

**MITIGATION PLAN (FINAL)**

**CUTAWHISKIE CREEK STREAM AND WETLAND RESTORATION SITE  
HERTFORD COUNT, NORTH CAROLINA  
CHOWAN RIVER BASIN CATALOGING UNIT 03010204  
CONTRACT NUMBER D06066-A**



**PREPARED FOR:**



**NC DENR - ECOSYSTEM ENHANCEMENT PROGRAM  
1652 Mail Service Center  
Raleigh, North Carolina 27699-16152**

**May 2008**

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CONTRACT NUMBER D06066-A**

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## EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) circulated a request for proposals (RFP) for stream and wetland restoration in the Chowan River Basin. In response to the RFP, Restoration Systems, LLC (RS) is providing approximately 3375 stream mitigation units and 12.3 riparian wetland restoration units at the Cutawhiskie Creek Restoration Site (hereafter referred to as the Site). The Site, which is in the Chowan River Basin (Cataloguing Unit 03010204), is located approximately 9 miles southwest of Murfreesboro (36.3292N, 77.1645W [NAD27]) (Figure 1, Appendix A) in Hertford County, North Carolina. The Site, which is delimited by a conservation easement, encompasses approximately 22.9 acres. The Site is positioned within the floodplains at the confluence of Cutawhiskie Creek and an unnamed tributary to Cutawhiskie Creek (UT). Prior to restoration activities, the Site included approximately 2593 feet of Cutawhiskie Creek, approximately 2080 linear feet of the UT, and approximately 13 acres of restorable wetlands.

### **Pre-Construction Site Conditions**

Cutawhiskie Creek and the UT were dredged in the mid-1960s in accordance with historic agricultural/silvicultural management practices. Impacts resulting from stream alteration include bank erosion, channel incision, and loss of characteristic riffle/pool complex morphology. Natural vegetation within adjacent areas, including stream buffers zones, was removed throughout much of the Site. The floodplain was impacted by deforestation and groundwater draw-down from stream channel dredging activities. A significant increase in nutrient and sediment loading has resulted from these site modifications, and adjacent wildlife habitats have been eliminated or fragmented.

The primary restoration features within the Site include the UT and approximately 13 acres of drained hydric soils within degraded wetlands. The UT has been dredged and straightened, such that it no longer retained stable dimension, pattern, and profile. The presence of hydric soils indicates that riparian wetlands were adjacent to Cutawhiskie Creek and the UT prior to anthropogenic channel impacts. Channel alteration had resulted in hydrologic modifications that effectively drained most of the adjacent wetlands.

### **Restoration Plan**

A restoration plan was developed to restore the historic stream and wetland functions that existed at the Site prior to dredging and forest removal. Site restoration activities included the excavation of a new stream channel, floodplain excavation, removal of stumps and debris, existing channel backfilling and on-site drainage ditch removal, and final grading and soil preparation within the adjacent floodplain. These activities were proposed to reintroduce surface water flood hydrodynamics from a 0.9-square mile watershed along the newly restored length of stream and floodplain. The new channel was constructed to reflect regional stream characteristics and accommodate bankfull flows. Characteristic wetland soil features, groundwater wetland hydrology, and hydrophytic vegetation communities are expected develop in areas adjacent to the constructed channel. Wetland and adjacent slope soil surfaces were restored and the Site reforested to riparian and upland slope hardwood communities. Plant community associations were designed to mimic various communities described by Schafale and Weakley (1990), including Coastal Plain Levee Forest, Cypress-Gum Swamp, Mesic-Mixed Hardwood Forest, and Coastal Plain Small Stream Swamp.

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## Post-Construction Site Conditions

On-site restoration activities provide the following project mitigation units (see Tables 1 and 2 and Figure 2 [Appendix A] for additional details):

- 3418 Stream Mitigation Units (SMU)
  - Priority 1 Stream Restoration: 2540 linear feet (2540 SMU)
  - Passive Stream Restoration (braided channel): 359 linear feet (359 SMU)
  - Stream Preservation: 2593 linear feet (519 SMU)
- 12.5 Riparian Wetland Mitigation Units (WMU)
  - Riparian Wetland Restoration: 11.9 acres (11.9 WMU)
  - Riparian Wetland Enhancement: 1.1 acres (0.6 WMU)

Numerous ecological benefits are anticipated as a result of on-site restoration activities. Stream channel restoration will reintroduce stable bankfull dimension, pattern, and profile along restored stream reaches, which is expected to greatly enhance lotic habitat quality and stream function. Floodplain excavation adjacent to restored streams will restore the characteristic flood regime as well as provide a lateral hydrologic input to restored wetland areas adjacent to the UT and within the greater Cutawhiskie Creek floodplain. Restored and enhanced wetland areas will help to improve water quality via nutrient removal, increase local vegetative biodiversity, provide wildlife habitat, and serve as a forested corridor, linking the Site with adjacent forested areas.

## Monitoring Plan

In order to ensure the Site meets regulatory stream and wetland restoration/enhancement monitoring criteria including stream geomorphology, hydrology, and vegetation will be monitored annually for five years or until success criteria has been achieved.

A longitudinal profile and permanent cross-sections were established to monitor the newly constructed reach of stream channel. Success criteria for stream restoration will include 1) successful classification of enhanced reaches as functioning systems (Rosgen 1996), and 2) channel stability indicative of a stable stream system.

Site groundwater hydrology within wetland restoration areas will be monitored by five (5) auto-logging monitoring gauges. Gauges will be downloaded monthly throughout the growing season. Hydrologic success criteria will be achieved by gauges registering groundwater levels within the upper 12 inches of the soil surface for a minimum number of consecutive days corresponding to at least 12.5 percent of the growing season in Hertford County under normal annual precipitation.

In order to monitor planted vegetation (i.e., bare root seedlings), vegetation monitoring plots have been established within planted portions of Site restoration and enhancement areas. Site vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey (CVS) (CVS-EOP Protocol for Recording Vegetation, Level 1-2 Plot Sampling Only, Version 4.0, 2006). Stem counts of planted species as well as an assessment of planted stem survivability will be performed annually. Vegetative monitoring success criteria will be achieved by plot data indicating an average number of planted stems per acre exceeding 320 stems/acre after the third year of monitoring and 260 stems/acre after the fifth and final year of project monitoring.

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## MITIGATION REPORT

### CUTAWHISKIE CREEK STREAM AND WETLAND RESTORATION SITE HERTFORD COUNT, NORTH CAROLINA CHOWAN RIVER BASIN CATALOGING UNIT 03010204

#### 1.0 INTRODUCTION

Restoration Systems, LLC (RS) has completed stream and wetland restoration construction activities at the Cutawhiskie Creek Stream and Wetland Restoration Site (Site) as stipulated under an agreement with the North Carolina Ecosystem Enhancement Program (NCEEP). The project provides full delivery of 12.3 riverine (riparian) wetland units and 3375 stream mitigation units for the Chowan River Basin (Cataloging Unit 03010204). The Site is located approximately 9 miles southwest of Murfreesboro (36.3292N, 77.1645W [NAD27]) (Figure 1, Appendix A) in Hertford County, North Carolina. The Site encompasses approximately 22.9 acres of primary and secondary floodplain associated with Cutawhiskie Creek and an unnamed tributary (UT). Prior to restoration activities, the Site included approximately 2790 feet of Cutawhiskie Creek, approximately 2080 linear feet of the UT, and approximately 13.3 acres of restorable wetlands.

Cutawhiskie Creek is a third-order stream that is approximately 40 feet wide and 9 feet deep through the on-site reach (Figure 1 and 2, Appendix A). Cutawhiskie Creek was dredged along its entire length in the mid-1960s in accordance with historic agricultural/silvicultural management practices. The side-cast material from dredging activities lines both banks of Cutawhiskie Creek, creating levees approximately 3 to 4 feet in height. The levees are vegetated with mature bottomland hardwood species.

The UT is a first order stream that had also been dredged and straightened, such that it no longer retained stable dimension, pattern, and profile. Prior to construction, side-cast material (spoil piles) from dredging lined the west bank of the channel. The UT varied in depth from approximately 5 feet at the northern-Site boundary to approximately 8 feet at the confluence with Cutawhiskie Creek. Due to its high level of incision, large flooding events were confined within the channel. These high-energy flows which historically would be dissipated within the adjacent floodplain exerted high shear stress on stream banks and intensified erosion.

The headwaters of the UT extends approximately one mile northwest of the Site just north of SR 1158 on the Hertford/Northampton County border. Land-use within the unnamed tributary's approximate 0.9-square mile watershed is comprised primarily of agriculture (row crops), forest (typically pine plantation), and light residential. Land-use within the Cutawhiskie Creek watershed, comprising approximately 18.2 square miles at the Site outfall, is similar, with a higher proportion of light residential and limited commercial and light industrial land-uses.

The table below provides summary information of the two major drainage features present within the Site prior to restoration activities.

<b>Pre-Construction Site Stream Channel Conditions</b>				
<b>Stream</b>	<b>Stream Type (Rosgen 1996)</b>	<b>Drainage Area at Site (mi<sup>2</sup>)</b>	<b>Stream Order (per USGS)</b>	<b>Extent within Site (linear feet)</b>
UT to Cutawhiskie Creek	G5	0.9	1 <sup>st</sup>	2,080
Cutawhiskie Creek	F5	18.2	3 <sup>rd</sup>	2,790

The Site restoration effort included stream channel restoration and preservation, and riparian wetland restoration and enhancement. Priority 1 stream restoration performed along the UT was achieved by excavating an appropriately sized bankfull channel on new location. The new stream was excavated along the existing floodplain such that the stream’s bankfull elevation corresponded to the existing floodplain grade. Some floodplain excavation was required in the upper reaches of the Site to reconnect the stream with the historic floodplain. This excavation minimized the hydrologic impacts upstream and provides quicker flood dissipation in periods of high flow. Flow from the restored stream channel has been directed into the lower floodplain portions of the Site to provide a perennial source of surface and groundwater recharge to the area. Swales and depression have been connected as necessary to facilitate passive channel redevelopment on a historic alluvial fan location.

Wetland restoration was achieved by plugging and backfilling the abandoned stream channel thereby reducing groundwater withdrawal rates and reconnecting surface water flood hydrodynamics for sufficient periods of time to achieve jurisdictional wetland hydrology. Restored wetland areas have been planted with the appropriate suite of native hardwood species to emulate Coastal Plain Small Stream Swamp and Cypress-Gum communities described by Schafale and Weakley (1990). Wetland enhancement was achieved by performing plantings within deforested jurisdictional wetland areas.

On-site restoration activities provide the following project mitigation units (see Tables 1 and 2 and Figure 2 [Appendix A] for additional details):

- 3418 Stream Mitigation Units (SMU)
  - Priority 1 Stream Restoration: 2540 linear feet (2540 SMU)
  - Passive Stream Restoration (braided channel): 359 linear feet (359 SMU)
  - Stream Preservation: 2593 linear feet (519 SMU)
- 12.5 Riparian Wetland Mitigation Units (WMU)
  - Riparian Wetland Restoration: 11.9 acres (11.9 WMU)
  - Riparian Wetland Enhancement: 1.1 acres (0.6 WMU)

## **2.0 RESTORATION SUMMARY**

### **2.1 Project Mitigation Goals**

The restoration concepts developed for the Site follow a watershed approach for stream and wetland design. Therefore, planning took into account the surrounding land-use and management practices that

could realize additional benefits from having an adjacent restoration project in-place. This concept subscribes to the restoration of all ecosystems located within the Site including upland plant communities. Restoration of land form in all areas that fit within the restoration scheme was therefore incorporated into the plan. Restoration activities are expected to provide the following stream and wetland mitigation units.

## 2.2 Restoration Approach

Site restoration activities included stream restoration and preservation and wetland restoration and enhancement. Stream and wetland preservation did not involve active restoration activities and thus is not detailed below; however, Site preservation totals are summarized in Table 1 and depicted on Figure 2 (Appendix A). As-built plans are provided in Appendix B.

**Table 1: Project Mitigation Structure and Objectives**

Project Segment or Reach ID	Mitigation Type	Approach	Mitigation Units Linear Footage (LF) or Acreage (AC)	Stationing	Comment
UT to Cutawhiskie Creek (active restoration)	R	PI	2,540 LF	0+00 – 25+40	
UT to Cutawhiskie Creek (passive restoration)	R	NA	359 LF	NA	Passive restoration through floodplain not stationed. Braided reach measured as straight line distance
Stream Preservation (Cutawhiskie Creek)	P	NA	519 LF	NA	2593 LF actual design units, however only 20 percent is available for SMU
Riparian Wetland Restoration	R	NA	11.9 AC	NA	
Riparian Wetland Enhancement	WE	NA	0.6 AC	NA	1.1 AC actual design units, however only 0.6 LF available as WMU
<i>R = Restoration</i> <i>P = Preservation</i> <i>WE = Wetland Enhancement</i>			<i>PI = Priority 1</i> <i>NA = Not applicable</i>		

### 2.2.1 Stream Restoration

Stream restoration efforts using Priority 1 methodology (Rosgen 1996) were designed to restore a highly degraded stream channel with a stable, meandering stream that approximates the hydrodynamics and stream geometry relative to natural conditions in the Coastal Plain region. Primary activities designed to restore the channel on a new location included floodplain excavation, floodplain preparation and stake out, stream construction, followed by the plugging and backfilling of the existing channel.

Stream restoration activities are designed to restore the former entrenched UT channel with approximately 2540 linear feet of a stable E-type channel configuration. Restoration of this channel will reduce sediment and nutrient loading, introduce natural flooding frequencies within the floodplain,



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increase in-stream habitat including pools and associated micro-habitat, and lower water temperatures resulting from the shading by planted vegetation.

### **2.2.2 Floodplain Excavation**

A new floodplain was excavated in the upper reaches of the Site in order to reconnect the stream with the historic floodplain at an appropriate elevation, and thereby minimizing hydrologic impacts upstream and providing more rapid flood dissipation in periods of high flow. Excess material from the floodplain excavation was stockpiled on-site and used to backfill the existing stream channel and the on-site drainage ditch. The resulting floodplain will provide a relatively level surface that is expected to develop and provide wetland functions. Planting of the floodplain with native vegetation is expected to quickly stabilize and help reduce flow velocities in floodwaters, filter pollutants, and provide wildlife habitat.

### **2.2.3 Floodplain Preparation and Grading**

Preparation of the floodplain and corresponding stream channel corridor included 1) clearing and grubbing stumps and woody debris, 2) minor grading, and 3) plugging and backfilling the on-site drainage ditch. The excavated stumps and woody debris collected as a result of the floodplain preparation were windrowed and burned on-site. Excess material from grading was stockpiled immediately adjacent to the existing stream channel and used as backfill after stream diversion was completed. Following stream diversion all spoil piles areas were graded to the floodplain elevation as specified in the plans.

### **2.2.4 Stream Channel Construction**

Following the floodplain preparation activities, the new channel was constructed to the average width, depth, and cross-sectional area derived from reference streams and regional curves. Stream banks and local belt-width area of constructed channels were immediately matted with coir fiber matting and seeded with temporary grasses. At the completion of channel construction the abandoned channel was plugged and filled with the material from stockpiles soils.

### **2.2.5 Plugs and Backfill of Abandoned Channel**

Following stream diversion, impermeable plugs were installed at regular intervals along the abandoned channel. The plugs consisted of impermeable soils excavated from the adjacent floodplain surface. The remaining portions of the abandoned channel were backfilled using the adjacent spoil material. The backfilled channel sections were filled, compacted, and graded to the approximate elevation of the adjacent floodplain surface.

### **2.2.6 Log Weir Outlet Structures**

Flows from the constructed stream channel dissipate within the floodplain of Cutawhiskie Creek, several feet above the normal water elevation. It is anticipated that the regular flows from the constructed stream channel will rehydrate the hydric soils adjacent to Cutawhiskie Creek. Reducing drainage outflows while conserving water during the growing season is the primary aim for wetland restoration in this area. In order to regulate water from these wetlands into Cutawhiskie Creek, log weir water outlet structures were constructed along the river levee at three locations. The log weir outlets are constructed of multiple, large diameter logs which have been tied together to form a confinement structure that will protect, reinforce, and restrain vegetation, thereby controlling down-slope movement due to hydrodynamic and gravitational forces.

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### **2.2.7 Riparian Wetland Restoration and Enhancement**

The removal of the dredged stream and on-site drainage ditch is expected to restore approximately 11.9 acres of riparian wetlands. These restoration activities should significantly reduce groundwater withdrawal rates and reconnect surface water flood hydrology from an approximately 0.9 square mile watershed onto the floodplain adjacent to approximately 2540 linear feet of Priority 1 stream restoration. Riparian wetland enhancement is expected to occur within 1.1 acres, where jurisdictional status has been verified or in hydric soil areas where wetland models have not indicated wetland loss. Numerous hydrodynamic and riparian hydrodynamic and biogeochemical functions will be restored, including pollutant removal, organic carbon export, sediment retention, nutrient cycling, flood storage, and energy dissipation. Biological functions associated with the riparian system, including in-stream aquatic habitat, structural floodplain habitat, and interspersed and connectivity between the restored stream, floodplain, and adjacent uplands, will also be restored.

### **2.2.8 Plant Community Restoration**

Restoration of riparian and upland buffer forest communities will provide habitat for area wildlife and allow for the development and expansion of characteristic forest species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Plant community restoration within the Site included the planting of approximately 17,375 bare-root specimens consistent with reference data, on-site observations, and community descriptions (Schafale and Weakley 1990).

Revegetating the floodplain and stream banks will provide stream bank stability, shade, cool surface waters, filter pollutants from adjacent runoff, and provide habitat for area wildlife. Scarification of all planting surfaces was provided prior to planting.

## **3.0 MONITORING PLAN**

In order to ensure the Site meets regulatory stream and wetland restoration monitoring criteria, each parameter on-site will be monitored annually for five (5) years or until success criteria has been achieved. Refer to Figures 3A and 3B (Appendix A) for monitoring plan details. As-built plan sheets are provided in Appendix B.

### **3.1 Stream Channel**

To ensure stable bankfull dimension, pattern, and profile along the restored channel, annual stream assessment surveys will be undertaken. A longitudinal profile survey along the entirety of the UT has been established to verify stream profile stability. Six stream channel cross-sections have also been established to monitor any potential instability and adverse changes in channel geometry (see Figures 3A and 3B [Appendix A] for cross-section locations). Measured parameters for future monitoring work will include cross-sectional area, bankfull width, average and maximum bankfull depth, width-to-depth ratio, and substrate size class distribution. Longitudinal profiles and cross-sections will be surveyed annually throughout the 5-year project monitoring period. Channel geomorphic data will be analyzed and presented in the Site's Annual Monitoring Reports. Success criteria for stream restoration and Level 1

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enhancement will include 1) successful classification of the reach as a functioning system (Rosgen 1996), and 2) channel stability indicative of a stable stream system.

Photo points have been established in conjunction with channel cross-sections to further document stability. Additional photo points may be added so that any potential areas of instability will be documented and addressed with remedial maintenance measures. As-built photos points are shown on Figure 3A-B. As-built photos are provided in Appendix C.

### **3.2 Groundwater Hydrology**

Five (5) auto-logging groundwater monitoring gauges have been installed in wetland restoration areas (see Figure 3A-B [Appendix A] for monitoring gauge locations). Gauges will be downloaded monthly throughout the growing season. Hydrologic success criteria will be achieved by registering groundwater levels within the upper 12 inches of the soil surface for a minimum number of consecutive days corresponding to at least 12.5 percent of the growing season in Hertford County under normal annual precipitation. Exceptions will be made if monitoring gauges do not achieve success criteria during documented Site drought conditions.

### **3.3 Vegetation**

Vegetation monitoring (10 X 10m<sup>2</sup>) plots have been established to monitor planted vegetation within Site restoration and enhancement areas. Site vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey (CVS) (CVS-EEP Protocol for Recording Vegetation, Level 1-2 Plot Sampling Only, Version 4.0, 2006). Established vegetation monitoring plot locations are displayed on Figures 3A-B (Appendix A). Plots will be monitored annually, and a stem count of planted species as well as an assessment of survivability of planted stems will be performed. Vegetative monitoring success will be achieved by plot data indicating an average number of planted stems per acre exceeding 320 stems/acre after the third year of monitoring and 260 stems/acre after the fifth and final year of project monitoring.

## **4.0 MAINTENANCE AND CONTINGENCY PLAN**

Restored areas within the Site will be inspected and monitored for a five year monitoring period or until success for all parameters are achieved. Identified problem areas will be noted, photographed, and reported in the yearly monitoring reports. Problem areas may be discussed with EEP staff to determine if remedial maintenance measures should be undertaken.

### **4.1 Stream Contingency Measures**

Stream contingency measures may include but is not limited to 1) structure repair or implementation, 2) repair of dimensions, pattern, or profile variables, and 3) bank stabilization. The method of contingency is dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include failure to a log weir outlet, headcut migration through the Site, or bank erosion.

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### Log Weir Failure

In the event that the log weir outlet structures are compromised, the affected structure(s) will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function as a water confinement structure that will protect, reinforce, and restrain vegetation, thereby controlling down-slope movement due to hydrodynamic and gravitational forces.

### Headcut Migration

In the event that a headcut occurs within the constructed stream, provisions for impeding the 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 or restoring stream geometry variables until stability is achieved. Channel repairs to stream geometry may include backfilling portions of the channel with coarse channel bed material and stabilization of banks with erosion control matting, vegetation transplants, or live stakes.

## **4.2 Hydrology Contingency Measures**

Target hydrological characteristics include saturation or inundation for a minimum of 12.5 percent of the growing season during average climatic conditions. In some instances, the regulatory wetland hydroperiod may include areas that are saturated between 5 and 12.5 percent of the growing season. If wetland parameters are marginal as indicated by vegetation and hydrology monitoring, a jurisdictional determination will be performed in the questionable areas.

Hydrological contingency may require consultation with hydrologists, EEP, and regulatory agencies if wetland hydrology restoration is not achieved. Ground surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain areas that supports jurisdictional wetlands.

## **4.3 Vegetation Contingency Measures**

If vegetation success criteria are not achieved for the planted stem/acre density calculations from combined sample plot data, supplemental plantings will be performed with native tree species approved by the appropriate regulatory agencies (i.e., EEP, United States Army Corps of Engineers, and North Carolina Division of Water Quality). Supplemental plantings will be performed as needed until vegetative success criteria are achieved.

## **5.0 REFERENCES**

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

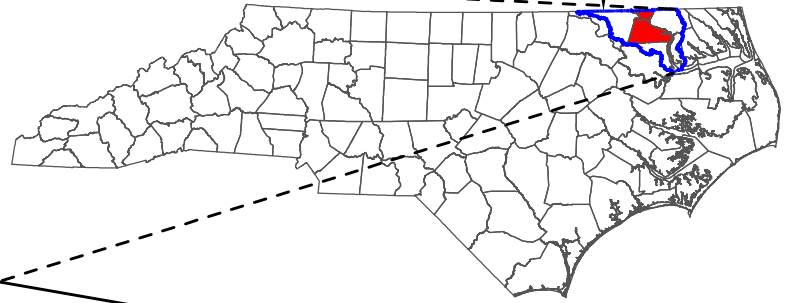
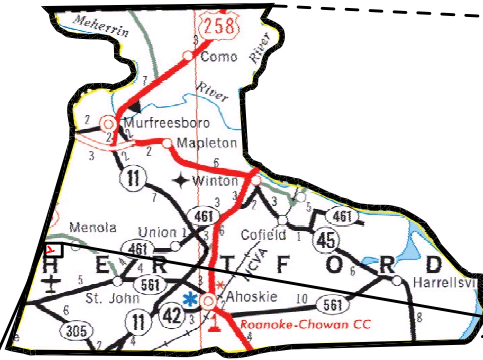
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**APPENDICES**

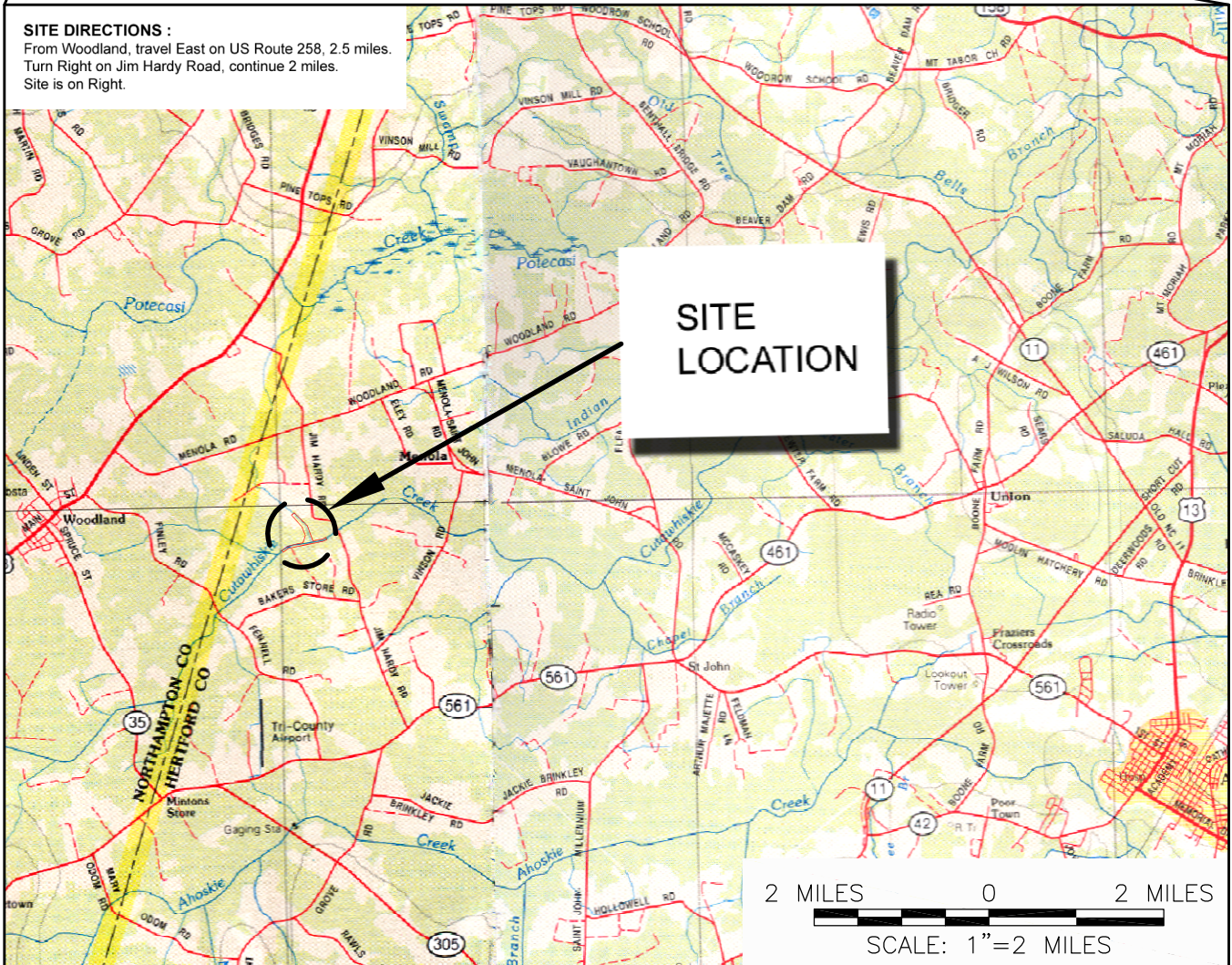
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**APPENDIX A: FIGURES**

CHOWAN RIVER BASIN  
(CU03010204)



**SITE DIRECTIONS :**  
From Woodland, travel East on US Route 258, 2.5 miles.  
Turn Right on Jim Hardy Road, continue 2 miles.  
Site is on Right.



Prepared by:



Project:

**SITE LOCATION  
CUTAWHISKIE CREEK  
RESTORATION SITE  
MITIGATION PLAN**

Hertford County, North Carolina

Dwn. By:

Ckd By:

FIGURE

TAL

JWG

Date:

MARCH 2008

Scale:

AS SHOWN

ESC Project No.:

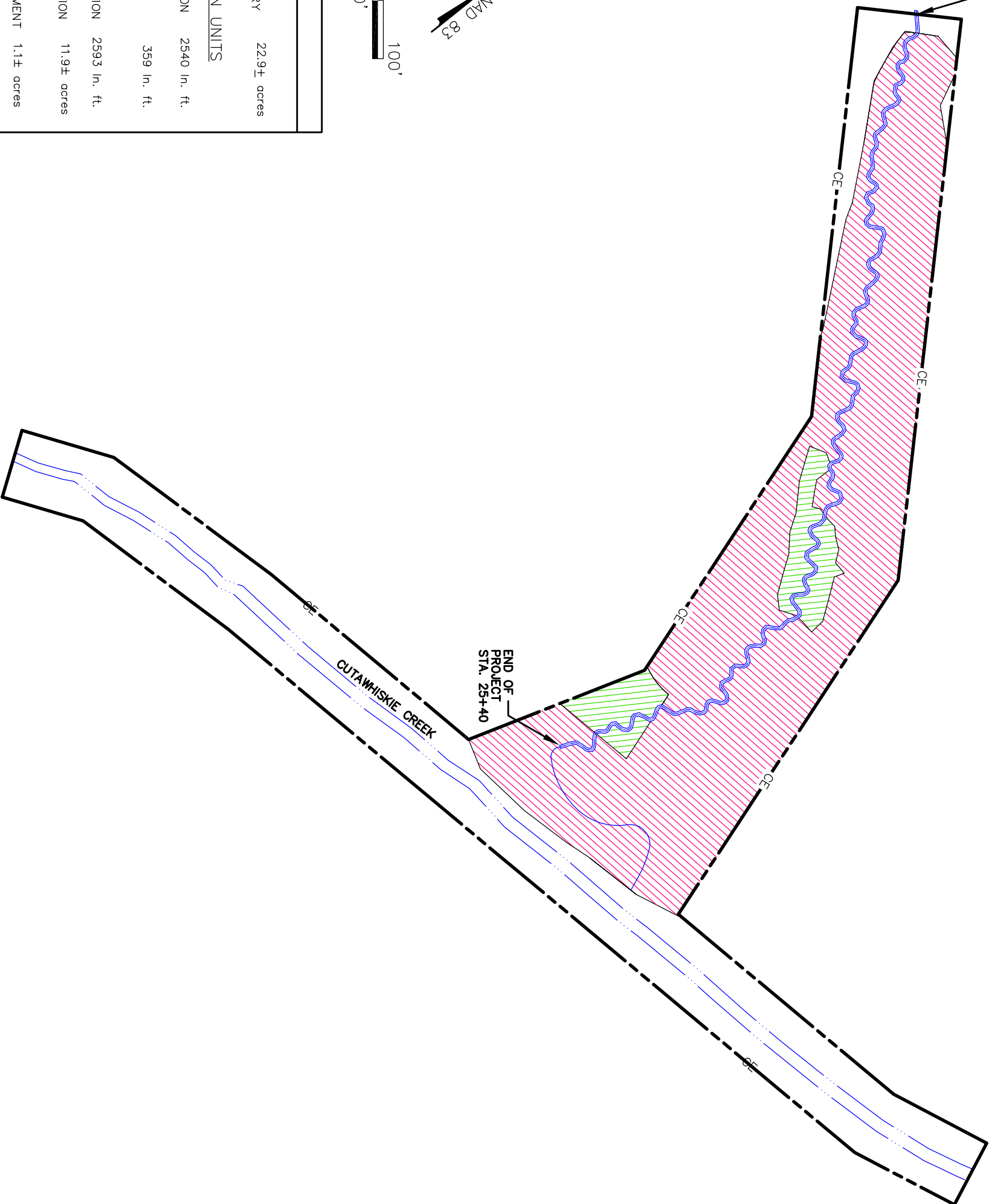
06-306

**1**

BEGINNING OF PROJECT  
STA. 0+00



—CE—	CONSERVATION EASEMENT BOUNDARY	22.9± acres
<b>RESTORATION DESIGN UNITS</b>		
	STREAM RESTORATION	2540 In. ft.
	BRAIDED STREAM RESTORATION	359 In. ft.
	STREAM PRESERVATION	2593 In. ft.
	WETLAND RESTORATION	11.9± acres
	WETLAND ENHANCEMENT	1.1± acres



REVISIONS


Client:



Project:

**CUTAWHISKIE CREEK RESTORATION SITE**

MITIGATION REPORT

HERTFORD COUNTY, NC

Title:

**STREAM AND WETLAND MITIGATION UNITS**

Dwn. By: TAL  
Ckd. By: JWG

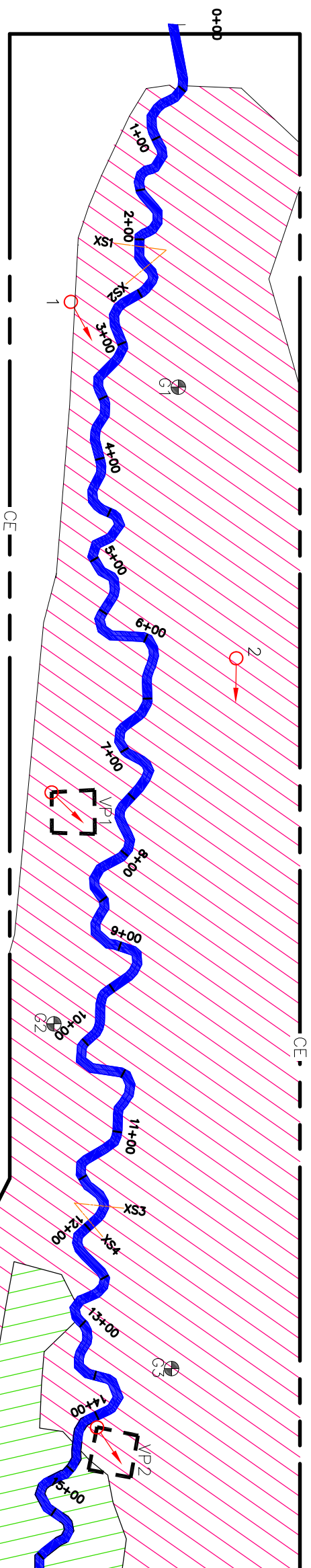
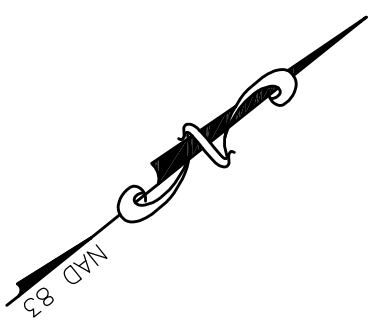
Date: MAR 2008  
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ESC Project No.: 06-306

FIGURE

2



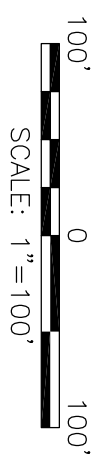


**LEGEND:**

	CONSERVATION EASEMENT BOUNDARY	22.9± acres
<b>RESTORATION DESIGN UNITS</b>		
	STREAM RESTORATION	2540 In. ft.
	BRAIDED STREAM RESTORATION	359 In. ft.
	STREAM PRESERVATION	2593 In. ft.
	WETLAND RESTORATION	11.9± acres
	WETLAND ENHANCEMENT	1.1± acres

**MONITORING SETUP:**

	VEGETATIVE MONITORING PLOT (5)
	GROUNDWATER MONITORING GAUGE (5)
	PERMANENT CROSS-SECTIONS (6)
	PERMANENT PHOTO POINT (8)



MATCHLINE (SEE SHEET 3B)



REVISIONS


Client:



Natural Resources Restoration & Conservation

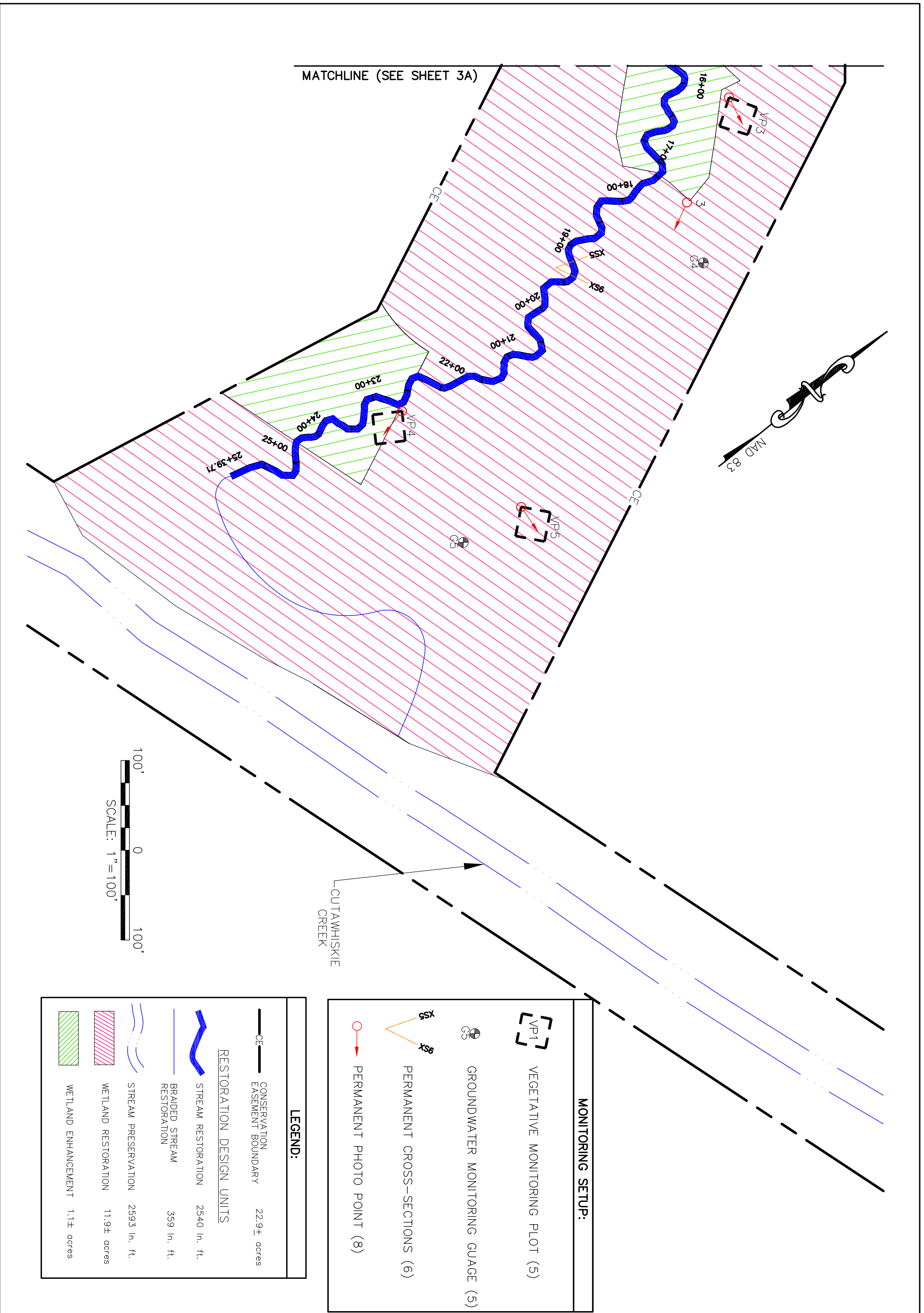
**Project:**  
CUTAWHISKIE CREEK RESTORATION SITE

**MITIGATION REPORT**  
HERTFORD COUNTY, NC

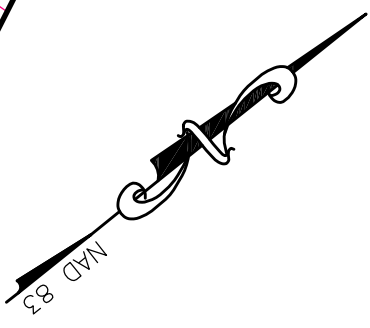
**Title:**  
MONITORING PLAN

**Dwn. By:** TAL  
**Ckd. By:** JWG  
**Date:** MAR 2008  
**Scale:** AS SHOWN  
**ESC Project No.:** 06-306

FIGURE  
**3A**



MATCHLINE (SEE SHEET 3A)



CUTAWHISKIE CREEK

LEGEND:	
	CONSERVATION EASEMENT BOUNDARY 22.9± acres
RESTORATION DESIGN UNITS	
	STREAM RESTORATION 2540 In. ft.
	BRAIDED STREAM RESTORATION 359 In. ft.
	STREAM PRESERVATION 2593 In. ft.
	WETLAND RESTORATION 11.9± acres
	WETLAND ENHANCEMENT 1.1± acres

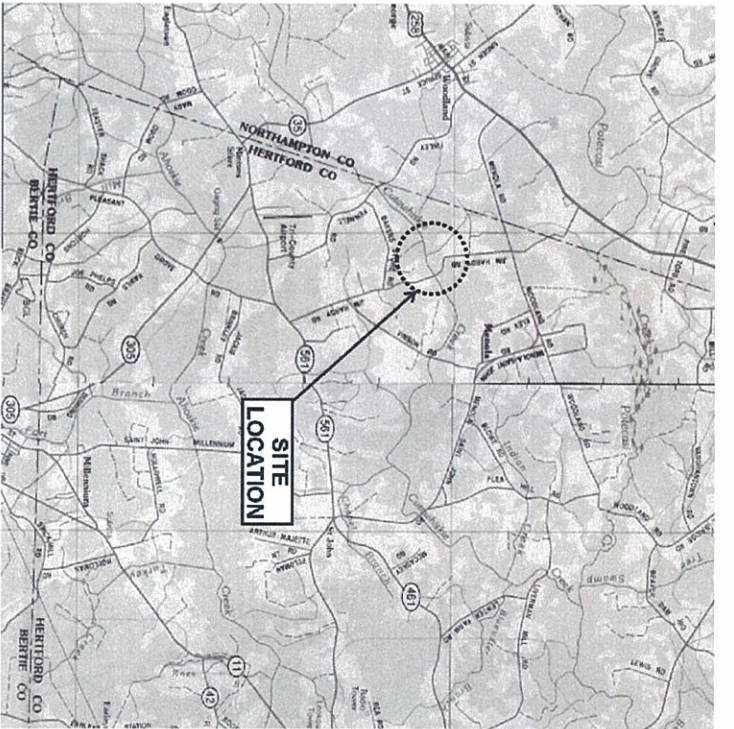
MONITORING SETUP:	
	VEGETATIVE MONITORING PLOT (5)
	GROUNDWATER MONITORING GAUGE (5)
	PERMANENT CROSS-SECTIONS (6)
	PERMANENT PHOTO POINT (8)

 EcoScience A Division of <b>PBS&amp;J</b>	REVISIONS <table border="1"> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> <tr><td> </td><td> </td></tr> </table>																
Client: Restoration Systems, LLC Natural Resources Restoration & Conservation	Project: <b>CUTAWHISKIE CREEK RESTORATION SITE</b> MITIGATION REPORT HERTFORD COUNTY, NC																
Title: <b>MONITORING PLAN</b>	Dwn. By: TAL Cld. By: JWG Date: MAR 2008 Scale: AS SHOWN ESC Project No.: 06-306																
FIGURE <b>3B</b>																	

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**APPENDIX B: AS-BUILT PLANS**

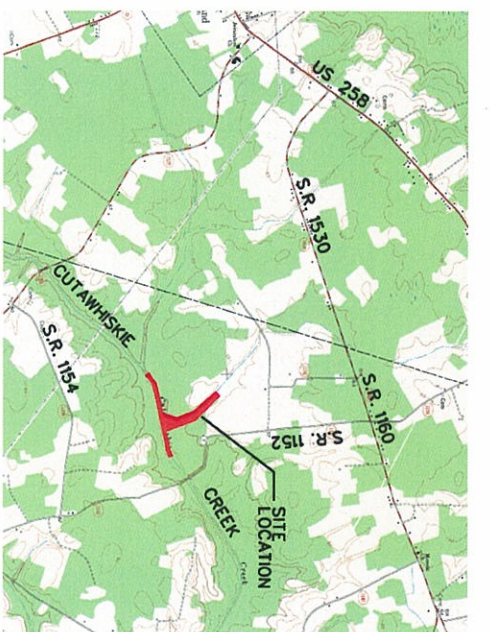
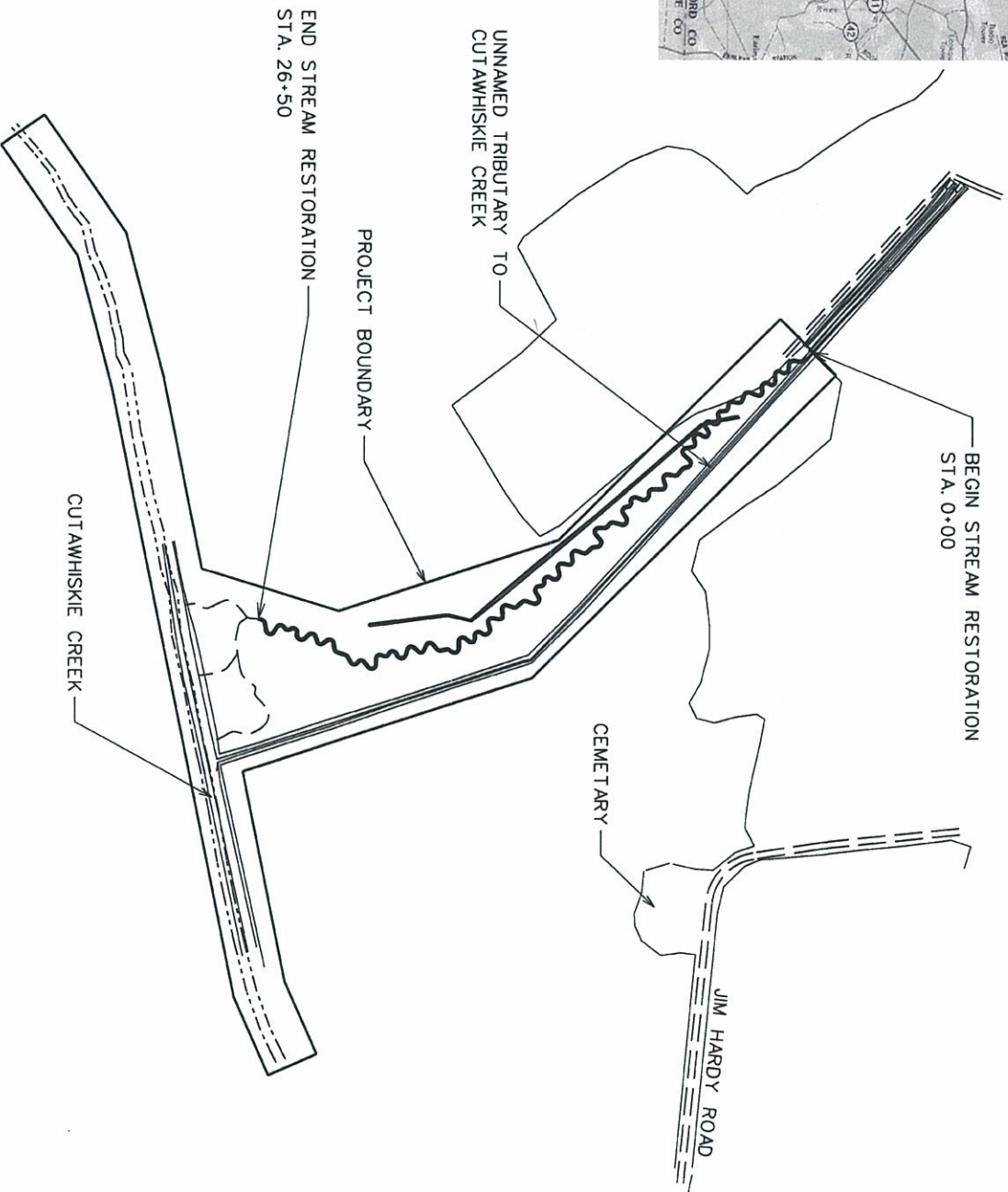
# PROJECT: CUTAWHISKIE CREEK STREAM & WETLAND RESTORATION



LOCATION MAP  
NOT TO SCALE

## CUTAWHISKIE CREEK STREAM AND WETLAND RESTORATION AS-BUILT

HERTFORD COUNTY, NC



VICINITY MAP  
NOT TO SCALE

LOCATION : HERTFORD COUNTY  
SITE IS LOCATED APPROXIMATELY 9 MILES  
SOUTHWEST OF MURFREESBORO

- TYPE OF WORK: STREAM AND WETLAND RESTORATION**
- STREAM RESTORATION
  - WETLAND RESTORATION
  - SITE GRADING
  - SITE PLANTING
  - EROSION AND SEDIMENT CONTROL

SITE AREA

23.9 ± ACRES

DISTURBED AREA

14.0 ± ACRES

FOREST PLANTING

18.0 ± ACRES

Prepared for:

**RESTORATION SYSTEMS**  
RALEIGH, NORTH CAROLINA

Prepared in the office of:



**EcoScience Corporation**  
1101 Haynes St., Suite 101  
Raleigh, North Carolina 27604  
Ph: 919 828-3433  
Fax: 919 828-3518

SEAL:

Drawn By:	JWG	Checked By:	GWN	Old By:	EBB
Date:	MAR 2008				

SHEET

1

No.	Revisions	Date

PROJECT ENGINEER

E. BRIAN BURKHART

PROJECT MANAGER

JENS W. GERATZ

PROJECT NUMBER

06-306

# INDEX OF SHEETS

# CONSTRUCTION SEQUENCING

- 1: TITLE SHEET
- 1A: INDEX OF SHEETS  
GENERAL NOTES  
CONSTRUCTION SEQUENCE  
ELEMENT SYMBOLOLOGY
- 2: TYPICAL SECTIONS
- 2A: GENERAL DETAILS
- 3: SUMMARY OF QUANTITIES
- 4: EXISTING CONDITIONS
- 5A, 5B: NEW CHANNEL LAYOUT
- 5C: NEW CHANNEL LINE DATA
- 6A, 6B: OVERALL SITE PLAN
- 7: PLANTING PLAN
- 8: **AS-BUILT LONGITUDINAL PROFILE**
- EC1, EC2: EROSION CONTROL PLAN
- EC3: EROSION CONTROL DETAILS
- X-1, X-2: CROSS SECTIONS
- X-3: **AS-BUILT CROSS SECTIONS**

## GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING STANDARDS:
  - A) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES," DATED JANUARY 2006, AND ANY SUPPLEMENTS THERETO ISSUED PRIOR TO THE DATE OF CONSTRUCTION.
  - B) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION: "ROADWAY STANDARD DRAWINGS, ENGLISH" DATED JANUARY 2006, AND ANY SUPPLEMENTS ISSUED THERETO PRIOR TO THE DATE OF CONSTRUCTION.
2. THE CONTRACTOR SHALL FIELD-VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO ANY CONSTRUCTION.
3. ALL CONSERVATION EASEMENT CORNER MARKERS SHALL BE PLACED BY OTHERS.
4. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR SITE SAFETY ASSOCIATED WITH THE WORK UNDER THIS CONTRACT AND FOR COMPLIANCE WITH ALL FEDERAL, STATE, AND LOCAL HEALTH AND SAFETY LAWS, CODES, REGULATIONS, AND ORDINANCES INCLUDING BUT NOT LIMITED TO THOSE CURRENTLY MANDATED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).
5. THE CONTRACTOR IS RESPONSIBLE FOR ANY DISTURBANCE OR DAMAGE TO EXISTING UTILITIES AND SHALL BE FINANCIALLY RESPONSIBLE FOR ANY DAMAGES THAT MAY OCCUR.
6. ALL DISTURBED AREAS ABOVE THE BANKFULL STAGE/TOP OF BANK SHALL BE SEEDED WITH TEMPORARY OR PERMANENT SEEDING AND MULCH, AS REQUIRED.
7. ALL DISTURBED AREAS BELOW THE BANKFULL BENCH SHALL BE PERMANENTLY SEEDED AND COVERED WITH FIBER COIR MATTING.
8. THE EXISTING CHANNEL SHALL BE PLUGGED AND FILLED TO THE MAXIMUM EXTENT FEASIBLE WITH MATERIAL EXCAVATED FROM ON-SITE SOURCES AND STOCKPILED ADJACENT TO REACHES OF THE CHANNEL OR ALONG DITCHES TO BE BACKFILLED. FLOODPLAIN POOLS MAY BE EXCAVATED TO PROVIDE ADDITIONAL BACKFILL MATERIAL, AS REQUIRED. DISTURBANCES SHALL BE PROTECTED IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
9. TEMPORARY SILT FENCE SHALL BE PLACED BETWEEN STOCKPILE LOCATIONS AND THE EXISTING CHANNEL AND SHALL BE INSTALLED ACCORDING TO THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
10. THE CONTRACTOR MAY UTILIZE THE DESIGNATED STAGING AREA AND THE AREA INSIDE THE PROPOSED CONSERVATION EASEMENT FOR STAGING AND STOCKPILING EQUIPMENT AND MATERIALS.
11. GROUND COVER ON EXPOSED SLOPES SHALL BE ESTABLISHED WITHIN 21 CALENDAR DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. PERMANENT COVER SHALL BE ESTABLISHED ON ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION.

1. VERIFY THE CONSERVATION EASEMENT BOUNDARY CORNERS AND SITE ACCESS.
2. MOBILIZE EQUIPMENT AND MATERIALS TO SITE. SITE ACCESS WILL BE RESTRICTED TO THE PATH SHOWN ON PAGE 6A. THIS ACCESS ROUTE WILL PROVIDE FOR LIMITED USAGE INCLUDING HEAVY EQUIPMENT, FUEL TRUCK, AND MATERIAL DELIVERIES. DAILY TRAFFIC PARKING IS DIRECTED TO LOCATIONS ON JIM HARDY ROAD OR AS OTHERWISE DIRECTED BY THE CONSTRUCTION MANAGER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ON-GOING REPAIRS TO THE ACCESS ROUTE THROUGHOUT THE CONSTRUCTION PERIOD.
3. LOCATE STAGING AREA AS DEPICTED ON THE PLANS OR AS DIRECTED BY THE CONSTRUCTION MANAGER, AND MARK CONSTRUCTION EQUIPMENT ACCESS LOCATIONS WITH VISIBLE MARKERS. CONSTRUCTION EQUIPMENT SHALL BE CONTAINED WITHIN THE PROJECT LIMITS AS DEPICTED ON THE PLANS OR AS SPECIFIED BY THE CONSTRUCTION MANAGER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ANY STAGING AREA IN AN ENVIRONMENTALLY SENSITIVE MANNER.
4. INSTALL TEMPORARY EROSION CONTROL MEASURES AS SHOWN ON SHEETS EC1 AND EC2, AND AS DIRECTED BY THE CONSTRUCTION MANAGER. TEMPORARY SILT FENCE WILL BE INITIALLY PLACED DIRECTLY ALONG THE WESTERN BANK OF THE EXISTING STREAM CHANNEL AND ALONG THE NORTH BANK OF CUTAWHISKE CREEK. AT THE END OF EACH DAY'S CONSTRUCTION WORK, THE CONTRACTOR WILL SEED ALL DISTURBED AREAS. IN ADDITION, THE CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING ALL TEMPORARY EROSION CONTROL MEASURES ON A DAILY BASIS THROUGHOUT THE CONSTRUCTION PERIOD. NO CONSTRUCTION SHALL COMMENCE UNTIL THE EROSION CONTROL MEASURES ARE INSTALLED ACCORDING TO THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. CLEAR AND GRUB VEGETATION WITHIN THE CLEARING LIMITS ONLY AS NEEDED TO COMPLETE THE PROJECT IN AN EFFICIENT MANNER AND AS DIRECTED BY THE CONSTRUCTION MANAGER. LARGE TREES, PARTICULARLY THOSE OVER ONE (1) FOOT IN DIAMETER, WILL BE SAVED AND PROTECTED FROM DAMAGE TO THE EXTENT FEASIBLE. STUMPS AND ROOTS SHALL BE LEFT IN PLACE WHEN POSSIBLE. GRUBBING WILL ONLY BE REQUIRED IN EXCAVATED AREAS. STOCKPILED VEGETATIVE DEBRIS MAY BE SCATTERED AROUND THE SITE TO INCREASE OPPORTUNITIES FOR WILDLIFE HABITAT.
6. BEGINNING AT THE NORTHERN END OF THE SITE, THE CONTRACTOR SHALL GRADE THE FLOODPLAIN AS SHOWN ON SHEETS 6A, 6B, X1, AND X2. STOCKPILE SOIL MATERIAL ADJACENT TO THE EXISTING CHANNEL OR AS DIRECTED BY THE CONSTRUCTION MANAGER TO BE USED FOR FUTURE BACKFILL OPERATIONS. STOCKPILE AREAS SHALL BE PROTECTED BY TEMPORARY SILT FENCE AS APPROPRIATE.
7. FOLLOWING CHANNEL STAKE OUT, STREAM CONSTRUCTION SHALL BEGIN FROM STATION 26+50 AND PROCEED IN THE UPSTREAM DIRECTION, TERMINATING AT APPROXIMATELY STATION 0+20. STREAM CHANNEL CONSTRUCTION SHALL CONSIST OF CHANNEL EXCAVATION, MINOR FLOODPLAIN ADJUSTMENTS, BACKFILLING EXISTING DITCH, AND PLACEMENT OF COIR FIBER EROSION CONTROL MATTING. CONSTRUCTION SHALL PROCEED IN THE DRY, WITH WATER FLOW REMAINING IN THE EXISTING CHANNEL.
8. IN AREAS WHERE SOIL SURFACES HAVE BEEN COMPACTED, RIPPING OR SCARIFICATION SHALL BE PERFORMED TO THE SATISFACTION OF THE CONSTRUCTION MANAGER. SOIL SURFACE SHOULD BE LEFT ROUGH WITH A HIGH DEGREE OF VARIABILITY. ALL DISTURBED AREAS SHALL BE STABILIZED WITH A PERMANENT SEEDING MIX AS SHOWN ON SHEET EC3.
9. CONSTRUCT THE BRADED CHANNEL SECTIONS AND PERFORM LOCALIZED GRADING PER THE DIRECTION OF THE CONSTRUCTION MANAGER. THE CONTRACTOR SHALL PERFORM THE GRADING WORK PROPOSED AND SHOWN ON SHEET 6B TO DIRECT FLOW IN A DIFFUSE AND SOUTHERLY MANNER TOWARD THE LOG WEIRS. THE CONTRACTOR SHALL ENSURE POSITIVE DRAINAGE WITHIN ALL PROPOSED ALIGNMENTS AND DRAINAGES.
10. PER THE CONSTRUCTION MANAGER, LOCATE AND CONSTRUCT THE THREE LOG WEIRS LOCATED ADJACENT TO CUTAWHISKE CREEK (SHEET 6B). FOLLOWING THE DETAIL ON SHEET 2A, THE LOGS SHALL BE Laid IN A SHALLOW PREPARED TROUGH AND SECURED WITH PILING BETWEEN SUCCESSIVE LOGS. THE END OF THE LOG WEIRS SHALL BE LEFT INTO THE EXISTING EMBANKMENT, OR EMBANKMENT APPLIED TO THE END OF EACH WEIR, WHICHEVER IS APPROPRIATE. THE EMBANKMENT AND OUTFALL SLOPE SHALL BE SEEDED AND MATTED WITH COIR FIBER EROSION CONTROL MATTING.
11. FOLLOWING THE COMPLETION AND STABILIZATION OF THE NEW CHANNEL, INSTALL TEMPORARY SILT FENCE WEST OF THE BERM AND STOCKPILED MATERIAL THAT IS LOCATED DIRECTLY ADJACENT TO THE EXISTING CHANNEL. INSTALL DITCH PLUG AT STATION 0+50 TO DIVERT STREAM. INSTALL PLUG AT CONFLUENCE WITH CUTAWHISKE CREEK. USE PUMP AND SPECIAL STILLING BASIN TO COMPLETELY DEWATER EXISTING CHANNEL. ONCE THE CHANNEL IS DRY, INSTALL THE REMAINING DITCH PLUGS AND BACKFILL REMAINING CHANNEL. USE EXCAVATED MATERIAL FROM THE NEW CHANNEL AND FLOODPLAIN EXCAVATION, AND EXISTING SIDE-CAST MATERIAL, TO BACKFILL THE OLD CHANNEL TO THE EXTENT FEASIBLE.
12. AT THE DISCRETION OF THE CONSTRUCTION MANAGER, THE CONTRACTOR MAY UTILIZE ADDITIONAL BORROW MATERIAL FROM THE FLOODPLAIN (I.E., CREATING FLOODPLAIN POOLS).
13. ONCE AGAIN, IN AREAS WHERE SOIL SURFACES HAVE BEEN COMPACTED, RIPPING OR SCARIFICATION SHALL BE PERFORMED TO THE SATISFACTION OF THE CONSTRUCTION MANAGER. SOIL SURFACE SHOULD BE LEFT ROUGH WITH A HIGH DEGREE OF VARIABILITY. ALL DISTURBED AREAS SHALL BE STABILIZED WITH A PERMANENT SEEDING MIX.
14. INSTALL ALL TREE AND SHRUB SPECIMENS. PLANTINGS SHALL FOLLOW THE SPECIFICATIONS AS OUTLINED ON THE PLANTING PLAN (SHEET 7) AND SHALL BE SUPERVISED BY A CERTIFIED FORESTER OR SIMILAR.
15. ONCE ALL DISTURBED AREAS HAVE BEEN ESTABLISHED WITH STABLE VEGETATION, THE CONTRACTOR SHALL REMOVE ANY REMAINING EROSION CONTROL MEASURES. REMOVE ANY STONE AND FILTER FABRIC AND SCARIFY ANY COMPACTED AREAS TO THE SATISFACTION OF THE CONSTRUCTION MANAGER. ALL DISTURBED PORTIONS OF THE SITE WILL BE SEEDED, MULCHED AND STABILIZED.

## NOTE:

ALL ELEVATIONS, GRADING, AND CONSTRUCTION CONTROL POINTS WERE DERIVED FROM TOPOGRAPHIC MAPPING PROVIDED TO ECOSCIENCE CORPORATION BY THE OWNER. THE GRADING PLAN AND SPECIFIED ELEVATIONS AS SHOWN ARE RELATIVE TO THIS TOPOGRAPHIC MAPPING. TOPOGRAPHIC MAP DISCREPANCIES IDENTIFIED AS A RESULT OF FIELD SURVEYS DURING CONSTRUCTION MAY BE ADJUSTED AT THE DISCRETION OF THE CONSTRUCTION MANAGER.



### REVISIONS

No.	Description

### Client:

RESTORATION SYSTEMS  
RALEIGH, NC

### Project:

CUTAWHISKE CREEK  
STREAM AND  
WETLAND  
RESTORATION  
SITE

### AS-BUILT

HERTFORD COUNTY,  
NORTH CAROLINA

INDEX OF SHEETS/  
GENERAL NOTES/  
CONSTRUCTION SEQUENCE

Drawn By: JWG Date: T.A.L.  
Checked By: EBB Date: MAR 2008

Scale: NO SCALE


ESC Project No.: 06-306

SHEET

1A

# ECOSCIENCE CORPORATION ELEMENT SYMBOLOLOGY

## TOPOGRAPHY & HYDROGRAPHY

MAJOR CONTOUR	..... 650 .....
MINOR CONTOUR	-----
GRAVEL /DIRT ROAD	=====
PAVED ROAD	=====
WETLAND /SWAMP	
DIRECTION OF FLOW	--->---
EXISTING STREAM	-----
EXISTING WETLAND BOUNDARY	---WLB---
HIGH QUALITY WETLAND BOUNDARY	---HQ WLB---
MEDIUM QUALITY WETLAND BOUNDARY	---MQ WLB---
LOW QUALITY WETLAND BOUNDARY	---LQ WLB---
PROPOSED WETLAND BOUNDARY	---WLB---
SPOT ELEVATION	+ 648







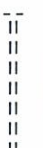





## BOUNDARIES, PROPERTIES, AND EASEMENTS

COUNTY LINE	-----
CITY LINE	-----
PROPERTY LINE	---P---
EXISTING IRON PIN	⊙ EIP
RIGHT OF WAY	---R/W---
PROPERTY MONUMENT	Ⓜ
PARCEL NUMBER	⑥
BENCHMARK	BM3500Δ
NCDOT MONUMENT	Ⓜ BL-5
UTILITY EASEMENT	---E---
POWER LINE	---P---
EXISTING EASEMENT	---E---
PROJECT BOUNDARY	-----






## VEGETATION

SINGLE TREE	
EXISTING WOODS LINE	
PROPOSED CLEARING LIMITS	-----




















## BUILDINGS & OTHER STRUCTURES

BUILDINGS	
WELL	⊙
BRIDGE	
BOX CULVERT OR TUNNEL	
CULVERT	
BRIDGE WING WALL, HEAD WALL, AND END WALL	
HEAD AND END WALL	
PIPE CULVERT	
FOOTBRIDGE	
DRAINAGE BOXES	
EXISTING FENCE	---x---x---
POWER POLE	•
TELEPHONE POLE	⊕
LIGHT POLE	⊗
POWER LINE TOWER	⊗
SANITARY SEWER MANHOLE	Ⓜ
STORM SEWER MANHOLE	Ⓜ
SANITARY SEWER	---SS---SS---
STORM SEWER	---S---S---
FOOTBRIDGE	
TRAIL, FOOTPATH	
RAIL ROAD	

## EROSION CONTROL SHEETS

TEMPORARY ROCK CHECK DAM	
TEMPORARY ROCK SILT CHECK	
TEMPORARY STONE OUTLET	
TEMPORARY SILT FENCE	---sf---
TEMPORARY DIVERSION DITCH	
TEMPORARY SPECIAL STILLING BASIN	
LIMITS OF DISTURBANCE	-----

## PROPOSED FEATURES AND STRUCTURES

CROSS-VANE	
RADIUS OF CURVATURE CENTER MARK	+R2
CHANNEL CROSSING	
MODIFIED CROSS-VANE	
J-HOOK VANE	
STEP CROSS-VANE	
LOG VANE	
LOG WEIR	
ROOT WAD	
TEMPORARY STAGING AREA, SOIL STOCKPILING	
NEW CHANNEL	
BORROW AREA	
CHANNEL BACKFILL	
GRADE CONTROL SILL	
MEANDER REVETMENT	
RIPRAP APRON	
IMPERVIOUS CHANNEL PLUG	
TOP OF RIFLE	ⓂTR1
BOTTOM OF RIFLE	ⓂBR1
CONSTRUCTED BERM	
PROPOSED WOVEN WIRE FENCE	
PROPOSED BARBED WIRE FENCE	
PROPOSED SAFETY FENCE	---//---
PROPOSED MAJOR CONTOURS	---755---
PROPOSED MINOR CONTOURS	-----
PROPOSED ACCESS ROAD	-----

REVISIONS


Client:

RESTORATION SYSTEMS  
RALEIGH, NC

Project:

CUTAWHISKIE CREEK  
STREAM AND WETLAND  
RESTORATION SITE

AS-BUILT

HERTFORD COUNTY,  
NORTH CAROLINA

Title:

ELEMENT SYMBOLOLOGY

Desn By:      Dwn By:

JWG              GWN

Clad By:

DATE:      MAR 2008

Scale:

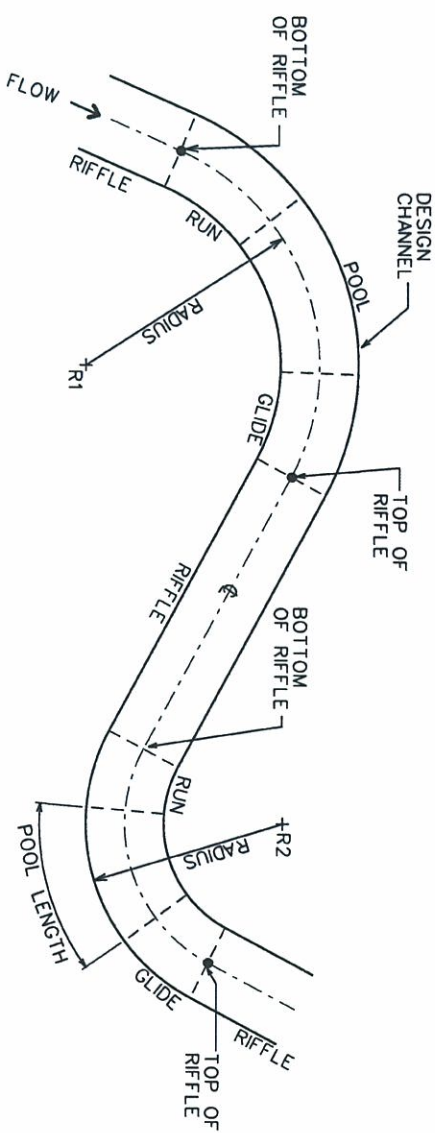
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ESC Project No.:

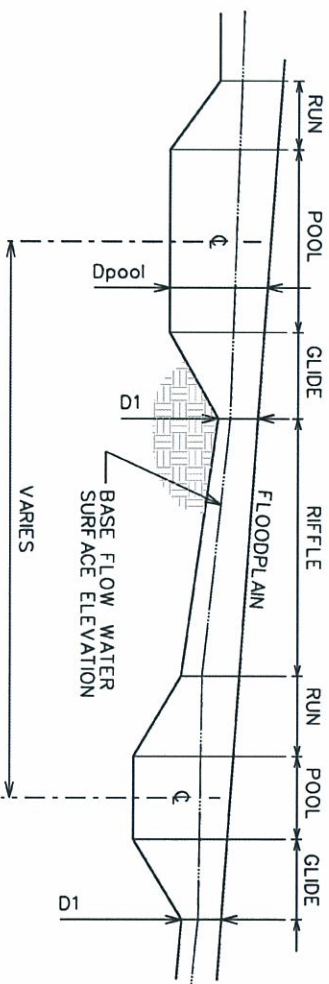
06-306

SHEET

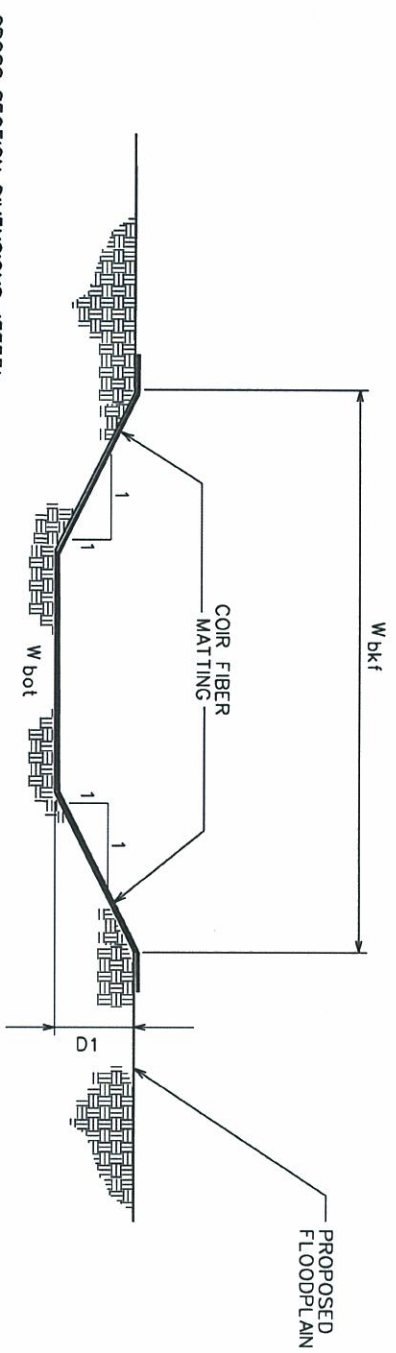
1B



**TYPICAL CHANNEL PLAN VIEW**



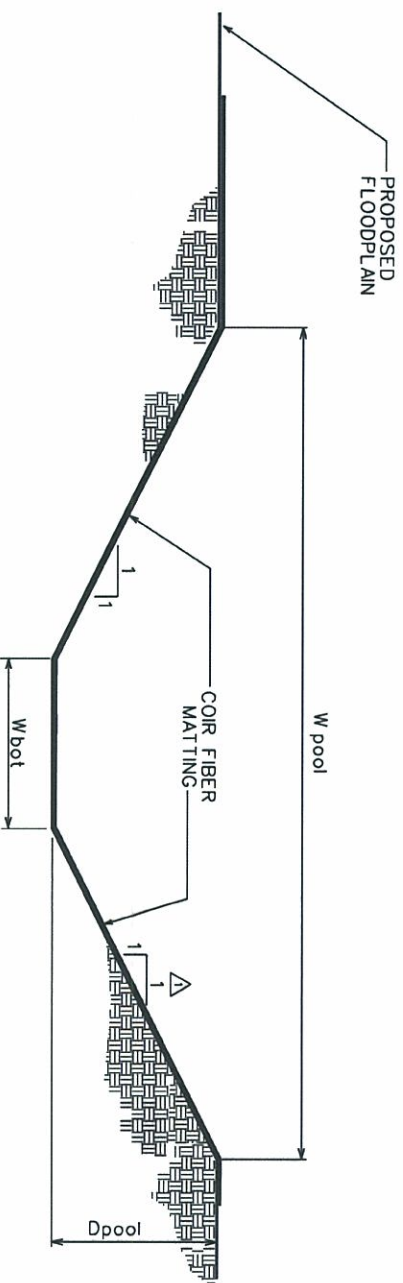
**TYPICAL CHANNEL PROFILE**



**CROSS-SECTION DIMENSIONS (FEET)**

W <sub>bkf</sub>	D <sub>1</sub>	W <sub>bot</sub>
7.0	2.0	3.0

**TYPICAL RIFFLE CROSS-SECTION**



**CROSS-SECTION DIMENSIONS (FEET)**

W <sub>pool</sub>	W <sub>bot</sub>	D <sub>pool</sub>
8	3.5	3.0

**TYPICAL POOL CROSS-SECTION**

REVISIONS

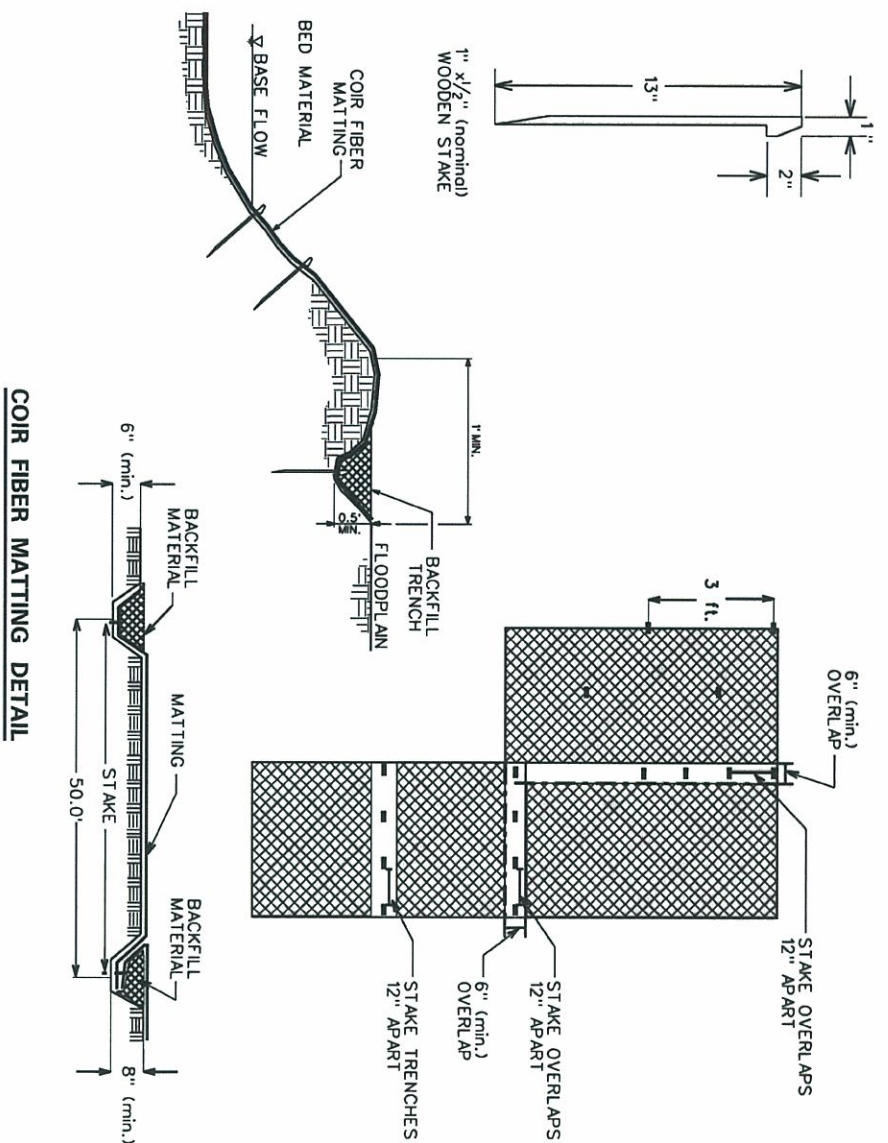

Client:  
**RESTORATION SYSTEMS**  
RALEIGH, NC

Project:  
**CUTAWHISKIE CREEK  
STREAM AND WETLAND  
RESTORATION SITE**  
**AS-BUILT**  
HERTFORD COUNTY,  
NORTH CAROLINA

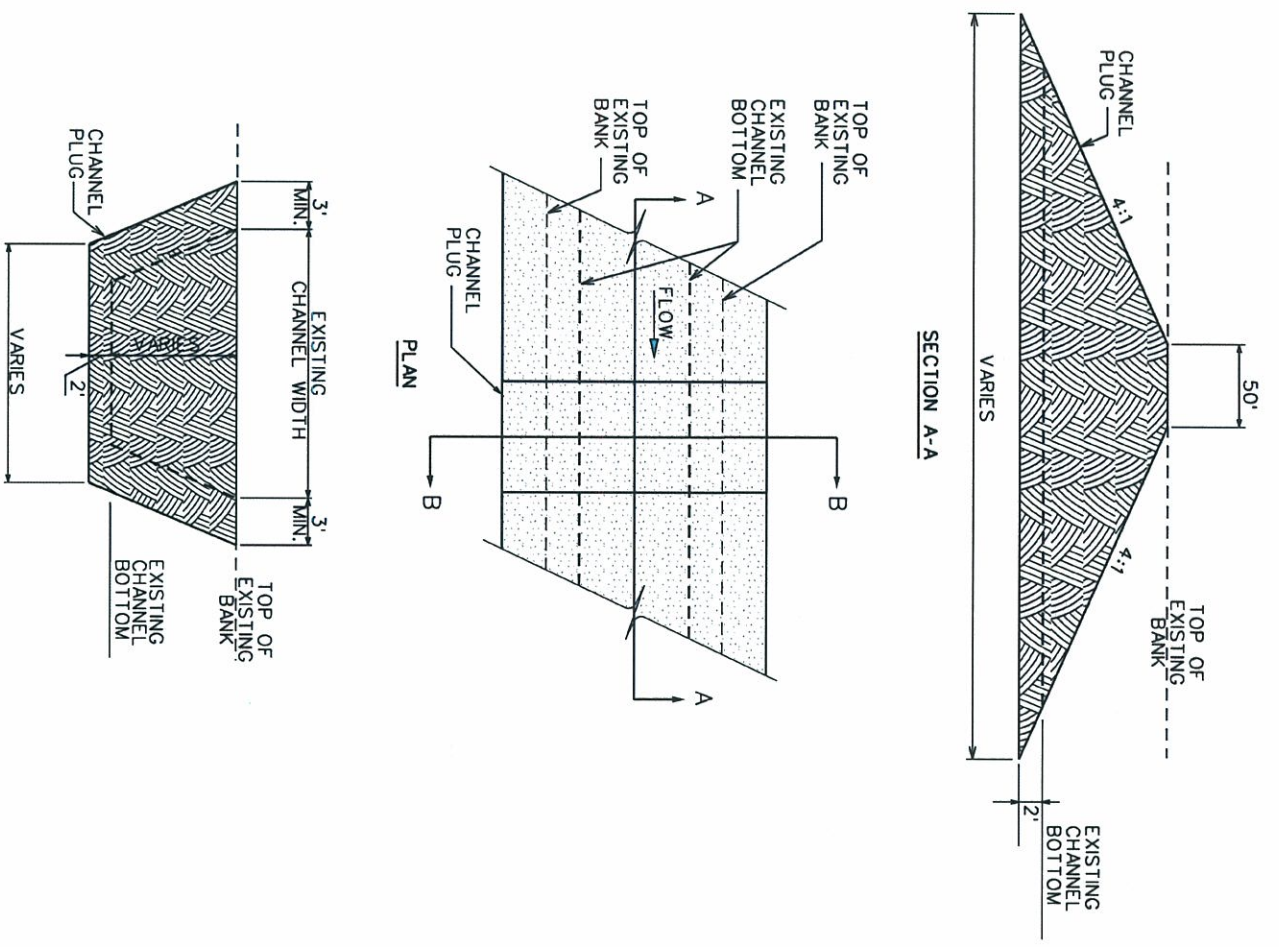
Title:  
**GENERAL DETAILS**

Des. By: JWG  
Date: MAR 2008  
GWN  
Scale: NOT TO SCALE  
ESC Project No.: 06-306

SHEET  
**2A**

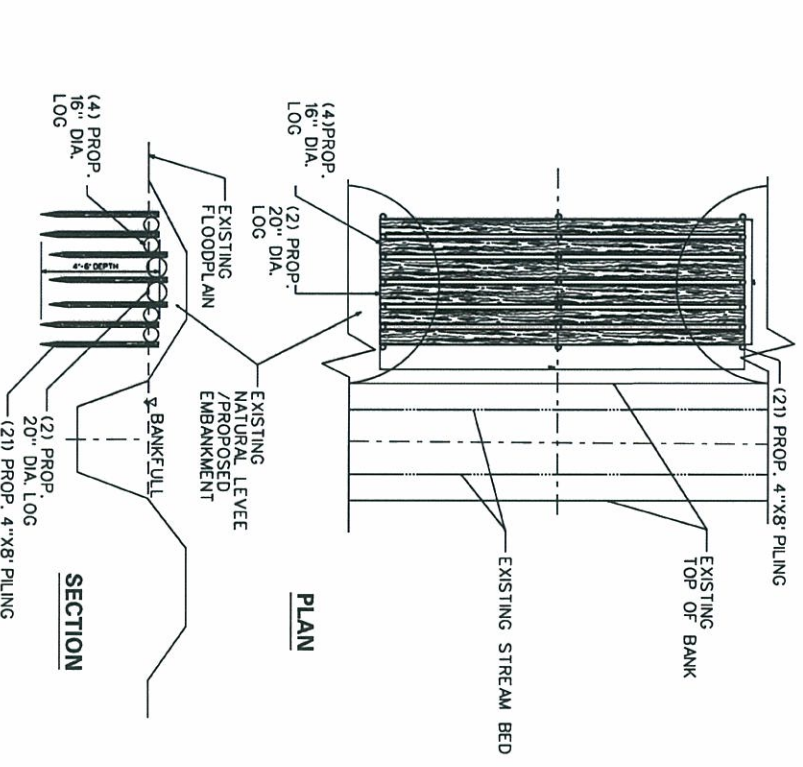


**COIR FIBER MATTING DETAIL**



**IMPERVIOUS CHANNEL PLUG**

- CHANNEL PLUG NOTES:
1. CHANNEL PLUGS TO BE LOCATED AS SHOWN ON PLAN SHEETS 6A AND 6B AND AT OTHER LOCATIONS AS DIRECTED BY THE CONSTRUCTION MANAGER.
  2. CHANNEL PLUG MATERIAL SHALL BE OBTAINED FROM SELECT IMPERVIOUS MATERIAL FROM ON-SITE AND APPROVED BY THE CONSTRUCTION MANAGER.
  3. SOIL SHALL BE COMPACTED TO 95% OF STANDARD PROCTOR.
  4. THE IMPERVIOUS CHANNEL PLUG WILL BE KEYED INTO THE ORIGINAL BANK A MINIMUM OF 3 FEET AND INTO THE ORIGINAL BED A MINIMUM OF 2 FEET.



**LOG WEIR DETAIL**

1. LOGS TO BE UNTREATED LOCAL HARDWOOD SPECIES.
2. PILES TO BE UNTREATED PENCIL-SHARPENED POSTS.
3. PILES TO BE CONNECTED TO LOGS USING REBAR TIE ROD OR DUCK BILL / CABLE SYSTEM.
4. LOG WEIR WILL BE KEYED INTO EXISTING LEVEE OR PROPOSED EMBANKMENT A MINIMUM OF 5 FEET.



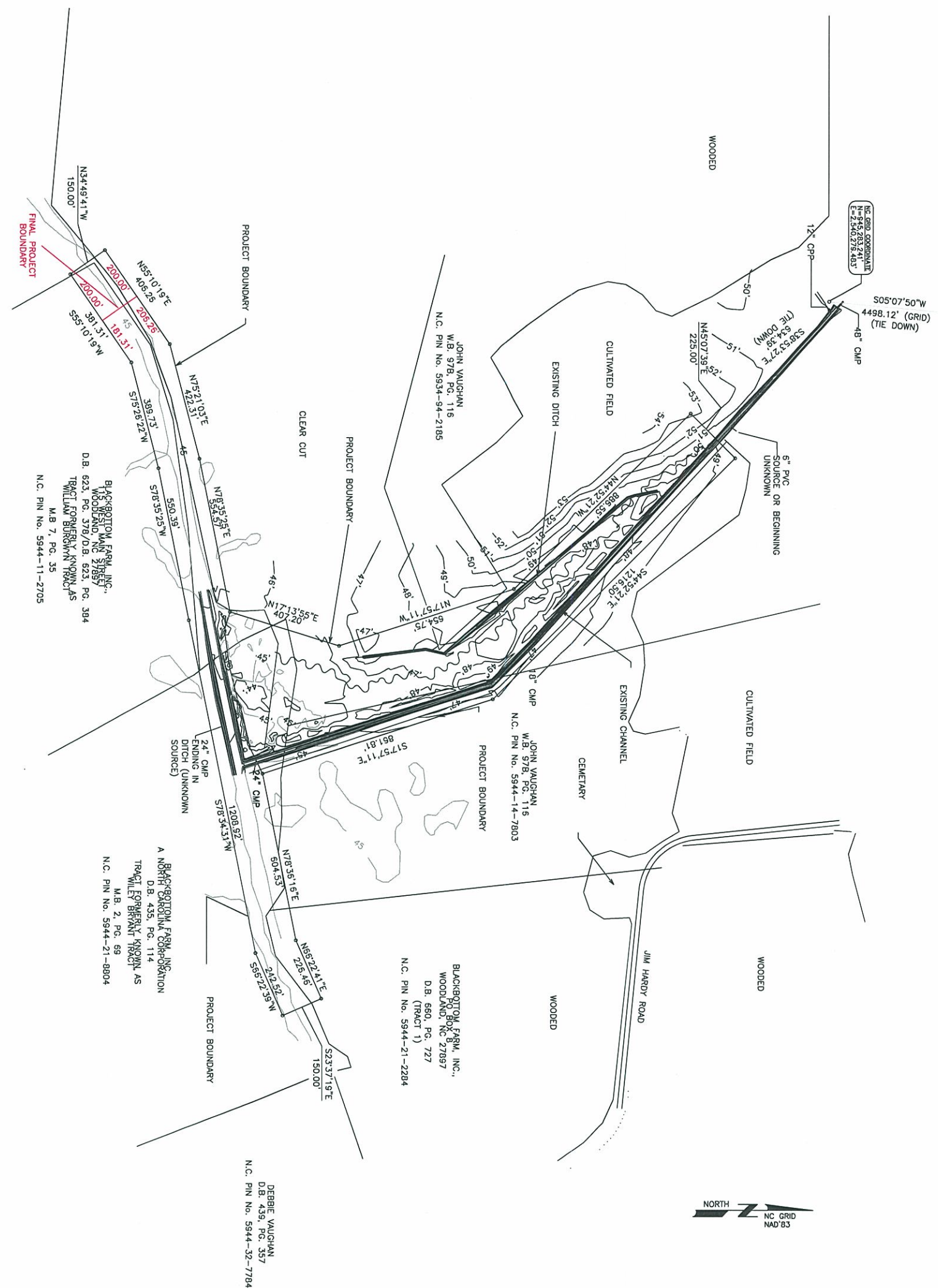
## SUMMARY OF QUANTITIES<sup>1</sup>

ITEM NO.	ITEM DESCRIPTION	UNIT
800	Mobilization	LS
SP	Construction Surveying	LS
SP	Grading	LS
1056	Filter Fabric, Type 2	SY
1605	Temporary Silt Fence	LF
1610	Stone for Erosion Control, Class A	TON
1610	Stone for Erosion Control, Class 1	TON
1610	Sediment Control Stone, No. 5	TON
1630	Silt Excavation	CY
1615	Temporary Mulching	ACR
1620	Seed for Temporary Seeding	LB
1620	Fertilizer for Temporary Seeding	TON
1660	Mowing	ACR
1660	Permanent Seeding and Mulching	ACR
1661	Seed for Repair Seeding	LB
1661	Fertilizer for Repair Seeding	TON
1670	Bare Root Seedlings	EA
SP	Impervious Select Material	CY
SP	Temporary Stream Diversion	LS
SP	Special Stilling Basin	EA
SP	Live Staking	SY
SP	Coir Fiber Matting	SY
SP	Disking/Scarification	ACR

<sup>1</sup> CONTRACTOR HAS BEEN CHOSEN TO COMPLETE WORK ON A TIME AND MATERIALS BASIS. THEREFORE, UNIT QUANTITIES HAVE NOT BEEN PROVIDED.

NCGS MARKER  
 "OPEN"  
 N=949,763.443  
 E=240,587.720  
 NAVD 1988  
 HORIZONTAL GROUND  
 DIMENSIONS NOTED

NC GRID COORDINATE  
 N=949,763.443  
 E=240,587.720  
 NAVD 1988



**EcoScience Corporation**  
 Raleigh, North Carolina

REVISIONS

CLIENT:  
 RESTORATION SYSTEMS  
 RALEIGH, NC

PROJECT:  
 CUTAWHISKIE CREEK  
 STREAM AND WETLAND  
 RESTORATION SITE  
 AS-BUILT

TITLE:  
 EXISTING CONDITIONS

HERTFORD COUNTY,  
 NORTH CAROLINA

DATE: MAR 2008  
 SCALE: NO SCALE  
 ESC PROJECT NO.: 08-306

SHEET  
 4



REVISIONS

NO.	DATE	DESCRIPTION

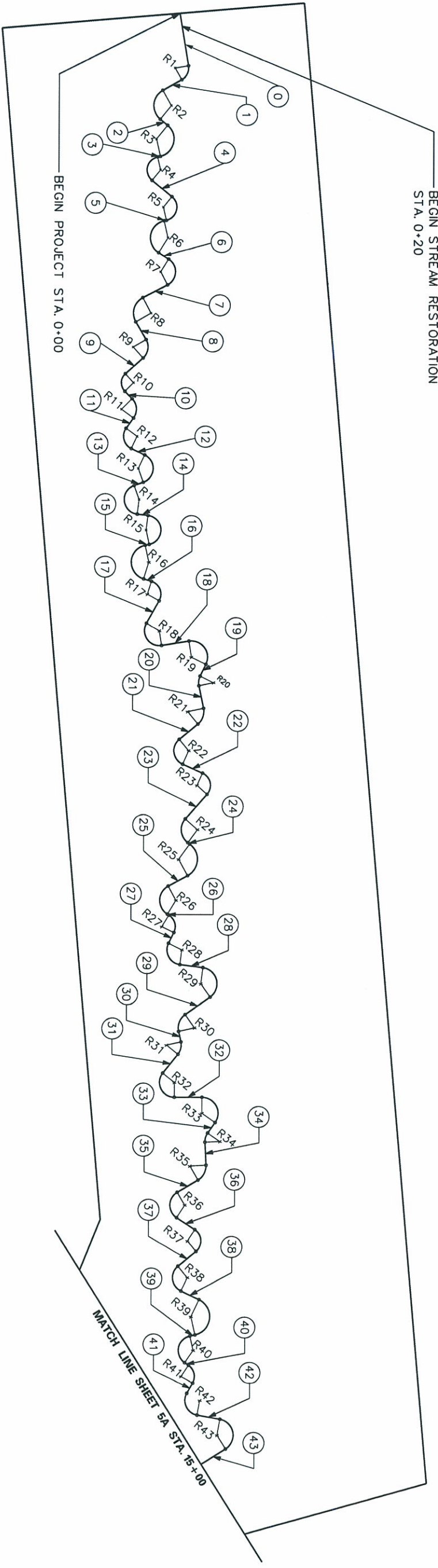
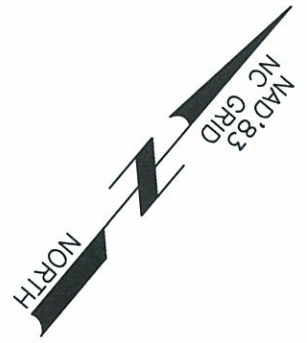
Client:  
**RESTORATION SYSTEMS**  
 RALEIGH, NC

Project:  
**CUTAWHISKE CREEK  
 STREAM AND WETLAND  
 RESTORATION SITE**  
**AS-BUILT**  
 HERTFORD COUNTY,  
 NORTH CAROLINA

Title:  
**NEW CHANNEL LAYOUT**

Des. By: **JWG**      Des. By: **GWN**  
 Ckd By: **JWG**      Date: **MAR 2008**  
 Scale: **1" = 50'**  
 ESC Project No.: **06-306**

SHEET  
**5A**



○ RIFLE BEARING DATA  
 R1 RADIUS ID



# RIFFLE DATA

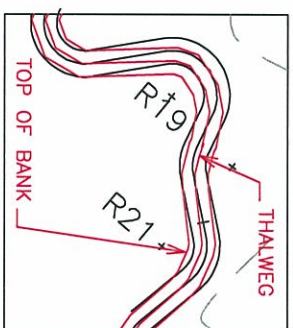
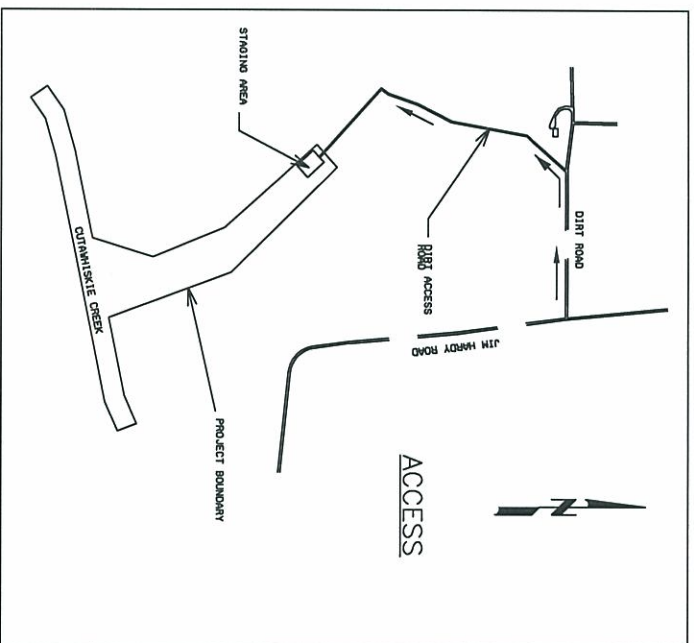
TOP OF RIFFLE ID	NORTHING	EASTING	STATION	BOTTOM OF RIFFLE ID	NORTHING	EASTING	STATION	RIFFLE LENGTH
TR1	944882.883	2540771.612	0+00.00	BR1	944857.174	2540801.502	0+39.43	39.43
TR2	944846.064	2540804.338	0+51.65	BR2	944831.016	2540798.663	0+67.72	16.08
TR3	944813.431	2540811.029	0+59.03	BR3	944813.541	2540818.115	1+00.12	7.09
TR4	944792.691	2540828.678	1+29.17	BR4	944791.022	2540827.414	1+31.26	2.09
TR5	944774.984	2540835.539	1+53.61	BR5	944775.281	2540834.635	1+72.71	19.10
TR6	944759.242	2540862.761	2+03.36	BR6	944757.871	2540861.722	2+05.08	1.72
TR7	944737.145	2540873.880	2+28.19	BR7	944738.359	2540882.585	2+36.98	8.79
TR8	944723.270	2540894.274	2+57.98	BR8	944704.233	2540886.420	2+78.57	20.59
TR9	944687.051	2540894.015	2+59.60	BR9	944681.699	2540928.697	3+08.82	15.22
TR10	944669.967	2540915.476	3+23.45	BR10	944652.607	2540912.986	3+40.99	17.54
TR11	944642.363	2540921.110	3+55.62	BR11	944622.219	2540939.382	3+88.11	9.34
TR12	944631.533	2540951.921	3+78.77	BR12	944622.219	2540962.585	4+16.72	11.03
TR13	944613.274	2540951.921	4+05.69	BR13	944616.104	2540962.585	4+49.86	7.15
TR14	944599.883	2540974.881	4+42.71	BR14	944595.723	2540971.248	4+79.67	17.91
TR15	944578.919	2540986.919	4+79.35	BR15	944583.311	2540993.468	4+87.39	8.04
TR16	944567.339	2541008.154	5+18.30	BR16	944564.931	2541006.280	5+21.35	3.05
TR17	944544.967	2541021.588	5+55.55	BR17	944547.331	2541027.197	5+61.64	6.09
TR18	944539.948	2541040.911	5+79.49	BR18	944521.160	2541044.413	5+98.60	19.11
TR19	944515.958	2541063.528	6+23.26	BR19	944531.470	2541071.014	6+43.82	20.56
TR20	944526.493	2541097.715	6+70.01	BR20	944517.116	2541100.048	6+79.67	9.66
TR21	944511.138	2541103.906	6+86.92	BR21	944500.554	2541117.313	7+04.00	17.08
TR22	944488.952	2541121.677	7+17.03	BR22	944471.344	2541118.419	7+34.94	17.91
TR23	944458.768	2541132.263	7+57.30	BR23	944463.221	2541147.818	7+73.48	16.18
TR24	944453.353	2541160.567	7+52.33	BR24	944429.017	2541159.950	8+16.57	24.34
TR25	944416.743	2541172.787	8+36.57	BR25	944416.862	2541174.485	8+38.27	1.70
TR26	944397.768	2541188.492	8+66.49	BR26	944382.602	2541182.520	8+82.79	16.30
TR27	944366.338	2541195.462	9+07.92	BR27	944366.530	2541196.745	9+09.22	1.30
TR28	944359.010	2541207.938	9+24.02	BR28	944350.431	2541210.031	9+32.85	8.83
TR29	944343.784	2541226.664	9+53.78	BR29	944333.109	2541241.174	9+71.03	17.25
TR30	944339.926	2541259.257	9+59.86	BR30	944318.112	2541253.450	10+22.43	22.57
TR31	944305.515	2541257.727	10+36.53	BR31	944300.637	2541264.064	10+44.53	8.00
TR32	944292.189	2541268.323	10+54.31	BR32	944274.225	2541268.724	10+72.28	17.97
TR33	944266.044	2541286.792	10+96.99	BR33	944279.257	2541302.542	11+17.55	20.56
TR34	944271.103	2541322.209	11+43.74	BR34	944261.477	2541323.046	11+53.40	9.66
TR35	944254.969	2541325.922	11+60.65	BR35	944242.418	2541337.508	11+77.73	17.08
TR36	944230.003	2541340.003	11+90.76	BR36	944213.394	2541334.032	12+08.67	17.91
TR37	944198.808	2541345.728	12+31.03	BR37	944200.772	2541361.798	12+47.21	16.18
TR38	944189.032	2541372.846	12+65.96	BR38	944171.952	2541369.695	12+83.33	17.37
TR39	944159.310	2541383.281	13+05.41	BR39	944163.060	2541397.700	13+20.31	14.90
TR40	944141.019	2541412.355	13+54.99	BR40	944137.928	2541409.997	13+58.88	3.89
TR41	944120.307	2541419.797	13+84.38	BR41	944120.646	2541423.311	13+87.91	3.53
TR42	944112.550	2541434.095	14+02.71	BR42	944103.874	2541435.736	14+11.54	8.83
TR43	944096.565	2541451.999	14+32.47	BR43	944104.917	2541466.972	14+49.72	17.25
TR44	944090.807	2541484.345	14+78.55	BR44	944069.328	2541477.404	15+01.12	22.57
TR45	944057.346	2541480.149	15+14.03	BR45	944044.445	2541492.481	15+31.88	17.85
TR46	944032.349	2541495.188	15+44.91	BR46	944025.566	2541489.512	15+62.83	17.91
TR47	944000.985	2541501.471	15+85.18	BR47	944003.230	2541517.494	16+01.36	16.18
TR48	943991.684	2541528.746	16+20.11	BR48	943974.552	2541525.894	16+37.48	17.37
TR49	943962.149	2541539.698	16+59.56	BR49	943966.150	2541554.049	16+74.46	14.90
TR50	943944.368	2541569.086	17+09.14	BR50	943941.331	2541566.852	17+12.91	3.77
TR51	943923.819	2541576.082	17+37.54	BR51	943924.085	2541583.985	17+45.45	7.91
TR52	943907.835	2541592.123	17+68.25	BR52	943886.513	2541583.046	17+82.76	14.51
TR53	943878.633	2541591.628	18+07.47	BR53	943878.631	2541612.186	18+28.03	20.56
TR54	943859.743	2541622.012	18+54.22	BR54	943831.636	2541616.329	18+64.12	15.93
TR55	943843.866	2541614.725	18+72.28	BR55	943838.266	2541617.928	18+88.21	17.91
TR56	943816.574	2541613.844	19+01.24	BR56	943805.179	2541600.031	19+19.15	17.91
TR57	943786.552	2541602.552	19+41.51	BR57	943780.059	2541617.330	19+57.69	16.18
TR58	943764.505	2541620.754	19+76.44	BR58	943751.287	2541609.256	19+93.81	17.37
TR59	943733.454	2541614.390	20+15.89	BR59	943729.241	2541628.681	20+30.79	14.90
TR60	943702.801	2541629.891	20+65.47	BR60	943701.366	2541628.278	20+69.36	3.89
TR61	943681.215	2541625.603	20+94.86	BR61	943679.695	2541628.788	20+98.39	3.53
TR62	943667.202	2541633.863	21+13.19	BR62	943658.919	2541630.801	21+22.02	8.83
TR63	943644.108	2541640.874	21+42.95	BR63	943634.724	2541638.116	21+60.20	17.25
TR64	943622.438	2541665.446	21+89.41	BR64	943609.401	2541649.508	22+10.00	20.59
TR65	943593.748	2541649.724	22+27.98	BR65	943591.768	2541652.287	22+31.22	3.24
TR66	943571.821	2541650.845	22+54.86	BR66	943563.279	2541633.703	22+72.25	17.38
TR67	943556.593	2541620.206	22+81.11	BR67	943534.207	2541622.806	23+04.69	21.59
TR68	943523.138	2541613.397	23+17.72	BR68	943523.176	2541598.159	23+35.63	17.91
TR69	943505.866	2541588.654	23+57.99	BR69	943492.772	2541598.159	23+74.17	16.18
TR70	943477.417	2541593.247	23+92.92	BR70	943471.892	2541576.780	24+10.29	17.37
TR71	943453.881	2541572.310	24+32.37	BR71	943443.088	2541582.580	24+42.71	14.90
TR72	943419.585	2541570.408	24+81.95	BR72	943420.149	2541566.561	24+85.84	3.89
TR73	943403.035	2541555.901	25+11.34	BR73	943400.125	2541557.900	25+14.87	3.53
TR74	943386.769	2541556.048	25+29.67	BR74	943381.127	2541559.255	25+38.50	8.83
TR75	943363.263	2541550.572	25+49.43	BR75	943354.310	2541565.314	25+76.68	17.25
TR76	943332.278	2541561.393	26+05.51	BR76	943327.932	2541539.225	26+28.10	22.59
TR77	943319.178	2541529.920	26+41.17	END	943310.631	2541527.696	26+50.40	8.83

# POOL RADIUS DATA

RADIUS ID	NORTHING	EASTING	RADIUS (R)
R1	944849.593	2540794.981	10.0
R2	944826.429	2540810.827	13.0
R3	944800.542	2540818.317	13.0
R4	944784.983	2540833.384	10.0
R5	944765.282	2540854.790	10.0
R6	944750.020	2540877.083	13.0
R7	944727.465	2540884.105	11.0
R8	944699.275	2540898.437	13.0
R9	944671.528	2540904.588	11.0
R10	944651.329	2540921.895	9.0
R11	944630.741	2540927.738	11.0
R12	944622.939	2540949.356	10.0
R13	944605.472	2540965.406	11.0
R14	944588.135	2540980.722	11.0
R15	944574.095	2540999.473	11.0
R16	944556.947	2541016.539	13.0
R17	944538.116	2541031.080	10.0
R18	944523.175	2541055.226	11.0
R19	944506.966	2541086.070	12.0
R20	944491.771	2541110.722	11.0
R21	944469.343	2541097.877	12.0
R22	944469.343	2541129.236	11.0
R23	944456.607	2541150.570	10.0
R24	944428.713	2541171.947	12.0
R25	944402.896	2541175.466	14.0
R26	944378.206	2541193.688	12.0
R27	944356.640	2541198.223	10.0
R28	944353.038	2541220.718	11.0
R29	944343.013	2541247.661	12.0
R30	944315.025	2541265.046	12.0
R31	944291.943	2541257.326	11.0
R32	944274.471	2541279.722	11.0
R33	944270.064	2541310.255	12.0
R34	944262.430	2541334.005	11.0
R35	944234.278	2541328.690	12.0
R36	944209.726	2541344.402	11.0
R37	944190.846	2541363.012	10.0
R38	944169.956	2541380.513	11.0
R39	944149.510	2541401.223	14.0
R40	944131.257	2541418.743	11.0
R41	944110.692	2541424.269	10.0
R42	944105.918	2541446.544	11.0
R43	944094.497	2541472.926	12.0
R44	944065.638	2541488.823	12.0

# RIFFLE BEARING DATA

0	S 49° 18' 0.07" E	40	N 84° 30' 9.83" E
1	S 20° 39' 14.25" W	41	S 10° 42' 36.90" E
2	N 89° 6' 14.14" E	42	N 60° 16' 27.43" E
3	S 37° 9' 8.79" W	43	S 17° 54' 29.33" W
4	N 89° 6' 39.66" E	44	S 43° 42' 34.18" E
5	S 37° 9' 8.78" W	45	S 18° 28' 48.97" W
6	N 82° 3' 24.27" E	46	N 82° 1' 31.84" E
7	S 22° 25' 6.27" W	47	S 9° 27' 6.78" W
8	S 70° 6' 46.34" E	48	N 74° 25' 28.49" E
9	S 8° 9' 44.59" W	49	S 36° 20' 19.51" W
10	S 84° 59' 45.98" E	50	N 89° 4' 35.1



**CERTIFICATE OF ACCURACY AND MAPPING FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY. ALL OTHER DETAILS, TOPO AND BOUNDARY WERE TAKEN FROM OTHER DRAWINGS BY OTHERS**

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wellheads, hazardous materials, underground utilities or any other features above, or below ground other than those shown.

I certify that this survey is of an existing parcel or parcels of land and does not create a new street or change an existing street.

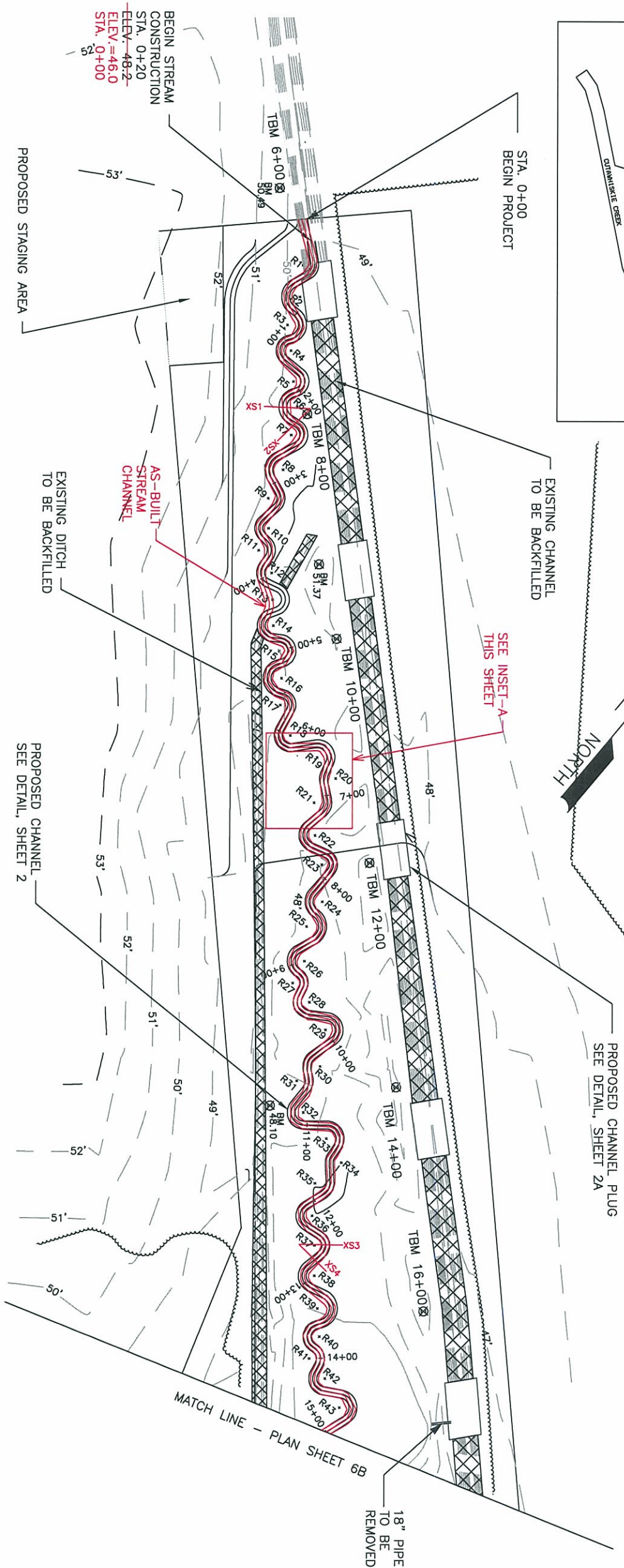
I certify that the elevations shown on said plot, meet the requirements of a Class C topographic survey in the State of North Carolina.



I, JOHN A. RUDOLPH, certify that this plot (RED-LINE CHANNEL ONLY) was drawn under my supervision from (an actual survey made under my supervision) (used description recorded in Book SEE - Page REFS, etc.) (other); that the ratio of precision as calculated by  $\frac{1}{100000}$  that the boundaries not surveyed are shown as broken lines plotted from information found in Book XX, Page XX; that this plot was prepared in accordance with G.S. 47-30 as amended. Witness my original signature, registration number, and seal this 20th day of MAY, A. D. 2008.



FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY



<p><b>EcoScience Corporation</b> Raleigh, North Carolina</p>	<p>REVISIONS</p> <table border="1"> <tr> <th>NO.</th> <th>DATE</th> <th>DESCRIPTION</th> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	NO.	DATE	DESCRIPTION												
	NO.	DATE	DESCRIPTION													
<p>CLIENT:</p> <p>RESTORATION SYSTEMS RALEIGH, NC</p>																
<p>PROJECT:</p> <p>CUTAWHISKIE CREEK STREAM AND WETLAND RESTORATION SITE AS-BUILT</p> <p>HERTFORD COUNTY, NORTH CAROLINA</p>																
<p>TITLE:</p> <p>OVERALL SITE PLAN</p>																
<p>DESIGN BY:</p> <p>JWG</p> <p>CHECK BY:</p> <p>TAL</p> <p>DATE:</p> <p>MAR 2007</p>																
<p>SCALE:</p> <p>1" = 50'</p>																
<p>ESC PROJECT NO.:</p> <p>06-306</p>																
<p>SHEET</p> <p><b>6A</b></p>																

NAD 83  
NC GRID



MATCH LINE PLAN SHEET 6A

**CERTIFICATE OF ACCURACY AND MAPPING FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY. ALL OTHER DETAILS, TOPO AND BOUNDARY WEETFAREN FROM OTHER DRAWINGS BY OTHERS**

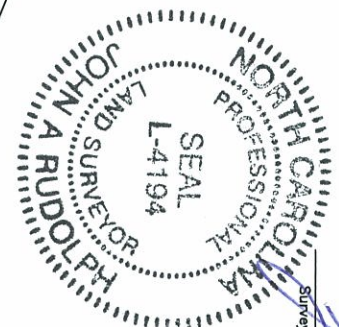
Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features shown, or show ground other than those shown.

I certify that the survey is of an existing parcel or parcels of land and does not create a new street or change an existing street.

I certify that the elevations shown on said plat, meet the requirements of a Class C topographic survey in the State of North Carolina.

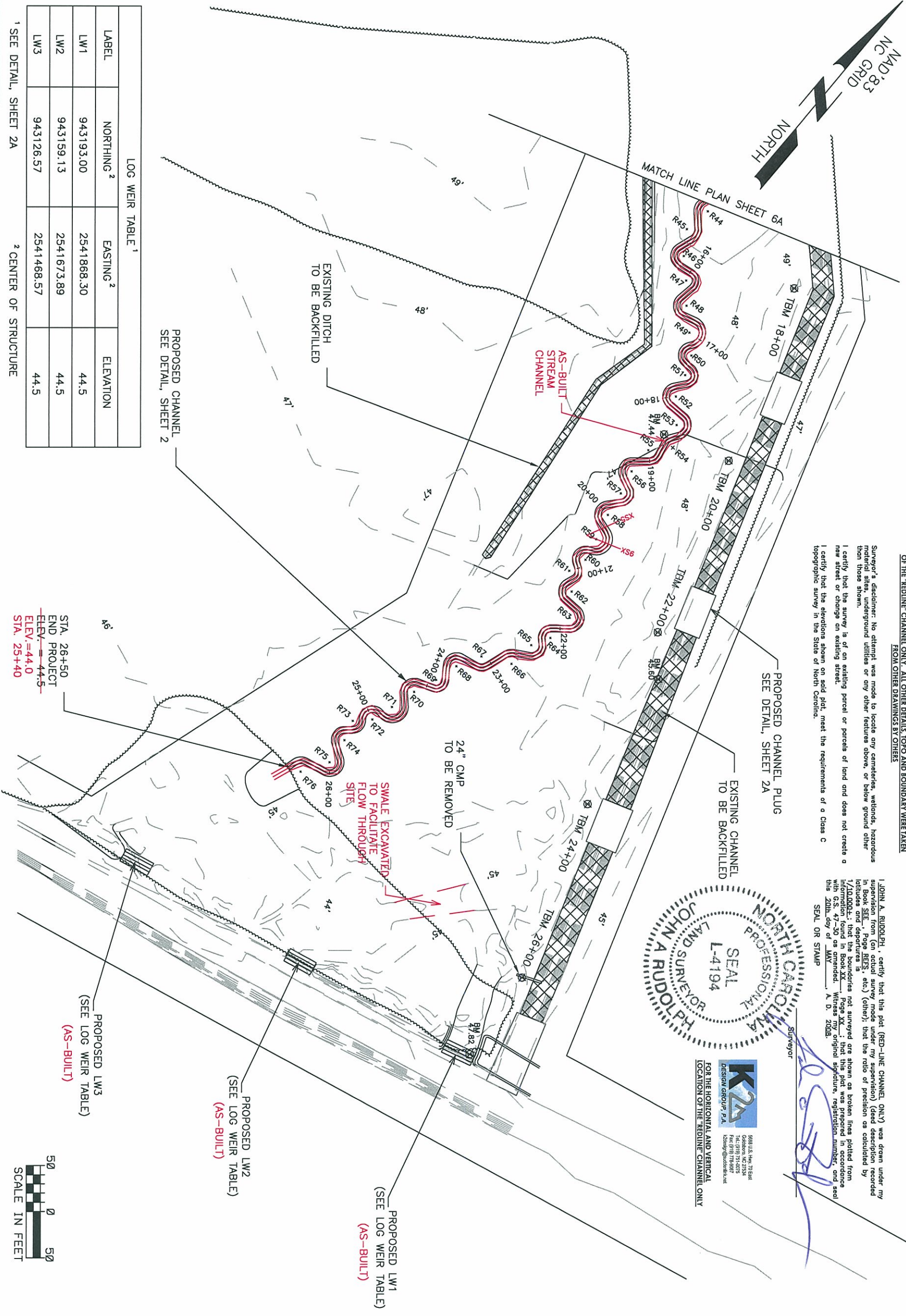
JOHN A. RUDOLPH, certify that this plat (RED-LINE CHANNEL ONLY) was drawn under my supervision from (an actual survey made under my supervision) (best description recorded in the public records of the State of North Carolina) (other), that the role of precision as calculated by 1/10,000th; that the boundaries not surveyed are shown as broken lines plotted from information found in Book XX, Page XX; that this plat was prepared in accordance with G.S. 47-30 as amended. Witness my original signature, registration number, and seal this 20th day of MAY, A. D. 2008.

SEAL OR STAMP



**K2A**  
DESIGN GROUP, P.A.  
6688 U.S. Hwy. 71 East  
Raleigh, NC 27613  
Tel: 919.351.0075  
Fax: 919.778.0087  
k2aengr@k2adef.com

FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY



LOG WEIR TABLE<sup>1</sup>

LABEL	NORTHING <sup>2</sup>	EASTING <sup>2</sup>	ELEVATION
LW1	943193.00	2541868.30	44.5
LW2	943159.13	2541673.89	44.5
LW3	943126.57	2541468.57	44.5

<sup>1</sup> SEE DETAIL, SHEET 2A

<sup>2</sup> CENTER OF STRUCTURE

PROPOSED CHANNEL  
SEE DETAIL, SHEET 2

EXISTING DITCH  
TO BE BACKFILLED

PROPOSED CHANNEL PLUG  
SEE DETAIL, SHEET 2A

EXISTING CHANNEL  
TO BE BACKFILLED

24" CMP  
TO BE REMOVED

SMALL EXCAVATED  
TO FACILITATE  
FLOW THROUGH  
SITE

PROPOSED LW3  
(SEE LOG WEIR TABLE)  
(AS-BUILT)

PROPOSED LW2  
(SEE LOG WEIR TABLE)  
(AS-BUILT)

PROPOSED LW1  
(SEE LOG WEIR TABLE)  
(AS-BUILT)



REVISIONS

NO.	DATE	DESCRIPTION
1		AS-BUILT INFORMATION ADDED

CLIENT:  
RESTORATION SYSTEMS  
RALEIGH, NC

PROJECT:  
CUTAWHISKE CREEK  
STREAM AND  
WETLAND  
RESTORATION  
SITE  
AS-BUILT  
HERTFORD COUNTY,  
NORTH CAROLINA

TITLE:  
OVERALL  
SITE PLAN

DSN BY: TAL  
JWG  
DATE: MAR 2007

SCALE:  
1" = 50'

ES&C PROJECT NO.:  
06-306

SHEET  
**6B**

PLANT COMMUNITY ASSOCIATION (Schalhe and Weakley, 1990)		Coastal Plain Small Stream Swamp	Coastal Plain Level Forest	Cypress- Gum Swamp	Mesic Mixed Hardwood Forest	TOTAL STEMS PLANTED
Area (acres)		9.3	3.7	4.6	0.4	18.0
Stem Target (per acre)		1000	1000	1000	1000	--
SPECIES		# planted (% total)	# planted (% total)	# planted (% total)	# planted (% total)	
Common Name	Scientific Name					
<del>Red Bay</del>	<del>Persea borbonica</del>	<del>465 (5)</del>	--	--	--	<del>465</del>
Swamp Chestnut Oak	Quercus michauxii	1395 (15)	--	--	--	1395
Green Ash	Fraxinus pennsylvanica	465 (5)	--	--	--	465
Sweetbay Magnolia	Magnolia virginiana	465 (5)	--	--	--	465
River Birch	Betula nigra	465 (5)	370 (10)	--	--	589
American Elm	Ulmus americana	465 (5)	370 (10)	--	--	507
Bald Cypress	Taxodium distichum	1395 (15)	555 (15)	1840 (40)	--	3790
Swamp Tupelo	Nyssa biflora	1395 (15)	555 (15)	1840 (40)	--	3900
Overcup Oak	Quercus lyrata	1395 (15)	555 (15)	920 (20)	--	2870
Cherrybark Oak	Quercus rugosa	930 (10)	555 (15)	--	40 (10)	1525
Tulip Poplar	Liriodendron tulipifera	465 (5)	--	--	20 (5)	485
Willow Oak	Quercus phellos	--	740 (20)	--	--	740
<del>American Beech</del>	<del>Fagus grandifolia</del>	--	--	--	60 (15)	<del>60</del>
Southern Red Oak	Quercus falcata	--	--	--	40 (10)	40
<del>Southern Sugar Maple</del>	<del>Acer floridanum</del>	--	--	--	40 (10)	<del>40</del>
<del>Black Gum</del>	<del>Nyssa sylvatica</del>	--	--	--	40 (10)	<del>40</del>
<del>Hickemott-Hickory</del>	<del>Corynorhiza</del>	--	--	--	40 (10)	<del>40</del>
Northern Red Oak	Quercus rubra	--	--	--	40 (10)	40
<del>Pignut-Hickory</del>	<del>Carya glabra</del>	--	--	--	40 (10)	<del>40</del>
White Oak	Quercus alba	--	--	--	40 (10)	40
<b>TOTAL</b>		9300	3700	4600	400	18,000

TOTAL  
STEMS  
PLANTED

1400

500

475

600

400

3800

3900

2900

1600

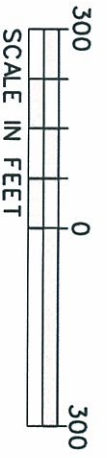
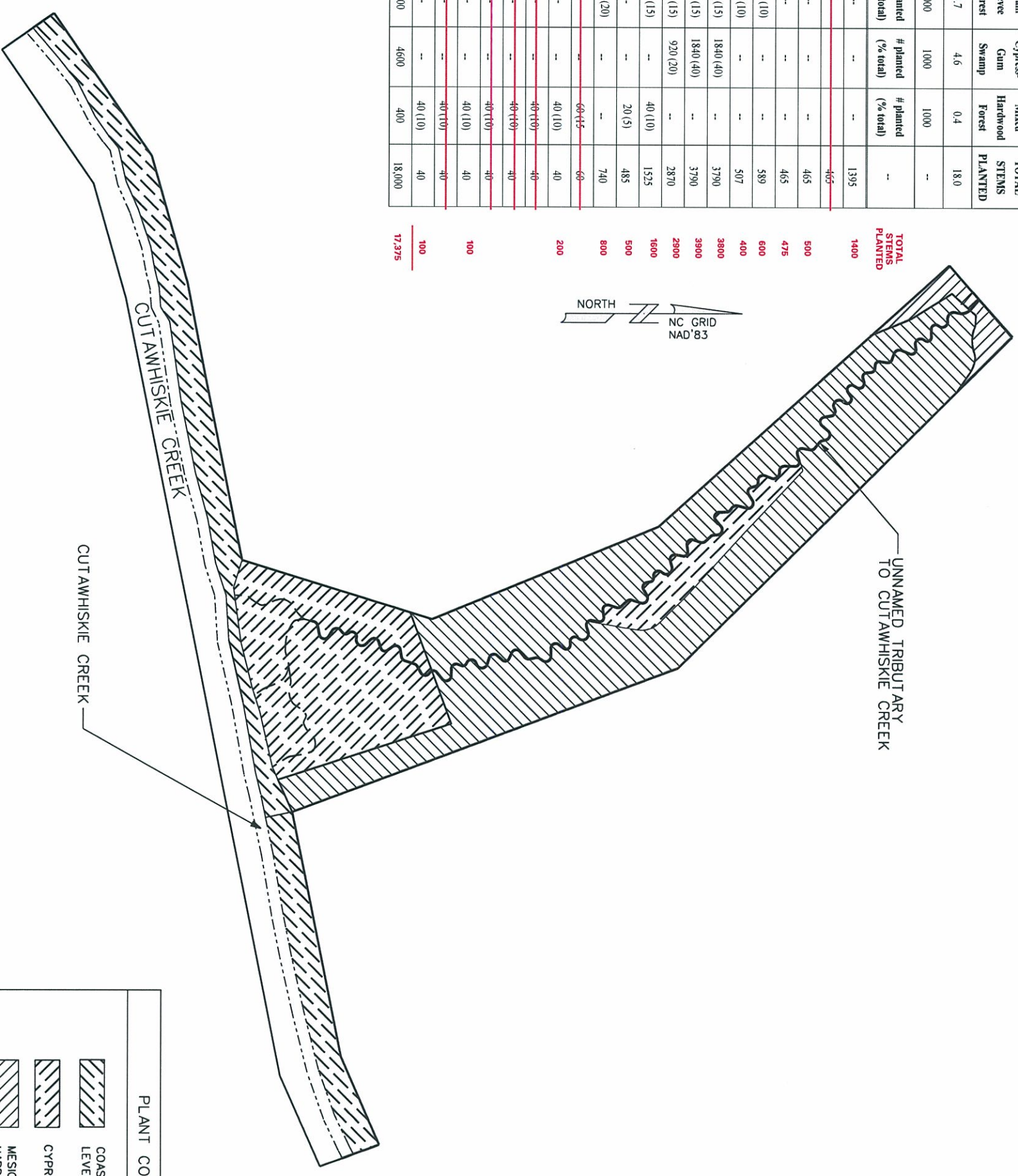
500

800

200

100

17,375



PLANT COMMUNITIES	
	COASTAL PLAIN LEVEL FOREST
	CYPRESS-GUM SWAMP
	MESIC-MIXED HARDWOOD FOREST
	COASTAL PLAIN SMALL STREAM SWAMP



REVISIONS

Client:  
**RESTORATION SYSTEMS**  
RALEIGH, NC

Project:  
**CUTAWHISKIE CREEK  
STREAM AND  
WETLAND  
RESTORATION  
SITE**  
HERFORD COUNTY,  
NORTH CAROLINA

Title:  
**PLANTING  
PLAN**

Drawn By: JWG  
Date: MAR 2008  
Scale: AS SHOWN  
ESC Project No.: 06-306

SHEET  
**7**





**EcoScience Corporation**  
Raleigh, North Carolina

REVISIONS

No.	Date	Description

Client:

RESTORATION SYSTEMS

Project:

CUTAWHISKIE CREEK  
STREAM AND  
WETLAND  
RESTORATION  
SITE  
**AS-BUILT**  
HERFORD COUNTY, NC

Title:

AS-BUILT  
LONGITUDINAL  
PROFILE

Dwn. By:

TAL

Ckd. By:

JWG MAR 2008

Scale:

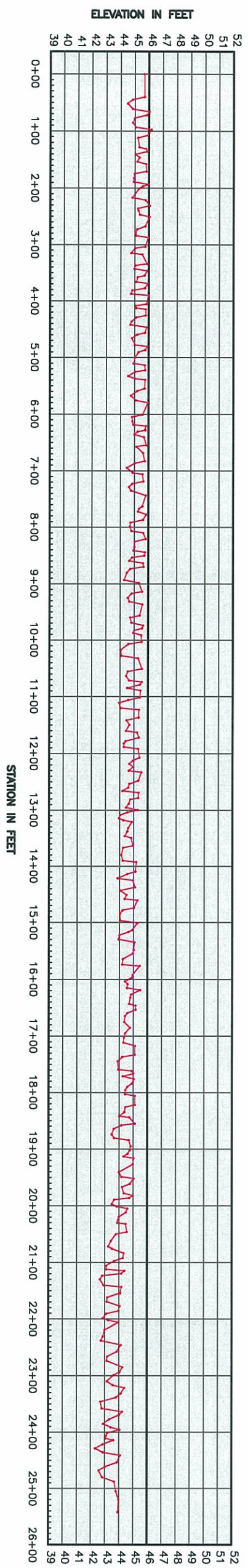
AS SHOWN

ESC Project No.:

06-306

SHEET

8



**CERTIFICATE OF ACCURACY AND MAPPING FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE REDLINE CHANNEL ONLY. ALL OTHER DETAILS, TOPO AND BOUNDARY WERE TAKEN FROM OTHER DRAWINGS BY OTHERS**

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features above, or below ground other than those shown.  
I certify that the survey is of an existing parcel or parcels of land and does not create a new street or change an existing street.  
I certify that the elevations shown on said plat, meet the requirements of a Class C topographic survey in the State of North Carolina.

I, JOHN A. RUDOLPH, certify that this plat (RED-LINE CHANNEL ONLY) was drawn under my supervision from (an actual survey made under my supervision) (dead description recorded in Book SEE Page REES, etc.) (other); that the ratio of precision as calculated by latitudes and departures is 1/10,000±; that the boundaries not surveyed are shown as broken lines plotted from information found in Book XX, Page XX; that this plat was prepared in accordance with G.S. 47-30 as amended. Witness my original signature, registration number, and seal this 20th day of MAY, A. D. 2008.

Seal of State of North Carolina  
Surveyor  
L-4194

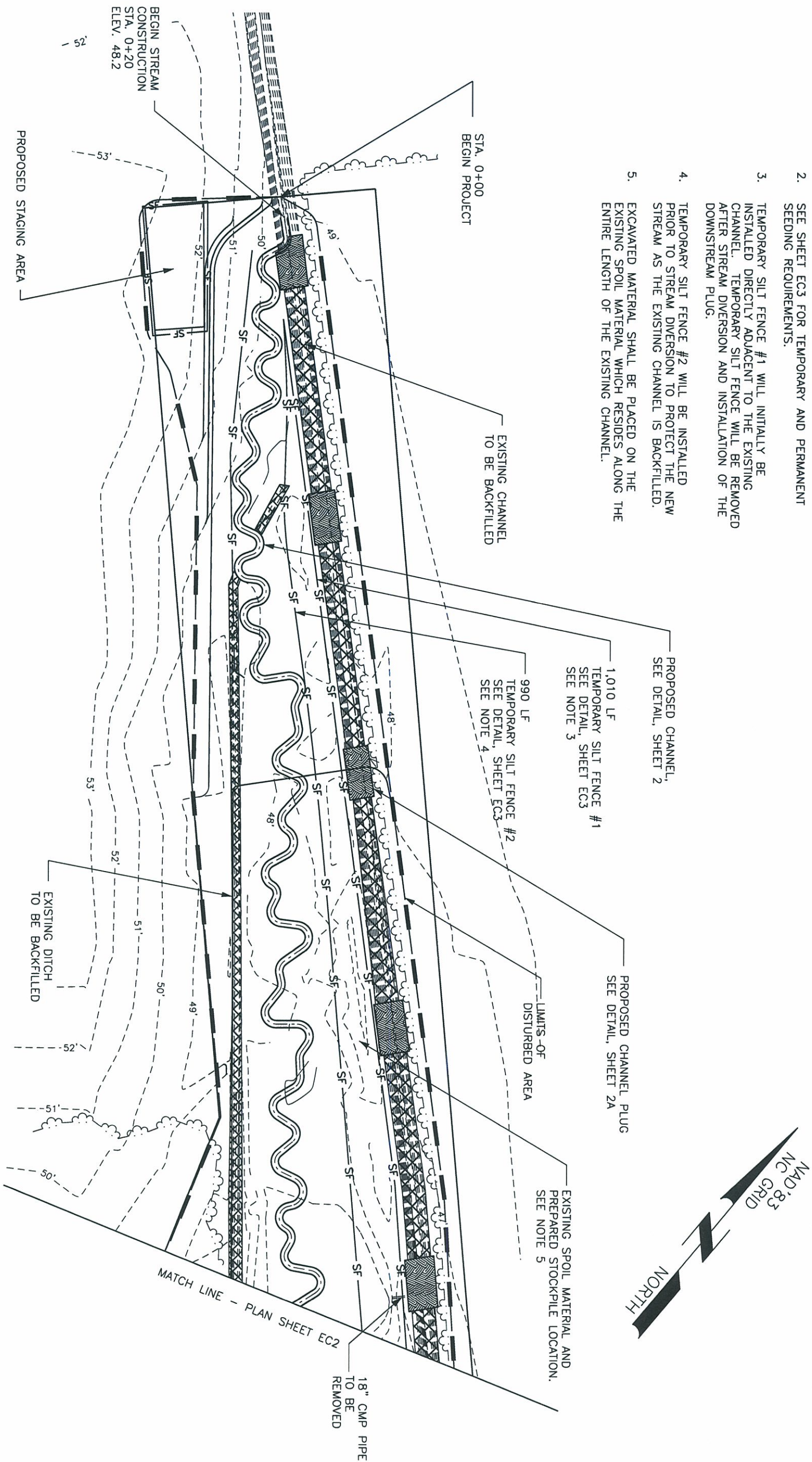


FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE REDLINE CHANNEL ONLY

6068 U.S. Hwy. 70 East  
Raleigh, NC 27612  
Tel: (919) 351-0025  
Fax: (919) 778-8877  
k2a@k2adesign.com

NOTES:

1. SEE SHEET 1A FOR GENERAL NOTES AND CONSTRUCTION SEQUENCING.
2. SEE SHEET EC3 FOR TEMPORARY AND PERMANENT SEEDING REQUIREMENTS.
3. TEMPORARY SILT FENCE #1 WILL INITIALLY BE INSTALLED DIRECTLY ADJACENT TO THE EXISTING CHANNEL. TEMPORARY SILT FENCE WILL BE REMOVED AFTER STREAM DIVERSION AND INSTALLATION OF THE DOWNSTREAM PLUG.
4. TEMPORARY SILT FENCE #2 WILL BE INSTALLED PRIOR TO STREAM DIVERSION TO PROTECT THE NEW STREAM AS THE EXISTING CHANNEL IS BACKFILLED.
5. EXCAVATED MATERIAL SHALL BE PLACED ON THE EXISTING SPOIL MATERIAL WHICH RESIDES ALONG THE ENTIRE LENGTH OF THE EXISTING CHANNEL.



REVISIONS

Client: RESTORATION SYSTEMS RALEIGH, NC

Project: CUTAWHISKIE CREEK STREAM AND WETLAND RESTORATION SITE AS-BUILT HERTFORD COUNTY, NORTH CAROLINA

Title: EROSION AND SEDIMENT CONTROL PLAN

Drawn By: EBB Date: MAR 2008

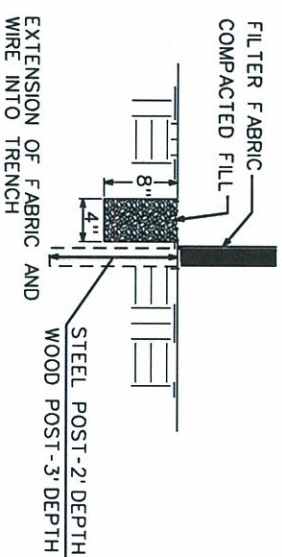
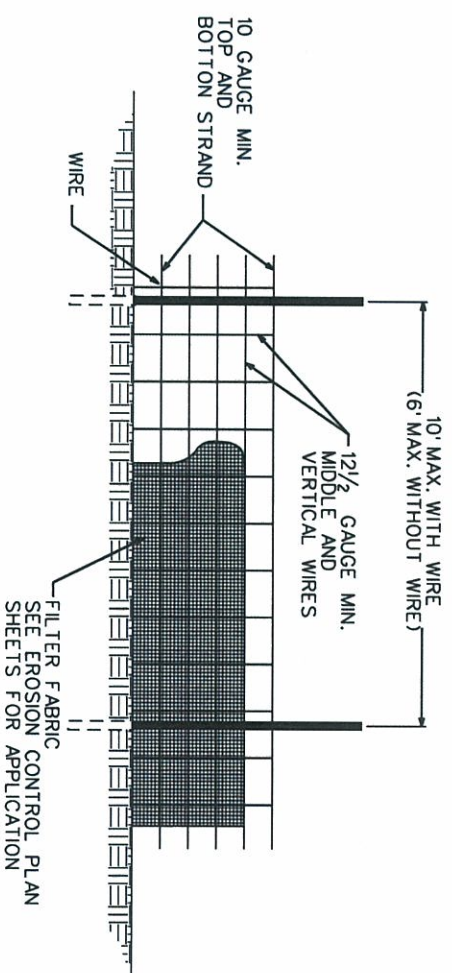
Checked By: GWN

Scale: 1" = 50'

ESC Project No.: 06-306

SHEET EC1

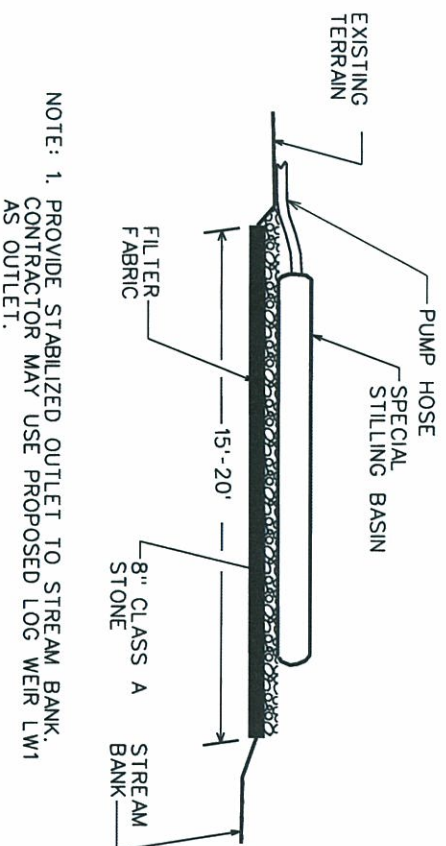




- NOTES:
1. USE WIRE A MINIMUM OF 32 INCHES IN WIDTH AND WITH A MINIMUM OF 6 LINE WIRES WITH 12 INCH STAY SPACING.
  2. USE FILTER FABRIC A MINIMUM OF 36 INCHES IN WIDTH AND FASTEN ADEQUATELY TO THE WIRE AS DIRECTED BY THE ENGINEER.
  3. PROVIDE 5 FOOT STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.
  4. USE 6 FOOT WOOD POST WITH 3 INCH DIAMETER.

NCDOT BMP'S FOR CONSTRUCTION AND MAINTENANCE ACTIVITIES, 5.1.1, AUGUST 2003

**TEMPORARY SILT FENCE**  
NCDOT STD. DWG. 1605.01



- NOTE: 1. PROVIDE STABILIZED OUTLET TO STREAM BANK. CONTRACTOR MAY USE PROPOSED LOG WEIR LW1 AS OUTLET.  
2. CONFORM TO NCDOT STD. DWG. 1630.06.

**SPECIAL STILLING BASIN**  
**W/ROCK PAD**

MATERIAL	SEED TYPE	MINIMUM SEED PURITY (%)	APPLICATION RATE	PLANTING DATES
Lime	N/A	N/A	2,000 lbs/acre or by Soil Test	Jan 1 – Dec 31
Fertilizer	N/A	N/A	300 lbs/acre or by Soil Test	Jan 1 – Dec 31
Mulch	Mulch shall be tacked down by crimping only		4,000 lbs/acre	Jan 1 – Dec 31
Temporary Seeding	Rye Grain ( <i>Secale cereale</i> )	97	30 lbs/acre	April 15 – Aug 15
	Browntop Millet ( <i>Panicum ramosum</i> )	97	10 lbs/acre	April 15 – Aug 15
	Winter Wheat ( <i>Triticum aestivum</i> )	97	30 lbs/acre	April 15 – Aug 15
	German Millet ( <i>Setaria italica</i> )	97	10 lbs/acre	April 15 – Aug 15
	Deer-Tongue ( <i>Panicum clandestinum</i> )	97	20 lbs/acre	April 1 – Oct 30
	Switchgrass ( <i>Panicum virgatum</i> )	97	20 lbs/acre	April 1 – Oct 30
Permanent Seeding	Wetland Seed Mix <sup>1</sup>	95	Mix Dependent	Year Round

1 Wetland Seed Mix to be applied along floodplain areas and other areas of high soil moisture only

REVISIONS

No.	Description

Client: RESTORATION SYSTEMS  
RALEIGH, NC

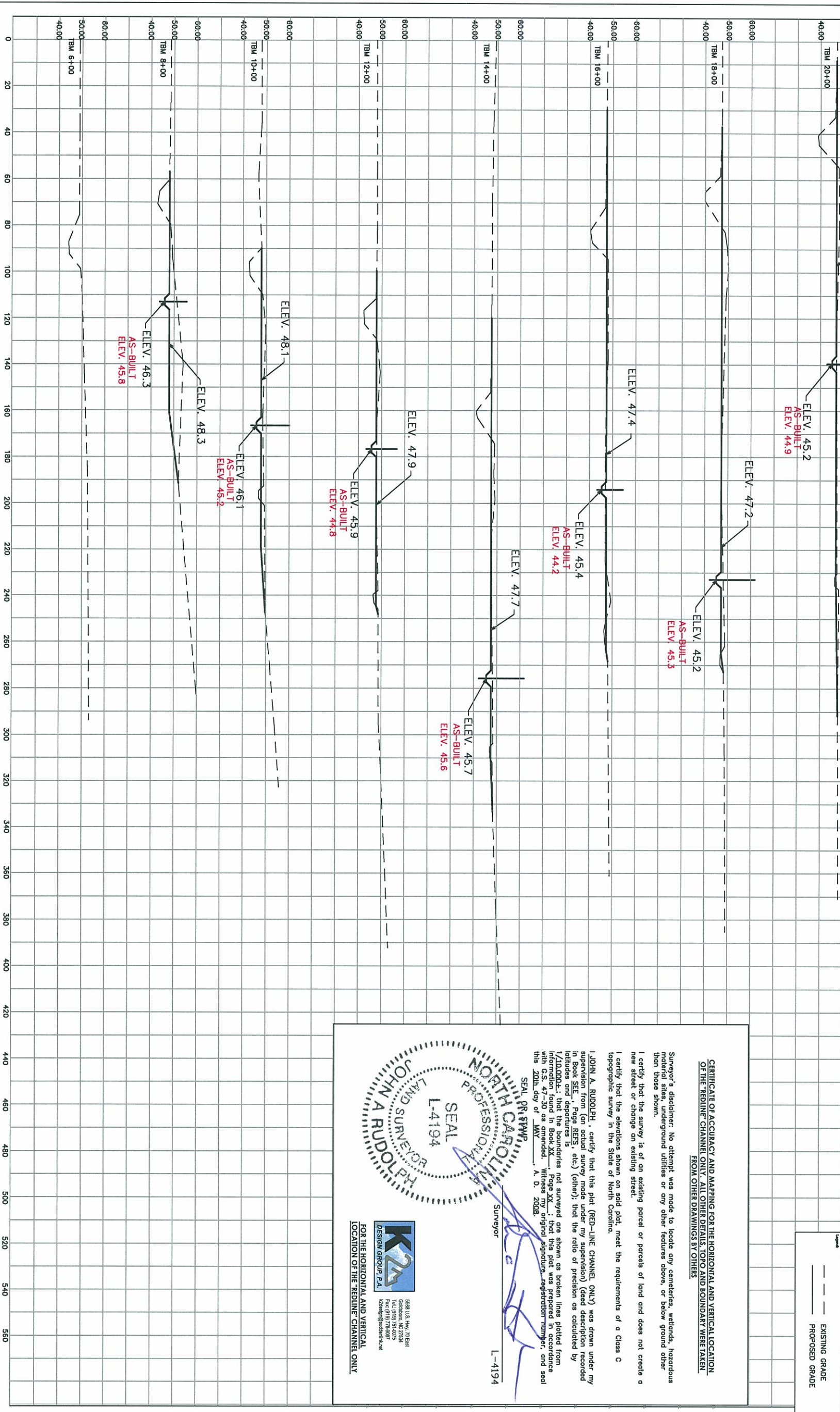
Project: CUTAWHSKIE CREEK STREAM AND WETLAND RESTORATION SITE  
AS-BUILT  
HERTFORD COUNTY, NORTH CAROLINA

Title: EROSION CONTROL DETAILS

Des. By: EBB  
Ckd. By: EBB  
Date: MAR 2008  
Scale: NO SCALE  
ESC Project No.: 06-306

RESTORATION SYSTEMS  
 CUTAWHSKIE CREEK  
 STREAM AND WETLAND  
 RESTORATION SITE  
 AS-BUILT

CROSS-SECTIONS  
 X1



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Surveyor  
 L-4194

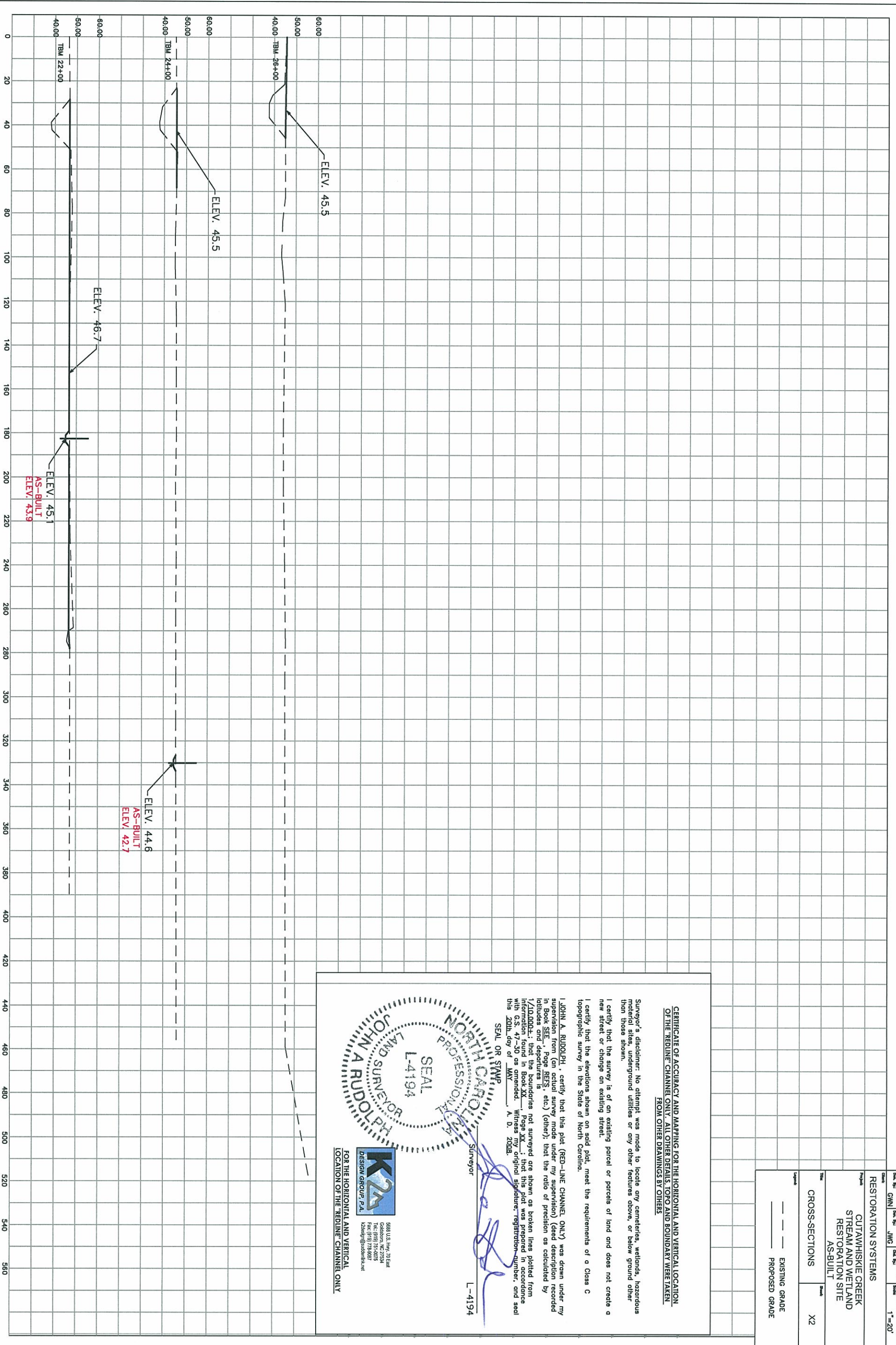


5698 U.S. Hwy. 70 East  
 Durham, NC 27684  
 P.O. Box 172407  
 Fax: (919) 774-0087  
 k25design@bellsouth.net

FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY.

RESTORATION SYSTEMS  
 CUTAWHSKIE CREEK  
 STREAM AND WETLAND  
 RESTORATION SITE  
 AS-BUILT

Sheet	Scale
CROSS-SECTIONS	X2
Legend	
---	EXISTING GRADE
---	PROPOSED GRADE

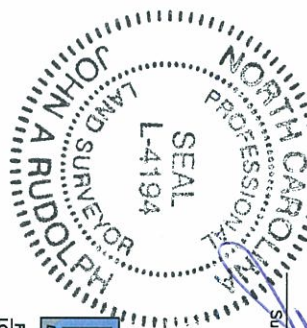


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SEAL OR STAMP



Surveyor  
 L-4194



FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE 'REDLINE' CHANNEL ONLY.



**EcoScience Corporation**  
Raleigh, North Carolina

REVISIONS

No.	Description	Date

Client: RESTORATION SYSTEMS

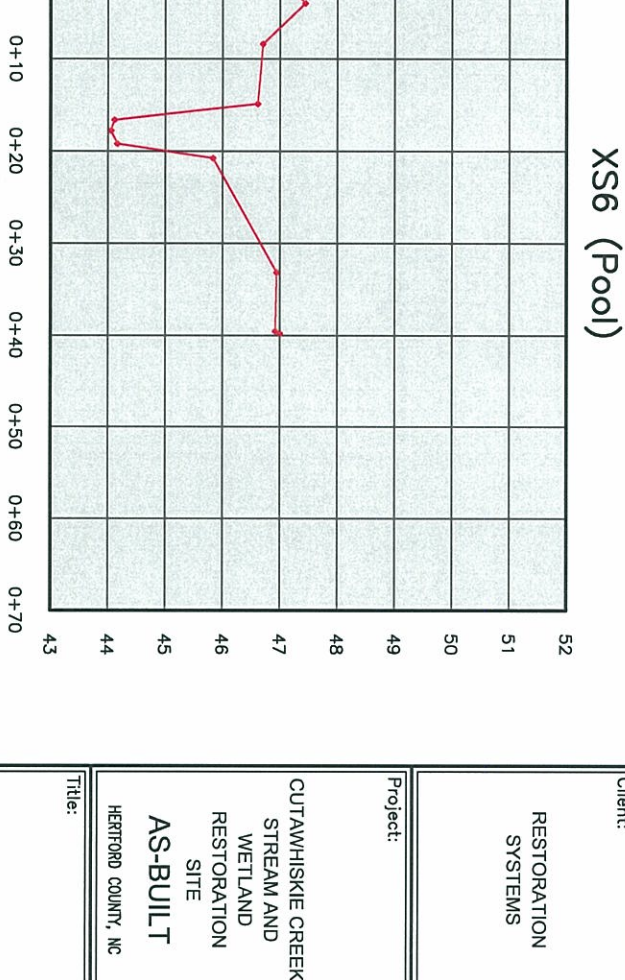
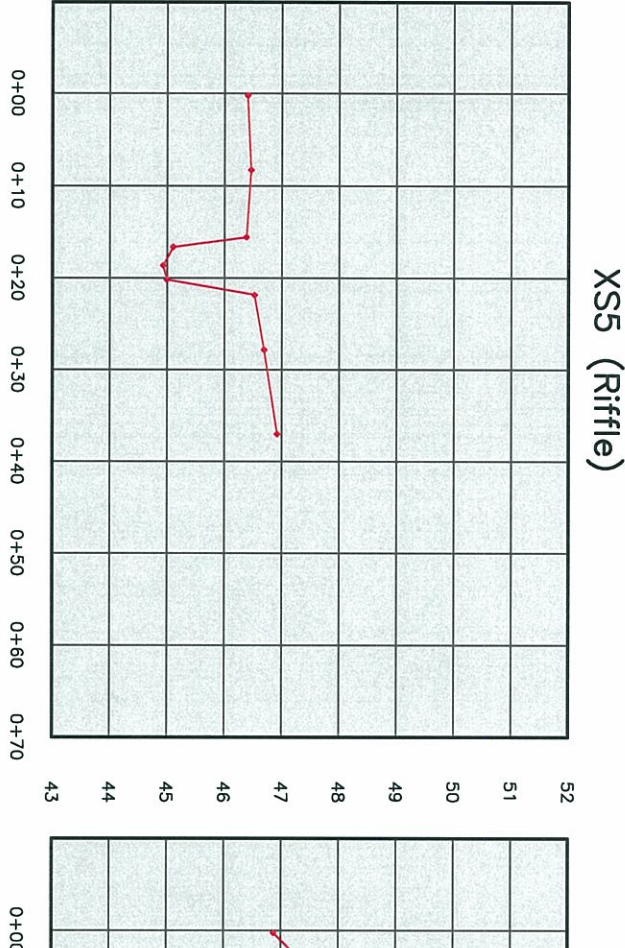
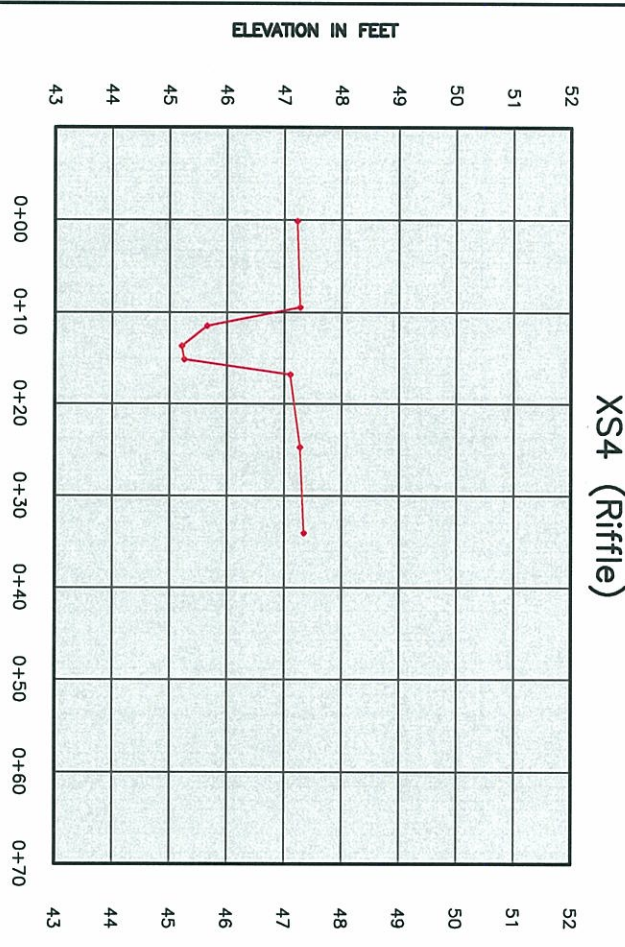
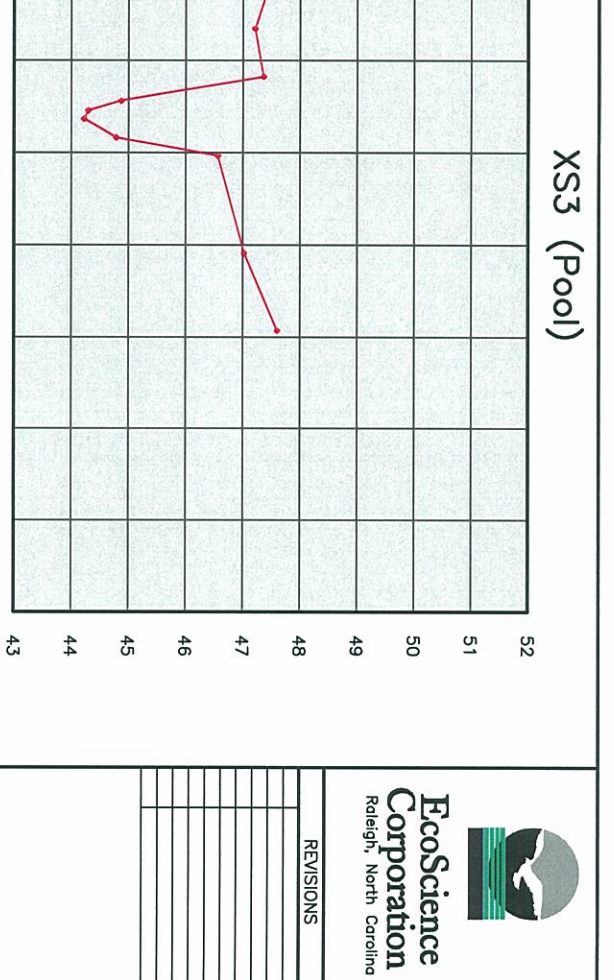
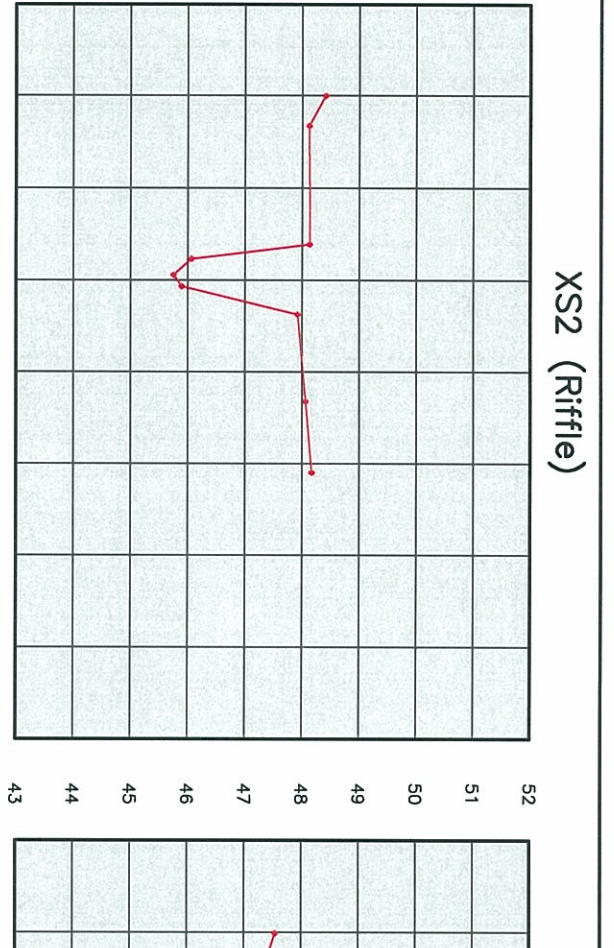
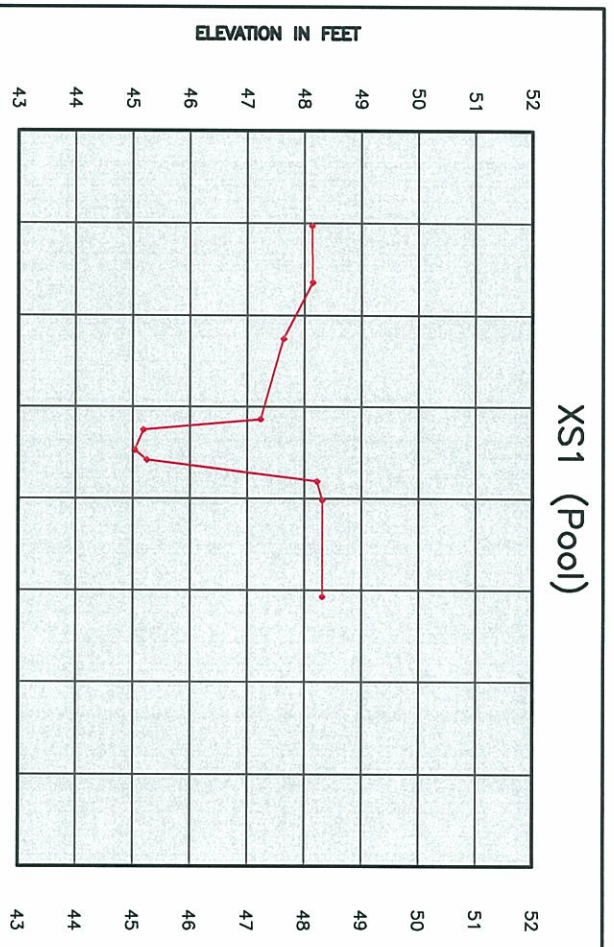
Project: CUTAWHSKIE CREEK STREAM AND WETLAND RESTORATION SITE

AS-BUILT  
HERFORD COUNTY, NC

Title: AS-BUILT CROSS SECTIONS

Dwn. By: TAL  
Ckd. By: JWG Date: MAR 2008  
Scale: AS SHOWN  
ESC Project No.: 06-306

SHEET  
**X3**



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SEAL DR: STAMP  
Surveyor  
L-4194



**K2A DESIGN GROUP, P.A.**  
1501 S. Hwy. 73 East  
Goldsboro, NC 27534  
Tel: (919) 751-0075  
Fax: (919) 776-0877  
k2a@k2adesign.com

FOR THE HORIZONTAL AND VERTICAL LOCATION OF THE REDLINE CHANNEL ONLY

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**APPENDIX C: AS-BUILT PHOTOS**



As-built (April 2008)



Photo Station 2

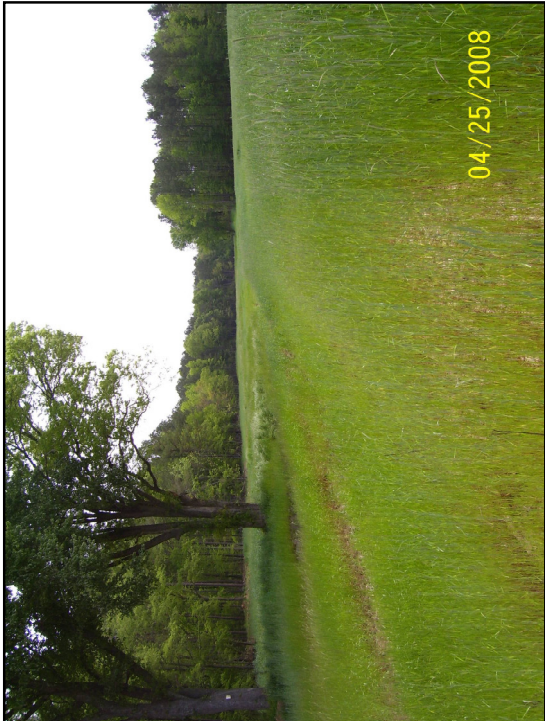


Photo Station 1

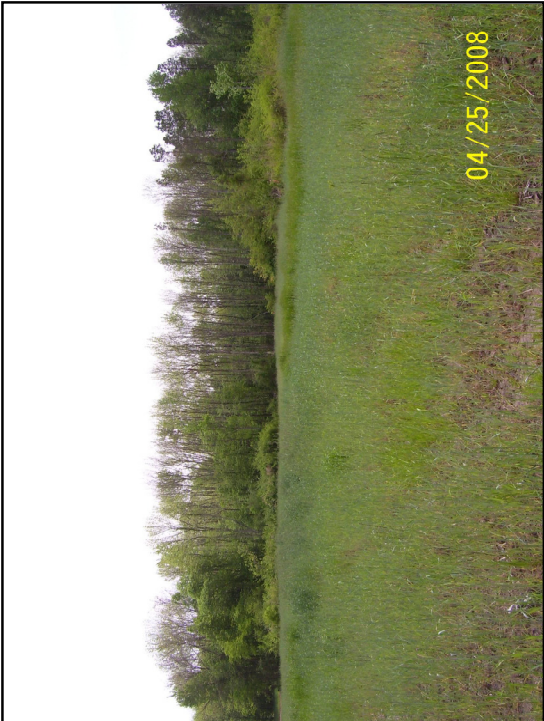


Photo Station 3

As-built (April 2008)



Vegetation Plot 2



Vegetation Plot 4



Vegetation Plot 1



Vegetation Plot 3

---

**As-built (April 2008)**



Vegetation Plot 5

As-built (April 2008)



Cross-Section 1. Looking downstream.



Cross-Section 1. Looking left to right.



Cross-Section 1. Looking upstream.

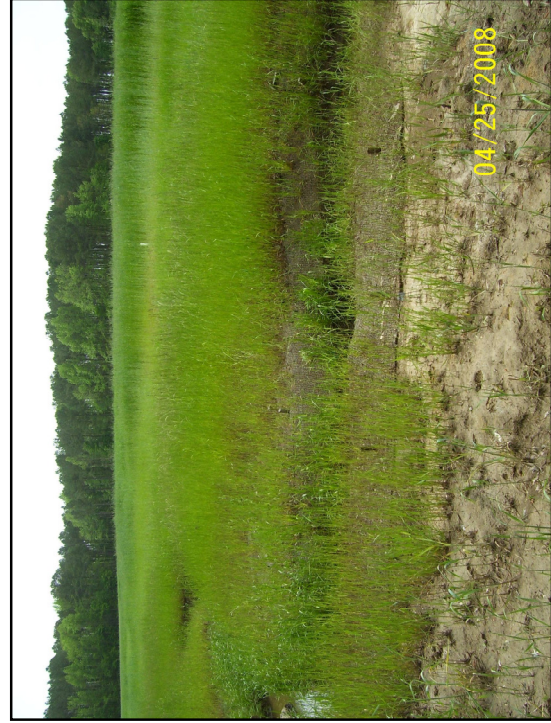


Cross-Section 1. Looking right to left.

**As-built (April 2008)**



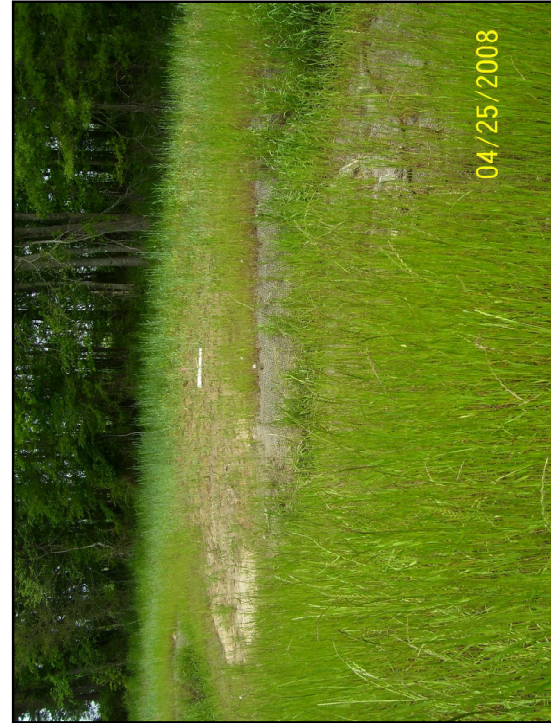
Cross-Section 2. Looking downstream.



Cross-Section 2. Looking left to right.

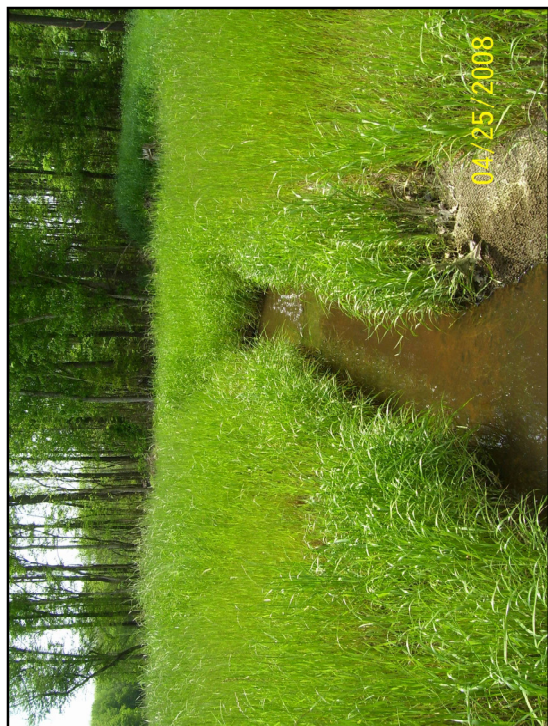


Cross-Section 2. Looking upstream.



Cross-Section 2. Looking right to left.

**As-built (April 2008)**



Cross-Section 3. Looking downstream.



Cross-Section 3. Looking left to right.



Cross-Section 3. Looking upstream.



Cross-Section 3. Looking right to left.

**As-built (April 2008)**



Cross-Section 4. Looking downstream.



Cross-Section 4. Looking left to right.



Cross-Section 4. Looking upstream.



Cross-Section 4. Looking right to left.

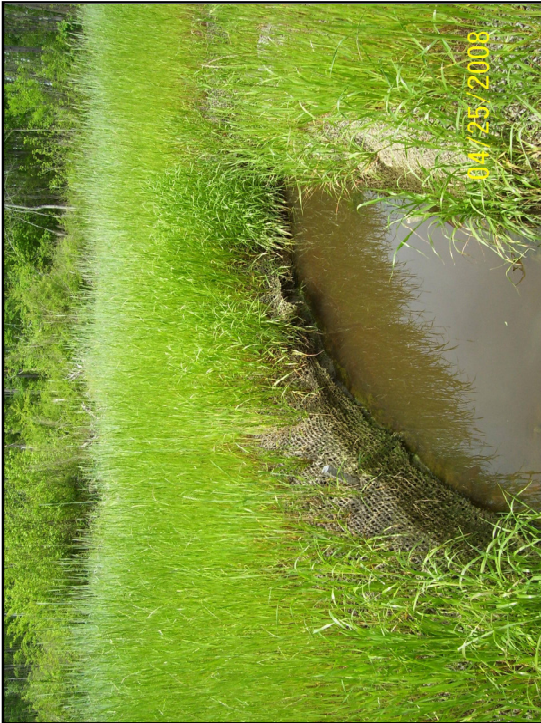
As-built (April 2008)



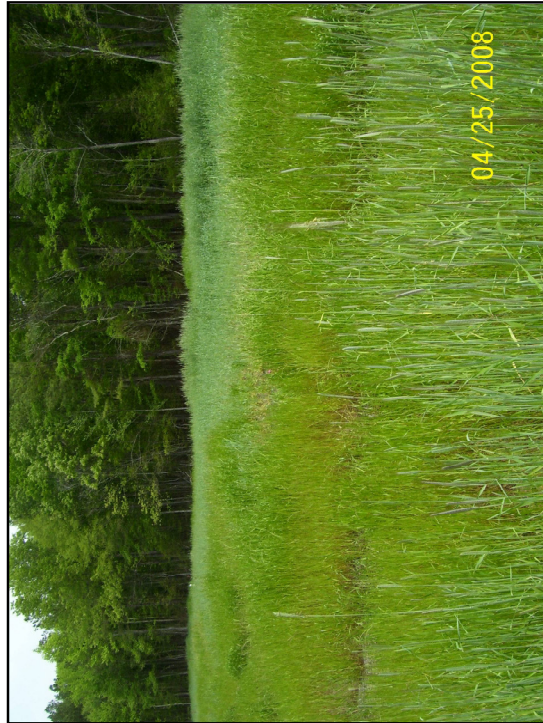
Cross-Section 5. Looking downstream.



Cross-Section 5. Looking left to right.



Cross-Section 5. Looking upstream.



Cross-Section 5. Looking right to left.



**As-built (April 2008)**



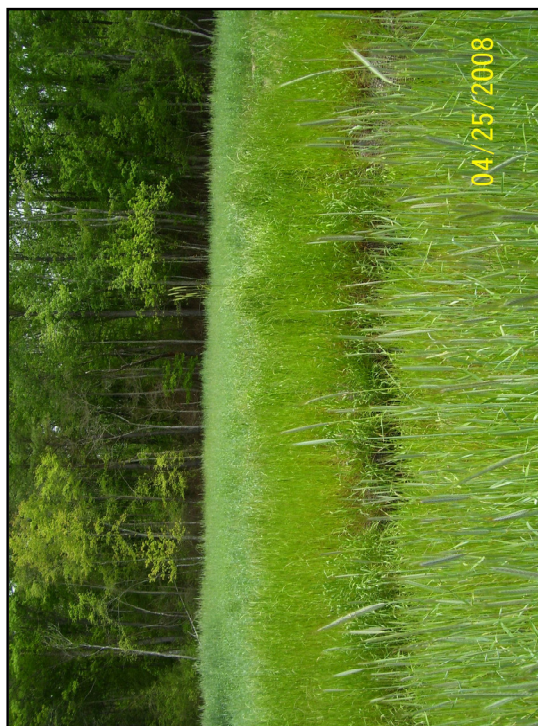
Cross-Section 6. Looking downstream.



Cross-Section 6. Looking left to right.



Cross-Section 6. Looking upstream.



Cross-Section 6. Looking right to left.