork Creek, and associated floodplains. Prior to construction, the project was characterized by agricultural land utilized for Christmas tree and ornamental landscape nursery plant production, timber harvest, and livestock grazing. Agricultural practices including the maintenance and removal of riparian vegetation and relocation, dredging, and straightening of onsite streams resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and reduced storage capacity and floodwater attenuation. In addition, hydric soils were disturbed due to regular plowing and vegetation maintenance, hoof shear from livestock, and the removal of groundwater hydrology inputs from the rerouting and straightening of Site tributaries.

Restoration of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Three Mile Creek watershed. Targeted mitigation efforts focused on improving water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat and were accomplished by:

1. Removing 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. Reducing 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. Reestablishing 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. Promoting 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. Improving 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. Providing a terrestrial wildlife corridor and refuge in an area that is developed for agricultural production.

As constructed, the Site restored historic stream and wetland functions, which existed onsite prior to channel straightening and dredging, agricultural impacts, and vegetation removal. Stream construction of meandering, C-/E-type stream channel resulted in 6057 linear feet of stream restoration, 618 linear feet of stream enhancement (Level I), 875 linear feet of stream enhancement (Level II), 6421 linear feet of stream preservation, 2.5 acres of riverine wetland restoration, and 2.3 acres of riverine wetland enhancement. The total amount of mitigation implemented at the Site is 8103 SMUs and 3.7 riverine WMUs.

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1.0 INTRODUCTION

1.1 Location and Setting

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of streams and wetlands at the Three Mile Creek Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in fulfilling stream and wetland mitigation goals. The Site, The Site, located in southwestern Avery County approximately 5.2 miles northeast of Spruce Pine, North Carolina, provides the minimum of 8021 stream mitigation units and 2.3 riparian wetland mitigation units as outlined in the October 2006 Technical Proposal (Figure 1, Appendix A). The Site is located in United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 06010108010020 (North Carolina Division of Water Quality Subbasin 04-03-06) of the French Broad River Basin.

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 Project Goals and Objectives

A Detailed Stream and Wetland Restoration Plan was completed for the Site in September 2007. The plan outlined methods to complete stream and wetland restoration activities at the Site. A 26.68-acre conservation easement was placed on the Site to incorporate all restoration activities. The Site contains 4.8 acres of hydric soil, Three Mile Creek, 12 unnamed tributaries (UTs) to Three Mile Creek, Fork Creek, and adjacent floodplains, which represent the primary hydrologic features of the Site. The drainage basin size is approximately 5.1 square miles at the Site outfall. The Site watershed is dominated by forest, agricultural land, and sparse industrial/residential development; less than five percent of the upstream watershed is composed of impervious surface.

Prior to construction, the project was characterized by agricultural land utilized for Christmas tree and ornamental landscape nursery plant production, timber harvest, and livestock grazing (Figure 2, Appendix A). Agricultural practices including the maintenance and removal of riparian vegetation and relocation, dredging, and straightening of onsite streams resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and reduced storage capacity and floodwater attenuation. In addition, hydric soils were disturbed due to regular plowing and vegetation maintenance, hoof shear from livestock, and the removal of groundwater hydrology inputs from the rerouting and straightening of Site tributaries.

The following objectives were proposed to provide mitigation credit requested under the EEP Request For Proposal (RFP) #16-D06125 dated June 27, 2006.

- Restore aquatic wetland, and riparian habitat within the upper portions of the Three Mile Creek watershed.
- Restore geomorphic stability to the subject stream reaches.
- Restore approximately ten acres of Piedmont/Mountain Bottomland and Piedmont/Low Mountain Alluvial Forests

Restoration of Site streams and wetlands will result in positive benefits for water quality and biological diversity in the Three Mile Creek watershed. Targeted mitigation efforts at the Site were accomplished by:

1. Removing 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. Reducing 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. Reestablishing 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. Promoting 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. Improving 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. Providing a terrestrial wildlife corridor and refuge in an area that is developed for agricultural production.

1.3 Project Structure, Restoration Type, and Approach

As constructed, the Site restored historic stream and wetland functions, which existed onsite prior to channel straightening and dredging, agricultural impacts, and vegetation removal. Stream construction of meandering, C-/E-type stream channel resulted in 6057 linear feet of stream restoration, 618 linear feet of stream enhancement (Level I), 875 linear feet of stream enhancement (Level II), 6421 linear feet of stream preservation, 2.5 acres of riverine wetland restoration, and 2.3 acres of riverine wetland enhancement (Table 1).

Table 1. Site Restoration Structures and Objectives

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Existing Linear Footage/ Acreage	Designed Linear Footage/ Acreage**	Comment
Three Mile Creek	1+25-37+30	Restoration	1	3552	3495	Restoration of a straightened channel on new location.
	37+30-42+15	Enhancement I	2	485	485	Restoration of dimension and profile in place.
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.

Table 1. Site Restoration Structures and Objectives (continued)

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Existing Linear Footage/ Acreage	Designed Linear Footage/ Acreage**	Comment
Tributary 2	0+00-1+33	Enhancement I	2	133	133	Restoration of dimension and profile in place.
	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	0+00-2+28	Restoration	1	136	198	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	214	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	931	931	Preservation of stable, forested stream reaches.
Tributary 6a	0+00-2+44	Restoration	1	124	214	Restoration of a ditched and disturbed channel on new location.
	NA	Preservation	NA	681	681	Preservation of stable, forested stream reaches.
Tributary 7	0+00-2+75	Restoration	1	146	245	Restoration of a ditched and disturbed channel on new location.
Tributary 8	0+00-3+43	Restoration	1	519	343	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 11a	0+00-0+92	Restoration	1	72	92	Restoration of a ditched and disturbed channel on new location.
	228	Restoration	1	228	228	Braiding surface flow of restoration channel.
	NA	Preservation	NA	49	49	Preservation of stable, forested stream reaches.
Tributary 11b	0+00-0+62	Restoration	1	51	62	Restoration of a ditched and disturbed channel on new location.
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 Sheets 1-23 in Appendix A (As-built Survey)
** Constructed 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.

1.4 Project History

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

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	August 2007	September 2007
Construction Completion	NA	January 2009
Site Planting	NA	February 2009
Mitigation Plan/As-builts	March 2009	April 2009

Table 3. Project Contacts Table

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer (919) 755-9490
Designer	Axiom Environmental, Inc. 20 Enterprise Street, Suite 7 Raleigh, NC 27607 Grant Lewis (919) 215-1693
Construction Contractor	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, North Carolina 27592 Lloyd Glover (919) 422-3392
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (919) 523-4375
Surveying Contractor	K2 Design Group, PA 5758 US Highway 70 East Goldsboro, North Carolina 27534 John Rudolph (919) 751-0075

Table 4. Project Background Table

Project County	Avery County, North Carolina
Drainage Area	Three Mile Creek: 5.1 square miles Fork Creek: 1.8 square miles Tributaries: 0.02-0.2 square mile
Drainage impervious cover estimate (%)	< 1
Stream Order	Three Mile Creek: Second and Third Fork Creek: Second Tributaries: First and Second
Physiographic Region	Blue Ridge
Ecoregion	Southern Crystalline Ridges and Mountains
Rosgen Classification of As-built	E-/C-type
Dominant Soil Types	Chandler, Cullowhee, Nikwasi, Micaville, Saunook, Thunder
Reference Site ID	Stone Mountain and Cranberry Creek
USGS HUC	06010108010020
NCDWQ Subbasin	04-03-06
NCDWQ Classification	WS-IV Tr (Stream Index # 7-2-25-(0.7))
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	Yes, the receiving water of the North Toe River (Stream Index Number 7-2-[27.7]b) is listed for impaired biological integrity and turbidity
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	+/- 8%

2.0 RESTORATION ACTIVITIES

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. Restoration plans constructed 6057 linear feet of stream restoration, 618 linear feet of stream enhancement (Level I), 875 linear feet of stream enhancement (Level II), 6421 linear feet of stream preservation, 2.5 acres of riverine wetland restoration, and 2.3 acres of riverine wetland enhancement. In total, the Site provides 8103 SMUs and 3.7 riverine WMUs (Sheets 1-23, Appendix A).

2.1 Stream Restoration

Portions of Three Mile Creek and eleven of the tributaries are located within a floodplain suitable for design channel excavation on new location. The streams were constructed on new location and the old dredged, straightened, and rerouted channels were abandoned and backfilled. Primary activities designed to restore the channels on new location included 1) belt-width preparation and grading, 2) floodplain bench excavation, 3) channel excavation, 4) installation of channel plugs, 5) backfilling of the abandoned channel, and 6) installation of in-stream structures.

3.1.1 Belt-width Preparation and Grading

The belt-width was prepared and graded; material excavated during grading was stockpiled immediately adjacent to channel segments to be abandoned and backfilled. These segments were backfilled after stream diversion was completed. After preparation of the corridor, the design channel and updated profile survey was developed and the location of each meander wavelength plotted and staked along the profile.

3.1.2 Floodplain Bench Excavation

A bankfull, floodplain bench was created to 1) remove 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 were 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 was stabilized with suitable erosion control measures. Planting of the bench with native floodplain vegetation occurred to reduce erosion of bench sediments, reduce flow velocities in flood waters, filter pollutants, and provide wildlife habitat.

3.1.3 Channel Excavation

The channel was constructed within the range of values depicted in the September 2007 Detailed Restoration Plan for the Site.

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

Particular attention was 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 were embedded into the break-in-slope to promote more rapid development of an overhanging bank.

3.1.4 Channel Backfilling

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

Borrow material was generated through excavation of groundwater storage depressions throughout the Site landscape. The primary purpose of these depressions was to provide suitable, low permeability material for ditch plugs and backfilling, to increase water storage potential within the wetland restoration area, and to increase potential for biological diversity within the complex.

3.1.5 Marsh Treatment Areas

Shallow wetland marsh treatment areas were excavated in the floodplain to intercept surface waters draining through agricultural areas prior to discharging into the mainstem Three Mile Creek channel. Marsh treatment areas are depicted on Sheets 2-7 (Appendix A) and consisted of shallow depressions that will provide treatment and attenuation of initial stormwater pulses. The outfall of each treatment area was constructed of hydrologically stable rip-rap or other suitable material to 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.

3.1.6 In-Stream Structures

In-stream structures were used within the Site for bank stabilization, grade control, and habitat improvement. This included the installation of 2 J-hook vanes, 4 log vanes, 10 rock cross-vanes, and 8 step-pool structures (Sheets 11-15, Appendix A).

J-hook Vanes/Log Vanes

J-hook vanes and log vanes were used to direct high velocity flows during bankfull events towards the center of the channel. J-hook vanes were constructed of boulders approximately 24 inches in minimum width. J-hook vane construction was initiated by imbedding footer rocks into the stream bed for stability to prevent undercutting of the structure. Header rocks were then placed atop the footer rocks at the design elevation. Footer and header rocks create an arm that slopes from the center of the channel upward at approximately 7 to 10 degrees, tying in at the bankfull floodplain elevation. Once the header and footer stones were in place, filter fabric was buried into a trench excavated around the upstream side of the J-hook vane arm. The filter fabric was then draped over the header rocks to force water over the vane. The upstream side of the structure was backfilled with suitable material to the elevation of the header stones.

Log vanes were constructed utilizing large tree trunks harvested from the Site. The tree stems harvested for log cross-vane arms were long enough to be imbedded into the stream channel and extend several feet into the floodplain. Logs create an arm that slopes from the center of the channel upward at approximately 5 to 7 degrees, tying in at the bankfull floodplain elevation. Logs extend from each stream bank at an angle of 20 to 30 degrees. A trench was dug into the stream channel that was deep enough for the head of the log to be at or below the channel invert. The trench was then extended into the floodplain and the log was set into the trench such that the log arm was below the floodplain elevation. Once the vane was in place, filter fabric was toed into a trench on the upstream side of the vane and draped over the structure to force water over the vane. The upstream side of the structure was then backfilled with suitable material.

Rock Cross-vanes

Rock cross-vanes were installed in the channel to 1) sustain bank stability, 2) direct high velocity flows during bankfull events toward the center of the channel, 3) maintain average pool depths throughout the reach, 4) preserve water surface elevations and reconnect bankfull stream flows with the adjacent floodplains, and 5) modify energy distributions through increases in channel roughness and local energy slopes during peak flows.

Rock cross-vanes were constructed of boulders approximately 24 inches in minimum width. Rock cross-vane construction was initiated by imbedding footer rocks into the stream bed for stability to prevent undercutting of the structure. Header rocks were then placed atop the footer rocks at the design elevation. Footer and header rocks create an arm that slopes from the center of the channel upward at approximately 7 to 10 degrees, tying in at the bankfull floodplain elevation. The cross-vane arms at both banks were tied into the bank with a sill to eliminate the possibility of water diverting around the structure. Once the header and footer stones were in place, filter fabric was buried into a trench excavated around the upstream side of the vane arms. The filter fabric was then draped over the header rocks to force water over the vane. The upstream side of the structure was backfilled with suitable material to the elevation of the header stones.

Step-Pool Structures

Step-pool structures were constructed to 1) sustain bank stability, 2) direct high velocity flows during bankfull events toward the center of the channel, 3) preserve water surface elevations and reconnect bankfull stream flows with the adjacent floodplains, and 4) modify energy distributions in steeper stream reaches through increases in channel roughness and local energy slopes during peak flows. Step-pool structures were installed at the infall of restoration reaches of Tributaries 3, 4, and 11A, and the outfall of Tributaries 2, 6A, 7, 8, and 11B to the Main Channel to lower hydrology to the elevation of the tributary or Main Channel, respectively. Step-pool structures were constructed of boulders approximately 24 inches in minimum width. These structures were constructed similar to a series of rock cross-vanes as described above.

3.1.7 Forded Channel Crossing

Landowner constraints necessitated the installation of two channel fords to allow access to portions of the property isolated by the conservation easement and stream restoration activities. The location of the channel fords are depicted on Sheets 11-15 (Appendix A). The fords were constructed of hydraulically stable rip-rap or suitable rock and are large enough to handle the weight of anticipated vehicular traffic. Approach grades to the fords were at an approximate 15:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines. The bed elevations of the fords are equal the floodplain elevation above and below the ford to reduce the risk of headcutting.

3.2 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 Three Mile Creek, and Fork Creek entailed the cessation of current land management practices and planting riparian buffers with native forest vegetation. Enhancement Level I also entailed dimension and profile adjustments along with the installation of instream habitat structures. Bank stabilization measures including the use of root/biodegradable erosion control matting, live staking, and bank sloping were implemented where necessary to prevent further bank erosion/degradation. Particular attention was directed toward providing vegetative cover and root growth along the outer bends of each stream meander. Riparian buffers 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.

3.3 Stream Preservation

The forested/upstream reach of Tributaries 3, 5, 6, and 11 were preserved as part of this project. Based on preliminary analysis and field investigations, these reaches are relatively stable due to a lack of human-induced impacts 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.

3.4 Wetland Restoration and Enhancement

Wetland restoration activities focused on 1) the reestablishment of historic water table elevations, 2) excavation and grading of elevated spoil and sediment embankments, 3) reestablishment of hydrophytic vegetation, and 4) reconstruction of stream corridors.

3.2.1 Reestablishment of Historic Groundwater Elevations

Preconstruction Tributaries 1 and 8 depths averaged 3-5 feet, while the constructed Tributaries 1 and 8 average approximately 0.7-1 foot. Hydric soils adjacent to the incised channels were drained due to lowering of the groundwater tables and a lateral drainage effect from existing stream reaches. Historic flow patterns were restored across the floodplain and channel inverts were reestablished to rehydrate soils adjacent to Site streams. In addition, preconstruction drainage ditches within the Site effectively removed wetland hydrology within the restoration area; these ditches were filled to rehydrate hydric soils. Filling of these ditches and restoring Site tributaries resulted in the restoration of jurisdictional hydrology to riverine wetlands.

3.2.2 Excavation and Grading of Elevated Spoil and Sediment Embankments

Spoil/sediment deposition adjacent to the preconstruction channels and area ditches were removed. Spoil materials were used to fill of onsite ditches, which represented a critical element of onsite wetland restoration.

3.2.3 Hydrophytic Vegetation

Onsite wetland areas endured significant disturbance from land use activities prior to construction such as land clearing and other anthropogenic maintenance. Wetland areas were revegetated with native vegetation typical of wetland communities in the region. Emphasis focused on developing a diverse plant assemblage. Plant Community Restoration is discussed in more detail in Section 4.0.

4.0 PLANT COMMUNITY RESTORATION

The Site was planted with native tree species in January 2009. Onsite observations, reference forest, and pertinent community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community association promoted during restoration efforts. Before plant community restoration was implemented, the entire Site was scarified. Scarification was performed as linear bands directed perpendicular to the land slope. Subsequently, community restoration was initiated on scarified surfaces. The Site was planted with species characteristic of Piedmont/Mountain Bottomland Forest within wetland areas, and a Piedmont/Low Mountain Alluvial Forest within the remainder of the Site. Fourteen tree species were planted at the Site; they are as shown in Table 5 (also in Figure 4, Appendix A).

Bare-root seedlings of canopy and understory tree species were planted within the Site at a density of approximately 2790 stems per acre within the stream-side assemblage and a density of approximately 660 stems per acre within the Piedmont/Mountain Bottomland Forest and Piedmont/Low Mountain Alluvial Forest communities. Bare-root seedlings were hand planted to minimize wetland soil disturbance. A total of 19,600 diagnostic tree and shrub seedlings were planted in support of Site restoration.

Table 5. Planted Tree Species

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*)	600	17	--	--	--	--	600
Cherrybark oak (*Quercus pagoda*)	900	25	--	--	--	--	900
Sycamore (*Platanus occidentalis*)	500	14	300	12	--	--	600
Hackberry (*Celtis laevigata*)	600	17	--	--	--	--	600
Green ash (*Fraxinus pennsylvanica*)	400	11	600	22	--	--	1000
Pawpaw (*Asimina triloba*)	300	8	300	12	--	--	600
Northern red oak (*Quercus rubra*)	--	--	400	15	--	--	400
White oak (*Quercus alba*)	--	--	400	15	--	--	400
Black cherry (*Prunus serotina*)	--	--	300	12	--	--	300
Red bud (*Cercis canadensis*)	--	--	--	--	2000	15	2000
Persimmon (*Diospyros virginiana*)	--	--	300	12	2300	17	2600
Silky dogwood (*Cornus amomum*)	300	8	--	--	3900	29	4200
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	2600	19.5	2600
Elderberry (*Sambucus canadensis*)	--	--	--	--	2600	19.5	2600
TOTAL	**3600**	**100**	**2600**	**100**	**13,400**	**100**	**19,600**

5.0 MONITORING PLAN

The Three Mile Stream and Wetland Restoration Site monitoring plan will entail analysis of the stream channel, hydrology, and vegetation. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. Locations of stream cross-sections and vegetation monitoring plots are depicted in Sheets 11-15 (Appendix A).

5.1 Stream

After completion of Site construction, one 3000-linear foot reach of Three Mile Creek was monitored for geometric activity along the restored channel. In addition, 11 stream cross-sections were established and permanently monumented within the monitoring reach.

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) water surface slope, and 7) stream substrate composition. A photographic record that will include preconstruction and post-construction pictures has been initiated (Appendix B).

Baseline/as-built measurements, performed in November 2008, emulated the proposed channel morphology; data are included in Tables 6 and 7A to 7C, and cross-section and longitudinal profile plots can be found in Appendix C.

5.2 Hydrology

After hydrological modifications were completed at the Site, four continuously recording, surficial monitoring gauges were installed in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993). Monitoring gauges were set to a depth of approximately 24 inches below the soil surface. Screened portions of each gauge were surrounded by filter fabric, buried in screened well sand, and sealed with a bentonite cap to prevent siltation and surface flow infiltration during floods.

Three groundwater gauges were installed in wetland restoration and enhancement areas to provide representative coverage of the Site. One additional gauge was placed in a reference wetland area. Hydrological sampling will be performed in restoration and reference areas during the growing season at daily intervals necessary to satisfy the hydrology success criteria within each physiographic landscape area (USEPA 1990).

5.3 Vegetation

Following Site planting, eight (10-meter by 10-meter) vegetation monitoring plots were established within the Site. 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 each year using the *CVS-EEP Protocol for Recording Vegetation Level 1-2 Plot Sampling Only* (Version 4.0) (Lee et al. 2006) in September of the first monitoring year and between June 1 and September 30 for each subsequent year until the vegetation success criteria are achieved.

A photographic record of plant growth will be included in each annual monitoring report.

6.0 SUCCESS CRITERIA

6.1 Stream Success Criteria

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system. Annual monitoring will continue until success criteria are met and no less than two bankfull events have occurred, as determined by in situ crest gauge, otherwise monitoring will continue until the second bankfull event has occurred.

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.

Table 6. Baseline Morphology and Hydraulic Summary
Threemile Creek

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	USGS gage data is unavailable for this project			17.4	23	20.7	27.2	33	30.1	21	29	25	23.1	27.8	26.1
Floodprone Width (ft)				32	250	100			100	50	350	250			250
BF Cross Sectional Area (ft2)				36.5	53	43			46	36	53	45	46.5	55.3	53.1
BF Mean Depth (ft)				1.5	2.8	2.2	1.4	1.7	1.6	1.5	2.1	1.8	1.8	2.2	2.1
BF Max Depth (ft)				1.9	3.3	2.8	2.2	2.6	2.4	2	2.7	2.3	2.2	2.7	2.5
Width/Depth Ratio				6.6	14.5	10	16.1	23.8	20	12	16	14	12	15	12
Entrenchment Ratio				1.5	8	6.5	3	3.7	3.4	2.2	7.4	4.4	9	11	10
Bank Height Ratio				1.9	2.5	1.8	1	1.6	1.3	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===	25	29	28
Hydraulic radius (ft)						===			===			===	1.8	2	2
Pattern															
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			40	55	46.8	27	76	47	27	76	47
Radius of Curvature (ft)							62.4	312.1	94.5	45	252	52	45	252	52
Meander Wavelength (ft)							101.7	273.2	199.4	136	252	200	136	252	200
Meander Width ratio							1.3	1.8	1.6	1.2	3	2	1.2	3	2
Profile															
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===	17	111	51
Riffle slope (ft/ft)							0.26%	1.83%	1.18%	1.94%	2.91%	2.43%	0.43%	4.80%	1.54%
Pool length (ft)									===			===	26	78	46
Pool spacing (ft)							65.2	166.7	104.3	67	176	115	76	176	126
Substrate															
d50 (mm)						===			===			===			===
d84 (mm)						===			===			===			===
Additional Reach Parameters															
Valley Length (ft)						===			===			===			4057
Channel Length (ft)						===			===			===			3528
Sinuosity						1.1			1.2			1.15			1.15
Water Surface Slope (ft/ft)						1.03%			1.21%			0.97%			0.98%
BF slope (ft/ft)						===			===			===			===
Rosgen Classification						C/E4			Cb3			Ce4			C/E 3/4

Table 7A. Morphology and Hydraulic Monitoring Summary
Threemile Creek - Stream and Wetland Restoration Site

Parameter	Cross Section 1 Riffle (UT 8)						Cross Section 2 Pool (UT 8)						Cross Section 3 Riffle						Cross Section 4 Pool					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	4.8						6.3						27.8						27.9					
Floodprone Width (ft)	250						----						250						----					
BF Cross Sectional Area (ft2)	1.8						4.8						51.1						63.4					
BF Mean Depth (ft)	0.4						0.8						1.8						2.3					
BF Max Depth (ft)	0.6						1.3						2.2						3.7					
Width/Depth Ratio	12.8						----						15.1						----					
Entrenchment Ratio	52.1						----						9.0						----					
Bank Height Ratio	1						----						1						----					
Wetted Perimeter (ft)	5.1						6.9						29						29.6					
Hydraulic Radius (ft)	0.4						0.7						1.8						2.1					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2008)			MY-01 (2009)			MY-02 (2010)			MY-03 (2011)			MY-04 (2012)			MY-05 (2013)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	30	76	50															
Radius of Curvature (ft)	50	252	101															
Meander Wavelength (ft)	151	252	214															
Meander Width Ratio	1.2	3	2															
Profile																		
Riffle Length (ft)	17	111	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%															
Pool Length (ft)	26	78	46															
Pool Spacing (ft)	76	176	126															

Additonal Reach Parameters						
Valley Length (ft)	4057					
Channel Length (ft)	3,528					
Sinuosity	1.15					
Water Surface Slope (ft/ft)	0.0098					
BF Slope (ft/ft)	------					
Rosgen Classification	C/E 3/4					

Table 7B. Morphology and Hydraulic Monitoring Summary
Threemile Creek - Stream and Wetland Restoration Site

Parameter	Cross Section 5 Riffle						Cross Section 6 Pool						Cross Section 7 Riffle						Cross Section 8 Pool					
Dimension	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5	MY 0	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	26.4						21.6						23.1						25.7					
Floodprone Width (ft)	250						----						250						----					
BF Cross Sectional Area (ft2)	55						49.9						46.5						52.1					
BF Mean Depth (ft)	2.1						2.3						2.0						2.0					
BF Max Depth (ft)	2.6						3.5						2.4						3.4					
Width/Depth Ratio	12.7						----						11.5						----					
Entrenchment Ratio	9.5						----						10.8						----					
Bank Height Ratio	1						----						1						----					
Wetted Perimeter (ft)	27.9						23.5						24.7						27.1					
Hydraulic Radius (ft)	2						2.1						1.9						1.9					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2008)			MY-01 (2009)			MY-02 (2010)			MY-03 (2011)			MY-04 (2012)			MY-05 (2013)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Pattern																		
Channel Beltwidth (ft)	30	76	50															
Radius of Curvature (ft)	50	252	101															
Meander Wavelength (ft)	151	252	214															
Meander Width Ratio	1.2	3	2															
Profile																		
Riffle Length (ft)	17	111	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%															
Pool Length (ft)	26	78	46															
Pool Spacing (ft)	76	176	126															

Additonal Reach Parameters						
Valley Length (ft)	4057					
Channel Length (ft)	3,528					
Sinuosity	1.15					
Water Surface Slope (ft/ft)	0.0098					
BF Slope (ft/ft)	------					
Rosgen Classification	C/E 3/4					

Table 7C. Morphology and Hydraulic Monitoring Summary
Threemile Creek - Stream and Wetland Restoration Site

Parameter	Cross Section 9 Riffle						Cross Section 10 Pool (UT 1)						Cross Section 11 Riffle (UT1)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	25.7						9.5						6.4					
Floodprone Width (ft)	250						----						150					
BF Cross Sectional Area (ft2)	55.3						6.1						5.3					
BF Mean Depth (ft)	2.2						0.6						0.8					
BF Max Depth (ft)	2.7						1.1						1.2					
Width/Depth Ratio	11.9						----						7.7					
Entrenchment Ratio	9.7						----						23.4					
Bank Height Ratio	1						----						1					
Wetted Perimeter (ft)	27.1						9.6						7.1					
Hydraulic Radius (ft)	2						0.6						0.7					
Substrate																		
d50 (mm)	----						----						----					
d84 (mm)	----						----						----					
Parameter	**MY-00 (2008)**			**MY-01 (2009)**			**MY-02 (2010)**			**MY-03 (2011)**			**MY-04 (2012)**			**MY-05 (2013)**		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	30	76	50															
Radius of Curvature (ft)	50	252	101															
Meander Wavelength (ft)	151	252	214															
Meander Width Ratio	1.2	3	2															
Profile																		
Riffle Length (ft)	17	111	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%															
Pool Length (ft)	26	78	46															
Pool Spacing (ft)	76	176	126															
Additonal Reach Parameters																		
Valley Length (ft)	4057																	
Channel Length (ft)	3,528																	
Sinuosity	1.15																	
Water Surface Slope (ft/ft)	0.0098																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 3/4																	

6.2 Hydrologic 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.

6.2 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 inventory of a reference (relatively undisturbed) forest community used to orient the planting plan, and appropriate Schafale and Weakley (1990) community descriptions. All species planted and identified in the reference forest will be utilized to define "Characteristic Tree Species" as termed in the success criteria (Table 8).

Table 8. Characteristic Tree Species

Planted Species	Reference Species
Pawpaw (*Asimina triloba*)	Red maple (*Acer rubrum*)
Sugarberry (*Celtis laevigata*)	Ironwood (*Carpinus caroliniana*)
Redbud (*Cercis canadensis*)	Dogwood (*Cornus florida*)
Buttonbush(*Cephalanthus occidentalis*)	Strawberry bush (*Euonymous americana*)
Silky dogwood(*Cornus amomum*)	Spice bush (*Lindera benzoin*)
Persimmon (*Diospyros virginiana*)	Tulip poplar (*Liriodendron tulipifera*)
Green ash (*Fraxinus pennsylvanica*)	Sycamore (*Platanus occidentalis*)
Sycamore (*Platanus occidentalis*)	White pine (*Pinus strobes*)
Black cherry (*Prunus serotina*)	Black cherry (*Prunus serotina*)
White oak (*Quercus alba*)	White oak (*Quercus alba*)
Swamp chestnut oak (*Quercus michauxii*)	Red oak (Q*uercus* sp.)
Cherrybark oak (*Quercus pagoda*)	Rhododendron (*Rhododendron* sp.)
Northern red oak (*Quercus rubra*)	Wild azalea (*Rhododendron periclymenoides*)
Elderberry(*Sambucus canadensis*)	Black locust (*Robinia pseudoacacia*)
	Hemlock (*Tsuga* sp.)

An average density of 320 stems per acre of Characteristic Tree Species must be surviving at the end of the third monitoring year. Subsequently, 290 Characteristic Tree Species per acre must be surviving at the end of year 4 and 260 Characteristic Tree Species per acre at the end of year 5.

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

7.0 MONITORING REPORT SUBMITTAL

An Annual Stream and Wetland Monitoring Report will be prepared at the end of each monitoring year (growing season). The monitoring report will depict the sample plot and quadrant locations and include photographs which illustrate Site conditions. Data compilation and analyses will be presented including graphic and tabular format, where practicable.

8.0 CONTINGENCY

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented.

Stream

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 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) headcut migration through the Site, and/or 2) bank erosion.

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.

Hydrology

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

Vegetation

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

9.0 REFERENCES

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.

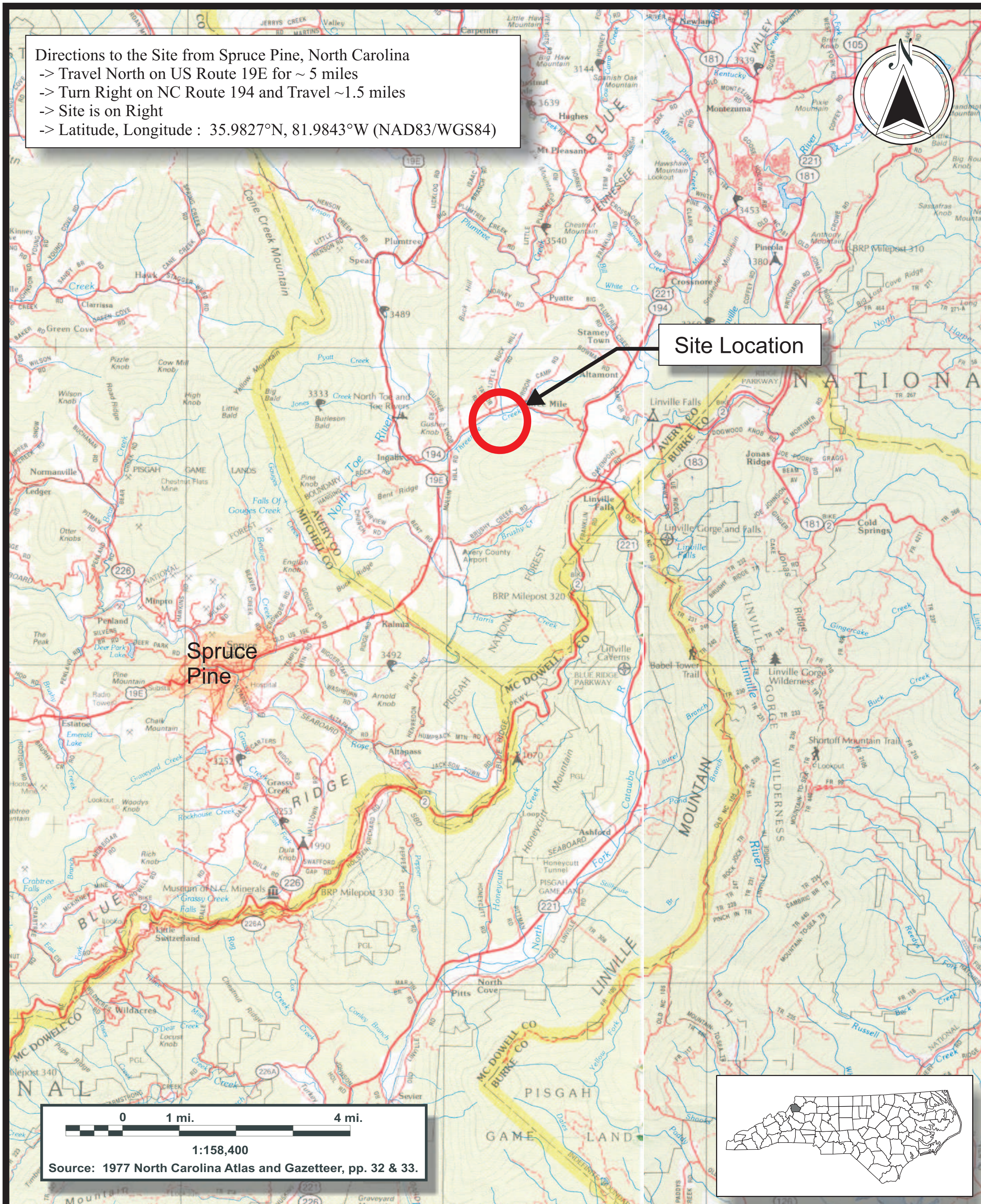
North Carolina Wetlands Restoration Program (NCWRP). 1993. Installing Monitoring Wells/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1). North Carolina Department of Environment, Health, and Natural Resources, Raleigh, North Carolina

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

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

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.

Appendix A.
Figures and As-built Construction Sheets

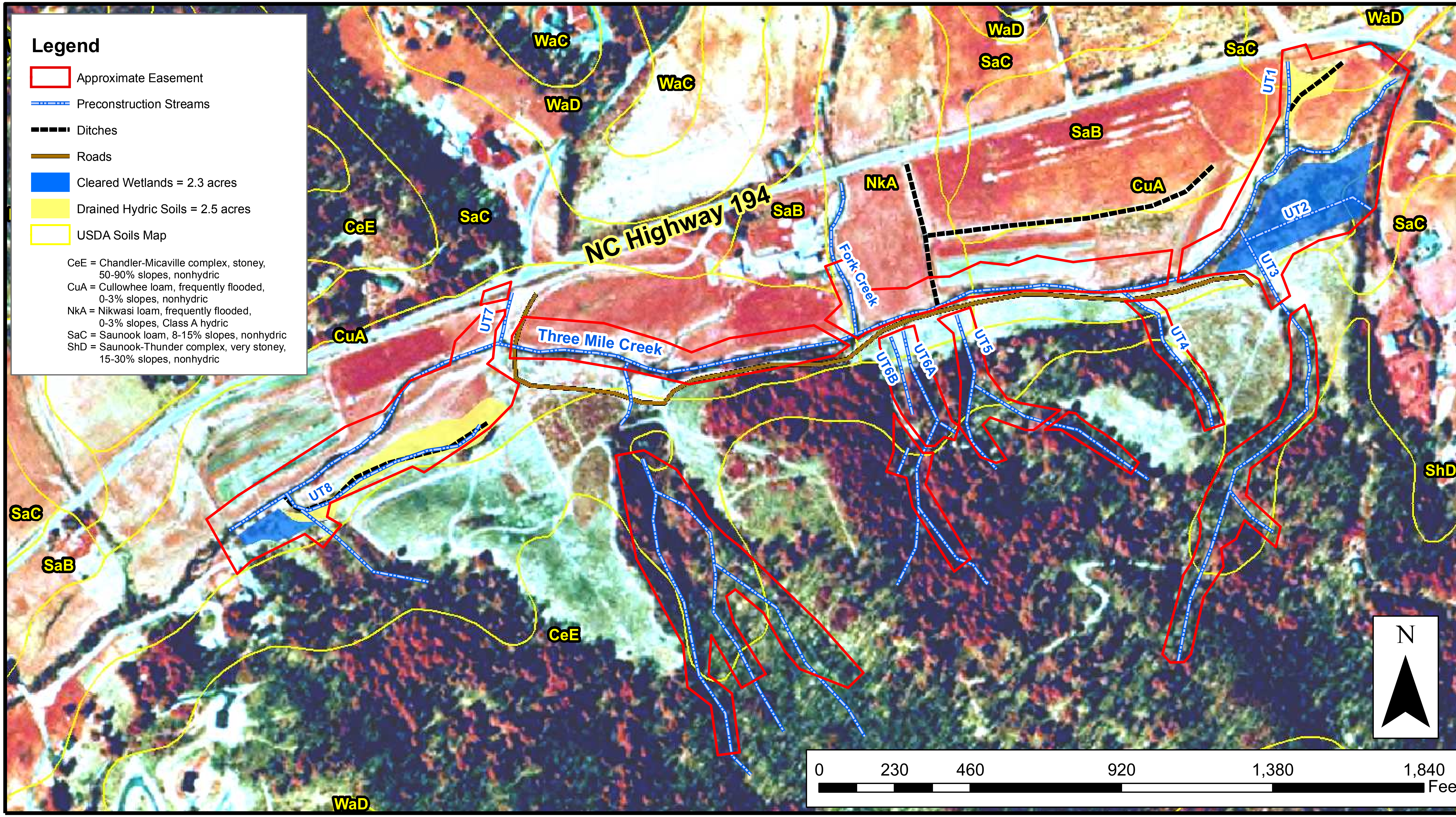


Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

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

Dwn. by:	CLF
Ckd by:	WGL
Date:	Nov 2008
Project:	07-004

FIGURE 1



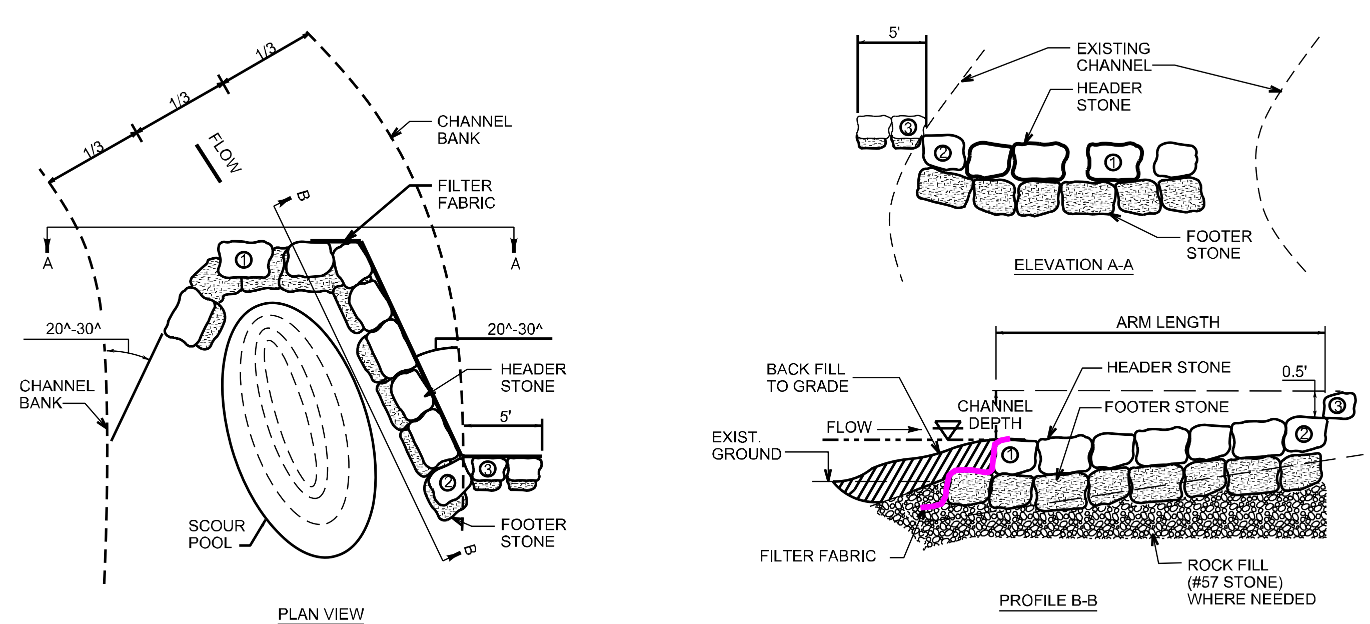
Axiom Environmental, Inc.

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

PRECONSTRUCTION CONDITIONS
THREE MILE CREEK RESTORATION SITE
Avery County, North Carolina

Dwn. By: CLF	FIGURE	
Date: Nov 2008	2	
Project: 07-004		

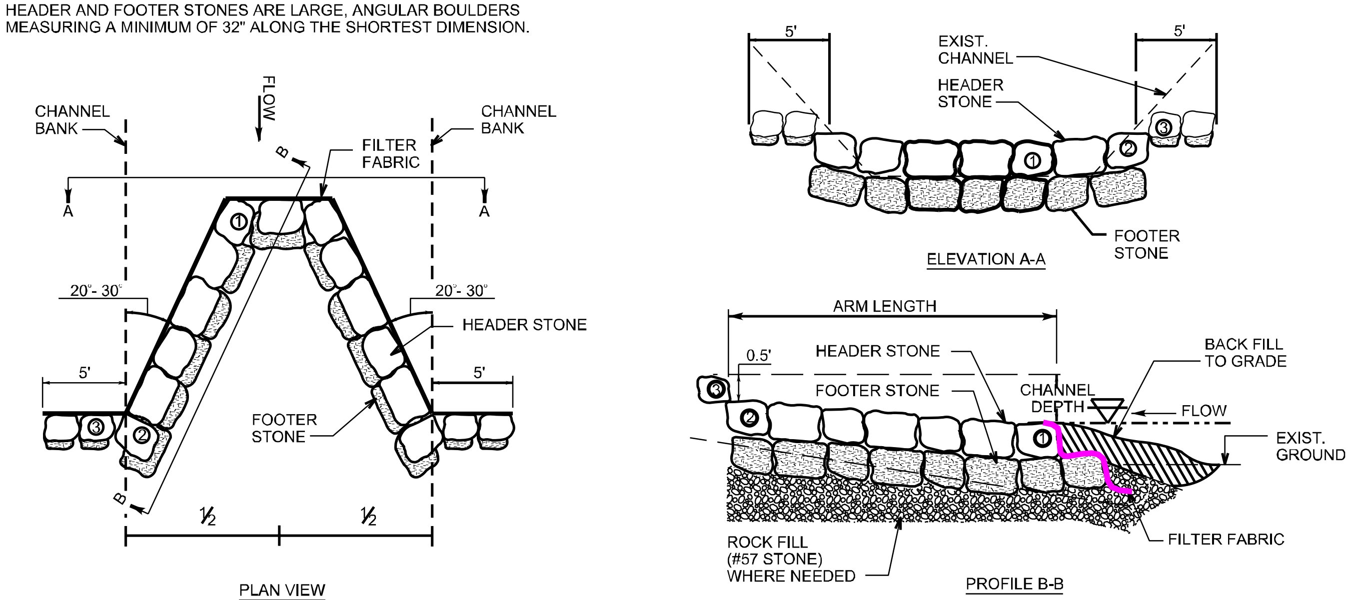
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 32" ALONG THE SHORTEST DIMENSION.



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.



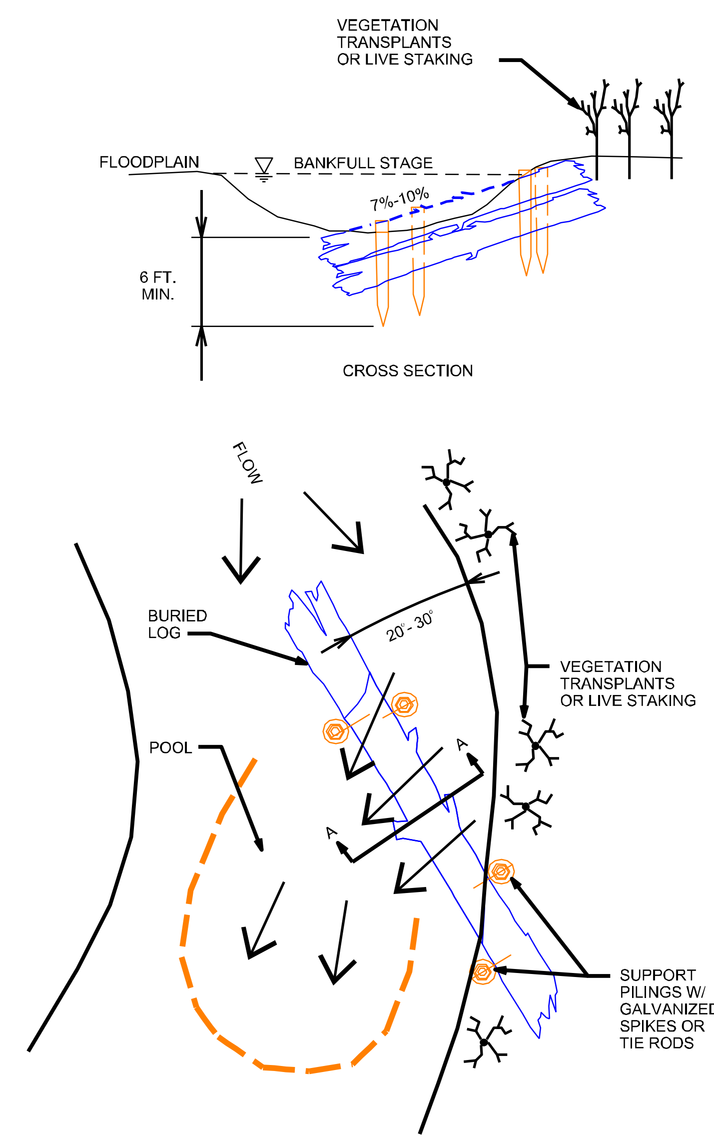
TYPICAL CROSS-VANE

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

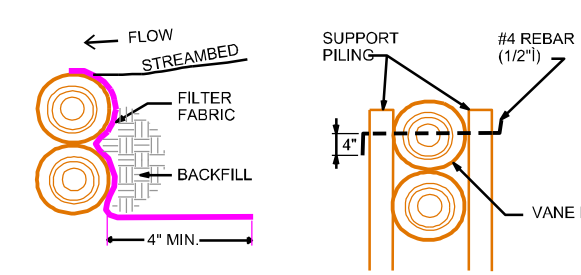
2. SUPPORT PILINGS SHALL BE PENCIL SHARPENED, UNTREATED, PEELED, A MINIMUM OF 4 INCHES IN TOP DIAMETER, AND 8 FEET LONG.

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.



TYPICAL LOG VANE



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

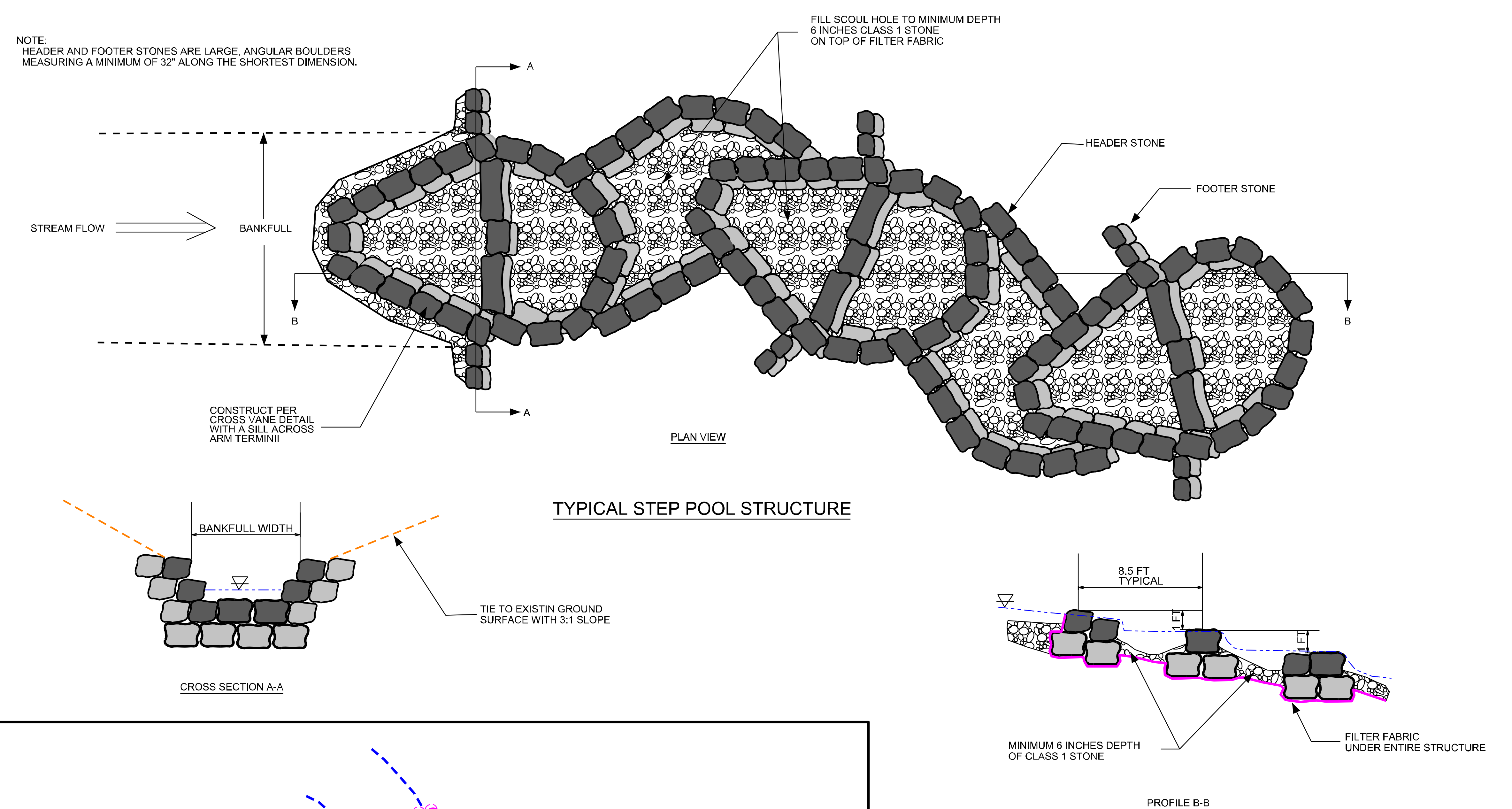
Date: July 2007

Project No.: 07-004

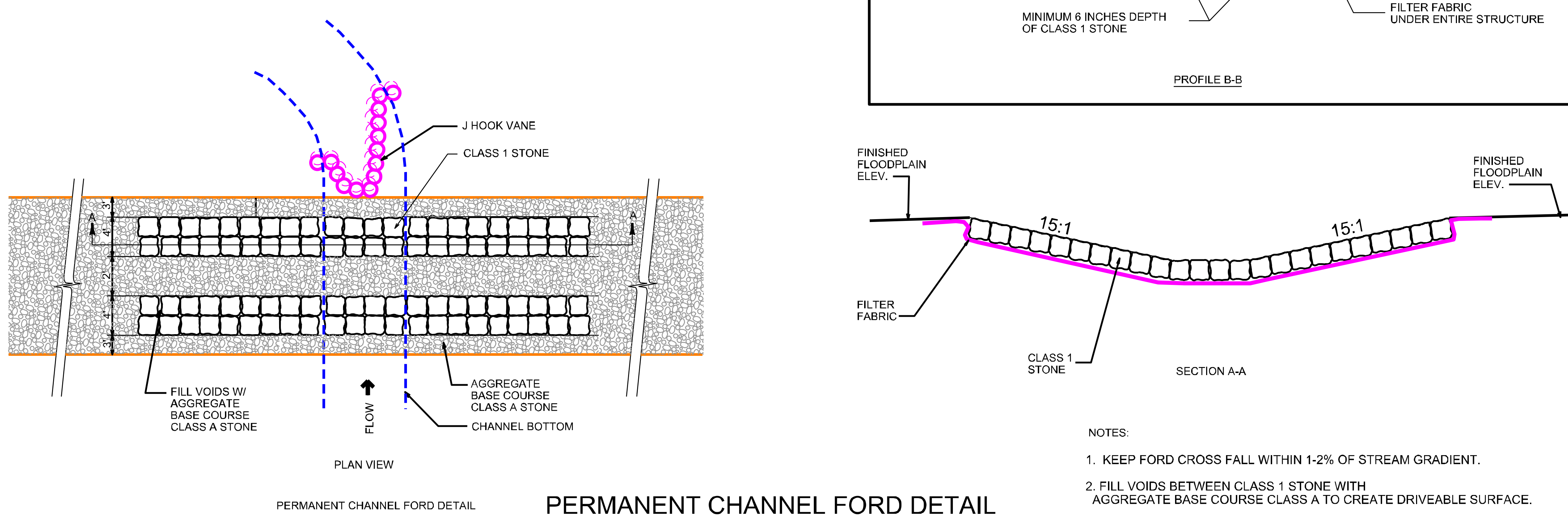
FIGURE NO.

3A

TYPICAL STEP POOL STRUCTURE



PERMANENT CHANNEL FORD DETAIL



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.

Axiom Environmental, Inc.

NOTES/REVISIONS

Project:

Threemile Creek Restoration Site

Avery County
North Carolina

Title:

TYPICAL STRUCTURE DETAILS

Scale: NO SCALE

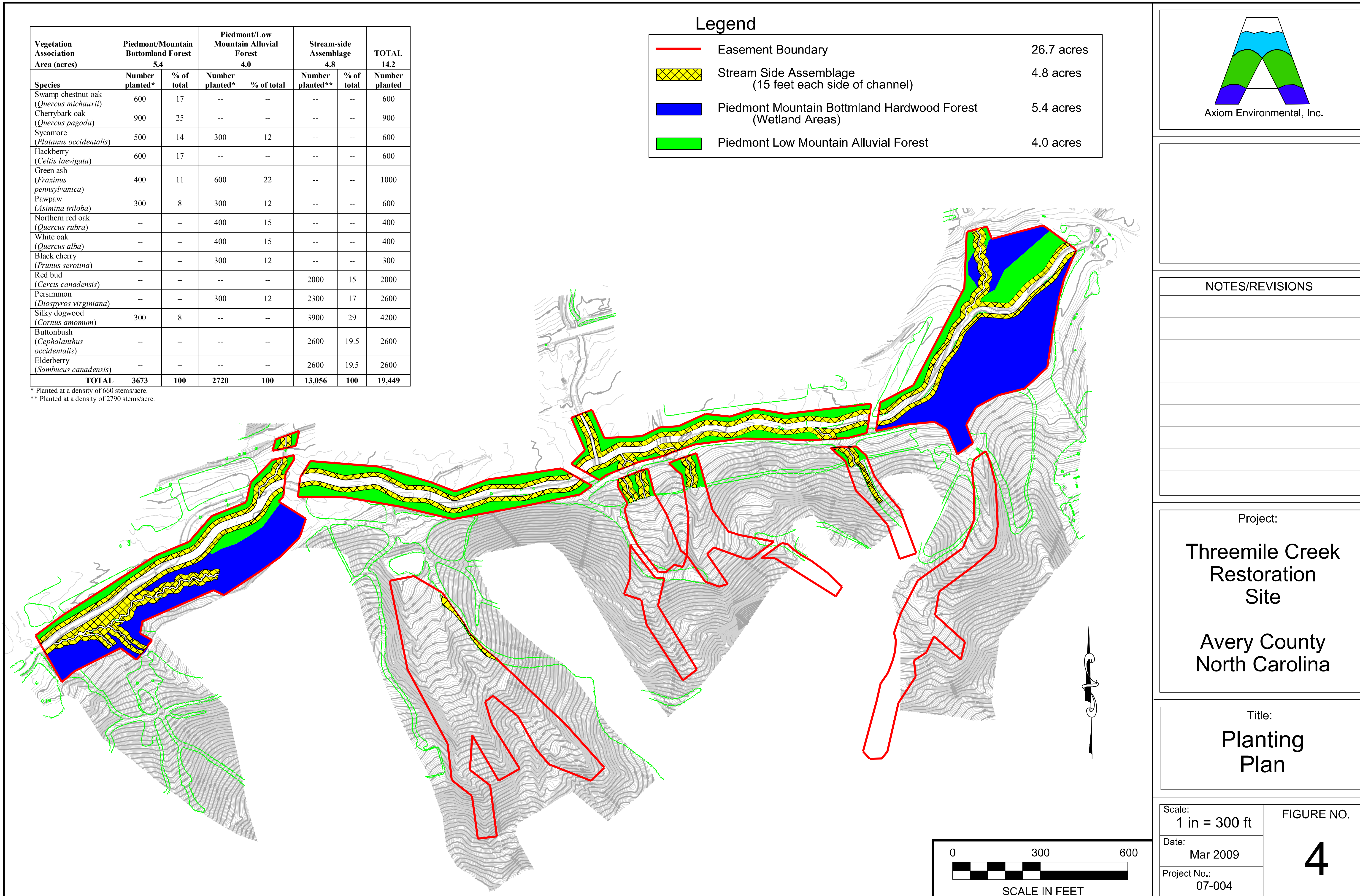
Date: July 2007

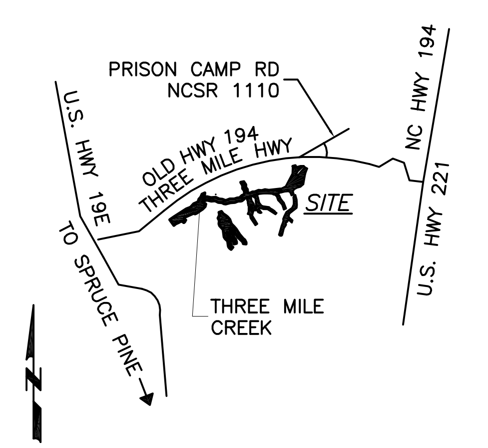
Project No.: 07-004

FIGURE NO. 3B

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*)	600	17	--	--	--	--	600
Cherrybark oak (*Quercus pagoda*)	900	25	--	--	--	--	900
Sycamore (*Platanus occidentalis*)	500	14	300	12	--	--	600
Hackberry (*Celtis laevigata*)	600	17	--	--	--	--	600
Green ash (*Fraxinus pennsylvanica*)	400	11	600	22	--	--	1000
Pawpaw (*Asimina triloba*)	300	8	300	12	--	--	600
Northern red oak (*Quercus rubra*)	--	--	400	15	--	--	400
White oak (*Quercus alba*)	--	--	400	15	--	--	400
Black cherry (*Prunus serotina*)	--	--	300	12	--	--	300
Red bud (*Cercis canadensis*)	--	--	--	--	2000	15	2000
Persimmon (*Diospyros virginiana*)	--	--	300	12	2300	17	2600
Silky dogwood (*Cornus amomum*)	300	8	--	--	3900	29	4200
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	2600	19.5	2600
Elderberry (*Sambucus canadensis*)	--	--	--	--	2600	19.5	2600
TOTAL	3673	100	2720	100	13,056	100	19,449

* Planted at a density of 660 stems/acre.
** Planted at a density of 2790 stems/acre.





VICINITY MAP (NTS)

DEED REFERENCE(S):

BEING A PORTION OF THE PROPERTY RECORDED IN D.B. 95, PG. 1728 OF THE AVERY COUNTY REGISTRY.

NCDOT R/W INFORMATION:

R/W WIDTH OBTAINED FROM NCDOT R/W OFFICE OF AVERY COUNTY ON 07/10/07. PH. (336) 667–9111

FOR FURTHER REFERENCES, SEE M.B. 1, PG. 53 RECORDED IN AVERY COUNTY REGISTRY.

POSSIBLE WATER RIGHT DEED REFERENCE(S):

NOT FIELD LOCATABLE, RECORDED IN D.B. 1580, PG. 761 OF THE AVERY COUNTY REGISTRY.

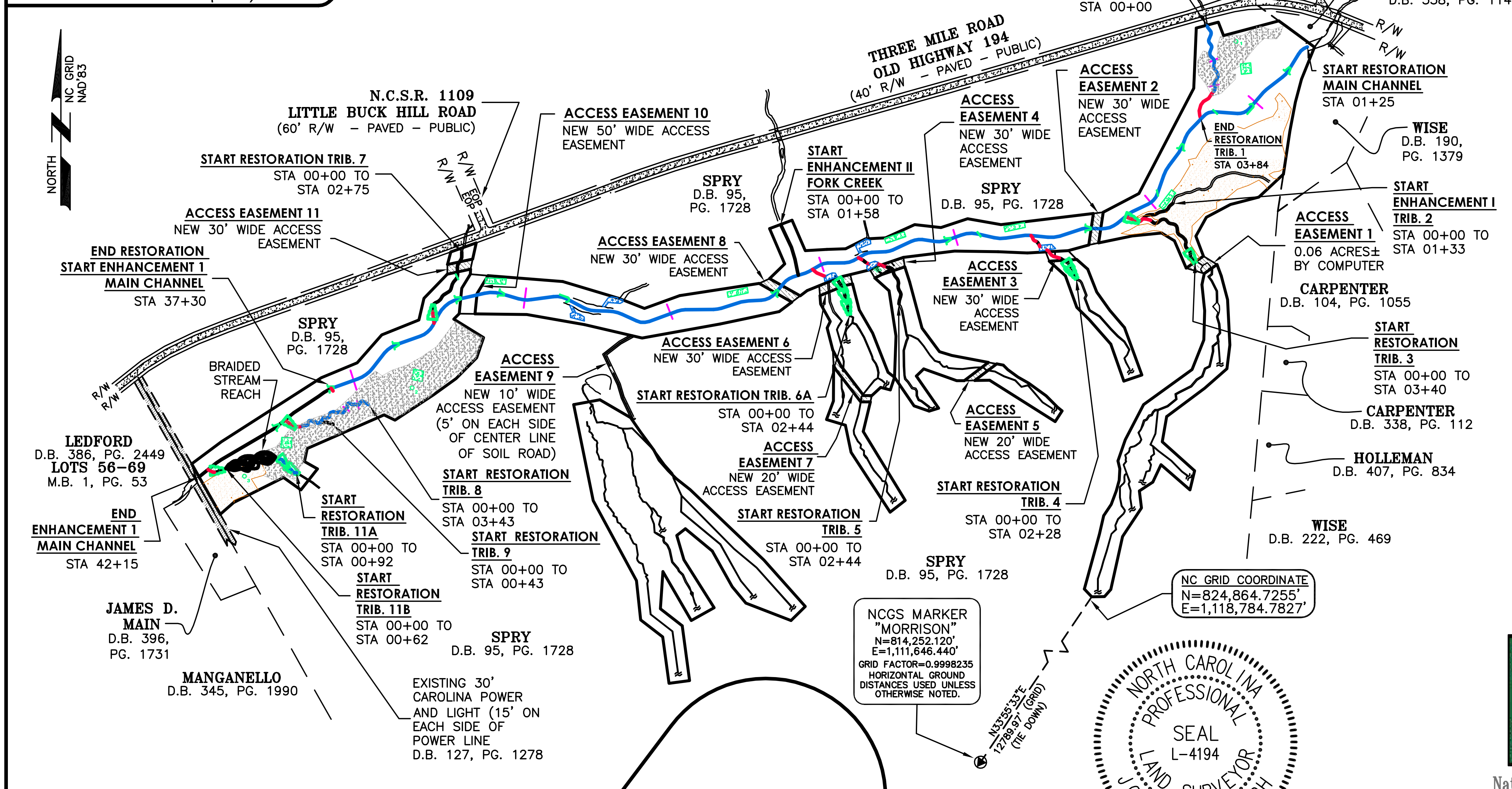
A PORTION OF THE AREA REPRESENTED BY THIS PLAT IS LOCATED IN A FLOOD HAZARD BOUNDARY ACCORDING TO FEMA MAP NUMBER(S) 3710181200J ZONE(S): AE DATED: PRELIMINARY JUNE 22, 2007.

A PORTION OF THE AREA REPRESENTED BY THIS PLAT IS LOCATED IN A FLOOD HAZARD BOUNDARY ACCORDING TO FEMA MAP NUMBER(S) 370010 0100 B ZONE(S): A DATED: SEPT. 28, 1990.

CONSERVATION EASEMENT IS 26.68 ACRES± EXCLUDING THREE MILE ROAD R/W AND EXCLUDING ALL ACCESS EASEMENTS IN THE EXCEPTION OF ACCESS EASEMENT 1 WHICH IS INCLUDED. ALL ACREAGE CALCULATED BY COMPUTER.

LEGEND:

EIS	–	Existing Iron Stake
EIP	–	Existing Iron Pipe
NMC	–	Non Monumented Corner
ECM	–	Existing Concrete Monument
R/W	–	Right–Of–Way
D.B.	–	Deed Book
PG.	–	Page
NCSR	–	North Carolina Secondary Road
EOP	–	Edge Of Pavement
•		Iron Stake Set (No. 5 Rebar with Plastic Cap Inscribed with "BOUNDARY MARKER") unless Otherwise Noted. Driven Flush with Grade Unless Otherwise Noted
PPS	–	Pump Pipe Set (3" O.D.) 2' Above Grade
ISS	–	Iron Stake Set (No. 5 Rebar)
O	–	Non–Monumented Corner
Trib.	–	Tributary
C/E	–	Conservation Easement
≈	–	Spring



GENERAL NOTES:

1) *NOTE: NO ABSTRACT TITLE, NOR TITLE COMMITMENT, NOR RESULTS OF TITLE SEARCH WERE FURNISHED TO THE SURVEYOR. ALL DOCUMENTS OF RECORD REVIEWED ARE NOTED HEREON (SEE REFERENCES). THERE MAY EXIST OTHER DOCUMENTS OF RECORD THAT MAY AFFECT THIS SURVEYED PARCEL.*

2) *COORDINATES SHOWN ARE BASED ON NC STATE PLANE COORDINATES 1983.*

3) *ACCESS EASEMENTS SHOWN ARE FOR THE USE OF RESTORATION SYSTEMS, LLC & THE SPRY FAMILY.*

4) *SPRINGS SHOWN (≈) ARE THE BEGINNINGS OF THE UNNAMED TRIBUTARIES FLOWING TOWARD THREE MILE CREEK.*

5) *THIS PLAT SHOWS THE CONSTRUCTED CENTERLINE OF THE NEW CHANNEL AS FIELD LOCATED JANUARY, 2009.*

6) *ALL DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.*

7) *FOR COMPLETE BOUNDARY INFORMATION SEE PLAT RECORDED IN M.B. 40, PG.'S 217–220 BY K2 DESIGN GROUP, P.A.*

8) *ALL WETLAND RESTORATION AND ENHANCEMENT AREAS WERE OBTAINED AND IDENTIFIED BY AXIOM ENVIRONMENTAL, INC.*

SHEET 1 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

Natural Resources Restoration & Conservation

TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

400 200 0 400 800 1200

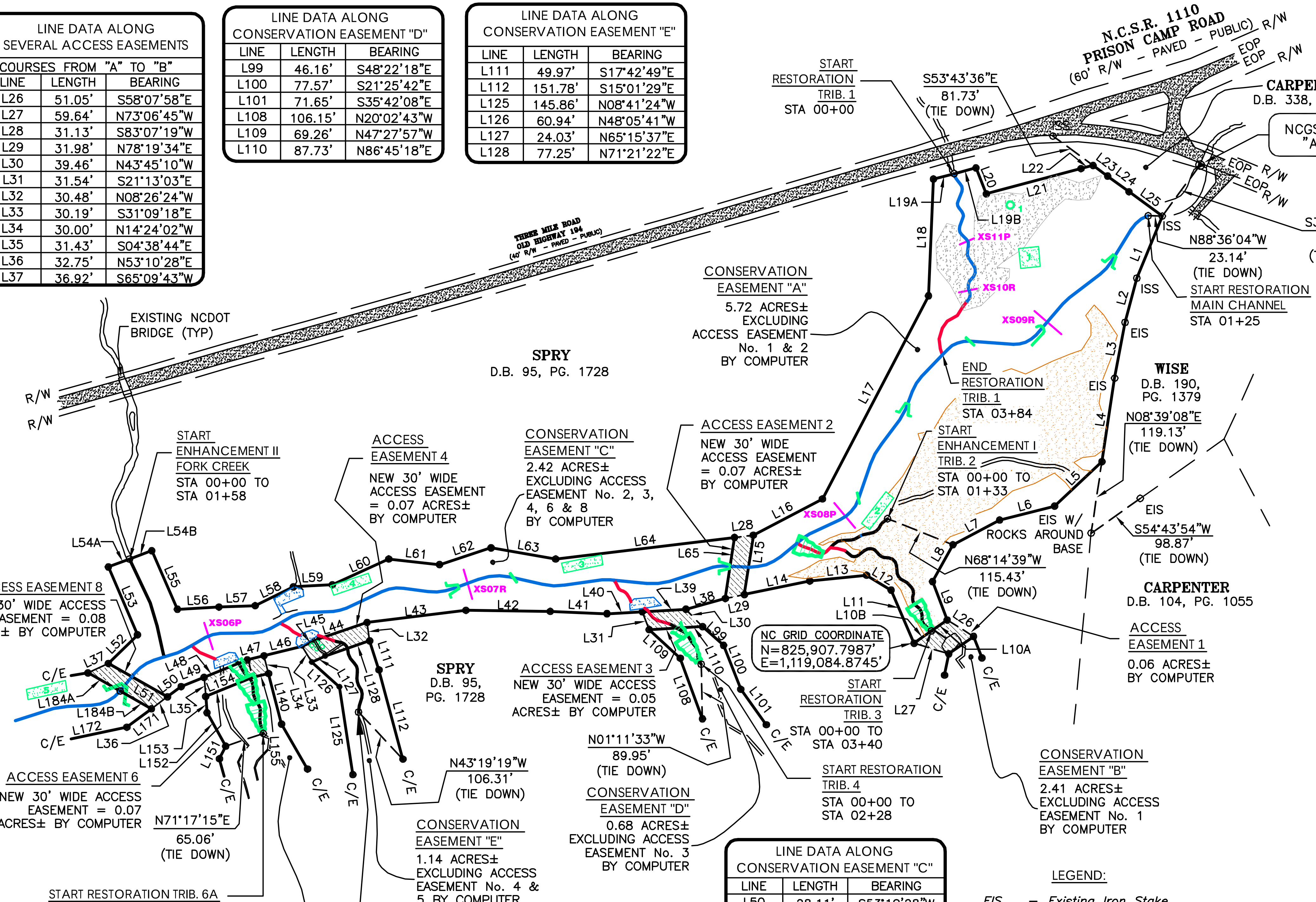
GRAPHIC SCALE 1" = 400'

NORTH CAROLINA PROFESSIONAL SEAL L–4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

DRAWN BY:	FGR
DATE:	1/20/09
DWG. NO.:	RSS922AB 08
SURVEYED BY:	J.A.R.

K2 DESIGN GROUP, P.A.
5688 U.S. Hwy. 70 East
Goldsboro, NC 27534
Tel.: (919) 751-0075
Fax: (919) 778-9087
k2design@suddenlink.net



LEGEND

- J HOOK VANE
- STEP POOL DROP STRUCTURE
- CROSS–SECTION
- LOG VANE
- FORD CROSSING
- ROCK CROSS–VANE
- MONITORING WELL
- MODIFIED FROM DESIGN
- VEGETATIVE PLOT AREA
- MONITORING REACH
- ACCESS EASEMENT
- STONE STRUCTURE
- MARSH TREATMENT AREA BMP
- WETLAND ENHANCEMENT
- WETLAND RESTORATION

LINE DATA ALONG SEVERAL ACCESS EASEMENTS
COURSES FROM "A" TO "B"

LINE	LENGTH	BEARING
L26	51.05'	S58°07'58"E
L27	59.64'	N73°06'45"W
L28	31.13'	S83°07'19"W
L29	31.98'	N78°19'34"E
L30	39.46'	N43°45'10"W
L31	31.54'	S21°13'03"E
L32	30.48'	N08°26'24"W
L33	30.19'	S31°09'18"E
L34	30.00'	N14°24'02"W
L35	31.43'	S04°38'44"E
L36	32.75'	N53°10'28"E
L37	36.92'	S65°09'43"W

LINE DATA ALONG CONSERVATION EASEMENT "D"

LINE	LENGTH	BEARING
L99	46.16'	S48°22'18"E
L100	77.57'	S21°25'42"E
L101	71.65'	S35°42'08"E
L108	106.15'	N20°02'43"W
L109	69.26'	N47°27'57"W
L110	87.73'	N86°45'18"E

LINE DATA ALONG CONSERVATION EASEMENT "E"

LINE	LENGTH	BEARING
L111	49.97'	S17°42'49"E
L112	151.78'	S15°01'29"E
L125	145.86'	N08°41'24"W
L126	60.94'	N48°05'41"W
L127	24.03'	N65°15'37"E
L128	77.25'	N71°21'22"E

LINE DATA ALONG CONSERVATION EASEMENT "A"

LINE	LENGTH	BEARING
L1	109.98'	S22°18'24"W
L2	75.28'	S14°50'24"W
L3	93.14'	S10°34'24"W
L4	138.71'	S08°39'08"W
L5	106.64'	S46°48'00"W
L6	93.07'	S75°46'54"W
L7	86.68'	S62°03'58"W
L8	69.09'	S29°02'03"W
L9	67.60'	S20°51'12"E
L10A	31.45'	S54°55'57"W
L10B	34.96'	S54°55'57"W
L11	94.86'	N23°19'36"W
L12	47.23'	N58°46'04"W
L13	93.82'	S84°11'44"W
L14	109.46'	S78°19'34"W
L15	98.61'	N08°35'57"E
L16	128.02'	N62°17'37"E
L17	376.30'	N27°33'43"E
L18	191.98'	N02°26'44"E
L19A	34.89'	N75°17'27"E
L19B	37.13'	N75°17'27"E
L20	45.97'	S21°53'17"E
L21	160.71'	N75°04'37"E
L22	20.53'	N75°04'37"E
L23	29.57'	S53°43'36"E
L24	43.58'	S53°43'36"E
L25	67.63'	S53°43'36"E

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

LINE DATA ALONG CONSERVATION EASEMENT "G"

LINE	LENGTH	BEARING
L140	85.71'	S14°24'02"E
L151	23.08'	N26°28'03"E
L152	63.05'	N29°12'26"W
L153	26.76'	N04°38'44"W
L154	83.57'	N68°01'49"E
L155	26.54'	N76°03'22"E

LINE DATA ALONG CONSERVATION EASEMENT "C"

LINE	LENGTH	BEARING
L38	67.07'	S74°41'56"W
L39	71.83'	S86°45'18"W
L40	57.91'	S86°45'18"W
L41	93.19'	N87°39'29"W
L42	138.37'	N89°15'49"W
L43	163.76'	S82°59'41"W
L44	84.24'	S71°21'22"W
L45	29.00'	S65°15'37"W
L46	64.69'	S76°03'22"W
L47	28.40'	S76°03'22"W
L48	76.32'	S68°01'49"W
L49	40.66'	S68°01'49"W

LINE DATA ALONG CONSERVATION EASEMENT "C"

LINE	LENGTH	BEARING
L50	28.11'	S53°10'28"W
L51	111.32'	N60°29'26"W
L52	67.06'	N45°24'38"E
L53	121.24'	N23°13'33"W
L54A	37.21'	N69°24'09"E
L54B	38.86'	N69°24'09"E
L55	104.99'	S23°37'46"E
L56	68.33'	N86°58'13"E
L57	59.43'	N87°47'44"E
L58	69.98'	N63°50'03"E
L59	64.04'	N86°55'51"E
L60	101.71'	N65°25'53"E
L61	83.87'	S83°44'27"E
L62	88.85'	N72°01'00"E
L63	107.77'	S80°13'49"E
L64	295.68'	N83°07'19"E
L65	101.38'	S08°35'57"W

LEGEND:

- EIS – Existing Iron Stake
- EIP – Existing Iron Pipe
- NMC – Non Monumented Corner
- ECM – Existing Concrete Monument
- R/W – Right–Of–Way
- D.B. – Deed Book
- PG. – Page
- NCSR – North Carolina Secondary Road
- EOP – Edge Of Pavement
- • Iron Stake Set (No. 5 Rebar with Plastic Cap Inscribed with "BOUNDARY MARKER") unless Otherwise Noted
- PPS – Pump Pipe Set (3" O.D.)
- ISS – Iron Stake Set (No. 5 Rebar)
- O – Non–Monumented Corner
- Trib. – Tributary
- C/E – Conservation Easement

SHEET 2 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

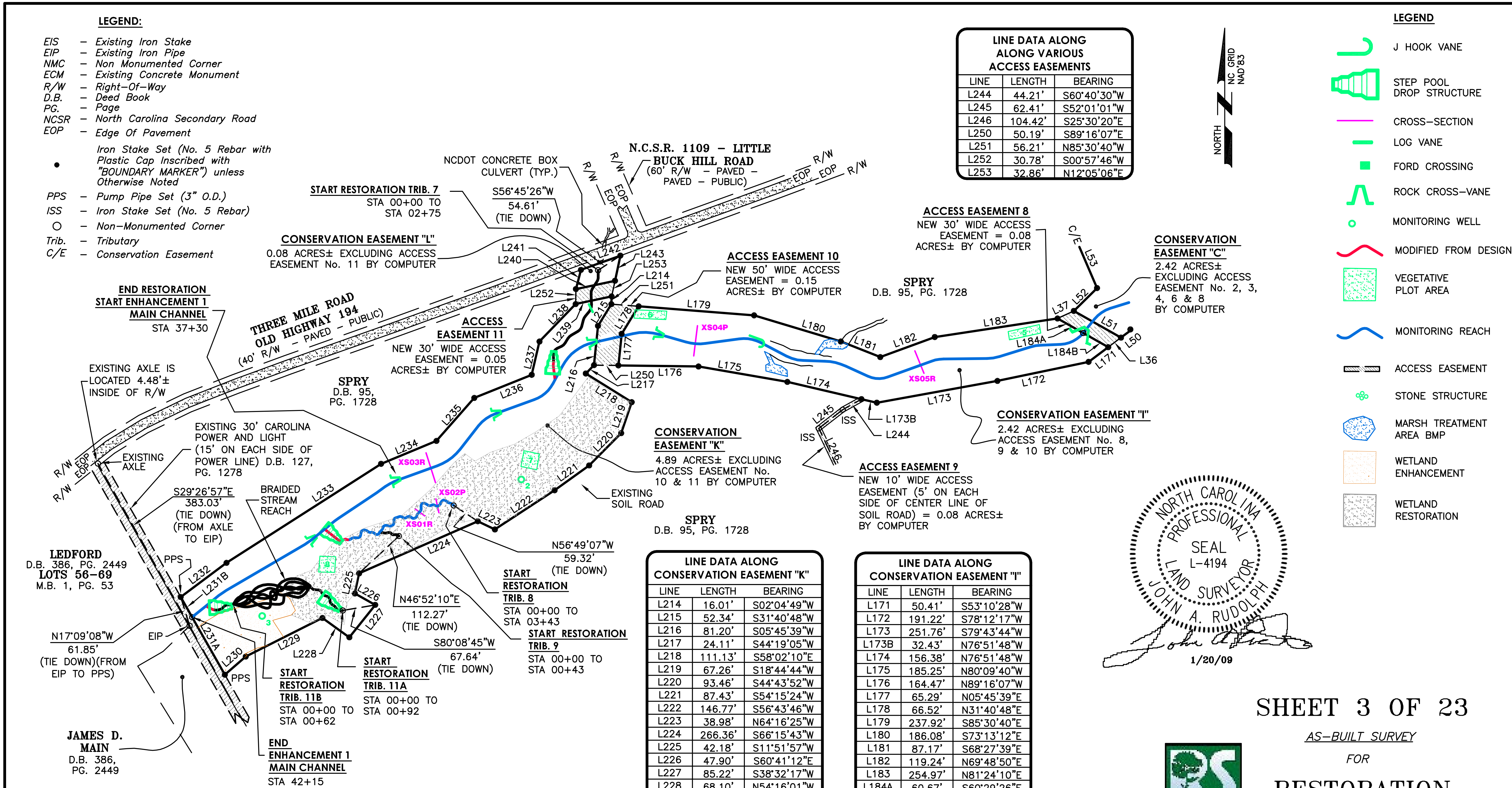
THREE MILE CREEK SITE

Natural Resources Restoration & Conservation

TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

200 100 0 200 400 600

GRAPHIC SCALE 1" = 200'



LINE DATA ALONG ALONG VARIOUS ACCESS EASEMENTS

LINE	LENGTH	BEARING
L244	44.21'	S60°40'30"W
L245	62.41'	S52°01'01"W
L246	104.42'	S25°30'20"E
L250	50.19'	S89°16'07"E
L251	56.21'	N85°30'40"W
L252	30.78'	S00°57'46"W
L253	32.86'	N12°05'06"E

LINE DATA ALONG CONSERVATION EASEMENT "K"

LINE	LENGTH	BEARING
L214	16.01'	S02°04'49"W
L215	52.34'	S31°40'48"W
L216	81.20'	S05°45'39"W
L217	24.11'	S44°19'05"W
L218	111.13'	S58°02'10"E
L219	67.26'	S18°44'44"W
L220	93.46'	S44°43'52"W
L221	87.43'	S54°15'24"W
L222	146.77'	S56°43'46"W
L223	38.98'	N64°16'25"W
L224	266.36'	S66°15'43"W
L225	42.18'	S11°51'57"W
L226	47.90'	S60°41'12"E
L227	85.22'	S38°32'17"W
L228	68.10'	N54°16'01"W
L229	176.35'	S63°16'24"W
L230	56.95'	S48°57'49"W
L231A	136.17'	N29°34'40"W
L231B	47.46'	N29°34'40"W
L232	117.47'	N53°12'13"E
L233	377.07'	N57°20'50"E
L234	123.11'	N67°29'29"E
L235	117.71'	N41°20'35"E
L236	127.15'	N68°04'18"E
L237	70.33'	N13°11'01"E
L238	107.04'	N43°58'15"E
L239	75.50'	N77°59'53"E

LINE DATA ALONG CONSERVATION EASEMENT "I"

LINE	LENGTH	BEARING
L171	50.41'	S53°10'28"W
L172	191.22'	S78°12'17"W
L173	251.76'	S79°43'44"W
L173B	32.43'	N76°51'48"W
L174	156.38'	N76°51'48"W
L175	185.25'	N80°09'40"W
L176	164.47'	N89°16'07"W
L177	65.29'	N05°45'39"E
L178	66.52'	N31°40'48"E
L179	237.92'	S85°30'40"E
L180	186.08'	S73°13'12"E
L181	87.17'	S68°27'39"E
L182	119.24'	N69°48'50"E
L183	254.97'	N81°24'10"E
L184A	60.67'	S60°29'26"E
L184B	59.09'	S60°29'26"E

LINE DATA ALONG CONSERVATION EASEMENT "L"

LINE	LENGTH	BEARING
L240	82.01'	S77°59'53"W
L241	40.73'	N14°41'08"E
L242	86.05'	N70°08'19"E
L243	52.75'	S12°05'06"W

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

SHEET 3 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

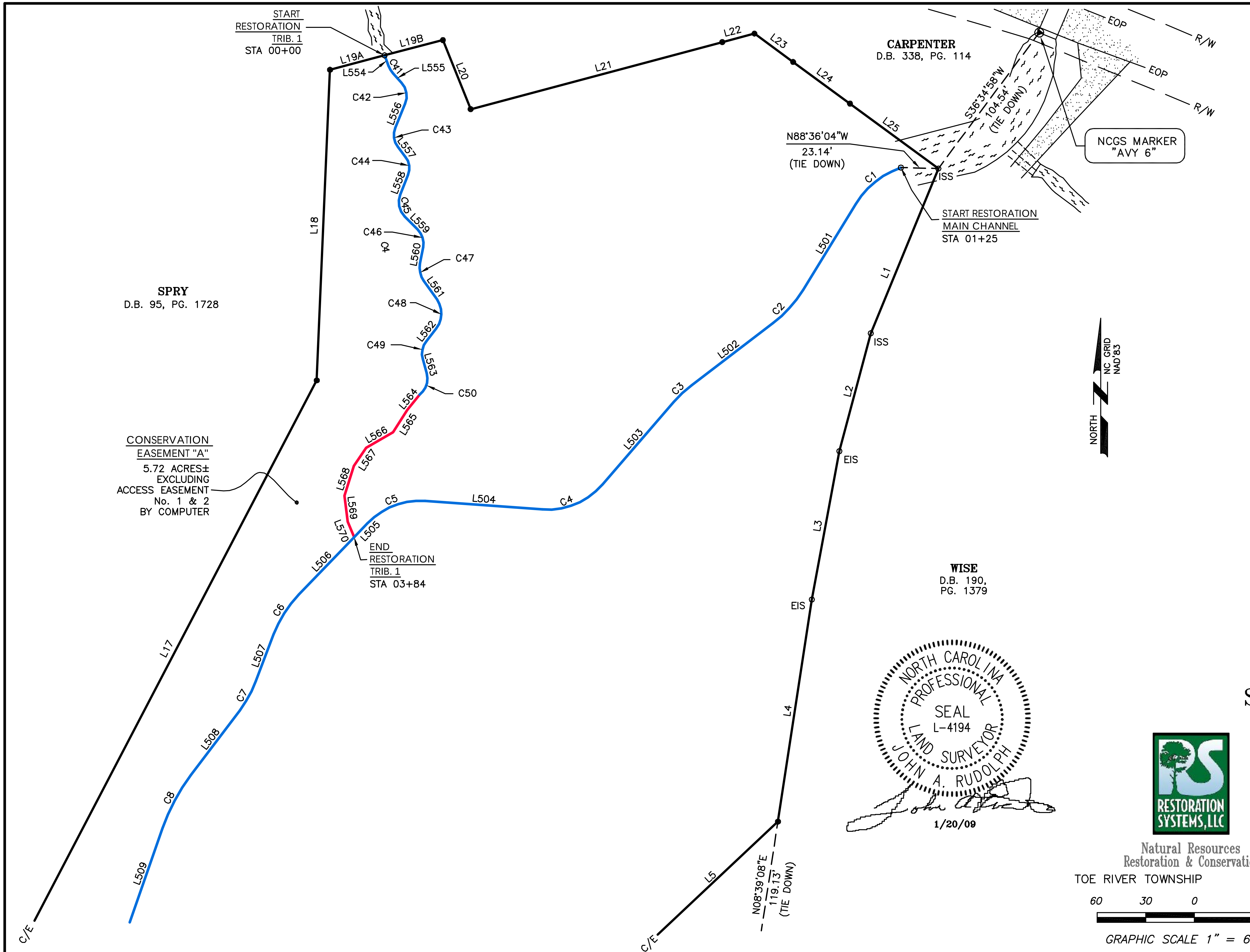
THREE MILE CREEK SITE

Natural Resources Restoration & Conservation

TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

200 0 200 400 600

GRAPHIC SCALE 1" = 200'



LEGEND:

EIS	–	Existing Iron Stake
EIP	–	Existing Iron Pipe
NMC	–	Non Monumented Corner
ECM	–	Existing Concrete Monument
R/W	–	Right–Of–Way
D.B.	–	Deed Book
PG.	–	Page
NCSR	–	North Carolina Secondary Road
EOP	–	Edge Of Pavement
•		Iron Stake Set (No. 5 Rebar with Plastic Cap Inscribed with "BOUNDARY MARKER") unless Otherwise Noted. Driven Flush with Grade Unless Otherwise Noted
PPS	–	Pump Pipe Set (3" O.D.) 2' Above Grade
ISS	–	Iron Stake Set (No. 5 Rebar)
O	–	Non–Monumented Corner
Trib.	–	Tributary
C/E	–	Conservation Easement
≈	–	Spring
		MONITORING REACH
		MODIFIED FROM DESIGN

SHEET 4 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

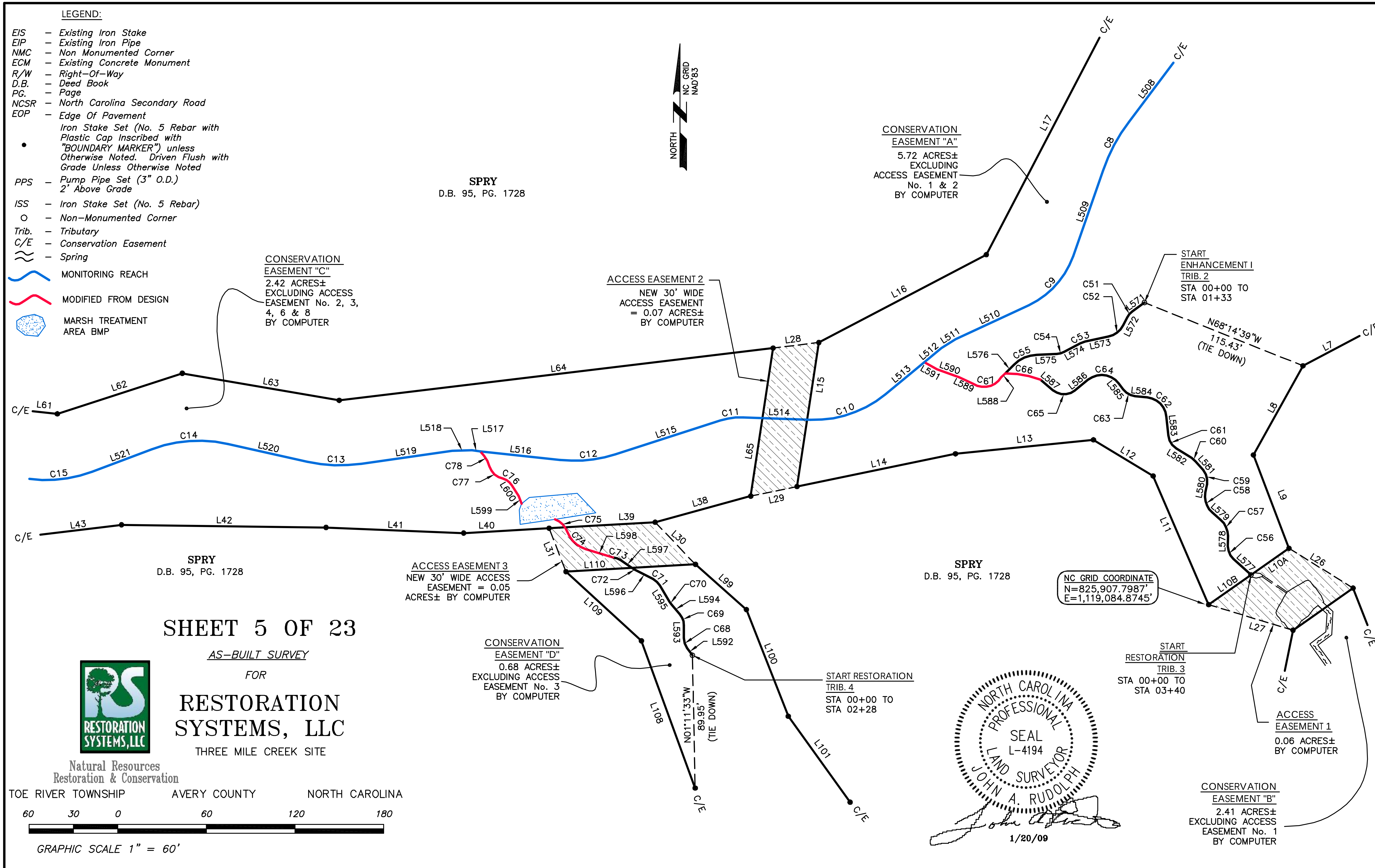
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources
Restoration & Conservation

TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'



LEGEND:

EIS – Existing Iron Stake
EIP – Existing Iron Pipe
NMC – Non Monumented Corner
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R/W – Right–Of–Way
D.B. – Deed Book
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PPS – Pump Pipe Set (3" O.D.) 2' Above Grade
ISS – Iron Stake Set (No. 5 Rebar)
○ – Non–Monumented Corner
Trib. – Tributary
C/E – Conservation Easement
≈ – Spring
MONITORING REACH
MODIFIED FROM DESIGN
MARSH TREATMENT AREA BMP

SHEET 5 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

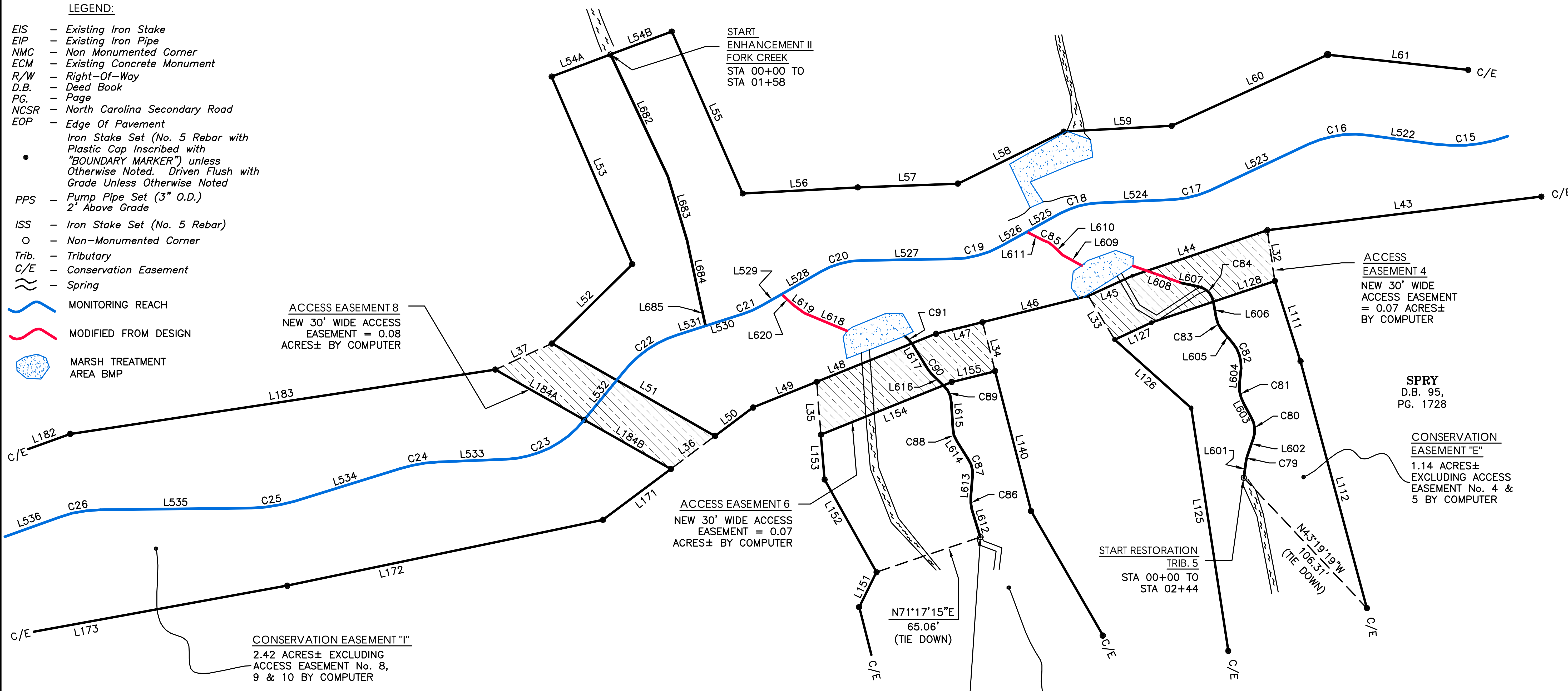
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'



SHEET 6 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

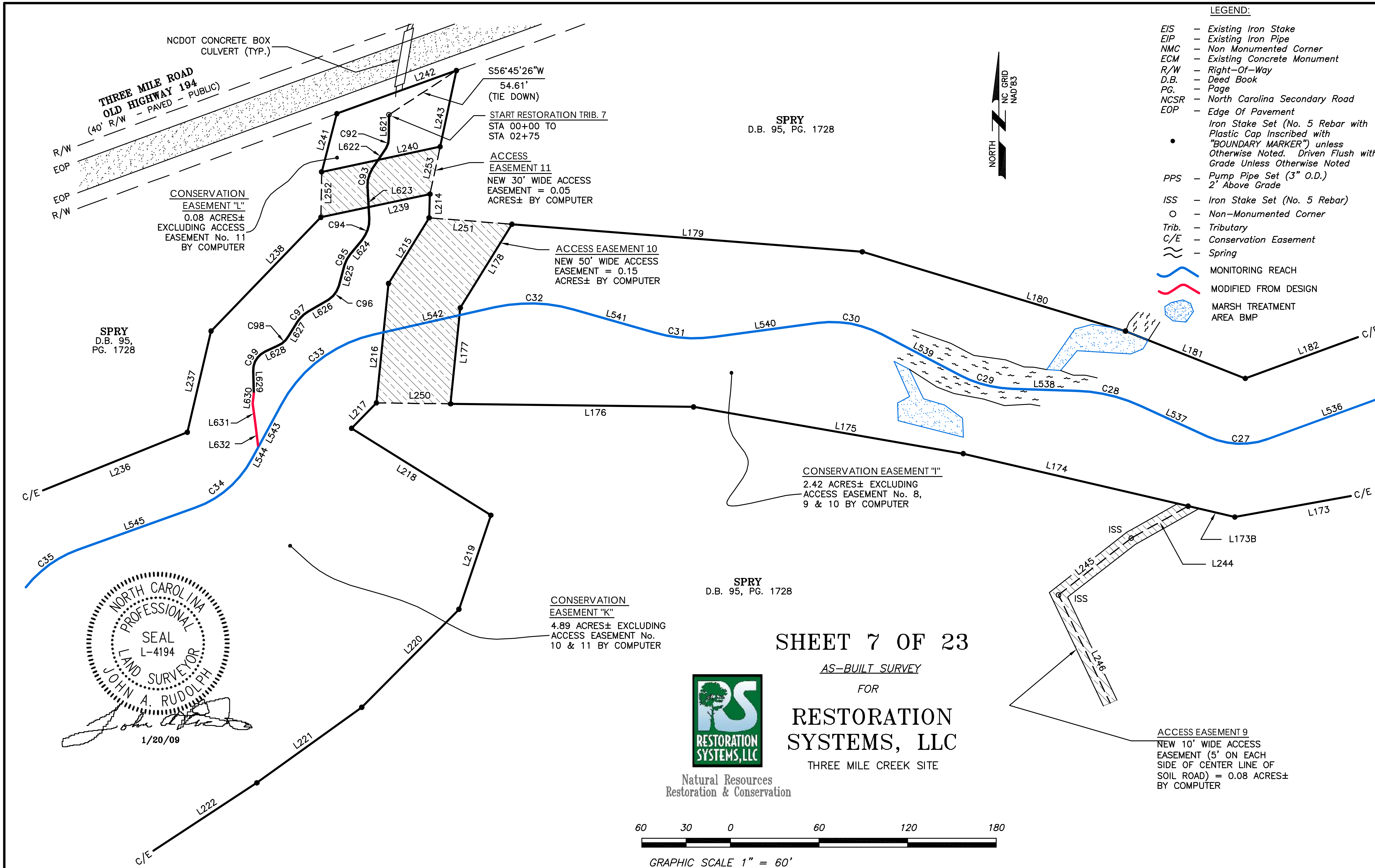
TOE RIVER TOWNSHIP AVERY COUNTY NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09


THREE MILE ROAD
OLD HIGHWAY 194
(40' R/W - PAVED - PUBLIC)
NCDOT CONCRETE BOX CULVERT (TYP.)
R/W
EOP
EOP
R/W
S56°45'26"W
54.61'
(TIE DOWN)
START RESTORATION TRIB. 7
STA 00+00 TO
STA 02+75
ACCESS EASEMENT 11
NEW 30' WIDE ACCESS
EASEMENT = 0.05
ACRES± BY COMPUTER
CONSERVATION EASEMENT "L"
0.08 ACRES±
EXCLUDING ACCESS
EASEMENT No. 11
BY COMPUTER
ACCESS EASEMENT 10
NEW 50' WIDE ACCESS
EASEMENT = 0.15
ACRES± BY COMPUTER
SPRY
D.B. 95, PG. 1728
SPRY
D.B. 95,
PG. 1728
SPRY
D.B. 95, PG. 1728
NORTH
NC GRID
NAD'83
CONSERVATION EASEMENT "I"
2.42 ACRES± EXCLUDING
ACCESS EASEMENT No. 8,
9 & 10 BY COMPUTER
CONSERVATION EASEMENT "K"
4.89 ACRES± EXCLUDING
ACCESS EASEMENT No.
10 & 11 BY COMPUTER
ACCESS EASEMENT 9
NEW 10' WIDE ACCESS
EASEMENT (5' ON EACH
SIDE OF CENTER LINE OF
SOIL ROAD) = 0.08 ACRES±
BY COMPUTER
ISS
ISS
L173B
L244
L245
L246
C/E
L173
L174
L175
L176
L177
L178
L179
L180
L181
L182
L214
L215
L216
L217
L218
L219
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C27
C28
C29
C30
C31
C32
C33
C34
C35
C92
C93
C94
C95
C96
C97
C98
C99
L621
L622
L623
L624
L625
L626
L627
L628
L629
L630
L631
L632
LEGEND:
EIS - Existing Iron Stake
EIP - Existing Iron Pipe
NMC - Non Monumented Corner
ECM - Existing Concrete Monument
R/W - Right-Of-Way
D.B. - Deed Book
PG. - Page
NCSR - North Carolina Secondary Road
EOP - Edge Of Pavement
• Iron Stake Set (No. 5 Rebar with Plastic Cap Inscribed with "BOUNDARY MARKER") unless Otherwise Noted. Driven Flush with Grade Unless Otherwise Noted
PPS - Pump Pipe Set (3" O.D.) 2' Above Grade
ISS - Iron Stake Set (No. 5 Rebar)
O - Non-Monumented Corner
Trib. - Tributary
C/E - Conservation Easement
- Spring
MONITORING REACH
MODIFIED FROM DESIGN
MARSH TREATMENT AREA BMP
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4194
LAND SURVEYOR
JOHN A. RUDOLPH
1/20/09
SHEET 7 OF 23
AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE
RESTORATION SYSTEMS, LLC
Natural Resources
Restoration & Conservation
60 30 0 60 120 180
GRAPHIC SCALE 1" = 60'

LEGEND:

EIS	–	Existing Iron Stake
EIP	–	Existing Iron Pipe
NMC	–	Non Monumented Corner
ECM	–	Existing Concrete Monument
R/W	–	Right–Of–Way
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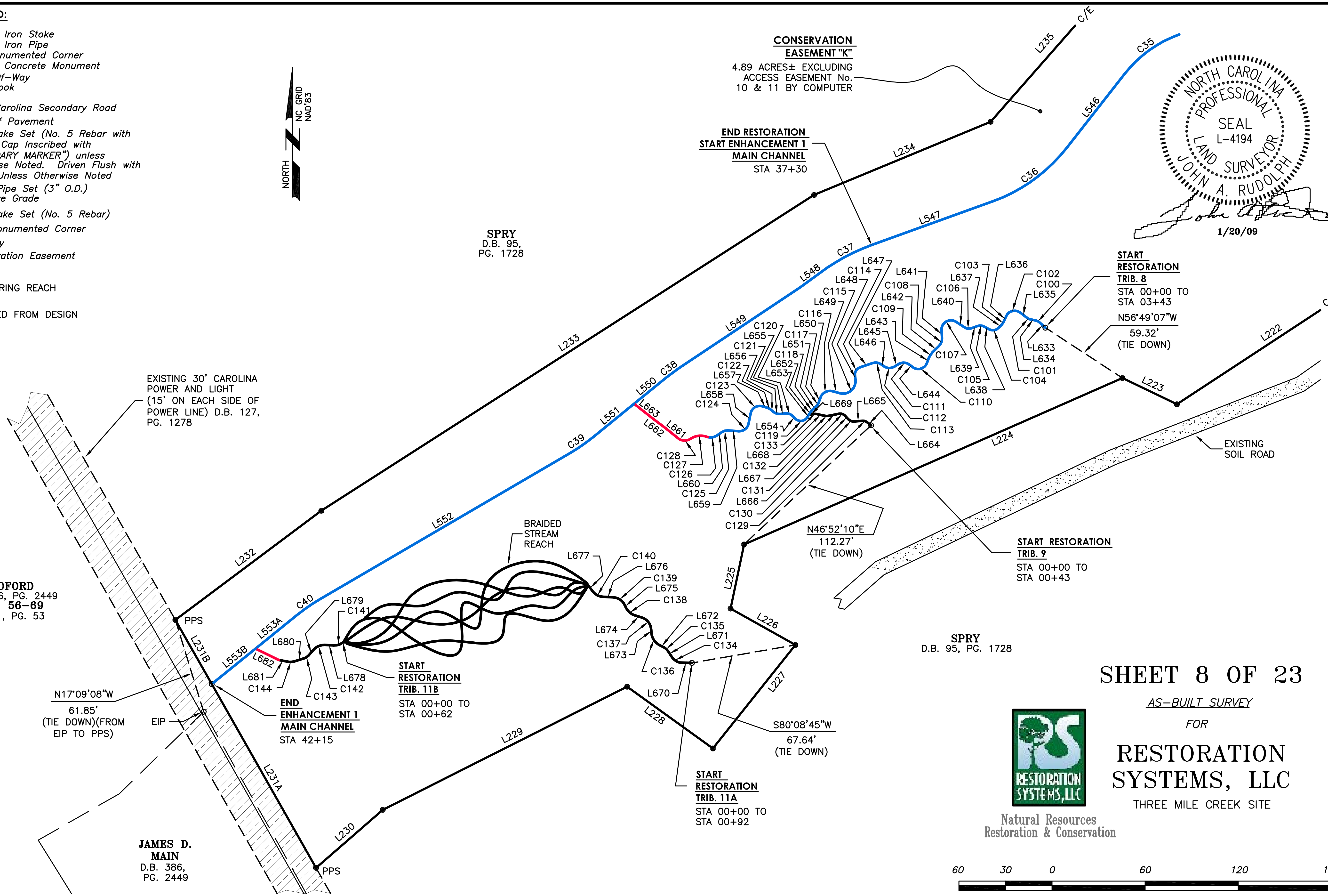
PPS	–	Pump Pipe Set (3" O.D.) 2' Above Grade
ISS	–	Iron Stake Set (No. 5 Rebar)
o	–	Non–Monumented Corner
Trib.	–	Tributary
C/E	–	Conservation Easement
≈	–	Spring
(blue line)		MONITORING REACH
(red line)		MODIFIED FROM DESIGN



SHEET 8 OF 23

AS–BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'

LINE DATA ALONG MAIN CHANNEL

LINE	LENGTH	BEARING
L501	62.39'	S31°30'05"W
L502	63.31'	S52°38'31"W
L503	67.29'	S40°48'41"W
L504	72.39'	N85°52'49"W
L505	11.89'	S43°53'11"W
L506	49.24'	S43°53'11"W
L507	30.86'	S20°42'48"W
L508	49.94'	S37°01'07"W
L509	61.33'	S19°12'06"W
L510	54.62'	S65°00'22"W
L511	11.40'	S57°43'43"W
L512	14.98'	S50°27'05"W
L513	34.14'	S50°27'05"W
L514	45.31'	N87°52'55"W
L515	74.76'	S72°09'18"W
L516	54.37'	N83°48'23"W
L517	5.62'	N83°48'23"W
L518	13.42'	S88°59'20"W
L519	61.89'	S81°47'02"W
L520	54.93'	N77°22'02"W
L521	43.15'	S69°17'48"W
L522	40.83'	N82°20'03"W
L523	64.77'	S64°56'04"W
L524	45.04'	S87°28'17"W
L525	22.63'	S61°11'15"W
L526	17.74'	S61°11'15"W
L527	54.21'	S89°02'55"W
L528	26.68'	S60°05'01"W
L529	13.43'	S60°05'01"W
L530	22.99'	S72°20'00"W
L531	17.49'	S72°20'00"W
L532	37.24'	S39°02'05"W
L533	39.83'	S87°44'45"W
L534	65.51'	S72°45'52"W
L535	89.17'	S89°21'24"W
L536	95.27'	S70°00'49"W
L537	49.84'	N65°23'01"W
L538	44.25'	N88°11'46"W
L539	60.15'	N62°21'39"W
L540	70.25'	S82°15'37"W
L541	56.89'	N74°03'20"W
L542	83.61'	S77°20'00"W
L543	32.71'	S28°18'57"W
L544	8.72'	S28°18'57"W
L545	84.16'	S70°16'44"W
L546	60.77'	S38°05'13"W
L547	83.10'	S70°08'58"W
L548	21.38'	S54°02'31"W
L549	94.30'	S56°17'51"W
L550	26.85'	S50°51'15"W
L551	34.25'	S50°51'15"W
L552	186.75'	S59°42'41"W
L553A	33.99'	S51°02'39"W
L553B	36.30'	S51°02'39"W

CURVE DATA ALONG MAIN CHANNEL

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C1	39°22'48"	53.00	S51°11'29"W	35.71
C2	21°08'26"	75.00	S42°04'18"W	27.52
C3	11°49'50"	72.50	S46°43'36"W	14.94
C4	53°18'30"	45.00	S67°27'56"W	40.37
C5	50°14'00"	45.00	S69°00'11"W	38.20
C6	23°10'23"	72.50	S32°18'00"W	29.12
C7	16°18'19"	72.50	S28°51'57"W	20.56
C8	17°49'01"	121.00	S28°06'36"W	37.48
C9	45°48'16"	57.50	S42°06'14"W	44.75
C10	41°40'00"	75.50	S71°17'05"W	53.70
C11	19°57'46"	45.00	S82°08'12"W	15.60
C12	24°02'19"	90.00	S84°10'28"W	37.48
C13	20°50'56"	102.00	N87°47'30"W	36.91
C14	33°20'10"	90.00	S85°57'53"W	51.63
C15	28°22'10"	87.00	S83°28'52"W	42.64
C16	32°43'54"	63.00	S81°18'01"W	35.50
C17	21°28'44"	59.00	S75°40'26"W	21.99
C18	26°17'03"	51.50	S74°19'46"W	23.42
C19	27°51'40"	61.00	S75°07'05"W	29.37
C20	28°57'54"	50.00	S74°33'58"W	25.01
C21	12°14'59"	60.00	S66°12'30"W	12.80
C22	33°17'55"	67.00	S55°41'03"W	38.39
C23	48°42'40"	63.00	S63°23'25"W	51.96
C24	14°58'53"	90.00	S80°15'18"W	23.47
C25	16°35'33"	90.00	S81°03'38"W	25.97
C26	19°20'35"	76.00	S79°41'07"W	25.54
C27	44°36'09"	54.00	N87°41'06"W	40.98
C28	22°48'44"	112.00	N76°47'23"W	44.30
C29	25°50'06"	80.00	N75°16'42"W	35.77
C30	35°22'44"	72.50	N80°03'01"W	44.06
C31	23°41'04"	99.00	N85°53'52"W	40.63
C32	28°36'40"	109.00	N88°21'40"W	53.87
C33	49°01'03"	95.00	S52°49'28"W	78.82
C34	41°57'47"	71.50	S49°17'50"W	51.20
C35	32°11'31"	78.00	S54°10'58"W	43.25
C36	32°03'46"	106.00	S54°07'05"W	58.55
C37	14°16'07"	129.50	S63°00'54"W	32.17
C38	5°01'36"	111.00	S53°22'03"W	9.73
C39	8°51'26"	111.00	S55°16'58"W	17.14
C40	8°40'02"	125.50	S55°22'40"W	18.97

LINE DATA ALONG TRIBUTARY 1

LINE	LENGTH	BEARING
L554	6.82'	S19°58'07"E
L555	7.63'	S42°07'37"E
L556	15.94'	S22°11'21"W
L557	7.65'	S37°24'57"E
L558	13.14'	S21°31'14"W
L559	11.27'	S44°46'17"E
L560	10.16'	S10°42'15"W
L561	14.12'	S35°15'44"E
L562	9.90'	S38°11'47"W
L563	9.12'	S15°33'39"E
L564	12.07'	S39°06'38"W
L565	16.37'	S32°13'46"W
L566	19.09'	S60°16'58"W
L567	13.53'	S34°21'40"W
L568	19.38'	S17°29'25"W
L569	16.09'	S07°23'14"E
L570	10.32'	S21°57'20"E

CURVE DATA ALONG TRIBUTARY 1

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C41	22°09'30"	14.50	S31°02'52"E	5.57
C42	64°18'58"	12.50	S09°58'08"E	13.31
C43	59°36'18"	12.00	S07°36'48"E	11.93
C44	58°56'11"	11.50	S07°56'51"E	11.31
C45	66°17'31"	12.50	S11°37'31"E	13.67
C46	55°28'32"	12.50	S17°02'01"E	11.64
C47	45°57'59"	14.00	S12°16'44"E	10.93
C48	73°27'31"	15.00	S01°28'02"W	17.94
C49	53°45'26"	12.50	S11°19'04"W	11.30
C50	67°38'19"	12.50	S18°15'31"W	13.91

LINE DATA ALONG TRIBUTARY 2

LINE	LENGTH	BEARING
L571	10.19'	S53°47'00"W
L572	6.05'	S27°06'47"W
L573	16.27'	S78°18'20"W
L574	12.37'	S61°28'44"W
L575	13.40'	S87°47'27"W
L576	8.07'	S45°00'27"W

CURVE DATA ALONG TRIBUTARY 2

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C51	26°40'14"	11.50	S40°26'53"W	5.30
C52	51°11'34"	14.50	S52°42'33"W	12.53
C53	16°49'36"	11.50	S69°53'32"W	3.37
C54	26°18'42"	11.50	S74°38'05"W	5.23
C55	42°46'59"	23.50	S66°23'57"W	17.14

LINE DATA ALONG TRIBUTARY 3

LINE	LENGTH	BEARING
L577	16.14'	N47°23'11"W
L578	6.97'	N00°07'15"E
L579	7.69'	N48°19'47"W
L580	5.75'	N10°24'41"E
L581	7.75'	N40°34'39"W
L582	12.41'	N57°58'16"W
L583	12.91'	N05°44'02"W
L584	8.48'	N83°48'19"W
L585	5.04'	N36°59'36"W
L586	11.56'	S50°53'45"W
L587	10.93'	N50°09'54"W
L588	3.87'	S45°00'27"W
L589	10.42'	N65°16'18"W
L590	15.99'	N70°10'41"W
L591	9.80'	N60°41'16"W

CURVE DATA ALONG TRIBUTARY 3

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C56	47°30'26"	11.50	N23°37'58"W	9.26
C57	48°27'01"	14.50	N24°06'16"W	11.90
C58	58°44'28"	14.50	N18°57'33"W	14.22
C59	50°59'20"	11.50	N15°04'59"W	9.90
C60	17°23'37"	11.50	N49°16'27"W	3.48
C61	52°14'13"	11.50	N31°51'09"W	10.13
C62	78°04'17"	14.50	N44°46'11"W	18.26
C63	46°48'44"	11.50	N60°23'58"W	9.14
C64	92°06'39"	14.50	N83°02'55"W	20.88
C65	80°26'49"	11.50	N88°52'50"W	14.85
C66	21°14'21"	65.74	N79°32'51"W	24.23
C67	90°31'10"	13.71	N77°03'48"E	19.48

LINE DATA ALONG TRIBUTARY 4

LINE	LENGTH	BEARING
L592	6.10'	N35°51'47"W
L593	8.69'	N00°07'04"W
L594	8.75'	N40°31'21"W
L595	13.12'	N30°56'24"W
L596	13.20'	N62°38'21"W
L597	10.82'	N55°50'45"W
L598	19.21'	N73°12'18"W
L599	5.61'	N21°51'48"W
L600	8.44'	N33°03'19"W

CURVE DATA ALONG TRIBUTARY 4

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C68	35°44'44"	11.50	N17°59'25"W	7.06
C69	40°24'17"	11.50	N20°19'12"W	7.94
C70	9°34'57"	11.50	N35°43'52"W	1.92
C71	31°41'57"	11.50	N46°47'22"W	6.28
C72	6°47'35"	11.50	N59°14'33"W	1.36
C73	28°08'11"	11.50	N69°54'51"W	5.59
C74	52°11'59"	19.28	N47°06'19"W	16.96
C75	45°10'17"	15.68	N43°35'28"W	12.04
C76	38°30'16"	11.50	N52°18'28"W	7.58
C77	61°57'41"	11.97	N48°02'33"W	12.33
C78	28°36'56"	24.16	N31°22'11"W	11.94

LINE DATA ALONG TRIBUTARY 5

LINE	LENGTH	BEARING
L592	6.10'	N35°51'47"W
L593	8.69'	N00°07'04"W
L594	8.75'	N40°31'21"W
L595	13.12'	N30°56'24"W
L596	13.20'	N62°38'21"W
L597	10.82'	N55°50'45"W
L598	19.21'	N73°12'18"W
L599	5.61'	N21°51'48"W
L600	8.44'	N33°03'19"W
L601	10.57'	N07°26'59"E
L602	10.98'	N19°14'00"E
L603	9.36'	N29°08'56"W
L604	9.62'	N05°05'50"E
L605	10.30'	N40°17'54"W
L606	9.38'	N09°43'45"W
L607	9.74'	N78°50'48"W
L608	30.83'	N70°33'35"W
L609	12.93'	N61°19'35"W
L610	8.66'	N46°41'12"W
L611	11.44'	N62°59'25"W

CURVE DATA ALONG TRIBUTARY 5

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C69	40°24'17"	11.50	N20°19'12"W	7.94
C71	31°41'57"	11.50	N46°47'22"W	6.28
C73	28°08'11"	11.50	N69°54'51"W	5.59
C74	52°11'59"	19.28	N47°06'19"W	16.96
C75	45°10'17"	15.68	N43°35'28"W	12.04
C76	38°30'16"	11.50	N52°18'28"W	7.58
C77	61°57'41"	11.97	N48°02'33"W	12.33
C78	28°36'56"	24.16	N31°22'11"W	11.94
C79	11°47'01"	11.50	N13°20'30"E	2.36
C80	48°22'56"	15.50	N04°57'28"W	12.70
C81	34°14'45"	20.00	N12°01'33"W	11.78
C82	45°23'43"	20.00	N17°36'02"W	15.43
C83	30°34'09"	15.50	N25°00'49"W	8.17
C84	69°07'04"	11.50	N44°17'16"W	13.05
C85	27°33'54"	11.50	N60°28'09"W	5.48

LINE DATA ALONG TRIBUTARY 6A

LINE	LENGTH	BEARING
L612	17.25'	N16°46'24"W
L613	12.11'	N05°22'11"E
L614	12.87'	N32°32'34"W
L615	15.70'	N03°18'09"W
L616	9.71'	N46°24'26"W
L617	18.16'	N31°44'00"W
L618	27.54'	N67°12'15"W
L619	8.43'	N54°04'16"W
L620	9.07'	N46°49'33"W

CURVE DATA ALONG TRIBUTARY 6A

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C86	22°08'35"	20.00	N05°42'07"W	7.68
C87	37°54'45"	15.50	N13°35'12"W	10.07
C88	29°14'25"	15.50	N17°55'21"W	7.82
C89	43°06'17"	15.50	N24°51'17"W	11.39
C90	14°40'25"	11.50	N39°04'13"W	2.94
C91	23°51'36"	15.50	N43°39'48"W	6.41

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

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SHEET 9 OF 23

AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

Natural Resources Restoration & Conservation

LINE DATA ALONG
TRIBUTARY 7

LINE	LENGTH	BEARING
L621	16.06'	S00°11'53"W
L622	16.80'	S33°14'47"W
L623	21.80'	S02°51'19"E
L624	12.51'	S39°56'38"W
L625	14.78'	S15°13'20"W
L626	16.04'	S59°49'36"W
L627	11.02'	S31°20'38"W
L628	9.52'	S64°59'50"W
L629	15.06'	S02°07'43"E
L630	7.03'	S06°56'02"W
L631	13.27'	S07°23'33"E
L632	16.47'	S07°14'29"E

CURVE DATA ALONG
TRIBUTARY 7

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C92	33°02'54"	12.00	S16°43'20"W	6.83
C93	36°06'07"	20.00	S15°11'44"W	12.39
C94	42°47'57"	21.00	S18°32'39"W	15.32
C95	24°43'17"	19.00	S27°34'59"W	8.13
C96	44°36'16"	15.50	S37°31'28"W	11.76
C97	28°28'58"	20.50	S45°35'07"W	10.09
C98	33°39'12"	17.00	S48°10'14"W	9.84
C99	67°07'32"	14.00	S31°26'03"W	15.48

LINE DATA ALONG
TRIBUTARY 8

LINE	LENGTH	BEARING
L633	4.83'	N47°51'29"W
L634	4.05'	N76°30'47"W
L635	5.14'	N52°08'39"W
L636	3.66'	S22°58'08"W
L637	3.35'	S44°50'30"W
L638	3.78'	N61°09'47"W
L639	3.99'	S69°17'01"W
L640	6.79'	N57°01'27"W
L641	5.21'	S03°17'56"E
L642	5.80'	S45°26'37"W
L643	3.23'	S20°10'53"W
L644	2.75'	N52°48'36"W
L645	3.61'	S59°41'00"W
L646	2.55'	N55°29'39"W
L647	8.45'	S71°12'42"W
L648	2.91'	S06°00'15"E
L649	4.92'	N75°07'24"W
L650	3.18'	S18°36'39"W
L651	3.11'	S48°08'59"W
L652	2.70'	S32°29'34"W
L653	1.71'	S32°29'34"W
L654	1.79'	N42°06'41"W
L655	3.15'	S82°55'25"W
L656	2.78'	N50°57'47"W
L657	3.45'	N72°56'28"W
L658	6.64'	S10°39'16"W
L659	7.21'	N86°42'52"W
L660	4.48'	S56°38'30"W
L661	11.16'	S51°09'16"E
L662	9.54'	N52°51'42"W
L663	16.16'	N51°48'53"W

CURVE DATA ALONG
TRIBUTARY 8

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C100	29°14'42"	5.50	N61°53'26"W	2.78
C101	24°22'07"	5.50	N64°19'43"W	2.32
C102	104°53'13"	6.00	S75°24'44"W	9.51
C103	21°52'22"	5.50	S33°54'19"W	2.09
C104	73°59'43"	5.00	S81°50'22"W	6.02
C105	49°33'13"	5.00	N85°56'23"W	4.19
C106	53°41'32"	5.00	N83°52'13"W	4.52
C107	126°16'29"	6.00	S59°50'18"W	10.71
C108	48°44'33"	6.50	S21°04'21"W	5.36
C109	25°15'44"	10.50	S32°48'45"W	4.59
C110	107°00'31"	6.00	S73°41'08"W	9.65
C111	67°30'24"	6.00	N86°33'48"W	6.67
C112	64°49'21"	6.00	N87°54'20"W	6.43
C113	53°17'39"	6.00	N82°08'28"W	5.38
C114	77°12'57"	5.00	S32°36'14"W	6.24
C115	110°52'51"	8.00	S49°26'10"W	13.18
C116	86°15'57"	6.50	S61°44'37"W	8.89
C117	29°32'20"	6.00	S33°22'49"W	3.06
C118	15°39'25"	6.00	S40°19'17"W	1.63
C119	105°23'45"	5.00	S85°11'27"W	7.95
C120	54°57'54"	6.00	N69°35'38"W	5.54
C121	46°06'48"	5.50	N74°01'11"W	4.31
C122	21°58'42"	5.50	N61°57'07"W	2.10
C123	96°24'16"	6.00	S58°51'24"W	8.95
C124	82°37'52"	6.00	S51°58'12"W	7.92
C125	36°38'39"	6.00	S74°57'49"W	3.77
C126	50°50'35"	6.50	S82°03'47"W	5.58
C127	57°00'39"	11.34	S84°46'59"W	10.82
C128	62°39'52"	7.34	S87°36'35"W	7.64

LINE DATA ALONG
TRIBUTARY 9

LINE	LENGTH	BEARING
L664	3.33'	N52°51'46"W
L665	5.36'	S85°42'18"W
L666	3.26'	N43°22'56"W
L667	6.94'	S79°06'03"W
L668	5.14'	N77°21'34"W
L669	3.08'	S76°36'38"W

CURVE DATA ALONG
TRIBUTARY 9

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C129	41°25'56"	4.50	N73°34'44"W	3.18
C130	50°54'45"	4.50	N68°50'19"W	3.87
C131	57°31'01"	4.00	N72°08'27"W	3.85
C132	23°32'24"	7.00	N89°07'45"W	2.86
C133	26°01'48"	4.50	S89°37'32"W	2.03

LINE DATA ALONG
TRIBUTARY 11A

LINE	LENGTH	BEARING
L670	7.90'	N88°32'31"W
L671	4.11'	N32°41'45"W
L672	3.77'	N61°48'24"W
L673	2.50'	N04°13'07"W
L674	4.31'	N73°47'31"W
L675	2.32'	N26°11'24"W
L676	6.63'	N87°36'08"W
L677	6.07'	N37°19'44"W

CURVE DATA ALONG
TRIBUTARY 11A

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C134	40°51'05"	9.50	N53°07'17"W	6.63
C135	29°06'39"	6.50	N47°15'04"W	3.27
C136	57°35'17"	9.50	N33°00'45"W	9.15
C137	69°34'24"	8.50	N39°00'19"W	9.70
C138	47°36'06"	9.50	N49°59'27"W	7.67
C139	61°24'44"	8.50	N56°53'46"W	8.68
C140	50°16'24"	8.50	N62°27'56"W	7.22

LINE DATA ALONG
TRIBUTARY 11B

LINE	LENGTH	BEARING
L678	5.80'	N87°19'15"W
L679	4.87'	S40°45'38"W
L680	6.57'	S72°48'25"W
L681	5.53'	N79°42'36"W
L682	16.58'	N63°38'20"W

CURVE DATA ALONG
TRIBUTARY 11B

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST
C141	39°05'38"	9.00	S73°07'57"W	6.02
C142	51°55'07"	9.00	S66°43'12"W	7.88
C143	32°02'47"	6.00	S56°47'02"W	3.31
C144	31°07'18"	9.00	S88°22'05"W	4.83

LINE DATA ALONG
FORK CREEK

LINE	LENGTH	BEARING
L682	79.95'	S25°12'56"E
L683	39.61'	S16°40'03"E
L684	40.14'	S12°02'33"E
L685	11.84'	S12°23'42"E

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

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AS–BUILT SURVEY

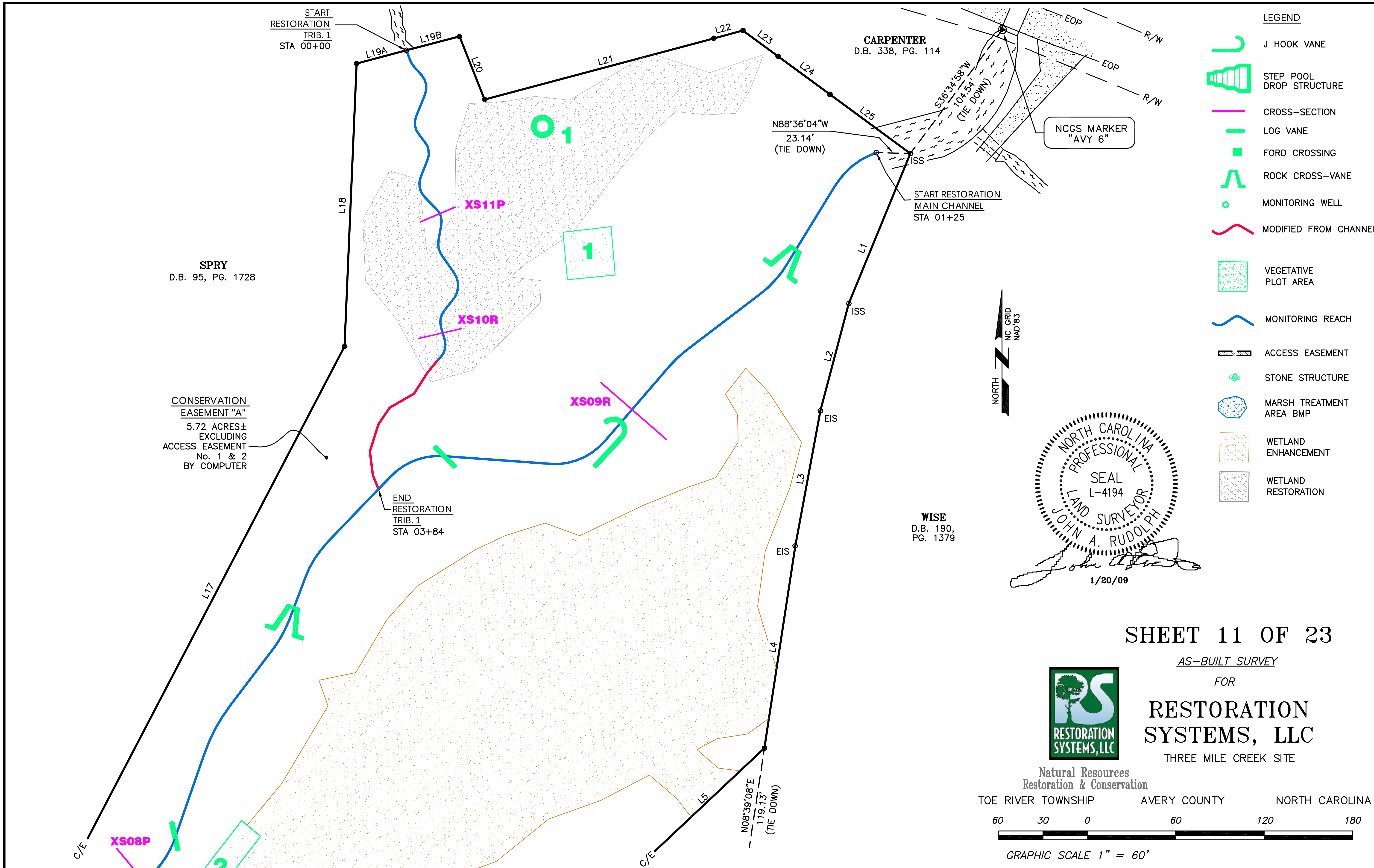
FOR

RESTORATION SYSTEMS, LLC

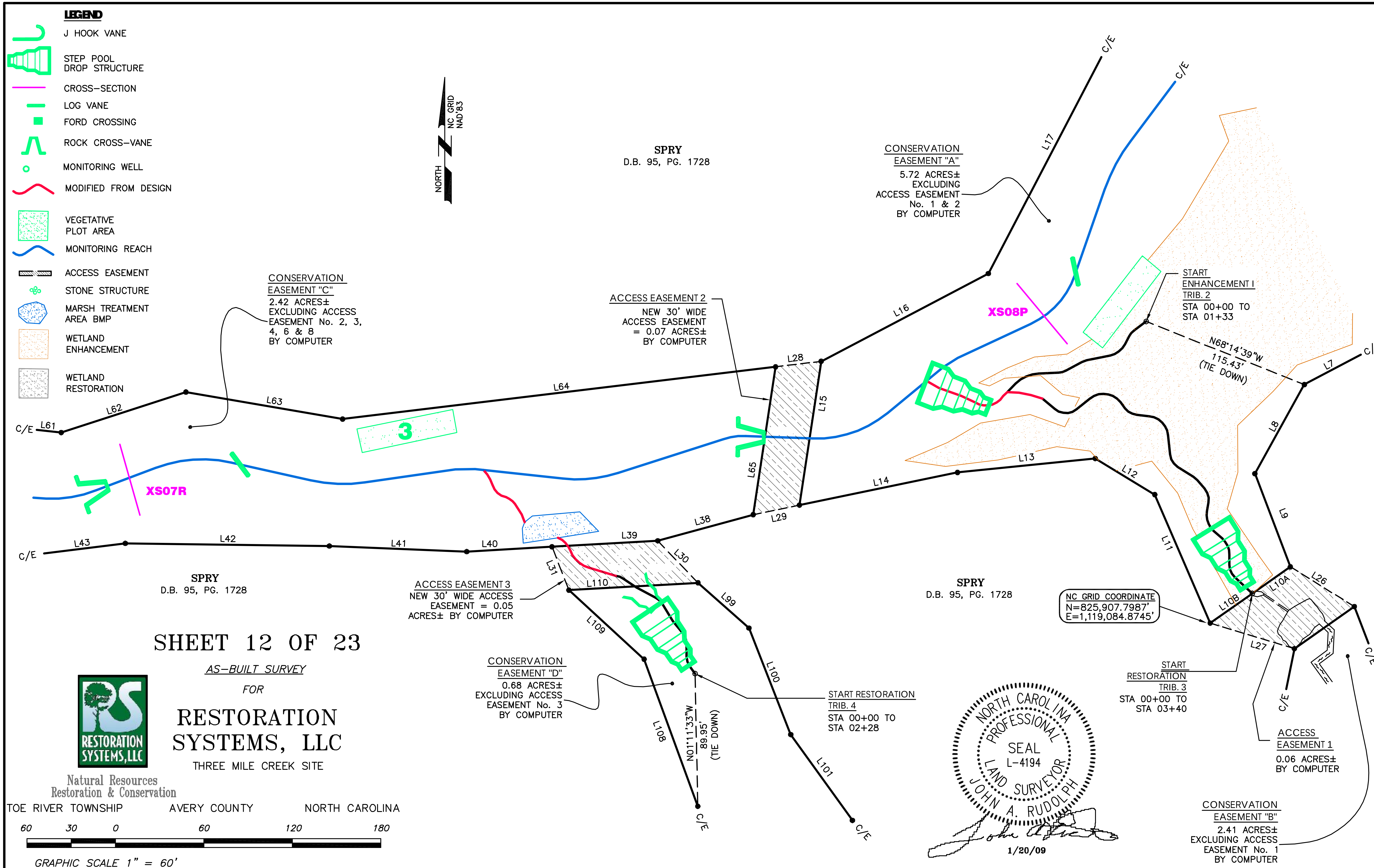
THREE MILE CREEK SITE

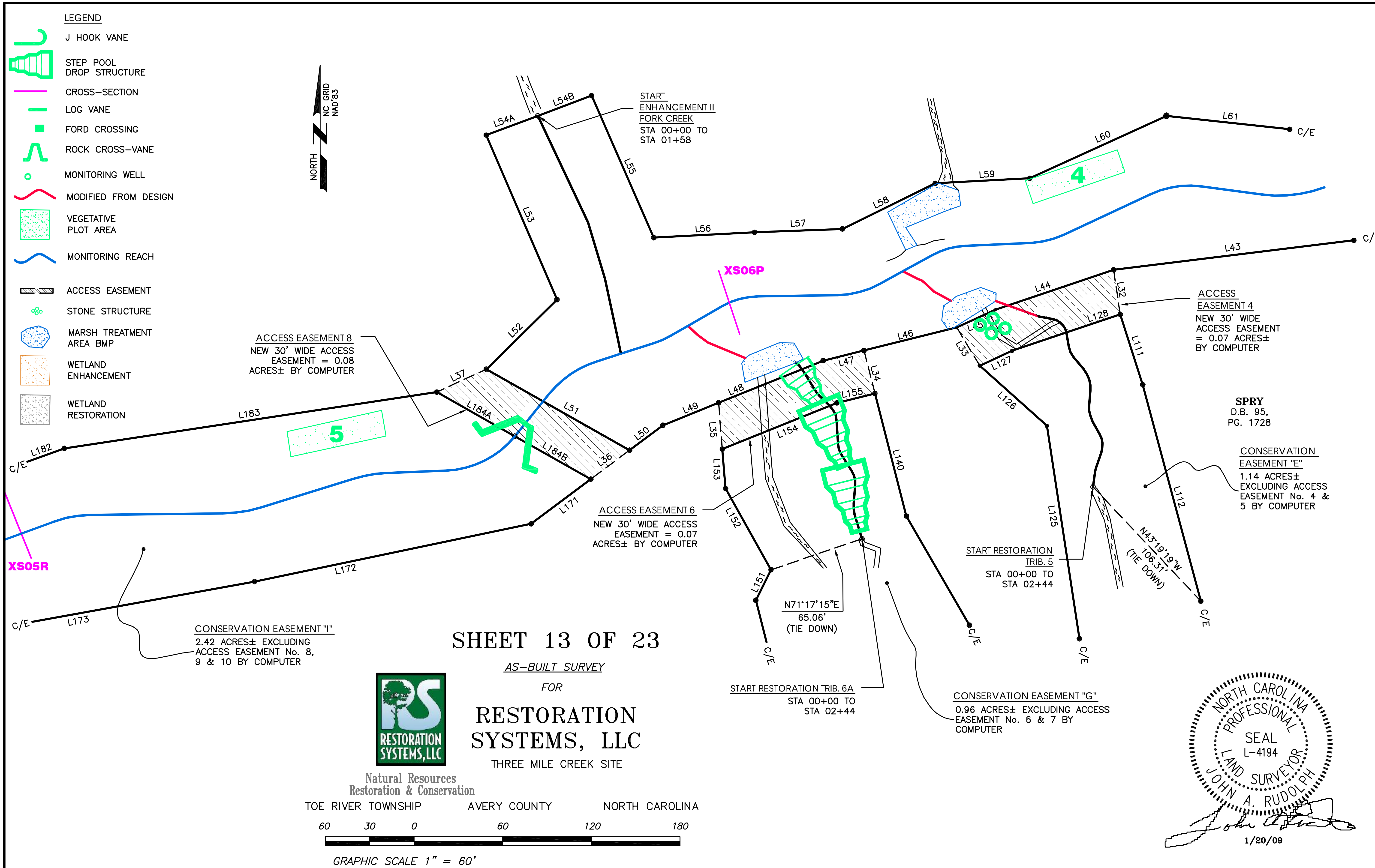
RESTORATION SYSTEMS, LLC

Natural Resources Restoration & Conservation



START RESTORATION TRIB. 1 STA 00+00
L19A
L19B
L20
L21
L22
L23
L24
L25
L18
L17
L1
L2
L3
L4
L5
CARPENTER
D.B. 338, PG. 114
EOP
R/W
S36°34'58"W
104.54'
(TIE DOWN)
NCGS MARKER
"AVY 6"
N88°36'04"W
23.14'
(TIE DOWN)
ISS
START RESTORATION MAIN CHANNEL STA 01+25
SPRY
D.B. 95, PG. 1728
XS11P
XS10R
XS09R
XS08P
CONSERVATION EASEMENT "A"
5.72 ACRES±
EXCLUDING
ACCESS EASEMENT
No. 1 & 2
BY COMPUTER
END RESTORATION TRIB. 1 STA 03+84
EIS
WISE
D.B. 190,
PG. 1379
N08°39'08"E
119.13'
(TIE DOWN)
C/E
NORTH
NC GRID NAD'83
LEGEND
J HOOK VANE
STEP POOL DROP STRUCTURE
CROSS–SECTION
LOG VANE
FORD CROSSING
ROCK CROSS–VANE
MONITORING WELL
MODIFIED FROM CHANNEL
VEGETATIVE PLOT AREA
MONITORING REACH
ACCESS EASEMENT
STONE STRUCTURE
MARSH TREATMENT AREA BMP
WETLAND ENHANCEMENT
WETLAND RESTORATION
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH
1/20/09
SHEET 11 OF 23
AS–BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE
RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation
TOE RIVER TOWNSHIP
AVERY COUNTY
NORTH CAROLINA
60 30 0 60 120 180
GRAPHIC SCALE 1" = 60'


LEGEND
J HOOK VANE
STEP POOL DROP STRUCTURE
CROSS–SECTION
LOG VANE
FORD CROSSING
ROCK CROSS–VANE
MONITORING WELL
MODIFIED FROM DESIGN
VEGETATIVE PLOT AREA
MONITORING REACH
ACCESS EASEMENT
STONE STRUCTURE
MARSH TREATMENT AREA BMP
WETLAND ENHANCEMENT
WETLAND RESTORATION
NORTH
NC GRID NAD'83
SPRY
D.B. 95, PG. 1728
CONSERVATION EASEMENT "A"
5.72 ACRES± EXCLUDING ACCESS EASEMENT No. 1 & 2 BY COMPUTER
CONSERVATION EASEMENT "C"
2.42 ACRES± EXCLUDING ACCESS EASEMENT No. 2, 3, 4, 6 & 8 BY COMPUTER
ACCESS EASEMENT 2
NEW 30' WIDE ACCESS EASEMENT = 0.07 ACRES± BY COMPUTER
START ENHANCEMENT I
TRIB. 2
STA 00+00 TO STA 01+33
N68°14'39"W
115.43'
(TIE DOWN)
XS08P
XS07R
3
C/E
L7
L8
L9
L10A
L10B
L11
L12
L13
L14
L15
L16
L17
L26
L27
L28
L29
L30
L31
L38
L39
L40
L41
L42
L43
L61
L62
L63
L64
L65
L99
L100
L101
L108
L109
L110
SPRY
D.B. 95, PG. 1728
ACCESS EASEMENT 3
NEW 30' WIDE ACCESS EASEMENT = 0.05 ACRES± BY COMPUTER
SPRY
D.B. 95, PG. 1728
NC GRID COORDINATE
N=825,907.7987'
E=1,119,084.8745'
START RESTORATION TRIB. 3
STA 00+00 TO STA 03+40
CONSERVATION EASEMENT "D"
0.68 ACRES± EXCLUDING ACCESS EASEMENT No. 3 BY COMPUTER
N01°11'33"W
89.95'
(TIE DOWN)
START RESTORATION
TRIB. 4
STA 00+00 TO STA 02+28
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH
1/20/09
ACCESS EASEMENT 1
0.06 ACRES± BY COMPUTER
CONSERVATION EASEMENT "B"
2.41 ACRES± EXCLUDING ACCESS EASEMENT No. 1 BY COMPUTER
SHEET 12 OF 23
AS–BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE
RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation
TOE RIVER TOWNSHIP
AVERY COUNTY
NORTH CAROLINA
60
30
0
60
120
180
GRAPHIC SCALE 1" = 60'



LEGEND

- J HOOK VANE
- STEP POOL DROP STRUCTURE
- CROSS-SECTION
- LOG VANE
- FORD CROSSING
- ROCK CROSS-VANE
- MONITORING WELL
- MODIFIED FROM DESIGN
- VEGETATIVE PLOT AREA
- MONITORING REACH
- ACCESS EASEMENT
- STONE STRUCTURE
- MARSH TREATMENT AREA BMP
- WETLAND ENHANCEMENT
- WETLAND RESTORATION

SHEET 13 OF 23

AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

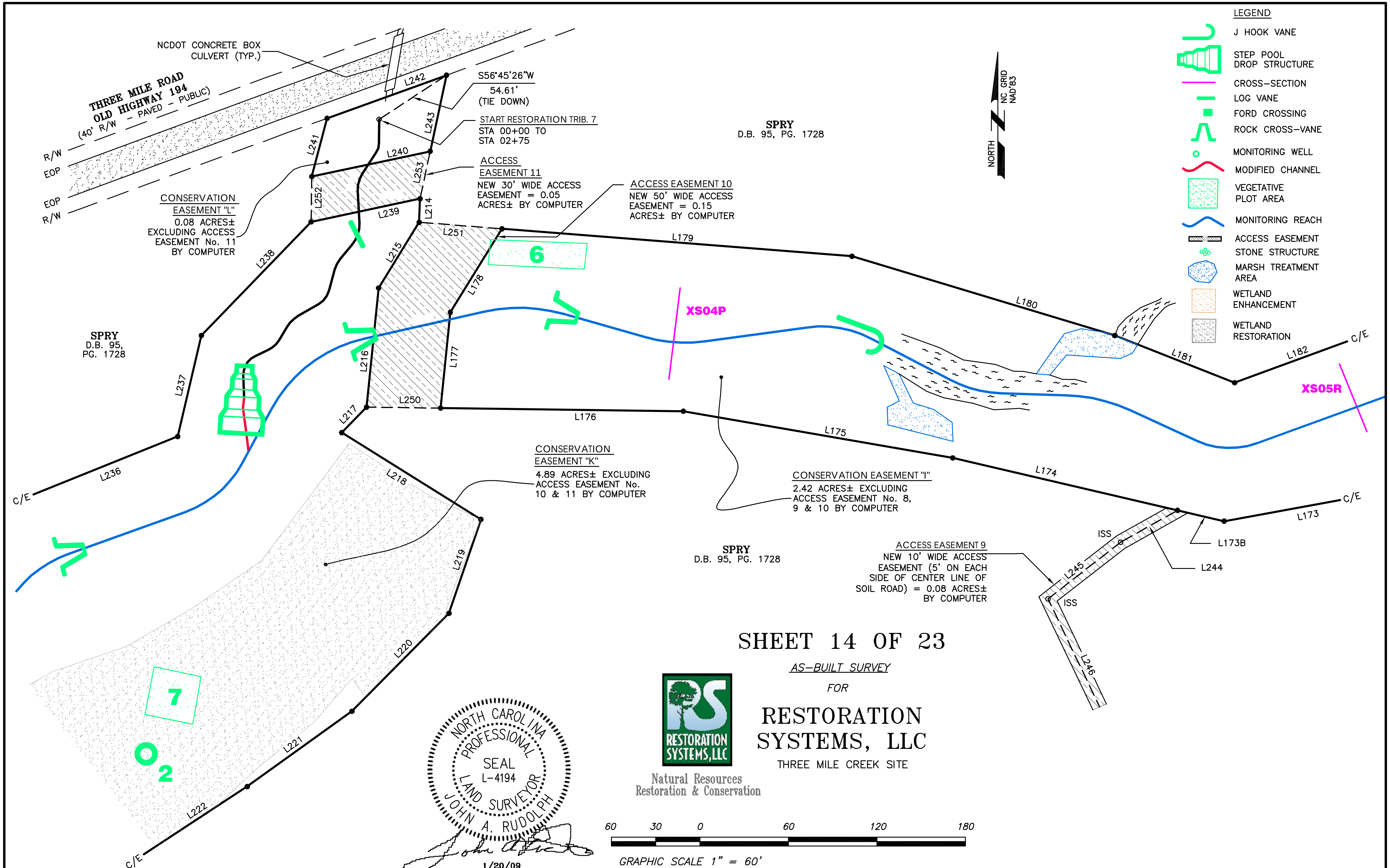
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation

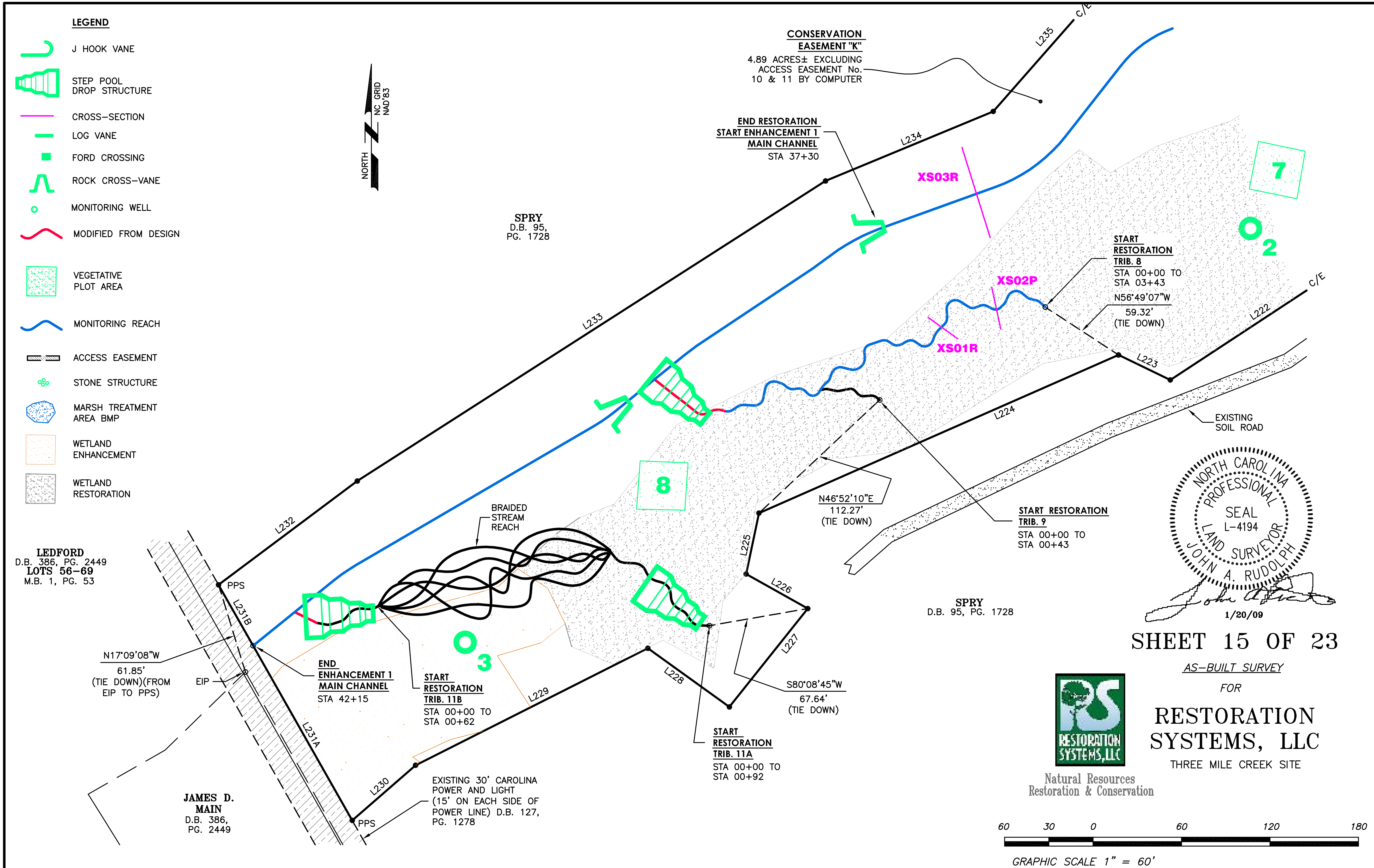
TOE RIVER TOWNSHIP   AVERY COUNTY   NORTH CAROLINA

60 30 0 60 120 180

GRAPHIC SCALE 1" = 60'



THREE MILE ROAD
OLD HIGHWAY 194
(40' R/W - PAVED - PUBLIC)
NCDOT CONCRETE BOX CULVERT (TYP.)
R/W
EOP
EOP
R/W
S56°45'26"W
54.61'
(TIE DOWN)
START RESTORATION TRIB. 7
STA 00+00 TO
STA 02+75
ACCESS EASEMENT 11
NEW 30' WIDE ACCESS EASEMENT = 0.05 ACRES± BY COMPUTER
ACCESS EASEMENT 10
NEW 50' WIDE ACCESS EASEMENT = 0.15 ACRES± BY COMPUTER
CONSERVATION EASEMENT "L"
0.08 ACRES± EXCLUDING ACCESS EASEMENT No. 11 BY COMPUTER
SPRY
D.B. 95, PG. 1728
SPRY
D.B. 95, PG. 1728
SPRY
D.B. 95, PG. 1728
L242
L243
L241
L240
L253
L252
L239
L214
L251
L238
L215
L178
L179
L180
L181
L182
L237
L216
L177
L250
L217
L176
L175
L174
L173
L173B
L244
L245
L246
L236
L218
L219
L220
L221
L222
C/E
C/E
C/E
C/E
XS04P
XS05R
6
7
2
ISS
ISS
CONSERVATION EASEMENT "K"
4.89 ACRES± EXCLUDING ACCESS EASEMENT No. 10 & 11 BY COMPUTER
CONSERVATION EASEMENT "I"
2.42 ACRES± EXCLUDING ACCESS EASEMENT No. 8, 9 & 10 BY COMPUTER
ACCESS EASEMENT 9
NEW 10' WIDE ACCESS EASEMENT (5' ON EACH SIDE OF CENTER LINE OF SOIL ROAD) = 0.08 ACRES± BY COMPUTER
NORTH
NC GRID NAD'83
LEGEND
J HOOK VANE
STEP POOL DROP STRUCTURE
CROSS-SECTION
LOG VANE
FORD CROSSING
ROCK CROSS-VANE
MONITORING WELL
MODIFIED CHANNEL
VEGETATIVE PLOT AREA
MONITORING REACH
ACCESS EASEMENT
STONE STRUCTURE
MARSH TREATMENT AREA
WETLAND ENHANCEMENT
WETLAND RESTORATION
SHEET 14 OF 23
AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE
RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH
1/20/09
60 30 0 60 120 180
GRAPHIC SCALE 1" = 60'


LEGEND
J HOOK VANE
STEP POOL DROP STRUCTURE
CROSS–SECTION
LOG VANE
FORD CROSSING
ROCK CROSS–VANE
MONITORING WELL
MODIFIED FROM DESIGN
VEGETATIVE PLOT AREA
MONITORING REACH
ACCESS EASEMENT
STONE STRUCTURE
MARSH TREATMENT AREA BMP
WETLAND ENHANCEMENT
WETLAND RESTORATION
NORTH
NC GRID NAD'83
SPRY D.B. 95, PG. 1728
CONSERVATION EASEMENT "K"
4.89 ACRES± EXCLUDING ACCESS EASEMENT No. 10 & 11 BY COMPUTER
END RESTORATION START ENHANCEMENT 1 MAIN CHANNEL STA 37+30
L235
C/E
L234
L233
L232
XS03R
XS02P
XS01R
7
8
O2
O3
START RESTORATION TRIB. 8 STA 00+00 TO STA 03+43
N56°49'07"W 59.32' (TIE DOWN)
L222
L223
L224
L225
L226
L227
L228
L229
L230
L231A
L231B
EXISTING SOIL ROAD
START RESTORATION TRIB. 9 STA 00+00 TO STA 00+43
N46°52'10"E 112.27' (TIE DOWN)
BRAIDED STREAM REACH
SPRY D.B. 95, PG. 1728
S80°08'45"W 67.64' (TIE DOWN)
START RESTORATION TRIB. 11A STA 00+00 TO STA 00+92
START RESTORATION TRIB. 11B STA 00+00 TO STA 00+62
END ENHANCEMENT 1 MAIN CHANNEL STA 42+15
EXISTING 30' CAROLINA POWER AND LIGHT (15' ON EACH SIDE OF POWER LINE) D.B. 127, PG. 1278
PPS
EIP
N17°09'08"W 61.85' (TIE DOWN)(FROM EIP TO PPS)
LEDFORD D.B. 386, PG. 2449 LOTS 56–69 M.B. 1, PG. 53
JAMES D. MAIN D.B. 386, PG. 2449
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH
1/20/09
SHEET 15 OF 23
AS–BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE
RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation
60 30 0 60 120 180
GRAPHIC SCALE 1" = 60'

SHEET 16 OF 23

AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

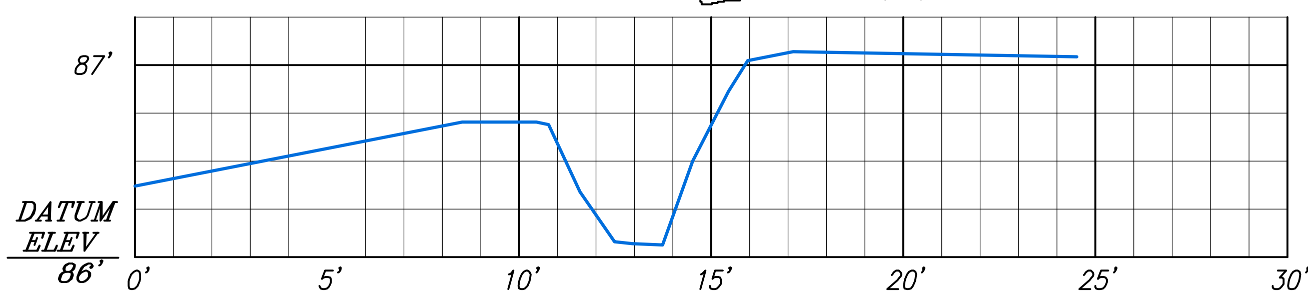
THREE MILE CREEK SITE

Natural Resources
Restoration & Conservation

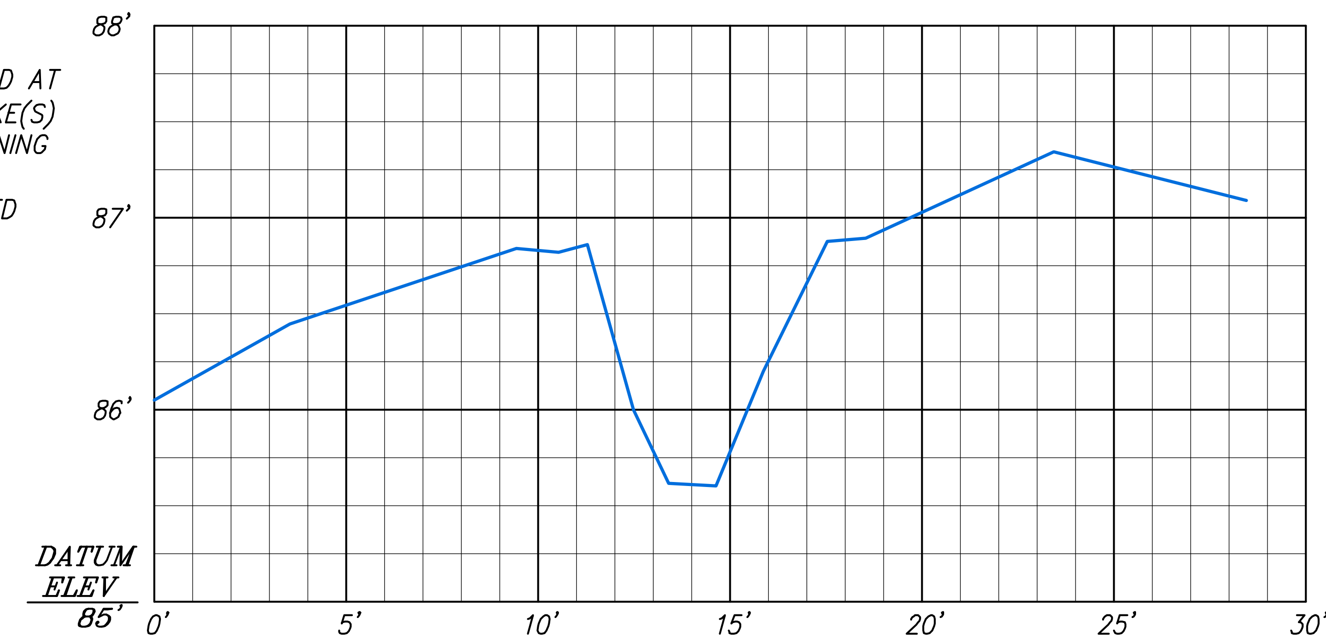
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

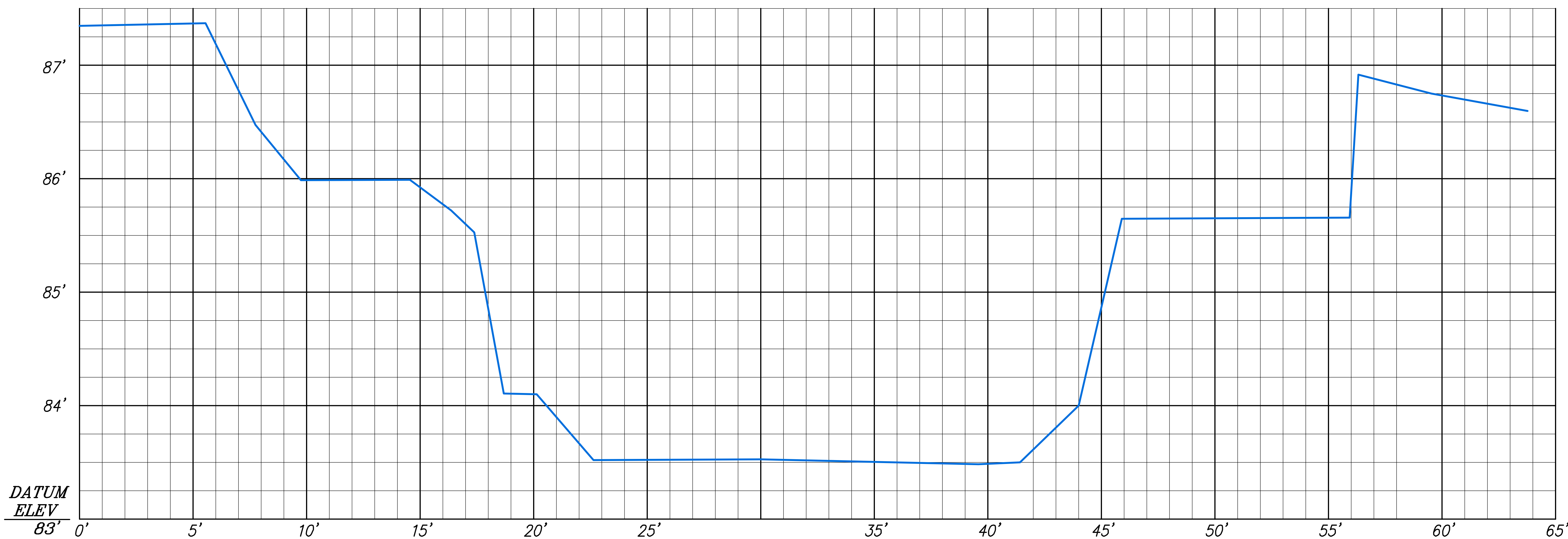
NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)



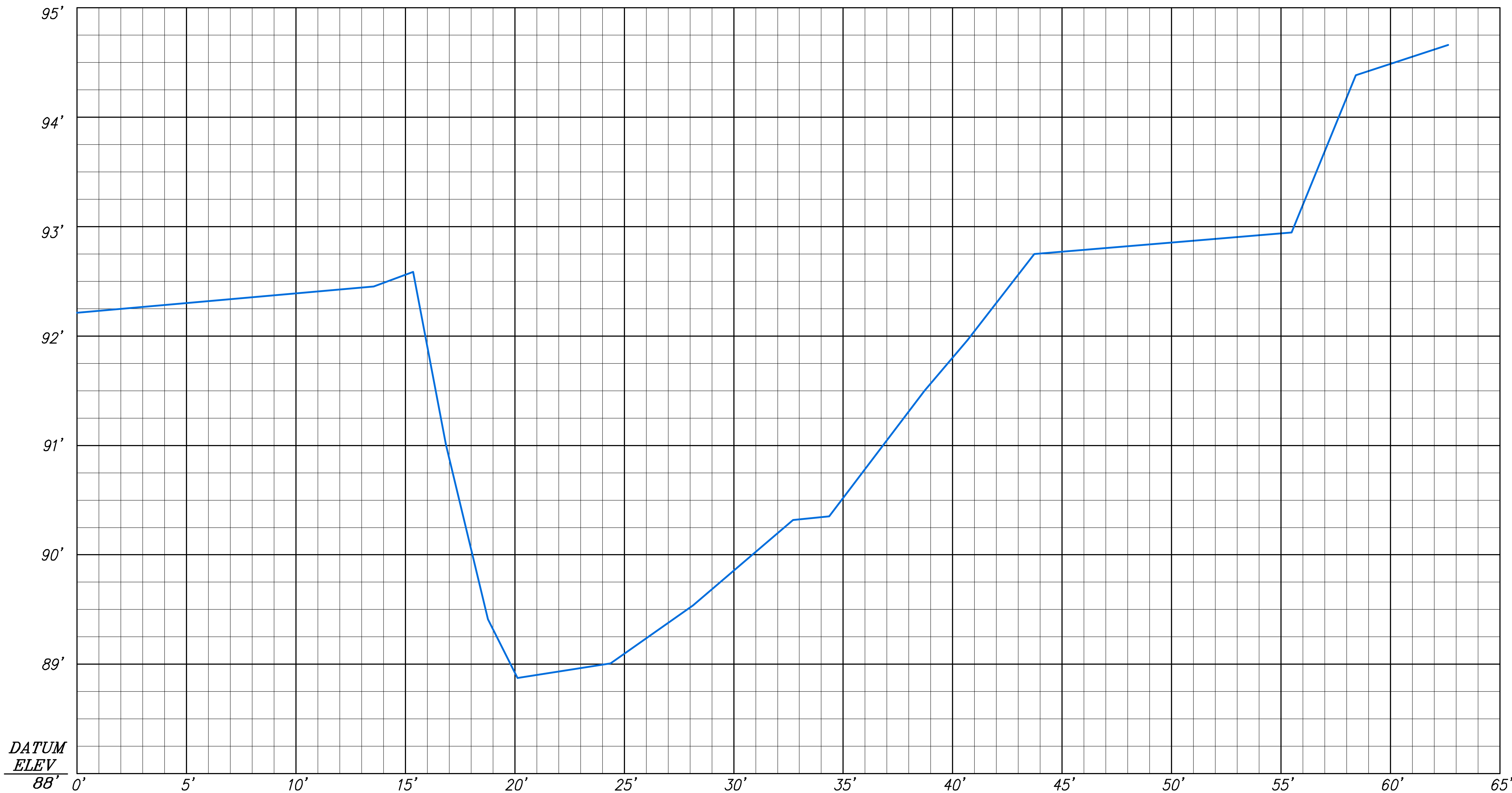
CROSS-SECTION 1R
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



CROSS-SECTION 2P
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



CROSS-SECTION 3R
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



CROSS-SECTION 4P
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

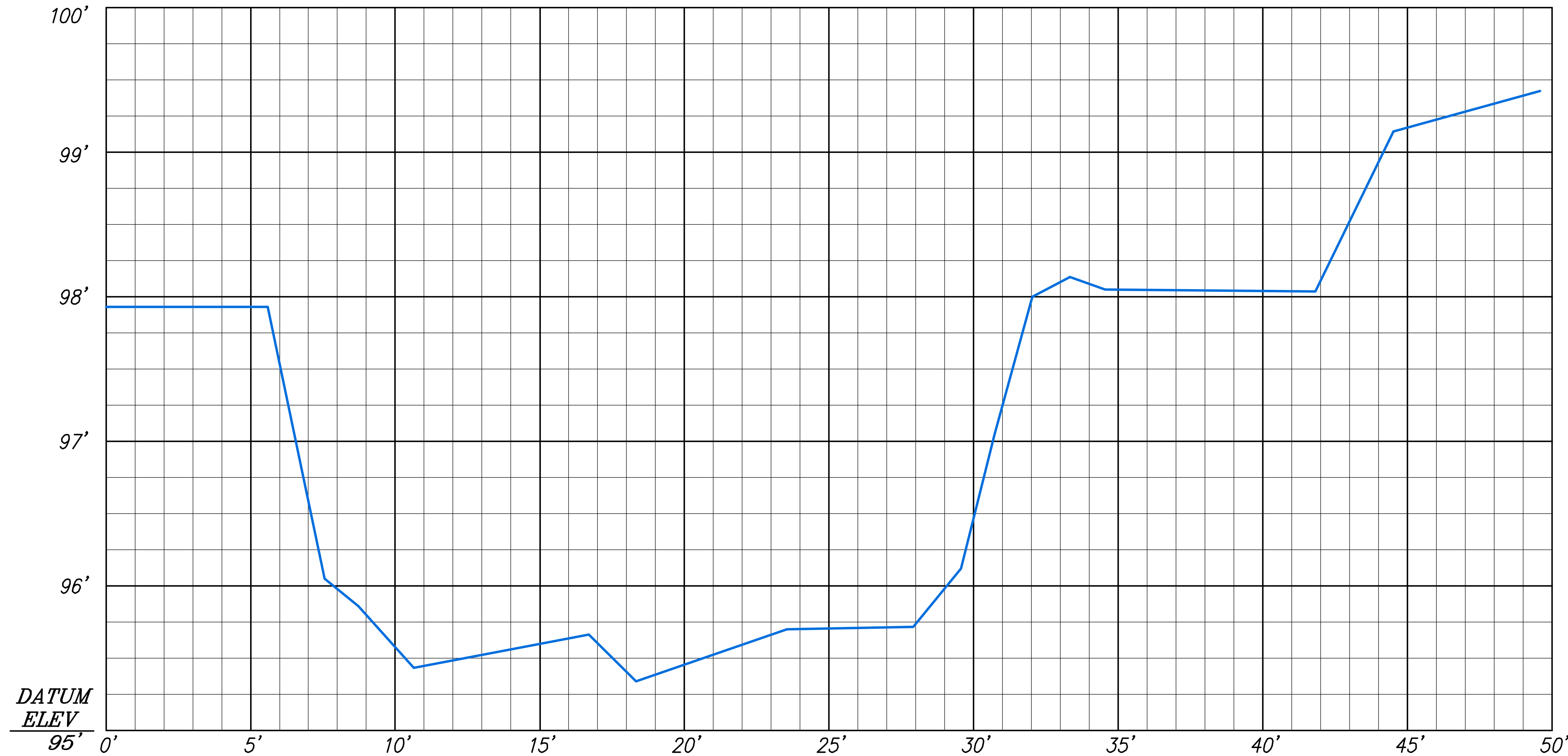
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

SHEET 17 OF 23

AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation



CROSS-SECTION 5R
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

SHEET 18 OF 23

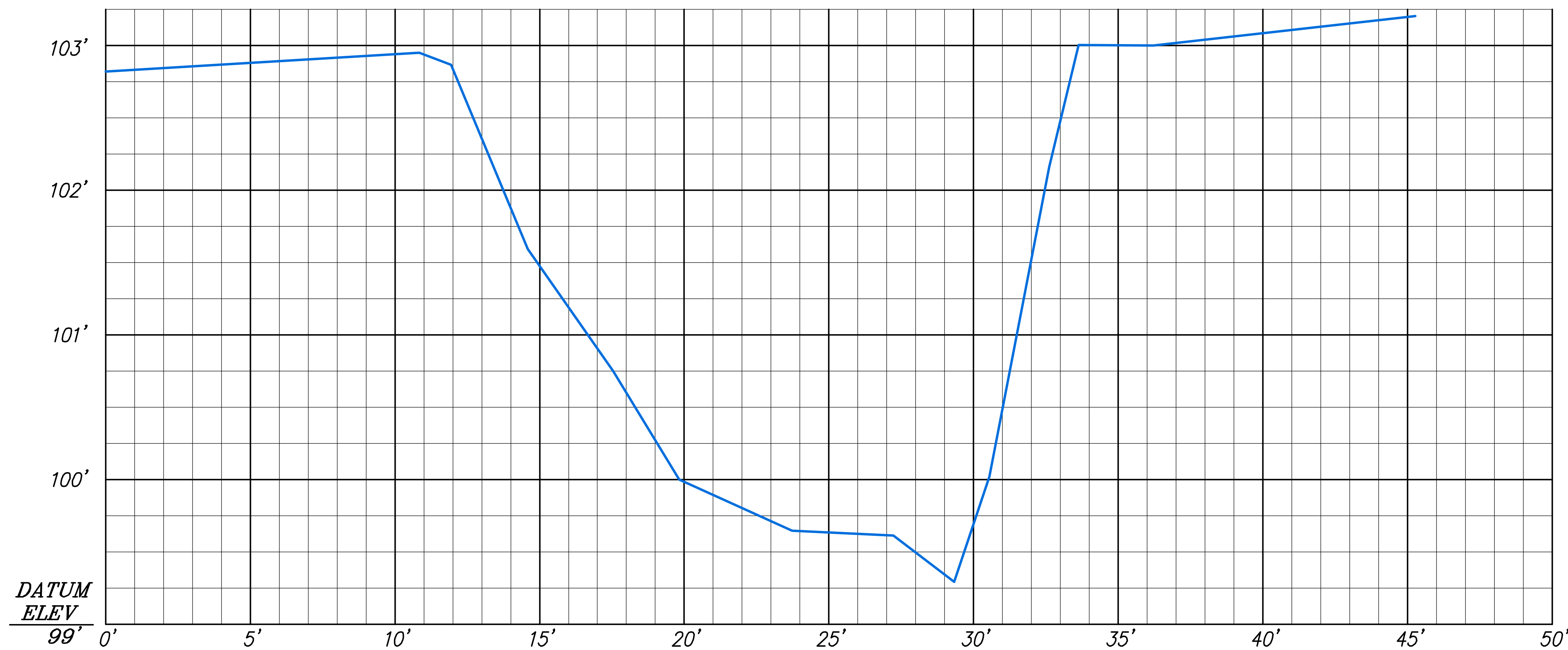
AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

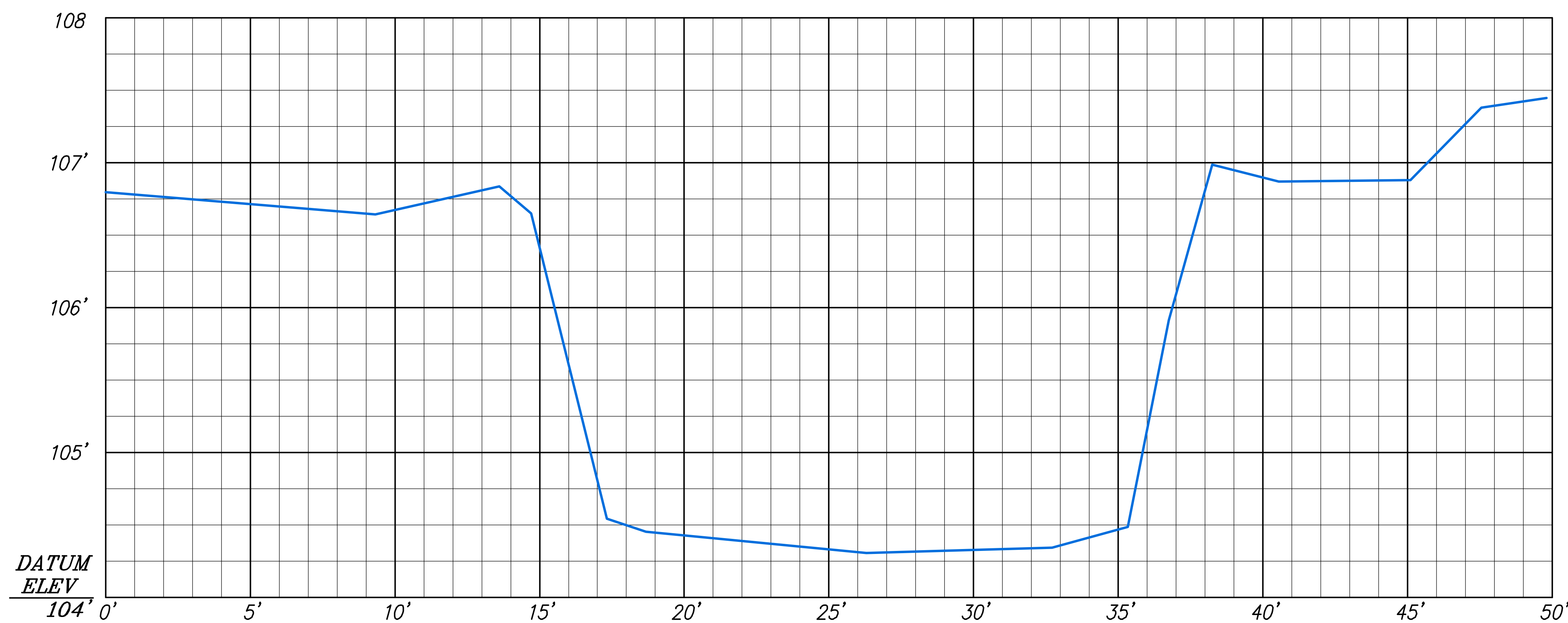
THREE MILE CREEK SITE

Natural Resources Restoration & Conservation



CROSS-SECTION 6P (EAST BANK TO WEST BANK)

SCALE: 1"=5' HORZ./1"=1' VERT.



CROSS-SECTION 7R (EAST BANK TO WEST BANK)

SCALE: 1"=5' HORZ./1"=1' VERT.

NOTE:

TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

SHEET 19 OF 23

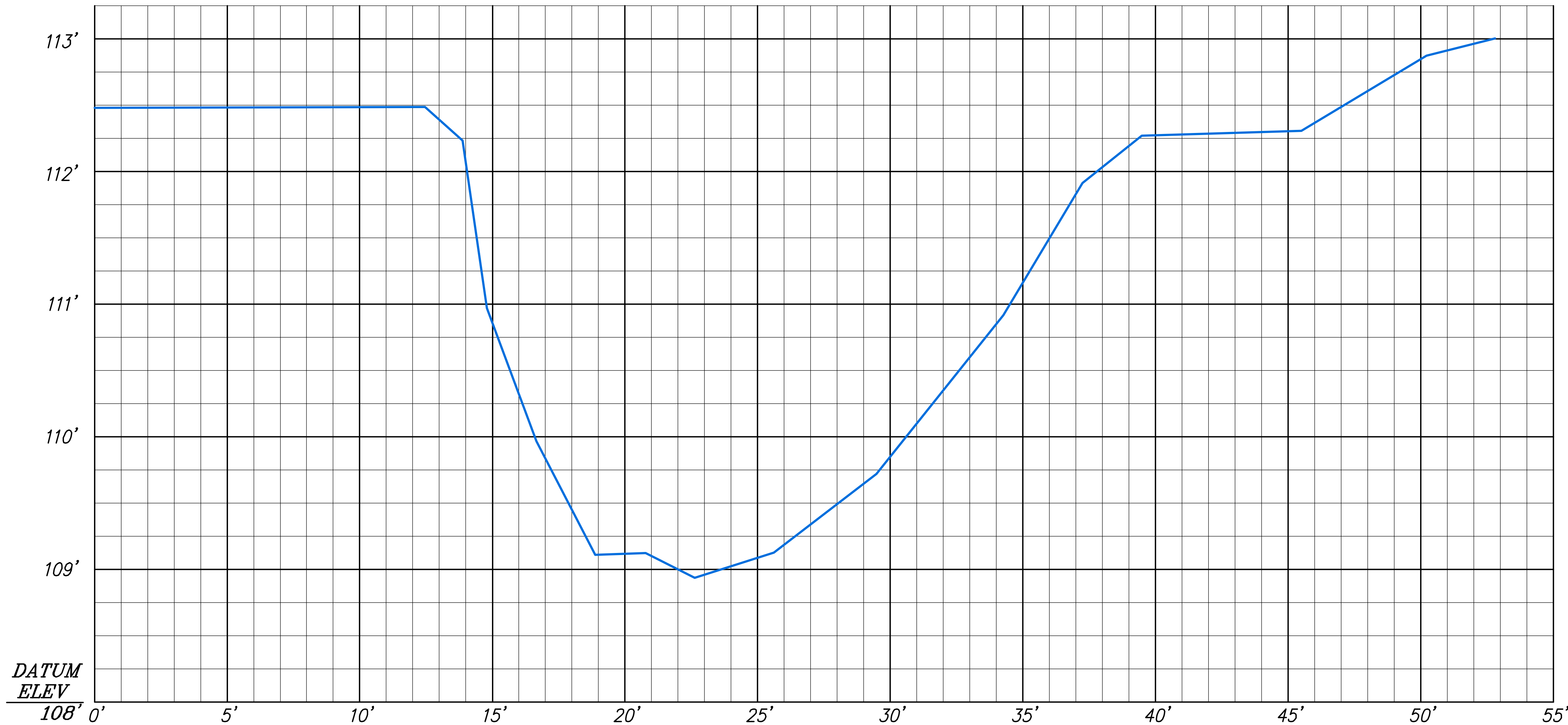
AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

Natural Resources Restoration & Conservation



CROSS-SECTION 8P
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

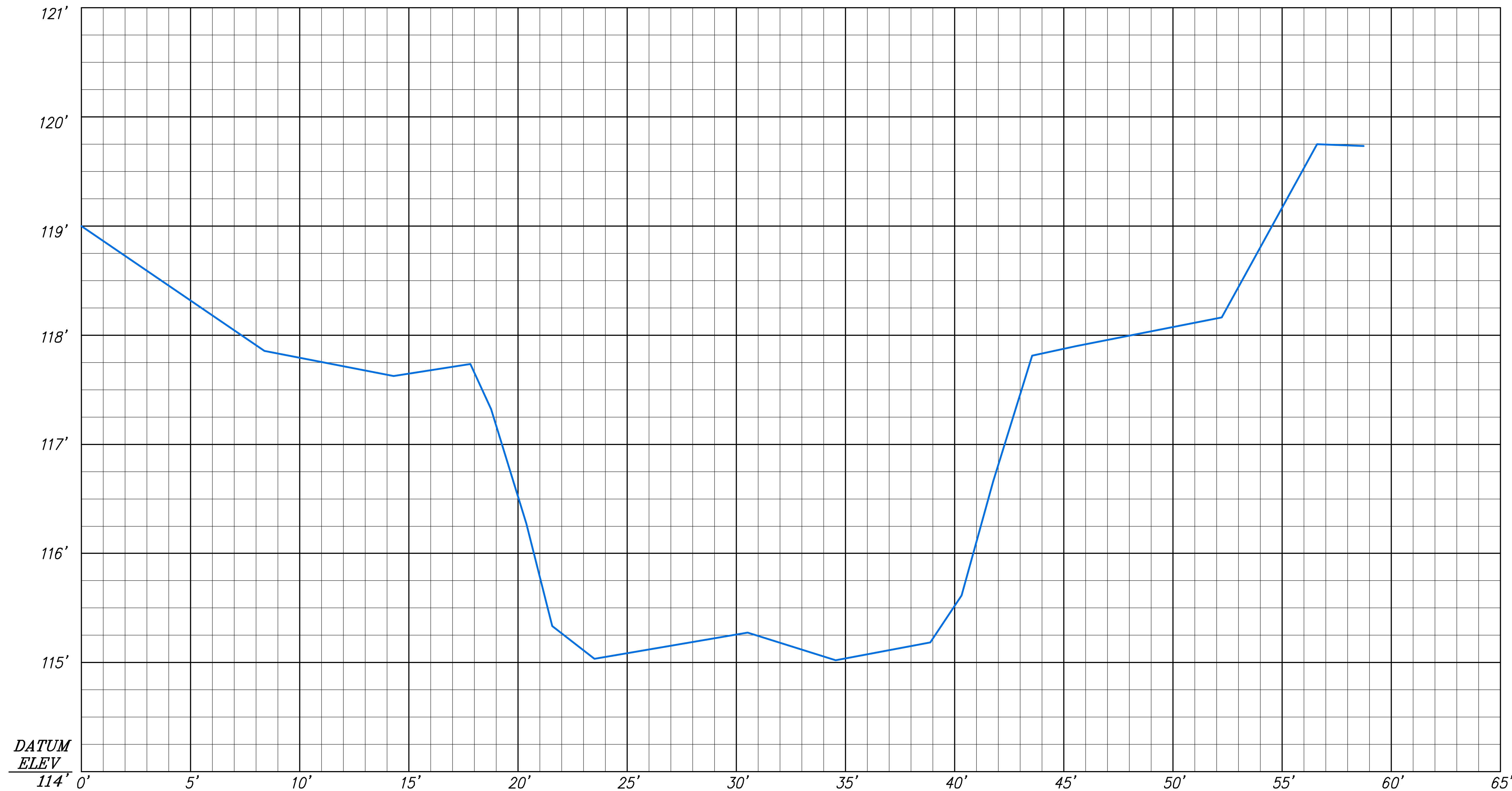
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

SHEET 20 OF 23

AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation



CROSS-SECTION 9R
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

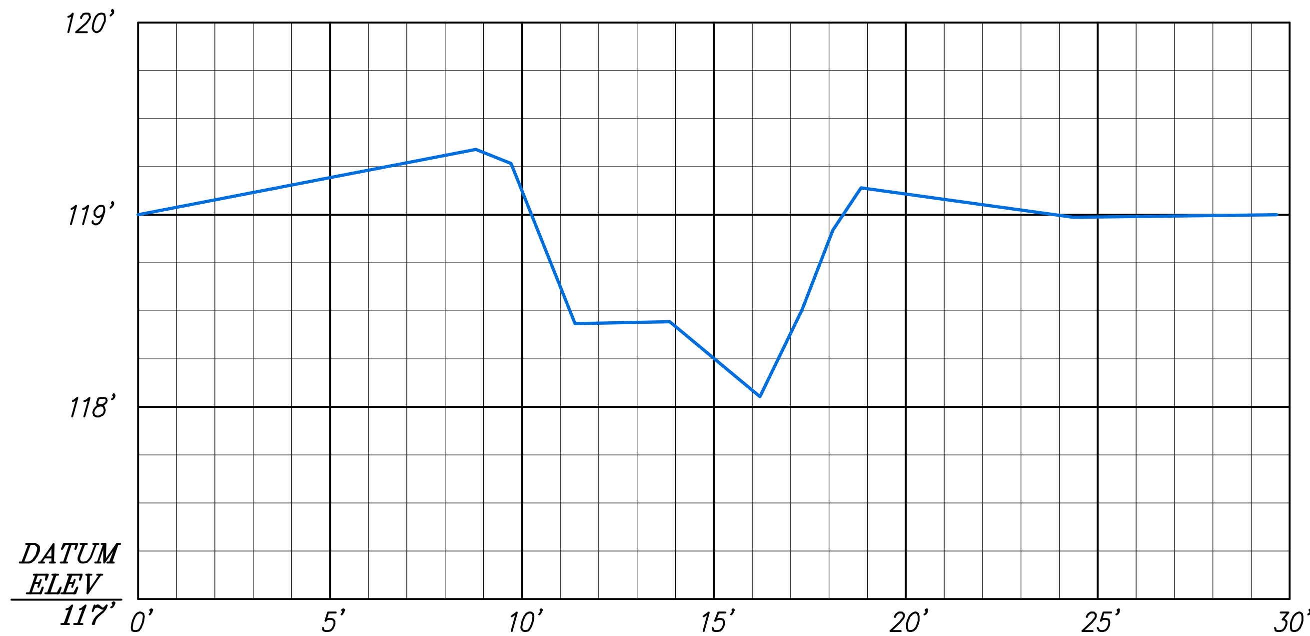
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

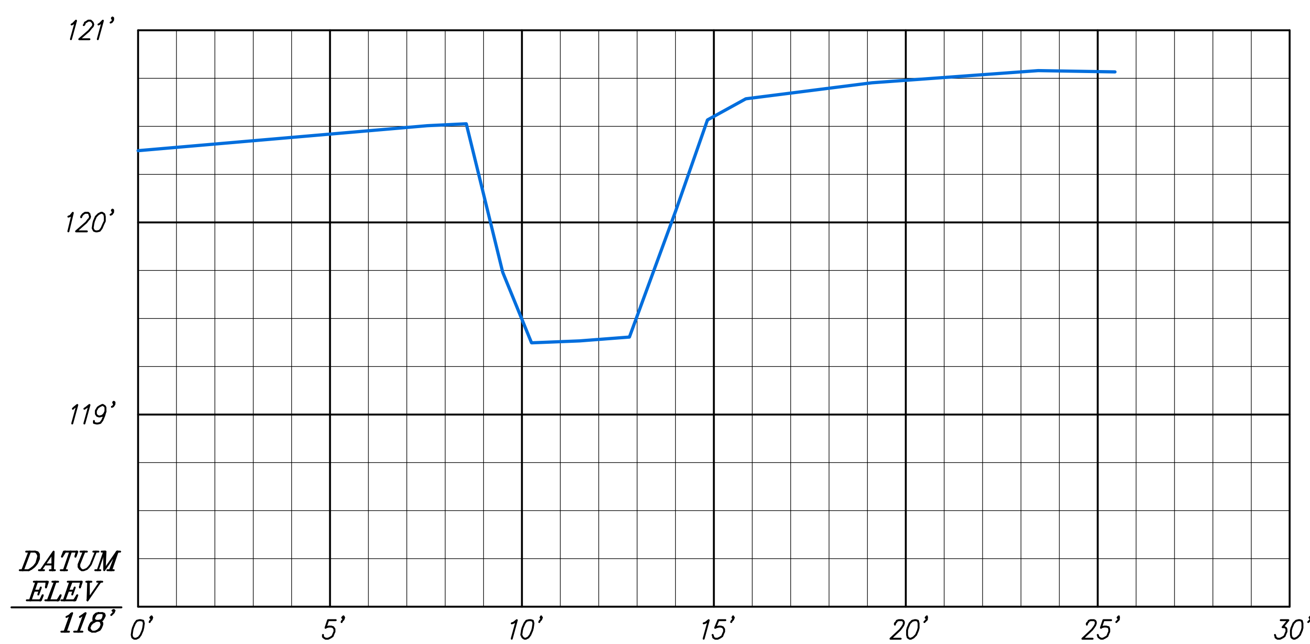
SHEET 21 OF 23

AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation



CROSS-SECTION 10R
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.



CROSS-SECTION 11P
(EAST BANK TO WEST BANK)
SCALE: 1"=5' HORZ./1"=1' VERT.

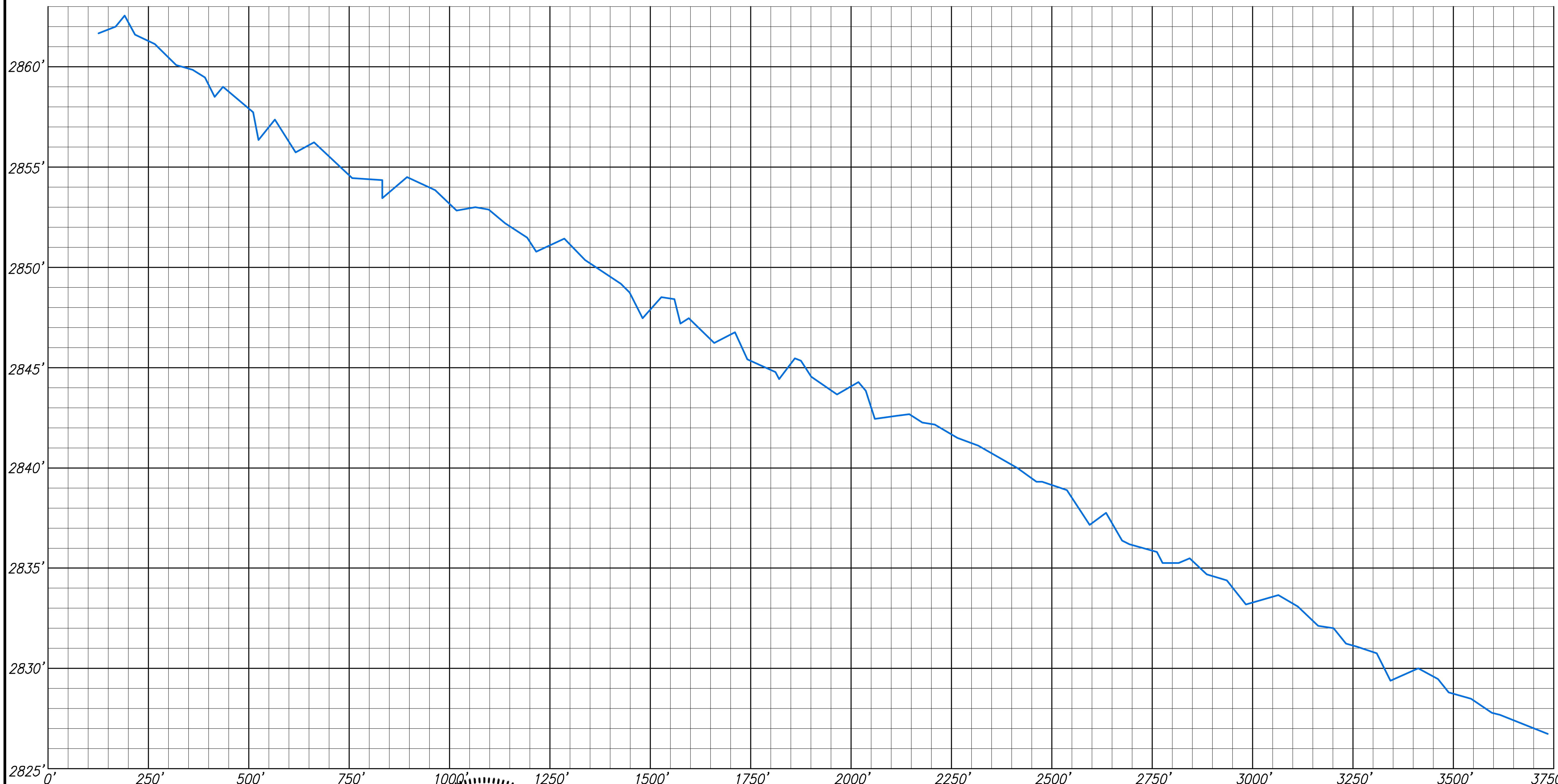
NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH
1/20/09

NOTE:
TBM IS NATURAL GROUND AT BOTTOM OF METAL STAKE(S) LOCATED AT THE BEGINNING AND END OF EACH CROS-SECTION (ASSUMED ELEVATION)

SHEET 22 OF 23

AS-BUILT SURVEY
FOR
RESTORATION SYSTEMS, LLC
THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC
Natural Resources Restoration & Conservation



NOTE:

ALL ELEVATIONS SHOWN ARE REFERENCED TO NAVD 1988. BENCHMARK USED: NCGS MARKER "MORRISON" WITH AN ELEVATION OF 2,679.26' NAVD 88. (THIS SHEET ONLY).

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN A. RUDOLPH

1/20/09

MAIN CHANNEL CENTERLINE PROFILE

SCALE: 1"=250' HORZ./1"=5' VERT.

SHEET 23 OF 23

AS-BUILT SURVEY

FOR

RESTORATION SYSTEMS, LLC

THREE MILE CREEK SITE

RESTORATION SYSTEMS, LLC

Natural Resources Restoration & Conservation

Appendix B.
Preconstruction and
Construction Photographs

Three Mile Creek Preconstruction Conditions
Taken March 2007

Three Mile Creek During Construction
Taken June 2008

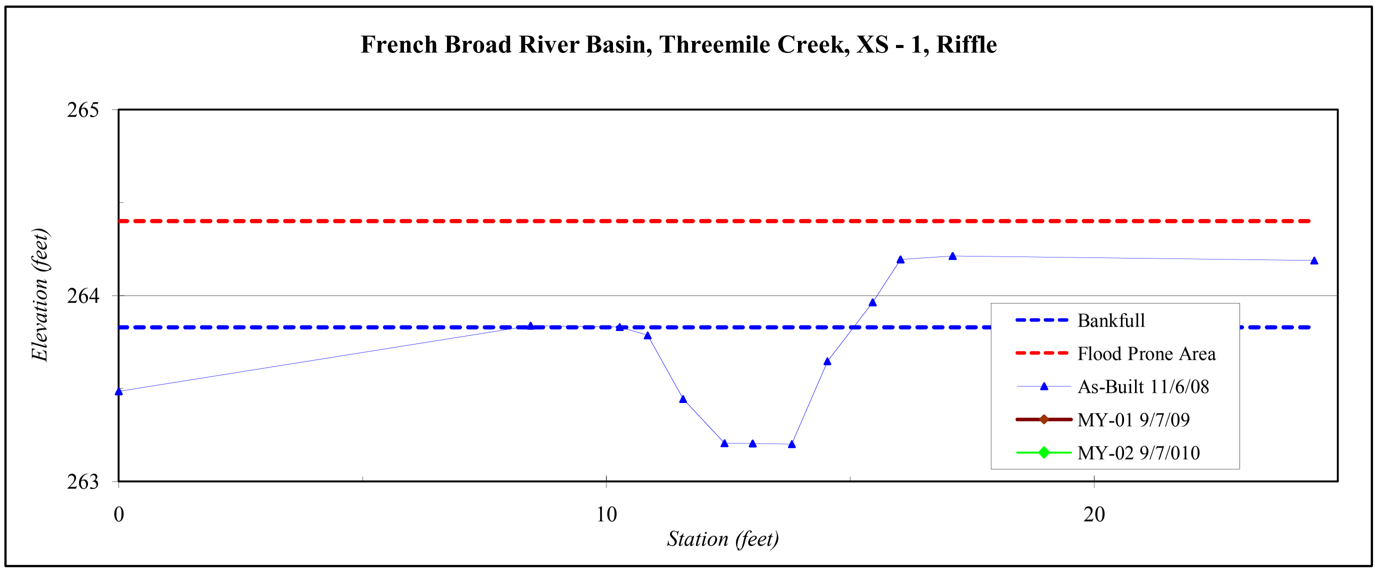
Appendix C.
As-built Cross-section and Longitudinal Profile Plots

River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 1, Riffle
Drainage Area (sq mi):	0.05
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	263.49
8.4	263.84
10.3	263.83
10.8	263.79
11.6	263.44
12.4	263.21
13.0	263.20
13.8	263.20
14.5	263.65
15.5	263.96
16.0	264.19
17.1	264.21
24.5	264.19

SUMMARY DATA	
Bankfull Elevation:	263.8
Bankfull Cross-Sectional Area:	1.8
Bankfull Width:	4.8
Flood Prone Area Elevation:	264.4
Flood Prone Width:	>80
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.4
W / D Ratio:	12.7
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E

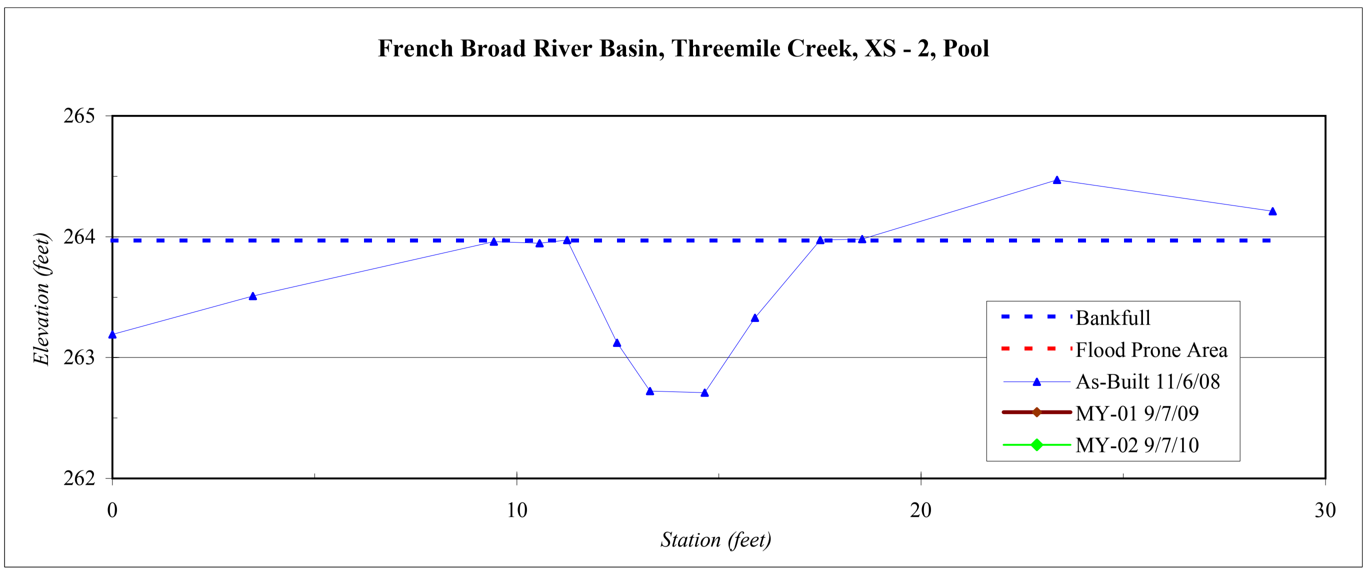


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 2, Pool
Drainage Area (sq mi):	0.05
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.00	263.19
3.47	263.51
9.43	263.96
10.56	263.95
11.25	263.97
12.48	263.12
13.30	262.72
14.64	262.71
15.89	263.33
17.51	263.97
18.54	263.98
23.36	264.47
28.70	264.21

SUMMARY DATA	
Bankfull Elevation:	264.0
Bankfull Cross-Sectional Area:	4.8
Bankfull Width:	6.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

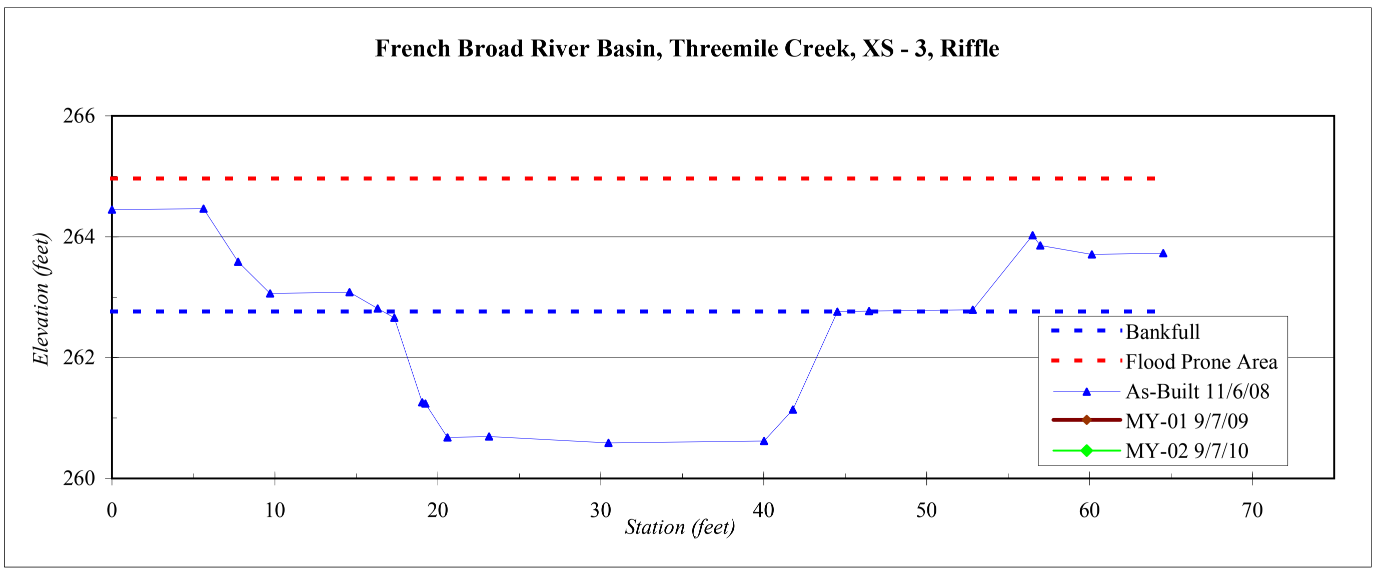


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.00	264.45
5.62	264.46
7.74	263.59
9.71	263.06
14.57	263.08
16.31	262.81
17.33	262.66
19.03	261.26
19.23	261.24
20.58	260.68
23.13	260.69
30.48	260.59
40.01	260.62
41.78	261.14
44.5	262.8
46.5	262.8
52.8	262.8
56.5	264.0
57.0	263.9
60.1	263.7
64.5	263.7

SUMMARY DATA	
Bankfull Elevation:	262.8
Bankfull Cross-Sectional Area:	51.1
Bankfull Width:	27.8
Flood Prone Area Elevation:	265.0
Flood Prone Width:	>65
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.8
W / D Ratio:	15.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

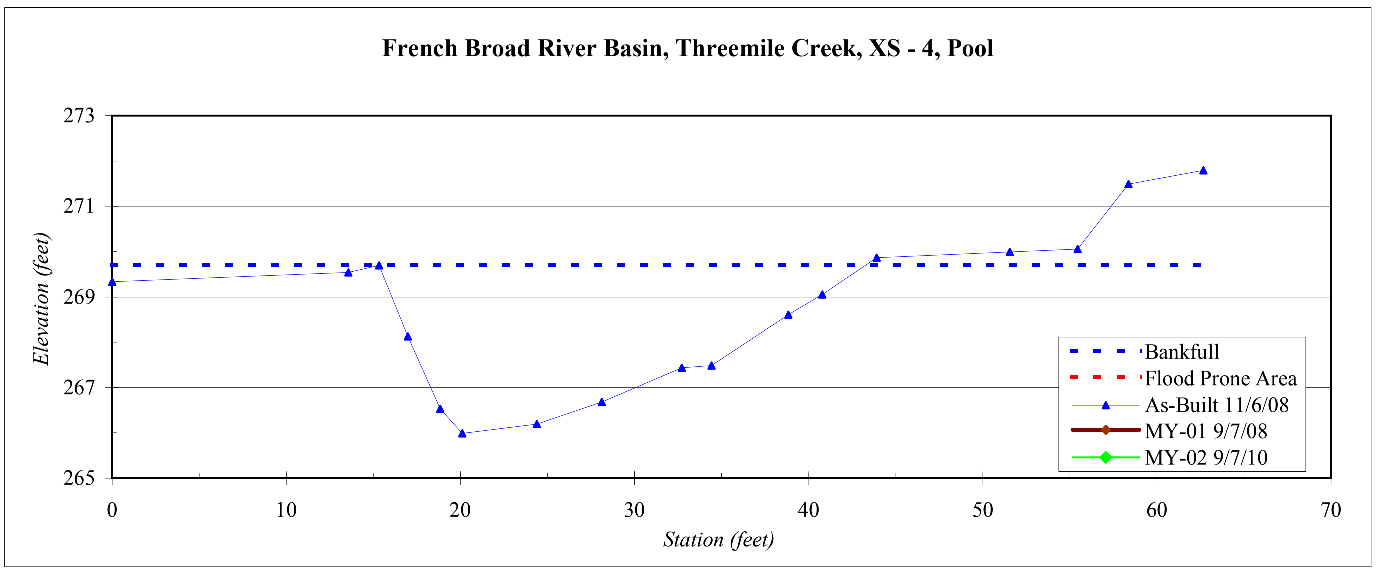


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 4, Pool
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	269.3
13.6	269.5
15.3	269.7
17.0	268.1
18.8	266.5
20.1	266.0
24.4	266.2
28.1	266.7
32.7	267.4
34.4	267.5
38.8	268.6
40.8	269.1
43.9	269.9
51.6	270.0
55.5	270.06
58.4	271.49
62.7	271.79

SUMMARY DATA	
Bankfull Elevation:	269.7
Bankfull Cross-Sectional Area:	63.4
Bankfull Width:	27.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	3.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

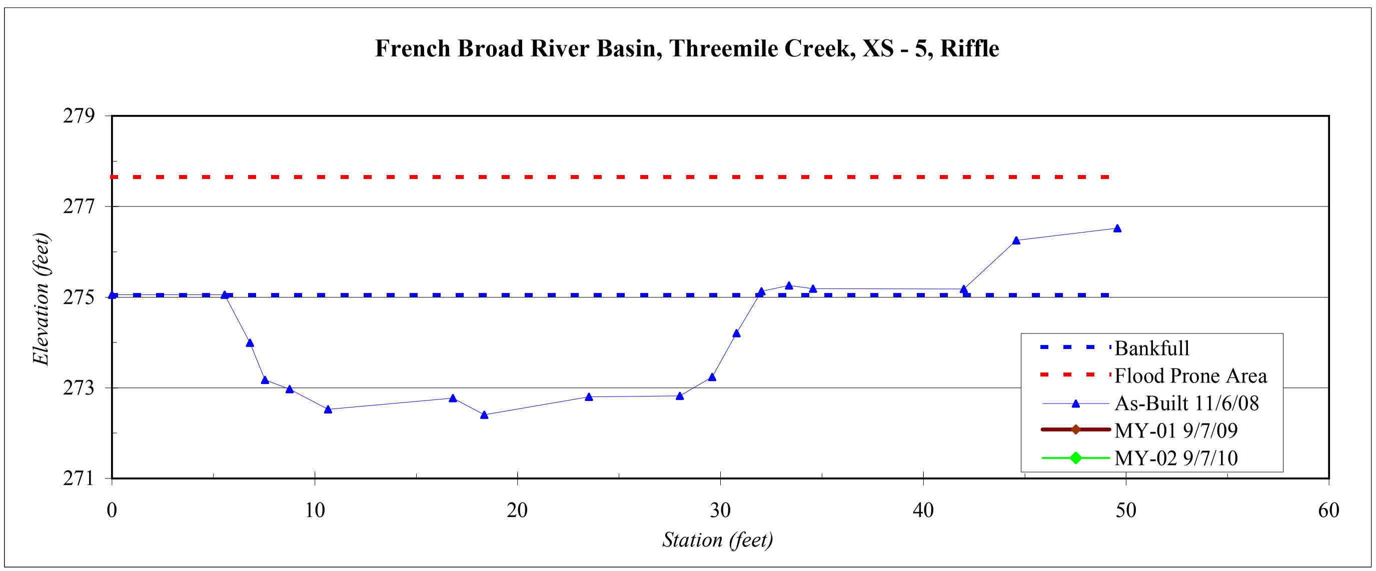


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	275.1
5.6	275.1
6.8	274.0
7.5	273.2
8.8	273.0
10.7	272.5
16.8	272.8
18.4	272.4
23.5	272.8
28.0	272.8
29.6	273.2
30.8	274.2
32.0	275.1
33.4	275.3
34.6	275.2
42.0	275.2
44.6	276.3
49.6	276.5

SUMMARY DATA	
Bankfull Elevation:	275.1
Bankfull Cross-Sectional Area:	55.0
Bankfull Width:	21.6
Flood Prone Area Elevation:	277.7
Flood Prone Width:	>65
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	2.1
W / D Ratio:	12.6
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

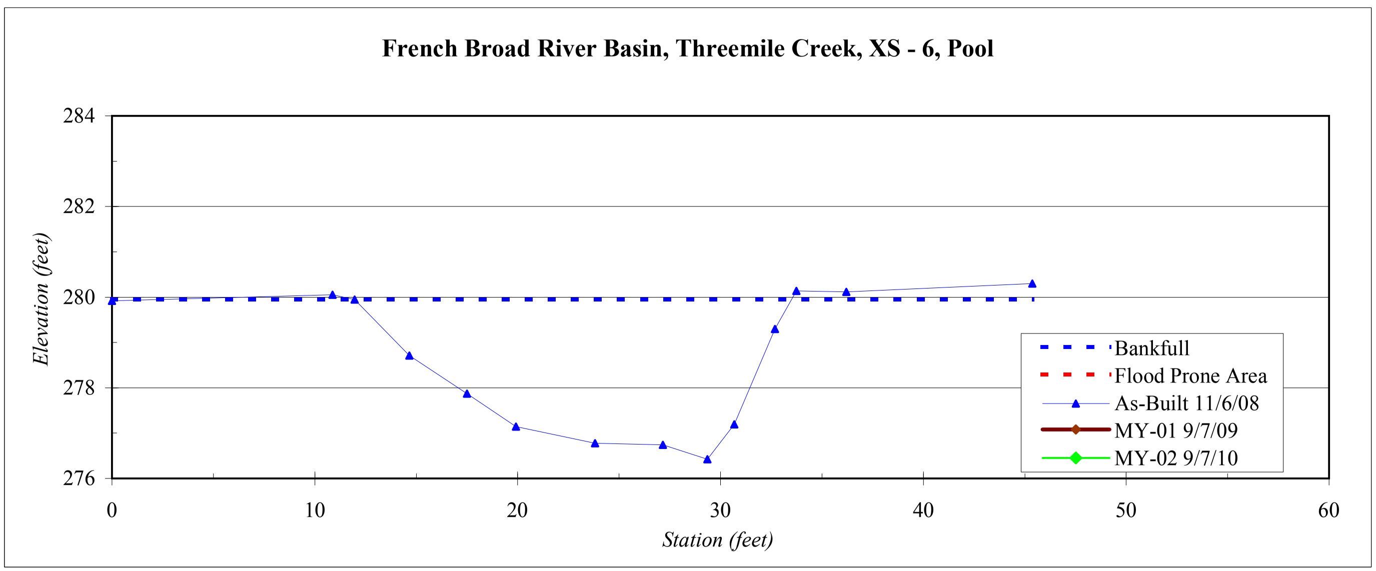


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 6, Pool
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	279.9
10.9	280.1
12.0	279.9
14.7	278.7
17.5	277.9
19.9	277.1
23.8	276.8
27.2	276.7
29.4	276.4
30.7	277.2
32.7	279.3
33.7	280.1
36.2	280.1
45.4	280.3

SUMMARY DATA	
Bankfull Elevation:	280.0
Bankfull Cross-Sectional Area:	49.9
Bankfull Width:	21.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	3.7
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

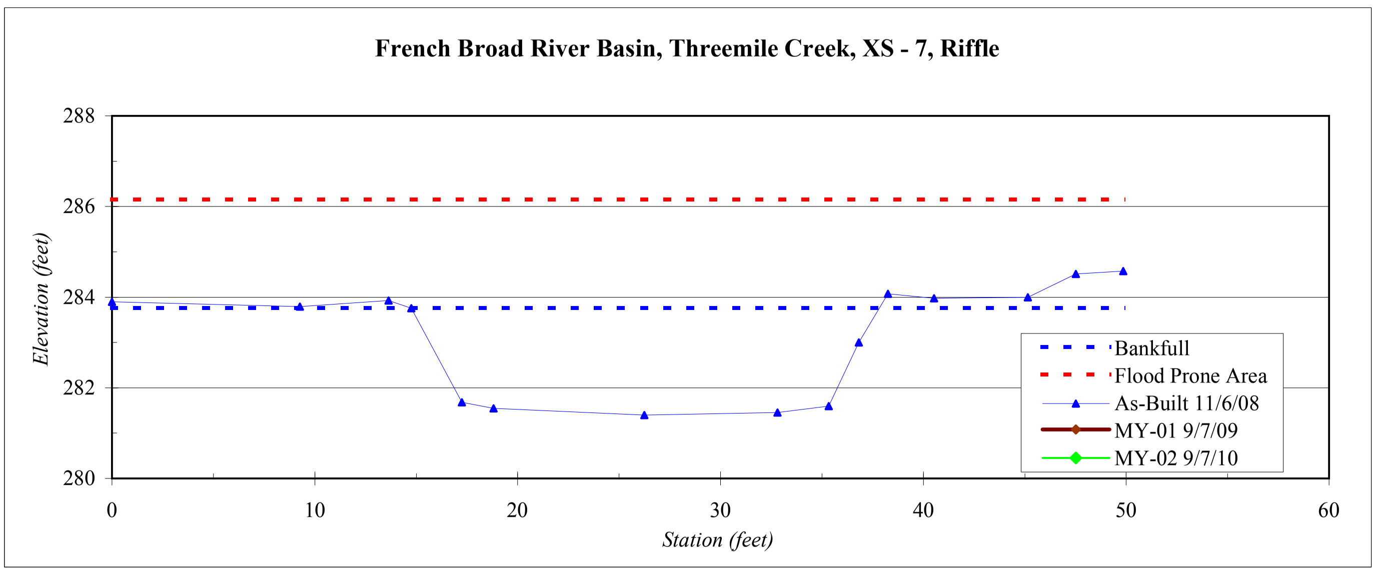


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 7, Riffle
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	283.9
9.3	283.8
13.6	283.9
14.8	283.8
17.2	281.7
18.8	281.5
26.2	281.4
32.8	281.5
35.3	281.6
36.8	283.0
38.2	284.1
40.5	284.0
45.2	284.0
47.5	284.5
49.9	284.6

SUMMARY DATA	
Bankfull Elevation:	283.8
Bankfull Cross-Sectional Area:	46.5
Bankfull Width:	23.1
Flood Prone Area Elevation:	286.2
Flood Prone Width:	>65
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	2.0
W / D Ratio:	11.5
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

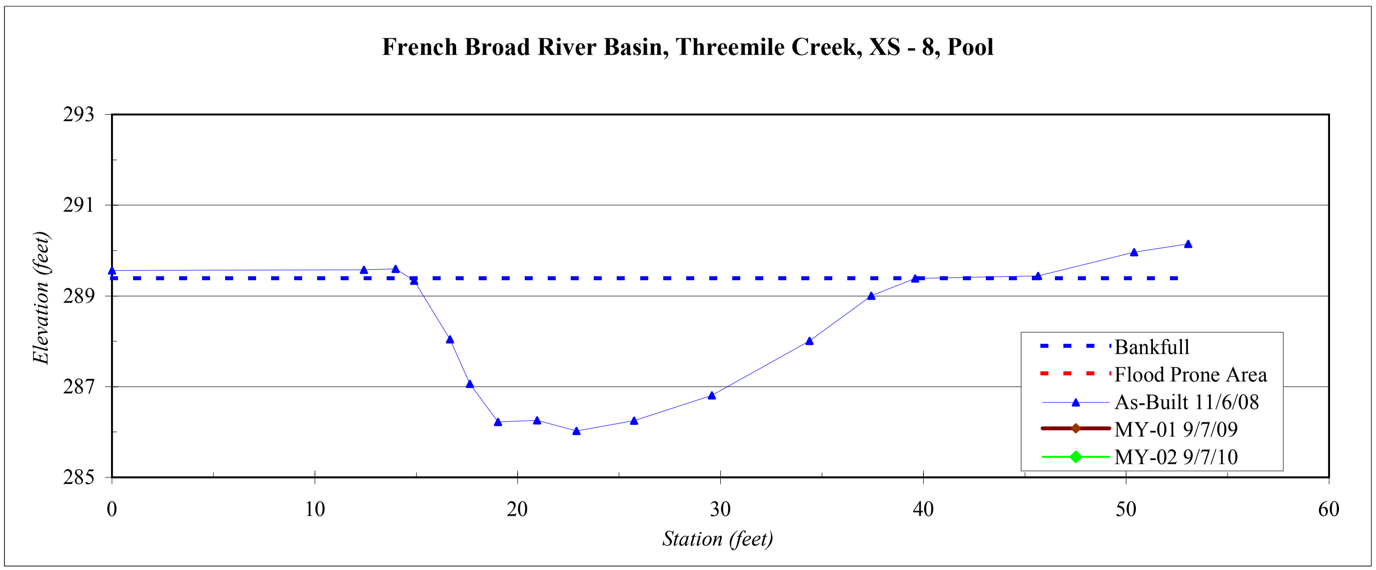


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 8, Pool
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	289.6
12.4	289.6
14.0	289.6
14.9	289.3
16.7	288.0
17.6	287.1
19.0	286.2
21.0	286.3
22.9	286.0
25.7	286.3
29.6	286.8
34.4	288.0
37.4	289.0
39.6	289.4
45.7	289.4
50.4	290.0
53.1	290.1

SUMMARY DATA	
Bankfull Elevation:	289.4
Bankfull Cross-Sectional Area:	52.1
Bankfull Width:	25.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.4
Mean Depth at Bankfull:	2.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

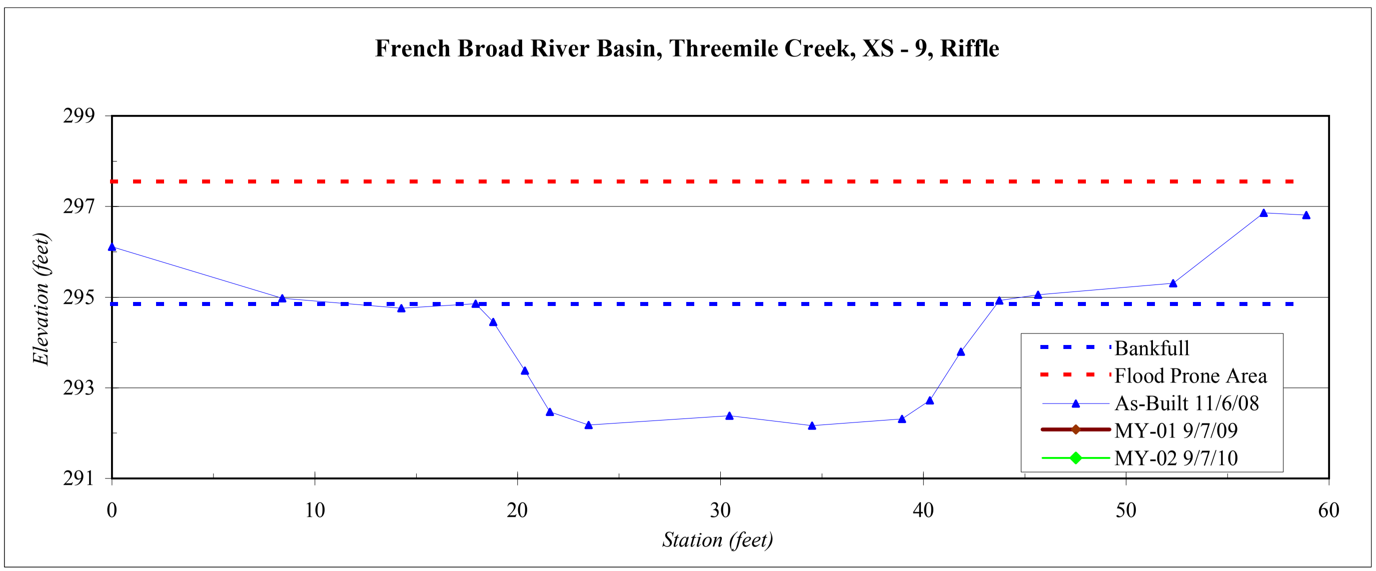


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 9, Riffle
Drainage Area (sq mi):	4.7
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	296.1
8.4	295.0
14.3	294.8
17.9	294.9
18.8	294.5
20.4	293.4
21.6	292.5
23.5	292.2
30.4	292.4
34.5	292.2
38.9	292.3
40.3	292.7
41.9	293.8
43.7	294.9
45.7	295.0
52.3	295.3
56.8	296.9
58.9	296.8

SUMMARY DATA	
Bankfull Elevation:	294.9
Bankfull Cross-Sectional Area:	55.3
Bankfull Width:	25.7
Flood Prone Area Elevation:	297.6
Flood Prone Width:	>65
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	2.2
W / D Ratio:	11.9
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

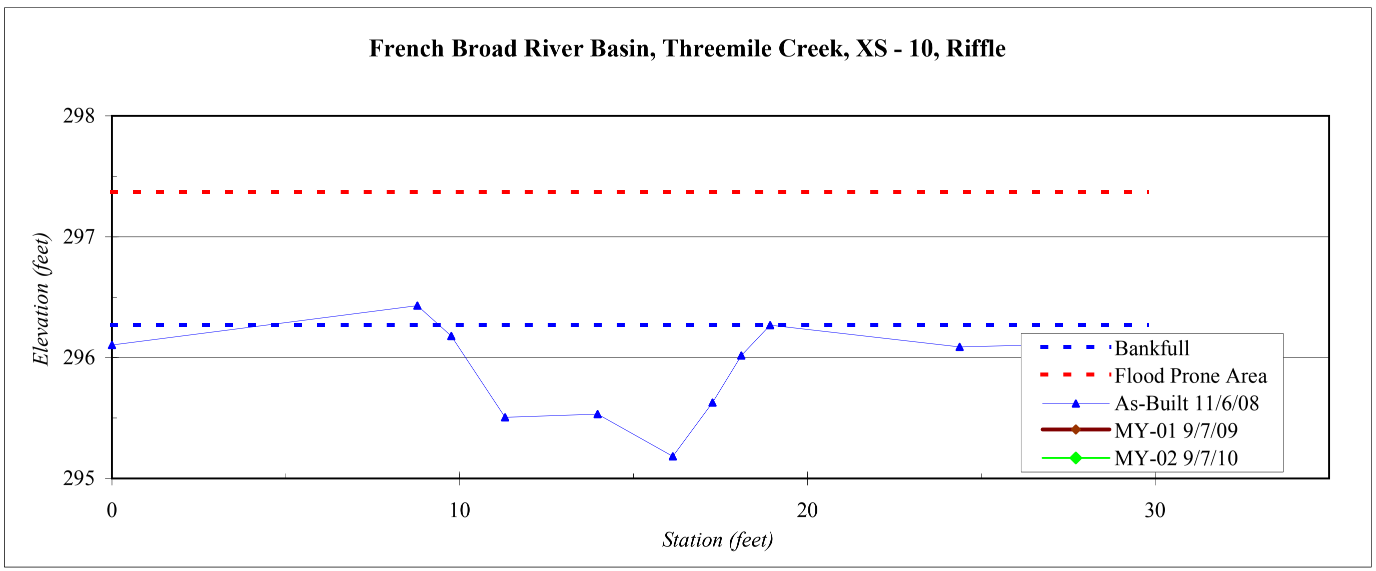


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 10, Riffle
Drainage Area (sq mi):	0.05
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	296.1
8.8	296.4
9.8	296.2
11.3	295.5
14.0	295.5
16.1	295.2
17.3	295.6
18.1	296.0
18.9	296.3
24.4	296.1
29.8	296.1

SUMMARY DATA	
Bankfull Elevation:	296.3
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	9.5
Flood Prone Area Elevation:	297.4
Flood Prone Width:	>35
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.6
W / D Ratio:	14.8
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

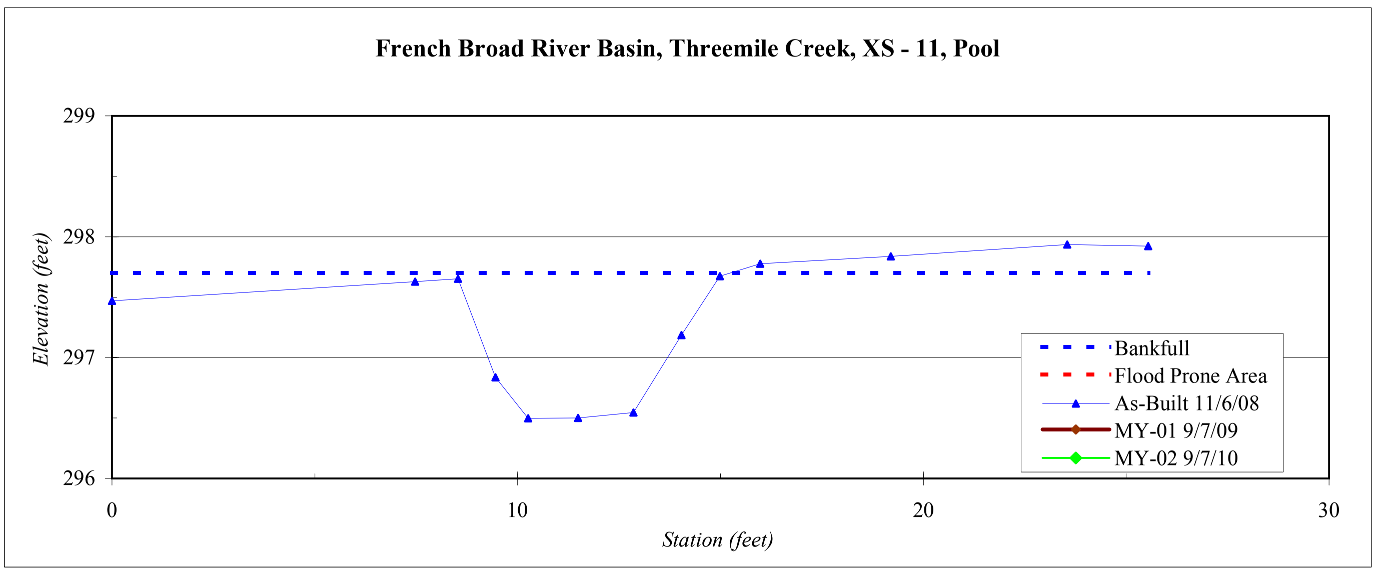


River Basin:	French Broad
Watershed:	Threemile Creek
XS ID	XS - 11, Pool
Drainage Area (sq mi):	0.05
Date:	11/6/2008
Field Crew:	Lewis, St.Clair

Station	Elevation
0.0	297.5
7.5	297.6
8.5	297.7
9.5	296.8
10.3	296.5
11.5	296.5
12.9	296.5
14.0	297.2
15.0	297.7
16.0	297.8
19.2	297.8
23.5	297.9
25.5	297.9

SUMMARY DATA	
Bankfull Elevation:	297.7
Bankfull Cross-Sectional Area:	5.3
Bankfull Width:	6.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

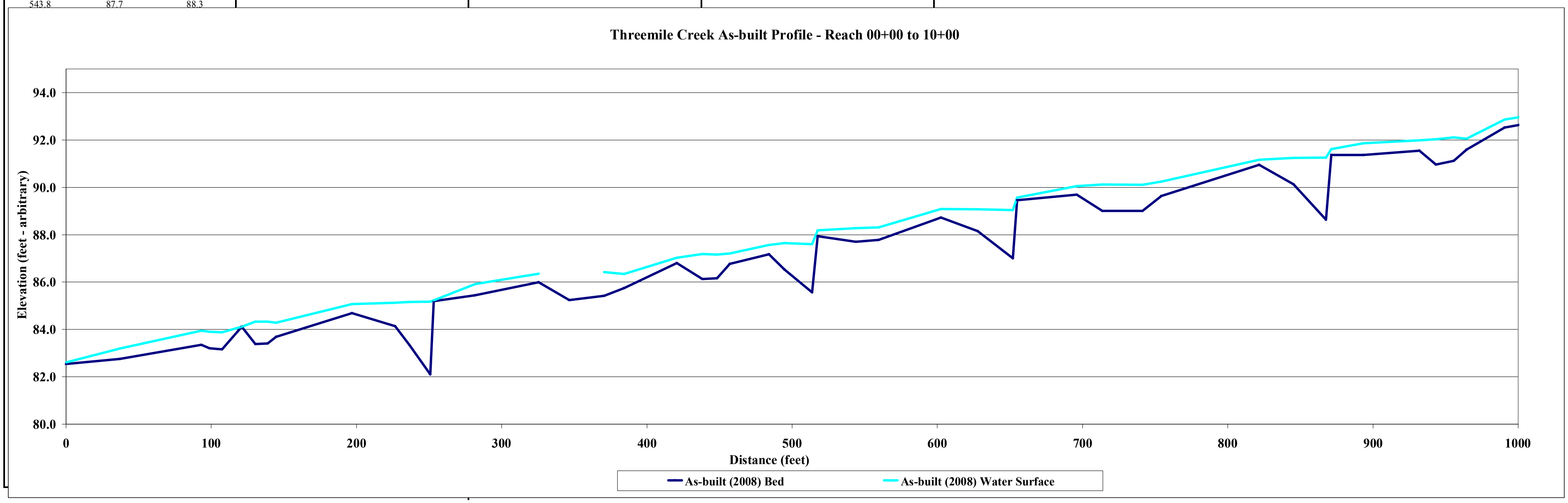
Stream Type	E/C



Project Name	Threemile Creek - As-built (2008) Profile
Reach	all
Feature	Profile
Date	10/21/08
Crew	Lewis, St.Clair

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	82.5	82.6									
37.1	82.8	83.2									
93.1	83.4	83.9									
98.8	83.2	83.9									
107.4	83.2	83.9									
121.0	84.1	84.1									
130.4	83.4	84.3									
138.8	83.4	84.3									
144.7	83.7	84.3									
197.0	84.7	85.1									
226.7	84.1	85.1									
236.5	83.3	85.2									
250.9	82.1	85.2									
253.2	85.2	85.2									
281.5	85.4	85.9									
325.5	86.0	86.4									
346.6	85.2										
370.6	85.4	86.4									
384.2	85.7	86.3									
420.6	86.8	87.0									
438.2	86.1	87.2									
448.3	86.2	87.2									
457.1	86.8	87.2									
484.0	87.2	87.6									
494.7	86.5	87.6									
513.8	85.6	87.6									
517.6	87.9	88.2									
543.8	87.7	88.3									

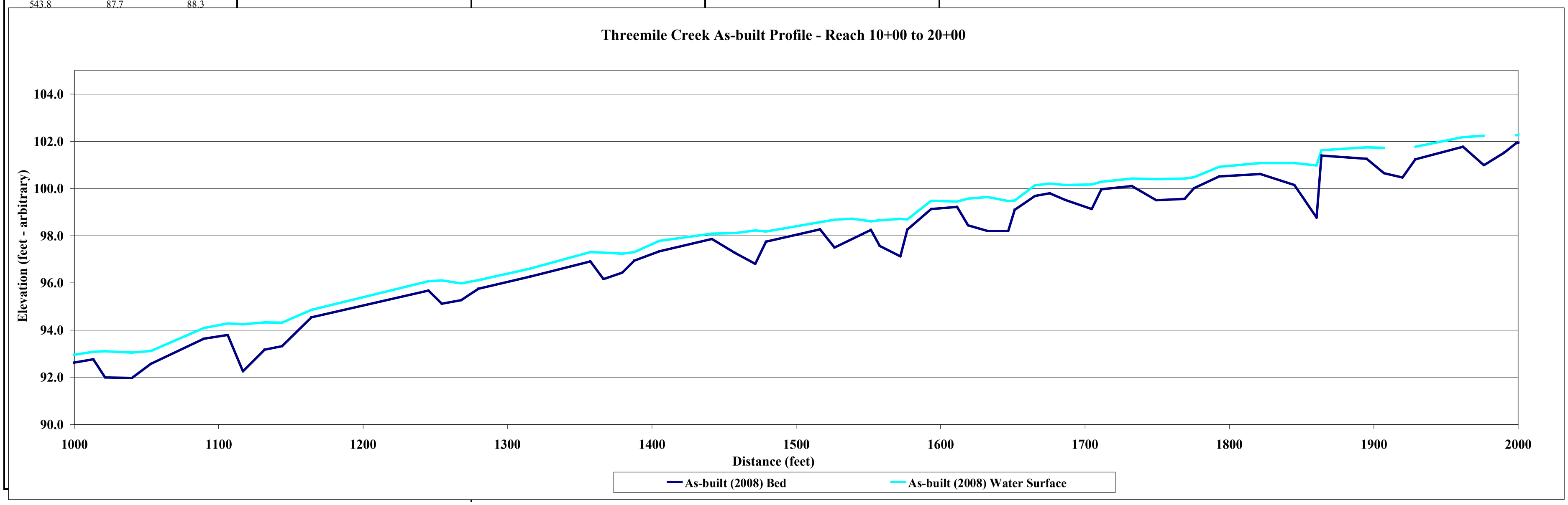
	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0098			
Riffle Length	51.0			
Avg. Riffle Slope	0.0154			
Pool Length	46.0			
Pool to Pool Spacing	110.0			



Project Name	Threemile Creek - As-built (2008) Profile
Reach	all
Feature	Profile
Date	10/21/08
Crew	Lewis, St.Clair

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6									
37.1	82.8	83.2									
93.1	83.4	83.9									
98.8	83.2	83.9									
107.4	83.2	83.9									
121.0	84.1	84.1									
130.4	83.4	84.3									
138.8	83.4	84.3									
144.7	83.7	84.3									
197.0	84.7	85.1									
226.7	84.1	85.1									
236.5	83.3	85.2									
250.9	82.1	85.2									
253.2	85.2	85.2									
281.5	85.4	85.9									
325.5	86.0	86.4									
346.6	85.2										
370.6	85.4	86.4									
384.2	85.7	86.3									
420.6	86.8	87.0									
438.2	86.1	87.2									
448.3	86.2	87.2									
457.1	86.8	87.2									
484.0	87.2	87.6									
494.7	86.5	87.6									
513.8	85.6	87.6									
517.6	87.9	88.2									
543.8	87.7	88.3									

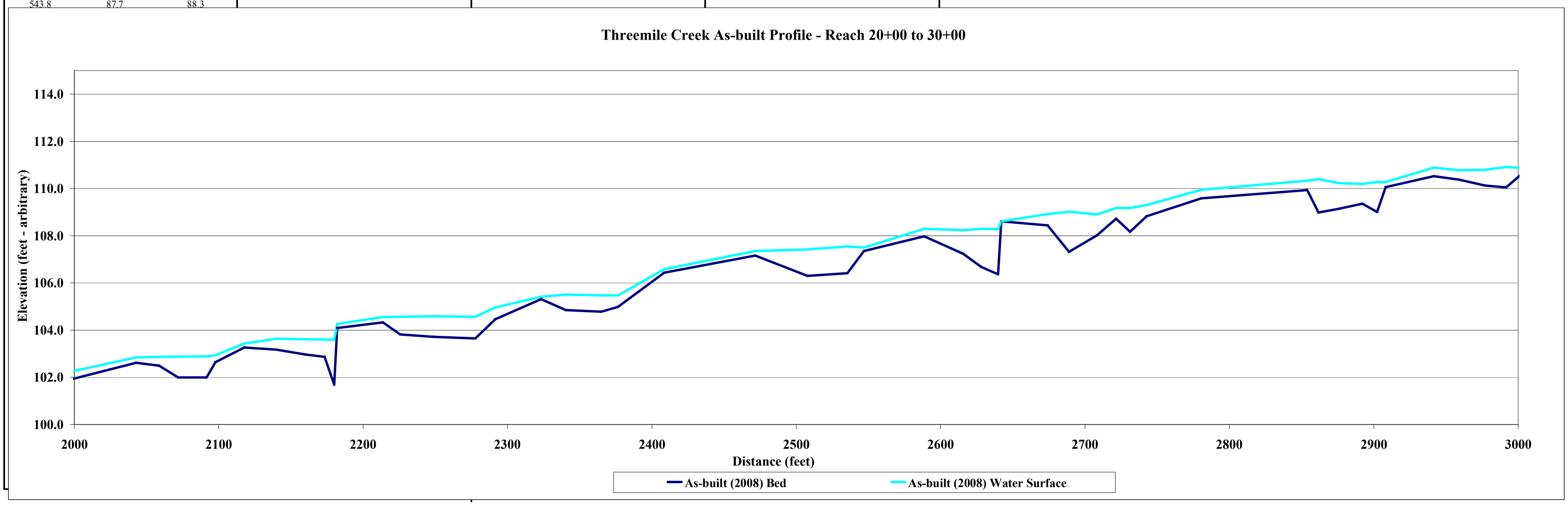
	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0098			
Riffle Length	51.0			
Avg. Riffle Slope	0.0154			
Pool Length	46.0			
Avg. Pool Slope	110.0			



Project Name	Threemile Creek - As-built (2008) Profile
Reach	all
Feature	Profile
Date	10/21/08
Crew	Lewis, St.Clair

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6									
37.1	82.8	83.2									
93.1	83.4	83.9									
98.8	83.2	83.9									
107.4	83.2	83.9									
121.0	84.1	84.1									
130.4	83.4	84.3									
138.8	83.4	84.3									
144.7	83.7	84.3									
197.0	84.7	85.1									
226.7	84.1	85.1									
236.5	83.3	85.2									
250.9	82.1	85.2									
253.2	85.2	85.2									
281.5	85.4	85.9									
325.5	86.0	86.4									
346.6	85.2										
370.6	85.4	86.4									
384.2	85.7	86.3									
420.6	86.8	87.0									
438.2	86.1	87.2									
448.3	86.2	87.2									
457.1	86.8	87.2									
484.0	87.2	87.6									
494.7	86.5	87.6									
513.8	85.6	87.6									
517.6	87.9	88.2									
543.8	87.7	88.3									

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0098			
Riffle Length	51.0			
Avg. Riffle Slope	0.0154			
Pool Length	46.0			
Avg. Pool Slope	110.0			



Project Name	Threemile Creek - As-built (2008) Profile
Reach	all
Feature	Profile
Date	10/21/08
Crew	Lewis, St.Clair

2008 As-built Survey			2009 Year 1 Monitoring \Survey			2010 Year 2 Monitoring \Survey			2011 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	82.5	82.6									
37.1	82.8	83.2									
93.1	83.4	83.9									
98.8	83.2	83.9									
107.4	83.2	83.9									
121.0	84.1	84.1									
130.4	83.4	84.3									
138.8	83.4	84.3									
144.7	83.7	84.3									
197.0	84.7	85.1									
226.7	84.1	85.1									
236.5	83.3	85.2									
250.9	82.1	85.2									
253.2	85.2	85.2									
281.5	85.4	85.9									
325.5	86.0	86.4									
346.6	85.2										
370.6	85.4	86.4									
384.2	85.7	86.3									
420.6	86.8	87.0									
438.2	86.1	87.2									
448.3	86.2	87.2									
457.1	86.8	87.2									
484.0	87.2	87.6									
494.7	86.5	87.6									
513.8	85.6	87.6									
517.6	87.9	88.2									
543.8	87.7	88.3									

	As-built	2008	2009	2010
Avg. Water Surface Slope	0.0098			
Riffle Length	51.0			
Avg. Riffle Slope	0.0154			
Pool Length	46.0			
Avg. Pool Slope	110.0